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What Is Amazon QuickSight?

Amazon QuickSight is a cloud-scale business intelligence (BI) service that you can use to deliver easy-to-understand insights to the people who you work with, wherever they are. Amazon QuickSight connects to your data in the cloud and combines data from many different sources. In a single data dashboard, QuickSight can include AWS data, third-party data, big data, spreadsheet data, SaaS data, B2B data, and more. As a fully managed cloud-based service, Amazon QuickSight provides enterprise-grade security, global availability, and built-in redundancy. It also provides the user-management tools that you need to scale from 10 users to 10,000, all with no infrastructure to deploy or manage.

QuickSight gives decision-makers the opportunity to explore and interpret information in an interactive visual environment. They have secure access to dashboards from any device on your network and from mobile devices.

To learn more about the major components and processes of Amazon QuickSight and the typical workflow for creating data visualizations, see the following sections. Get started today to unlock the potential of your data and make the best decisions that you can.

Topics

• Why QuickSight? (p. 1)
• Starting Work with QuickSight (p. 2)

Why QuickSight?

Every day, the people in your organization make decisions that affect your business. When they have the right information at the right time, they can make the choices that move your company in the right direction.

Here are some of the benefits of using Amazon QuickSight for analytics, data visualization, and reporting:

• The in-memory engine, called SPICE, responds with blazing speed.
• No upfront costs for licenses and a low total cost of ownership (TCO).
• Collaborative analytics with no need to install an application.
• Combine a variety of data into one analysis.
• Publish and share your analysis as a dashboard.
• Control features available in a dashboard.
• No need to manage granular database permissions—dashboard viewers can see only what you share.

For advanced users, QuickSight Enterprise edition offers even more features:

• Saves you time and money with automated and customizable data insights, powered by machine learning (ML). This enables your organization to do the following, without requiring any knowledge of machine learning:
  • Automatically make reliable forecasts.
  • Automatically identify outliers.
  • Find hidden trends.
  • Act on key business drivers.
  • Translate data into easy-to-read narratives, like headline tiles for your dashboard.
• Provides extra Enterprise security features, including the following:
  • Federated users, groups, and single sign-on (SSO) with AWS Identity and Access Management (IAM) Federation, SAML, OpenID Connect, or AWS Directory Service for Microsoft Active Directory.
  • Granular permissions for AWS data access.
  • Row level security.
  • Highly secure data encryption at rest.
  • Access to AWS data and on-premises data in Amazon Virtual Private Cloud
  • Offers pay-per-session pricing for the users that you place in the "reader" security role—readers are dashboard subscribers, people who view reports but don't create them.
  • Empowers you to make QuickSight part of your own websites and applications by deploying embedded console analytics and dashboard sessions.
  • Makes our business your business with multitenancy features for value-added resellers (VARs) of analytical services.
  • Enables you to programmatically script dashboard templates that can be transferred to other AWS accounts.
  • Simplifies access management and organization with shared and personal folders for analytical assets.
  • Enables larger data import quotas for SPICE data ingestion and more frequently scheduled data refreshes.

To learn more, see the following video, which contains a two-minute introduction to Amazon QuickSight: Introducing Amazon QuickSight. The audio contains all of the relevant information.

To discover the power of end-to-end BI from AWS, sign up at https://aws.amazon.com/QuickSight.

Starting Work with QuickSight

To start work with QuickSight, we recommend that you read the following sections:

• How Amazon QuickSight Works (p. 3)– Learn essential terminology and how QuickSight components work together.
• Getting Started with Data Analysis in Amazon QuickSight (p. 20) – Complete important setup tasks and learn how to use a dashboard, create an analysis, and publish a dashboard.
• AWS Security in Amazon QuickSight (p. 643) – Understand how you can help to secure access to data in QuickSight.
How Amazon QuickSight Works

Using Amazon QuickSight, you can access data and prepare it for use in reporting. It saves your prepared data either in SPICE memory or as a direct query. You can use a variety of data sources for analysis. When you create an analysis, the typical workflow looks like this:

1. Create a new analysis.
2. Add new or existing datasets.
3. Choose fields to create the first chart. QuickSight automatically suggests the best visualization.
4. Add more charts, tables, or insights to the analysis. Resize and rearrange them on one or more sheets. Use extended features to add variables, custom controls, colors, additional pages (called sheets), and more.
5. Publish the analysis as a dashboard to share it with other people.

The following illustration shows the basic workflow.

Terminology

Data preparation is the process of transforming data for use in an analysis. This includes making changes like the following:

- Filtering out data so that you can focus on what's important to you.
- Renaming fields to make them easier to read.
- Changing data types so that they are more useful.
- Adding calculated fields to enhance analysis.
- Creating SQL queries to refine data.
SPICE is the Super-fast, Parallel, In-memory Calculation Engine in QuickSight. SPICE is engineered to rapidly perform advanced calculations and serve data. The storage and processing capacity available in SPICE speeds up the analytical queries that you run against your imported data. By using SPICE, you save time because you don’t need to retrieve the data every time that you change an analysis or update a visual.

A data analysis is the basic workspace for creating data visualizations, which are graphical representations of your data. Each analysis contains a collection of visualizations that you arrange and customize.

A data visualization, also known as a visual, is a graphical representation of data. There are many types of visualizations, including diagrams, charts, graphs, and tables. All visuals begin in AutoGraph mode, which automatically selects the best type of visualization for the fields that you select. You can also take control and choose your own visuals. You can enhance your analytics by applying filters, changing colors, adding parameter controls, custom click actions, and more.

Machine learning (ML) Insights propose narrative add-ons that are based on an evaluation of your data. You can choose one from the list, for example forecasting or anomaly (outlier) detection. Or you can create your own. You can combine insight calculations, narrative text, colors, images, and conditions that you define.

A sheet is a page that displays a set of visualizations and insights. You can imagine this as a sheet from a newspaper, except that it’s filled with charts, graphs, tables, and insights. You can add more sheets, and make them work separately or together in your analysis.

A dashboard is the published version of an analysis. You can share with other users of Amazon QuickSight for reporting purposes. You specify who has access and what they can do with the dashboard.

Using sample data

To get a first look at how QuickSight works, you can explore Amazon QuickSight using the following sample data:

- B2b Sales data
- Business overview data (revenue)
- ML insights data
- People overview data (human resources)
- Sales pipeline data
- Web and social media analytics data (marketing)

Also, a variety of datasets are available free online that you can use with Amazon QuickSight, for example the AWS public datasets. These datasets come in a variety of formats.
Exploring Interactive Dashboards in Amazon QuickSight

Intended audience: Amazon QuickSight Dashboard subscribers or viewership

In Amazon QuickSight, a data dashboard is a collection of charts, graphs, and insights. It's like a newspaper that's all about the data that you’re interested in, except it has digital pages. Instead of reading it, you interact with it.

Dashboards come in a wide variety of designs, depending on what you do and the analytics that you need to do it well. Using QuickSight, you can interact with your data on a webpage or your mobile device. If you also subscribe by mail, you can see a static preview of it.

The story told by your data reflects the expertise of the analysts and data scientists who built the dashboards. They refine the data, add calculations, find angles on the story, and decide how to present it. The publisher designs the dashboard and fills it with interactive data visualizations and controls that adjust your view. Publishers can customize the level of interactivity that you have, including filter and search options. You can interact with the active items on the screen to filter, sort, drill down, or jump to another tool.

When you view a dashboard, you’re seeing the most recently received data. As you interact with the items on the screen, any changes you make change your view of the dashboard, and no one else's. Thus, your device's privacy is assured, although the publisher can tell what you looked at. After you close the dashboard, your explorations aren't preserved and neither is the data. As always, while you're an Amazon QuickSight reader, your monthly subscription is provided by the publishers of the dashboards at no additional cost to you.

If you're also a dashboard publisher—we call them authors, because they write reports—you can also save a copy of the dashboard for further analysis. If you find a new feature of the data that you want to publish, work with the original authors to update it. That way, everyone can see the same version of the story. However, you can also use your copy to learn how their design works or to inspire your work on something entirely new. Then, when you're finished, you can publish your analysis as a new dashboard.

To learn to set up dashboards, see Working with Dashboards (p. 461).

Topics
- Exploring Dashboards (p. 5)
- Dashboard Subscriber Alerts (p. 17)

Exploring Dashboards

To access a dashboard that you've been invited to share, follow the instructions in the invitation email. You can also access a dashboard if it's embedded into an application or website that you already have access to. When you open the dashboard, the screen should look something like the following example.
To fit the dashboard to your screen, open the View menu at upper right and select **Fit to window**.

Depending on how the dashboard is configured, you can find all or some of the following elements:

- **The menu bar** – This displays the name of the dashboard. Also, the menu bar shows what you can do with the dashboard, including **Undo**, **Redo**, and **Reset**, on the left. As you interact with the dashboard, you can use these as tools to help you explore, knowing that you can change your view without losing anything. On the right, you can find options to **Print** the dashboard, work with **Data**, choose a different **AWS Region**, and open your **User Profile**. The user profile menu has options so you can choose the language that Amazon QuickSight displays. It also has links to the Amazon QuickSight **Community** and the online documentation (**Help**).

- **The dashboard sheets** – If your dashboard has multiple sheets, these display as tabs across the top of the dashboard.

- **The Filter menu** – This option displays to the left of the dashboard, if the dashboard publisher allows filtering.

- **The Controls palette** – If your dashboard includes controls, you can use them to choose the options (parameters) that you want to apply to your dashboard. Sometimes a control value is selected for you, and sometimes it's set to **ALL**.

- **The dashboard title** – If your dashboard has a title, it is usually a larger heading. It might have some status information or instructions below it.

- **The dashboard widgets** – The items on the screen can include charts, graphs, insights, narratives, or images. To see them all, you might need to scroll vertically or horizontally. The following screenshot shows more of the previous example dashboard:
Using Filters on Dashboard Data

You can use filters to refine the data displayed in a visual. Filters are applied to the data before any aggregate functions. If you have multiple filters, all top-level filters apply together using AND. If the filters are grouped inside a top-level filter, the filters in the group apply using OR.

Amazon QuickSight applies all of the enabled filters to the field. For example, suppose that there is one filter of state = WA and another filter of sales >= 500. In this case, the dataset contains only records that meet both of those criteria. If you disable one of these, only one filter applies. Take care that multiple filters applied to the same field aren't mutually exclusive.

Viewing Filters

To see the existing filters, choose Filter on the element settings menu, then choose to view filters. The filters display in the Applied filters panel in order of creation, with the oldest filter on top.
Understanding Filter Icons

Filters in the Applied filters panel display icons to indicate how they are scoped and whether they are enabled.

A filter that isn't enabled is grayed out, and you can't select its check box.

One of several scope icons displays to the right of the filter name to indicate the scope set on that filter. The scope icon resembled four boxes in a square. If all boxes are filled, the filter applies to all visuals on the analysis sheet. If only one box is filled, the filter applies to the selected visual only. If some boxes are filled, the filter applies to some of the visuals on the sheet, including the one currently selected.

The scope icons match the ones that display on the filter menu when you are choosing the scope for the filter.

Viewing Filter Details

To see filter details, choose Filter at left. The filter view retains your last selection. So when you open Filter, you see either the Applied filters or the Edit filter view.

In the Applied filters view, you can choose any filter to view its details. The filters in this list can change depending on the scope of the filter, and which visual you currently have selected.
Filtering Data During Your Session

While your dashboard session is active, you can filter data in three ways:

1. If your dashboard has controls at the top of the screen, you can use them to filter data by choosing from a preset list of values.
2. You can use the filter icon on each widget's settings menu.
3. You can create your own filters by using the filter panel on the left side of the page. The filter icon looks like the following.

To create a filter, choose the Filter icon at left.

The first step is to choose which dashboard element you want to filter.

Click on the item you choose, so that a highlight appears around the selected item. Also, if any filters are already there, they display in a list. If there aren't any filters, you can add one by using the plus sign (+) near Filters.
Filtering options vary depending on the data type of the field you want to filter, and on the options you choose inside the filter. The following screenshot shows some of the options available for a time-range date filter.
For each filter, you can choose whether to apply it to one, some, or all dashboard elements. You can also enable or disable filters by using the check box next to the name of the filter. To delete a filter, edit it and scroll to the bottom to see the options. Remember that your filters aren’t saved from one session to the next.

For more detailed information on creating filters, see Filtering Data (p. 296).

Using the Elements on the Dashboard

Each widget has a settings menu that appears when you select that widget. This menu provides options to zoom in or out, filter the data, export the data, and more. The options vary depending on what type of widget the element is.

When you choose a data point, several actions are available. You can click or tap on a data point, for example on a bar in a bar chart, on a point where the line bends on a line chart, and so on. The available options vary based on what type of item it is. The following screenshot shows a list of actions available on most chart types.
These actions are as follows:

- Focus on or exclude.
  You can focus on or exclude specific data in a field, for example regions, metrics, or dates.
- Drill up or drill down.
  If your dashboard contains data on which you can drill down or up, you can drill up to a higher level or drill down to explore deeper details.
- Custom URL actions.
  If your dashboard contains custom actions, you can activate them by choosing a data point or by right-clicking it. For example, you might be able to email someone directly from the dashboard. Or you might open another sheet, website, or application, and send it the value you chose from this one.
- Change chart colors or specific field colors.
  You can change all the chart colors to a specific color. Or you can choose a specific field value to change its color of the element it’s part of.

### Sorting Dashboard Data

You can sort data in three ways:

1. You can hover over the label for the field you want to sort by, and choose the sort icon.
2. You can choose the filter icon at the upper right of one of the dashboard elements.
3. You can click or tap on the field and choose **Sort** from the context menu.

Sorting for pivot tables is different; you specify the sort order by using the column sort icon on the pivot table.

**Exporting Data from a Dashboard**

To export data from an analysis or dashboard to a comma-separated value (CSV) file, use the settings menu at the upper right of a widget. Exports only include data that currently displays in the item that you choose.
Dashboard Subscriber Alerts

Amazon QuickSight enables you to subscribe to updates for certain events, such as dashboard updates and anomaly alerts.

Topics

- Sign Up for Dashboard Emails (p. 17)
- Sign Up for Anomaly Alerts (p. 18)

Sign Up for Dashboard Emails

You can sign up to get a dashboard in report form, and receive it in an email. You can also configure your report settings.

To change subscription and report settings for a dashboard

1. Open a dashboard that is shared with you.
2. Choose the Reports icon at upper right.
3. The Change report preferences page appears. This page shows the current report schedule, and also the subscription and optimization options.
For **Subscription**, choose **Subscribe** to start receiving reports, or **Unsubscribe** to stop receiving reports.

Under **Optimize**, choose the device to view the report on:

- If you usually use a mobile device or you want to view reports in a portrait format, choose **Viewing on a mobile device**. When you receive the report, the charts and narratives display in a single vertical column.
- If you usually use a desktop computer or you want to view reports in a landscape format, choose **Viewing on a desktop**. When you receive the report, the charts and narratives display in the same layout shown in your dashboard on your desktop.

4. Choose **Update** to confirm your choices, or choose **Cancel** to discard your changes.

**Sign Up for Anomaly Alerts**

On a dashboard that has a narrative insight that’s configured for anomaly detection, you can sign up to get alerts for anomalies and contribution analysis. You receive anomaly alerts when anomalies are updated. The alerts email displays the total number of anomalies, and provides detail on the top five, according to your personal alert configuration. You receive key driver contribution analysis when it’s updated, provided that contribution analysis is configured to run with anomaly detection.

**To set up anomaly alerts**

1. Open a dashboard that is shared with you.
2. You can configure alerts from one of two screens. Choose one of the following, then go to the next step:
   - In the dashboard, locate the anomaly widget that you're interested in. Select it so that it has a highlighted box around it.
   - If you're in the dashboard and have the Explore Anomalies page open, you can configure the alert without returning to the dashboard view.
3. At upper right, choose Configure alert. The Alert configuration screen appears.
4. For Severity, choose the lowest level of significance that you want to see.
   For Direction, choose to get alerts about anomalies that are Higher than expected or Lower than expected. You can also choose [ALL] to receive alerts about all anomalies.
5. Choose OK to confirm your choices.
6. To stop receiving to an anomaly alert, locate the anomaly widget in the dashboard and use the bell icon to unsubscribe. You can also use the To manage this alert link at the bottom of an alert email.
Getting Started with Data Analysis in Amazon QuickSight

Use the topics in this section to create your first analysis. You can use sample data to create either a simple or a more advanced analysis, or you can connect to your own data to create an analysis.

Topics
- Setting Up for Amazon QuickSight (p. 20)
- Signing In to Amazon QuickSight (p. 23)
- Quick Start: Create an Analysis with a Single Visual Using Sample Data (p. 23)
- Tutorial: Create A Multivisual Analysis and a Dashboard Using Sample Data (p. 27)
- Create an Analysis Using Your Own Local Text File Data (p. 49)
- Create an Analysis Using Your Own Amazon S3 Data (p. 50)
- Create an Analysis Using Your Own Database Data (p. 52)

Setting Up for Amazon QuickSight

In this section, you sign up for an AWS account, create an IAM admin user, and sign up for Amazon QuickSight.

Topics
- Sign up for AWS (p. 20)
- Create an IAM user (p. 21)
- Signing Up for an Amazon QuickSight Subscription (p. 21)

Sign up for AWS

If you do not have an AWS account, complete the following steps to create one.

To sign up for an AWS account
2. Follow the online instructions.

Part of the sign-up procedure involves receiving a phone call and entering a verification code on the phone keypad.

Topics
- Create an IAM user (p. 21)
- Signing Up for an Amazon QuickSight Subscription (p. 21)
Create an IAM user

To create an administrator user for yourself and add the user to an administrators group (console)

1. Sign in to the IAM console as the account owner by choosing **Root user** and entering your AWS account email address. On the next page, enter your password.
   
   **Note**
   
   We strongly recommend that you adhere to the best practice of using the **Administrator** IAM user below and securely lock away the root user credentials. Sign in as the root user only to perform a few account and service management tasks.

2. In the navigation pane, choose **Users** and then choose **Add user**.

3. For **User name**, enter **Administrator**.

4. Select the check box next to **AWS Management Console access**. Then select **Custom password**, and then enter your new password in the text box.

5. (Optional) By default, AWS requires the new user to create a new password when first signing in. You can clear the check box next to **User must create a new password at next sign-in** to allow the new user to reset their password after they sign in.

6. Choose **Next: Permissions**.

7. Under **Set permissions**, choose **Add user to group**.

8. Choose **Create group**.

9. In the **Create group** dialog box, for **Group name** enter **Administrators**.

10. Choose **Filter policies**, and then select **AWS managed - job function** to filter the table contents.

11. In the policy list, select the check box for **AdministratorAccess**. Then choose **Create group**.
   
   **Note**
   
   You must activate IAM user and role access to Billing before you can use the **AdministratorAccess** permissions to access the AWS Billing and Cost Management console. To do this, follow the instructions in step 1 of the tutorial about delegating access to the billing console.

12. Back in the list of groups, select the check box for your new group. Choose **Refresh** if necessary to see the group in the list.

13. Choose **Next: Tags**.

14. (Optional) Add metadata to the user by attaching tags as key-value pairs. For more information about using tags in IAM, see Tagging IAM entities in the IAM User Guide.

15. Choose **Next: Review** to see the list of group memberships to be added to the new user. When you are ready to proceed, choose **Create user**.

You can use this same process to create more groups and users and to give your users access to your AWS account resources. To learn about using policies that restrict user permissions to specific AWS resources, see Access management and Example policies.

Signing Up for an Amazon QuickSight Subscription

When you first sign up for Amazon QuickSight, you get a free trial subscription for four users for two months. During the process of signing up, you choose which edition of QuickSight to use and set options for your identity provider.

Before you begin, you must be able to connect to an existing AWS account. The person who performs this action needs to have the correct AWS Identity and Access Management (IAM) permissions. For more information, see IAM Policy Examples for Amazon QuickSight (p. 682).
You can use the Policy Simulator to test your permissions. If you sign in as an IAM user and your AWS account is part of an AWS Organization, make sure you didn't inherit any IAM permissions that deny access to the required permissions.

**To subscribe to QuickSight**

1. Sign in to your AWS account and open QuickSight from the AWS Management Console. It is located under Analytics, and you can find it by searching for QuickSight.

   Your AWS account number is displayed for verification purposes.

2. Choose Sign up for QuickSight.

3. Choose Standard or Enterprise. To confirm, choose Continue.

4. If you choose Standard, skip this step and proceed to the next one.

   If you choose Enterprise, select the method that you want to connect with. Choose one of the following:
   - Use Role Based Federation (SSO)
   - Use Active Directory

   To sign up for QuickSight with federated users, you need the correct IAM permissions defined as follows:
   - To use Role Based Federation (SSO) with QuickSight Standard Edition or with QuickSight Enterprise Edition, see IAM Identity-Based Policies for Amazon QuickSight: All Access for Standard Edition (p. 683).

5. For both Standard and Enterprise editions, make choices for the following items:
   - Enter a unique account name for QuickSight. Your account name can only contain characters (A–Z and a–z), digits (0–9), and hyphens (-). If you use Microsoft AD, and it has a default alias, this alias is used for the account name.
   - Enter a notification email address for the QuickSight account owner or group. This email address receives service and usage notifications.
   - (Optional) Choose the AWS Region that you want to use for your initial data storage capacity, called SPICE.
   - (Optional) Choose whether to allow autodiscovery of your AWS resources. You can change these options later in Manage Account. For more information, see Allowing Autodiscovery of AWS Resources (p. 647).

6. Review the choices you made, then choose Finish.

7. (Optional) To open QuickSight, choose Go to QuickSight.

   If you are using Enterprise edition, you can manage user groups, by choosing Manage access to QuickSight. Otherwise, close the browser and notify your users how to connect.

8. (Optional) If you are using SSO or a federation, select the users and groups who are going to use QuickSight.
Signing In to Amazon QuickSight

You can sign in on the Amazon QuickSight page, https://quicksight.aws.amazon.com/. Follow the screen prompts to sign in. For your convenience, the procedure is outlined here. It varies slightly depending on the type of account you have.

1. For **Account name**, type the QuickSight account name. This is the name that was created for the QuickSight subscription in this AWS account. Take note of it in case you need it later.
2. Enter your email address if you are prompted for it.
3. If the username is blank, enter the user name you want to use to sign in. User names that contain a semicolon (;) aren't supported. Choose one of the following:
   - For organizational users – the user name provided by your administrator.
   - Your account can be based on IAM credentials, a Single Sign-On (SSO) service, or your email address. If you received an invitation email from another Amazon QuickSight user, it indicates what type of credentials to use.
   - For individual users – the user name you created for yourself.
   - This is usually the IAM credentials you created.
4. Enter your password in **Password**. If you aren't sure, ask the administrator. If you create a new password, enter your password again to confirm it.
   - Passwords are case-sensitive, must be between 8 and 64 characters in length, and must contain at least one character from three of the following categories:
     - Lowercase letters (a–z)
     - Uppercase letters (A–Z)
     - Numbers (0–9)
     - Nonalphanumeric characters (~!@#$%^&*_-+=`|(){}[]:;"'<>,.?/)
5. Choose **Sign in**. In some cases, this button is labeled **Create account and sign in**.
6. (Only for users invited by email.) You are prompted to type the account name provided in your email invitation. If you mistype it, you get an authentication error. To change the account name, choose the account name next to the **Account name**, and type in the correct one.

If your sign-in process happens automatically and you need to use a different account, use a private or incognito browser window. Doing this prevents the browser from reusing cached settings.

Quick Start: Create an Analysis with a Single Visual

Using Sample Data

Use the following procedure to use the Web and Social Media Analytics sample data set to create an analysis containing a line chart visual. This visual shows the count by month of people that have added themselves to the mailing list.

1. On the Amazon QuickSight start page, choose **New analysis**. If you don't have the sample data, you can download it here: web-and-social-analytics.csv.zip. Unzip the file so you can use the .CSV file.

   To upload the sample data, use the following steps:
   a. Choose **New dataset** from the **New analysis** screen. (Or, choose **Datasets** at left, and then choose **New dataset**.)
b. Choose Upload a file.

c. Choose the sample file, web-and-social-analytics.csv, from your drive. If you don't see it, check that you unzipped the web-and-social-analytics.csv.zip file.

d. Confirm file upload settings by choosing Next on the Confirm file upload settings screen.

e. Choose Visualize on the Data source details screen.

f. Skip the next step. Choosing Visualize brings you to the same screen as the process in Step 2.

2. On the Datasets page, choose the Web and Social Media Analytics data set, and then choose Create Analysis.

3. In the Fields list pane, choose Date, and then choose Mailing list adds.
Amazon QuickSight uses AutoGraph to create the visual, selecting the visual type that it determines is most compatible with those fields. In this case, it selects a line chart that shows mailing list adds by day, which is the date granularity default.

4. Expand the Field wells pane by choosing the expand icon.
5. Choose the X axis field well, choose **Aggregate**, and then choose **Month**.

The line chart updates to show mailing list adds by month, rather than by the default of by year.
Tutorial: Create A Multivisual Analysis and a Dashboard Using Sample Data

Use the procedures in the following sections to complete these tasks:

- Create and prepare a Marketing data set using the Web and Social Media Analytics sample data.
- Create a Marketing analysis and add several visuals to it.
- Modify the visuals in the analysis, including the following:
  - Adding another measure to an existing visual
  - Changing chart colors
  - Changing date granularity
  - Changing the size and layout of the visuals
  - Applying a filter
- Publish a dashboard based on the analysis.
Tutorial: Create a Prepared Data Set

Use the following procedure to prepare the Marketing data set and create an analysis. If you don't see the Web and Social Media Analytics sample data already in Amazon QuickSight, you can download it: web-and-social-analytics.csv.zip.

1. On the Amazon QuickSight start page, choose **Datasets** at left.

2. On the **Datasets** page, choose **New dataset**.

   ![Datasets page screenshot](image)

   **Find analyses & more**
   - Favorites
   - Recent
   - My folders
   - Shared folders

   **Analyses**
   - Analysis
   - Analysis
   - Analysis

   **Dashboards**
   - Analysis
   - Analysis
   - Analysis

   **Datasets**
   - Dataset
   - Dataset
   - Dataset
3. In the FROM EXISTING DATA SOURCES section of the Create a Data Set page, choose the Web and Social Media Analytics Amazon S3 data source and then choose Edit dataset.

Amazon QuickSight opens the data preparation page.

4. For Dataset Name, enter Marketing Sample to replace Web and Social Media Analytics for the dataset name.

5. Exclude some fields from the dataset.

In the Fields pane, choose the field menu for the Twitter followers cumulative and Mailing list cumulative fields, and then choose Exclude field. To select more than one field at a time, press the Ctrl key while you select (Command key on Mac).
6. Rename a field.

In the Dataset preview pane, scroll to the Website Pageviews field and choose the edit icon.
In the **Edit field** page that opens, for **Name**, enter **Website page views**, and then choose **Apply**.

7. Add a calculated field that substitutes a text string for any 0-length string value in the **Events** field.
   
a. On the data preparation page, scroll to the top of the **Fields** pane, and then choose **Add calculated field**.
b. In the **Add calculated field** page that opens, for **Add name**, enter `populated_event`.

c. In the **Functions** pane at right, double-click the **ifelse** function from the list of functions. This adds the function to the calculated field formula.
d. Expand the Field list pane by selecting the drop-down arrow, and then double-click the **Events** field. This adds the field to the calculated field formula.

e. In formula editor, enter the following additional functions and parameters required, bolded in the following: `ifelse(strlen(Events)=0, 'Unknown', Events)`.
The final formula should be as follows: \( \text{ifelse}(\text{strlen}({\text{Events}})=0, \ 'Unknown', \ {\text{Events}}) \).

To create the calculated field, follow these steps:

1. Choose Save.

The new calculated field is created, and appears at the top of the Fields pane.

8. Choose Save.
Next Steps

Create an analysis by using the procedure in Tutorial: Create an Analysis (p. 35).

Tutorial: Create an Analysis

Create an analysis, add a visual using AutoGraph, and add another visual by choosing a specific visual type. This procedure builds on the data set you create and prepare using the steps in Tutorial: Create a Prepared Data Set (p. 28).

Create the Analysis

Create the analysis.

1. On the Amazon QuickSight start page, choose New analysis.

2. On the Datasets page, choose the Marketing Sample data set and then choose Create Analysis.
Create a Visual By Using AutoGraph

Create a visual by using AutoGraph, which is selected by default.

On the analysis page, choose **Date** and **Return visitors** in the **Fields list** pane.

Amazon QuickSight creates a line chart using this data.
Create a Scatter Plot Visual

Create a visual by choosing a visual type and dragging fields to the field wells.

1. On the analysis page, choose **Add** and then **Add visual** on the application bar. A new, blank visual is created, and AutoGraph is selected by default.

2. In the **Visual types** pane, choose the scatter plot icon.
3. Choose fields in the **Fields list** pane to add to the **Field wells** pane.

- Choose **Desktop Uniques** to populate the **X axis** field well.
- Choose **Mobile Uniques** to populate the **Y axis** field well.
- Choose **Date** to populate the **Group/Color** field well.

A scatter plot is created using these fields.
Next Steps

Modify the visuals in the analysis by using the procedure in Tutorial: Modify Visuals (p. 39).

Tutorial: Modify Visuals

Use the following procedures to modify the visuals created using the procedures in Tutorial: Create an Analysis (p. 35).

Modify the Line Chart Visual

Modify the line chart visual by making it show an additional measure by date, and also by changing the chart color.

1. In the analysis, select the line chart visual.
2. Add another measure to the visual.

Select the New visitors SEO field in the Fields list pane. This measure is added to the Value field well, and the line chart updates with a line to represent it. Note that the visual title updates as well.
3. Change the color of the line used to represent the Return visitors measure.

Choose the line on the chart that represents Return visitors. To do this, choose the end of the line, not the middle of the line.

Choose **Color Return visitors**, and then choose the red icon from the color selector.
4. Choose the **Date** field in the **X axis** field well, choose **Aggregate**, and then choose **Month**.

**Modify the Scatter Plot Visual**

Modify the scatter plot visual by changing the data granularity.

1. In the analysis, select the scatter plot visual.
2. Choose the **Group/Color** field well, choose **Aggregate**, and then choose **Month**.
The scatter plot updates to show the measures by month, rather than by the default of by year.

Modify Both Visuals by Changing Visual Layout and Adding a Filter

Modify both visuals by changing visual size and location, and by adding a filter and applying it to both of them.
Change the Visual Layout

Modify both visuals by changing visual size and location.

1. In the analysis, select the line chart visual.
2. Choose the resize handle in the lower right corner of the visual and drag up and to the left, until the visual is half its former size both horizontally and vertically.
3. Repeat this procedure on the scatter plot visual.
4. Choose the move handle on the scatter plot visual, and drag it up to the right of the line chart visual so that they are side-by-side.

Modify Both Visuals by Adding a Filter

Modify both visuals by adding a filter and applying it to both of them.

1. In the analysis, choose the scatter plot visual.
2. Choose Filter at left.
3. On the Filters pane, choose the plus icon, and then choose the Date field to filter on.

4. Choose the new filter to expand it.

5. In the Edit filter pane, for Filter type, choose the After comparison type.
6. Enter a start date value of 1/1/2014.

Choose Date, choose 2014 for the year, January for the month, and then choose 1 on the calendar.
7. In the **Edit filter** pane, choose **Apply** to apply the filter to the visual.

The filter is applied to the scatter plot visual. This is indicated with a filter icon on the visual dropdown menu.
8. Apply the filter to the line chart visual.

In the Filter pane at left, choose the Date filter again and choose Only this visual, and then choose All visuals of this dataset.

The filter is applied to the line chart visual as well.

Next Steps

Create a dashboard from the analysis by using the procedure in Tutorial: Create a Dashboard (p. 48).
Tutorial: Create a Dashboard

Use the following procedure to create a dashboard from the analysis created using the procedure in Tutorial: Create an Analysis (p. 35).

1. In the analysis, choose **Share** in the application bar at upper-right, and then choose **Publish dashboard**.

2. In the **Publish dashboard** page that opens, choose **Publish new dashboard as**, and enter the name **Marketing Dashboard**.

3. Choose **Publish dashboard**.

   The dashboard is now published.

4. On the **Share dashboard** page that opens, choose the X icon to close it. You can share the dashboard later by using the sharing option on the dashboard page.
Create an Analysis Using Your Own Local Text File Data

To create your first analysis using your own local text file data, follow these steps:

**Topics**
- Step 1: Create a File Dataset and an Analysis (p. 49)
- Step 2: Create a Visual (p. 49)

### Step 1: Create a File Dataset and an Analysis

Complete the following procedure to create a dataset and an analysis:

1. Check [Data Source Quotas (p. 72)](#) to make sure your target file doesn't exceed data source limits.
2. On the Amazon QuickSight start page, choose **Datasets** in the pane at left.
3. On the **Datasets** page, choose **New data set**.
4. In the **FROM NEW DATA SOURCES** section of the **Create a Data Set** page, choose **Upload a file**.
5. In the **Open** dialog box, browse to a text file, select it, and then choose **Open**.

   A file must be 1 GB or less to be uploaded to Amazon QuickSight.

6. Choose **Next**.
7. Choose **Visualize**.

### Step 2: Create a Visual

Next, create a visual.

In the **Fields list** pane of the analysis page, choose the fields you want to use.

Amazon QuickSight creates the visual, using AutoGraph to determine the most appropriate visual type for the fields you selected. For more information about AutoGraph, see [Using AutoGraph (p. 329)](#). For more information about modifying the visual, see [Working with Amazon QuickSight Visuals (p. 243)](#).
Create an Analysis Using Your Own Amazon S3 Data

To create your first analysis using your own Amazon S3 data, follow these steps:

Topics
- Step 1: Create an Amazon S3 Dataset and an Analysis (p. 51)
- Step 2: Create a Visual (p. 51)
Step 1: Create an Amazon S3 Dataset and an Analysis

Complete the following procedure to create a data set and an analysis:

1. Create a manifest file to identify the S3 files you want to import, using one of the formats specified in Supported Formats for Amazon S3 Manifest Files (p. 104).
2. Check Data Source Quotas (p. 72) to make sure your target file set doesn't exceed data source limits.
3. Either save the manifest file to a local directory or upload it into Amazon S3.
4. On the Amazon QuickSight start page, choose Datasets in the pane at left.
6. In the FROM NEW DATA SOURCES section of the Create a Data set page, choose the Amazon S3 icon.
7. For Data source name, type a name for the data source.
8. For Upload a manifest file, do one of the following options:
   - Choose URL and type or paste in a URL for the manifest file. You can find this in the Amazon S3 console by right-clicking on the manifest file, choosing Properties, and looking at the Link field.
   - Choose Upload and then choose Upload a JSON manifest file. In Open, browse to a file, select it, and then choose Open.
9. Choose Connect.
10. Choose Visualize.

Step 2: Create a Visual

Next, create a visual.

In the Fields list pane of the analysis page, choose the fields you want to use.

Amazon QuickSight creates the visual, using AutoGraph to determine the most appropriate visual type for the fields you selected. For more information about AutoGraph, see Using AutoGraph (p. 329). For more information about modifying the visual, see Working with Amazon QuickSight Visuals (p. 243).
Create an Analysis Using Your Own Database Data

To create your first analysis using your own database data, follow these steps:

**Topics**
- Connect to a Database Data Source (p. 53)
- Step 2: Create a Database Data Set and an Analysis (p. 54)
- Step 3: Create a Visual (p. 56)
Connect to a Database Data Source

Choose the situation that applies to you and follow the steps in the procedure to connect to your data source.

Your Amazon QuickSight Account

- Your Amazon QuickSight Account Has Autodiscovered AWS Data Sources (p. 53)
- Your Amazon QuickSight Account Does Not Have Autodiscovered AWS Data Sources (p. 53)

Your Amazon QuickSight Account Has Autodiscovered AWS Data Sources

If your Amazon QuickSight account has any autodiscovered AWS data sources, icons for those data sources appear on your start page. If you have credentials for one of these AWS data sources, use the following procedure. Otherwise, use the procedure in Your Amazon QuickSight Account Does Not Have Autodiscovered AWS Data Sources (p. 53).

1. Check Data Source Quotas (p. 72) to make sure your target table or query doesn't exceed data source limits.
2. Confirm that the database credentials you plan to use have appropriate permissions as described in Required Permissions (p. 646).
3. Make sure you have configured the cluster or instance for Amazon QuickSight access by following the instructions in Network and Database Configuration Requirements (p. 724).
4. On the Amazon QuickSight start page, choose Datasets in the pane at left.
6. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose either the RDS or the Redshift Auto-discovered icon, depending on the AWS service you want to connect to.
7. Enter the connection information for the data source, as follows:
   - For Data source name, type a name for the data source.
   - For Instance ID, choose the name of the instance or cluster you want to connect to.
   - Database name shows the default database for the Instance ID cluster or instance. If you want to use a different database on that cluster or instance, type its name.
   - For Username, type the user name of an account that has permissions to access the target database, and also to read (perform a SELECT statement on) any tables in that database that you want to use.
   - For Password, type the password associated with the user account you entered.
8. (Optional) Choose Validate connection to verify your connection information is correct.
9. Choose Create data source.
   
   **Note**
   Amazon QuickSight automatically secures connections to Amazon RDS instances and Amazon Redshift clusters by using Secure Sockets Layer (SSL). You don't need to do anything to enable this.
10. Go to Step 2: Create a Database Data Set and an Analysis (p. 54).

Your Amazon QuickSight Account Does Not Have Autodiscovered AWS Data Sources

If you don't have any autodiscovered AWS data sources, use the following procedure:
1. Check Data Source Quotas (p. 72) to make sure your target table or query doesn't exceed data source limits.

2. Confirm that the database credentials you plan to use have appropriate permissions as described in Required Permissions (p. 646).

3. Make sure you have configured the cluster or instance for Amazon QuickSight access by following the instructions in Network and Database Configuration Requirements (p. 724).

4. On the Amazon QuickSight start page, choose Manage data.


6. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose the Redshift Manual connect icon if you want to connect to an Amazon Redshift cluster in another region or associated with a different AWS account, or choose the appropriate database management system icon to connect to an instance of Amazon Aurora, MariaDB, Microsoft SQL Server, MySQL, or PostgreSQL.

7. Enter the connection information for the data source, as follows:
   - For Data source name, type a name for the data source.
   - For Database server, type or paste one of the following values:
     - For an Amazon Redshift cluster or Amazon RDS instance, type the endpoint of the cluster or instance without the port number. For example, if the endpoint value is clustername.1234abcd.us-west-2.redshift.amazonaws.com:1234, then type clustername.1234abcd.us-west-2.redshift.amazonaws.com. You can get the endpoint value from the Endpoint field on the cluster or instance detail page in the AWS console.
     - For an Amazon EC2 instance of MariaDB, Microsoft SQL Server, MySQL, or PostgreSQL, type the public DNS. You can get the public DNS value from the Public DNS field on the instance detail pane in the EC2 console.
     - For a non–Amazon EC2 instance of MariaDB, Microsoft SQL Server, MySQL, or PostgreSQL, type the host name or public IP address of the database server.
   - For Port, type the port that the cluster or instance uses for connections.
   - For Database name, type the name of the database that you want to use.
   - For Username, type the user name of an account that has permissions to access the target database and also to read (perform a SELECT statement on) any tables in that database that you want to use.
   - For Password, type the password associated with the user account you entered.

8. (Optional) If you are connecting to anything other than an Amazon Redshift cluster and you don't want a secured connection, uncheck Enable SSL. We strongly recommend leaving this checked, as an unsecured connection can be open to tampering. For more information on how the target instance uses Secure Sockets Layer (SSL) to secure connections, refer to the documentation for that database management system.

Amazon QuickSight automatically secures connections to Amazon Redshift clusters by using SSL. You don't need to do anything to enable this.

9. (Optional) Choose Validate connection to verify your connection information is correct.

10. Choose Create data source.

11. Go to Step 2: Create a Database Data Set and an Analysis (p. 54).

**Step 2: Create a Database Data Set and an Analysis**

Complete the following procedure to create a data set and an analysis:

1. For Schema: contain sets of tables, choose Select and then choose a schema. Note that in some cases where there is only a single schema in the database, that schema will be automatically chosen and the schema selection option won't be displayed.
2. Choose a table and then choose Select.

3. Choose the Import to SPICE for quicker analytics radio button and then create an analysis by choosing Visualize.
Step 3: Create a Visual

Next, create a visual.

In the Fields list pane of the analysis page, choose the fields you want to use.

Amazon QuickSight creates the visual, using AutoGraph to determine the most appropriate visual type for the fields you selected. For more information about AutoGraph, see Using AutoGraph (p. 329). For more information about modifying the visual, see Working with Amazon QuickSight Visuals (p. 243).
Step 3: Create a Visual

Fields list:
- Date
- Desktop uniques
- Events
- Free sign up
- Mailing list adds
- Mailing list cumulative
- Mobile uniques
- New visitors CPC
- New visitors SEO

Visual types:
Using the Amazon QuickSight Console

In the following topic, you can find a brief introduction to using the Amazon QuickSight user interface.

Topics
- Using the Amazon QuickSight Menu and Landing Page (p. 58)
- Using the Amazon QuickSight Start Page (p. 60)
- Choosing a Language in Amazon QuickSight (p. 62)
- Using the Amazon QuickSight Mobile App (p. 64)

Using the Amazon QuickSight Menu and Landing Page

After you sign in to Amazon QuickSight, you see the Amazon QuickSight landing page. This page provides tabs for your analyses, your dashboards, and our tutorial videos. It also provides a menu bar at the top, with options for the following:

- Searching Amazon QuickSight
- Choosing the AWS Region that you want to work in
- Accessing your user profile (community, language selection, and help)
- Creating a new analysis
- Managing data

Note
Consult your administrator before changing your AWS Region. Your default AWS Region is configured by your Amazon QuickSight administrator. Changing the AWS Region changes where your work is stored.
To view videos about Amazon QuickSight, choose your username at the upper-right of any page, and then choose **Tutorial videos**. Choose a video to play it.

To access the user profile menu, choose your user icon at the upper right of any page in Amazon QuickSight. Use this menu to manage Amazon QuickSight features, visit the community, send product feedback, choose a language, get help from the documentation, or sign out of Amazon QuickSight.
The following options are available from the user profile menu:

- **Manage QuickSight** – If you have appropriate permissions, you can access administrative functions such as managing users, subscriptions, SPICE (p. 78) capacity, and account settings.

- **Community** – Choose this option to visit the Amazon QuickSight online community.

- **Send feedback** – This is your direct connection to the product team. Use this simple form to report problems, request features, or tell us how you are using Amazon QuickSight.

- **What's new** – Find out what new features are available in Amazon QuickSight.

- **Language setting** – Choose the language you want to use in the Amazon QuickSight user interface.

- **Region setting** – Choose the AWS region that you want to work in.

  **Note**
  Consult your administrator before changing your AWS Region. Your default AWS Region is configured by your Amazon QuickSight administrator. Changing the AWS Region changes where your work is stored.

- **Tutorial videos** – This will open the Tutorial videos page where you can watch videos about Amazon QuickSight.

- **Help** – This will open the official AWS documentation, which you can view online, in Kindle, or as a PDF.

- **Sign out** – Choose this option to sign out of Amazon QuickSight and your AWS session.

---

**Using the Amazon QuickSight Start Page**

To see available dashboards, choose **Dashboards** at left. Choose any dashboard on the page to open it.
To see available analyses, choose **Analyses** at left. This is the default page when Amazon QuickSight opens. Choose any analysis to open it.

To see your list of favorite dashboards and analyses, choose **Favorites**. You can add items to your favorites by selecting the star near the title of the dashboard or analysis, so that the star is filled in. Clear the star to remove the item from your favorites.

To create a new analysis, choose **New analysis**, near the top left. This takes you to **Datasets**. Choose one to start analyzing it.

To see current datasets, or to create a new dataset, choose **Datasets**. This takes you to the **Datasets** page, which displays the datasets that you have access to. (If they don't all fit on one page, you can navigate between pages.) From here, you can choose a dataset to analyze.

To create a new dataset, choose **New dataset**. From here, you can upload a file, or you can create a new dataset based on a data source (a connection to external data). Icons for new data sources are at the top of the screen under **From new data sources**. Icons for existing data sources are displayed below them, under **From existing data sources**.
Searching Amazon QuickSight

From the search bar, you can search for analyses and dashboards. To use the search tool, go to the Start Page and choose the search box at the top-left of the page. Then enter the name, or part of the name, of the data set, analyses, or dashboard you want to find. The search is not case-sensitive.

After you locate the item that you're looking for, you can open it directly from the search results. You can modify a data set, create an analysis from a data set, or access an analysis or dashboard. Choose an item from the search results to open it.

Choosing a Language in Amazon QuickSight

You can choose the language that you want to use in the Amazon QuickSight user interface. This option is set separately for each individual user. The first time a user signs in, Amazon QuickSight detects and
Amazon QuickSight selects a suitable language. This choice is based on the user's browser preferences and interactions with localized AWS websites.

Amazon QuickSight supports the following languages:

**Languages available in the Amazon QuickSight user interface**

<table>
<thead>
<tr>
<th>Official name</th>
<th>Language code</th>
<th>Localized name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dansk</td>
<td>da</td>
<td>Danish</td>
</tr>
<tr>
<td>Deutsch</td>
<td>de</td>
<td>German</td>
</tr>
<tr>
<td>English</td>
<td>en</td>
<td>English</td>
</tr>
<tr>
<td>Español</td>
<td>es</td>
<td>Spanish</td>
</tr>
<tr>
<td>Français</td>
<td>fr</td>
<td>French</td>
</tr>
<tr>
<td>Italiano</td>
<td>it</td>
<td>Italian</td>
</tr>
<tr>
<td>Nederlands</td>
<td>nl</td>
<td>Dutch</td>
</tr>
<tr>
<td>Norsk</td>
<td>nb</td>
<td>Norwegian</td>
</tr>
<tr>
<td>Português</td>
<td>pt</td>
<td>Portuguese</td>
</tr>
<tr>
<td>Suomi</td>
<td>fi</td>
<td>Finnish</td>
</tr>
<tr>
<td>Svenska</td>
<td>sv</td>
<td>Swedish</td>
</tr>
<tr>
<td>日本語</td>
<td>ja</td>
<td>Japanese</td>
</tr>
<tr>
<td>한국어</td>
<td>ko</td>
<td>Korean</td>
</tr>
<tr>
<td>中文 (简体)</td>
<td>zh-CN</td>
<td>Simplified Chinese</td>
</tr>
<tr>
<td>中文 (繁體)</td>
<td>zh-TW</td>
<td>Traditional Chinese</td>
</tr>
</tbody>
</table>

Choosing a language translates only user interface elements. It doesn't translate the following:

- Amazon QuickSight reserved keywords
- User input
- Data
- Date or number formats
- ML Insights, suggested insights, or computations in narratives (including text)

Use the following procedure to change the language in the Amazon QuickSight interface.

1. Choose your username at top right.
2. To open the language options menu, choose the > symbol near the current language.
3. Choose the language that you want to use.

Using the Amazon QuickSight Mobile App

The Amazon QuickSight mobile app enables you to securely get insights from your data from anywhere; favorite, browse, and interact with your dashboards; explore your data with drilldowns and filters; stay ahead of the curve via forecasting; get email alerts when unexpected changes happen in your data; and share those insights with colleagues.

For a quick tour of the app, see Amazon QuickSight announces the all-new QuickSight Mobile app on the AWS Big Data Blog.

To begin using the QuickSight Mobile app, do one of the following:

- Download the iOS version from the iOS App Store
- Download the Android version from Google Play
Organizing Assets into Folders for Amazon QuickSight

Applies to: Enterprise Edition

In Amazon QuickSight Enterprise edition, your team members can create personal and shared folders to add hierarchical structure to QuickSight asset management. Using folders, people can more easily organize, navigate through, and discover dashboards, analyses, and datasets. Within a folder, you can still use your usual tools to search for assets or to add assets to your favorites list.

You can use the following types of folders with QuickSight:

- **Personal folders** to organize work for yourself.
  - Personal folders are visible only to the person who owns them. You can't transfer ownership of personal folders to anyone else.
- **Shared folders** to organize work and simplify sharing among multiple people.
  - Shared folders are visible to people who have access to them. To manage shared folders, you need to be a QuickSight administrator. You can transfer ownership of shared folders if you are already an owner.

**Topics**
- Overview of QuickSight Folders (p. 65)
- Security for Shared Folders (p. 66)
- Limitations (p. 66)

**Overview of QuickSight Folders**

In Amazon QuickSight, you can create personal and shared folders. You can also favorite your personal or shared folders for easy access by selecting the favorite (⭐️) icon next to it.

You can do the following with personal folders:

- Create subfolders.
- Add assets to your folder, including datasets, analyses, and dashboards. To add assets to a personal folder, you need to already have access to the assets. Multiple assets can have the same name.

You can do the following with shared folders:

- Share these folders with other users in the same AWS account.
- People who have QuickSight admin privileges can do the following:
  - Create or delete a shared folder and subfolders inside of it. You can move either of these around within the top-level folder.
• Add or remove owners and viewers. When you make a person an owner of the folder, you give them ownership of every asset in the folder.

Security for Shared Folders

The following rules apply to security for shared folders:

• To create a shared folder and to share the folder with one or more groups, you must be an Amazon QuickSight administrator.
• Shared folders have two access levels, owners and viewers:
  • The folder owner owns everything (folders, analyses, dashboards, datasets) inside of the folder.
  • The folder viewer can only use the assets (folders, dashboards, datasets) in the folder. A viewer can't edit or share those assets.
• QuickSight readers' sharing status for a folder gets shared with the folder. However, a reader gets only read access to folders, and only dashboard access to visuals.
• AWS security is enforced on every object within a folder. The folder applies the same type of security to the assets of whoever the folder is shared with according to their access level (admin, author, or reader).
• The top-level folder is the root folder of any subfolders. When a subfolder is shared at any level, the person whom the folder was shared with sees the root folder in the top-level folders view.
• The folder permission is the permission on the current folder, combined with permissions of all the folders leading to the root folder.
• Items in the shared folder can be shared or private:
  • A shared asset inherits its permission from the folder. A shared asset is created when an asset that belongs to the folder owner is added to a shared folder.
  • A private asset opts out of the permission inheritance. A private asset is created when an asset is added to a shared folder, and this asset can be viewed by but doesn't belong to the folder owner.

Limitations

The following limitations apply to folders:

• Folders can't be shared with people in other AWS accounts.
• For people who have QuickSight reader permissions, the following limitations apply:
  • Readers can't own a personal or shared folder.
  • Readers can't create or manage folders or folder content.
  • In shared folders, readers can only see dashboard assets.

In addition, these limitations apply to shared folders:

• The name of a shared folder (at the top level of the tree) must be unique in your AWS account.
• In a single folder, multiple assets can't have the same name. For example, in your top-level folder, you can't create two subfolders with the same name. In the same folder, you can't add two assets with the same name, even if they have different asset IDs. The path to each asset behaves like an Amazon S3 key name. It must be unique in your AWS account.

For Amazon QuickSight quotas, the Service Quotas console provides the most accurate and up-to-date information.
You can do the following in the Service Quotas console:

- View the default Amazon QuickSight quotas for each AWS Region
- Request quota increases for adjustable quotas
Working with Data in Amazon QuickSight

People in many different roles use Amazon QuickSight to help them do analysis and advanced calculations, design data dashboards, embed analytics, and make better-informed decisions. Before any of that can happen, someone who understands your data needs to add it to QuickSight. QuickSight supports direct connections and uploads from a variety of sources.

After your data is available in QuickSight Standard edition, you can do the following:

- Transform the dataset with field formatting, hierarchies, data type conversions, and calculations.
- Create one or more data analyses based on your newly created dataset.
- Share your analysis with other people so they can help design it.
- Add charts, graphs, more datasets, and multiple pages (called sheets) to your data analysis.
- Create visual appeal with customized formatting and themes.
- Make them interactive by using parameters, controls, filters, and custom actions.
- Combine data from multiple data sources, and then build new hierarchies for drilling down and calculations only available during analytics, like aggregations, window functions, and more.
- Publish your analysis as an interactive data dashboard.
- Share the dashboard so other people can use the dashboard, even if they don't use the analysis that it's based on.
- Add more data to create more analyses and dashboards.

After your data is available in QuickSight Enterprise edition, you can do different things depending on your role. If you can build datasets, design analyses, and publish dashboards, you can do all of the things people using Standard edition can do.

In addition, these are some examples of additional tasks that you can do:

- Create analyses that use QuickSight insights, including machine learning (ML) powered insights for forecasting, anomaly and outlier detection, and key driver identification.
- Design narrative insights with text, colors, images, and calculations.
- Add data from private virtual private clouds (VPCs) and on-premises data sources, with data encryption at rest.
- Control access in datasets by adding row and column level security.
- Refresh imported datasets every hour.
- Share emailed reports.

If you develop applications or use the AWS SDKs and AWS Command Line Interface (AWS CLI), you can do the following and more:

- Add embedded analytics and embedded interactive dashboards to websites and applications.
- Use API operations to manage data sources and datasets.
• Refresh imported data more frequently by using the data ingestion API operations.
• Script, transfer, and make templates from analyses and dashboards by using API operations.
• Programmatically assign people to security roles based on settings managed by system administrators.

If you perform administrative functions in QuickSight, you can do the following and more:
• Manage security with shared folders to organize your teams' work and help them collaborate using dashboards, analytics, and datasets.
• Add QuickSight to your VPC to enable access to data in VPC and on-premises data sources.
• Protect sensitive data with finely grained access control to AWS data sources.
• Manually assign people to the QuickSight author security role so they can prepare datasets, design analytics, and publish data dashboards at a fixed cost per month.
• Manually assign people to the QuickSight reader security role so they can securely interact with published data dashboards on a pay-per-session basis.

If you subscribe to dashboards, you can do the following:
• Use and subscribe to interactive dashboards designed by your team of experts.
• Enjoy a simplified uncluttered interface.
• View dashboard snapshots in email.
• Focus on making decisions with the data at your fingertips.

After you connect to or import data, you create a dataset to shape and prepare data to share and reuse. You can view your available datasets on the Datasets page, which you reach by choosing Manage data on the Amazon QuickSight start page. You can view available data sources and create a new dataset on the Create a Data Set page, which you reach by choosing New data set on the Datasets page.

Topics
• Supported Data Sources (p. 69)
• Data Source Quotas (p. 72)
• Supported Data Types and Values (p. 73)
• Importing Data into SPICE (p. 78)
• Working with Data Sources in Amazon QuickSight (p. 88)
• Working with Datasets (p. 99)

Supported Data Sources

Amazon QuickSight supports a variety of data sources that you can use to provide data for analyses. The following data sources are supported.

Connecting to Relational Data

You can use any of the following relational data stores as data sources for Amazon QuickSight:
• Amazon Athena
• Amazon Aurora
• Amazon Elasticsearch Service 7.7 or later
• Amazon Redshift
• Amazon Redshift Spectrum
• Amazon S3
• Amazon S3 Analytics
• Apache Spark 2.0 or later
• AWS IoT Analytics
• MariaDB 10.0 or later
• Microsoft SQL Server 2012 or later
• MySQL 5.1 or later
• Oracle 19.7 (supports 12c) or later
• PostgreSQL 9.3.1 or later
• Presto 0.167 or later
• Snowflake
• Teradata 14.0 or later

Note
You can access additional data sources not listed here by linking or importing them through supported data sources.

Amazon Redshift clusters, Amazon Athena databases, and Amazon RDS instances must be in AWS. Other database instances must be in one of the following environments to be accessible from Amazon QuickSight:

• Amazon EC2
• Local (on-premises) databases
• Data in a data center or some other internet-accessible environment

For more information, see Infrastructure Security in Amazon QuickSight (p. 723).

Importing File Data

You can use files in Amazon S3 or on your local (on-premises) network as data sources. QuickSight supports files in the following formats:

• CSV and TSV – Comma-delimited and tab-delimited text files
• ELF and CLF – Extended and common log format files
• JSON – Flat or semi-structured data files
• XLSX – Microsoft Excel files

QuickSight supports UTF-8 file encoding, but not UTF-8 (with BOM).

Files in Amazon S3 that have been compressed with zip, or gzip (www.gzip.org), can be imported as-is. If you used another compression program for files in Amazon S3, or if the files are on your local network, remove compression before importing them.

JSON Data

Amazon QuickSight natively supports JSON flat files and JSON semi-structured data files.
You can either upload a JSON file or connect to your Amazon S3 bucket that contains JSON data. Amazon QuickSight automatically performs schema and type inference on JSON files and embedded JSON objects. Then it flattens the JSON, so you can analyze and visualize application-generated data.

Basic support for JSON flat-file data includes the following:

- Inferring the schema
- Determining data types
- Flattening the data
- Parsing JSON (JSON embedded objects) from flat files

Support for JSON file structures (.json) includes the following:

- JSON records with structures
- JSON records with root elements as arrays

You can also use the `parseJson` function to extract values from JSON objects in a text file. For example, if your CSV file has a JSON object embedded in one of the fields, you can extract a value from a specified key-value pair (KVP). For more information on how to do this, see `parseJson` (p. 504).

The following JSON features aren't supported:

- Reading JSON with a structure containing a list of records
- List attributes and list objects within a JSON record; these are skipped during import
- Customizing upload or configuration settings
- `parseJSON` functions for SQL and analyses
- Error messaging for invalid JSON
- Extracting a JSON object from a JSON structure
- Reading delimited JSON records

You can use the `parseJson` function to parse flat files during data preparation. This function extracts elements from valid JSON structures and lists.

The following JSON values are supported:

- JSON object
- String (double quoted)
- Number (integer and float)
- Boolean
- NULL

### Software as a Service (SaaS) Data

QuickSight can connect to a variety of Software as a Service (SaaS) data sources either by connecting directly or by using Open Authorization (OAuth).

SaaS sources that support direct connection include the following:

- Jira
SaaS sources that use OAuth require that you authorize the connection on the SaaS website. For this to work, QuickSight must be able to access the SaaS data source over the network. These sources include the following:

- Adobe Analytics
- GitHub
- Salesforce

You can use reports or objects in the following editions of Salesforce as data sources for Amazon QuickSight:

- Enterprise Edition
- Unlimited Edition
- Developer Edition
- Twitter (Twitter Standard Search API returns data for 7 days only)

To connect to on-premises data sources, you need to add your data sources and a QuickSight-specific network interface to Amazon Virtual Private Cloud (Amazon VPC). When configured properly, a VPC based on Amazon VPC resembles a traditional network that you operate in your own data center. It enables you to secure and isolate traffic between resources. You define and control the network elements to suit your requirements, while still getting the benefit of cloud networking and the scalable infrastructure of AWS.

For detailed information, see Infrastructure Security in Amazon QuickSight (p. 723).

Data Source Quotas

Data sources that you use with Amazon QuickSight must conform to the following quotas.

Topics
- SPICE Quotas for Imported Data (p. 72)
- Quotas for Direct SQL Queries (p. 73)

SPICE Quotas for Imported Data

When you create a new dataset in Amazon QuickSight, SPICE (p. 78) limits the number of rows you can add to a dataset. You can ingest data into SPICE from a query or from a file. Each file can have up to 2,047 columns. Each column name can have up to 127 Unicode characters. Each field can have up to 2,047 Unicode characters.

To retrieve a subset of data from a larger set, you can deselect columns or apply filters to reduce the size of the data. If you are importing from Amazon S3, each manifest can specify up to 1,000 files.

Quotas for SPICE are as follows:

- 2,047 Unicode characters for each field
- 127 Unicode characters for each column name
- 2,000 columns for each file
- 1,000 files for each manifest
• For Standard edition, 25 million (25,000,000) rows or 25 GB for each dataset
• For Enterprise edition, 250 million (250,000,000) rows or 500 GB for each dataset

In rare cases, if you’re ingesting large rows into SPICE, you might reach the quota for gigabytes per dataset before you reach the quota on rows. The size is based on the SPICE capacity the data occupies after ingestion into SPICE. You can calculate your capacity by using the formula described in Capacity Planning for SPICE Datasets (p. 79).

Quotas for Direct SQL Queries

If you aren’t importing data into SPICE, different quotas apply for space and time. For operations such as connecting, sampling data for a dataset, and generating visuals, timeouts can occur. In some cases, these are timeout quotas set by the source database engine. In other cases, such as visualizing, Amazon QuickSight generates a timeout after 2 minutes.

However, not all database drivers react to the 2-minute timeout, for example Amazon Redshift. In these cases, the query runs for as long as it takes for the response to return, which can result in long-running queries on your database. When this happens, you can cancel the query from the database server to free up database resources. Follow the instructions for your database server about how to do this. For example, for more information on how to cancel queries in Amazon Redshift, see Canceling a Query in Amazon Redshift, and Implementing Workload Management in Amazon Redshift in the Amazon Redshift Database Developer Guide.

Each result set from a direct query can have up to 2,000 columns. Each column name can have up to 127 Unicode characters. If you want to retrieve data from a larger table, you can use one of several methods to reduce the size of the data. You can deselect columns, or apply filters. In a SQL query, you can also use predicates, such as WHERE, HAVING. If your visuals time out during a direct query, you can simplify your query to optimize execution time or you can import the data into SPICE.

Quotas for queries are as follows:
• 127 Unicode characters for each column name.
• 2,000 columns for each dataset.
• 2-minute quota for generating a visual, or an optional dataset sample.
• Data source timeout quotas apply (varies for each database engine).

Supported Data Types and Values

Amazon QuickSight currently supports the following primitive data types: Date, Decimal, Integer, String. QuickSight accepts Boolean values by promoting them to integers. It can also derive geospatial data types. Geospatial data types use metadata to interpret the physical data type. Latitude and longitude are numeric. All other geospatial categories are strings.

Make sure that any table or file that you use as a data source contains only fields that can be implicitly converted to these data types. Amazon QuickSight skips any fields or columns that can't be converted. If you get an error that says "fields were skipped because they use unsupported data types", alter your query or table to remove or recast unsupported data types.

String and Text Data

Fields or columns that contain characters are called strings. A field with the data type of STRING can initially contain almost any type of data. Examples include names, descriptions, phone numbers,
account numbers, JSON data, cities, post codes, dates, and numbers that can be used to calculate. These types are sometimes called textual data in a general sense, but not in a technical sense. QuickSight doesn't support binary and character large objects (BLOBs) in dataset columns. In the QuickSight documentation, the term "text" always means "string data".

The first time you query or import the data, QuickSight tries to interpret the data that it identifies as other types, for example dates and numbers. It's a good idea to verify that the data types assigned to your fields or columns are correct.

For each string field in imported data, QuickSight uses a field length of 8 bytes plus the UTF-8 encoded character length. Amazon QuickSight supports UTF-8 file encoding, but not UTF-8 (with BOM).

**Numeric Data**

Numeric data includes integers and decimals. Integers with a data type of `INT` are negative or positive numbers that don't have a decimal place. QuickSight doesn't distinguish between large and small integers. Decimals with a data type of `DECIMAL` are negative or positive numbers that contain at least one decimal place, before or after the decimal point.

Truncation of data beyond the fourth decimal place to the right. QuickSight supports displaying of no more than four decimal places to the right of the decimal point. The full value is still used in all calculations, but it doesn't display.

The following rules apply:

- When you create or edit a dataset, you can use your data in its original state to create calculations on decimal data.
- When this data is imported into SPICE.

QuickSight enables you to create calculations that are based on `DECIMAL` data having more than four decimal places to the right of the decimal point. However, QuickSight can display no more than four decimal places to the right of the decimal point. The value is truncated, not rounded, when displayed in data preparation or analyses and when imported into SPICE. For example, 13.00049 is truncated to 13.0004.

As an example, take a decimal field with a value of $0.00006$, which displays in the user interface as $0.0$. The full value $0.00006$ is still used in all calculations. The following examples show how the true value functions in calculations:

- $\text{My-Decimal} > 0 = \text{true}$: The display value is $\text{true}$.
- $\text{ceil(My-Decimal)} = 1$: The display value is $1$.
- $\text{My-Decimal} + 0.00009 = 0.00015$: The display value is $0.0001$.
- $\text{My-Decimal} * 1.5 = 0.00009$: The display value is $0.0$.

For each `INT` and `DECIMAL` field in imported data, QuickSight uses a field length of 8 bytes. QuickSight supports UTF-8 file encoding, but not UTF-8 (with BOM).

**Date and Time Data**

Fields with a data type of `Date` also include time data, and are also known as `DateTime` fields. QuickSight supports dates and times that use supported data formats (p. 76).

QuickSight uses UTC time for querying, filtering, and displaying date data. When date data doesn't specify a time zone, QuickSight assumes UTC values. When date data does specify a time zone,
QuickSight converts it to display in UTC time. For example, a date field with a time zone offset like `2015-11-01T03:00:00-08:00` is converted to UTC and displayed in Amazon QuickSight as `2015-11-01T15:30:00`.

For each `DATE` field in imported data, QuickSight uses a field length of 8 bytes. QuickSight supports UTF-8 file encoding, but not UTF-8 (with BOM).

### Supported Data Types from Other Data Sources

The following table lists data types that are supported when using the following data sources with Amazon QuickSight.

<table>
<thead>
<tr>
<th>Database Engine or Source</th>
<th>Numeric Data Types</th>
<th>String Data Types</th>
<th>Datetime Data Types</th>
<th>Boolean Data Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Athena, Presto</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td></td>
<td>• timestamp</td>
<td></td>
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<tr>
<td></td>
<td>• double</td>
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<td></td>
<td>• integer</td>
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<td></td>
<td>• real</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>• smallint</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• tinyint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazon Aurora, MariaDB, and MySQL</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td></td>
<td>• datetime</td>
<td></td>
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<tr>
<td></td>
<td>• double</td>
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<td>• timestamp</td>
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<td></td>
<td>• int</td>
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<td>• integer</td>
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<td></td>
<td>• mediumint</td>
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<td></td>
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<td></td>
<td>• numeric</td>
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<td>• smallint</td>
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<td>• tinyint</td>
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<td></td>
<td>• char</td>
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<td>• enum</td>
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<td>• set</td>
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<td>• text</td>
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<tr>
<td></td>
<td>• varchar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oracle</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• bit</td>
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<tr>
<td></td>
<td>• decimal</td>
<td></td>
<td>• datetime</td>
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<td>• decimal</td>
<td></td>
<td>• datetime2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• int</td>
<td></td>
<td>• datatimeoffset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• money</td>
<td></td>
<td>• smalldatetime</td>
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<td></td>
<td>• numeric</td>
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</tr>
<tr>
<td></td>
<td>• real</td>
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<td></td>
<td>• smallint</td>
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<td></td>
<td>• smallmoney</td>
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<tr>
<td></td>
<td>• tinyint</td>
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<tr>
<td></td>
<td>• char</td>
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<tr>
<td></td>
<td>• nchar</td>
<td></td>
<td></td>
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<td></td>
<td>• nvarchar</td>
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<td></td>
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<tr>
<td></td>
<td>• text</td>
<td></td>
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<tr>
<td></td>
<td>• varchar</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>• varying character</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>PostgreSQL</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
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<td>• timestamp</td>
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<td>• double</td>
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<td>• integer</td>
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<td></td>
<td>• numeric</td>
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<td></td>
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</tr>
</tbody>
</table>
### Supported Data Types from Other Data Sources

<table>
<thead>
<tr>
<th>Database Engine or Source</th>
<th>Numeric Data Types</th>
<th>String Data Types</th>
<th>Datetime Data Types</th>
<th>Boolean Data Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• precision</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• real</td>
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<tr>
<td></td>
<td>• smallint</td>
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<td></td>
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</tr>
<tr>
<td>Apache Spark</td>
<td>• bigint</td>
<td>• varchar</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td></td>
<td>• timestamp</td>
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<td>• double</td>
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<td></td>
<td>• tinyint</td>
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<td></td>
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</tr>
<tr>
<td>Snowflake</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• byteint</td>
<td>• character</td>
<td>• datetime</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td>• string</td>
<td>• time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• double</td>
<td>• text</td>
<td>• timestamp</td>
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<td></td>
<td>• doubleprecision</td>
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<td>• timestamp</td>
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</tr>
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<td></td>
<td>• float</td>
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<td></td>
<td>• float4</td>
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<td>• float8</td>
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<tr>
<td></td>
<td>• tinyint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsoft SQL Server</td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• bit</td>
</tr>
<tr>
<td></td>
<td>• bit</td>
<td>• nchar</td>
<td>• datetime</td>
<td></td>
</tr>
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<td></td>
<td>• decimal</td>
<td>• nvarchar</td>
<td>• datetime2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• int</td>
<td>• text</td>
<td>• smalldatetime</td>
<td></td>
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<tr>
<td></td>
<td>• money</td>
<td>• varchar</td>
<td></td>
<td></td>
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<td>• numeric</td>
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<td>• smallmoney</td>
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<tr>
<td></td>
<td>• tinyint</td>
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</tr>
</tbody>
</table>

### Supported Date Formats

Amazon QuickSight supports the date and time formats described in this section. Before you add data to Amazon QuickSight, check if your date format is compatible. If you need to use an unsupported format, see Using Unsupported or Custom Dates (p. 146).

The supported formats vary depending on the data source type, as follows:
<table>
<thead>
<tr>
<th>Data Source</th>
<th>Clocks</th>
<th>Date Formats</th>
</tr>
</thead>
<tbody>
<tr>
<td>File uploads</td>
<td>Both 24-hour and 12-hour clocks</td>
<td>Supported date and time formats are described in the Joda API documentation.</td>
</tr>
<tr>
<td>Amazon S3 sources</td>
<td></td>
<td>For a complete list of Joda date formats, see Class DateTimeFormat on the Joda website.</td>
</tr>
<tr>
<td>Athena</td>
<td></td>
<td>For datasets stored in memory (SPICE), Amazon QuickSight supports dates in the following range: Jan 1, 1400 00:00:00 UTC through Dec 31, 9999, 23:59:59 UTC.</td>
</tr>
<tr>
<td>Salesforce</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relational databases sources</th>
<th>24-hour clock only</th>
<th>The following data and time formats:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1. dd/MM/yyyy HH:mm:ss, for example 31/12/2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. dd/MM/yyyy, for example 31/12/2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. dd/MMM/yyyy HH:mm:ss, for example 31/DEC/2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. dd/MMM/yyyy, for example 31/DEC/2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. dd–MMM–yyyy HH:mm:ss, for example 31–DEC–2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. dd–MM–yyyy HH:mm:ss, for example 31-12-2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. dd–MM–yyyy, for example 31-12-2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. MM/dd/yyyy HH:mm:ss, for example 12/31/2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10MM/dd/yyyy, for example 12/31/2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11MM–dd–yyyy HH:mm:ss, for example 12-31-2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12MM–dd–yyyy, for example 12-31-2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13MMM/dd/yyyy HH:mm:ss, for example DEC/31/2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14MMM/dd/yyyy, for example DEC/31/2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15MMM–dd–yyyy HH:mm:ss, for example DEC-31-2016 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16MMM–dd–yyyy, for example DEC-31-2016.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17yyyy/MM/dd HH:mm:ss, for example 2016/12/31 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18yyyy/MM/dd, for example 2016/12/31.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19yyyy/MMM/dd HH:mm:ss, for example 2016/DEC/31 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20yyyy/MMM/dd, for example 2016/DEC/31.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21yyyy–MM–dd HH:mm:ss, for example 2016-12-31 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22yyyy–MM–dd, for example 2016-12-31.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23yyyy–MMM–dd HH:mm:ss, for example 2016-DEC-31 15:30:00.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24yyyy–MMM–dd, for example 2016-DEC-31.</td>
</tr>
</tbody>
</table>
### UnSupported Values in Data

If a field contains values that don't conform with the data type that Amazon QuickSight assigns to the field, the rows containing those values are skipped. For example, take the following source data.

<table>
<thead>
<tr>
<th>Sales ID</th>
<th>Sales Date</th>
<th>Sales Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>10/14/2015</td>
<td>12.43</td>
</tr>
<tr>
<td>002</td>
<td>5/3/2012</td>
<td>25.00</td>
</tr>
<tr>
<td>003</td>
<td>Unknown</td>
<td>18.17</td>
</tr>
<tr>
<td>004</td>
<td>3/8/2009</td>
<td>86.02</td>
</tr>
</tbody>
</table>

Amazon QuickSight interprets **Sales Date** as a date field and drops the row containing a nondate value, so only the following rows are imported.

<table>
<thead>
<tr>
<th>Sales ID</th>
<th>Sales Date</th>
<th>Sales Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>10/14/2015</td>
<td>12.43</td>
</tr>
<tr>
<td>002</td>
<td>5/3/2012</td>
<td>25.00</td>
</tr>
<tr>
<td>004</td>
<td>3/8/2009</td>
<td>86.02</td>
</tr>
</tbody>
</table>

In some cases, a database field might contain values that the JDBC driver can't interpret for the source database engine. In such cases, the uninterpretable values are replaced by null so that the rows can be imported. The only known occurrence of this issue is with MySQL date, datetime, and timestamp fields that have all-zero values, for example `0000-00-00 00:00:00`. For example, take the following source data.

<table>
<thead>
<tr>
<th>Sales ID</th>
<th>Sales Date</th>
<th>Sales Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>2004-10-12 09:14:27</td>
<td>12.43</td>
</tr>
<tr>
<td>002</td>
<td>2012-04-07 12:59:03</td>
<td>25.00</td>
</tr>
<tr>
<td>003</td>
<td>0000-00-00 00:00:00</td>
<td>18.17</td>
</tr>
<tr>
<td>004</td>
<td>2015-09-30 01:41:19</td>
<td>86.02</td>
</tr>
</tbody>
</table>

In this case, the following data is imported.

<table>
<thead>
<tr>
<th>Sales ID</th>
<th>Sales Date</th>
<th>Sales Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>2004-10-12 09:14:27</td>
<td>12.43</td>
</tr>
<tr>
<td>002</td>
<td>2012-04-07 12:59:03</td>
<td>25.00</td>
</tr>
<tr>
<td>003</td>
<td>(null)</td>
<td>18.17</td>
</tr>
<tr>
<td>004</td>
<td>2015-09-30 01:41:19</td>
<td>86.02</td>
</tr>
</tbody>
</table>

### Importing Data into SPICE

When you import data into a dataset rather than using a direct SQL query, it becomes **SPICE data** because of how it's stored. **SPICE** is the Amazon QuickSight **Super-fast, Parallel, In-memory Calculation**
Engine. It's engineered to rapidly perform advanced calculations and serve data. In Enterprise edition, data stored in SPICE is encrypted at rest.

When you create or edit a dataset, you choose to use either SPICE or a direct query, unless the dataset contains uploaded files. Importing (also called ingesting) your data into SPICE can save time and money:

- Your analytical queries process faster.
- You don't need to wait for a direct query to process.
- Data stored in SPICE can be reused multiple times without incurring additional costs. If you use a data source that charges per query, you're charged for querying the data when you first create the dataset and later when you refresh the dataset.

SPICE capacity is allocated separately for each AWS Region. Default SPICE capacity is automatically allocated to your home AWS Region. For each AWS account, SPICE capacity is shared by all the people using QuickSight in a single AWS Region. The other AWS Regions have no SPICE capacity unless you choose to purchase some. QuickSight administrators can view how much SPICE capacity you have in each AWS Region and how much of it is currently in use. A QuickSight administrator can purchase more SPICE capacity or release unused SPICE capacity as needed. For more information, see Managing SPICE Capacity (p. 629).

Topics
- Capacity Planning for SPICE Datasets (p. 79)
- Refreshing Data (p. 80)
- View SPICE Ingestion History (p. 82)
- Troubleshooting Skipped Row Errors (p. 83)
- SPICE Ingestion Error Codes (p. 85)

Capacity Planning for SPICE Datasets

The amount of SPICE capacity a dataset uses isn't the same as the size of its source file or table. The logical size computation occurs after all the data type transformations and calculated columns you define during data preparation. These fields are materialized in SPICE in a way that enhances query performance. Any changes you make in an analysis have no effect on the logical size of the data in SPICE. Only changes that are saved in the dataset apply to SPICE capacity.

In capacity planning for SPICE, consider what data types you plan to define in the dataset. For example, the file you want to import might contain all strings (text). But for these to be used in a meaningful way in an analysis, you prepare the data by changing the data types to their proper form. For example, fields containing prices are changed from strings to decimals, and fields containing dates are changed from strings to dates. If you create a calculation to make the conversion, you can remove the original field from the dataset and substitute the formatted calculated field. In that case, you don't need to include the size of the original field in your capacity planning. Only included fields are stored in SPICE.

Note
Geospatial data types use metadata to interpret the physical data type. Latitude and longitude are numeric. All other geospatial categories are strings.

To calculate how much SPICE capacity your dataset needs, multiply the number of rows by the number of bytes SPICE uses per row. Currently, SPICE needs 8 bytes per field for decimal, int, and date fields. For each string field (text), SPICE needs 8 bytes plus the UTF-8 encoded character length. The formula looks like the following:

\[
\text{Total logical row size in bytes} = (\text{Number of Numeric Fields} \times 8 \text{ bytes per field} + \text{Number of String Fields} \times 8 + \text{UTF-8 encoded character length})
\]
Refreshing Data

When refreshing data, Amazon QuickSight handles datasets differently depending on the connection properties and the storage location of the data. If QuickSight connects to the data store by using a direct query, the data automatically refreshes when you open an associated dataset, analysis, or dashboard. To refresh SPICE datasets, QuickSight must independently authenticate using stored credentials to connect to the data. QuickSight can't refresh manually uploaded data—even from S3 buckets, even though it's stored in SPICE—because QuickSight doesn't store its connection and location metadata. If you want to automatically refresh data that's stored in an S3 bucket, create a dataset by using the S3 data source card.

For files that you manually uploaded to SPICE, you refresh these manually by importing the file again. If you want to reuse the name of the original dataset for the new file, first rename or delete the original dataset, then give the preferred name to the new dataset. Also, check that the field names are the same name and data type. Open your analysis, and replace the original dataset with the new dataset. For more information, see Replacing Datasets (p. 185).

You can refresh your SPICE (p. 78) datasets at any time. Refreshing imports the data into SPICE again, so the data includes any changes since the last import.

You can refresh SPICE data by using any of the following approaches:

- You can use the options on Datasets page.
- You can refresh a dataset while editing a dataset.
- You can schedule refreshes in the dataset settings.
- You can use the CreateIngestion API operation to refresh the data.

When you create or edit a SPICE dataset, you can enable email notifications about data loading status. This option notifies the owners of the dataset if the data fails to load or refresh. To turn on notifications, select the Email owners when a refresh fails option that appears on the Finish data set creation screen. This option isn't available for datasets that you create by using Upload a File on the datasets page.

In the following sections, you can find an explanation of different approaches to refreshing data.
Refreshing a Dataset

Use the following procedure to refresh a SPICE (p. 78) dataset based on an Amazon S3 or database data source on the Datasets page.

To refresh SPICE data from the Datasets page

1. On the Datasets page, choose the dataset, and then choose Refresh Now.
2. Keep the refresh type as Full refresh.
3. If you are refreshing an Amazon S3 dataset, choose one of the following options for S3 Manifest:
   - To use the same manifest file you last provided to Amazon QuickSight, choose Existing Manifest. If you have changed the manifest file at the file location or URL that you last provided, the data returned reflects those changes.
   - To specify a new manifest file by uploading it from your local network, choose Upload Manifest, and then choose Upload manifest file. For Open, choose a file, and then choose Open.
   - To specify a new manifest file by providing a URL, enter the URL of the manifest in Input manifest URL. You can find the manifest file URL in the Amazon S3 console by opening the context (right-click) menu for the manifest file, choosing Properties, and looking at the Link box.
5. If you are refreshing an Amazon S3 dataset, choose OK, then OK again.
   If you are refreshing a database dataset, choose OK.

Refreshing a Dataset During Data Preparation

Use the following procedure to refresh a SPICE (p. 78) dataset based on an Amazon S3 or database data source during data preparation.

To refresh SPICE data during data preparation

1. On the Datasets page, choose the dataset, and then choose Edit Data Set.
2. On the dataset screen, choose Refresh now.
3. Keep the refresh type set to Full refresh.
4. (Optional) If you are refreshing an Amazon S3 dataset, choose one of the following options for S3 Manifest:
   - To use the same manifest file you last provided to Amazon QuickSight, choose Existing Manifest. If you have changed the manifest file at the file location or URL that you last provided, the data returned reflects those changes.
   - To specify a new manifest file by uploading it from your local network, choose Upload Manifest, and then choose Upload manifest file. For Open, choose a file, and then choose Open.
   - To specify a new manifest file by providing a URL, enter the URL of the manifest in Input manifest URL. You can find the manifest file URL in the Amazon S3 console by opening the context (right-click) menu for the manifest file, choosing Properties, and looking at the Link box.
5. Choose Refresh.
6. If you are refreshing an Amazon S3 dataset, choose OK, then OK again.
   If you are refreshing a database dataset, choose OK.

**Refreshing a Dataset on a Schedule**

Use the following procedure to schedule refreshing the data. If your dataset is based on a direct query and not stored in SPICE (p. 78), you can refresh your data by opening the dataset. You can also refresh your data by refreshing the page in an analysis or dashboard.

**To refresh SPICE (p. 78) data on a schedule**

1. On the Datasets page, choose the dataset, and then choose Schedule refresh.
2. For Schedule Refresh, choose Create.
3. On the Create a Schedule screen, choose settings for your schedule.
   a. For Time zone, choose the time zone that applies to the data refresh.
   b. For Repeats, choose one of the following:
      • For Standard or Enterprise editions, you can choose Daily, Weekly, or Monthly.
      • Daily: Repeats every day.
      • Weekly: Repeats on the same day of each week.
      • Monthly: Repeats on the same day number of each month. To refresh data on the 29th, 30th or 31st day of the month, choose Last day of month from the list.
      • For Enterprise edition only, you can choose Hourly. This setting refreshes your dataset every hour, beginning at the time you choose. So, if you select 1:05 as the starting time, the data refreshes at five minutes after the hour, every hour.
        If you decide to use an hourly refresh, you can't also use additional refresh schedules. To create an hourly schedule, remove any other existing schedules for that dataset. Also, remove any existing hourly schedule before you create a daily, weekly, or monthly schedule.
   c. For Starting, choose a date for the refresh to start.
   d. For At, specify the time that the refresh should start. Use HH:MM and 24-hour format, for example 13:30.
4. Choose Create.

Using the Amazon QuickSight console, you can create five schedules for each dataset. When you have created five, the Create button is disabled.

**View SPICE Ingestion History**

You can view the ingestion history for SPICE datasets to find out, for example, when the latest ingestion started and what its status is.

The SPICE ingestion history page includes the following information:

- Date and time that the ingestion started (UTC)
- Status of the ingestion
- Amount of time that the ingestion took
- Rows skipped and rows ingested (imported) successfully
- The job type for the refresh: scheduled, full refresh, and so on
Use the following procedure to view a dataset's SPICE ingestion history.

To view a dataset's SPICE ingestion history
1. On the start screen, choose Manage Data.
2. Choose the dataset that you want to examine. Then choose View history, located just under the Last refreshed status.
3. (Optional) Choose a time frame to filter the entries from the last hour to the last 90 days.
4. (Optional) Choose a specific job status to filter the entries, for example Running or Completed. Otherwise, you can view all entries by choosing All.
5. To exit this screen, choose Back.

Troubleshooting Skipped Row Errors

When you import data, Amazon QuickSight previews a portion of your data. If it can't interpret a row for any reason, it skips this row.

Fortunately, there's a limited number of things that can go wrong. Some issues can be avoided by being aware of examples like the following:

- Make sure that there is no inconsistency between the field data type and the field data, for example occasional string data in a field with a numeric data type. Here are a few examples that can be difficult to detect when scanning the contents of a table:
  - '' – Using an empty string to indicate a missing value
  - 'NULL' – Using the word "null" to indicate a missing value
  - "$1000 – Including a dollar sign in a currency value turns it into a string
  - 'O'Brien' – Using punctuation to mark a string that itself contains the same punctuation.

However, this type of error isn't always this easy to find, especially if you have a lot of data, or if your data is typed in by hand. For example, some customer service or sales applications involve entering information verbally provided by customers. The person who originally typed in the data might have put it in the wrong field. They might add, or forget to add, a character or digit. For example, they might enter a date of "0/10/12020" or enter someone's gender in a field meant for age.

- Make sure that your imported file is correctly processed with or without a header. If there is a header row, make sure that you choose the Contains header upload option.
- Make sure that the data doesn't exceed one or more of the Data Source Quotas (p. 72).
- Make sure that the data is compatible with the Supported Data Types and Values (p. 73).
- Make sure that your calculated fields contain data that works with the calculation, rather than being incompatible with or excluded by the function in the calculated field. For example, if you have a calculated field in your dataset that uses parseDate (p. 499), QuickSight skips rows where that field doesn't contain a valid date.

QuickSight provides a detailed list of the errors that occur when the SPICE engine attempts to ingest data. When a saved dataset reports skipped rows, you can view the errors so you can take action to fix the issues.

To view errors for rows that were skipped during SPICE ingestion (data import)
1. On the Datasets page, choose the problematic dataset to view its information and settings.
2. Choose View error summary. This link is located under the dataset import information and the number of rows skipped.
3. Examine the **File import log** that opens. It displays the following sections:
   - **Summary** – Provides a percentage score of how many rows were skipped out of the total number of rows in the import. For example, if there are 864 rows skipped out of a total of 1,728, the score is 50.00%.
   - **Skipped Rows** – Provides the row count, field name, and error message for each set of similar skipped rows.
   - **Troubleshooting** – Provides a link to download a file that contains error information.

4. Under **Troubleshooting**, choose **Download error rows file**.

   The error file has a row for each error. The file is named `error-report_123_fe8.csv`, where `123_fe8` is replaced with a unique identifying string. The file contains the following columns:
   - **ERROR_TYPE** – The type or error code for the error that occurred when importing this row. You can look up this error in the SPICE Ingestion Error Codes (p. 85) section that follows this procedure.
   - **COLUMN_NAME** – The name of the column in your data that caused the error.
   - **All the columns from your imported row** – The remaining columns duplicate the entire row of data. If a row has more than one error, it can appear multiple times in this file.

5. Choose **Edit data set** to make changes to your dataset. You can filter the data, omit fields, change data types, adjust existing calculated fields, and add calculated fields that validate the data.

6. After you've made changes indicated by the error codes, import the data again. If more SPICE ingestion errors appear in the log, step through this procedure again to fix all remaining errors.

**Tip**

If you can't solve the data issues in a reasonable amount of time by using the dataset editor, consult the administrators or developers who own the data. In the long run, it's more cost-effective to cleanse the data closer to its source, rather than adding exception processing while you're preparing the data for analysis. By fixing it at the source, you avoid a situation where multiple people fix the errors in different ways, resulting in different reporting results later on.

**To practice troubleshooting skipped rows**

1. Download **CSV files for troubleshooting skipped rows.zip**.
2. Extract the files into a folder that you can use to upload the sample .csv file into QuickSight.

   The zip file contains the following two text files:
3. Import the data by following these steps:
   a. Choose **Datasets, New dataset**.
   b. Choose **Upload a file**.
   c. Find and choose the file named *sample dataset - data ingestion error.csv*.
   d. Choose **Upload a file, Edit settings and prepare data**.
   e. Choose **Save** to exit.

4. Choose your dataset to view its information, then choose **View error summary**. Examine the errors and the data to help you resolve the issues.

**SPICE Ingestion Error Codes**

The following list of errors codes and descriptions can help you understand and troubleshoot issues with data ingestion into SPICE.

**Topics**
- Error Codes for Skipped Rows (p. 85)
- Error Codes during Data Import (p. 86)

**Error Codes for Skipped Rows**

The following list of errors codes and descriptions can help you understand and troubleshoot issues with skipped rows.

- **ARITHMETIC_EXCEPTION** – An arithmetic exception occurred while processing a value.
- **ENCODING_EXCEPTION** – An unknown exception occurred while converting and encoding data to SPICE.
- **ELASTICSEARCH_CURSOR_NOT_ENABLED** – The Elasticsearch domain doesn't have SQL cursors enabled ("opendistro.sql.cursor.enabled" : "true"). For more information, see Authorizing Connections to Amazon Elasticsearch (p. 663).
- **INCORRECT_FIELD_COUNT** – One or more rows have too many fields. Make sure that the number of fields in each row matches the number of fields defined in the schema.
- **INCORRECT_SAGEMAKER_OUTPUT_FIELD_COUNT** – The SageMaker output has an unexpected number of fields.
- **INDEX_OUT_OF_BOUNDS** – The system requested an index that isn't valid for the array or list being processed.
- **MALFORMED_DATE** – A value in a field can't be transformed to a valid date. For example, if you try to convert a field that contains a value like "sale date" or "month-1", the action generates a malformed date error. To fix this error, remove nondate values from your data source. Check that you aren't importing a file with a column header mixed into the data. If your string contains a date or time that doesn't convert, see Using Unsupported or Custom Dates (p. 146).
- **MISSING_SAGEMAKER_OUTPUT_FIELD** – A field in the SageMaker output is unexpectedly empty.
NUMBER_BITWIDTH_TOO_LARGE – A numeric value exceeds the length supported in SPICE. For example, your numeric value has more than 19 digits, which is the length of a bigint data type. For a long numeric sequence that isn’t a mathematical value, use a string data type.

NUMBER_PARSE_FAILURE – A value in a numeric field is not a number. For example, a field with a data type of int contains a string or a float.

SAGEMAKER_OUTPUT_COLUMN_TYPE_MISMATCH – The data type defined in the SageMaker schema doesn’t match the data type received from SageMaker.

STRING_TRUNCATION – A string is being truncated by SPICE. Strings are truncated where the length of the string exceeds the SPICE quota. For more information about SPICE, see Importing Data into SPICE (p. 78). For more information about quotas, see Service Quotas.

UNDEFINED – An unknown error occurred while ingesting data.

UNSUPPORTED_DATE_VALUE – A date field contains a date that is in a supported format but is not in the supported range of dates, for example "12/31/1399" or "01/01/10000". For more information, see Using Unsupported or Custom Dates (p. 146).

Error Codes during Data Import

For imports and data refresh jobs that fail, QuickSight provides an error code indicating what caused the failure. The following list of errors codes and descriptions can help you understand and troubleshoot issues with data ingestion into SPICE.

ACCOUNT_CAPACITY_LIMIT_EXCEEDED – This data exceeds your current SPICE capacity. Purchase more SPICE capacity or clean up existing SPICE data and then retry this ingestion.

CONNECTION_FAILURE – Amazon QuickSight can't connect to your data source. Check the data source connection settings and try again.

CUSTOMER_ERROR – There was a problem parsing the data. If this persists, contact Amazon QuickSight technical support.

DATA_SET_DELETED – The data source or dataset was deleted or became unavailable during ingestion.

DATA_SET_SIZE_LIMIT_EXCEEDED – This dataset exceeds the maximum allowable SPICE dataset size. Use filters to reduce the dataset size and try again. For information on SPICE quotas, see Data Source Quotas (p. 72).

DATA_SOURCE_AUTH_FAILED – Data source authentication failed. Check your credentials and use the Edit data source option to replace expired credentials.

DATA_SOURCE_CONNECTION_FAILED – Data source connection failed. Check the URL and try again. If this error persists, contact your data source administrator for assistance.

DATA_SOURCE_NOT_FOUND – No data source found. Check your Amazon QuickSight data sources.

DATA_TOLERANCE_EXCEPTION – There are too many invalid rows. Amazon QuickSight has reached the quota of rows that it can skip and still continue ingesting. Check your data and try again.

FAILURE_TO_ASSUME_ROLE – Amazon QuickSight couldn't assume the correct AWS Identity and Access Management (IAM) role. Verify the policies for Amazon QuickSight-service-role in the IAM console.

FAILURE_TO_PROCESS_JSON_FILE – Amazon QuickSight couldn't parse a manifest file as valid JSON.

IAM_ROLE_NOT_AVAILABLE – Amazon QuickSight doesn't have permission to access the data source. To manage Amazon QuickSight permissions on AWS resources, go to the Security and Permissions page under the Manage Amazon QuickSight option as an administrator.

INGESTION_CANCELED – The ingestion was canceled by the user.
INGESTION_SUPERSEDED – This ingestion has been superseded by another workflow.

INTERNAL_SERVICE_ERROR – An internal service error occurred.

INVALID_DATA_SOURCE_CONFIG – Invalid values appeared in connection settings. Check your connection details and try again.

INVALID_DATAPREP_SYNTAX – Your calculated field expression contains invalid syntax. Correct the syntax and try again.

INVALID_DATE_FORMAT – An invalid date format appeared.

IOT_DATA_SET_FILE_EMPTY – No AWS IoT Analytics data was found. Check your account and try again.

IOT_FILE_NOT_FOUND – An indicated AWS IoT Analytics file wasn’t found. Check your account and try again.

OAUTH_TOKEN_FAILURE – Credentials to the data source have expired. Renew your credentials and retry this ingestion.

PASSWORD_AUTHENTICATION_FAILURE – Incorrect credentials appeared for a data source. Update your data source credentials and retry this ingestion.

PERMISSION_DENIED – Access to the requested resources was denied by the data source. Request permissions from your database administrator or ensure proper permission has been granted to Amazon QuickSight before retrying.

QUERY_TIMEOUT – A query to the data source timed out waiting for a response. Check your data source logs and try again.

ROW_SIZE_LIMIT_EXCEEDED – The row size quota exceeded the maximum.

S3_FILE_INACCESSIBLE – Couldn’t connect to an S3 bucket. Make sure that you grant Amazon QuickSight and users necessary permissions before you connect to the S3 bucket.

S3_MANIFEST_ERROR – Couldn’t connect to S3 data. Make sure that your S3 manifest file is valid. Also verify access to the S3 data. Both Amazon QuickSight and the Amazon QuickSight user need permissions to connect to the S3 data.

S3_UPLOADED_FILE_DELETED – The file or files for the ingestion were deleted (between ingestions). Check your S3 bucket and try again.

SOURCE_API_LIMIT_EXCEEDED_FAILURE – This ingestion exceeds the API quota for this data source. Contact your data source administrator for assistance.

SOURCE_RESOURCE_LIMIT_EXCEEDED – A SQL query exceeds the resource quota of the data source. Examples of resources involved can include the concurrent query quota, the connection quota, and physical server resources. Contact your data source administrator for assistance.

SPICE_TABLE_NOT_FOUND – An Amazon QuickSight data source or dataset was deleted or became unavailable during ingestion. Check your dataset in Amazon QuickSight and try again. For more information, see Troubleshooting Skipped Row Errors (p. 83).

SQL_EXCEPTION – A general SQL error occurred. This error can be caused by query timeouts, resource constraints, unexpected data definition language (DDL) changes before or during a query, and other database errors. Check your database settings and your query, and try again.

SQL_INVALID_PARAMETER_VALUE – An invalid SQL parameter appeared. Check your SQL and try again.

SQL_NUMERIC_OVERFLOW – Amazon QuickSight encountered an out-of-range numeric exception. Check related values and calculated columns for overflows, and try again.

SQL_SCHEMA_MISMATCH_ERROR – The data source schema doesn’t match the Amazon QuickSight dataset. Update your Amazon QuickSight dataset definition.
SQL_TABLE_NOT_FOUND – Amazon QuickSight can’t find the table in the data source. Verify the table specified in the dataset or custom SQL and try again.

SSL_CERTIFICATE_VALIDATION_FAILURE – Amazon QuickSight can’t validate the Secure Sockets Layer (SSL) certificate on your database server. Check the SSL status on that server with your database administrator and try again.

UNRESOLVABLE_HOST – Amazon QuickSight can’t resolve the host name of the data source. Verify the host name of the data source and try again.

UNROUTABLE_HOST – Amazon QuickSight can’t reach your data source because it’s inside a private network. Ensure that your private VPC connection is configured correctly in Enterprise Edition, or allow Amazon QuickSight IP address ranges to allow connectivity for Standard Edition.

Working with Data Sources in Amazon QuickSight

Use a data source to access an external data store. Amazon S3 data sources save the manifest file information. In contrast, Salesforce and database data sources save connection information like credentials. In such cases, you can easily create multiple datasets from the data store without having to re-enter information. Connection information isn’t saved for text or Microsoft Excel files.

Topics
- Creating a Data Source (p. 88)
- Editing a Data Source (p. 98)
- Deleting a Data Source (p. 99)

Creating a Data Source

Intended audience: Amazon QuickSight authors

As an analysis author in Amazon QuickSight, you don’t need to understand anything about the infrastructure that you use to connect to your data. You set up a new data source only once.

After a data source is set up, you can access it from its tile in the Amazon QuickSight console. You can use it to create one or more datasets. After a dataset is set up, you can also access the dataset from its tile. By abstracting away the technical details, Amazon QuickSight simplifies data connections.

Note
You don’t need to store connection settings for files that you plan to upload manually. For more information about file uploads, see Creating Datasets (p. 99).

Before you begin adding a new data-source connection profile to Amazon QuickSight, first collect the information that you need to connect to the data source. In some cases, you might plan to copy and paste settings from a file. If so, make sure that the file doesn’t contain formatting characters (list bullets or numbers) or blank space characters (spaces, tabs). Also make sure that the file doesn’t contain non-text “gremlin” characters such as non-ASCII, null (ASCII 0), and control characters.

The following list includes the information to collect the most commonly used settings:

- The data source to connect to.

Make sure that you know which source that you need to connect to for reporting. This source might be different than the source that stores, processes, or provides access to the data.
For example, let’s say that you’re a new analyst in a large company. You want to analyze data from your ordering system, which you know uses Oracle. However, you can’t directly query the online transaction processing (OLTP) data. A subset of data is extracted and stored in a bucket on Amazon S3, but you don’t have access to that either. Your new co-workers explain that they use AWS Glue crawlers to read the files and AWS Lake Formation to access them. With more research, you learn that you need to use an Amazon Athena query as your data source in Amazon QuickSight. The point here is that it isn’t always obvious which type of data source to choose.

• A descriptive name for the new data source tile.

Each new data source connection needs a unique and descriptive name. This name displays on the Amazon QuickSight list of existing data sources, which is at the bottom of the Create a Data Set screen. Use a name that makes it easy to distinguish your data sources from other similar data sources. Your new Amazon QuickSight data source profile displays both the database software logo and the custom name that you assign.

• The name of the server or instance to connect to.

A unique name or other identifier identifies the server connector of the data source on your network. The descriptors vary depending on which one you’re connecting to, but it’s usually one or more of the following:
  • Hostname
  • IP address
  • Cluster ID
  • Instance ID
  • Connector
  • Site-based URL

• The name of the collection of data that you want to use.

The descriptor varies depending on the data source, but it’s usually one of the following:
  • Database
  • Warehouse
  • S3 bucket
  • Catalog
  • Schema

In some cases, you might need to include a manifest file or a query.

• The user name that you want Amazon QuickSight to use.

Every time Amazon QuickSight connects using this data source profile (tile), it uses the user name from the connection settings. In some cases, this might be your personal login. But if you’re going to share this with other people, ask the system administrator about creating credentials to use for Amazon QuickSight connections.

• What type of connection to use. You can choose a public network or a VPC connection. If you have more than one VPC connection available, identify which one to use to reach your source of data.

• Additional settings, such as Secure Sockets Layer (SSL) or API tokens, are required by some data sources.

After you save the connection settings as a data source profile, you can create a dataset by selecting its tile. The connections are stored as data source connection profiles in Amazon QuickSight.

To view your existing connection profiles, open the Amazon QuickSight start page, choose Datasets, choose New Dataset, and then scroll to the heading FROM EXISTING DATA SOURCES.

For more information, see the following topics:
Creating a Data Source and Data Set from SaaS Sources

To analyze and report on data from software as a service (SaaS) applications, you can use SaaS connectors to access your data directly from Amazon QuickSight. The SaaS connectors simplify accessing third-party application sources using OAuth, without any need to export the data to an intermediate data store.

You can use either a cloud-based or server-based instance of a SaaS application. To connect to an SaaS application that is running on your corporate network, make sure that Amazon QuickSight can access the application’s Domain Name System (DNS) name over the network. If Amazon QuickSight can’t access the SaaS application, it generates an unknown host error.

Here are examples of some ways that you can use SaaS data:

- Engineering teams who use Jira to track issues and bugs can report on developer efficiency and bug burndown.
- Marketing organizations can integrate Amazon QuickSight with Adobe Analytics to build consolidated dashboards to visualize their online and web marketing data.
- Teams using social media can access Twitter data to analyze and understand their customers’ sentiment.

Use the following procedure to create a data source and dataset by connecting to sources available through Software as a Service (SaaS). In this procedure, we use a connection to GitHub as an example. Other SaaS data sources follow the same process, although the screens—especially the SaaS screens—might look different.

To create a data source and dataset by connecting to sources through SaaS

1. On the Amazon QuickSight start page, choose **Datasets**.
2. On the **Datasets** page, choose **New dataset**.
3. In the **FROM NEW DATA SOURCES** section of the **Create a Data Set** page, choose the icon that represents the SaaS source that you want to use. For example, you might choose Adobe Analytics or GitHub.

   For sources using OAuth, the connector takes you to the SaaS site to authorize the connection before you can create the data source.

4. Choose a name for the data source, and enter that. If there are more screen prompts, enter the appropriate information. Then choose **Create data source**.
5. If you are prompted to do so, enter your credentials on the SaaS login page.
6. When prompted, authorize the connection between your SaaS data source and Amazon QuickSight.

The following example shows the authorization for Amazon QuickSight to access the GitHub account for the Amazon QuickSight documentation.
Creating a Data Source

1. After authorization is complete, choose a table or object to connect to. Then choose Select.
2. On the Finish data set creation screen, choose one of these options:
   - To save the data source and dataset, choose Edit/Preview data. Then choose Save from the top menu bar.
   - To create a dataset and an analysis using the data as-is, choose Visualize. This option automatically saves the data source and the dataset.
   You can also choose Edit/Preview data to prepare the data before creating an analysis. This opens the data preparation screen. For more information about data preparation, see Preparing Datasets (p. 126).

The following constraints apply:
- The SaaS source must support REST API operations for Amazon QuickSight to connect to it.
- If you are connecting to Jira, the URL must be public address.
- If you are connecting to Twitter, the Twitter standard search API returns data for the previous seven days only. In other words, no tweets are found for a date older than one week.
- If you don't have enough SPICE (p. 78) capacity, choose Edit/Preview data. In the data preparation screen, you can remove fields from the dataset to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see Preparing Datasets (p. 126).

Creating a Data Source Using Presto

Presto (or PrestoDB) is an open-source, distributed SQL query engine, designed for fast analytic queries against data of any size. It supports both nonrelational and relational data sources. Supported nonrelational data sources include the Hadoop Distributed File System (HDFS), Amazon S3, Cassandra, MongoDB, and HBase. Supported relational data sources include MySQL, PostgreSQL, Amazon Redshift, Microsoft SQL Server, and Teradata.

For more information about Presto, see the following:
- Introduction to Presto, a description of Presto on the AWS website.
- Creating a Presto cluster with Amazon Elastic MapReduce (EMR) in the Amazon EMR Release Guide.
- For general information on Presto, see the Presto documentation.

The results of the queries that you run through the Presto query engine can be turned into Amazon QuickSight datasets. Presto processes the analytic queries on the backend databases. Then it returns results to the Amazon QuickSight client. You can directly query your data through Presto, or you can import the results of your query into SPICE.

Before you use Amazon QuickSight as a Presto client to run queries, make sure that you configure data source profiles. You need a data source profile in Amazon QuickSight for each Presto data source that you want to access. Use the following procedure to create a connection to Presto.
To create a new connection to a Presto data source from Amazon QuickSight (console)

1. On the Amazon QuickSight start page, choose Datasets at top right. Then choose New dataset.
2. Choose the Presto tile.
   
   Note
   In most browsers, you can use Ctrl-F or Cmd-F to open a search box and enter presto to locate it.
3. Add the settings for the new data source:
   - **Data source name** – Enter a descriptive name for your data source connection. This name appears in the Existing data sources section at the bottom of the Data sets screen.
   - **Connection type** – Choose the connection type that you need to use to connect to Presto.
     
     To connect through the public network, choose Public network.
     
     If you use a public network, your Presto server must be secured and authenticated using Lightweight Directory Access Protocol (LDAP). For information on configuring Presto to use LDAP, see LDAP Authentication in the Presto documentation.
     
     To connect through a virtual private connection, choose the appropriate VPC name from the VPC connections list.
     
     If your Presto server allows unauthenticated access, AWS requires that you connect to it securely by using a private VPC connection. For information on configuring a new VPC, see Connecting to a VPC with Amazon QuickSight (p. 727).
   - **Database server** – The name of the database server.
   - **Port** – The port that the server is using to accept incoming connections from Amazon QuickSight.
   - **Catalog** – The name of the catalog that you want to use.
   - **Authentication required** – (Optional) This option only appears if you choose a VPC connection type. If the Presto data source that you’re connecting to doesn’t require authentication, choose No. Otherwise, keep the default setting (Yes).
   - **Username** – Enter a user name to use to connect to Presto. Amazon QuickSight applies the same user name and password to all connections that use this data source profile. If you want to monitor Amazon QuickSight separately from other user accounts, create a Presto account for each Amazon QuickSight data source profile.
     
     The Presto account that you use needs to be able to access the database and run SELECT statements on at least one table.
   - **Password** – The password to use with the Presto user name. Amazon QuickSight encrypts all credentials that you use in data source profile. For more information, see Data Encryption in Amazon QuickSight (p. 644).
   - **Enable SSL** – SSL is enabled by default.
4. Choose Validate connection to test your settings.
5. After you validate your settings, choose Create data source to complete the connection.

Creating a Data Source Using Apache Spark

You can connect directly to Apache Spark using Amazon QuickSight, or you can connect to Spark through Spark SQL. Using the results of queries, or direct links to tables or views, you create data sources in Amazon QuickSight. You can either directly query your data through Spark, or you can import the results of your query into SPICE (p. 78).

Before you use Amazon QuickSight with Spark products, you must configure Spark for Amazon QuickSight.
Amazon QuickSight requires your Spark server to be secured and authenticated using LDAP, which is available to Spark version 2.0 or later. If Spark is configured to allow unauthenticated access, Amazon QuickSight refuses the connection to the server. To use Amazon QuickSight as a Spark client, you must configure LDAP authentication to work with Spark.

The Spark documentation contains information on how to set this up. To start, you need to configure it to enable front-end LDAP authentication over HTTPS. For general information on Spark, see the Apache Spark website. For information specifically on Spark and security, see Spark security documentation.

To make sure that you have configured your server for Amazon QuickSight access, follow the instructions in Network and Database Configuration Requirements (p. 724).

Using Amazon Timestream Data with Amazon QuickSight

Following, you can find how to connect to your Amazon Timestream data using Amazon QuickSight. For a brief overview, see the Getting Started with Amazon Timestream and Amazon QuickSight video tutorial on YouTube.

Creating a New Amazon QuickSight Data Source Connection for a Timestream Database

Following, you can find how to connect to Amazon Timestream from Amazon QuickSight.

Before you can proceed, Amazon QuickSight needs to be authorized to connect to Amazon Timestream. If connections aren't enabled, you get an error when you try to connect. A QuickSight administrator can authorize connections to AWS resources. To authorize, open the menu by clicking on your profile icon at top right. Choose Manage QuickSight, Security & permissions, Add or remove. Then enable the check box for Amazon Timestream, then choose Update to confirm. For more information, see Accessing Data Sources (p. 646).

To connect to Amazon Timestream

1. Begin by creating a new dataset. Choose Datasets from the navigation pane at left, then choose New Dataset.
2. Choose the Timestream data source card.
3. For Data source name, enter a descriptive name for your Timestream data source connection, for example US Timestream Data. Because you can create many datasets from a connection to Timestream, it's best to keep the name simple.
4. Choose Validate connection to check that you can successfully connect to Timestream.
5. Choose Create data source to proceed.
6. For Database, choose Select to view the list of available options.
7. Choose the one you want to use, then choose Select to continue.
8. Do one of the following:
   - To import your data into QuickSight's in-memory engine (called SPICE), choose Import to SPICE for quicker analytics.
   - To allow QuickSight to run a query against your data each time you refresh the dataset or use the analysis or dashboard, choose Directly query your data.

   If you want to enable autorefresh on a published dashboard that uses Timestream data, the Timestream dataset needs to use a direct query.
9. Choose Edit/Preview and then Save to save your dataset and close it.
10. Repeat these steps for the number of concurrent direct connections to Timestream that you want to open in a dataset. For example, let's say you want to use four tables in a QuickSight dataset.
Currently, QuickSight datasets connect to only one table at a time from a Timestream data source. To use four tables in the same dataset, you need to add four data source connections in QuickSight.

Managing Permissions for Timestream data

The following procedure describes how to view, add, and revoke permissions to allow access to the same Timestream data source. The people that you add need to be active users in QuickSight before you can add them.

To edit permissions on a data source

1. Choose Datasets at left, then scroll down to find the data source card for your Timestream connection. An example might be US Timestream Data.
2. Choose the Timestream data source card.
3. Choose Share data source. A list of current permissions appears.
4. To add permissions, choose Invite users, then follow these steps:
   a. Add people to allow them to use the same data source.
   b. When you're finished adding everyone that you want to add, choose the Permission that you want to apply.
5. (Optional) To edit permissions, you can choose user or owner.
   • Choose user to allow read access.
   • Choose owner to allow that user to edit, share, or delete this QuickSight data source.
6. (Optional) To revoke permissions, choose Revoke access. After you revoke someone's access, they can't create new datasets from this data source. However, their existing datasets will still have access to this data source.
7. When you are finished, choose Close.

Adding a New QuickSight Dataset for Timestream

After you have an existing data source connection for Timestream data, you can create Timestream datasets to use for analysis.

Currently, you can use a Timestream connection only for a single table in a dataset. To add data from multiple Timestream tables in a single dataset, create an additional QuickSight data source connection for each table.

To create a dataset using Amazon Timestream

1. Choose Datasets at left, then scroll down to find the data source card for your Timestream connection. If you have many data sources, you can use the search bar at the top of the page to find your data source with a partial match on the name.
2. Choose the Timestream data source card, and then choose Create data set.
3. For Database, choose Select to view a list of available databases and choose the one that you want to use.
4. For Tables, choose the table that you want to use.
5. Choose Edit/Preview.
6. (Optional) To add more data, use the following steps:
   a. Choose Add data at top right.
   b. To connect to different data, choose Switch data source, and choose a different dataset.
Creating a Data Source

c. Follow the UI prompts to finish adding data.
d. After adding new data to the same dataset, choose **Configure this join** (the two red dots). Set up a join for each additional table.
e. If you want to add calculated fields, choose **Add calculated field**.
f. To add a model from SageMaker, choose **Augment with SageMaker**. This option is only available in QuickSight Enterprise edition.
g. Clear the check box for any fields that you want to omit.
h. Update any data types that you want to change.

7. When you are done, choose **Save** to save and close the dataset.

Adding Timestream Data to an Analysis

Following, you can find how to add an Amazon Timestream dataset to a QuickSight analysis. Before you begin, make sure that you have an existing dataset that contains the Timestream data that you want to use.

**To add Amazon Timestream data to an analysis**

1. Choose **Analyses** at left.
2. Do one of the following:
   - To create a new analysis, choose **New analysis** at right.
   - To add to an existing analysis, open the analysis that you want to edit.
     - Choose the pencil icon near at top left.
     - Choose **Add data set**.
3. Choose the Timestream dataset that you want to add.

For more information, see **Working with Analyses**.

Using Amazon Elasticsearch with Amazon QuickSight

Following, you can find how to connect to your Amazon Elasticsearch Service data using Amazon QuickSight.

**Creating a New QuickSight Data Source Connection for Elasticsearch**

Following, you can find how to connect to Amazon Elasticsearch Service from Amazon QuickSight.

Before you can proceed, Amazon QuickSight needs to be authorized to connect to Amazon Elasticsearch Service. If connections aren't enabled, you get an error when you try to connect. A QuickSight administrator can authorize connections to AWS resources.

**To authorize QuickSight to initiate a connection to Amazon Elasticsearch Service**

1. Open the menu by clicking on your profile icon at top right, then choose **Manage QuickSight**. If you don't see the **Manage QuickSight** option on your profile menu, ask your QuickSight administrator for assistance.
2. Choose **Security & permissions, Add or remove**.
3. Enable the option for **Amazon Elasticsearch**.
4. Choose **Update**.

After Elasticsearch is accessible, you create a data source so people can use the specified domains.
To connect to Amazon Elasticsearch

1. Begin by creating a new dataset. Choose Datasets from the navigation pane at left, then choose New Dataset.
2. Choose the Amazon Elasticsearch data source card.
3. For Data source name, enter a descriptive name for your Elasticsearch data source connection, for example Elasticsearch ML Data. Because you can create many datasets from a connection to Elasticsearch, it’s best to keep the name simple.
4. For Connection type, choose the network you want to use. This can be a virtual private cloud (VPC) based on Amazon VPC or a public network. The list of VPCs contains the names of VPC connections, rather than VPC IDs. These names are defined by the QuickSight administrator.
5. For Domain, choose the Elasticsearch domain that you want to connect to.
6. Choose Validate connection to check that you can successfully connect to Elasticsearch.
7. Choose Create data source to proceed.
8. For Tables, choose the one you want to use, then choose Select to continue.
9. Do one of the following:
   - To import your data into the QuickSight in-memory engine (called SPICE), choose Import to SPICE for quicker analytics. For information about how to enable importing Elasticsearch data, see Authorizing Connections to Amazon Elasticsearch (p. 663).
   - To allow QuickSight to run a query against your data each time you refresh the dataset or use the analysis or dashboard, choose Directly query your data.
     To enable autorefresh on a published dashboard that uses Elasticsearch data, the Elasticsearch dataset needs to use a direct query.
10. Choose Edit/Preview and then Save to save your dataset and close it.

Managing Permissions for Elasticsearch Data

The following procedure describes how to view, add, and revoke permissions to allow access to the same Amazon Elasticsearch data source. The people that you add need to be active users in QuickSight before you can add them.

To edit permissions on a data source

1. Choose Datasets at left, then scroll down to find the data source card for your Amazon Elasticsearch Service connection. An example might be US Amazon Elasticsearch Service Data.
2. Choose the Amazon Elasticsearch data source card.
3. Choose Share data source. A list of current permissions appears.
4. To add permissions, choose Invite users, then follow these steps:
   a. Add people to allow them to use the same data source.
   b. When you’re finished adding everyone that you want to add, choose the Permission that you want to apply.
5. (Optional) To edit permissions, you can choose user or owner.
   - Choose user to allow read access.
   - Choose owner to allow that user to edit, share, or delete this QuickSight data source.
6. (Optional) To revoke permissions, choose Revoke access. After you revoke someone’s access, they can’t create new datasets from this data source. However, their existing datasets still have access to this data source.
7. When you are finished, choose Close.
Adding a New QuickSight Dataset for Amazon Elasticsearch Service

After you have an existing data source connection for Amazon Elasticsearch, you can create Elasticsearch datasets to use for analysis.

To create a dataset using Amazon Elasticsearch

1. From the start page, choose **Datasets, New dataset**.
2. Scroll down to the data source card for your Elasticsearch connection. If you have many data sources, you can use the search bar at the top of the page to find your data source with a partial match on the name.
3. Choose the **Amazon Elasticsearch** data source card, and then choose **Create data set**.
4. For **Tables**, choose the Elasticsearch index that you want to use.
5. Choose **Edit/Preview**.
6. Choose **Save** to save and close the dataset.

Adding Amazon Elasticsearch Service Data to an Analysis

After you have an Elasticsearch dataset available, you can add it to a QuickSight analysis. Before you begin, make sure that you have an existing dataset that contains the Elasticsearch data that you want to use.

To add Amazon Elasticsearch data to an analysis

1. Choose **Analyses** at left.
2. Do one of the following:
   - To create a new analysis, choose **New analysis** at right.
   - To add to an existing analysis, open the analysis that you want to edit.
     - Choose the pencil icon near at top left.
     - Choose **Add data set**.
3. Choose the Amazon Elasticsearch dataset that you want to add.

   For information on using Elasticsearch in visualizations, see Limitations for Using Elasticsearch (p. 97).
4. For more information, see **Working with Analyses**.

Limitations for Using Elasticsearch

The following limitations apply to using Elasticsearch datasets:

- Elasticsearch datasets support a subset of the visual types, sort options, and filter options.
- To enable autorefresh on a published dashboard that uses Elasticsearch data, the Elasticsearch dataset needs to use a direct query.
- Multiple subquery operations aren't supported. To avoid errors during visualization, don't add multiple fields to a field well, use one or two fields per visualization, and avoid using the **Color** field well.
- Custom SQL isn't supported.
- Crossdataset joins and self joins aren't supported.
- Calculated fields aren't supported.
- The "other" category isn't supported. If you use an Elasticsearch dataset with a visualization that supports the "other" category, disable the "other" category by using the menu on the visual.
Editing a Data Source

You can edit an existing database data source to update the connection information, such as the server name or the user credentials. You can also edit an existing Amazon Athena data source to update the data source name. You can't edit Amazon S3 or Salesforce data sources.

Editing a Database Data Source

Use the following procedure to edit a database data source.

1. In the **FROM EXISTING DATA SOURCES** section of the **Create a Data Set** page, choose a database data source.
2. Choose **Edit Data Source**.
3. Modify the data source information:
   - If you are editing an autodiscovered database data source, you can modify any of the following settings:
     - For **Data source name**, enter a name for the data source.
     - For **Instance ID**, choose the name of the instance or cluster that you want to connect to from the list provided.
     - **Database name** shows the default database for the **Instance ID** cluster or instance. If you want to use a different database on that cluster or instance, enter its name.
     - For **UserName**, enter the user name of an account that has permissions to do the following:
       - Access the target database.
       - Read (perform a SELECT statement on) any tables in that database that you want to use.
     - For **Password**, enter the password for the user account that you entered.
   - If you are editing an external database data source, you can modify any of the following settings:
     - For **Data source name**, enter a name for the data source.
     - For **Database server**, enter one of the following values:
       - For an Amazon Redshift cluster, enter the endpoint of the cluster without the port number. For example, if the endpoint value is `clustername.1234abcd.us-west-2.redshift.amazonaws.com:1234`, then enter `clustername.1234abcd.us-west-2.redshift.amazonaws.com`. You can get the endpoint value from the **Endpoint** field on the cluster detail page on the Amazon Redshift console.
       - For an Amazon EC2 instance of PostgreSQL, MySQL, or SQL Server, enter the public DNS address. You can get the public DNS value from the **Public DNS** field on the instance detail pane in the EC2 console.
       - For a non–Amazon EC2 instance of PostgreSQL, MySQL, or SQL Server, enter the hostname or public IP address of the database server.
     - For **Port**, enter the port that the cluster or instance uses for connections.
     - For **Database name**, enter the name of the database that you want to use.
     - For **UserName**, enter the user name of an account that has permissions to do the following:
       - Access the target database.
       - Read (perform a SELECT statement on) any tables in that database that you want to use.
     - For **Password**, enter the password for the user account that you entered.
4. Choose **Validate connection**.
5. If the connection validates, choose **Update data source**. If not, correct the connection information and try validating again.
6. If you want to create a new dataset using the updated data source, proceed with the instructions at **Creating a Dataset from a Database** (p. 110). Otherwise, close the **Choose your table** dialog box.
Editing an Athena Data Source

Use the following procedure to edit an Athena data source.

1. In the FROM EXISTING DATA SOURCES section of the Create a Data Set page, choose an Athena data source.
2. Choose Edit Data Source.
3. For Data source name, enter a new name.
4. The Manage data source sharing screen appears. On the Users tab, locate the user that you want to remove.
5. If you want to create a new dataset using the updated data source, proceed with the instructions at Creating a Dataset Using Amazon Athena Data (p. 108). Otherwise, close the Choose your table dialog box.

Deleting a Data Source

You can delete a data source if you no longer need it. Deleting a query-based database data source makes any associated datasets unusable. Deleting an Amazon S3, Salesforce, or SPICE-based database data source doesn't affect your ability to use any associated datasets. This is because the data is stored in SPICE (p. 78). However, you can no longer refresh those datasets.

To delete a data source

1. In the FROM EXISTING DATA SOURCES section of the Create a Data Set page, choose the data source that you want to delete.
2. Choose Delete.

Working with Datasets

A dataset identifies the specific data in a data source that you want to use. For example, the data source might be a table if you are connecting to a database data source. It might be a file if you are connecting to an Amazon S3 data source. A dataset also stores any data preparation you have performed on that data, such as renaming a field or changing its data type.

Topics

- Creating Datasets (p. 99)
- Editing a Dataset (p. 116)
- Duplicating a Dataset (p. 117)
- Changing a Dataset (p. 117)
- Sharing Datasets (p. 118)
- Using Row-Level Security (RLS) to Restrict Access to a Dataset (p. 119)
- Using Column-Level Security (CLS) to Restrict Access to a Dataset (p. 122)
- Deleting a Dataset (p. 124)

Creating Datasets

To create a dataset, choose New data set on the Datasets page. You can then create a dataset based on an existing data source, or connect to a new data source and base the dataset on that.

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Creating Datasets Using New Data Sources

To create a dataset from a new data source, provide connection information to the data source:

- For local text or Excel files, you can simply identify the file location and upload the file.
- For Amazon S3, provide a manifest identifying the files or buckets that you want to use, and also the import settings for the target files.
- For Amazon Athena, all Athena databases for your AWS account are returned. No additional credentials are required.
- For Salesforce, provide credentials to connect with.
- For Amazon Redshift, Amazon RDS, Amazon EC2, or other database data sources, provide information about the server and database that host the data. Also provide valid credentials for that database instance.

Creating a Dataset Using a Local Text File

To create a dataset using a local text file data source, identify the location of the file, and then upload it. The file data is automatically imported into SPICE (p. 78) as part of creating a dataset.

To create a dataset based on a local text file

1. Check Data Source Quotas (p. 72) to make sure that your target file doesn't exceed data source quotas.
   
   Supported file types include .csv, .tsv, .json, .clf, or .elf files.
2. On the Amazon QuickSight start page, choose Datasets.
4. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose Upload a file.
5. In the Open dialog box, browse to a file, select it, and then choose Open.
   
   A file must be 1 GB or less to be uploaded to Amazon QuickSight.
6. To prepare the data before creating the dataset, choose Edit/Preview data. Otherwise, choose Visualize to create an analysis using the data as-is.
   
   If you choose the former, you can specify a dataset name as part of preparing the data. If you choose the latter, a dataset with the same name as the source file is created. To learn more about data preparation, see Preparing Data (p. 125).

Creating a Dataset Using a Microsoft Excel File

To create a dataset using a Microsoft Excel file data source, upload an .xlsx file from a local or networked drive. The data is imported into SPICE (p. 78).

For more information about creating new Amazon S3 datasets using Amazon S3 data sources, see Creating a Dataset Using an Existing Amazon S3 Data Source (p. 114) or Creating a Dataset Using Amazon S3 Files (p. 101).

To create a dataset based on an Excel file

1. Check Data Source Quotas (p. 72) to make sure that your target file doesn't exceed data source quotas.
2. On the Amazon QuickSight start page, choose **Datasets**.
3. On the **Datasets** page, choose **New dataset**.
4. In the **FROM NEW DATA SOURCES** section of the **Create a Data Set** page, choose **Upload a file**.
5. In the **Open** dialog box, choose a file, and then choose **Open**.

A file must be 1 GB or less to be uploaded to Amazon QuickSight.
6. If the Excel file contains multiple sheets, choose the sheet to import. You can change this later by preparing the data.
7. **Note**
   On the following screens, you have multiple chances to prepare the data. Each of these takes you to the **Prepare Data** screen. This screen is the same one where you can access after the data import is complete. It enables you to change the upload settings even after the upload is complete.

Choose **Select** to confirm your settings. Or you can choose **Edit/Preview data** to prepare the data immediately.

A preview of the data appears on the next screen. You can't make changes directly to the data preview.
8. If the data headings and content don't look correct, choose **Edit settings and prepare data** to correct the file upload settings.

Otherwise, choose **Next**.
9. On the **Data Source Details** screen, you can choose **Edit/Preview data**. You can specify a dataset name in the **Prepare Data** screen.

If you don't need to prepare the data, you can choose to create an analysis using the data as-is. Choose **Visualize**. Doing this names the dataset the same as the source file, and takes you to the **Analysis** screen. To learn more about data preparation and excel upload settings, see **Preparing Data** (p. 125).

### Creating a Dataset Using Amazon S3 Files

To create a dataset using one or more text files (.csv, .tsv, .clf, or .elf) from Amazon S3, create a manifest for Amazon QuickSight. Amazon QuickSight uses this manifest to identify the files that you want to use and to the upload settings needed to import them. When you create a dataset using Amazon S3, the file data is automatically imported into SPICE (p. 78).

You must grant Amazon QuickSight access to any Amazon S3 buckets that you want to read files from. For information about granting Amazon QuickSight access to AWS resources, see **Accessing Data Sources** (p. 646).

#### To create an Amazon S3 dataset

1. Check **Data Source Quotas** (p. 72) to make sure that your target file set doesn't exceed data source quotas.
2. Create a manifest file to identify the text files that you want to import, using one of the formats specified in **Supported Formats for Amazon S3 Manifest Files** (p. 104).
3. Save the manifest file to a local directory, or upload it into Amazon S3.
4. On the Amazon QuickSight start page, choose **Datasets**.
5. On the **Datasets** page, choose **New dataset**.
6. In the **FROM NEW DATA SOURCES** section of the **Create a Data Set** page, choose the Amazon S3 icon.
7. For **Data source name**, enter a description of the data source. This name should be something that helps you distinguish this data source from others.

8. For **Upload a manifest file**, do one of the following:
   - To use a local manifest file, choose **Upload**, and then choose **Upload a JSON manifest file**. For **Open**, choose a file, and then choose **Open**.
   - To use a manifest file from Amazon S3, choose **URL**, and enter the URL for the manifest file. To find the URL of a pre-existing manifest file in the Amazon S3 console, navigate to the appropriate file and choose it. A properties panel displays, including the link URL. You can copy the URL and paste it into Amazon QuickSight.

9. Choose **Connect**.

10. To make sure that the connection is complete, choose **Edit/Preview data**. Otherwise, choose **Visualize** to create an analysis using the data as-is.

    If you choose **Edit/Preview data**, you can specify a dataset name as part of preparing the data. Otherwise, the dataset name matches the name of the manifest file.

    To learn more about data preparation, see Preparing Data (p. 125).

**Datasets Based on Multiple Amazon S3 Files**

You can use one of several methods to merge or combine files from Amazon S3 inside Amazon QuickSight:

- **Combine files by using a manifest** – In this case, the files must have the same number of fields (columns). The data types must match between fields in the same position in the file. For example, the first field must have the same data type in each file. The same goes for the second field, and the third field, and so on. Amazon QuickSight takes field names from the first file.

  The files must be listed explicitly in the manifest. However, they don't have to be inside the same S3 bucket.

  In addition, the files must follow the rules described in Supported Formats for Amazon S3 Manifest Files (p. 104).

  For more details about combining files using a manifest, see Creating a Dataset Using Amazon S3 Files (p. 101).

- **Merge files without using a manifest** – To merge multiple files into one without having to list them individually in the manifest, you can use Athena. With this method, you can simply query your text files, like they are in a table in a database. For more information, see the post Analyzing Data in Amazon S3 Using Athena in the Big Data blog.

- **Use a script to append files before importing** – You can use a script designed to combine your files before uploading.

**Datasets Using S3 Files in Another AWS Account**

Use this section to learn how to set up security so you can use Amazon QuickSight to access Amazon S3 files in another AWS account.

For you to access files in another account, the owner of the other account must first set Amazon S3 to grant you permissions to read the file. Then, in Amazon QuickSight, you must set up access to the buckets that were shared with you. After both of these steps are finished, you can use a manifest to create a dataset.

**Note**

To access files that are shared with the public, you don't need to set up any special security. However, you still need a manifest file.
Amazon QuickSight User Guide
Creating Datasets

Topics

• Setting Up Amazon S3 to Allow Access from a Different Amazon QuickSight Account (p. 103)
• Setting Up Amazon QuickSight to Access Amazon S3 Files in Another AWS Account (p. 103)

Setting Up Amazon S3 to Allow Access from a Different Amazon QuickSight Account

Use this section to learn how to set permissions in Amazon S3 files so they can be accessed by Amazon QuickSight in another AWS account.

For information on accessing another account's Amazon S3 files from your Amazon QuickSight account, see Setting Up Amazon QuickSight to Access Amazon S3 Files in Another AWS Account (p. 103). For more information about S3 permissions, see Managing Access Permissions to Your Amazon S3 Resources and How Do I Set Permissions on an Object?

You can use the following procedure to set this access from the S3 console. Or you can grant permissions by using the AWS CLI or by writing a script. If you have a lot of files to share, you can instead create an S3 bucket policy on the s3:GetObject action. To use a bucket policy, add it to the bucket permissions, not to the file permissions. For information on bucket policies, see Bucket Policy Examples in the Amazon S3 Developer Guide.

To set access from a different QuickSight account from the S3 console

1. Get the email address of the AWS account email that you want to share with. Or you can get and use the canonical user ID. For more information on canonical user IDs, see AWS Account Identifiers in the AWS General Reference.
2. Sign in to the AWS Management Console and open the Amazon S3 console at https://console.aws.amazon.com/s3/.
3. Find the Amazon S3 bucket that you want to share with Amazon QuickSight. Choose Permissions.
4. Choose Add Account, and then enter an email address, or paste in a canonical user ID, for the AWS account that you want to share with. This email address should be the primary one for the AWS account.
5. Choose Yes for both Read bucket permissions and List objects. Choose Save to confirm.
6. Find the file that you want to share, and open the file's permission settings.
7. Enter an email address or the canonical user ID for the AWS account that you want to share with. This email address should be the primary one for the AWS account.
8. Enable Read object permissions for each file that Amazon QuickSight needs access to.
9. Notify the Amazon QuickSight user that the files are now available for use.

Setting Up Amazon QuickSight to Access Amazon S3 Files in Another AWS Account

Use this section to learn how to set up Amazon QuickSight so you can access Amazon S3 files in another AWS account. For information on allowing someone else to access your Amazon S3 files from their Amazon QuickSight account, see Setting Up Amazon S3 to Allow Access from a Different Amazon QuickSight Account (p. 103).

Use the following procedure to access another account's Amazon S3 files from Amazon QuickSight. Before you can use this procedure, the users in the other AWS account must share the files in their Amazon S3 bucket with you.

To access another account's Amazon S3 files from QuickSight

1. Verify that the user or users in the other AWS account gave your account read and write permission to the S3 bucket in question.
2. Choose your profile icon, and then choose Manage Amazon QuickSight.
3. Choose Edit AWS Permissions.
4. Choose Choose S3 buckets.
5. On the Select Amazon S3 buckets screen, choose the S3 buckets you can access across AWS tab.

   The default tab is named S3 buckets linked to Amazon QuickSight account. It shows all the buckets your Amazon QuickSight account has access to.

6. Do one of the following:

   • To add all the buckets that you have permission to use, choose Choose accessible buckets from other AWS accounts.
   • If you have one or more Amazon S3 buckets that you want to add, enter their names. Each must exactly match the unique name of the Amazon S3 bucket.

   If you don't have the appropriate permissions, you see the error message “We can't connect to this S3 bucket. Make sure that any S3 buckets you specify are associated with the AWS account used to create this Amazon QuickSight account.” This error message appears if you don't have either account permissions or Amazon QuickSight permissions.

   Note
   To use Amazon Athena, Amazon QuickSight needs to access the Amazon S3 buckets that Athena uses.
   You can add them here one by one, or use the Choose accessible buckets from other AWS accounts option.

7. Choose Select buckets to confirm your selection.
8. Create a new dataset based on Amazon S3, and upload your manifest file. For more information Amazon S3 datasets, see Creating a Dataset Using Amazon S3 Files (p. 101).

Supported Formats for Amazon S3 Manifest Files

You use JSON manifest files to specify files in Amazon S3 to import into Amazon QuickSight. These JSON manifest files can use either the Amazon QuickSight format described following or the Amazon Redshift format described in Using a manifest to specify data files in the Amazon Redshift Database Developer Guide. You don't have to use Amazon Redshift to use the Amazon Redshift manifest file format.

If you use an Amazon QuickSight manifest file, it must have a .json extension, for example my_manifest.json. If you use an Amazon Redshift manifest file, it can have any extension.

If you use an Amazon Redshift manifest file, Amazon QuickSight processes the optional mandatory option as Amazon Redshift does. If the associated file isn't found, Amazon QuickSight ends the import process and returns an error.

Files that you select for import must be delimited text (for example, .csv or .tsv), log (.clf), or extended log (.elf) format, or JSON (.json). All files identified in one manifest file must use the same file format. Plus, they must have the same number and type of columns. Amazon QuickSight supports UTF-8 file encoding, but not UTF-8 (with BOM). If you are importing JSON files, then for globalUploadSettings specify format, but not delimiter, textqualifier, or containsHeader.

Make sure that any files that you specify are in Amazon S3 buckets that you have granted Amazon QuickSight access to. For information about granting Amazon QuickSight access to AWS resources, see Accessing Data Sources (p. 646).

Manifest File Format for Amazon QuickSight

Amazon QuickSight manifest files use the following JSON format.
Use the fields in the `fileLocations` element to specify the files to import, and the fields in the `globalUploadSettings` element to specify import settings for those files, such as field delimiters.

The manifest file elements are described following:

- **fileLocations** – Use this element to specify the files to import. You can use either or both of the `URIs` and `URIPrefixes` arrays to do this. You must specify at least one value in one or the other of them.
- **URIs** – Use this array to list URIs for specific files to import.

Amazon QuickSight can access Amazon S3 files that are in any AWS Region. However, you must use a URI format that identifies the AWS Region of the Amazon S3 bucket if it's different from that used by your Amazon QuickSight account.

URIs in the following formats are supported.

<table>
<thead>
<tr>
<th>URI Format</th>
<th>Example</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://s3.amazonaws.com/">https://s3.amazonaws.com/</a>&lt;bucket name&gt;/&lt;file name&gt;</td>
<td><a href="https://s3.amazonaws.com/awsexamplebucket/data.csv">https://s3.amazonaws.com/awsexamplebucket/data.csv</a></td>
<td>This URI type identifies the AWS Region for the Amazon S3 bucket.</td>
</tr>
<tr>
<td>s3://&lt;bucket name&gt;/&lt;file name&gt;</td>
<td>s3://awsexamplebucket/data.csv</td>
<td></td>
</tr>
<tr>
<td><a href="https://s3-">https://s3-</a>&lt;region name&gt;.amazonaws.com/&lt;bucket name&gt;/&lt;file name&gt;</td>
<td><a href="https://s3-us-east-1.amazonaws.com/awsexamplebucket/data.csv">https://s3-us-east-1.amazonaws.com/awsexamplebucket/data.csv</a></td>
<td></td>
</tr>
</tbody>
</table>
**URI Format**

<table>
<thead>
<tr>
<th>Example</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>https://&lt;bucket name&gt;.s3-&lt;region name&gt;.amazonaws.com/&lt;file name&gt;</td>
<td><a href="https://awsexamplebucket.s3-us-east-1.amazonaws.com/data.csv">https://awsexamplebucket.s3-us-east-1.amazonaws.com/data.csv</a></td>
</tr>
</tbody>
</table>

**URIPrefixes** – Use this array to list URI prefixes for S3 buckets and folders. All files in a specified bucket or folder are imported. Amazon QuickSight recursively retrieves files from child folders.

QuickSight can access Amazon S3 buckets or folders that are in any AWS Region. Make sure to use a URI prefix format that identifies the S3 bucket's AWS Region if it's different from that used by your QuickSight account.

URI prefixes in the following formats are supported.

<table>
<thead>
<tr>
<th>URI Prefix Format</th>
<th>Example</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://s3.amazonaws.com/">https://s3.amazonaws.com/</a>&lt;bucket name&gt;/&lt;folder name1&gt;/(&lt;folder name2&gt;/etc.)</td>
<td><a href="https://s3.amazonaws.com/awsexamplebucket/folder1/">https://s3.amazonaws.com/awsexamplebucket/folder1/</a></td>
<td></td>
</tr>
<tr>
<td>s3://&lt;bucket name&gt;</td>
<td>s3://awsexamplebucket/</td>
<td></td>
</tr>
<tr>
<td>s3://&lt;bucket name&gt;/&lt;folder name1&gt;/(&lt;folder name2&gt;/etc.)</td>
<td>s3://awsexamplebucket/folder1/</td>
<td></td>
</tr>
<tr>
<td><a href="https://s3-">https://s3-</a>&lt;region name&gt;.amazonaws.com/&lt;bucket name&gt;/</td>
<td><a href="https://s3-your-region-for-example-us-east-2.amazonaws.com/awsexamplebucket/">https://s3-your-region-for-example-us-east-2.amazonaws.com/awsexamplebucket/</a></td>
<td>This URIPrefix type identifies the AWS Region for the Amazon S3 bucket.</td>
</tr>
<tr>
<td><a href="https://s3-">https://s3-</a>&lt;region name&gt;.amazonaws.com/&lt;bucket name&gt;/&lt;folder name1&gt;/(&lt;folder name2&gt;/etc.)</td>
<td><a href="https://s3-us-east-1.amazonaws.com/awsexamplebucket/folder1/">https://s3-us-east-1.amazonaws.com/awsexamplebucket/folder1/</a></td>
<td>This URIPrefix type identifies the AWS Region for the Amazon S3 bucket.</td>
</tr>
<tr>
<td>https://&lt;bucket name&gt;.s3-&lt;region name&gt;.amazonaws.com</td>
<td><a href="https://awsexamplebucket.s3-us-east-1.amazonaws.com">https://awsexamplebucket.s3-us-east-1.amazonaws.com</a></td>
<td>This URIPrefix type identifies the AWS Region for the Amazon S3 bucket.</td>
</tr>
</tbody>
</table>

**globalUploadSettings** – (Optional) Use this element to specify import settings for the Amazon S3 files, such as field delimiters. If this element is not specified, Amazon QuickSight uses the default values for the fields in this section.

**Important**

For log (.clf) and extended log (.elf) files, only the format field in this section is applicable, so you can skip the other fields. If you choose to include them, their values are ignored.
• **format** – (Optional) Specify the format of the files to be imported. Valid formats are CSV, TSV, CLF, ELF, and JSON. The default value is CSV.

• **delimiter** – (Optional) Specify the file field delimiter. This must map to the file type specified in the format field. Valid formats are commas (,) for .csv files and tabs (\t) for .tsv files. The default value is comma (,).

• **textqualifier** – (Optional) Specify the file text qualifier. Valid formats are single quote (‘), double quotes ("). The leading backslash is a required escape character for a double quote in JSON. The default value is double quotes ("), If your text doesn't need a text qualifier, don't include this property.

• **containsHeader** – (Optional) Specify whether the file has a header row. Valid formats are true or false. The default value is true.

**Manifest File Examples for Amazon QuickSight**

The following are some examples of completed Amazon QuickSight manifest files.

The following example shows a manifest file that identifies two specific .csv files for import. These files use double quotes for text qualifiers. The format, delimiter, and containsHeader fields are skipped because the default values are acceptable.

```json
{
    "fileLocations": [
        {
            "URIs": [
                "https://yourBucket.s3.amazonaws.com/data-file-2.json"
            ]
        },
        "globalUploadSettings": {
            "textqualifier": ""
        }
    ]
}
```

The following example shows a manifest file that identifies one specific .tsv file for import. This file also includes a bucket in another AWS Region that contains additional .tsv files for import. The textqualifier and containsHeader fields are skipped because the default values are acceptable.

```json
{
    "fileLocations": [
        {
            "URIs": [
                "https://s3.amazonaws.com/awsexamplebucket/data.tsv"
            ],
            "URIprefixes": [
                "https://s3-us-east-1.amazonaws.com/awsexamplebucket/"
            ]
        },
        "globalUploadSettings": {
            "format": "TSV",
            "delimiter": "\t"
        }
    ]
}
```
Creating a Dataset Using Amazon Athena Data

Use the following procedure to create a new dataset that connects to Amazon Athena data or to Athena Federated Query data.

To connect to Amazon Athena

1. Begin by creating a new dataset. Choose **Datasets** from the navigation pane at left, then choose **New dataset**.
2. a. To use an existing Athena connection profile (common), scroll down to the **FROM EXISTING DATA SOURCES** section, and choose the card for the existing data source that you want to use. Choose **Create dataset**.
Creating Datasets

Cards are labeled with the Athena data source icon and the name provided by the person who created the connection.

b. To create a new Athena connection profile (less common), use the following steps:

1. In the **FROM NEW DATA SOURCES** section, choose the **Athena** data source card.
2. For **Data source name**, enter a descriptive name.
3. For **Athena workgroup**, choose your workgroup.
4. Choose **Validate connection** to test the connection.
5. Choose **Create data source**.

3. On the **Choose your table** screen, do the following:

   a. For **Catalog**, choose one of the following:
      - If you are using Athena Federated Query, choose the catalog you want to use.
      - Otherwise, choose **AwsDataCatalog**.
   b. Choose one of the following:
      - To write a SQL query, choose **Use custom SQL**.
      - To choose a database and table, choose your catalog that contains your databases from the dropdown under **Catalog**. Then, choose a database from the dropdown under **Database** and choose a table from the **Tables** list that appears for your database.

If you don't have the right permissions, you receive the following error message: "You don't have sufficient permissions to connect to this dataset or run this query." Contact your QuickSight administrator for assistance. For more information, see Authorizing Connections to Amazon Athena (p. 667).

4. Choose **Edit/preview data**.
5. To create a dataset and analyze the data using the table, choose **Visualize**. For more information, see Working with Amazon QuickSight Visuals (p. 243).

Creating a Dataset from Salesforce

Use the following procedure to create a dataset by connecting to Salesforce and selecting a report or object to provide data.

**To create a dataset using Salesforce from a report or object**

1. Check Data Source Quotas (p. 72) to make sure that your target report or object doesn't exceed data source quotas.
2. On the Amazon QuickSight start page, choose **Datasets**.
3. On the **Datasets** page, choose **New dataset**.
4. In the **FROM NEW DATA SOURCES** section of the **Create a Data Set** page, choose the **Salesforce** icon.
5. Enter a name for the data source and then choose **Create data source**.
6. On the Salesforce login page, enter your Salesforce credentials.
7. For **Data elements: contain your data**, choose **Select** and then choose either **REPORT** or **OBJECT**.
   **Note**
   Joined reports aren't supported as Amazon QuickSight data sources.
8. Choose one of the following options:
• To prepare the data before creating an analysis, choose **Edit/Preview data** to open data preparation. For more information about data preparation, see Preparing Datasets (p. 126).
• Otherwise, choose a report or object and then choose **Select**.

9. Choose one of the following options:

• To create a dataset and an analysis using the data as-is, choose **Visualize**.
  
  **Note**
  If you don’t have enough SPICE (p. 78) capacity, choose **Edit/Preview data**. In data preparation, you can remove fields from the dataset to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see Preparing Datasets (p. 126).

• To prepare the data before creating an analysis, choose **Edit/Preview data** to open data preparation for the selected report or object. For more information about data preparation, see Preparing Datasets (p. 126).

### Creating Datasets from New Database Data Sources

You can use a variety of database data sources to provide data to Amazon QuickSight. This includes Amazon RDS instances and Amazon Redshift clusters. It also includes MariaDB, Microsoft SQL Server, MySQL, Oracle, and PostgreSQL instances in your organization, Amazon EC2, or similar environments.

When creating a new database dataset, you can select one table, join several tables, or create a SQL query to retrieve the data that you want. You can also change whether the dataset uses a direct query or instead stores data in SPICE (p. 78).

When you create a dataset based on an AWS service like Amazon RDS, Amazon Redshift, or Amazon EC2, data transfer charges might apply when consuming data from that source. Those charges might also vary depending on whether that AWS resource is in the home AWS Region that you chose for your Amazon QuickSight account. For details on pricing, see the pricing page for the service in question.

**Topics**

- Creating a Dataset from a Database (p. 110)

### Creating a Dataset from a Database

The following procedures walk you through connecting to database data sources and creating datasets. Use Creating a Dataset from an Autodiscovered Amazon Redshift Cluster or Amazon RDS Instance (p. 110) to create datasets from AWS data sources that your Amazon QuickSight account autodiscovered, or use Creating a Dataset Using a Database That’s Not Autodiscovered (p. 112) to create datasets from any other database data sources.

**Creating a Dataset from an Autodiscovered Amazon Redshift Cluster or Amazon RDS Instance**

Use the following procedure to create a connection to an autodiscovered AWS data source.

**To create a connection to an autodiscovered AWS data source**

1. Check Data Source Quotas (p. 72) to make sure that your target table or query doesn't exceed data source quotas.
2. Confirm that the database credentials you plan to use have appropriate permissions as described in Required Permissions (p. 646).
3. Make sure that you have configured the cluster or instance for Amazon QuickSight access by following the instructions in Network and Database Configuration Requirements (p. 724).
4. On the Amazon QuickSight start page, choose **Datasets**.
5. On the Datasets page, choose New dataset.

6. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose either the RDS or the Redshift Auto-discovered icon, depending on the AWS service that you want to connect to.

7. Enter the connection information for the data source, as follows:

   - For Data source name, enter a name for the data source.
   - For Instance ID, choose the name of the instance or cluster that you want to connect to.
   - Database name shows the default database for the Instance ID cluster or instance. If you want to use a different database on that cluster or instance, enter its name.
   - For UserName, enter the user name of an account that has permissions to do the following:
     - Access the target database.
     - Read (perform a SELECT statement on) any tables in that database that you want to use.
   - For Password, enter the password for the user account that you entered.

8. Choose Validate connection to verify your connection information is correct.

9. If the connection validates, choose Create data source. If not, correct the connection information and try validating again.

   **Note**
   Amazon QuickSight automatically secures connections to Amazon RDS instances and Amazon Redshift clusters by using Secure Sockets Layer (SSL). You don't need to do anything to enable this.

10. Choose one of the following:

   - Custom SQL

      On the next screen, you can choose to write a query with the Use custom SQL option. Doing this opens a screen named Enter custom SQL query, where you can enter a name for your query, and then enter the SQL. For best results, compose the query in a SQL editor, and then paste it into this window. After you name and enter the query, you can choose Edit/Preview data or Confirm query. Choose Edit/Preview data to immediately go to data preparation. Choose Confirm query to validate the SQL and make sure that there are no errors.

   - Choose tables

      If you prefer to connect to specific tables, for Schema: contain sets of tables, choose Select and then choose a schema. In some cases where there is only a single schema in the database, that schema is automatically chosen, and the schema selection option isn’t displayed.

      To prepare the data before creating an analysis, choose Edit/Preview data to open data preparation. Use this option if you want to join to more tables.

      Otherwise, after choosing a table, choose Select.

11. Choose one of the following options:

   - Prepare the data before creating an analysis. To do this, choose Edit/Preview data to open data preparation for the selected table. For more information about data preparation, see Preparing Datasets (p. 126).

   - Create a dataset and analysis using the table data as-is and to import the dataset data into SPICE for improved performance (recommended). To do this, check the table size and the SPICE indicator to see if you have enough capacity.

      If you have enough SPICE capacity, choose Import to SPICE for quicker analytics, and then create an analysis by choosing Visualize.

   **Note**
   If you want to use SPICE and you don’t have enough space, choose Edit/Preview data. In data preparation, you can remove fields from the dataset to decrease its size. You can also
apply a filter or write a SQL query that reduces the number of rows or columns returned. For more information about data preparation, see Preparing Datasets (p. 126).

- To create a dataset and an analysis using the table data as-is, and to have the data queried directly from the database, choose the Directly query your data option. Then create an analysis by choosing Visualize.

Creating a Dataset Using a Database That's Not Autodiscovered

Use the following procedure to create a connection to any database other than an autodiscovered Amazon Redshift cluster or Amazon RDS instance. Such databases include Amazon Redshift clusters and Amazon RDS instances that are in a different AWS Region or are associated with a different AWS account. They also include MariaDB, Microsoft SQL Server, MySQL, Oracle, and PostgreSQL instances that are on-premises, in Amazon EC2, or in some other accessible environment.

To create a connection to a database that isn't an autodiscovered Amazon Redshift cluster or RDS instance

1. Check Data Source Quotas (p. 72) to make sure that your target table or query doesn't exceed data source quotas.
2. Confirm that the database credentials that you plan to use have appropriate permissions as described in Required Permissions (p. 646).
3. Make sure that you have configured the cluster or instance for Amazon QuickSight access by following the instructions in Network and Database Configuration Requirements (p. 724).
4. On the Amazon QuickSight start page, choose Manage data.
6. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose the Redshift Manual connect icon if you want to connect to an Amazon Redshift cluster in another AWS Region or associated with a different AWS account. Or choose the appropriate database management system icon to connect to an instance of Amazon Aurora, MariaDB, Microsoft SQL Server, MySQL, Oracle, or PostgreSQL.
7. Enter the connection information for the data source, as follows:
   - For Data source name, enter a name for the data source.
   - For Database server, enter one of the following values:
     - For an Amazon Redshift cluster or Amazon RDS instance, enter the endpoint of the cluster or instance without the port number. For example, if the endpoint value is clustername.1234abcd.us-west-2.redshift.amazonaws.com:1234, then enter clustername.1234abcd.us-west-2.redshift.amazonaws.com. You can get the endpoint value from the Endpoint field on the cluster or instance detail page in the AWS console.
     - For an Amazon EC2 instance of MariaDB, Microsoft SQL Server, MySQL, Oracle, or PostgreSQL, enter the public DNS address. You can get the public DNS value from the Public DNS field on the instance detail pane in the Amazon EC2 console.
     - For a non-Amazon EC2 instance of MariaDB, Microsoft SQL Server, MySQL, Oracle, or PostgreSQL, enter the hostname or public IP address of the database server. If you are using Secure Sockets Layer (SSL) for a secured connection (recommended), you likely need to provide the hostname to match the information required by the SSL certificate. For a list of accepted certificates see QuickSight SSL and CA Certificates (p. 726).
   - For Port, enter the port that the cluster or instance uses for connections.
   - For Database name, enter the name of the database that you want to use.
   - For UserName, enter the user name of an account that has permissions to do the following:
     - Access the target database.
• Read (perform a SELECT statement on) any tables in that database that you want to use.
• For Password, enter the password associated with the user account you entered.

8. (Optional) If you are connecting to anything other than an Amazon Redshift cluster and you don’t want a secured connection, make sure that Enable SSL is clear. We strongly recommend leaving this checked, because an unsecured connection can be open to tampering.

For more information on how the target instance uses SSL to secure connections, see the documentation for the target database management system. Amazon QuickSight doesn’t accept self-signed SSL certificates as valid. For a list of accepted certificates, see QuickSight SSL and CA Certificates (p. 726).

Amazon QuickSight automatically secures connections to Amazon Redshift clusters by using SSL. You don’t need to do anything to enable this.

Some databases, such as Presto and Apache Spark, must meet additional requirements before Amazon QuickSight can connect. For more information, see Creating a Data Source Using Presto (p. 91), or Creating a Data Source Using Apache Spark (p. 92).

9. (Optional) Choose Validate connection to verify your connection information is correct.

10. If the connection validates, choose Create data source. If not, correct the connection information and try validating again.

11. Choose one of the following:

• Custom SQL

On the next screen, you can choose to write a query with the Use custom SQL option. Doing this opens a screen named Enter custom SQL query, where you can enter a name for your query, and then enter the SQL. For best results, compose the query in a SQL editor, and then paste it into this window. After you name and enter the query, you can choose Edit/Preview data or Confirm query. Choose Edit/Preview data to immediately go to data preparation. Choose Confirm query to validate the SQL and make sure that there are no errors.

• Choose tables

If you prefer to connect to specific tables, for Schema: contain sets of tables, choose Select and then choose a schema. In some cases where there is only a single schema in the database, that schema is automatically chosen, and the schema selection option isn’t displayed.

To prepare the data before creating an analysis, choose Edit/Preview data to open data preparation. Use this option if you want to join to more tables.

Otherwise, after choosing a table, choose Select.

12. Choose one of the following options:

• Prepare the data before creating an analysis. To do this, choose Edit/Preview data to open data preparation for the selected table. For more information about data preparation, see Preparing Datasets (p. 126).

• Create a dataset and an analysis using the table data as-is and import the dataset data into SPICE for improved performance (recommended). To do this, check the table size and the SPICE indicator to see if you have enough space.

If you have enough SPICE capacity, choose Import to SPICE for quicker analytics, and then create an analysis by choosing Visualize.

Note
If you want to use SPICE and you don’t have enough space, choose Edit/Preview data. In data preparation, you can remove fields from the dataset to decrease its size. You can also apply a filter or write a SQL query that reduces the number of rows or columns returned. For more information about data preparation, see Preparing Datasets (p. 126).
• Create a dataset and an analysis using the table data as-is and have the data queried directly from the database. To do this, choose the **Directly query your data** option. Then create an analysis by choosing **Visualize**.

### Creating a Dataset Using an Existing Data Source

After you make an initial connection to a Salesforce, AWS data store, or other database data source, Amazon QuickSight saves the connection information. It adds the data source to the **FROM EXISTING DATA SOURCES** section of the **Create a Data Set** page. You can use these existing data sources to create new datasets without re-specifying connection information.

### Creating a Dataset Using an Existing Amazon S3 Data Source

Use the following procedure to create a dataset using an existing Amazon S3 data source.

**To create a dataset using an existing S3 data source**

1. On the Amazon QuickSight start page, choose **Datasets**.
2. On the **Datasets** page, choose **New dataset**.
3. In the **FROM EXISTING DATA SOURCES** section of the **Create a Data Set** page, choose the Amazon S3 data source to use.
4. To prepare the data before creating the dataset, choose **Edit/Preview data**. To create an analysis using the data as-is, choose **Visualize**.

### Creating a Dataset Using an Existing Amazon Athena Data Source

If you want to create a dataset using an existing Amazon Athena data source, use the following procedure.

**To create a dataset from an existing Athena connection profile**

1. On the Amazon QuickSight start page, choose **Manage data**.
2. On the **Datasets** page, choose **New data set**.
   
   The **Create a Data Set** page displays.
3. Scroll down to the **FROM EXISTING DATA SOURCES** section of the **Create a Data Set** page.
4. Choose the connection profile icon for the existing data source you want to use. Connection profiles are labeled with the data source icon and the name provided by the person who created the connection.

   Choose the **Create data set** button to proceed.

   Amazon QuickSight creates a connection profile for this data source based only on the Athena workgroup. The database and table aren't saved.
5. On the **Choose your table** screen, do one of the following:
   
   • OPTION 1: To write a SQL query, select the button for **Use custom SQL**.
   • OPTION 2: To choose a database and table, first select your database from the **Database** list. Next, choose a table from the list that appears for the selected database.

### Create a Dataset Using an Existing Salesforce Data Source

Use the following procedure to create a dataset using an existing Salesforce data source.
To create a dataset using an existing Salesforce data source

1. On the Amazon QuickSight start page, choose Manage data.
3. In the FROM EXISTING DATA SOURCES section of the Create a Data Set page, choose the Salesforce data source to use.
4. Choose Create Data Set.
5. Choose one of the following:
   - **Custom SQL**
     
     On the next screen, you can choose to write a query with the Use custom SQL option. Doing this opens a screen named Enter custom SQL query, where you can enter a name for your query, and then enter the SQL. For best results, compose the query in a SQL editor, and then paste it into this window. After you name and enter the query, you can choose Edit/Preview data or Confirm query. Choose Edit/Preview data to immediately go to data preparation. Choose Confirm query to validate the SQL and make sure that there are no errors.
   - **Choose tables**
     
     If you prefer to connect to specific tables, for Data elements: contain your data, choose Select and then choose either REPORT or OBJECT.
     
     To prepare the data before creating an analysis, choose Edit/Preview data to open data preparation. Use this option if you want to join to more tables.
     
     Otherwise, after choosing a table, choose Select.
6. On the next screen, choose one of the following options:
   - To create a dataset and an analysis using the data as-is, choose Visualize.
     
     **Note**
     
     If you don’t have enough SPICE (p. 78) capacity, choose Edit/Preview data. In data preparation, you can remove fields from the dataset to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see Preparing Datasets (p. 126).
   - To prepare the data before creating an analysis, choose Edit/Preview data to open data preparation for the selected report or object. For more information about data preparation, see Preparing Datasets (p. 126).

Creating a Dataset Using an Existing Database Data Source

Use the following procedure to create a dataset using an existing database data source.

To create a dataset using an existing database data source

1. On the Amazon QuickSight start page, choose Manage data.
3. In the FROM EXISTING DATA SOURCES section of the Create a Data Set page, choose the database data source to use, and then choose Create Data Set.
4. Choose one of the following:
   - **Custom SQL**
     
     On the next screen, you can choose to write a query with the Use custom SQL option. Doing this opens a screen named Enter custom SQL query, where you can enter a name for your query, and then enter the SQL. For best results, compose the query in a SQL editor, and then paste it into
this window. After you name and enter the query, you can choose **Edit/Preview data** or **Confirm query**. Choose **Edit/Preview data** to immediately go to data preparation. Choose **Confirm query** to validate the SQL and make sure that there are no errors.

- **Choose tables**

  If you prefer to connect to specific tables, for **Schema: contain sets of tables**, choose **Select** and then choose a schema. In some cases where there is only a single schema in the database, that schema is automatically chosen, and the schema selection option isn't displayed.

  To prepare the data before creating an analysis, choose **Edit/Preview data** to open data preparation. Use this option if you want to join to more tables.

  Otherwise, after choosing a table, choose **Select**.

5. Choose one of the following options:

- **Prepare the data before creating an analysis.** To do this, choose **Edit/Preview data** to open data preparation for the selected table. For more information about data preparation, see Preparing Datasets (p. 126).

- **Create a dataset and an analysis using the table data as-is and import the dataset data into SPICE (p. 78)** for improved performance (recommended). To do this, check the SPICE indicator to see if you have enough space.

  If you have enough SPICE capacity, choose **Import to SPICE for quicker analytics**, and then create an analysis by choosing **Visualize**.

  **Note**

  If you want to use SPICE and you don't have enough space, choose **Edit/Preview data**. In data preparation, you can remove fields from the dataset to decrease its size. You can also apply a filter or write a SQL query that reduces the number of rows or columns returned. For more information about data preparation, see Preparing Datasets (p. 126).

- **Create a dataset and an analysis using the table data as-is and have the data queried directly from the database.** To do this, choose the **Directly query your data** option. Then create an analysis by choosing **Visualize**.

---

**Editing a Dataset**

You can edit an existing dataset to perform data preparation. For more information about Amazon QuickSight data preparation functionality, see Preparing Data (p. 125).

You can open a dataset for editing from the **Datasets** page, or from the analysis page. Editing a dataset from either location modifies the dataset for all analyses that use it.

**Editing a Dataset from the Datasets Page**

To edit a dataset from the **Datasets** page, choose the dataset, and then choose **Edit analysis data sets**. The dataset opens in the data preparation page.

If you want to create a copy of the dataset, choose **Duplicate data set**, and enter a name for the copy.

**Editing a Dataset from the Analysis Page**

Use the following procedure to edit a dataset from the analysis page.

**To edit a dataset from the analysis page**

1. On the analysis page, choose the dataset list at the top of the **Fields list** pane and then choose **Edit analysis data sets**.
2. In Data sets in this analysis, choose the dataset you want to edit, and then choose Edit. The dataset opens in the data preparation page.

Duplicating a Dataset

You can duplicate an existing dataset to save a copy of it with a new name. The new dataset is a completely separate copy.

If you want to create a copy of the dataset, open the Datasets page and choose the dataset that you want to make a copy of. Then choose Duplicate data set, and enter a name for the copy. The Duplicate data set option is available if both of the following are true: you own the dataset and you have permission to the data source.

Changing a Dataset

In two situations, changes to a dataset might cause concern. One is if you deliberately edit the dataset. The other is if your data source has changed so much that it affects the analyses based on it.

Important
Analyses that are in production usage should be protected so they continue to function correctly.

We recommend the following when you're dealing with data changes:

- Document your data sources and datasets, and the visuals that rely upon them. Documentation should include screenshots, fields used, placement in field wells, filters, sorts, calculations, colors, formatting, and so on. Record everything that you need to recreate the visual.

- When you edit a dataset, try not to make changes that might break existing visuals. For example, don't remove columns that are being used in a visual. If you must remove a column, create a calculated column in its place. The replacement column should have the same name and data type as the original.

- If your data source or dataset changes in your source database, adapt your visual to accommodate the change, as described previously. Or you can try to adapt the source database. For example, you might create a view of the source table (document). Then if the table changes, you can adjust the view to include or exclude columns (attributes), change data types, fill null values, and so on. Or, in another circumstance, if your dataset is based on a slow SQL query, you might create a table to hold the results of the query.

If you can't sufficiently adapt the source of the data, recreate the visuals based on your documentation of the analysis.

- If you no longer have access to a data source, your analyses based on that source are empty. The visuals you created still exist, but they can't display until they have some data to show. This result can happen if permissions are changed by your administrator.

- If you remove the dataset a visual is based on, you might need to recreate it from your documentation. You can edit the visual and select a new dataset to use with it. If you need to consistently use a new file to replace an older one, store your data in a location that is consistently available. For example, you might store your .csv file in S3 and create an S3 dataset to use for your visuals. For more information on access files stored in S3, see Creating a Dataset Using Amazon S3 Files (p. 101).

Or you can import the data into a table, and base your visual on a query. This way, the data structures don't change, even if the data contained in them changes.
Sharing Datasets

You can give other Amazon QuickSight users and groups access to a dataset by sharing it with them. Then they can create analyses from it. If you make them co-owners, they can also refresh, edit, delete, or reshare the dataset.

Sharing a Dataset

Use the following procedure to share a dataset.

To share a dataset

1. On the Datasets page, choose the dataset. Then choose Share (if this dataset hasn't been shared with anyone). Or choose Shared with <X> users (if the dataset has been shared with others).
2. Choose Invite Users.
3. Enter the user or group that you want to share this dataset with. Then choose the add icon. You can only invite users who belong to the same Amazon QuickSight account.

   Repeat this step until you have entered information for everyone you want to share the dataset with.
4. For Permission, choose the role for each user or group, to give them permissions on the dataset.

   Choose User to allow the user to create analyses from the dataset. Choose Owner to allow the user to do that and also refresh, edit, delete, and reshare the dataset.
5. Choose Share.

Users receive emails with a link to the dataset. Groups don't receive invitation emails.

Viewing and Editing the Permissions of Users That a Dataset Is Shared With

If you have owner permissions on a dataset, you can use the following procedure to view, edit, or change user access to it.

To view, edit, or change user access to a dataset if you have owner permissions for it

1. On the Datasets page, choose the dataset. Then choose Share (if this dataset hasn't been shared with anyone). Or choose Shared with <X> users (if the dataset has been shared with others).

   A list of all users with access to the dataset is displayed.
2. (Optional) To change roles, choose the field in the Permission column next to the user or group. Then choose either User or Owner.

Revoking Access to a Dataset

If you have owner permissions on a dataset, you can use the following procedure to revoke user access to a dataset.

To revoke user access to a dataset if you have owner permissions for it

1. On the Datasets page, choose the dataset. Then choose Share (if this dataset hasn't been shared with anyone). Or choose Shared with <X> users (if the dataset has been shared with others).
Using Row-Level Security (RLS) to Restrict Access to a Dataset

In the Enterprise edition of Amazon QuickSight, you can restrict access to a dataset by configuring row-level security (RLS) on it. You can do this before or after you have shared the dataset. Only the people you shared with can see any of the data. By adding row-level security, you can further control their access.

To do this, you create a query or file that has one column named `UserName`, `GroupName`, or both. You can also think of this as adding a rule for that user or group. Then you can add one column to the query or file for each field that you want to grant or restrict access to. For each user or group name that you add, you add the values for each field. You can use NULL (no value) to mean all values. To see examples of dataset rules, see Creating Dataset Rules for Row-Level Security (p. 120).

To apply the dataset rules, you add the rules as a permissions dataset to your dataset. Keep in mind the following points:

- The permissions dataset can't contain duplicate values. Duplicates are ignored when evaluating how to apply the rules.
- Each user or group specified can see only the rows that match the field values in the dataset rules.
- If you add a rule for a user or group and leave all other columns with no value (NULL), you grant them access to all the data.
- If you don't add a rule for a user or group, that user or group can't see any of the data.
- The full set of rule records that are applied per user must not exceed 999. This applies to the total number of rules that are directly assigned to a user name plus any rules that are assigned to the user through group names.
- If a field includes a comma (,), Amazon QuickSight treats each word separated from another by a comma as an individual value in the filter. For example, in `('AWS', 'INC')`, `AWS, INC` is considered as two strings: `AWS` and `INC`. To filter with `AWS, INC`, wrap the string with double quotation marks in the permissions dataset.

Amazon QuickSight treats spaces as literal values. If you have a space in a field that you are restricting, the dataset rule applies to those rows. Amazon QuickSight treats both NULLs and blanks (empty strings "") as "no value". A NULL is an empty field value.

Depending on what data source your dataset is coming from, you can configure a direct query to access a table of permissions. Terms with spaces inside them don't need to be delimited with quotes. If you use a direct query, you can easily change the query in the original data source.

Or you can upload dataset rules from a text file or spreadsheet. If you are using a comma-separated value (CSV) file, don't include any spaces on the given line. Terms with spaces inside them need to be delimited with quotes. If you use dataset rules that are file-based, apply any changes by overwriting the existing rules in the dataset's permissions settings.

Data sets that are restricted are marked with the word `RESTRICTED` in the Datasets screen.

Row-level security only works for fields containing textual data (string, char, varchar, and so on). It doesn't currently work for dates or numeric fields. Anomaly detection is not supported for datasets that use row-level security (RLS).
Creating Dataset Rules for Row-Level Security

Use the following procedure to create a permissions file or query to use as dataset rules.

To create a permissions files or query to use as dataset rules

1. Create a file or a query that contains the dataset rules (permissions) for row-level security.

   It doesn't matter what order the fields are in. However, all the fields are case-sensitive. They must exactly match the field names and values.

   The structure should look similar to one of the following. You must have at least one field that identifies either users or groups. You can include both, but only one is required, and only one is used at a time. The field you use for users or groups can have any name you choose.

   **Note**
   If you are specifying groups, use only Amazon QuickSight groups or Microsoft AD groups.

The following example shows a table with groups.

<table>
<thead>
<tr>
<th>GroupName</th>
<th>Region</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMEA-Sales</td>
<td>EMEA</td>
<td>Enterprise,SMB,Startup</td>
</tr>
<tr>
<td>US-Sales</td>
<td>US</td>
<td>Enterprise</td>
</tr>
<tr>
<td>US-Sales</td>
<td>US</td>
<td>SMB, Startup</td>
</tr>
<tr>
<td>US-Sales</td>
<td>US</td>
<td>Startup</td>
</tr>
<tr>
<td>APAC-Sales</td>
<td>APAC</td>
<td>Enterprise,SMB</td>
</tr>
<tr>
<td>Corporate-Reporting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APAC-Sales</td>
<td>APAC</td>
<td>Enterprise,Startup</td>
</tr>
</tbody>
</table>

The following example shows a table with user names.

<table>
<thead>
<tr>
<th>UserName</th>
<th>Region</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlejandroRosalez</td>
<td>EMEA</td>
<td>Enterprise,SMB,Startup</td>
</tr>
<tr>
<td>MarthaRivera</td>
<td>US</td>
<td>Enterprise</td>
</tr>
<tr>
<td>NikhilJayashankar</td>
<td>US</td>
<td>SMB, Startup</td>
</tr>
<tr>
<td>PauloSantos</td>
<td>US</td>
<td>Startup</td>
</tr>
<tr>
<td>SaanviSarkar</td>
<td>APAC</td>
<td>Enterprise,SMB</td>
</tr>
<tr>
<td><a href="mailto:sales-tps@example.com">sales-tps@example.com</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZhangWei</td>
<td>APAC</td>
<td>Enterprise,Startup</td>
</tr>
</tbody>
</table>

Or if you prefer to use a .csv file, the structure should look similar to one of the following.
Using Row-Level Security (RLS) to Restrict Access to a Dataset

Following is a SQL example.

```sql
/* for users*/
select User as UserName, Region, Segment
from tps-permissions;

/* for groups*/
select Group as GroupName, Region, Segment
from tps-permissions;
```

2. Create a dataset for the dataset rules. To make sure that you can easily find it, give it a meaningful name, for example Permissions-Sales-Pipeline.

Creating Row-Level Security

Use the following procedure to apply row-level security (RLS) by using a file or query as a dataset that contains the rules for permissions.

To apply row-level security by using a file or query

1. Confirm that you have added your rules as a new dataset. If you added them, but don't see them under the list of datasets, refresh the screen.
2. On the Datasets page, choose the dataset, and then choose Permissions.
3. From the list of datasets, choose your permissions dataset.
   
   If your permissions dataset doesn't appear on this screen, return to your datasets, and refresh the page.
4. Choose the permissions policy. Each dataset has only one active permissions dataset. If you try to add a second permissions dataset, it overwrites the existing one.

   **Important**
   
   Some restrictions apply to NULL and empty string values when working with row-level security.
   
   If your dataset has NULL values or empty strings ("") in the restricted fields, these rows are ignored when the restrictions are applied.
   
   Inside the permissions dataset, NULL values and empty strings are treated the same. For more information, see the following table.
### Using Column-Level Security (CLS) to Restrict Access to a Dataset

In the Enterprise edition of Amazon QuickSight, you can restrict access to a dataset by configuring column-level security (CLS) on it. A dataset or analysis with CLS enabled has the restricted

![RESTRICTED symbol]

By default, all users and groups have access to the data. By using CLS, you can manage access to specific columns in your dataset.

If you use an analysis or dashboard that contains datasets with CLS restrictions that you don't have access to, you can't create, view, or edit visuals that use the restricted fields. For most visual types, if a visual has restricted columns that you don't have access to, you can't see the visual in your analysis or dashboard.

### Rules for UserName, GroupName, Region, Segment

<table>
<thead>
<tr>
<th>Rules for UserName, GroupName, Region, Segment</th>
<th>Granted Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlejandroRosalez,EMEA-Sales,EMEA,&quot;Enterprise,SMB,Startup&quot;</td>
<td>Sees all EMEA Enterprise, SMB, and Startup</td>
</tr>
<tr>
<td><a href="mailto:sales-tps@example.com">sales-tps@example.com</a>,Corporate-Reporting,&quot;&quot;,&quot;&quot;</td>
<td>Sees all rows</td>
</tr>
<tr>
<td>User or group has no entry</td>
<td>Sees no rows</td>
</tr>
</tbody>
</table>

Anyone you shared your dashboard with can see all the data in it, unless the dataset is restricted by dataset rules.

5. To save your changes, choose **Apply data set**. Then, on the **Confirm: saving data set rules** screen, choose **Apply data set**. Changes in permissions apply immediately to existing users.

6. (Optional) To remove permissions, first remove the dataset rules from the dataset.

   Make certain the dataset rules are removed. Then, choose the permissions dataset and choose **Remove data set**.

   To overwrite permissions, choose a new permissions dataset and apply it. You can reuse the same dataset name, but you need to apply the new permissions in the **Permissions** screen to make these permissions active. SQL queries dynamically update, so these can be managed outside of Amazon QuickSight. For queries, the permissions are updated when the direct query cache is automatically refreshed.

If you delete a file-based permissions dataset before you remove it from the target dataset, restricted users can't access the dataset. While the dataset is in this state, it remains marked as **RESTRICTED**. However, when you view **Permissions** for that dataset, you can see that it has no selected dataset rules. To fix this, you can specify new dataset rules. Creating a dataset with the same name is not enough to fix this. You must choose the new permissions dataset in the **Permissions** screen. This restriction doesn't apply to direct SQL queries.
Tables and pivot tables behave differently. If a table or pivot table uses restricted columns in the **Rows** or **Columns** field wells, and you don't have access to these restricted columns, you can't see the visual in an analysis or dashboard. If a table or pivot table has restricted columns in the **Values** field well, you can see the table in an analysis or dashboard with only the values that you have access to. The values for restricted columns show as Not Authorized.

To enable column-level security on an analysis or dashboard, you need administrator access.

**To create a new analysis with CLS**

1. On the Amazon QuickSight start page, choose the **Analyses** tab.
2. At upper right, choose **New analysis**.
3. Choose a dataset, and choose **Column-level security**.
4. Select the columns that you want to restrict, and then choose **Next**. By default, all groups and users have access to all columns.
5. Choose who can access each column, and then choose **Apply** to save your changes.

**To use an existing analysis for CLS**

1. On the Amazon QuickSight start page, choose the **Datasets** tab.
2. Open your dataset and choose **Column-level security**.
3. Select the columns that you want to restrict, and then choose **Next**. By default, all groups and users have access to all columns.
4. Choose who can access each column, and then choose **Apply** to save your changes.

**To create a dashboard with CLS**

1. On the Amazon QuickSight navigation pane, choose the **Analyses** tab.
2. Choose the analysis that you want to create a dashboard of.
3. At upper right, choose **Share**, and then choose **Publish dashboard**.
4. Choose one of the following:
   - To create a new dashboard, choose **Publish new dashboard as** and enter a name for the new dashboard.
   - To replace an existing dashboard, choose **Replace an existing dashboard** and choose the dashboard from the list.

   Additionally, you can choose **Advanced publish options**. For more information, see Publishing a Dashboard (p. 461).
5. Choose **Publish dashboard**.
6. (Optional) Do one of the following:
   - To publish a dashboard without sharing, choose **x** at the upper right of the **Share dashboard with users** screen when it appears. You can share the dashboard later by choosing **Share** from the application bar.
   - To share the dashboard, follow the procedure in Sharing Dashboards (p. 463).
Deleting a Dataset

Important
Currently, deleting a dataset is irreversible and can cause irreversible loss of work. Deletes don't cascade to delete dependent objects. Instead, dependent objects stop working, even if you replace the deleted dataset with an identical dataset.

Before you delete a dataset, we strongly recommend that you first point each dependent analysis or dashboard to a new dataset.

Currently, when you delete a dataset while dependent visuals still exist, the analyses and dashboards that contain those visuals have no way to assimilate new metadata. They remain visible, but they can't function. They can't be repaired by adding an identical dataset.

This is because datasets include metadata that is integral to the analyses and dashboards that depend on that dataset. This metadata is uniquely generated for each dataset. Although the Amazon QuickSight engine can read the metadata, it isn't readable by humans (for example, it doesn't contain field names). So, an exact replica of the dataset has different metadata. Each dataset's metadata is unique, even for multiple datasets that share the same name and the same fields.

To delete a dataset

1. Make sure that the dataset isn't being used by any analysis or dashboard that someone wants to keep using.

   On the Datasets page, choose the dataset that you no longer need. Then choose Delete Data Set.

2. If you receive a warning if this dataset is in use, track down all dependent analyses and dashboards and point them at a different dataset. If this isn't feasible, try one or more of these best practices instead of deleting it:

   - Rename the dataset, so that the dataset is clearly deprecated.
   - Filter the data, so that the dataset has no rows.
   - Remove everyone else's access to the dataset.

   We recommend that you use whatever means you can to inform owners of dependent objects that this dataset is being deprecated. Also, make sure that you provide sufficient time for them to take action.

3. After you make sure that there are no dependent objects that will stop functioning after the dataset is deleted, choose the dataset and choose Delete Data Set. Confirm your choice, or choose Cancel.

Important
Currently, deleting a dataset is irreversible and can cause irreversible loss of work. Deletes don't cascade to delete dependent objects. Instead, dependent objects stop working, even if you replace the deleted dataset with an identical dataset.
Preparing Data

Datasets store any data preparation you have done on that data, so that you can reuse that prepared data in multiple analyses. Data preparation provides options such as adding calculated fields, applying filters, and changing field names or data types. If you are basing the data source on a SQL database, you can also use data preparation to join tables. Alternatively, you can enter a SQL query if you want to work with data from more than a single table.

If you want to transform the data from a data source before using it in Amazon QuickSight, you can prepare it to suit your needs. You then save this preparation as part of the dataset.

You can prepare a dataset when you create it, or by editing it later. For more information about creating a new dataset and preparing it, see Creating Datasets (p. 99). For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

Use the following topics to learn more about data preparation.

Topics
- Describing Data (p. 125)
- Preparing Datasets (p. 126)
- Choosing File Upload Settings (p. 130)
- Joining Data (p. 131)
- Using the Query Editor (p. 137)
- Selecting Fields (p. 139)
- Organizing Fields into Folders in Amazon QuickSight (p. 141)
- Changing a Field Name (p. 144)
- Changing a Field Data Type (p. 144)
- Mapping and Joining Fields (p. 145)
- Using Unsupported or Custom Dates (p. 146)
- Working with Calculated Fields in Datasets (p. 147)
- Adding a Filter (p. 152)
- Adding Geospatial Data (p. 163)
- Integrating SageMaker Models with Amazon QuickSight (p. 172)

Describing Data

Using Amazon QuickSight, you can add information, or metadata, about the columns (fields) in your datasets. By adding metadata, you make the dataset self-explanatory and easier to reuse. Doing this can help data curators and their customers know where the data came from and what it means. It's a way of communicating to the people who use your dataset or combine it with other datasets to build dashboards. Metadata is especially important for information that is shared between organizations.

After you add metadata to a dataset, field descriptions become available to anyone who is using the dataset. A column description appears when someone who is actively browsing the Fields list pauses
Preparing Datasets

You can prepare data in any dataset to make it more suitable for analysis, for example changing a field name or adding a calculated field. For database datasets, you can also determine the data used by specifying a SQL query or joining two or more tables.

Use the following topics to learn how to prepare datasets.

Topics
- Preparing a Dataset Based on File Data (p. 126)
- Preparing a Dataset Based on Salesforce Data (p. 128)
- Preparing a Dataset Based on Database Data (p. 129)

Preparing a Dataset Based on File Data

Use the following procedure to prepare a dataset based on text or Microsoft Excel files from either your local network or Amazon S3.

1. Open a file dataset for data preparation by choosing one of the following options:
   - Create a new local file dataset, and then choose Edit/Preview data. For more information about creating a new dataset from a local text file, see Creating a Dataset Using a Local Text File (p. 100). For more information about creating a new dataset from a Microsoft Excel file, see Creating a Dataset Using a Microsoft Excel File (p. 100).
   - Create a new Amazon S3 dataset, and then choose Edit/Preview data. For more information about creating a new Amazon S3 dataset using an existing Amazon S3 data source, see Creating a Dataset Using an Existing Amazon S3 Data Source (p. 114).
Preparing a Dataset Based on File Data

- Open an existing Amazon S3, text file, or Microsoft Excel dataset for editing, from either the analysis page or the Your Datasets page. For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

2. (Optional) On the data preparation page, enter a new name into the dataset name box on the application bar.

   This name defaults to the file name for local files. For example, it defaults to Group 1 for Amazon S3 files.

3. Review the file upload settings and correct them if necessary. For more information about file upload settings, see Choosing File Upload Settings (p. 130).

   Important
   If you want to change upload settings, make this change before you make any other changes to the dataset. New upload settings cause Amazon QuickSight to reimport the file. This process overwrites all of your other changes.

4. Prepare the data by doing one or more of the following:

   - Selecting Fields (p. 139)
   - Changing a Field Name (p. 144)
   - Changing a Field Data Type (p. 144)
   - Adding a Calculated Field to an Analysis (p. 197)
   - Adding a Filter (p. 152)

5. Check the SPICE (p. 78) indicator to see if you have enough capacity to import the dataset. File datasets automatically load into SPICE. The import happens when you choose either Save & visualize or Save.

   If you don’t have access to enough SPICE capacity, you can make the dataset smaller by using one of the following options:

   - Apply a filter to limit the number of rows.
   - Select fields to remove from the dataset.

   Note
   The SPICE indicator doesn’t update to how much space you save by removing fields or filtering the data. It continues to reflect the SPICE usage from the last import.

6. Choose Save to save your work, or Cancel to cancel it.

   You might also see Save & visualize. This option appears based on the screen that you started from. If this option isn’t there, you can create a new visualization by starting from the dataset screen.

Preparing a Dataset Based on a Microsoft Excel File

Use the following procedure to prepare a Microsoft Excel dataset.

1. Open a text file dataset for preparation by choosing one of the following options:

   - Create a new Microsoft Excel dataset, and then choose Edit/Preview data. For more information about creating a new Excel dataset, see Creating a Dataset Using a Microsoft Excel File (p. 100).
   - Open an existing Excel dataset for editing. You can do this from the analysis page or the Your Datasets page. For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

2. (Optional) On the data preparation page, enter a name into the dataset name box in the application bar. If you don’t rename the dataset, its name defaults to the Excel file name.
3. Review the file upload settings and correct them if necessary. For more information about file upload settings, see Choosing File Upload Settings (p. 130).

   **Important**
   If it's necessary to change upload settings, make this change before you make any other changes to the dataset. Changing upload settings causes Amazon QuickSight to reimport the file. This process overwrites any changes you have made so far.

4. (Optional) Change the worksheet selection.

5. (Optional) Change the range selection. To do this, open **Upload Settings** from the on–dataset menu beneath the login name at the top right.

6. Prepare the data by doing one or more of the following:
   - Selecting Fields (p. 139)
   - Changing a Field Name (p. 144)
   - Changing a Field Data Type (p. 144)
   - Adding a Calculated Field to an Analysis (p. 197)
   - Adding a Filter (p. 152)

7. Check the **SPICE** (p. 78) indicator to see if you have enough space to import the dataset. Amazon QuickSight must import Excel datasets into SPICE. This import happens when you choose either **Save & visualize** or **Save**.
   
   If you don't have enough SPICE capacity, you can choose to make the dataset smaller using one of the following methods:
   - Apply a filter to limit the number of rows.
   - Select fields to remove from the dataset.
   - Define a smaller range of data to import.

   **Note**
   The SPICE indicator doesn't update to reflect your changes until after your load them. It shows the SPICE usage from the last import.

8. Choose **Save** to save your work, or **Cancel** to cancel it.

   You might also see **Save & visualize**. This option appears based on the screen that you started from. If this option isn't there, you can create a new visualization by starting from the dataset screen.

## Preparing a Dataset Based on Salesforce Data

Use the following procedure to prepare a Salesforce dataset.

1. Open a Salesforce dataset for preparation by choosing one of the following options:
   - Create a new Salesforce dataset and choose **Edit/Preview data**. For more information about creating a new Salesforce dataset using a new Salesforce data source, see Creating a Dataset from Salesforce (p. 109). For more information about creating a new Salesforce dataset using an existing Salesforce data source, see Create a Dataset Using an Existing Salesforce Data Source (p. 114).
   - Open an existing Salesforce dataset for editing from either the analysis page or the **Your Datasets** page. For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

2. (Optional) On the data preparation page, enter a name into the dataset name box in the application bar if you want to change the dataset name. This name defaults to the report or object name.

3. (Optional) Change the data element selection to see either reports or objects.
4. (Optional) Change the data selection to choose a different report or object.

If you have a long list in the Data pane, you can search to locate a specific item by typing a search term into the Search tables box. Any item whose name contains the search term is shown. Search is case-insensitive and wildcards are not supported. Choose the cancel icon (X) to the right of the search box to return to viewing all items.

5. Prepare the data by doing one or more of the following:

   • Selecting Fields (p. 139)
   • Changing a Field Name (p. 144)
   • Changing a Field Data Type (p. 144)
   • Adding a Calculated Field to an Analysis (p. 197)
   • Adding a Filter (p. 152)

6. Check the SPICE (p. 78) indicator to see if you have enough space to import the dataset. Importing data into SPICE is required for Salesforce datasets. Importing occurs when you choose either Save & visualize or Save.

   If you don't have enough SPICE capacity, you can remove fields from the dataset or apply a filter to decrease its size. For more information about adding and removing fields from a dataset, see Selecting Fields (p. 139).

   Note
   The SPICE indicator doesn't update to reflect the potential savings of removing fields or filtering the data. It continues to reflect the size of the dataset as retrieved from the data source.

7. Choose Save to save your work, or Cancel to cancel it.

   You might also see Save & visualize. This option appears based on the screen you started from. If this option isn't there, you can create a new visualization by starting from the dataset screen.

Preparing a Dataset Based on Database Data

Use the following procedure to prepare a dataset based on a query to a database. The data for this dataset can be from an AWS database data source like Amazon Athena, Amazon RDS, or Amazon Redshift, or from an external database instance. You can choose whether to import a copy of your data into SPICE (p. 78), or to query the data directly.

1. Open a database dataset for preparation by choosing one of the following options:

   • Create a new database dataset and choose Edit/Preview data. For more information about creating a new dataset using a new database data source, see Creating Datasets from New Database Data Sources (p. 110). For more information about creating a new dataset using an existing database data source, see Creating a Dataset Using an Existing Database Data Source (p. 115).

   • Open an existing database dataset for editing from either the analysis page or the Your Datasets page. For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

2. (Optional) On the data preparation page, enter a name into the dataset name box on the application bar.

   This name defaults to the table name if you selected one before data preparation. Otherwise, it's Untitled data source.

3. Decide how your data is selected by choosing one of the following:

   • To use a single table to provide data, choose a table or change the table selection.
If you have a long table list in the **Tables** pane, you can search for a specific table by typing a search term for **Search tables**.

Any table whose name contains the search term is shown. Search is case-insensitive and wildcards are not supported. Choose the cancel icon (X) to the right of the search box to return to viewing all tables.

- To use two or more joined tables to provide data, choose two tables and join them using the join pane. You must import data into QuickSight if you choose to use joined tables. For more information about joining data using the Amazon QuickSight interface, see [Joining Data](p. 131).
- To use a custom SQL query to provide data in a new dataset, choose **Switch to Custom SQL** tool on the **Tables** pane. For more information, see [Using the Query Editor](p. 137).

To change the SQL query in an existing dataset, choose **Edit SQL** on the **Fields** pane to open the SQL pane and edit the query.

4. Prepare the data by doing one or more of the following:

- Selecting Fields (p. 139)
- Changing a Field Name (p. 144)
- Changing a Field Data Type (p. 144)
- Adding a Calculated Field to an Analysis (p. 197)
- Adding a Filter (p. 152)

5. If you aren't joining tables, choose whether to query the database directly or to import the data into SPICE by selecting either the **Query** or **SPICE** radio button. We recommend using SPICE for enhanced performance.

   If you want to use SPICE, check the SPICE indicator to see if you have enough space to import the dataset. Importing occurs when you choose either **Save & visualize** or **Save**.

   If you don't have enough space, you can remove fields from the dataset or apply a filter to decrease its size.

   **Note**
   The SPICE indicator doesn't update to reflect the potential savings of removing fields or filtering the data. It continues to reflect the size of the dataset as retrieved from the data source.

6. Choose **Save** to save your work, or **Cancel** to cancel it.

   You might also see an option to **Save & visualize**. This option appears based on the screen you started from. If this option isn't there, you can create a new visualization by starting from the dataset screen.

## Choosing File Upload Settings

If you are using a file data source, confirm the upload settings, and correct them if necessary.

**Important**
If it's necessary to change upload settings, make these changes before you make any other changes to the dataset. Changing upload settings causes Amazon QuickSight to reimport the file. This process overwrites any changes you have made so far.
Changing Text File Upload Settings

Text file upload settings include the file header indicator, file format, text delimiter, text qualifier, and start row. If you are working with an Amazon S3 data source, the upload settings you select are applied to all files you choose to use in this dataset.

Use the following procedure to change text file upload settings.

1. On the data preparation page, open the Upload Settings pane by choosing the expand icon.
2. In File format, choose the file format type.
3. If you chose the custom separated (CUSTOM) format, specify the separating character in Delimiter.
4. If the file doesn't contain a header row, deselect the Files include headers check box.
5. If you want to start from a row other than the first row, specify the row number in Start from row. If the Files include headers check box is selected, the new starting row is treated as the header row. If the Files include headers check box is not selected, the new starting row is treated as the first data row.
6. In Text qualifier, choose the text qualifier, either single quotes (') or double quotes ("").

Changing Microsoft Excel File Upload Settings

Microsoft Excel file upload settings include the range header indicator and whole worksheet selector.

Use the following procedure to change Microsoft Excel file upload settings.

1. On the data preparation page, open the Upload Settings pane by choosing the expand icon.
2. Leave Upload whole sheet selected.
3. If the file doesn't contain a header row, deselect the Range contains headers check box.

Joining Data

You can use the join interface in Amazon QuickSight to join objects from one or more data sources. By using Amazon QuickSight to join the data, you can merge disparate data without duplicating the data from different sources.

The following limitations apply to joins:

- For joins of multiple data sources, the result set is a SPICE dataset.
- For joins of multiple data sources, there's no size restriction on the data that you use to create the dataset. Make sure to always begin the join with your largest table. Often, this is a fact table. The rest of the tables combined must total less than 1 GB in size.
- You can't join on calculated fields that you created in Amazon QuickSight.
- You can't join on fields that use the geospatial data type.

For some examples of joining tables across data sources, see the Joining across data sources on Amazon QuickSight post on the AWS Big Data Blog.

Creating a Join

Use the following procedure to join tables to use in a dataset. Before you begin, import or connect to your data. You can create a join between any of the data sources supported by Amazon QuickSight,
except Internet of Things (IoT) data. For example, you can add comma-separated value (.csv) files, tables, views, SQL queries, or JSON objects in an Amazon S3 bucket.

To add one or more joins

1. Open the dataset that you want to work with.
2. (Optional) Before you get started, decide if you want to disable the autogenerated preview based on a sample of your data. To disable it, choose Auto-preview at top right. It's enabled by default.
3. 
4. If you haven't already done so, choose a Query mode. You can choose SPICE to store your dataset in SPICE (p. 78) or choose Direct query to pull live data every time. If your dataset contains one or more manually uploaded file, your dataset is automatically stored in SPICE.

   - If you choose SPICE, the data is ingested into QuickSight, and visuals that use the dataset run queries in SPICE, instead of on the database.
   - If you choose Direct query, the data isn't ingested into SPICE, and visuals that use the dataset run queries on the database, instead of in SPICE.

   If you choose this option, make sure to set unique keys in the join, if applicable, to improve performance when loading visuals.
5. On the data preparation page, choose the button labeled Add data.
6. Follow the interface prompts to choose the applicable settings from the following:

   - To add data from the same data source, choose a schema and one or more tables. The options that display can vary depending on your data source.
   - To add data from a different data source, choose Switch data source and follow the screen prompts.
   - To add a new file, choose Upload a file.
   - To write a query for a SQL data source, open the query editor by choosing Use custom SQL.
   - To create self-joins, add a table multiple times. A counter appears after the name. An example is Product, Product (2), and Product (3). Field names in the Fields or Filters sections include the same counter so you can know which instance of the table a field came from.

After you add data, you can interact with each table by choosing its menu icon. You can rearrange the tables by dragging and dropping them. An icon with red dots appears to indicate that you need to configure this join.
7. Two red dots appear for joins that aren't yet configured. To create joins, choose the first join configuration icon.
8. (Optional) To change an existing join, reopen **Join configuration** by choosing the join icon between two tables.

9. The **Join Configuration** pane opens. On the join interface, specify the join type and the fields to use to join the tables.

10. At the bottom of the screen, you can see options to set a field in one table equal to a field in another table.

- In the **Join clauses** section, choose the join column for each table.

(Optional) If the tables that you selected join on multiple columns, choose **Add a new join clause**. Doing this adds another row to the join clauses, so you can specify the next set of columns to join. Repeat this process until you have identified all of the join columns for the two data objects.
11. In the **Join configuration** pane, choose the kind of join to apply. If the join fields are a unique key for one or both tables, enable the unique key setting. Unique keys only apply to direct queries, not to SPICE data.

For more information about joins, see [Join Types (p. 135)](#).

12. Choose **Apply** to confirm your choices.

To cancel without making changes, choose **Cancel**.
13. The join icon in the workspace changes to show the new relationship.

14. (Optional) In the Fields section, you can use each field's menu to do one or more of the following:
   - Add a hierarchy to a geospatial field.
   - Include or Exclude the field.
   - Edit name & description of the field.
   - Change data type.
   - Add a calculation (a calculated field).
   - Restrict access to only me, so only you can see it. This can be helpful when you are adding fields to a dataset that's already in use.

15. (Optional) In the Filters section, you can add or edit filters. For more information, see Adding a Filter (p. 152).

Join Types

Amazon QuickSight supports the following join types:

- Inner joins
- Left and right outer joins
- Full outer joins

Let's take a closer look at what these join types do with your data. For our example data, we're using the following tables named widget and safety rating.

```sql
SELECT * FROM safety-rating

<table>
<thead>
<tr>
<th>rating_id</th>
<th>safety_rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>A-</td>
</tr>
<tr>
<td>4</td>
<td>B+</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
</tr>
</tbody>
</table>

SELECT * FROM WIDGET

<table>
<thead>
<tr>
<th>widget_id</th>
<th>widget</th>
<th>safety_rating_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WidgetA</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>WidgetB</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>WidgetC</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>WidgetD</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>WidgetE</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>WidgetF</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>WidgetG</td>
<td></td>
</tr>
</tbody>
</table>
```
Inner Joins

Use an inner join

( )

when you want to see only the data where there is a match between two tables. For example, suppose
that you perform an inner join on the safety-rating and widget tables.

In the following result set, widgets without safety ratings are removed, and safety ratings without
associated widgets are removed. Only the rows that match perfectly are included.

```
SELECT * FROM safety-rating
INNER JOIN widget
ON safety_rating.rating_id = widget.safety_rating_id
```

<table>
<thead>
<tr>
<th>rating_id</th>
<th>safety_rating</th>
<th>widget_id</th>
<th>widget</th>
<th>safety_rating_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
<td></td>
<td>WidgetB</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>A+</td>
<td></td>
<td>WidgetC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td></td>
<td>WidgetD</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>A-</td>
<td></td>
<td>WidgetA</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td></td>
<td>WidgetF</td>
<td>5</td>
</tr>
</tbody>
</table>

Left and Right Outer Joins

These are also known as left or right outer joins. Use a left

( )

or right

( )

outer join when you want to see all the data from one table, and only the matching rows from the other
table.

In a graphical interface, you can see which table is on the right or the left. In a SQL statement, the first
table is considered to be on the left. Therefore, choosing a left outer join as opposed to a right outer join
depends only on how the tables are laid out in your query tool.

For example, suppose that you perform a left outer join

( )

on safety-rating (the left table) and widgets (the right table). In this case, all safety-rating rows
are returned, and only matching widget rows are returned. You can see blanks in the result set where
there is no matching data.

```
SELECT * FROM safety-rating
LEFT OUTER JOIN widget
ON safety_rating.rating_id = widget.safety_rating_id
```

<table>
<thead>
<tr>
<th>rating_id</th>
<th>safety_rating</th>
<th>widget_id</th>
<th>widget</th>
<th>safety_rating_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
<td></td>
<td>WidgetB</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>A+</td>
<td></td>
<td>WidgetC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td></td>
<td>WidgetD</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>A-</td>
<td></td>
<td>WidgetA</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>B+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td></td>
<td>WidgetF</td>
<td>5</td>
</tr>
</tbody>
</table>
If you instead use a right outer join,
call the tables in the same order so safety-rating is on the left and widgets is on the right. In this case, only matching safety-rating rows are returned, and all widget rows are returned. You can see blanks in the result set where there is no matching data.

```
SELECT * FROM safety-rating
RIGHT OUTER JOIN widget
ON safety_rating.rating_id = widget.safety_rating_id
```

<table>
<thead>
<tr>
<th>rating_id</th>
<th>safety_rating</th>
<th>widget_id</th>
<th>widget</th>
<th>safety_rating_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>A-</td>
<td>1</td>
<td>WidgetA</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>A+</td>
<td>2</td>
<td>WidgetB</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>A+</td>
<td>3</td>
<td>WidgetC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>4</td>
<td>WidgetD</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>6</td>
<td>WidgetF</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

### Full Outer Joins

These are sometimes called just outer joins, but this term can refer to either a left outer, right outer, or full outer join. To define the meaning, we use the complete name: full outer join.

Use a full outer join
to see data that matches, plus data from both tables that doesn't match. This type of join includes all rows from both tables. For example, if you perform a full outer join on the safety-rating and widget tables, all rows are returned. The rows are aligned where they matched, and all extra data is included on separate rows. You can see blanks in the result set where there is no matching data.

```
SELECT * FROM safety-rating
FULL OUTER JOIN widget
ON safety_rating.rating_id = widget.safety_rating_id
```

<table>
<thead>
<tr>
<th>rating_id</th>
<th>safety_rating</th>
<th>widget_id</th>
<th>widget</th>
<th>safety_rating_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
<td>2</td>
<td>WidgetB</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>A+</td>
<td>3</td>
<td>WidgetC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>4</td>
<td>WidgetD</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>A-</td>
<td>1</td>
<td>WidgetA</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>B+</td>
<td>6</td>
<td>WidgetF</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

### Using the Query Editor

When you create a dataset or prepare your data for use in an analysis, you can customize the data in the query editor.

The query editor is made up of multiple components, as follows:

- **Query mode** – At the top left, you can choose between direct query or SPICE query modes:
- **Direct query** – To run the SELECT statement directly against the database
Creating a Basic SQL Query

Use the following procedure to connect to a data source by using a custom SQL query.

To create a basic SQL query

1. Create a new data source and validate the connection.
2. Fill in the options necessary to connection, however you don't need to select a schema or a table.
3. Choose **Use custom SQL**.
4. (Optional) You can enter your query in the SQL editor, or continue on to the next step to use the full-screen version. To enter it now, create a name for the query. Then type or paste a SQL query into the editor. The SQL editor offers syntax highlighting, basic autocomplete, autoindent, and line numbering.

   (Optional) Choose **Confirm query** to validate it and view settings for direct query, SPICE memory, and SageMaker settings.

5. Choose **Edit/Preview data**. The full query editor appears with the SQL editor displayed. The query is processed and a sample of the query results displays in the data preview pane. You can make
changes to the SQL and confirm them by choosing Apply. When you are done with the SQL, choose Close to continue.

6. At the top, enter a name for the dataset. Then choose Save & visualize.

Modifying Existing Queries

To update a SQL query

1. Open the dataset that you want to work with.
2. In the workspace with the grid, locate the box-shaped object that represents the existing query.
3. Open the options menu on the query object and choose Edit SQL query. If this option doesn't appear in the list, the query object isn't based on SQL.

To view previous versions of queries, open the Query archive at left.

Selecting Fields

When you prepare data, only the fields you select on the data preparation page are available for subsequent use in a visual. By default, all of the fields in the table or file you are preparing are selected. You can toggle a field by either selecting or deselecting its check box in the Fields pane.
You can also toggle a field by hovering over the field menu, which appears next to each field on hover. Then choose either **Exclude field** or **Include field**. The same menu contains additional actions, such as **Rename field**, **Add calculation**, and **Change data type**.

You can select or deselect all fields at once by choosing either **All** or **None** at the top of the **Fields** pane.
If you edit a dataset and exclude a field that is used in a visual, that visual breaks. You can fix it the next time you open that analysis.

**Searching for Fields**

If you have a long field list in the **Fields** pane, you can search to locate a specific field by typing a search term for **Search fields**. Any field whose name contains the search term is shown.

Search is case-insensitive and wildcards are not supported. Choose the cancel icon (X) to the right of the search box to return to viewing all fields.

**Organizing Fields into Folders in Amazon QuickSight**

When prepping your data in Amazon QuickSight, you can use folders to organize your fields for multiple authors across your enterprise. Arranging fields into folders and subfolders can make it easier for authors to find and understand fields in your dataset.

You can create folders while preparing your dataset, or when editing a dataset. For more information about creating a new dataset and preparing it, see Creating Datasets (p. 99). For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

While performing an analysis, authors can expand and collapse folders, search for specific fields within folders, and see your descriptions of folders on the folder menu. Folders appear at the top of the **Fields** pane in alphabetical order.

**Creating a Folder**

Use the following procedure to create a new folder in the **Fields** pane.

**To create a new folder**

1. On the data preparation page, in the **Fields** pane, select the field menu for the fields that you want to place in a folder and choose **Add to folder**.

   To select more than one field at a time, press the Ctrl key while you select (Command key on Mac).

   ![Add to folder menu](image)

2. On the **Add to folder** page that appears, choose **Create a new folder** and enter a name for the new folder.

3. Choose **Apply**.
Creating a Subfolder

To further organize your data fields in the Fields pane, you can create subfolders within parent folders. Use the following procedure to create a subfolder.

To create a subfolder

1. On the data preparation page, in the Fields pane, select the field menu for a field already in a folder and choose Move to folder.
2. On the Move to folder page that appears, choose Create a new folder and enter a name for the new folder.
3. Choose Apply.

The subfolder appears within the parent folder at the top of the list of fields. Subfolders are arranged in alphabetical order.

Adding Fields to an Existing Folder

Use the following procedure to add fields to an existing folder in the Fields pane.

To add one or more fields to a folder

1. On the data preparation page, in the Fields pane, select the fields that you want to add to a folder.
   To select more than one field at a time, press the Ctrl key while you select (Command key on Mac).
2. On the field menu, choose Add to folder.
3. On the Add to folder page that appears, choose a folder for Existing folder.
4. Choose Apply.

The field or fields are added to the folder.

Moving Fields Between Folders

Use the following procedure to move fields between folders in the Fields pane.

To move fields between folders

1. On the data preparation page, in the Fields pane, select the fields that you want to move to another folder.
   To select more than one field at a time, press the Ctrl key while you select (Command key on Mac).
2. On the field menu, choose Move to folder.
3. On the Move to folder page that appears, choose a folder for Existing folder.
4. Choose Apply.

Removing Fields from a Folder

Use the following procedure to remove fields from a folder in the Fields pane. Removing a field from a folder doesn't delete the field.
To remove fields from a folder
1. On the data preparation page, in the Fields pane, select the fields that you want to remove.
2. On the field menu, choose Remove from folder.

The fields that you selected are removed from the folder and placed back in the list of fields in alphabetical order.

Editing a Folder Name and Adding a Folder Description

You can edit the name or add a description of a folder to provide context about the data fields inside it. The folder name appears in the Fields pane. While performing an analysis, authors can read your folder's description when they select the folder menu in the Fields pane.

To edit a folder name or edit or add a description for a folder
1. On the data preparation page, in the Fields pane, select the folder menu for the folder that you want to edit and choose Edit name & description.
2. On the Edit folder page that appears, do the following:
   • For Name, enter a name for the folder.
   • For Description, enter a description of the folder.
3. Choose Apply.

Moving Folders

You can move folders and subfolders to new or existing folders in the Fields pane. Use the following procedure to move a folder.

To move a folder
1. On the data preparation page, in the Fields pane, choose Move folder on the folder menu.
2. On the Move folder page that appears, do one of the following:
   • Choose Create a new folder and enter a name for the folder.
   • For Existing folder, choose a folder.
3. Choose Apply.

The folder appears within the folder that you chose in the Fields pane.

Removing Folders from the Fields Pane

Use the following procedure to remove a folder from the Fields pane.

To remove a folder
1. On the data preparation page, in the Fields pane, choose Remove folder on the folder menu.
2. On the Remove folder? page that appears, choose Remove.

The folder is removed from the Fields pane. Any fields that were in the folder are placed back in the list of fields in alphabetical order. Removing folders doesn't exclude fields from view or delete fields from the dataset.
Changing a Field Name

You can change any field name from what is provided by the data source. If you change the name of a field used in a calculated field, make sure also to change it in the calculated field function. Otherwise, the function fails.

Use the following procedure to change a field name.

1. In the data preview pane, choose the edit icon on the field that you want to change.
2. Highlight the field name and enter a new name.
3. Choose Apply.

Changing a Field Data Type

When Amazon QuickSight retrieves data, it assigns each field a data type based on the data in the field. The possible data types are as follows:

- **Date** – The date data type is used for date data in a supported format. For information about the date formats Amazon QuickSight supports, see Data Source Quotas (p. 72).
- **Decimal** – The decimal data type is used for numeric data that requires one or more decimal places of precision, for example 18.23. The decimal data type supports values with up to four decimal places to the right of the decimal point. Values that have a higher scale than this are truncated to the fourth decimal place when displayed in data preparation or analyses and when imported into QuickSight. For example, 13.00049 is truncated to 13.0004.
- **Geospatial** – The geospatial data type is used for geospatial data, for example longitude and latitude, or cities and countries.
- **Int** – The int data type is used for numeric data that only contains integers, for example 39.
- **String** – The string data type is used for nondate alphanumeric data.

During data preparation, you can change the data type of any field from the data source but not that of any calculated field you create. Amazon QuickSight converts the field data according to the data type
you choose. Rows that contain data that is incompatible with that data type are skipped. For example, suppose that you convert the following field from String to Int.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10020</td>
<td>36803</td>
<td>14267a</td>
<td>98457</td>
</tr>
<tr>
<td>78216b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All records containing alphabetic characters in that field are skipped, as shown following.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10020</td>
<td>36803</td>
<td>98457</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you have a database dataset with fields whose data types aren't supported by Amazon QuickSight, use a SQL query during data preparation. Then use CAST or CONVERT commands (depending on what is supported by the source database) to change the field data types. For more information about adding a SQL query during data preparation, see Using the Query Editor (p. 137). For more information about how different source data types are interpreted by Amazon QuickSight, see Supported Data Types from Other Data Sources (p. 75).

You might have numeric fields that act as dimensions rather than metrics, for example ZIP codes and most ID numbers. In these cases, it's helpful to give them a string data type during data preparation. Doing this lets Amazon QuickSight understand that they are not useful for performing mathematical calculations and can only be aggregated with the `Count` function. For more information about how Amazon QuickSight uses dimensions and measures, see Setting a Field as a Dimension or Measure (p. 187).

In SPICE (p. 78), numbers converted from numeric into an integer are truncated by default. If you want to round your numbers instead, you can create a calculated field using the `round` (p. 508) function. To see whether numbers are rounded or truncated before they are ingested into SPICE, check your database engine.

**To change a field data type**

1. In the data preview pane, choose the data type icon under the field you want to change.
2. Choose the target data type. Only data types other than the one currently in use are listed.

---

**Mapping and Joining Fields**

When you are using different datasets together in Amazon QuickSight, you can simplify the process of mapping fields or joining tables during the data preparation stage. You should already be verifying that your fields have the correct data type and an appropriate field name. However, if you already know which datasets are going to be used together, you can take a couple of extra steps to make your work easier later on.

**Topics**

- Mapping Fields (p. 146)
- Joining Fields (p. 146)
Mapping Fields

Amazon QuickSight can automatically map fields between datasets in the same analysis. The following tips can help make it easier for Amazon QuickSight to automatically map fields between datasets, for example if you are creating a filter action across datasets:

- Matching field names – Field names must match exactly, with no differences in case, spacing, or punctuation. You can rename fields that describe the same data, so an automatic mapping is accurate.
- Matching data types – Fields must have the same data type for automatic mapping. You can change the data types while you are preparing the data. This step also gives you the opportunity to discover whether you need to filter out any data that isn't the correct data type.
- Using calculated fields – You can use calculated fields to create a matching field, and give it the correct name and data type for automatic mapping.

Note
After an automatic mapping exists, you can rename a field without breaking the field mapping. However, if you change the data type, the mapping is broken.

For more information on field mapping for filter actions across datasets, see Creating and Editing Custom Actions in Amazon QuickSight (p. 321).

Joining Fields

You can create joins between data from different data sources, including files or databases. The following tips can help make it easier for you to join data from different files or data sources:

- Similar field names – It is simpler to join fields when you can see what should match; for example, order ID and order-id seem as if they should be the same. But if one is a work order, and the other is a purchase order, then the fields are probably different data. If possible, make sure that the files and tables that you want to join have field names making it clear what data they contain.
- Matching data types – Fields must have the same data type before you can join on them. Make sure the files and tables that you want to join having matching data types in join fields. You can't use a calculated field for a join. Also, you can't join two existing datasets. You create the joined dataset by directly accessing the source data.

For more information on joining data across data sources, see Joining Data (p. 131).

Using Unsupported or Custom Dates

Amazon QuickSight natively supports a limited number of date formats. However, you can't always control the format of the data provided to you. When your data contains a date in an unsupported format, you can tell Amazon QuickSight how to interpret it.

You can do this by editing the dataset, and changing the format of the column from text or numeric to date. A screen appears after you make this change, so you can enter the format. For example, if you are using a relational data source, you can specify MM-dd-yyyy for a text field containing '09-19-2017', so it is interpreted as 2017-09-19T00:00:00.000Z. If you are using a nonrelational data source, you can do the same thing starting with a numeric field or a text field.

Amazon QuickSight only supports text to date for relational (SQL) sources.

For more information on supported date formats, see Supported Date Formats (p. 76).

Use this procedure to help Amazon QuickSight understand dates in different formats.
1. For a dataset containing unsupported date formats, edit the data as follows. For the column containing your datetime data, change the data type from text to date. Do this by choosing the colorful data type icon beneath the column name in the data preview.

Note
Integer dates that aren't Unix epoch datetimes don't work as is. For example, these formats are not supported as integers:MMddyy,MMddyyyy,ddMMyy,ddMMyyyy, and yyMMdd. The workaround is to first change them to text format. Make sure all your rows contain six digits (not five). Then change the text data type to datetime.

For more information on Unix epoch datetimes, see epochDate (p. 485).

When you change the data type to date, the Edit date format screen appears.

2. Enter your date format, indicating which parts are month, date, year, or time. Formats are case-sensitive.

3. Choose Validate to make sure Amazon QuickSight can now interpret your datetime data with the format you specified. Rows that don't validate are skipped and omitted from the dataset.

4. When you are satisfied with the results, choose Update. Otherwise, choose Close.

Working with Calculated Fields in Datasets

Create calculated fields to transform your data by using one or more of the following:
Handling Decimal Values in Calculated Fields

The decimal data type supports up to four decimal places to the right of the decimal point. During data preparation, calculated fields that use decimal data with more than four decimal places use the full value to perform the calculation. If the result is again decimal data that uses more than four decimal places, the result is then truncated when the dataset is imported into SPICE (p. 78) or displayed in an analysis.

As an example, take decimal field Field_A with a value of 0.00006, which is displayed in the user interface as 0.0. The full value 0.00006 is still used in all calculations. The following are some examples of how you can use this value in calculations:

- Field_A > 0 = true. The calculated field value displayed in the analysis or imported into SPICE is true.
- ceil(Field_A) = 1. The calculated field value displayed in the analysis or imported into SPICE is 1.
- Field_A + 0.00009 = 0.00015. The calculated field value displayed in the analysis or imported into SPICE is 0.0001.
- Field_A * 1.5 = 0.00009. The calculated field value displayed in the analysis or imported into SPICE is 0.0.

Using the Calculations Editor

Create calculated fields to transform your data before you analyze it. For details about supported functions and operators, see Calculated Field Function and Operator Reference for Amazon QuickSight (p. 471).

You can add calculated fields directly to a dataset. The fields that you add become available to anyone who uses the dataset. When you use the dataset in an analysis, you can add additional calculated fields. The fields that you add to an analysis are available only in that analysis. For information about adding fields to an analysis instead, see Adding a Calculated Field to an Analysis (p. 197).

To add or edit a calculated field

1. Open the dataset that you want to work with.

   To open a dataset from within an analysis, open the list by choosing the pencil icon near the dataset at left. Choose the menu ellipses (...). Then choose Edit. This action opens the dataset editor, also called the data preparation screen. In this screen, you can add a field directly to the dataset, rather than adding it only to the analysis.

2. Open the expression editor for calculated fields by doing one of the following:
• To create a new field, choose **Add calculated field** at left.
• To edit an existing field, choose it from **Calculated fields** at left, then choose **Edit** from the context (right-click) menu.

3. Enter a descriptive name for **Add title** to name the new calculated field. This name appears in the field list in the dataset, so it should look similar to the other fields. For this example, we name the field **Total Sales This Year**.

4. (Optional) Add a comment, for example to explain what the expression does, by enclosing text in slashes and asterisks.

   /* Calculates sales per year for this year*/

5. Identify the metrics, functions, and other items to use. For this example, we need to identify the following:
   • The metric to use
   • Functions: ifelse and datediff

   We want to build a statement like "If the sale happened during this year, show the total sales, and otherwise show 0."

   To add the `ifelse` function, open the **Functions** list. Choose **All** to close the list of all functions. Now you should see the function groups: **Aggregate, Conditional, Date**, and so on.
Choose **Conditional**, and then double-click on **ifelse** to add it to the workspace.

```
ifelse()
```

6. Place your cursor inside the parenthesis in the workspace, and add three blank lines.

```
ifelse(
)
```

7. With your cursor on the first blank line, find the **dateDiff** function. It's listed for **Functions** under **Dates**. You can also find it by entering **date** for **Search functions**. The **dateDiff** function returns all functions that have **date** as part of their name. It doesn't return all functions listed under **Dates**; for example, the **now** function is missing from the search results.

Double-click on **dateDiff** to add it to the first blank line of the **ifelse** statement.

```
ifelse(
    dateDiff()
)
```

8. Add the parameters that **dateDiff** uses. Place your cursor inside the **dateDiff** parentheses to begin to add **date1**, **date2**, and **period**:

1. For **date1**, the first parameter is the field that has the date in it. Find it under **Fields**, and add it to the workspace by double-clicking it or entering its name.

2. For **date2**, add a comma, then choose **truncDate()** for **Functions**. Inside its parenthesis, add period and date, like this: **truncDate( "YYYY", now() )**

3. For **period**: Add a comma after **date2** and enter **YYYY**. This is the period for the year. To see a list of all the supported periods, find **dateDiff** in the **Functions** list, and open the documentation by choosing **Learn more**. If you're already viewing the documentation, as you are now, see **dateDiff** (p. 484).

Add a few spaces for readability, if you like. Your expression should look like the following.

```
ifelse(
    dateDiff( {Date}, truncDate( "YYYY", now() ) ,"YYYY" )
)
```

9. Specify the return value. For our example, the first parameter in an **ifelse** needs to return a value of **TRUE** or **FALSE**. Because we want the current year, and we're comparing it to this year, we specify that the **dateDiff** statement should return 0. The **if** part of the **ifelse** evaluates as true for rows where there is no difference between the year of the sale and the current year.

```
dateDiff( {Date}, truncDate( "YYYY", now() ) ,"YYYY" ) = 0
```

To create a field for **TotalSales** for last year, you can change 0 to 1.
Another way to do the same thing is to use addDateTime instead of truncDate. Then for each previous year, you change the first parameter for addDateTime to represent each year. For this, you use -1 for last year, -2 for the year before that, and so on. If you use addDateTime, you leave the dateDiff function = 0 for each year.

```sql
  dateDiff( {Discharge Date}, addDateTime(-1, "YYYY", now() ),"YYYY" ) = 0 /* Last year */
```

10. Move your cursor to the first blank line, just under dateDiff. Add a comma.

   For the then part of the ifelse statement, we need to choose the measure (metric) that contains the sales amount, TotalSales.

   To choose a field, open the Fields list and double-click a field to add it to the screen. Or you can enter the name. Add curly braces {} around names that contain spaces. It's likely that your metric has a different name. You can know which field is a metric by the number sign in front of it (#).

   Your expression should look like the following now.

   ```sql
   ifelse( dateDiff( {Date}, truncDate( "YYYY", now() ),"YYYY" ) = 0,
    {TotalSales}
   )
   ```

11. Add an else clause. The ifelse function doesn't require one, but we want to add it. For reporting purposes, you usually don't want to have any null values, because sometimes rows with nulls are omitted.

   We set the else clause of ifelse to 0. The result is that this field is 0 for rows that contain sales from previous years.

   To do this, on the blank line add a comma and then a 0. If you added the comment at the beginning, your finished ifelse expression should look like the following.

   ```sql
   ifelse( dateDiff( {Date}, truncDate( "YYYY", now() ),"YYYY" ) = 0,
    {TotalSales},
   0
   )
   ```

12. Save your work by choosing Save at upper right.

   If there are errors in your expression, the editor displays an error message at the bottom. Check your expression for a red squiggly line, then hover your cursor over that line to see what the error message is. Common errors include missing punctuation, missing parameters, misspellings, and invalid data types.

   To avoid making changes, choose Cancel.

You can change the data type of any field in your dataset, including the types of calculated fields. You can only choose data types that match the data that's in the field.

**To change the data type of a calculated field**

- For Calculated fields (at left), choose the field that you want to change, then choose Change data type from the context (right-click) menu.
Unlike the other fields in the dataset, calculated fields can't be disabled. Instead, delete them.

**To delete a calculated field**
- For **Calculated fields** (at left), choose the field that you want to change, then choose **Delete** from the context (right-click) menu.

### Adding a Filter

You can use filters to refine the data in a dataset. Each filter applies only to a single field. You can apply filters to both regular and calculated fields.

If you create multiple filters, all top-level filters apply together using AND. If you group filters by adding them inside a top-level filter, the filters in the group apply using OR.

Amazon QuickSight applies all of the enabled filters to the field. For example, if there is one filter of `state = WA` and another filter of `sales >= 500`, then the dataset only contains records that meet both of those criteria. If you disable one of these, only one filter applies.

Take care that multiple filters applied to the same field aren't mutually exclusive.

**Note**
- The data preview shows you the results of your combined filters only as they apply to the first 1000 rows. If all of the first 1000 rows are filtered out, then no rows show in the preview. This effect occurs even when rows after the first 1000 aren't filtered out.

**Topics**
- Viewing Filters (p. 152)
- Adding a Filter (p. 153)
- Editing a Filter (p. 162)
- Deleting a Filter (p. 163)

### Viewing Filters

To see the filters for a dataset, start on the data preparation page. Choose the **Filters** pane on the left side of the screen. It's located beneath the **Fields** pane.
If a single field has multiple filters, they are grouped together. They display in order of create date, with the oldest filter on top.

**Viewing Filter Details**

Choose the filter to open the Edit Filter view and see filter details.

Choose the Edit filter selector to close that view and return to the Filters view.

**Adding a Filter**

You can apply filters to both regular and calculated fields, which include text (string data type), numeric (int or decimal data types), and date fields. Depending on the data type of the field you choose, you are offered different filtering options as described in the following topics.

**Topics**

- Adding a Text Filter (p. 153)
- Adding a Numeric Filter (p. 155)
- Adding a Date Filter (p. 156)

**Adding a Text Filter**

You have two options for creating text field filters. You can specify multiple field values to include or exclude using the Custom filter list filter type. Or you can specify a single value that the field value must equal or not equal using the Custom filter filter type.

**Adding a Text Filter by Specifying Multiple Field Values**

With the Custom filter list filter type, you specify one or more field values to filter on, and whether you want to include or exclude records that contain those values. The specified value and actual field value must match exactly for the filter to be applied to a given record.

Use the following procedure to create a text field filter by specifying multiple field values.
1. On the data preparation page, expand the Filters pane.
2. Choose New filter, and then choose a text field to filter on.
   Doing this creates a new filter with no criteria.
3. Choose the new filter to expand it.
4. Change the filter type to Custom filter list.
5. Enter a field value in Enter a value to add, and then choose the add icon.
   To remove a field value from the criteria, choose its delete icon.
6. (Optional) Repeat Step 5 until you have added all of the field values that you want to filter on.
7. Choose whether to include or exclude records that contain the field values you selected.
8. Choose Apply.

Adding a Text Filter by Specifying a Single Field Value

With the Custom filter filter type, you specify a single value that the field value must equal or not equal. If you choose an equal comparison, the specified value and actual field value must match exactly in order for the filter to be applied to a given record.

Use the following procedure to create a text field filter by specifying one field value.

1. On the data preparation page, expand the Filters pane.
2. Choose New filter, and then choose a text field to filter on.
   Doing this creates a new filter with no criteria.
3. Choose the new filter to expand it.
4. Change the filter type to Custom filter.
5. Choose a comparison type.
6. Enter a field value in the value box.

7. Choose Apply.
Adding a Numeric Filter

Fields with decimal or int data types are considered numeric fields. You create filters on numeric fields by specifying a comparison type, for example Greater than or Between, and a comparison value or values as appropriate to the comparison type. Comparison values must be positive integers and should not contain commas.

You can use the following comparison types in numeric filters:

- Equals
- Does not equal
- Greater than
- Greater than or equal to
- Less than
- Less than or equal to
- Between

Creating a Numeric Filter

Use the following procedure to create a numeric field filter.

1. On the data preparation page, expand the Filters pane.
2. Choose New filter, and then choose a numeric field to filter on.

   Doing this creates a new filter with no criteria.
3. Choose the new filter to expand it.
4. Choose a comparison type.

   ![Comparison types dropdown](image)

5. If you have chosen a comparison type other than Between or Not between, enter a comparison value.
If you have chosen a comparison type of Between or Not between, type the beginning of the value range in **Minimum value** and the end of the value range in **Maximum value**.

6. Choose **Apply**.

**Adding a Date Filter**

You create filters on date fields by selecting the filter conditions and date values that you want to use. There are two filter types for dates:

- **Range** – A series of dates based on a time range and comparison type. You can filter records based on whether the date field value is before or after a specified date, or within a date range. You enter date values in the format MM/DD/YYYY. You can use the following comparison types:
• **Between** – Between a start date and an end date
• **After** – After a specified date
• **Before** – Before a specified date

- **Relative** – A series of date/time elements based on the current date. You can filter records based on the current date and your selected unit of measure (UOM). Date filter UOMs include years, quarters, months, weeks, days, hours, and minutes. You can use the following comparison types:
  - **Previous** – The previous UOM—for example, the previous year.
  - **This** – This UOM, which includes all dates and times that fall within the select UOM, even if they occur in the future.
  - **to date or up to now** – UOM to date, or UOM up to now. The displayed phrase adapts to the UOM you choose. However, in all cases this option filters out data that is not between the beginning of the current UOM and the current moment.
  - **Last n** – The last specified number of the given UOM, which includes all of this UOM and all of the last \( n - 1 \) UOM. For example, let’s say today is May 10, 2017. You choose to use *years* as your UOM, and set Last \( n \) years to 3. The filtered data includes data for all of 2017, plus all of 2016, and all of 2015. If you have any data for the future dates of the current year (2017 in this example), these records are included in your dataset.

Comparisons are applied inclusive to the date specified. For example, if you apply the filter \(<\text{date}>\) Before 1/1/16, the records returned include all rows with date values through 1/1/16 23:59:59.

**Note**

If a column or attribute has no time zone information, then the client query engine sets the default interpretation of that datetime data. For example, suppose that a column contains a timestamp, rather than a timestamptz, and you are in a different time zone than the data’s origin. In this case, the engine can render the timestamp differently than you expect. Amazon QuickSight and [SPICE](p. 78) both use Universal Coordinated Time (UTC) times.

**Creating a Date Filter**

Use the following procedure to create a filter for a date field.

1. Choose **Filter** on the tool bar.
2. On the **Applied filters** pane, choose **Create one**, and then choose a date field to filter on.

   Doing this creates a new filter with no criteria.

   ![Applied filters](image)

3. If the filter does not expand to show options, choose the new filter to expand it.
4. Choose a filter type.

5. Do the following to create a date filter on a time range:
   
   a. To create a date filter on a time range, choose a comparison type.
b. Enter date values.

If you choose a **Between** comparison, enter a start and end date, or select the **Start date** or **End date** field to bring up the date picker control and select dates.

If you choose a **Before** or **After** comparison, enter a date, or choose the date field to bring up the date picker control and select a date instead.
6. Do the following to create a date filter on relative dates:

   a. Choose a unit of measure (UOM).
b. Choose one option. If you choose **Last n UOM**, specify a number for your range—for example, last 3 years, or last 2 hours.

For more information about date filter options, see [Adding a Date Filter](p. 156).
7. Choose Apply.

**Editing a Filter**

You can edit a filter by changing the filter criteria or enabling or disabling the filter.

You can't change the field a filter applies to. To apply a filter to a different field, create a new filter instead.

**Enabling or Disabling a Filter**

You can use the filter menu to enable or disable a filter. When you create a filter, it's enabled by default.

1. On the data preparation page, expand the Filters pane.
2. Choose the filter you want to enable or disable, and then choose the selector to the right of the filter name.
3. On the filter menu, choose Enable filter or Disable filter.

**Changing Filter Criteria**

Use the following procedure to modify a filter.

1. On the data preparation page, expand the Filters pane.
2. Choose the filter you want to modify to see the filter details.
3. Change the comparison type or values.
4. Choose Apply.

Deleting a Filter

Use the following procedures to delete a filter.

1. On the data preparation page, expand the Filters pane.
2. Choose the filter you want to enable or disable, and then choose the selector to the right of the filter name.
3. On the filter menu, choose Delete filter.

Adding Geospatial Data

You can flag geographic fields in your data, so that Amazon QuickSight can display them on a map. Amazon QuickSight can chart latitude and longitude coordinates. It also recognizes geographic components such as country, state, county, city, and zip code. You can also create geographic hierarchies that can disambiguate similar entities, for example the same city name in two states.

Note
For now, automatic geocoding works only for US locations. You can add latitude and longitude coordinates to your data to make geospatial charts.
Geospatial charts in Amazon QuickSight aren't currently supported in some geographies, including India and China. We are working on adding support for more regions.

Use the following procedures to add geospatial data types and hierarchies to your dataset.

1. On the data preparation page, label the geographic components with the correct data type.

   There are several ways to do this. One is to choose the field under Fields and use the ellipses icon (...) to open the context menu.

   Then choose the correct geospatial data type.
You can also change the data type in the work area with the data sample. To do this, choose the data type listed under the field name. Then choose the data type you want to assign.

2. Verify that all geospatial fields necessary for mapping are labeled as geospatial data types. You can check this by looking for the place marker icon. This icon appears under the field names across the top of the page, and also in the Fields pane on the left.

Also check the name of the data type, for example latitude or country.

3. (Optional) You can set up a hierarchy or grouping for geographical components (state, city), or for latitude and longitude coordinates. For coordinates, you must add both latitude and longitude to the geospatial field wells.

To create a hierarchy or grouping, first choose one of these fields in the Fields pane. Each field can only belong to one hierarchy. It doesn't matter which one you choose first, or what order you add the fields in.

Choose the ellipsis icon (…) next to the field name. Then choose Add to a hierarchy.

4. On the Add field to hierarchy screen, choose one of the following:
   - Choose Create a new geospatial hierarchy to create a new grouping.
   - Choose Add to existing geospatial hierarchy to add a field to a grouping that already exists. The existing hierarchies displayed include only those of matching geospatial types.
Choose **Add** to confirm your choice.

5. On the **Create hierarchy** screen, name your hierarchy.

If you are creating a latitude and longitude grouping, the **Create hierarchy** screen appears as follows. Depending on whether you chose latitude or longitude in the previous steps, either latitude or longitude displays on this screen. Make sure your latitude field shows under **Field to use for latitude**. Also make sure your longitude shows under **Field to use for longitude**.
For geographical components, the Create hierarchy screen has two choices:

- Choose **This hierarchy is for a single country** if your data only contains one country. Choose the specific country from the list. Your data doesn't need to contain every level of the hierarchy. You can add fields to the hierarchy in any order.

- Choose **This hierarchy is for multiple countries** if your data contains more than one country. Choose the field that contains the country names. Currently, Amazon QuickSight only supports US geographical areas. Thus, at this time, you can't create a hierarchy containing other geographical types. However, you can still use latitude and longitude values to visualize non-US geographic regions.
For either hierarchy type, choose **Update** to continue.

6. Continue by adding as many fields to the hierarchy as you need to.

Your geospatial groupings appear in the **Fields** pane.
Changing a Geospatial Grouping

You can change a geospatial hierarchy or grouping that exists in a dataset.

Use the following procedure to edit or disband a geospatial hierarchy.

1. Open the dataset. In the **Fields** pane, choose the hierarchy name.

2. Choose the ellipsis icon (...), then choose one of the following options.

   Choose **Disband hierarchy** to remove the hierarchy from the dataset. You can't undo this operation. However, you can recreate your hierarchy or grouping by starting again at step 1. Disbanding the hierarchy doesn't remove any fields from the dataset.
Choose Edit hierarchy to make changes to the hierarchy. Doing this reopens the creation screens, so you can make different choices in rebuilding your hierarchy.

**Geospatial Troubleshooting**

Use this section to discover the Amazon QuickSight requirements for correctly processing geospatial data. If Amazon QuickSight doesn't recognize your geospatial data as geospatial, use this section to help troubleshoot the issue. Make sure that your data follows the guidelines listed, so that it works in geospatial visuals.

**Note**

Geospatial charts in Amazon QuickSight currently aren't supported in some geographies, including India and China. We are working on adding support for more regions. If your geography follows all the guidelines listed here, and still generates errors, contact the Amazon QuickSight team from within the Amazon QuickSight console.

**Topics**

- Geocoding Issues (p. 169)
- Issues with Latitude and Longitude (p. 170)

**Geocoding Issues**

Amazon QuickSight geocodes place names into latitude and longitude coordinates. It uses these coordinates to display place names on the map. Amazon QuickSight skips any places that it can't geocode.

For this process to work properly, your data must include at least the country. Also, there can't be duplicate place names inside of a parent place name.

A few issues prevent place names from showing up on a map chart. These issues include unsupported, ambiguous, or invalid locations, as described following.

**Topics**

- Issues with Unsupported Areas (p. 169)
- Issues with Ambiguous Locations (p. 169)
- Issues with Invalid Geospatial Data (p. 170)
- Issues with the Default Country in Geocoding (p. 170)

**Issues with Unsupported Areas**

**Important**

At this time, Amazon QuickSight only supports geographical place names in data related to the US.

To map locations in countries other than the US, include latitude and longitude coordinates in your data. Use these coordinates in the geospatial field well to make locations show on a map chart.

**Issues with Ambiguous Locations**

Geospatial data can't contain ambiguous locations. For example, suppose that the data contains a city named Springfield, but the next level in the hierarchy is country. Because multiple states have a city named Springfield, it isn't possible to geocode the location to a specific point on a map.
To avoid this problem, you can add enough geographical data to indicate what location should show on a map chart. For example, you can add a state level into your data and its hierarchy. Or, you might add latitude and longitude.

**Issues with Invalid Geospatial Data**

Invalid geospatial data occurs when a place name (a city, for example) is listed under an incorrect parent (a state, for example). This issue might be a simple misspelling, or data entry error.

*Note*

Amazon QuickSight doesn't support regions (for example, West Coast or South) as geospatial data. However, you can use a region as a filter in a visual.

**Issues with the Default Country in Geocoding**

Make sure that you are using the correct default country.

The default for each hierarchy is based on the country or country field that you choose when you create the hierarchy.

To change this default, you can return to the Create hierarchy screen. Then edit or create a hierarchy, and choose a different country.

If you don't create a hierarchy, your default country is based on your region. For details, see the following table.

<table>
<thead>
<tr>
<th>Region</th>
<th>Default Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>US West (Oregon) Region</td>
<td>US</td>
</tr>
<tr>
<td>US East (Ohio) Region</td>
<td>US</td>
</tr>
<tr>
<td>US East (N. Virginia) Region</td>
<td>US</td>
</tr>
<tr>
<td>Asia Pacific (Singapore)</td>
<td>Singapore</td>
</tr>
<tr>
<td>Asia Pacific (Sydney)</td>
<td>Australia</td>
</tr>
<tr>
<td>Europe (Ireland) Region</td>
<td>Ireland</td>
</tr>
</tbody>
</table>

**Issues with Latitude and Longitude**

Amazon QuickSight uses latitude and longitude coordinates in the background to find place names on a map. However, you can also use coordinates to create a map without using place names. This approach also works with unsupported place names.

Latitude and longitude values must be numeric. For example, the map point indicated by 28.5383355 \(-81.3792365\) is compatible with Amazon QuickSight. But 28° 32' 18.0096'' N 81° 22' 45.2424'' W is not.

**Topics**

- Valid Ranges for Latitude and Longitude Coordinates (p. 170)
- Using Coordinates in Degrees, Minutes, and Seconds (DMS) Format (p. 171)

**Valid Ranges for Latitude and Longitude Coordinates**

Amazon QuickSight supports latitude and longitude coordinates within specific ranges.
### Coordinate Valid Range

<table>
<thead>
<tr>
<th>Coordinate</th>
<th>Valid Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>Between -90 and 90</td>
</tr>
<tr>
<td>Longitude</td>
<td>Between -180 to 180</td>
</tr>
</tbody>
</table>

Amazon QuickSight skips any data outside these ranges. Out-of-range points can't be mapped on a map chart.

#### Using Coordinates in Degrees, Minutes, and Seconds (DMS) Format

You can use a calculated field with a formula to create a numeric latitude and longitude out of character strings. Use this section to find different ways that you can create calculated fields in Amazon QuickSight, to parse GPS latitude and longitude into numeric latitude and longitude.

The following sample converts latitude and longitude to numeric format from separate fields. For example, suppose that you parse 51° 30' 26.4636'' N 0° 7' 39.9288'' W using space as a delimiter. In this case, you can use something like the following sample to convert the resulting fields to numeric latitude and longitude.

In this example, the seconds are followed by two single quotation marks. If your data has a double quotation mark instead, then you can use `strlen(LatSec)-1)` instead of `strlen(LatSec)-2)`.

```plaintext
/*Latitude*/
ifelse(
    LatDir = "N",
    parseInt(split(LatDeg, "°", 1)) +
    (parseDecimal(split(LatMin, ",", 1) ) /60) +
    (parseDecimal((substring(LatSec, 1, strlen(LatSec)-2) ) ) /3600),
    (parseInt(split(LatDeg, "°", 1)) +
    (parseDecimal(split(LatMin, ",", 1) ) /60) +
    (parseDecimal((substring(LatSec, 1, strlen(LatSec)-2) ) ) /3600)) * -1
)
/*Longitude*/
ifelse(
    LongDir = "E",
    parseInt(split(LongDeg, "°", 1)) +
    (parseDecimal(split(LongMin, "'", 1) ) /60) +
    (parseDecimal((substring(LongSec, 1, strlen(LongSec)-2) ) ) /3600),
    (parseInt(split(LongDeg, "°", 1)) +
    (parseDecimal(split(LongMin, "'", 1) ) /60) +
    (parseDecimal((substring(LongSec, 1, strlen(LongSec)-2) ) ) /3600)) * -1
)
```

If your data doesn't include the symbols for degree, minute and second, the formula looks like the following.

```plaintext
/*Latitude*/
ifelse(
    LatDir = "N",
    (LatDeg + (LatMin / 60) + (LatSec / 3600)),
    (LatDeg + (LatMin / 60) + (LatSec / 3600)) * -1
)
/*Longitude*/
ifelse(
```

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The formats of GPS latitude and longitude can vary, so customize your formulas to match your data. For more information, see the following links:

- Degrees Minutes Seconds to Decimal Degrees on LatLong.net
- Converting Degrees/Minutes/Seconds to Decimals using SQL on Stack Overflow
- Geographic Coordinate Conversion on Wikipedia

Integrating SageMaker Models with Amazon QuickSight

**Note**

You don’t need any technical experience in machine learning (ML) to author analyses and dashboards that use the ML-powered features in Amazon QuickSight.

You can augment your Amazon QuickSight Enterprise edition data with SageMaker machine learning models. You can run inferences on data stored in SPICE imported from any data source supported by Amazon QuickSight. For a full list of supported data sources, see Supported Data Sources (p. 69).

Using Amazon QuickSight with SageMaker models can save the time that you might otherwise spend managing data movement and writing code. The results are useful both for evaluating the model and—when you're satisfied with the results—for sharing with decision-makers. You can begin immediately after the model is built. Doing this surfaces your data scientists' prebuilt models, and enables you to apply the data science to your datasets. Then you can share these insights in your predictive dashboards. With the Amazon QuickSight serverless approach, the process scales seamlessly, so you don’t need to worry about inference or query capacity.

Amazon QuickSight supports SageMaker models that use regression and classification algorithms. You can apply this feature to get predictions for just about any business use case. Some examples include...
How SageMaker Integration Works

In general, the process works like this:

1. An Amazon QuickSight administrator adds permissions for Amazon QuickSight to access SageMaker. To do this, open Security & Permissions settings from the Manage QuickSight page. Go to QuickSight access to AWS services, and add SageMaker.

   When you add these permissions, Amazon QuickSight is added to an AWS Identity and Access Management (IAM) role that provides access to list all the SageMaker models in your AWS account. It also provides permissions to run SageMaker jobs that have names that are prefixed with quicksight-auto-generated-.

2. We recommend that you connect to an SageMaker model that has an inference pipeline, because it automatically performs data preprocessing. For more information, see Deploy an Inference Pipeline in the SageMaker Developer Guide.

3. After you identify the data and the pretrained model that you want to use together, the owner of the model creates and provides a schema file. This JSON file is a contract with SageMaker. It provides metadata about the fields, data types, column order, output, and settings that the model expects. The optional settings component provides the instance size and count of the compute instances to use for the job.

   If you're the data scientist who built the model, create this schema file using the format documented following. If you're a consumer of the model, get the schema file from the owner of the model.

4. In Amazon QuickSight, you begin by creating a new dataset with the data that you want to make predictions on. If you're uploading a file, you can add the SageMaker model on the upload settings screen. Otherwise, add the model on the data preparation page.

   Before you proceed, verify the mappings between the dataset and the model.

5. After the data is imported into the dataset, the output fields contain the data returned from SageMaker. You use these fields just as you use other fields, within the guidelines described in Usage Guidelines (p. 174).

   When you run SageMaker integration, Amazon QuickSight passes a request to SageMaker to run batch transform jobs with inference pipelines. Amazon QuickSight starts provisions and deployment of the instances needed in your AWS account. When processing is complete, these instances are shut down and terminated. The compute capacity incurs costs only when it's processing models.

   To make it easier for you to identify them, Amazon QuickSight names all its SageMaker jobs with the prefix quicksight-auto-generated-.

6. The output of the inference is stored in SPICE and appended to the dataset. As soon as the inference is complete, you can use the dataset to create visualizations and dashboards using the prediction data.
7. The data refresh starts every time you save the dataset. You can start the data refresh process manually by refreshing the SPICE dataset, or you can schedule it to run at a regular interval. During each data refresh, the system automatically calls SageMaker batch transform to update the output fields with new data.

You can use the Amazon QuickSight SPICE ingestion API operations to control the data refresh process. For more information about using these API operations, see the Amazon QuickSight API Reference.

Costs Incurred (No Additional Costs with Integration Itself)

Using this feature doesn’t require an additional fee in itself. Your costs include the following:

- The cost of model deployment through SageMaker, which is incurred only when the model is running. Saving a dataset—after either creating or editing it—or refreshing its data starts the data ingestion process. This process includes calling SageMaker if the dataset has inferred fields. Costs are incurred in the same AWS account where your QuickSight subscription is.
- Your QuickSight subscription costs are as follows:
  - The cost of storing your data in the in-memory calculation engine in QuickSight (SPICE). If you are adding new data to SPICE, you might need to purchase enough SPICE capacity to accommodate it.
  - QuickSight subscriptions for the authors or admins who build the datasets.
  - Pay-per-session charges for viewers (readers) to access interactive dashboards.

Usage Guidelines

In Amazon QuickSight, the following usage guidelines apply to this Enterprise edition feature:

- The processing of the model occurs in SPICE. Therefore, it can only apply to datasets that are stored in SPICE. The process currently supports up to 100 million rows per dataset.
- Only QuickSight admins or authors can augment datasets with ML models. Readers can only view the results when they are part of a dashboard.
- Each dataset can work with one and only one ML model.
- Output fields can’t be used to calculate new fields.
- Datasets can’t be filtered by fields that are integrated with the model. In other words, if your dataset field is currently mapped to the ML model, you can’t filter on that field.

In SageMaker, the following usage guidelines apply to a pretrained model that you use with Amazon QuickSight:

- When you create the model, associate it with the Amazon Resource Name (ARN) for the appropriate IAM role. The IAM role for the SageMaker model needs to have access to the Amazon S3 bucket that Amazon QuickSight uses.
- Make sure that your model supports .csv files for both input and output. Make sure that your data is in a tabular format.
- Provide a schema file that contains metadata about the model, including the list of input and output fields. Currently, you must create this schema file manually.
- Consider the amount of time that it takes to complete your inference, which depends on a number of factors. These include the complexity of the model, the amount of data, and the compute capacity defined. Completing the inference can take several minutes to several hours. Amazon QuickSight
caps all data ingestion and inferencing jobs to a maximum of 10 hours. To reduce the time it takes to perform an inference, consider increasing the instance size or the number of instances.

• Currently, you can use only batch transforms for integration with SageMaker, not real-time data. You can’t use an SageMaker endpoint.

## Defining the Schema File

Before you use an SageMaker model with Amazon QuickSight data, create the JSON schema file that contains the metadata that Amazon QuickSight needs to process the model. The Amazon QuickSight author or admin uploads the schema file when configuring the dataset.

The schema fields are defined as follows. All fields are required unless specified in the following description. Attributes are case-sensitive.

### inputContentType

The content type that this SageMaker model expects for the input data. The only supported value for this is ”text/csv”. QuickSight doesn't include any of the header names that you add to the input file.

### outputContentType

The content type of the output that is produced by the SageMaker model that you want to use. The only supported value for this is ”text/csv”.

### input

A list of features that the model expects in the input data. QuickSight produces the input data in exactly the same order. This list contains the following attributes:

• **name** – The name of the column. If possible, make this the same as the name of the corresponding column in the QuickSight dataset. This attribute is limited to 100 characters.

• **type** – The data type of this column. This attribute takes the values "INTEGER", "STRING", and "DECIMAL".

• **nullable** – (Optional) The nullability of the field. The default value is true. If you set nullable to false, QuickSight drops rows that don’t contain this value before calling SageMaker. Doing this helps avoid causing SageMaker to fail on missing required data.

### output

A list of output columns that the SageMaker model produces. QuickSight expects these fields in exactly the same order. This list contains the following attributes:

• **name** – This name becomes the default name for the corresponding new column that's created in QuickSight. You can override the name specified here in QuickSight. This attribute is limited to 100 characters.

• **type** – The data type of this column. This attribute takes the values "INTEGER", "STRING", and "DECIMAL".

### instanceTypes

A list of the ML instance types that SageMaker can provision to run the transform job. The list is provided to the QuickSight user to choose from. This list is limited to the types supported by SageMaker. For more information on supported types, see TransformResources in the SageMaker Developer Guide.

### defaultInstanceType

(Optional) The instance type that is presented as the default option in the SageMaker wizard in QuickSight. Include this instance type in instanceTypes.
instanceCount

(Optional) The instance count defines how many of the selected instances for SageMaker to provision to run the transform job. This value must be a positive integer.

description

This field provides a place for the person who owns the SageMaker model to communicate with the person who is using this model in QuickSight. Use this field to provide hints about successfully using this model. For example, this field can contain information about selecting an effective instance type to choose from the list in instanceTypes, based on the size of dataset. This field is limited to 1,000 characters.

version

The version of the schema, for example "1.0".

The following example shows the structure of the JSON in the schema file.

```json
{
   "inputContentType": "CSV",
   "outputContentType": "CSV",
   "input": [  
      { "name": "buying",  
        "type": "STRING"  
      },  
      { "name": "maint",  
        "type": "STRING"  
      },  
      { "name": "doors",  
        "type": "INTEGER"  
      },  
      { "name": "persons",  
        "type": "INTEGER"  
      },  
      { "name": "lug_boot",  
        "type": "STRING"  
      },  
      { "name": "safety",  
        "type": "STRING"  
      }  
   ],
   "output": [  
      { "name": "Acceptability",  
        "type": "STRING"  
      }  
   ],
   "description": "Use ml.m4.xlarge instance for small datasets, and ml.m4.4xlarge for datasets over 10 GB",
   "version": "1.0",
   "instanceCount": 1,
   "instanceTypes": [  
      "ml.m4.xlarge",
      "ml.m4.4xlarge"
   ],
   "defaultInstanceType": "ml.m4.xlarge"
}
```
The structure of the schema file is related to the kind of model that is used in examples provided by SageMaker. For example, see this related model in the amazon-sagemaker-examples GitHub repository. SageMaker documentation usually provides a similarly structured example notebook for each of its new features.

**Adding a SageMaker Model to Your QuickSight Dataset**

Using the following procedure, you can add a pretrained SageMaker model to your dataset, so that you can use predictive data in analyses and dashboards.

Before you begin, have the following items available:

- The data that you want to use to build the dataset.
- The name of the SageMaker model that you want to use to augment the dataset.
- The schema of the model. This schema includes field name mappings and data types. It's helpful if it also contains recommended settings for instance type and number of instances to use.

**To augment your Amazon QuickSight dataset with SageMaker**

1. Create a new dataset from the start page by choosing **Datasets**, and then choose **New dataset**.
   
   You can also edit an existing dataset.

2. Choose **Augment with SageMaker** on the data preparation screen.

3. For **Select your model**, choose the following settings:
   - **Model** – Choose the SageMaker model to use to infer fields.
   - **Name** – Provide a descriptive name for the model.
   - **Schema** – Upload the JSON schema file provided for the model.
   - **Advanced settings** – QuickSight recommends the selected defaults based on your dataset. You can use specific runtime settings to balance the speed and cost of your job. To do this, enter the SageMaker ML instance types for **Instance type** and number of instances for **Count**.

   Choose **Next** to continue.

4. For **Review inputs**, review the fields that are mapped to your dataset. QuickSight attempts to automatically map the fields in your schema to the fields in your dataset. You can make changes here if the mapping needs adjustment.

   Choose **Next** to continue.

5. For **Review outputs**, view the fields that are added to your dataset.

   Choose **Save and prepare data** to confirm your choices.

6. To refresh the data, choose the dataset to view details. Then either choose **Refresh Now** to manually refresh the data, or choose **Schedule refresh** to set up a regular refresh interval. During each data refresh, the system automatically runs the SageMaker batch transform job to update the output fields with new data.
Working with Analyses

To help you uncover hidden insights and trends in your data, identify key drivers, and forecast business metrics, Amazon QuickSight uses machine learning. You can also work with these insights in natural language narratives embedded in dashboards.

Using machine learning (ML) and natural language capabilities, Amazon QuickSight Enterprise Edition takes you beyond descriptive and diagnostic analysis and launches you into forecasting and decision-making. You can understand your data at a glance, share your findings, and discover the best decisions to achieve your goals. You can do this without developing teams and technology to create the necessary machine learning models and algorithms.

You likely have already built visualizations that answer questions about what happened, when, and where and that drill down to investigate and identify of patterns. With ML insights, you can avoid spending hours manually analyzing and investigating. You can choose from customized context-sensitive narratives, called autonarratives, and add them to your analysis. You can also choose to view forecasts, anomalies, and factors contributing to these. You can also add autonarratives that explain key information in plain language, providing a single data-driven truth for your company.

As time passes and data flows through the system, Amazon QuickSight continually learns so it can deliver ever more pertinent insights. Instead of deciding what the data means, you can decide what to do with the information it provides.

With a shared foundation based on machine learning, all of your analysts and stakeholders can see trends, anomalies, forecasts, and custom narratives built on millions of metrics. They can see root causes, consider forecasts, evaluate risks, and make well-informed, justifiable decisions.

You can create a dashboard like this with no manual analysis, no custom development skills, and no understanding of machine learning modeling or algorithms. All this capability is built into Amazon QuickSight Enterprise Edition.

Note
Machine learning capabilities are used as needed throughout the product. Features that actively use machine learning are labeled as such.

With ML Insights, Amazon QuickSight provides three major features:

- **ML-powered anomaly detection** – Amazon QuickSight uses Amazon's proven machine learning technology to continuously analyze all your data to detect anomalies (outliers). You can identify the top drivers that contribute to any significant change in your business metrics, such as higher-than-expected sales or a dip in your website traffic. Amazon QuickSight uses the Random Cut Forest algorithm on millions of metrics and billions of data points. Doing this enables you to get deep insights that are often buried in the aggregates and inaccessible through manual analysis.

- **ML-powered forecasting** – Amazon QuickSight enables nontechnical users to confidently forecast their key business metrics. The built-in ML Random Cut Forest algorithm automatically handles complex real-world scenarios. For example, it can detect seasonality and trends, exclude outliers, and impute missing values. You can interact with the data with point-and-click simplicity.

- **Autonarratives** – By using automatic narratives in Amazon QuickSight, you can build rich dashboards with embedded narratives to tell the story of your data in plain language. Doing this can save hours of sifting through charts and tables to extract the key insights for reporting. It also creates a shared understanding of the data within your organization so you can make decisions faster. You can use the
suggested autonarrative, or you can customize the computations and language to meet your unique requirements. Amazon QuickSight is like providing a personal data analyst to all of your users.

Topics

- Creating an Analysis (p. 179)
- Saving Changes to an Analysis (p. 180)
- Renaming an Analysis (p. 181)
- Adding a Title and Description to an Analysis (p. 181)
- Working with Multiple Sheets in an Amazon QuickSight Analysis (p. 182)
- Viewing Analysis Details (p. 183)
- Deleting an Analysis (p. 183)
- Export Data from an Analysis to a CSV File (p. 183)
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- Order of Evaluation in Amazon QuickSight (p. 214)
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- Changing Display Settings (p. 238)
- Using SPICE Data in an Analysis (p. 239)
- Sharing Analyses (p. 240)
- Working with Stories (Feature Removed) (p. 242)

Creating an Analysis

Use the following procedure to create a new analysis.

1. On the All analyses tab of the Amazon QuickSight start page, choose New analysis. You are taken to the Datasets page.
2. Choose a data set and then choose Create analysis.
If you don’t have any data sets, create a new one by choosing **New data set**. You can create an analysis as the last step in creating a new data set. For more information about creating a data set, see Creating Datasets (p. 99).

3. Create a visual. For more information about creating visuals, see Creating an Amazon QuickSight Visual (p. 243).

After you are done creating the analysis, you can iterate on it by modifying the visual, adding additional visuals, adding scenes to the default story, or adding additional stories.

## Saving Changes to an Analysis

When working on an analysis, you can set Autosave either on (the default) or off. When Autosave is on, your changes are automatically saved every minute or so. When Autosave is off, your changes are not automatically saved, which allows you to make changes and pursue different lines of inquiry without permanently altering the analysis. If you decide that you want to save your results after all, re-enable Autosave. Your changes up to that point are then saved.

In either Autosave mode, you can undo or redo any change you make by choosing **Undo** or **Redo** on the application bar.
Changing the Autosave Mode

To change the Autosave mode for an analysis, choose Autosave at upper-right in the application bar, and then choose Autosave ON or Autosave OFF.

When Autosave Can't Save Changes

Suppose that one of the following things occurs:

- Autosave is on and another user makes a conflicting change to the analysis.
- Autosave is on and there is a service failure, such that your most recent changes can’t be saved.
- Autosave is off, you turn it on, and one of the backlogged changes now being saved to the server conflicts with another user’s changes.

In this case, Amazon QuickSight gives you the option to do one of two things. You can either let Amazon QuickSight turn Autosave off and continue working in unsaved mode, or reload the analysis from the server and then redo your most recent changes.

If your client authentication expires while you are editing an analysis, you are directed to sign in again. On successful sign-in, you are directed back to the analysis where you can continue working normally.

If your permissions on the analysis are revoked while you are editing it, you can't make any further changes.

Renaming an Analysis

Use the following procedure to rename an analysis.

1. Open the analysis that you want to rename.
2. In the Analysis name field in the application bar, select the current name and then type a new name.

Adding a Title and Description to an Analysis

In addition to the analysis name, you can add a title and description to an analysis. A useful title and description provides context about the information in the analysis.

Add a Title and Description

Use the following procedure to add a title and description to an analysis. Titles and descriptions can contain up to 1024 characters.

1. On the analysis page, choose Add in the application bar and then choose Add title.
2. For Sheet title, enter a title and press Enter. To remove a title, choose Add in the application bar and then choose Delete title. Or, to remove the title, you can select the title and then choose the x-shaped delete icon.
3. Choose Add in the application bar and then choose Add description.
### Working with Multiple Sheets in an Amazon QuickSight Analysis

A sheet is a set of visuals that are viewed together in a single page. When you create an analysis, you place visuals in the workspace on a sheet. You can imagine this as a sheet from a newspaper, except that it is filled with data visualizations. You can add more sheets, and make them work separately or together in your analysis.

The top sheet, also called the default sheet, is the one on the far left. This sheet displays on top in an analysis or dashboard. Each analysis can contain up to 20 sheets.

You can share analyses and publish dashboards with multiple sheets. However, scheduled email reports only include the top sheet in an analysis.

Use the following list of actions to work with sheets:

- To add a new sheet, choose the plus-sign (+) to the right of the sheet tabs.
- To rename a sheet, choose the name of the sheet and start typing. Rename is also available from the sheet menu (⋮).

  - To duplicate a sheet, choose the name of the sheet, then choose Duplicate from the sheet menu (⋮). You can only duplicate a sheet if Autosave is turned on.

  - To delete a sheet, choose the name of the sheet, then choose Delete from the sheet menu (⋮). You can’t delete the sheet if it’s the only sheet in the analysis.

  - To change the order of the sheets, choose the name of the sheet and drag it to a new position.

  - To copy a visual to a new sheet, choose Duplicate visual to from the on-visual menu. Then choose the target sheet. Filters exist only on the sheet that you create them on. To duplicate filters, recreate them on the target sheet.

You can use the parameter controls on the top sheet to control multiple sheets. To do this, open each sheet that you want to work with the parameter. Then add a filter that uses the same parameter used in the control on the top sheet. Or, if you want a new sheet to operate independently, you can add parameters and parameter controls to it that are separate from those on the top sheet.
Viewing Analysis Details

To view an analysis, locate the analysis on the All analyses tab of the Amazon QuickSight start page. Then choose the analysis.

Deleting an Analysis

You can delete an analysis by using the All analyses tab of the Amazon QuickSight start page. Deleting an analysis doesn't affect any dashboards that are based on that analysis.

To remove an analysis, choose the details icon (⋮) on the analysis, and choose Delete. Confirm your choice by choosing Delete again. You can't undo this action.

Export Data from an Analysis to a CSV File

To export data from an analysis or dashboard to a comma-separated values (CSV) file, follow the procedure in Exporting Data (p. 247).

Adding a Data Set to an Analysis

After you have created an analysis, you can add more data sets to the analysis. Then, you can use them to create more visuals.

From within the analysis, you can open any data set for editing, for example to add or remove fields, or perform other data preparation. You can also remove, or replace data sets.

Topics

- Add or Edit a Data Set (p. 184)
- Replacing Datasets (p. 185)
- Remove a Data Set from an Analysis (p. 186)
Add or Edit a Data Set

The currently selected data set displays at the top of the **Fields list** pane. This is the data set that is used by the currently selected visual. Each visual can use only one data set. Choosing a different visual changes the selected data set to the one used by that visual.

To change the selected data set manually, choose the data set list at the top of the **Fields list** pane and then choose a different data set. This deselects the currently selected visual if it doesn't use this data set. Then, choose a visual that uses the selected data set. Or choose **Add Visual** to create a new visual using the selected data set.

If you choose **Suggested** on the tool bar to see suggested visuals, you'll see visuals based on the currently selected data set.

Only filters for the currently selected data set are shown in the **Filter** pane, and you can only create filters on the currently selected data set.

**Add or Edit a Data Set**

Use the following procedure to add a data set to an analysis or edit a data set used by an analysis.

1. On the analysis page, choose the pencil-shaped edit icon at the top of the **Fields list** pane.
Replacing Datasets

In an analysis, you can add, edit, replace, or remove datasets. Use this section to learn how to replace your dataset.

When you replace a dataset, the new dataset should have similar columns, if you expect the visual to work the way you designed it. Replacing the dataset also clears the undo and redo history for the analysis. This means you can't use the undo and redo buttons on the application bar to navigate your changes. So, when you decide to change the dataset, your analysis design should be somewhat stable—not in the middle of an editing phase.

Use the following procedure to replace a dataset.

**To replace a dataset**

1. On the analysis screen, choose the pencil icon above the dataset drop-down menu.

2. In the **Data sets in this analysis** page that opens, choose the ellipses next to the dataset you want to replace, and then choose **Replace**.
3. In the Select replacement dataset page, choose a dataset from the list, and then choose Select.
   
   **Note**
   Replacing a data set clears the undo and redo history for this analysis.

4. In the Replacing dataset page, choose Replace.

The dataset is replaced with the new one. The field list and visuals are updated with the new dataset.

At this point, you can choose to add a new dataset, edit the new dataset, or replace it with a different one. Choose Close to exit.

**If Your New Data Set Doesn't Match**

In some cases, the selected replacement data set doesn't contain all of the fields and hierarchies used by the visuals, filters, parameters, and calculated fields in your analysis. If so, you receive a warning from Amazon QuickSight that shows a list of mismatched or missing columns.

If this happens, you can update the field mapping between the two datasets. Use the following procedure to learn how.

**To update the field mapping**

1. In the Mismatch in replacement dataset page, choose Update field mapping.
2. In the Update field mapping page, choose the drop-down menu for the field(s) you want to map and choose a field from the list to map it to.
   
   If the field is missing from the new dataset, choose Ignore this field.

3. Choose Confirm to confirm your updates.
4. Choose Close to close the page and return to your analysis.

The dataset is replaced with the new one. The fields list and visuals are updated with the new dataset.

Any visuals that were using a field that's now missing from the new dataset update to blank. You can re-add fields to the visual or remove the visual from your analysis.

If you change your mind after replacing the data set, you can still recover. Let's say you replace the data set and then find that it's too difficult to change your analysis to match the new data set. You can undo any changes you made to your analysis. You can then replace the new data set with the original one, or with a data set that more closely matches the requirements of the analysis.

**Remove a Data Set from an Analysis**

Use the following procedure to delete a data set from an analysis.
1. On the analysis page, choose the data set list at the top of the Fields list pane, and then choose Edit analysis data sets.

2. In the Data sets in this analysis dialog box, choose the data set that you want to delete, and then choose the delete icon. You can't delete a data set if it's the only one in the analysis.

3. Choose Close to close the dialog box.

Modifying Data Set Fields in an Analysis

You can modify the dimension or measure setting of a field by using the Field list pane. You can also change numeric field data types, and numeric or date field formats, by using the Field list pane, visual field wells, or on-visual editors. When you change a field data type or format, it applies to all visuals in the analysis that use that data set.

Topics
- Setting a Field as a Dimension or Measure (p. 187)
- Changing a Field Data Type (p. 188)
- Customizing a Field Format (p. 188)

Setting a Field as a Dimension or Measure

In the Field list pane, dimension fields have blue icons and measure fields have green icons. Dimensions are text or date fields that can be items, like products, or attributes that are related to measures. You
can use dimensions to partition these items or attributes, like sales date for sales figures. *Measures* are numeric values that you use for measurement, comparison, and aggregation.

In some cases, Amazon QuickSight interprets a field as a measure that you want to use it as a dimension (or the other way around). If so, you can change the setting for that field.

Changing a field's measure or dimension setting changes it for all visuals in the analysis that use that data set. However, it doesn't change it in the data set itself.

**Change a Field's Dimension or Measure Setting**

1. In the **Field list** pane, hover over the field that you want to change.
2. Choose the selector icon to the right of the field name, and then choose **Convert to dimension** or **Convert to measure** as appropriate.

**Changing a Field Data Type**

You can use the **Field list** pane, visual field wells, or on-visual editors to change numeric field data types within the context of an analysis. Numeric fields default to displaying as numbers, but you can choose to have them display as currency or as a percentage instead. You can't change the data types for string or date fields.

Changing a field's data type in an analysis changes it for all visuals in the analysis that use that data set. However, it doesn't change it in the data set itself.

**Note**

- If you are working in a pivot table visual, applying a table calculation changes the data type of the cell values in some cases. This type of change occurs if the data type doesn't make sense with the applied calculation.
- For example, suppose that you apply the **Rank** function to a numeric field that you modified to use a currency data type. In this case, the cell values display as numbers rather than currency.
- Similarly, if you apply the **Percent difference** function instead, the cell values display as percentages rather than currency.

**Change a Numeric Field's Data Type**

Use the following procedure to change a field's data type.

1. Choose one of the following options:
   - In the **Field list** pane, hover over the numeric field that you want to change, and then choose the selector icon to the right of the field name.
   - On any visual that contains an on-visual editor associated with the numeric field that you want to change, choose that on-visual editor.
   - Expand the **Field wells** pane, and then choose the field well associated with the numeric field that you want to change.
2. Choose **Show as**, and then choose **Number**, **Currency**, or **Percent**.

**Customizing a Field Format**

Use the following procedure to customize the appearance of fields in an analysis.

1. In an analysis, choose a field to format, either by choosing it in the field well or in the **Fields list** of the **Visualize** pane.
2. Choose **Show as** to change how the field shows in the analysis, and choose from the options on the context menu. The list of available options varies based on the field's data type. If you choose a non-numeric field from the fields list, you can change the *count format*, which is the formatting used when the field is counted.

3. Choose **Format** to change the format of the field, and choose from the options on the context menu. If you don't see an option that you want to use, choose **More formatting options** from the context menu.

The **Format Data** pane opens, presenting options for the type of numeric or date field you chose. The following screenshots show the **Format Data** pane.
The options for Show as from the context menu now appear in the drop-down list at the top of the Format Data pane. The rest of the options are specific to the data type and how you choose to show the field.

For date and time data, the default format pattern is YYYY-MM-DDTHH:mm:ssZZ, for example 2016-09-22T17:00:00-07:00.

For numbers, you can choose from the following units to display after the number:

- No unit suffix. This is the default.
- Thousands (K)
- Millions (M)
- Billions (B)
- Trillions (T)
- A custom unit prefix or suffix

For currency, you can choose from the following symbols:

- Dollars ($)
- Euros (€)
- Pounds (£)
- Yen (¥)
Changing a Field Format

You can change the format of a field within the context of an analysis. The formatting options available for fields vary based on the field's data type.

Use menu options in the Field list pane or the visual field wells to make simple format changes, or use the Format data pane to make more extensive formatting changes.

Topics
- Format a Currency Field (p. 191)
- Format a Date Field (p. 192)
- Format a Number Field (p. 194)
- Format a Percent Field (p. 195)
- Format a Text Field (p. 196)
- Return a Field's Format to Default Settings (p. 197)

Format a Currency Field

When you format a currency field, you can either choose the currency symbol from a list of common options, or open the Format data pane and manually format the field. Manually formatting the field allows you to choose which symbol to use, which separators to use, the number of decimal places to show, which units to use, and how to display negative numbers.

Changing a field format changes it for all visuals in the analysis, but does not change it in the underlying data set.

If you want to choose the symbol for a currency field from a list of common options, you can access such a list in several ways. You can access it from the Field list pane, an on-visual editor, or a visual field well.

To select a currency field's symbol by choosing a list option:
- Choose one of the following options:
  - In the Field list pane, choose the selector icon to the right of the number field that you want to format.
  - On any visual that contains an on-visual editor associated with the currency field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.
  - Choose Format, and then choose the currency field that you want:
    - Display in dollars ($).
    - Display in pounds (£).
    - Display in euros (€).
    - Display in yen (¥).

To manually change a currency field's format:
1. Choose one of the following options:
   - In the Field list pane, choose the selector icon to the right of the number field that you want to format.
   - On any visual that contains an on-visual editor associated with the currency field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.
2. Choose Format, and then choose More Formatting Options.
The **Format data** pane opens.

3. Expand the **Symbol** section and choose from the following options:
   - Display in dollars ($). This is the default.
   - Display in pounds (£).
   - Display in euros (€).
   - Display in yen (¥).

4. Expand the **Separators** section and choose from the following options:
   - Under **Decimal**, choose a dot or a comma for the decimal separator. A dot is the default. If you choose a comma instead, you must use a dot or a space as the thousands separator.
   - Under **Thousands**, select or clear **Enabled** to indicate whether you want to use a thousands separator. **Enabled** is selected by default.
   - If you are using a thousands separator, choose whether to use a comma, dot, or space for the separator. A comma is the default. If you choose a dot instead, you must use a comma as the decimal separator.

5. Expand the **Decimal Places** section and choose the number of decimal places to use. The default is 2. Field values are rounded to the decimal places specified. For example, if you specify two decimal places, the value 6.728 is rounded to 6.73.

6. Expand the **Units** section and choose from the following options:
   - Choose the unit to use. Choosing a unit adds the appropriate suffix to the number value. For example, if you choose **Thousands**, a field value of 1234 displays as 1.234K.

   The unit options are as follows:
   - No unit suffix. This is the default.
   - Thousands (K)
   - Millions (M)
   - Billions (B)
   - Trillions (T)
   - If you want to use a custom prefix or suffix, specify it in the **Prefix** or **Suffix** box. Using a custom suffix is a good way to specify a currency suffix outside of those already offered by Amazon QuickSight. You can specify both. You can also specify a custom prefix in addition to the suffix added by selecting a unit.

7. Expand the **Negatives** section and choose whether to display a negative value by using a minus sign or by enclosing it in parentheses. Using a minus sign is the default.

8. Expand the **Null values** section and choose whether to display null values as **null** or as a custom value. Using **null** is the default.

   **Note**
   When using a table or pivot table, null values only display for fields that are placed in the **Rows**, **Columns**, or **Group by** field wells. Null values for fields in the **Values** field well appear empty in the table or pivot table.

**Format a Date Field**

When you format a date field, you can choose a list of common formatting options. Or you can open the **Format data** pane to choose from a list of common formats, or specify custom formatting for the date and time values.

Changing a field format changes it for all visuals in the analysis that use that data set, but does not change it in the data set itself.

If you want to format a date field by choosing from a list of common options, you can access such a list in several ways. You can access it from the **Field list** pane, a visual on-visual editor, or a visual field well.
To change a date field's format by choosing a list option:

- Choose one of the following options:
  - In the **Field list** pane, choose the selector icon to the right of the number field that you want to format.
  - On any visual that contains an on-visual editor associated with the number field that you want to format, choose that on-visual editor. Then, expand the **Field wells** pane, and then choose the field well associated with the number field that you want to change.
  - Choose **Format**, and then choose the format that you want. The following quick formatting options are offered for date fields:
    - Show the month, day, year, and time.
    - Show the month, day, and year.
    - Show the month and year.
    - Show the year.

To manually change a date field's format:

1. Choose one of the following options:
   - In the **Field list** pane, choose the selector icon to the right of the number field that you want to format.
   - On any visual that contains an on-visual editor associated with the number field that you want to format, choose that on-visual editor. Then, expand the **Field wells** pane, and then choose the field well associated with the number field that you want to change.

2. Choose **Format**, and then choose **More Formatting Options**.
   The **Format data** pane opens.

3. Expand the **Date** section. Choose an existing date format, or choose **Custom** and specify a format pattern in the **Custom** section lower down in the **Format data** pane. If you choose **Custom** for the **Date** section, you must also choose **Custom** for the following **Time** section. The pattern you specify in the **Custom** section must include any date and time formatting that you want.

   The default selection is **Custom**, with a default format pattern of `yyyy-MM-ddTHH:mm:ssZ`, for example `2016-09-22T17:00:00-07:00`.

4. Expand the **Time** section. Choose an existing time format, or choose **Custom** and specify a format pattern in the **Custom** section lower down in the **Format data** pane. If you choose **Custom** for the **Time** section, you must also choose **Custom** for the preceding **Date** section. The pattern you specify in the **Custom** section must include any date and time formatting that you want.

   The default selection is **Custom**, with a default format pattern of `yyyy-MM-ddTHH:mm:ssZ`, for example `2016-09-22T17:00:00-07:00`.

5. If you chose **Custom** in the **Date** and **Time** sections, expand the **Custom** section and specify the format pattern that you want, using the format pattern syntax specified in [Moment.js Display Format](https://momentjs.com/docs/#/displaying/) in the Moment.js JavaScript documentation.

   If you chose something other than **Custom** in the **Date** and **Time** sections, **Custom** is populated with the format pattern that reflects your selections. For example, if you chose Jun 21, 2016 in the **Date** section and 17:00:00pm in the **Time** section, the **Custom** section shows the format pattern `MMM dd, yyyy HH:mm:ssa`.

6. (Optional) Expand the **Custom** section and use **Preview** to verify your specified format.

7. Expand the **Null values** section and choose whether to display null values as **null** or as a custom value. Using `null` is the default.
Format a Number Field

When you format a number field, you can choose the decimal place and thousand separator format from a list of common options. Or you can open the Format Data pane and manually format the field. Manually formatting the field enables you to choose which separators to use and the number of decimal places to show. It also enables you to choose which units to use, and how to display negative numbers.

Changing a field format changes it for all visuals in the analysis, but does not change it in the underlying data set.

If you want to format a number field by choosing from a list of common options, you can access such a list from the Field list pane, an on-visual editor, or a visual field well.

To change a number field’s format by choosing a list option:

• Choose one of the following options:
  • In the Field list pane, choose the selector icon to the right of the number field that you want to format.
  • On any visual that contains an on-visual editor associated with the number field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.
  • Choose Format, and then choose the format that you want. The following quick formatting options are offered for number fields:
    • Use commas to separate groups of thousands and use a decimal point to show the fractional part of the number, for example 1,234.56.
    • Use a decimal point to show the fractional part of the number, for example 1234.56.
    • Show the number as an integer and use commas to separate groups of thousands, for example 1,234.
    • Show the number as an integer, for example 1234.

To manually change a number field’s format:

1. Choose one of the following options:
  • In the Field list pane, choose the selector icon to the right of the number field that you want to format.
  • On any visual that contains an on-visual editor associated with the number field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.

2. Choose Format, and then choose More Formatting Options.

The Format data pane opens.

3. Expand the Separators section and choose from the following options:
  • Under Decimal, choose a dot or a comma for the decimal separator. A dot is the default. If you choose a comma instead, you must use a dot or a space as the thousands separator.
  • Under Thousands, select or clear Enabled to indicate whether you want to use a thousands separator. Enabled is selected by default.
  • If you are using a thousands separator, choose whether to use a comma, dot, or space for the separator. A comma is the default. If you choose a dot instead, you must use a comma as the decimal separator.

4. Expand the Decimal Places section and choose from the following options:
  • Choose Auto to have Amazon QuickSight automatically determine the appropriate number of decimal places, or choose Custom to specify a number of decimal places. Auto is the default.
• If you chose Custom, enter the number of decimal places to use. Field values are rounded to the decimal places specified. For example, if you specify two decimal places, the value 6.728 is rounded to 6.73.

5. Expand the Units section and choose from the following options:
• Choose the unit to use. Choosing a unit adds the appropriate suffix to the number value. For example, if you choose Thousands, a field value of 1234 displays as 1.234K.

   The unit options are as follows:
   • No unit suffix. This is the default.
   • Thousands (K)
   • Millions (M)
   • Billions (B)
   • Trillions (T)
   • If you want to use a custom prefix or suffix, specify it in the Prefix or Suffix box. You can specify both. You can also specify a custom prefix in addition to the suffix added by selecting a unit.

6. Expand the Negatives section and choose whether to display a negative value by using a minus sign or by enclosing it in parentheses. Using a minus sign is the default.

7. Expand the Null values section and choose whether to display null values as null or as a custom value. Using null is the default.

   Note
   When using a table or pivot table, null values only display for fields that are placed in the Rows, Columns, or Group by field wells. Null values for fields in the Values field well appear empty in the table or pivot table.

Format a Percent Field

When you format a percent field, you can choose the number of decimal places from a list of common options. Or you can open the Format data pane and manually format the field. Manually formatting the field enables you to choose which separators to use. It also enables you to choose the number of decimal places to show and how to display negative numbers.

Changing a field format changes it for all visuals in the analysis, but does not change it in the underlying data set.

If you want to choose the number of decimal places for a percent field from a list of common options, you can access such a list in several ways. You can access it from the Field list pane, an on-visual editor, or a visual field well.

To change a percent field’s number of decimal places by choosing a list option:

• Choose one of the following options:
  • In the Field list pane, choose the selector icon to the right of the number field that you want to format.
  • On any visual that contains an on-visual editor associated with the percent field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.

  • Choose Format, and then choose the number of decimal places that you want. The following quick formats are offered for percent fields:
    • Display the value with two decimal places.
    • Display the value with one decimal place.
    • Display the value with no decimal places.
To manually change a percent field's format:

1. Choose one of the following options:
   - In the Field list pane, choose the selector icon to the right of the number field that you want to format.
   - On any visual that contains an on-visual editor associated with the number field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.

2. Choose Format, and then choose More Formatting Options.

The Format data pane opens.

3. Expand the Separators section and choose from the following options:
   - Under Decimal, choose a dot or a comma for the decimal separator. A dot is the default. If you choose a comma instead, you must use a dot or a space as the thousands separator.
   - Under Thousands, select or clear Enabled to indicate whether you want to use a thousands separator. Enabled is selected by default.
   - If you are using a thousands separator, choose whether to use a comma, dot, or space for the separator. A comma is the default. If you choose a dot instead, you must use a comma as the decimal separator.

4. Expand the Decimal Places section and choose from the following options:
   - Choose Auto to have Amazon QuickSight automatically determine the appropriate number of decimal places, or choose Custom to specify a number of decimal places. Auto is the default.
   - If you chose Custom, enter the number of decimal places to use. Field values are rounded to the decimal places specified. For example, if you specify two decimal places, the value 6.728 is rounded to 6.73.

5. Expand the Negatives section and choose whether to display a negative value by using a minus sign or by enclosing it in parentheses. Using a minus sign is the default.

6. Expand the Null values section and choose whether to display null values as null or as a custom value. Using null is the default.

   **Note**
   When using a table or pivot table, null values only display for fields that are placed in the Rows, Columns, or Group by field wells. Null values for fields in the Values field well appear empty in the table or pivot table.

Format a Text Field

When you format a text field, you can choose how to display null values using the Field list pane, an on-visual editor, or a visual field well.

To choose how to display a text field's null values:

1. Choose one of the following options:
   - In the Field list pane, choose the selector icon to the right of the number field that you want to format.
   - On any visual that contains an on-visual editor associated with the percent field that you want to format, choose that on-visual editor. Then, expand the Field wells pane, and then choose the field well associated with the number field that you want to change.

2. Choose Format, and then choose More Formatting Options.

   The Format data pane opens.

3. Expand the Null values section and choose whether to display null values as null or as a custom value. Using null is the default.
Return a Field’s Format to Default Settings

Use the following procedure to return a field’s format to the default settings.

1. In the Field list pane, choose the selector icon to the right of the field that you want to reset.
2. Choose Format, and then choose More Formatting options.
   The Format data pane opens.
3. Choose Reset to defaults.

Adding a Calculated Field to an Analysis

Create calculated fields to transform your data by using one or more of the following:

- Operators (p. 471)
- Functions (p. 478)
- Aggregate functions (You can only add these to an analysis.)
- Fields that contain data
- Other calculated fields

You can add calculated fields to a dataset during data preparation or from the analysis page. When you add a calculated field to a dataset during data preparation, it’s available to all analyses that use that dataset. When you add a calculated field to a dataset in an analysis, it’s available only in that analysis.

Analyses support both single-row operations and aggregate operations. Single-row operations are those that supply a (potentially) different result for every row. Aggregate operations supply results that are always the same for entire sets of rows. For example, if you use a simple string function with no conditions, it changes every row. If you use an aggregate function, it applies to all rows in a group. If you ask for the total sales amount for the US, the same number applies to the entire set. If you ask for data on a particular state, the total sales amount changes to reflect your new grouping. It still provides one result for the entire set.

By creating the aggregated calculated field within the analysis, you can then drill down into the data. The value of that aggregated field is recalculated appropriately for each level. This type of aggregation isn’t possible during dataset preparation.

For example, let’s say that you want to figure out the percentage of profit for each country, region, and state. You can add a calculated field to your analysis, \( \frac{\text{sum}(\text{salesAmount} - \text{cost})}{\text{sum}(\text{salesAmount})} \). This field is then calculated for each country, region, and state, at the time your analyst drills down into the geography.

For information on calculated fields in data sets, see Working with Calculated Fields in Datasets (p. 147).

Topics

- Using the Calculations Editor (p. 197)
- Using Aggregate Functions in Calculated Fields (p. 201)

Using the Calculations Editor

Create calculated fields to transform your data before you analyze it. For details about supported functions and operators, see Calculated Field Function and Operator Reference for Amazon QuickSight (p. 471).
You can add calculated fields directly to a dataset. The fields that you add become available to anyone who uses the dataset. When you use the dataset in an analysis, you can add additional calculated fields. The fields that you add to an analysis are available only in that analysis. For information about adding fields to an analysis instead, see Adding a Calculated Field to an Analysis (p. 197).

To add or edit a calculated field

1. Open the dataset that you want to work with.

   To open a dataset from within an analysis, open the list by choosing the pencil icon near the dataset at left. Choose the menu ellipses (...). Then choose Edit. This action opens the dataset editor, also called the data preparation screen. In this screen, you can add a field directly to the dataset, rather than adding it only to the analysis.

2. Open the expression editor for calculated fields by doing one of the following:
   - To create a new field, choose Add calculated field at left.
   - To edit an existing field, choose it from Calculated fields at left, then choose Edit from the context (right-click) menu.

3. Enter a descriptive name for Add title to name the new calculated field. This name appears in the field list in the dataset, so it should look similar to the other fields. For this example, we name the field Total Sales This Year.
4. (Optional) Add a comment, for example to explain what the expression does, by enclosing text in slashes and asterisks.

/* Calculates sales per year for this year*/

5. Identify the metrics, functions, and other items to use. For this example, we need to identify the following:

- The metric to use
- Functions: ifelse and datediff

We want to build a statement like "If the sale happened during this year, show the total sales, and otherwise show 0."

To add the ifelse function, open the Functions list. Choose All to close the list of all functions. Now you should see the function groups: Aggregate, Conditional, Date, and so on.

Choose Conditional, and then double-click on ifelse to add it to the workspace.

6. Place your cursor inside the parenthesis in the workspace, and add three blank lines.

ifelse(
)

7. With your cursor on the first blank line, find the dateDiff function. It's listed for Functions under Dates. You can also find it by entering date for Search functions. The dateDiff function returns all functions that have date as part of their name. It doesn't return all functions listed under Dates; for example, the now function is missing from the search results.

Double-click on dateDiff to add it to the first blank line of the ifelse statement.

ifelse(
dateDiff()
)

Add the parameters that dateDiff uses. Place your cursor inside the dateDiff parentheses to begin to add date1, date2, and period:

1. For date1: The first parameter is the field that has the date in it. Find it under Fields, and add it to the workspace by double-clicking it or entering its name.
2. For date2, add a comma, then choose truncDate() for Functions. Inside its parenthesis, add period and date, like this: truncDate( "YYYY", now() )
3. For period: Add a comma after date2 and enter YYYY. This is the period for the year. To see a list of all the supported periods, find dateDiff in the Functions list, and open the documentation by choosing Learn more. If you're already viewing the documentation, as you are now, see dateDiff (p. 484).

Add a few spaces for readability, if you like. Your expression should look like the following.
ifelse(
    dateDiff( {Date}, truncDate( "YYYY", now() ) ,"YYYY" )
)

8. Specify the return value. For our example, the first parameter in an ifelse needs to return a value of TRUE or FALSE. Because we want the current year, and we're comparing it to this year, we specify that the dateDiff statement should return 0. The if part of the ifelse evaluates as true for rows where there is no difference between the year of the sale and the current year.

To create a field for TotalSales for last year, you can change 0 to 1.

Another way to do the same thing is to use addDateTime instead of truncDate. Then for each previous year, you change the first parameter for addDateTime to represent each year. For this, you use -1 for last year, -2 for the year before that, and so on. If you use addDateTime, you leave the dateDiff function = 0 for each year.

9. Move your cursor to the first blank line, just under dateDiff. Add a comma.

For the then part of the ifelse statement, we need to choose the measure (metric) that contains the sales amount, TotalSales. To choose a field, open the Fields list and double-click a field to add it to the screen. Or you can enter the name. Add curly braces ( ) around names that contain spaces. It's likely that your metric has a different name. You can know which field is a metric by the number sign in front of it (#).

Your expression should look like the following now.

ifelse(
    dateDiff( {Date}, truncDate( "YYYY", now() ) ,"YYYY" ) = 0
    ,{TotalSales}
)

10. Add an else clause. The ifelse function doesn't require one, but we want to add it. For reporting purposes, you usually don't want to have any null values, because sometimes rows with nulls are omitted.

We set the else part of the ifelse to 0. The result is that this field is 0 for rows that contain sales from previous years.

To do this, on the blank line add a comma and then a 0. If you added the comment at the beginning, your finished ifelse expression should look like the following.

/* Calculates sales per year for this year*/
ifelse(
    dateDiff( {Date}, truncDate( "YYYY", now() ) ,"YYYY" ) = 0
    ,{TotalSales}
    ,0
)
11. Save your work by choosing **Save** at upper right.

If there are errors in your expression, the editor displays an error message at the bottom. Check your expression for a red squiggly line, then hover your cursor over that line to see what the error message is. Common errors include missing punctuation, missing parameters, misspellings, and invalid data types.

To avoid making any changes, choose **Cancel**.

**To add a parameter value to a calculated field**

1. You can reference parameters in calculated fields. By adding the parameter to your expression, you add the current value of that parameter.
2. To add a parameter, open the **Parameters** list, and select the parameter whose value you want to include.
3. (Optional) To manually add a parameter to the expression, type the name of the parameter. Then enclosed it in curly braces {}, and prefix it with a $, for example ${{parameterName}}.

You can change the data type of any field in your dataset, including the types of calculated fields. You can only choose data types that match the data that's in the field.

**To change the data type of a calculated field**

- For **Calculated fields** (at left), choose the field that you want to change, then choose **Change data type** from the context (right-click) menu.

Unlike the other fields in the dataset, calculated fields can't be disabled. Instead, delete them.

**To delete a calculated field**

- For **Calculated fields** (at left), choose the field that you want to change, then choose **Delete** from the context (right-click) menu.

**Using Aggregate Functions in Calculated Fields**

The aggregate functions for calculated fields in Amazon QuickSight include the following. These are only available during analysis and visualization. Each of these functions returns values grouped by the chosen dimension or dimensions. For each aggregation, there is also a conditional aggregation. These perform the same type of aggregation, based on a condition.

- **avg** (p. 203) averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
- **avgIf** (p. 203) calculates the average based on a conditional statement.
- **count** (p. 204) calculates the number of values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **countIf** (p. 204) calculates the count based on a conditional statement.
- **distinct_count** (p. 205) calculates the number of distinct values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **distinct_countIf** (p. 205) calculates the distinct count based on a conditional statement.
- **max** (p. 206) returns the maximum value of the specified measure, grouped by the chosen dimension or dimensions.
- **maxIf** (p. 206) calculates the maximum based on a conditional statement.
• median (p. 206) returns the median value of the specified measure, grouped by the chosen dimension or dimensions.
• medianIf (p. 207) calculates the median based on a conditional statement.
• min (p. 207) returns the minimum value of the specified measure, grouped by the chosen dimension or dimensions.
• minIf (p. 207) calculates the minimum based on a conditional statement.
• percentile (p. 208) computes the nth percentile of the specified measure, grouped by the chosen dimension or dimensions.
• stdev (p. 211) calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
• stdevIf (p. 211) calculates the sample standard deviation based on a conditional statement.
• stdevp (p. 211) calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.
• stdevpIf (p. 212) calculates the population deviation based on a conditional statement.
• var (p. 213) calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
• varIf (p. 213) calculates the sample variance based on a conditional statement.
• varp (p. 214) calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.
• varpIf (p. 214) calculates the population variance based on a conditional statement.
• sum (p. 212) adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
• sumIf (p. 213) calculates the sum based on a conditional statement.

When a calculated field formula contains an aggregation, it becomes a custom aggregation. To make sure that your data is accurately displayed, Amazon QuickSight applies the following rules:

• Custom aggregations can't contain nested aggregate functions. For example, this formula doesn't work: sum(avg(x)/avg(y)). However, nesting nonaggregated functions inside or outside aggregate functions does work. For example, ceil(avg(x)) works. So does avg(ceil(x)).
• Custom aggregations can't contain both aggregated and nonaggregated fields, in any combination. For example, this formula doesn't work: Sum(sales)+quantity.
• Filter groups can't contain both aggregated and nonaggregated fields.
• Custom aggregations can't be converted to a dimension. They also can't be dropped into the field well as a dimension.
• In a pivot table, custom aggregations can't be added to table calculations.
• Scatter plots with custom aggregations need at least one dimension under Group/Color in the field wells.

For more information about supported functions and operators, see Calculated Field Function and Operator Reference for Amazon QuickSight (p. 471).

Topics
• avg (p. 203)
• avgIf (p. 203)
• count (p. 204)
• countIf (p. 204)
• distinct_count (p. 205)
• distinct_countIf (p. 205)
• max (p. 206)
• maxIf (p. 206)
• median (p. 206)
• medianIf (p. 207)
• min (p. 207)
• minIf (p. 207)
• percentile (p. 208)
• percentileCont (p. 208)
• percentileDisc (percentile) (p. 209)
• stdev (p. 211)
• stdevp (p. 211)
• stdevIf (p. 211)
• stdevpIf (p. 212)
• sum (p. 212)
• sumIf (p. 213)
• var (p. 213)
• varIf (p. 213)
• varp (p. 214)
• varpIf (p. 214)

avg

The `avg` function averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions. For example, `avg(salesAmount)` returns the average for that measure grouped by the (optional) chosen dimension.

**Syntax**

```plaintext
avg(decimal)
```

**Arguments**

`decimal`

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**avgIf**

Based on a conditional statement, the `avgIf` function averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions. For example, `avgIf(ProdRev, CalendarDay >= ${BasePeriodStartDate} AND CalendarDay <= ${BasePeriodEndDate} AND SourcingType <> 'Indirect')` returns the average for that measure grouped by the (optional) chosen dimension, if the condition evaluates to true.

**Syntax**

```plaintext
avgIf(dimension or measure, condition)
```
Arguments

decimal

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

condition

One or more conditions in a single statement.

count

The count function calculates the number of values in a dimension or measure, grouped by the chosen dimension or dimensions. For example, count(product type) returns the total number of product types grouped by the (optional) chosen dimension, including any duplicates. The count(sales) function returns the total number of sales completed grouped by the (optional) chosen dimension, for example salesperson.

Syntax

\[
\text{count}(\text{dimension or measure})
\]

Arguments

dimension or measure

The argument must be a measure or a dimension. Null values are omitted from the results. Literal values don't work. The argument must be a field.

countIf

Based on a conditional statement, the countIf function calculates the number of values in a dimension or measure, grouped by the chosen dimension or dimensions.

Syntax

\[
\text{countIf}(\text{dimension or measure, condition})
\]

Arguments

dimension or measure

The argument must be a measure or a dimension. Null values are omitted from the results. Literal values don't work. The argument must be a field.

condition

One or more conditions in a single statement.

Return Type

Integer
Example

The following function returns a count of the sales transactions (Revenue) that meet the conditions, including any duplicates.

```sql
countIf (Revenue,
    # Conditions
    CalendarDay >= #BasePeriodStartDate AND
    CalendarDay <= #BasePeriodEndDate AND
    SourcingType <> 'Indirect'
)
```

**distinct_count**

The `distinct_count` function calculates the number of distinct values in a dimension or measure, grouped by the chosen dimension or dimensions. For example, `distinct_count(product type)` returns the total number of unique product types grouped by the (optional) chosen dimension, without any duplicates. The `distinct_count(ship date)` function returns the total number of dates when products were shipped grouped by the (optional) chosen dimension, for example region.

**Syntax**

```sql
distinct_count(dimension or measure)
```

**Arguments**

*dimension or measure*

The argument must be a measure or a dimension. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**distinct_countIf**

Based on a conditional statement, the `distinct_countIf` function calculates the number of distinct values in a dimension or measure, grouped by the chosen dimension or dimensions. For example, `distinct_countIf(product type)` returns the total number of unique product types grouped by the (optional) chosen dimension, without any duplicates. The `distinct_countIf(ProdRev,CalendarDay >= #BasePeriodStartDate AND CalendarDay <= #BasePeriodEndDate AND SourcingType <> 'Indirect')` function returns the total number of dates when products were shipped grouped by the (optional) chosen dimension, for example region, if the condition evaluates to true.

**Syntax**

```sql
distinct_countIf(dimension or measure, condition)
```

**Arguments**

*dimension or measure*

The argument must be a measure or a dimension. Null values are omitted from the results. Literal values don't work. The argument must be a field.
**condition**

One or more conditions in a single statement.

**max**

The `max` function returns the maximum value of the specified measure or date, grouped by the chosen dimension or dimensions. For example, `max(sales goal)` returns the maximum sales goals grouped by the (optional) chosen dimension.

**Syntax**

```
max(measure)
```

**Arguments**

**measure**

The argument must be a measure or a date. Null values are omitted from the results. Literal values don't work. The argument must be a field.

Maximum dates work only in the **Value** field well of tables and pivot tables.

**maxIf**

Based on a conditional statement, the `maxIf` function returns the maximum value of the specified measure, grouped by the chosen dimension or dimensions. For example, `maxIf(ProdRev, CalendarDay >= ${BasePeriodStartDate} AND CalendarDay <= ${BasePeriodEndDate} AND SourcingType <> 'Indirect')` returns the maximum sales goals grouped by the (optional) chosen dimension, if the condition evaluates to true.

**Syntax**

```
maxIf(measure, condition)
```

**Arguments**

**measure**

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**condition**

One or more conditions in a single statement.

**median**

The `median` aggregation returns the median value of the specified measure, grouped by the chosen dimension or dimensions. For example, `median(revenue)` returns the median revenue grouped by the (optional) chosen dimension.

**Syntax**

```
median(measure)
```
Arguments

measure

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

medianIf

Based on a conditional statement, the medianIf aggregation returns the median value of the specified measure, grouped by the chosen dimension or dimensions. For example, medianIf(Revenue, SaleDate >= ${BasePeriodStartDate} AND SaleDate <= ${BasePeriodEndDate}) returns the median revenue grouped by the (optional) chosen dimension, if the condition evaluates to true.

Syntax

\[
\text{medianIf}(\text{measure}, \text{condition})
\]

Arguments

measure

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

condition

One or more conditions in a single statement.

min

The min function returns the minimum value of the specified measure or date, grouped by the chosen dimension or dimensions. For example, \( \text{min}(\text{return rate}) \) returns the minimum rate of returns grouped by the (optional) chosen dimension.

Syntax

\[
\text{min}(\text{measure})
\]

Arguments

measure

The argument must be a measure or a date. Null values are omitted from the results. Literal values don't work. The argument must be a field.

Minimum dates work only in the Value field well of tables and pivot tables.

minIf

Based on a conditional statement, the minIf function returns the minimum value of the specified measure, grouped by the chosen dimension or dimensions. For example, minIf(ProdRev, CalendarDay >= ${BasePeriodStartDate} AND CalendarDay <= ${BasePeriodEndDate}) returns the minimum product revenue grouped by the (optional) chosen dimension, if the condition evaluates to true.
$(\{BasePeriodEndDate\} \text{ AND } \text{SourcingType} \not= 'Indirect')$ returns the minimum rate of returns grouped by the (optional) chosen dimension, if the condition evaluates to true.

### Syntax

\[
\text{minIf(measure, condition)}
\]

### Arguments

**measure**
- The argument must be a measure. Null values are omitted from the results. Literal values don't work.
- The argument must be a field.

**condition**
- One or more conditions in a single statement.

### percentile

The **percentile** function calculates the percentile of the values in measure, grouped by the dimension that's in the field well. There are two varieties of percentile calculation available in QuickSight:

- **percentileCont** (p. 208) uses linear interpolation to determine result.
- **percentileDisc (percentile)** (p. 209) uses actual values to determine result.

The **percentile** function is an alias of **percentileDisc**.

#### percentileCont

The **percentileCont** function calculates percentile based on a continuous distribution of the numbers in the measure. It uses the grouping and sorting that are applied in the field wells. It answers questions like: What values are representative of this percentile? To return an exact percentile value that might not be present in your dataset, use **percentileCont**. To return the nearest percentile value that is present in your dataset, use **percentileDisc** instead.

### Syntax

\[
\text{percentileCont(expression, percentile)}
\]

### Arguments

**measure**
- Specifies a numeric value to use to compute the percentile. The argument must be a measure or metric. Nulls are ignored in the calculation.

**percentile**
- The percentile value can be any numeric constant 0–100. A percentile value of 50 computes the median value of the measure.

### Returns

The result of the function is a number.
Usage Notes

The `percentileCont` function calculates a result based on a continuous distribution of the values from a specified measure. The result is computed by linear interpolation between the values after ordering them based on settings in the visual. It's different from `percentileDisc`, which simply returns a value from the set of values that are aggregated over. The result from `percentileCont` might or might not exist in the values from the specified measure.

Examples of `percentileCont`

The following examples help explain how `percentileCont` works.

Example Comparing median, `percentileCont`, and `percentileDisc`

The following example shows the median for a dimension (category) by using the `median`, `percentileCont`, and `percentileDisc` functions. The median value is the same as the `percentileCont` value. `percentileCont` interpolates a value, which might or might not be in the data set. However, because `percentileDisc` always displays a value that exists in the dataset, the two results might not match. The last column in this example shows the difference between the two values. The code for each calculated field is as follows:

- 50%Cont = percentileCont( `example` , 50 )
- median = median( `example` )
- 50%Disc = percentileDisc( `example` , 50 )
- Cont-Disc = percentileCont( `example` , 50 ) - percentileDisc( `example` , 50 )
- `example` = left( `category` , 1 ) (To make a simpler example, we used this expression to shorten the names of categories down to their first letter.)

<table>
<thead>
<tr>
<th><code>example</code></th>
<th>median</th>
<th>50%Cont</th>
<th>50%Disc</th>
<th>Cont-Disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>22.48</td>
<td>22.48</td>
<td>22.24</td>
<td>0.24</td>
</tr>
<tr>
<td>B</td>
<td>20.96</td>
<td>20.96</td>
<td>20.95</td>
<td>0.01</td>
</tr>
<tr>
<td>C</td>
<td>24.92</td>
<td>24.92</td>
<td>24.92</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>24.935</td>
<td>24.935</td>
<td>24.92</td>
<td>0.015</td>
</tr>
<tr>
<td>E</td>
<td>14.48</td>
<td>14.48</td>
<td>13.99</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Example 100th percentile as maximum

The following example shows a variety of `percentileCont` values for the `example` field. The calculated fields `n%Cont` are defined as `percentileCont( {example} , n)`. The interpolated values in each column represent the numbers that fall into that percentile bucket. In some cases, the actual data values match the interpolated values. For example, the column 100%Cont shows the same value for every row because 6783.02 is the highest number.

<table>
<thead>
<tr>
<th><code>example</code></th>
<th>50%Cont</th>
<th>75%Cont</th>
<th>99%Cont</th>
<th>100%Cont</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20.97</td>
<td>84.307</td>
<td>699.99</td>
<td>6783.02</td>
</tr>
<tr>
<td>B</td>
<td>20.99</td>
<td>88.84</td>
<td>880.98</td>
<td>6783.02</td>
</tr>
<tr>
<td>C</td>
<td>20.99</td>
<td>90.48</td>
<td>842.925</td>
<td>6783.02</td>
</tr>
<tr>
<td>D</td>
<td>21.38</td>
<td>85.99</td>
<td>808.49</td>
<td>6783.02</td>
</tr>
</tbody>
</table>

`percentileDisc` (percentile)

The `percentileDisc` function calculates the percentile based on the actual numbers in `measure`. It uses the grouping and sorting that are applied in the field wells. The `percentile` function is an alias of `percentileDisc.`
Use this function to answer the following question: Which actual data points are present in this percentile? To return the nearest percentile value that is present in your dataset, use `percentileDisc`. To return an exact percentile value that might not be present in your dataset, use `percentileCont` instead.

**Syntax**

```
percentileDisc(expression, percentile)
```

**Arguments**

- `measure`
  
  Specifies a numeric value to use to compute the percentile. The argument must be a measure or metric. Nulls are ignored in the calculation.

- `percentile`
  
  The percentile value can be any numeric constant 0–100. A percentile value of 50 computes the median value of the measure.

**Returns**

The result of the function is a number.

**Usage Notes**

`percentileDisc` is an inverse distribution function that assumes a discrete distribution model. It takes a percentile value and a sort specification and returns an element from the given set.

For a given percentile value \( P \), `percentileDisc` uses the sorted values in the visual and returns the value with the smallest cumulative distribution value that is greater than or equal to \( P \).

**Examples of percentileDisc**

The following examples help explain how `percentileDisc` works.

**Example Comparing median, percentileDisc, and percentileCont**

The following example shows the median for a dimension (category) by using the `percentileCont`, and `percentileDisc`, and `median` functions. The median value is the same as the `percentileCont` value. `percentileCont` interpolates a value, which might or might not be in the data set. However, because `percentileDisc` always displays the closest value that exists in the dataset, the two results might not match. The last column in this example shows the difference between the two values. The code for each calculated field is as follows:

- `50%Cont = percentileCont( example , 50 )`
- `median = median( example )`
- `50%Disc = percentileDisc( example , 50 )`
- `Cont-Disc = percentileCont( example , 50 ) - percentileDisc( example , 50 )`
- `example = left( category, 1 )` (To make a simpler example, we used this expression to shorten the names of categories down to their first letter.)

<table>
<thead>
<tr>
<th>example</th>
<th>median</th>
<th>50%Cont</th>
<th>50%Disc</th>
<th>Cont-Disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>22.48</td>
<td>22.48</td>
<td>22.24</td>
<td>0.24</td>
</tr>
</tbody>
</table>
Example 100th percentile as maximum

The following example shows a variety of `percentileDisc` values for the example field. The calculated fields `n%Disc` are defined as `percentileDisc( example, n)`. The values in each column are actual numbers that come from the dataset.

<table>
<thead>
<tr>
<th>example</th>
<th>50%Disc</th>
<th>75%Disc</th>
<th>99%Disc</th>
<th>100%Disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20.97</td>
<td>73.98</td>
<td>699.99</td>
<td>6783.02</td>
</tr>
<tr>
<td>B</td>
<td>42.19</td>
<td>88.84</td>
<td>820.08</td>
<td>6783.02</td>
</tr>
<tr>
<td>C</td>
<td>30.52</td>
<td>90.48</td>
<td>733.44</td>
<td>6783.02</td>
</tr>
<tr>
<td>D</td>
<td>41.38</td>
<td>85.99</td>
<td>901.29</td>
<td>6783.0</td>
</tr>
</tbody>
</table>

**stdev**

The `stdev` function calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.

**Syntax**

`stdev(measure)`

**Arguments**

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**stdevp**

The `stdevp` function calculates the population standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

**Syntax**

`stdevp(measure)`

**Arguments**

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**stdevIf**

Based on a conditional statement, the `stdevIf` function calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
Using Aggregate Functions in Calculated Fields

Syntax

\[ \text{stdevIf}(\text{measure}, \text{conditions}) \]

Arguments

\textit{measure}

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

\textit{condition}

One or more conditions in a single statement.

\textbf{stdevpIf}

Based on a conditional statement, the \textit{stdevpIf} function calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.

Syntax

\[ \text{stdevpIf}(\text{measure}, \text{conditions}) \]

Arguments

\textit{measure}

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

\textit{condition}

One or more conditions in a single statement.

\textbf{sum}

The \textit{sum} function adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions. For example, \textit{sum(profit amount)} returns the total profit amount grouped by the (optional) chosen dimension.

Syntax

\[ \text{sum}(\text{measure}) \]

Arguments

\textit{measure}

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.
sumIf

Based on a conditional statement, the `sumIf` function adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions. For example, `sumIf(ProdRev, CalendarDay >= ${BasePeriodStartDate} AND CalendarDay <= ${BasePeriodEndDate} AND SourcingType <> 'Indirect')` returns the total profit amount grouped by the (optional) chosen dimension, if the condition evaluates to true.

Syntax

```
sumIf(measure, conditions)
```

Arguments

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work.

The argument must be a field.

`condition`

One or more conditions in a single statement.

var

The `var` function calculates the sample variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

Syntax

```
var(measure)
```

Arguments

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work.

The argument must be a field.

varIf

Based on a conditional statement, the `varIf` function calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.

Syntax

```
varIf(measure, conditions)
```

Arguments

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work.

The argument must be a field.
**varp**

The $\text{varp}$ function calculates the population variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

**Syntax**

```
varp(measure)
```

**Arguments**

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

**varpIf**

Based on a conditional statement, the $\text{varpIf}$ function calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.

**Syntax**

```
varpIf(measure, conditions)
```

**Arguments**

`measure`

The argument must be a measure. Null values are omitted from the results. Literal values don't work. The argument must be a field.

`condition`

One or more conditions in a single statement.

---

**Order of Evaluation in Amazon QuickSight**

When you open or update an analysis, before displaying it Amazon QuickSight evaluates everything that is configured in the analysis in a specific sequence. Amazon QuickSight translates the configuration into a query that a database engine can run. The query returns the data in a similar way whether you connect to a database, a SaaS source, or the Amazon QuickSight analytics engine (*SPICE* (p. 78)).

If you understand the order that the configuration is evaluated in, you know the sequence that dictates when a specific filter or calculation is applied to your data.

The following illustration shows the order of evaluation. The column on the left shows the order of evaluation when no level-aware aggregation is involved. The column in the middle shows the order
of evaluation for analyses that contain calculated fields to compute at the prefilter level. The column on the right shows the order of evaluation for analyses that contain calculated fields to compute at the preaggregate level. Following the illustration, there is a more detailed explanation of the order of evaluation.

The following list shows the sequence in which Amazon QuickSight applies the configuration in your analysis. Anything that's set up in your data set happens outside your analysis, for example calculations at the data set level, filters, and security settings. These all apply to the underlying data. The following list only covers what happens inside the analysis.

1. **Prefilter level – Evaluates the data before analysis filters**
   a. **Simple calculations** – Calculations without any aggregations.
   b. **Level-aware aggregations: PRE_FILTER** – With this setting, at this point Amazon QuickSight first evaluates prefilter calculations. It then applies any filters that are configured on these calculations.

2. **Preaggregate level – Evaluates the data set before aggregations**
   a. **Filters added during analysis** – Filters created in the analysis apply to the data set for fields that aren't aggregated in the visuals, which are similar to WHERE clauses.
   b. **Level-aware aggregations: PRE_AGG** – With this setting, at this point Amazon QuickSight first performs preaggregate calculations before the aggregation is applied. It then applies any filters that are configured on these calculations.
   c. **Top/bottom N filters** – Filters that are configured on dimensions to display top/bottom N items.

3. **Display level – Evaluates aggregations, table calculations, and any remaining configurations applied in the visuals**
a. **Display-level aggregations** – With this setting, at this point Amazon QuickSight first performs aggregations based on the fields in the field wells. It then applies any filters that are configured on these fields, similar to `HAVING` clauses.

b. **Table calculations** – With this setting, at this point Amazon QuickSight first performs window calculations on the display-level aggregations. It then applies any filters to the table calculations.

c. **Totals** – Totals for measures as requested in tabular type visuals.

### Using Level-Aware Aggregations

You can choose when to compute your aggregation in relation to display-level aggregations in a query. In addition to the regular filters and calculations, you can also add level-aware aggregations (LAA). Level-aware aggregations are available in both Standard and Enterprise editions, in all supported AWS Regions.

Without using any level-aware aggregations, you influence the timing of your filters and aggregations simply by where you place them, as follows:

1. Before you import or access data with Amazon QuickSight, you can filter and aggregate the source tables. If you are using a direct query, you can also edit the SQL—adding WHERE clauses, joins, and even aggregations—before the data becomes part of a data set. Amazon QuickSight treats all new data the same way, and doesn't detect any of your transformative prework.

2. Before you start an analysis, you can prepare your data at the data set level by creating filters. You can also add simple calculations, format dates, and define hierarchies. In addition, if you choose you can add row-level security.

   Data that is filtered out of the data set is completely unavailable to anyone creating an analysis on this data. However, these filters run again each time the data is refreshed.

3. Inside an analysis, you can add aggregations, calculations, and more filters. You can apply the filters either to the entire analysis or only to parts of it, for example to specific visuals. You can also create table calculations such as windowing functions. In specific types of visuals, you can also add totals and subtotals.

Using these standard methods, you create a customized view of your data. Amazon QuickSight builds a query based on the combination of settings in each visual in an analysis, the analysis itself, and the data set behind it. Usually this is all you need to answer your analytical questions. But in some cases, you need more options.

Using level-aware aggregations (LAA), you can inject calculations at a specific point in Amazon QuickSight's process to evaluate and build queries. With LAA options, you can create calculations that run at the prefilter or preaggregate level. These help you to answer the following types of questions:

- How many of my customers made only 1 purchase order? Or 10? Or 50? We want the visual to use the count as a dimension rather than a metric in the visual.
- What are the total sales per market segment for customers whose lifetime spend is greater than $100,000? The visual should only show the market segment and the total sales for each.
- How much is the contribution of each industry to the entire company's profit (percent of total)? We want to be able to filter the visual to show some of the industries, and how they contribute to the total sales for the displayed industries. However, we also want to see each industry's percent of total sales for the entire company (including industries that are filtered out).
- What are the total sales in each category as compared to the industry average? The industry average should include all of the categories, even after filtering.
- How are my customers grouped into cumulative spending ranges? We want to use the grouping as a dimension rather than a metric.
For more complex questions, you can inject a calculation or filter before Amazon QuickSight gets to a specific point in its evaluation of your settings. To directly influence your results, you add a calculation level keyword to a table calculation. For more information on how Amazon QuickSight evaluates queries, see Order of Evaluation in Amazon QuickSight (p. 214).

Supported calculation levels include the following:

- **PRE_FILTER** – Before applying filters from the analysis, Amazon QuickSight evaluates prefilter calculations. Then it applies any filters that are configured on these prefilter calculations.
- **PRE_AGG** – Before computing display-level aggregations, Amazon QuickSight performs preaggregate calculations. Then it applies any filters that are configured on these preaggregate calculations. This work happens before applying top and bottom $N$ filters.

You can use the **PRE_FILTER** or **PRE_AGG** keyword as a parameter in the following table calculation functions. When you specify a calculation level, you use an unaggregated measure in the function. For example, you can use `countOver({ORDER ID}, [{Customer ID}], PRE_AGG)`. By using **PRE_AGG**, you specify that the `countOver` executes at the preaggregate level.

- `sumOver` (p. 543)
- `minOver` (p. 531)
- `maxOver` (p. 529)
- `avgOver` (p. 524)
- `countOver` (p. 526)
- `varOver` (p. 540)
- `varpOver` (p. 542)
- `stdevOver` (p. 538)
- `stdevpOver` (p. 539)
- `rank` (p. 545)
- `denseRank` (p. 544)
- `percentileRank` (p. 547)

By default, the first parameter for each function must be an aggregated measure. If you use either **PRE_FILTER** or **PRE_AGG**, you use a nonaggregated measure for the first parameter.

For level-aware aggregations, the visual aggregation defaults to **MIN** to eliminate duplicates. To change the aggregation, open the field's context (right-click) menu, and then choose a different aggregation.

For examples of when and how to use level-aware aggregations in real life scenarios, see the following post in the AWS Big Data Blog: Create advanced insights using Level Aware Aggregations in Amazon QuickSight.

---

**Parameters in Amazon QuickSight**

*Parameters* are named variables that can transfer a value for use by an action or an object. They let you create an easier way for a dashboard user to interact with dashboard features in a less technical way. Parameters can also connect one dashboard to another, allowing a dashboard user to drill down into data that's in a different analysis.

For example, a dashboard user can use a list to choose a value. That value sets a parameter that in turn sets a filter, calculation, or URL action to the chosen value. Then the visuals in the dashboard react to the user's choices.
To make the parameters accessible to the dashboard viewer, you add a parameter control. You can set up cascading controls, so that a selection in one control filters the options that display in another control. A control can appear as a list of options, a slider, or a text entry area. If you don’t create a control, you can still pass a value to your parameter in the dashboard URL.

For a parameter to work, it needs to be connected to something in your analysis, regardless of whether it has a related control. You can reference parameters in the following:

- Calculated fields (except for multivalue parameters)
- Filters
- Dashboard and analysis URLs
- Actions

Some ways that you can use parameters are the following:

- Using a calculation, you can transform data that is shown in an analysis.
- If you add a control with a filter to an analysis you are publishing, the dashboard users can filter the data without creating their own filters.
- Using controls and custom actions, you can let dashboard users set values for the URL actions.

**Topics**

- Setting Up Parameters in Amazon QuickSight (p. 218)
- Using a Control with a Parameter in Amazon QuickSight (p. 220)
- Creating Parameter Defaults in Amazon QuickSight (p. 222)
- Connecting to Parameters in Amazon QuickSight (p. 227)

**Setting Up Parameters in Amazon QuickSight**

Use the following procedure to create or edit a basic parameter.

1. Choose an analysis to work with, and decide which field you want to parameterize.
2. Choose the **Parameters** pane from the left side of the screen.
3. Add a new parameter by choosing the add icon (⊕) near the top of the pane.
   
   Edit an existing parameter by first choosing the V-shaped icon near the parameter name and then choosing **Edit parameter**.
4. The following screen appears.
A parameter consists of the following parts, which you enter on this screen:

Name

Enter an alphanumeric value for the parameter Name. This name is used as a reference in the consumers of the parameters (for example, calculated field, filter, custom URL action, and so on). For ease of use, you can choose a name that reflects the data type and purpose of the parameter.

Data type

Choose a value for Data type. This data type can't be altered after you create the parameter. If you want to use the parameter for a text box or drop-down list, choose String.

Values

Choose one of the following:

- **Single value** – for parameters that can contain only one value.
- **Multiple values** – for parameters that can contain one or more values. Multivalue parameters can't be datetime data types. They also don't support dynamic default values.

To switch an existing parameter between single and multiple values, delete and recreate the parameter.
Static default value

Choose a static default value for the parameter. This static value is used during the first page load, if a dynamic default value or URL parameter isn't provided.

Dynamic default value

Choose Set a dynamic default to create a default that is user-specific. A dynamic default is a per-user default value for the first page load of the dashboard. Using a dynamic default, you can create a personalized view for each user.

Calculated fields can't be used as dynamic defaults.

Dynamic defaults don't prevent someone from selecting a different value. If you want to also secure the data, you can add row-level locking. For more information, see Using Row-Level Security (RLS) to Restrict Access to a Dataset (p. 119).

This option only appears if you choose a single value parameter. Multivalue parameters can't have dynamic defaults.

Note

If you choose a multivalue parameter, the screen changes to remove the default options. Instead, you see a box with the text Enter values you want to use for this control. You can enter multiple values in this box, each on a single line. These values are used as the default selected values in the parameter control. The values here are unioned with what you choose to enter for the parameter control. For more information on parameter controls, see Parameter Controls (p. 220).

Show as blank by default

Select this option to show the default value for multivalue lists as blank. This option only applies to multivalue parameters.

5. Choose Create or Update to complete creating or updating the parameter.

After you create a parameter, you can use it in a variety of ways. You can create a control (such as a button) so that you can choose a value for your parameter. For more information, see the following sections.

Using a Control with a Parameter in Amazon QuickSight

In dashboards, parameter controls appear at the top of the data sheet, which contains a set of visuals. Providing a control allows users to choose a value to use in a predefined filter or URL action. Dashboard users can use controls to apply filtering across all visuals datasets on a dashboard, without having to create the filters themselves.

The following rules apply:

- To create or edit a control for a parameter, make sure that the parameter exists.
- Multiselect list controls are compatible with analysis URLs, dashboard URLs, custom actions, and custom filters. The filter must be either equal or not equal to the values provided. No other comparisons are supported.
- Lists show up to 1,000 values. If there are more than 1,000 distinct values, a search box appears so you can filter the list. When the filtered list contains less than 1,001 values, the contents of the list appear as line items.
• The **Style** option displays only the style types that are appropriate for the parameter's data type and single or multivalue setting. If the style that you want to use isn't in the list, recreate your parameter with the appropriate settings and try again.

• If your parameter links to a dataset field, it must be an actual field. Calculated fields aren't supported.

• The values display alphabetically in the control, unless there are more than 1,000 distinct values. Then the control displays a search box instead. Each time you search for the value you want to use, it initiates a new query. If the results contain more than 1,000 values, you can scroll through the values with pagination.

Use the following procedure to create or edit a control for an existing parameter.

**To create or edit a control for an existing parameter**

1. Choose an existing parameter's context menu, the icon near the parameter name, and choose **Add control**.

2. Enter a name to give the new control a label. This label appears at the top of the workspace, and later at the top of the sheet that a dashboard displays on.

3. Choose a style for the control from the following:

   - **Text box**
     A text box lets a user type in their own value. A text box works with numbers and text (strings).

   - **Dropdown**
     A dropdown list control that you can use to select a single value. A list control works with numbers and text (strings).

   - **Dropdown multiselect**
     A list control that you can use to select multiple values. A list control works with numbers and text (strings).

   - **List**
     A list control that you can use to select a single value. A list control works with numbers and text (strings).

   - **List - multiselect**
     A list control that you can use to select multiple values. A list control works with numbers and text (strings).

   - **Slider**
     A slider lets a user select a numeric value by sliding the control from one end of the bar to another. A slider works with numbers.

   - **Date-picker**
     A date-picker lets a user select a date from a calendar control.

4. (Optional) If you choose a dropdown control, the screen expands so you can choose the values to display. You can either specify a list of values, or use a field in a dataset. Choose one of the following:

   - **Specific values**
     To create a list of specific values, type in one per line, with no separating spaces or commas, as shown in the following screenshot.

   In the control, the values display in the order you typed them, not alphabetically.
• **Link to a data set field**

To link to a field, choose the dataset that contains your field, then choose the field from the list. If you change the default values in the parameter, choose **Reset** on the control to show the new values.

The values that you choose here are unioned with the static default values in the parameter settings.

5. (Optional) Enable the option **Hide [ALL] option from the control if the parameter has a default configured**. Doing this shows only the data values and removes the option to select all items in the control. If you don't configure a static default on the parameter, this option doesn't work. You can add a default after adding a control by choosing the parameter, and selecting **Edit parameter**.

6. (Optional) You can limit the values displayed in the controls, so they only show values that are valid for what is selected in other controls. This is called a cascading control.

   To create one, choose **Show relevant values only**. Choose one or more controls that can change what displays in this control.

7. When you finish choosing options for your control, choose **Add**.

The finished control appears at the top of the workspace. The context menu, shaped like a v, offers four options:

- **Reset** restores the user's selection to its default state.
- **Refresh list** applies only to drop-downs that are linked to a field in a dataset. Choosing **Refresh list** queries the data to check for changes. Data used in the control is cached.
- **Edit** reopens the control creation screen so that you can change your settings.
- **Delete** removes the control. You can recreate it by choosing the parameter context menu.

In the workspace, you can also resize and rearrange your controls. The dashboard users see them as you do, except without being able to edit or delete them.

**Creating Parameter Defaults in Amazon QuickSight**

Use this section to learn more about the types of parameter defaults that are available, and how to set up each of them.

Each field can have a parameter and a control associated with it. When someone views a dashboard or email report, any sheet control that has a static default value configured uses the static default. The default value can change how data is filtered, how custom actions behave, and what text displays in a dynamic sheet title. Email reports don't support dynamic defaults.

The simplest default is a static (unchanging) default, which shows the same value to everyone. As the designer of the dashboard, you choose the default value. It can't be changed by the person using the dashboard. However, that person can choose any value from the controls. Setting a default doesn't change this. To restrict the values that a person can select, consider using row-level security. For more information, see **Using Row-Level Security (RLS) to Restrict Access to a Dataset (p. 119)**.

**To create or edit a static default value that applies to everyone's dashboard view**

1. Choose the context menu (v) by the parameter that you want to edit, or create a new parameter by following the steps in **Setting Up Parameters in Amazon QuickSight (p. 218)**.
2. Enter a value for **Static default value** to set a static default.
To display a different default depending on who is viewing the dashboard, you create a dynamic default parameter (DDP). Using dynamic defaults involves some preparation to map people to their assigned defaults. First, you need to create a database query or a data file that contains information about the people, the fields, and the default values to display. You add this to a dataset, then add the dataset to your analysis. Following, you can find procedures that you can use to gather information, create the dataset, and add the dynamic default to the parameter.

Use the following guidelines when creating a dataset for dynamic default values:

- We recommend that you use a single dataset to contain all dynamic default definitions for a logical grouping of users or groups. If you can, maintain them in a single table or file.

- We also recommend that the fields in your dataset have names that closely match the field names in the analysis. Not all dataset fields need to be part of the analysis, for example if you're using the same dataset for the defaults in multiple dashboards. The fields can be in any order.

- We don't recommend that you combine both user and group names in the same column or even in the same dataset. This kind of configuration is more work to maintain and troubleshoot.

- If you use a comma-delimited file to create your dataset, make sure to remove any space between values in the file. The following example shows the correct comma-separated value (CSV) format. Enclose text (strings) that include nonalphanumeric characters—like spaces, apostrophes, and so on—in single or double quotation marks. You can enclose fields that are dates or times in quotation marks, but it isn't required. You can enclose numeric fields in quotation marks, for example if the numbers contain special characters, as shown following.

  "Value includes spaces","Field contains ' other characters",12345.6789,"20200808"
  ValueWithoutSpaces,"1000,67","Value 3",2020-AUG-08

- After you create the dataset, make sure to double-check the data types that QuickSight selects for the fields.

Before you begin, you need a list of the user or group names for the people who are going to have dynamic defaults. To generate a list of users or groups, you can use the AWS CLI to get the information. To run CLI commands, make sure that you have the AWS CLI installed and configured. For more information, see Installing the AWS CLI in the AWS CLI User Guide.

This is just one example of how to get a list of user or group names. Use whatever method works best for you.

To identify people for a dynamic default parameter (DDP)

- List either individual user names or group names:

  - To list individual user names, include a column that identifies the people for your DDP. This column should contain each person's system user name that they use to connect from your identity provider to QuickSight. This user name is often the same as a person's email alias before the @ sign, but not always.

  To get a list of users, use the ListUsers QuickSight API operation or AWS CLI command. The CLI command is shown in the following example. Specify the AWS Region for your identity provider, for example us-east-1.

  ```
  awsacct1="111111111111"
  namespace="default"
  region="us-east-1"

  aws quicksight list-users --aws-account-id $awsacct1 --namespace $namespace --region $region
  ```
The following example alters the previous command by adding a query that limits the results to active users.

```
awsacct1="111111111111"
namespace="default"
region="us-east-1"

aws quicksight list-users --aws-account-id $awsacct1 --namespace $namespace --region $region --query 'UserList[?Active==`true`]'
```

The result set looks similar to the following sample. This example is an excerpt from JSON output (--output json). People who have federated user names have principal IDs that start with the word federated.

```
[
  {
    "Arn": "arn:aws:quicksight:us-east-1:111111111111:user/default/anacasilva",
    "UserName": "anacarolinasilva",
    "Email": "anacasilva@example.com",
    "Role": "ADMIN",
    "Active": true,
    "PrincipalId": "federated/iam/AIDAJ64EIEIOPX5CEIEIO"
  },
  {
    "UserName": "Reader/liujie-stargate",
    "Role": "READER",
    "Active": true,
    "PrincipalId": "federated/iam/AR0AIJSEIEIOMXT6IEIO:liujie-stargate"
  },
  {
    "Arn": "arn:aws:quicksight:us-east-1:111111111111:user/default/embedding/cxoportal",
    "UserName": "embedding/cxoportal",
    "Email": "saanvisarkar@example.com",
    "Role": "AUTHOR",
    "Active": true,
    "PrincipalId": "federated/iam/AR0AJT6IEIOWB6BEIEIO:cxoportal"
  },
  {
    "Arn": "arn:aws:quicksight:us-east-1:111111111111:user/default/zhangwei@example.com",
    "UserName": "zhangwei@example.com",
    "Email": "zhangwei@example.com",
    "Role": "AUTHOR",
    "Active": true,
    "PrincipalId": "user/d-96123-example-id-1123"
  }
]
```

- To list group names, include a column that identifies the groups containing the user names for your DDP. This column should contain the system group names that are used to connect from your identity provider to QuickSight. To identify groups that you can add to the dataset, use one or more of the following QuickSight API operations or CLI commands:
  - **ListGroup** – Lists QuickSight groups by AWS account ID and namespace for the AWS Region that contains your identity provider.
  - **ListGroupMemberships** – Lists the users in the specified QuickSight group.
  - **ListUserGroups** – Lists the QuickSight groups that a QuickSight user is a member of.
Or you can ask your network administrator to query your identity provider to get this information.

The next two procedures provide instructions on how to finish creating a dataset for dynamic default values. The first procedure is for creating a dataset for a single-value DDP. The second one is for creating a dataset for a multivalue DDP.

To create a dataset for a single-value DDP

1. Create dataset columns with single-value parameters. The first column in the query or file should be for the people using the dashboard. This field can contain user names or group names. However, support for groups is only available in QuickSight Enterprise edition.
2. For each field that displays a dynamic default for a single-value parameter, add a column to the dataset. The name of the column doesn't matter—you can use the same name as the field or parameter.

Single-value parameters only work as specified if the combination of user entity and dynamic default is unique for that parameter's field. If there are multiple values a default field for a user entity, the single-value control for that field displays the static default instead. If no static default is defined, the control doesn't display a default value. Be careful if you use group names, because some user names can be members of multiple groups. If those groups have different default values, then this type of user name functions as a duplicate entry.

The following example shows a table that appears to contain two single-value parameters. We make this assumption because no user name is paired with multiple default values. To make this table easier to understand, we add the word 'default' in front of the field names from the analysis. Thus, you can read the table by making the following statement, changing the values for each row: When viewed by anacarolinasilva, the controls display a default region NorthEast and a default segment SMB.

<table>
<thead>
<tr>
<th>viewed-by</th>
<th>default-region</th>
<th>default-segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>anacarolinasilva</td>
<td>NorthEast</td>
<td>SMB</td>
</tr>
<tr>
<td>liujie</td>
<td>SouthEast</td>
<td>SMB</td>
</tr>
<tr>
<td>saanvisarkar</td>
<td>NorthCentral</td>
<td>SMB</td>
</tr>
<tr>
<td>zhangwei</td>
<td>SouthCentral</td>
<td>SMB</td>
</tr>
</tbody>
</table>

3. Import this data into QuickSight, and save it as a new dataset.
4. In your analysis, add the dataset that you created. The analysis needs to use at least one other dataset that matches the columns you defined for the defaults. For more information, see Adding a Data Set to an Analysis (p. 183).

To create a dataset for a multivalue DDP

1. Create dataset columns with multivalue parameters. The first column in the query or file should be for the people using the dashboard. This field can contain user names or group names. However, support for groups is only available in QuickSight Enterprise edition.
2. For each field that displays a dynamic default for a multivalue parameter, add a column to the dataset. The name of the column doesn't matter—you can use the same name as the field or parameter.

Unlike single-value parameters, multivalue parameters allow multiple values in the field that's associated with the parameter.
The following example shows a table that appears to contain a single-value parameter and a multivalue parameter. We can make this assumption because each user name has a unique value in one column, and some user names have multiple values in the other column. To make this table easier to understand, we add the word 'default' in front of the field names from the analysis. Thus, you can read the table by making the following statement, changing the values for each row: When viewed-by is liujie, the controls display a default-region value of SouthEast, and a default-city value of Atlanta. And if we read ahead one row, we see that liujie also has Raleigh in default-city.

<table>
<thead>
<tr>
<th>viewed-by</th>
<th>default-region</th>
<th>default-city</th>
</tr>
</thead>
<tbody>
<tr>
<td>anacarolinasilva</td>
<td>NorthEast</td>
<td>New York</td>
</tr>
<tr>
<td>liujie</td>
<td>SouthEast</td>
<td>Atlanta</td>
</tr>
<tr>
<td>liujie</td>
<td>SouthEast</td>
<td>Raleigh</td>
</tr>
<tr>
<td>saanvisarkar</td>
<td>NorthCentral</td>
<td>Chicago</td>
</tr>
<tr>
<td>zhangwei</td>
<td>SouthCentral</td>
<td>Dallas</td>
</tr>
<tr>
<td>zhangwei</td>
<td>SouthCentral</td>
<td>Kansas City</td>
</tr>
</tbody>
</table>

In this example, the parameter that we apply default-region to works correctly whether it's a single-value or multivalue parameter. If it's a single-value parameter, two entries work for one user because both entries are the same value, SouthEast. If it's a multivalue parameter, it still works, except that only one value is selected by default. However, if we change the parameter that's using default-city as its default from a multivalue to a single-value parameter, we don't see these defaults selected. Instead, the parameter uses the static default, if there is one defined. For example, if the static default is set to Atlanta, liujie has Atlanta selected in that control, but not Raleigh.

In some cases, your static default value might also be used as a dynamic default. If so, make sure to test the control for a user name that doesn't use a default value that can be both.

If a user name belongs to multiple groups, the named user sees a set of default values that is a union of the two groups' default values.

3. Import this data into QuickSight, and save it as a new dataset.

4. In your analysis, add the dataset that you created. The analysis needs to use at least one other dataset that matches the columns you defined for the defaults. For more information, see Adding a Data Set to an Analysis (p. 183).

Use the following procedure to add a dynamic default parameter to your analysis. Before you begin, make sure that you have a dataset that contains the dynamic defaults for each user name or group name. Also make sure that your analysis is using this dataset. For help with these requirements, see the procedures preceding.

**To add a DDP to your analysis**

1. In the QuickSight console, open the Parameters menu at left and choose an existing parameter. Choose Edit parameter from the parameter's menu. To add a new parameter, choose the plus (+) sign near Parameters.

2. Choose Set a dynamic default.

3. Configure the following options with your settings:
• **Dataset with default values and user information** – Choose the dataset that you created and added to your analysis.

• **User name column** – To create defaults that are based on user names, choose the column in the dataset that contains the user names.

• **Group name column** – To create defaults that are based on group names, choose the column in the dataset that contains the group names.

• **Column for default value** – Choose the column that contains default values for this parameter.

4. Choose **Apply** to save your setting changes, and then choose **Update** to save the parameter changes. To exit without saving changes, choose **Cancel** instead.

5. Add a filter for each field that contains dynamic defaults to make the defaults work. To learn more about using filters with parameters, see Using Filters with Parameters in Amazon QuickSight (p. 229)

Amazon QuickSight uses the static default value for anyone whose user name doesn't exist in the dataset, doesn't have a default assigned, or doesn't have a unique default. Each person can have only one set of defaults. If you don't want to use dynamic defaults, you can set a static default instead.

### Connecting to Parameters in Amazon QuickSight

Use this section after you have a parameter set up, to connect it and make it work.

After you create a parameter, you can create consumers of the parameters. *Parameter consumers* are components that consume the value of a parameter, such as filters, controls, calculated fields, or custom actions.

You can choose your next step from the shortcuts on this screen.
You can navigate to each of these options in another way, as follows:

- To create a filter, choose Filter to the left of the screen. In short, you create a Custom Filter and enable Use parameters. The list shows only eligible parameters.
- To add a new control for the parameter, choose Parameters on the left. In short, choose your parameter, and then Add control.
- To use a parameter in a calculated field, either edit an existing calculated field, or add a new one by choosing Add at the top left. The parameter list appears below the field list.

  **Note**
  You can't use multivalue parameters with calculated fields.
- To create a URL action, choose the v-shaped menu on a visual, and then choose URL Actions.

For more information on each of these topics, see the following sections.

**Topics**
- Using Filters with Parameters in Amazon QuickSight (p. 229)
- Using Calculated Fields with Parameters in Amazon QuickSight (p. 231)
- Using Custom Actions with Parameters in Amazon QuickSight (p. 232)
Using Filters with Parameters in Amazon QuickSight

Use this section to filter the data in an analysis or dashboard by a single-value parameter value. To use a multivalued parameter—one with a multiselect drop-down control—create a custom filter that is equal (or not equal) to the values.

Before using a filter with a parameter, you should already know how to work with filters.

1. Verify that your analysis has a parameter already created. Choose Edit from either the parameter or the control menu to find out what settings are in use.
2. Choose the Filter pane from the left of the screen. If there is already a filter for the field that you want to use, choose it to open its settings. Otherwise, create a filter for the field that you want to filter by parameter.
3. Choose Use Parameters.
4. Choose your parameters from the list or lists below Use parameters. For text (string) fields, first choose Custom Filter, and then enable Use Parameters.

For date fields, choose the Start date and End date parameters, as shown in the following screenshot.

For fields with other data types, choose Select a parameter and then choose your parameter from the list.
Note
Parameters that can hold multiple values must use equal or not equal as the comparison type.

5. Choose **Apply** to save your changes.

Test your new filter by choosing the control near the top of the analysis. In this example, we use a basic parameter that has no defaults, and a dynamic control that is linked to the **Region** field in the sample dataset named **Sales Pipeline**. The control queries the data, returning all values.

Two context menus appear in the following screenshot. The menu that is highlighted in the screenshot manages the parameter. The menu that is not highlighted manages the control settings. Using the control's menu, you can reset the control by choosing **Reset**, or refresh your data by choosing **Refresh list**.
If you delete or recreate a parameter that you are using in a filter, you can update the filter with the new parameter. To do this, open the filter, choose the new parameter that you want to use, and then choose Apply.

If you rename a parameter, you don't need to update the filter or any other consumers.

**Using Calculated Fields with Parameters in Amazon QuickSight**

You can pass the value of a parameter to a calculated field in an analysis. When you create a calculation, you can choose existing parameters from the list of parameters under **Parameter list**. You can't create a calculated field that contains a multivalued parameter—those with a multiselect drop-down control.
For the formula, you can use any of the available functions. You can pass the viewer's selection from the parameter control, to the `ifElse` function. In return, you get a metric. The following shows an example.

```plaintext
ifelse(
    ${KPIMetric} = 'Sales', sum({Weighted Revenue}),
    ${KPIMetric} = 'Forecast', sum({Forecasted Monthly Revenue}),
    ${KPIMetric} = '# Active', distinct_count(ActiveItem),
    NULL
)
```

The preceding example creates a metric (a decimal) that you can use in a field well. Then, when a user chooses a value from the parameter control, the visual updates to reflect their selection.

**Using Custom Actions with Parameters in Amazon QuickSight**

A custom action enables you to launch URLs or filter visuals by selecting a data point in a visual or choosing the action name from the context menu. When you use a URL action with a parameter, you can pass or send parameters dynamically to the URL. To make this work, you set up a parameter, and then use it in the URL when you create a custom action with an action type of URL action. The parameters on both the sending and the receiving end must match in name and data type. All parameters are compatible with URL actions.

For details on creating a URL action, see Creating and Editing Custom Actions in Amazon QuickSight (p. 321). If you just want to use a parameter in a link without creating a URL action, see Using Parameters in a URL (p. 233).
Using Parameters in a URL

You can use a parameter name and value in a URL in Amazon QuickSight to set a default value for that parameter in a dashboard or analysis.

The following example shows the URL of a dashboard that sets a parameter for another dashboard.

https://us-east-2.quicksight.aws.amazon.com/sn/dashboards/abc123-abc1-abc2-abc3-abcdedef1234#p.myParameter=12345

In the previous example, the first part is the link to the target dashboard: https://us-east-2.quicksight.aws.amazon.com/sn/dashboards/abc123-abc1-abc2-abc3-abcdedef1234. The hash sign (#) follows the first part to introduce the fragments, which contain the values that you want to set.

The values in the fragments aren't received or logged by AWS servers. This functionality keeps your data values more secure.

The fragment after # follows these rules:

- Parameters are prefixed with p.. The names are the parameter name, not the control name. You can view the parameter name by opening the analysis, and choosing Parameter on the left sidebar.
- The value is set using equals (=). The following rules apply:
  - Literal values don't use quotation marks.
  - Spaces inside values are automatically encoded by the browser, so you don't need to use escape characters when manually creating a URL.
  - To return all values, set the parameter equal to “[ALL]”.
  - In custom actions, target parameter names begin with $, for example: <<$passThroughParameter>>
  - In custom actions, parameter values display with angle brackets << >>, for example <<dashboardParameter1>>. The dashboard user sees the lookup value, not the variable.
- For a custom URL action, multivalue parameters only need one instance of the same parameter in the fragment, for example: p.city=<<$city>>
- For a direct URL, multiple values for a single parameter have two instances of the same parameter in the fragment. For an example, see following.
- Ampersands (&) separate multiple parameters. For an example, see following.

The server converts the date to UTC and sends it to the backend as a string without a time zone. To use Universal Coordinated Time (UTC) dates, exclude the time zone. Following are some examples of date formats that work:

- 2017-05-29T00%3A00%3A00
- 2018-04-04 14:51 -08:00
- Wed Apr 04 2018 22:51 GMT+0000


In the browser, this code becomes the following.
The previous example sets four parameters:

- `shipDate` is a date parameter: Sept 30, 2018.
- `city` is a multivalued string parameter: New York, and Seattle
- `teamMember` is an integer parameter: 12.
- `percentageRank` is a decimal parameter: 2.3.

The following example shows how to set values for a parameter that accepts multiple values.

To pass values from one dashboard (or analysis) to another dashboard based on the user's data point selection, use custom URL actions. If you choose, you can also generate these URLs manually, and use them to share a specific view of the data.

For information on creating custom actions, see Using Custom Actions for Filtering and Navigating (p. 320).

Using Themes in Amazon QuickSight

In Amazon QuickSight, a theme is a collection of settings that you can apply to multiple analyses and dashboards. Amazon QuickSight includes some themes, and you can add your own by using the theme editor. You can share themes with permissions levels set to user or owner. Anyone who has access to the theme can apply it to analyses and dashboards, or use Save as to make their own copy of it. Theme owners can also edit the theme and share it with others.

An analysis can have only one theme applied. If you apply a theme to an analysis (by using the Apply button), it instantly changes it for everyone—both analysis and dashboard viewers. To explore and save color options without applying them, avoid editing and saving the applied theme.

All colors come in pairs of background and foreground colors. The foreground colors are meant to specifically appear above their matching background color, so choose something that contrasts well.

The following table defines the different settings.

<table>
<thead>
<tr>
<th>Group</th>
<th>Setting</th>
<th>What the Setting Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>Primary background</td>
<td>The background color used for visuals and other high emphasis UI.</td>
</tr>
<tr>
<td>Main</td>
<td>Primary foreground</td>
<td>The color of text and other foreground elements that appear over the primary background regions such as grid lines, borders, table banding, icons, and so on.</td>
</tr>
<tr>
<td>Group</td>
<td>Setting</td>
<td>What the Setting Changes</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Main</td>
<td>Secondary background</td>
<td>The background color used for the sheet background and sheet controls.</td>
</tr>
<tr>
<td>Main</td>
<td>Secondary foreground</td>
<td>The foreground color used for any sheet title, sheet control text, or UI that appears over the secondary background.</td>
</tr>
<tr>
<td>Main</td>
<td>Accent</td>
<td>This setting is used as an interactive hint for the following:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Buttons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Borders around the selected visual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loading indicators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Narration customizations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Links</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Filter panes for embedded dashboards</td>
</tr>
<tr>
<td>Main</td>
<td>Accent foreground</td>
<td>The foreground color applies to any text or other elements that appear over the accent color.</td>
</tr>
<tr>
<td>Main</td>
<td>Font</td>
<td>The font to use for all of the text. You can choose from a variety of fonts supported by Amazon QuickSight.</td>
</tr>
<tr>
<td>Data</td>
<td>Data Colors</td>
<td>These are the data colors that charts rotate through when assigning colors to groups. You can add or remove colors to this list, or choose a color to change it.</td>
</tr>
<tr>
<td>Data</td>
<td>Min max gradient</td>
<td>The default minimum and maximum gradient colors to use when a gradient is used as a scale, for example in heat maps.</td>
</tr>
<tr>
<td>Data</td>
<td>Empty fill color</td>
<td>This is the color used with your data colors to indicate a lack of data. For example, this color appears in the empty portion of the progress bars that are shown in key performance indication (KPI) and gauge charts, or for empty heat map cells.</td>
</tr>
</tbody>
</table>
### Using Themes in Amazon QuickSight

<table>
<thead>
<tr>
<th>Group</th>
<th>Setting</th>
<th>What the Setting Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout</td>
<td>Border</td>
<td>This setting toggles the border around the visuals that aren't currently selected. The selected visual's border still displays the accent color.</td>
</tr>
<tr>
<td>Layout</td>
<td>Margin</td>
<td>This setting toggles the space between the sheet boundaries and the visuals.</td>
</tr>
<tr>
<td>Layout</td>
<td>Gutter</td>
<td>This setting shows or hides the space between visuals in the grid.</td>
</tr>
<tr>
<td>Other</td>
<td>Success</td>
<td>These colors are used for success messages, for example the check mark for a successful download.</td>
</tr>
<tr>
<td>Other</td>
<td>Success foreground</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Warning</td>
<td>These colors are used for warning and informational messages.</td>
</tr>
<tr>
<td>Other</td>
<td>Warning foreground</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Danger</td>
<td>These colors are used for error messages.</td>
</tr>
<tr>
<td>Other</td>
<td>Danger foreground</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Dimension</td>
<td>These colors are used for the names of fields that are identified as dimensions. This option also sets the color for dimensions in the filter panel of embedded dashboards.</td>
</tr>
<tr>
<td>Other</td>
<td>Dimension foreground</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Measure</td>
<td>These colors are used for the names of fields that are identified as measures. These colors also apply to measures in the filter panel of embedded dashboards.</td>
</tr>
<tr>
<td>Other</td>
<td>Measure foreground</td>
<td></td>
</tr>
</tbody>
</table>

**To take a short tour of the theme viewer and editor**

1. Open an analysis, or create a new one. You must have an analysis open to work with themes. However, the view you see with the theme applied is only a preview.

   Themes are separate from analyses. No changes are made to your analysis, even when you save a theme.

2. Choose **Themes** on the left. The theme panel opens.

3. The list of themes shows the following:
   - **Applied theme** shows the theme that is currently applied to this analysis and its dashboards.
   - **My themes** shows themes that you created and themes that are shared with you.
   - **Starter themes** shows themes created by Amazon QuickSight.

4. Each theme has context menu that you can access from the ... icon.
The actions that are available to you on each theme depend on your level of access.

- **Theme owners** – If you created the theme, or someone shared it with you and made you an owner, you can do the following:
  - **Edit** – Change the settings for the theme, and save them.
  - **Save** – Save changes you made to the theme. If you edit the applied theme save your changes, the new theme settings apply to all the analyses and dashboards that use it. An informational message displays before you overwrite an applied theme.
  - **Share** – Share the theme and assign user or owner permissions to other people.
  - **Delete** – Delete a theme. You can’t undo this action. An informational message displays before you confirm deletion.

- **Theme users** – If someone shared the theme with you, or if it's an Amazon QuickSight theme, you can do the following:
  - **Apply** – Apply the theme to the current analysis. This option also applies the theme to dashboards created from the analysis. An informational message displays before you overwrite an applied theme.
  - **Save as** – Save the current theme to another name, so you can edit it.

- **Analysis authors** – If you have access to the analysis, but not the theme, you can do the following:
  - You can see the analysis with the theme applied.
  - You can see the theme in the **Theme** panel.
  - You can use **Save as** to create your own copy of the theme.

- **Dashboard viewers** – If you have access to the dashboard, but not the theme, you can do the following:
  - You can see the dashboard with the theme applied.
  - You can’t see the theme or its settings. Dashboard users can’t see the **Theme** panel.

5. To explore a theme's settings, choose the icons on the left to see settings for colors.

The following procedure walks you through creating a theme. You can start on the analysis, or a copy of the analysis, that you want to use to preview the colors. Or you can start a new analysis. After you save the theme, you can apply it to the current analysis or to other analyses. If you share it, other people can use it too.

**To use the theme editor**

1. Open an analysis, or create a new one. Choose **Themes** at left.

   You must have an analysis open to work with themes. However, the view you see with the theme applied is only a preview. Themes are separate from analyses. No changes are made to your analysis, even when you save a theme.

2. Choose **Main**. The color picker used in each of these settings is the standard one used throughout Amazon QuickSight.

   Set colors for **Primary background** and **Primary foreground** to use in visuals and other high impact UI.

   Set colors for **Secondary background** and **Secondary foreground** to use in sheets and sheet controls.

   Set colors for **Accent** and **Accent foreground** to use in interactive hints including buttons, borders around selected visuals, loading indicators, narration customizations, links, and the filter pane in embedded dashboards.

3. Choose **Data**.
Set the **Colors** to use as data colors. Charts rotate through these when assigning colors. You can add or delete colors, or change the order they're in by dragging and dropping. To change an existing color, select it to open the color editor.

Set colors for **Min max gradient** to use when a gradient is used as a scale, for example in heat maps.

Set the color for **Empty fill** to use when showing a lack of data, for example the unfilled part of a progress bar.

4. **Choose Layout.**

   Enable or disable the **Border** check box to show or hide the border around the visuals that aren't currently selected.

   Enable or disable the **Margin** check box to show or hide the space between the sheet boundaries and the visuals.

   Enable or disable the **Gutter** check box to show or hide the space between visuals in the grid.

5. **Choose Other.**

   Set the color for **Success** to use in success messages, for example when you successfully download a .csv file. The success foreground color isn't currently used.

   Set the color for **Warning** to use in warning and informational messages. The warning foreground color isn't currently used.

   Set the color for **Danger** to use in error messages. The danger foreground color isn't currently used.

   Set the color for **Dimension** to use for the names of fields that are identified as dimensions. This option also sets the color for dimensions in the filter panel of embedded dashboards.

   Set the color for **Measure** to use for the names of fields that are identified as measures. This option also sets the color for measures in the filter panel of embedded dashboards.

6. To save the theme, choose **Main** and give the new theme a name, and then choose **Save** at the upper-right of the browser.

   Saving a theme doesn't apply it to the analysis, even though you can see a preview of the colors that uses the current analysis.

7. To share the theme, save or close the theme you are viewing. Find the theme in your theme collection. **Choose Share** from the context menu (…).

8. To apply the theme, save or close the theme you are viewing. Find the theme in your theme collection. **Choose Apply** from the context menu (…).

---

**Changing Display Settings**

You can make your analysis and dashboard fit better on larger or smaller screens by adjusting their display width.

**To change the display settings for your view only**

1. Choose **View** from the menu bar at upper right.

2. To scale the analysis or dashboard that you are viewing, select **Fit to window**.

   To reset the analysis or dashboard you are viewing to its usual scale, clear the check box for **Fit to window**.
To change the display settings for everyone

1. Open the analysis that you want to edit.
2. Choose Settings at left.
3. For Scaling mode, choose one of the following options:
   - Autofit – Use a responsive layout. This type of layout automatically adjusts the width of the analysis or dashboard to fit the screen.
   - Optimized – Use a fixed width layout. Choose a setting based on the screen size in pixels.
4. Choose Apply to save your selection.
5. To publish this change to your dashboard, choose Share from the menu bar, and then choose Publish dashboard.

Using SPICE Data in an Analysis

When you use stored data to create an analysis, a data import indicator appears next to the data set list at the top of the Fields list pane. When you first open the analysis and the data set is importing, this icon appears as a spinner.

After the SPICE import is complete, the indicator displays the percentage of rows that were successfully imported. A message also appears at the top of the visualization pane to provide counts of the rows imported and skipped.
If any rows were skipped, you can choose **View summary** in this message bar to see details about why those rows failed to import. To edit the data set and resolve the issues that led to skipped rows, choose **Edit data set**. For more information about common causes for skipped rows, see **Troubleshooting Skipped Row Errors** (p. 83).

![Edit data set](image)

If an import fails altogether, the data import indicator appears as an exclamation point icon, and an **Import failed** message is displayed.

### Sharing Analyses

You can share an analysis with one or more other users by emailing them a link, making it easy to collaborate and disseminate findings. You can only share an analysis with other users in your Amazon QuickSight account.

After you share an analysis, you can review the other users who have access to it, and also revoke access from any user.

**Topics**

- Sharing an Analysis (p. 240)
- Viewing the Users an Analysis Is Shared With (p. 241)
- Revoking Access to an Analysis (p. 242)
- Printing a Dashboard or Analysis (p. 242)

### Sharing an Analysis

Use the following procedure to share an analysis.

1. On the analysis page, choose **Share** on the application bar, and then choose **Share analysis**.

   You can only share analyses with users or groups who are in your Amazon QuickSight account.

2. Add a user or group to share with. To do this, for **Type a user name or email**, enter the first user or group that you want to share this analysis with. Then choose **Share**. Repeat this step until you have entered information for everyone you want to share the analysis with.

   Edit sharing for this analysis by choosing **Manage analysis access**.
The **Share with users and groups in your account** screen appears, as shown following. On this screen, you can edit permissions and add more users or groups.

3. For **Permission**, choose the role to assign to each user or group. The role determines the permission level to grant to that user or group.

4. Choose **Share**.

   The users that you have shared the analysis with get emails with a link to the analysis. Groups don't receive invitation emails.

**Viewing the Users an Analysis Is Shared With**

If you have shared an analysis, you can use the following procedure to see which users or groups have access to it.

1. On the analysis page, choose **Share** on the application bar, and then choose **Share analysis**.
2. Choose Manage analysis access.
3. Review who this analysis has been shared with. You can search to locate a specific user account by typing a search term. The search returns any user, group, or email address that contains the search term. Searching is case-sensitive and wildcards are not supported. Delete the search term to view all users and groups.

Revoking Access to an Analysis

Use the following procedure to revoke access to an analysis.

1. On the analysis page, choose Share on the application bar, and then choose Share analysis.
2. Choose Manage analysis access.
3. Locate the user or group whose access you want to revoke, and then choose the trash-can icon next to the user or group.
4. Choose Confirm.

Printing a Dashboard or Analysis

You can print a dashboard or an analysis.

Use the following procedure to print.

1. Open the dashboard or the analysis that you want to print.
2. Choose the Print icon at upper right.
3. On the Prepare for printing screen, choose the paper size and orientation that you want to use.
4. Choose Go to Preview.
5. Do one of the following:
   - To proceed to printing, choose Print to open your operating system's print dialog.
   - To make changes to the paper size or orientation, choose Configure.
6. To exit the preview screen, choose Exit preview.

Working with Stories (Feature Removed)

Warning
The story feature was permanently removed from Amazon QuickSight on September 30, 2020. However, you can still tell stories with your data. We recommend that you create multisheet dashboards to deliver the same information. To recreate the effect of showing changes in data, duplicate a chart and apply the same filter to each copy, but with different values. For example, to show a progression of time, use date filters to focus on different periods of time.
For more information about setting up dashboards, see Working with Dashboards (p. 461).
Working with Amazon QuickSight Visuals

A visual is a graphical representation of your data. You can create a wide variety of visuals in an analysis, using different datasets and visual types.

After you have created a visual, you can modify it in a range of ways to customize it to your needs. Possible customizations include changing what fields map to visual elements, changing the visual type, sorting visual data, or applying a filter.

Amazon QuickSight supports up to 50 datasets in a single analysis, and up to 30 visuals in a single sheet, and a limit of 20 sheets per analysis.

Use the following sections to learn how to create and modify visuals.

Topics

- Creating an Amazon QuickSight Visual (p. 243)
- Duplicating an Amazon QuickSight Visual (p. 246)
- Renaming an Amazon QuickSight Visual (p. 246)
- Deleting an Amazon QuickSight Visual (p. 246)
- Exporting Data (p. 247)
- Changing Visual Layout in Amazon QuickSight (p. 248)
- Viewing Visual Data in Amazon QuickSight (p. 251)
- Formatting a Visual in Amazon QuickSight (p. 256)
- Changing the Fields Used by a Visual in Amazon QuickSight (p. 275)
- Changing Colors on Visuals in Amazon QuickSight (p. 287)
- Sorting Visual Data in Amazon QuickSight (p. 294)
- Filtering Data (p. 296)
- Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)
- Using Custom Actions for Filtering and Navigating (p. 320)
- Understanding Field Mapping for Custom Actions in Amazon QuickSight (p. 324)
- Working with Visual Types in Amazon QuickSight (p. 325)

Creating an Amazon QuickSight Visual

You can create a visual in several ways. You can select the fields that you want and use AutoGraph to let Amazon QuickSight determine the most appropriate visual type. Or you can choose a specific visual type and choose fields to populate it. If you aren’t sure what questions your data can answer for you, you can choose Suggested on the tool bar and choose a visual that Amazon QuickSight suggests. Suggested visuals are ones that we think are of interest, based on a preliminary examination of your data. For more information about AutoGraph, see Using AutoGraph (p. 329).
You can add more visuals to the workspace by choosing Add, then Add visual. Visuals created after June 21, 2018, are smaller in size, fitting two on each row. You can resize the visuals and drag them to rearrange them.

To create a useful visual, it helps to know what question you are trying to answer as specifically as possible. It also helps to use the smallest dataset that can answer that question. Doing so helps you create simpler visuals that are easier to analyze.

**Fields as Dimensions and Measures**

In the **Fields list** pane, dimension fields have blue icons and measure fields have green icons. **Dimensions** are text or date fields that can be items, like products. Or they can be attributes that are related to measures and can be used to partition them, like sales date for sales figures. **Measures** are numeric values that you use for measurement, comparison, and aggregation. You typically use a combination of dimension and measure fields to produce a visual, for example sales totals (a measure) by sales date (a dimension). For more information about the types of fields expected by the different visual types, see the specific visual type topics in the Working with Visual Types in Amazon QuickSight (p. 325) section. For more information about changing a field's measure or dimension setting, see Setting a Field as a Dimension or Measure (p. 187).

**Field Limitations**

You can only use one date field per visual. This limitation applies to all visual types.

You can’t use the same field for more than one dimension field well or drop target on a visual. For more information about how expected field type is indicated by field wells and drop targets, see Using Visual Field Controls (p. 275).

**Searching for Fields**

If you have a long field list in the **Fields list** pane, you can search to locate a specific field. To do so, choose the search icon at the top of the **Fields list** pane and then enter a search term into the search box. Any field whose name contains the search term is shown. Search is case-insensitive and wildcards aren't supported. Choose the cancel icon (X) to the right of the search box to return to viewing all fields.

**Creating a Visual**

Use the following procedure to create a new visual.
1. On the Amazon QuickSight start page, choose the analysis that you want to add a visual to.
2. On the analysis page, choose the dataset that you want to use from the dataset list at the top of the **Fields list** pane. For more information, see Adding a Data Set to an Analysis (p. 183).
3. Choose Add on the application bar, and then choose Add visual.
   A new, blank visual is created and receives focus.
4. Use one of the following options:
   - Choose the fields to use from the **Fields list** pane at left. If the Fields list isn’t visible, choose Visualize to display it. Amazon QuickSight creates the visual, using the visual type it determines is most compatible with the data you selected.
   - Create a visual by choosing a visual type and then choosing fields to populate it.
     1. Choose the icon of a visual type from the **Visual types** pane.
The field wells display the fields that are visualized.

<table>
<thead>
<tr>
<th>Field wells</th>
<th>X axis</th>
<th>Date (MONTH)</th>
<th>Value</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>StartDate</td>
<td>Wed Oct 14 20...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Click anywhere on the field wells to open them.

2. From the Fields list pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the color of the target field well. If you choose to use a dimension field to populate a Value field well, the Count aggregate function is automatically applied to it to create a numeric value.

Amazon QuickSight creates the visual using the visual type you selected.

- Create a visual using a suggestion.

On the tool bar, choose Suggested, then choose a suggested visual.
Duplicating an Amazon QuickSight Visual

You can duplicate a visual to make a new copy of it on the same sheet or on a different sheet.

To duplicate a visual, on the v-shaped on-visual menu, choose **Duplicate visual to**, then choose the sheet where you want the visual to appear. The display automatically shows you the duplicated visual.

Duplicated visuals keep all the same filters and settings as the source visual. However, if you duplicate a visual onto a different sheet, all of its copied filters apply to the duplicate only. All copied filters are scoped down to apply only to that visual. If you want the filters to apply to more visuals on the new sheet, edit the filter and change the setting.

Parameters and controls apply to all sheets. To make parameter controls work with a visual that you duplicate to a different sheet, add filters on the target sheet and connect them to the parameter. To do this, choose **Custom filter** as the filter type.

Renaming an Amazon QuickSight Visual

Use the following procedure to rename a visual.

1. On the analysis page, choose the visual that you want to rename.
2. Select the visual name at the top left of the visual and enter a new name.
3. Press **Enter** or click outside of the visual name field to save the new name.

Deleting an Amazon QuickSight Visual

Use the following procedure to delete a visual.

1. On the analysis page, choose the visual that you want to delete.
2. Choose the on-visual menu at the upper-right corner of the visual, and then choose **Delete**.
Using the Amazon QuickSight console, you can export data from any type of chart or graph. The export contains only the data in the fields that are currently visible in the selected visualization. Any data that is filtered out is excluded from the export file. You can export data into the following formats:

- A text file containing comma-separated values (CSV), available for all visual types.
- A Microsoft Excel workbook file (.xlsx), available for pivot tables and table charts only.

The following rules apply:

- Exported files are downloaded to the default download directory configured in the browser that you're currently using.
- The downloaded file is named for the visualization that you exported it from. To make the file name unique, it has a sequential timestamp (a Unix epoch data type) or a date in the format yyyy-MM-dd_THH_mm_ss.SSSZ.
- For table charts, Amazon QuickSight supports exporting up to 1 million rows or 500 MB of data, whichever limit is reached first.

For all other visuals, including pivot tables, the limits that apply to exporting are the same limits that apply to the visual type.

- You can't export data from an insight, because insights consume the data, but don't contain the data.
- QuickSight doesn't support exporting data from more than a single visualization at a time. To export data from additional visuals in the same analysis or dashboard, repeat this process for each visual. To export all the data from a dashboard or analysis, you need to connect to the original data source using valid credentials and a tool that allows you to extract data.

Use the following procedure to export data from a visualization in Amazon QuickSight. Before you begin, open the analysis or dashboard that contains the data that you want to export.
To export data from a visualization

1. Choose the visualization that you want to export. Make sure that it is selected and highlighted.
2. At top right on the visual, open the menu and choose one of the following:
   - To export to CSV, choose Export to CSV.
   - To export to XSLX, choose Export to Excel. This option is available only for pivot tables and table charts.
3. Depending on your browser settings, one of the following happens:
   - The file automatically goes to your default Download location.
   - A dialog box appears so you can choose a file name and location.
   - A dialog box appears so you can choose to open the file with the default software or to save to.

Changing Visual Layout in Amazon QuickSight

When you create an analysis, you see a workspace that contains one full-sized visual. You can add more visuals to the workspace by choosing Add, then Add visual. You can resize the visuals and drag them to rearrange them.

If you change a visual to make it considerably smaller, the on-visual menu and editors are hidden so that the chart elements have more room to display. Bar chart visuals can also display fewer data points. To see a resized visual in full pane mode so that on-visual editors and all data points are displayed, use the Maximize option on the on-visual menu. Choose Minimize to return the visual to its original size when you are done.

In some cases, you might resize a visual that uses a legend so that it is taller than it is wide. In such cases, the legend displays on the bottom of the chart if it had been displaying on the right-hand side.

If you reduce the size of the browser window, Amazon QuickSight resizes and if necessary reorders visuals for optimal display. For example, smaller visuals that were side by side might be displayed sequentially. The original layout is restored when the size of the browser window is increased again.

Changing Visual Location

On the analysis page, choose the handle on the visual that you want to relocate. Drag the visual to where you want it.
Changing Visual Size

To change visual size, on the analysis page choose the resize handle (ん) on the visual that you want to resize. Drag to change the visual's dimensions.
Editing a Resized Visual

Use the following procedure to open a resized visual in full pane mode for editing.

1. On the analysis page, choose the visual that you want to edit.
2. Choose the on-visual menu at the upper-right corner of the visual, and then choose Maximize.

The visual opens in full pane mode, displaying the on-visual editors if they were hidden.
3. Edit the visual. When you are done, choose the on-visual menu at the upper-right corner of the visual, and then choose Minimize.

Viewing Visual Data in Amazon QuickSight

Amazon QuickSight offers a variety of ways to see the details of the data being displayed in a visual. The axes or rows and columns of the visual (depending on the visual type) have labels. Hovering over any graphical element in a visual displays the data associated with that element. Some visual types use visual cues to emphasize the element that you are hovering over and make it easier to differentiate. For example, the visual type might change the color of the element or highlight it.

Use the following sections to learn more about viewing data in visuals.

Topics
- Viewing Visual Details (p. 251)
- Scrolling Through Visual Data (p. 252)
- Focusing on Visual Elements (p. 253)
- Excluding Visual Elements (p. 255)

Viewing Visual Details

When viewing a visual, you can hover your cursor over any graphical element to get details on that element. For example, when you hover over a single bar on a bar chart, information about that specific bar displays in a tooltip.

Hovering your cursor over a single data point on a scatter plot also displays information about that specific data point.
You can customize the information that appears when you hover your cursor over data in a chart. For more information, see Customizing Visual Tooltips (p. 257).

**Scrolling Through Visual Data**

For bar charts, line charts, and pivot tables, the content of the visual can be larger than the size that you want the visual to be.

In these cases, scrub bars appear so you can either reduce the data that is displayed or scrub through it. This process is similar to the way that you can scrub through a video.

To reduce the length of the scrub bar, hover over one end of it until the cursor changes shape. Then drag the widget to make the scrub bar larger or smaller. To scroll through the data, click and hold the scrub bar and slide it toward the end that you want to see.
**Focusing on Visual Elements**

When viewing visuals, you can choose data that you want to focus on or exclude. To perform this choice, choose an element such as a bar or bubble, or a row or column header.

Focusing on or excluding data causes Amazon QuickSight to create a filter and show only the data that you selected.
To remove the filter, choose Filters at left and then disable or delete the filter. You can also use Undo to remove a filter.

If your visual has a legend that shows categories (dimensions), you can click on the values in the legend to see a menu of available actions. For example, suppose that your bar chart has a field in the Color or Group/Color field well. The bar chart menu displays the actions that you can choose by clicking or right-clicking on a bar, such as the following:

- Focusing on, or excluding, visual elements
- Changing colors of visual elements
- Drilling down into a hierarchy
- Custom actions activated from the menu, including filtering or URL actions
Excluding Visual Elements

When viewing visuals, you can choose an element on the visual, and then choose to focus on the element. Elements to focus on can include, for example, a bar or bubble, or a row or column header in the case of a pivot table. The exception is that you can't exclude elements that are mapped to date fields. You can exclude multiple elements on a single chart.

Excluding the element creates a filter that removes only that element from the visual:
To see the excluded element again, you can either choose **Undo** on the application bar, or you can disable or delete the filter.

For more information about filters, see Filtering Data (p. 296).

### Formatting a Visual in Amazon QuickSight

Use visual formatting to choose display options for your data visualization.

**Note**

Any format changes applied from the field wells are applied only to the selected visual.

**Topics**

- Customizing a Visual Title (p. 256)
- Customizing a Visual Legend (p. 257)
- Customizing Tooltips in an Amazon QuickSight Visual (p. 257)
- Customizing Visual Labels (p. 261)
- Customizing Data Labels on Visuals (p. 261)
- Displaying Totals and Subtotals (p. 263)
- Adding Conditional Formatting to Visuals (p. 263)
- Customizing Style and Font (p. 265)
- Changing Range and Scale in Your Visuals (p. 266)
- Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)
- Displaying, Customizing, and Removing Reference Lines (p. 269)
- Format Options Available in Analytics (p. 271)

### Customizing a Visual Title

Use the following procedure to hide or display the title or subtitle for a visual. The visual title and subtitle displays by default.

2. On the analysis page, choose the visual that you want to format.
3. At the visual's right, choose Format Visual (⚙).
4. In the Format Visual pane, choose the following settings:
   • Select or clear the Show title check box.
   • Select or clear the Show subtitle check box.
   • Choose the font size that you want to use for visual titles and subtitles.
5. Choose the X icon at upper right to close the Format Visual pane.

Customizing a Visual Legend

The visual legend helps you identify what a visual element represents by mapping its value to a color. By default, the visual legend displays to the right of the visual. You can choose to hide or display the visual legend, and format the legend title and position.

To display or hide a visual legend
2. On the analysis page, choose the visual that you want to format.
3. At the visual's right, for Menu options (⚙), choose Hide legend or Show legend to hide or show the visual legend.

   When shown, the legend displays the values in alphabetical order.

To customize a visual legend
1. At the visual's right, choose Format Visual (⚙).
2. In the Format Visual pane, expand the Legend section. In this section, you can format the legend title and position.
3. Choose the X icon at upper right to close the Format Visual pane.

Customizing Tooltips in an Amazon QuickSight Visual

When you hover your cursor over any graphical element in an Amazon QuickSight visual, a tooltip appears with information about that specific element. For example, when you hover your cursor over dates in a line chart, a tooltip appears with information about those dates. By default, the fields in the Fields well determine what information displays in tooltips.

You can provide your viewers with additional information about data in your visual, customizing what viewers can see. You can even prevent tooltips from appearing when viewers hover a cursor over an element. To do this, you can customize the tooltips for that visual. Use the following procedures to learn how.
Customizing Tooltips in a Visual

Use the following procedure to learn how to customize tooltips in a visual.

**To customize tooltips in a visual**

1. On the analysis page, choose the visual that you want to format.
2. On the menu in the upper-right corner of the visual, choose the *Format visual* icon.
3. In the *Format visual* pane that opens at left, choose *Tooltip*.
4. For *Type*, choose *Detailed tooltip*.

A new set of options appear, as shown following.
To show or hide titles in a tooltip

- Choose Use primary value as title.

Clearing the option hides titles in the tooltip. Selecting the option shows the primary field value as the title in the tooltip.

To show or hide aggregations for fields in the tooltip

- Choose Show aggregations.

Clearing the option hides the aggregation for fields in the tooltip. Selecting the option shows the aggregation for fields in the tooltip.

To add a field to the tooltip

1. Choose Add field.
2. In the Add field to tooltip page that opens, choose Select field and then select a field from the list.
3. (Optional) For Label, enter a label for the field. This option creates a custom label for the field in the tooltip.
4. (Optional) Depending on whether you add a dimension or a measure, choose how you want the aggregation to display in the tooltip. If you don't select an option, QuickSight uses the default aggregation.
   If you add a measure to the tooltip, you can select how you want the field to be aggregated. To do so, choose Select aggregation, and then select an aggregation from the list. For more information about the types of aggregations in QuickSight, see Changing Field Aggregation (p. 282).
5. Choose Save.

A new field is added to the list of fields in your tooltip.

To remove a field from the tooltip

- Under the Fields list, select the field menu for the field that you want to remove (the three dots) and choose Hide.

To rearrange the order of the fields in the tooltip

- Under the Fields list, select the field menu for a field (the three dots) and choose either Move up or Move down.

To customize the label for a field in the tooltip

1. Select the field menu for the field that you want to customize (the three dots) and choose Edit.
2. In the Edit tooltip field page that opens, for Label, enter the label that you want to appear in the tooltip.
3. Choose Save.

Hiding Tooltips in a Visual

If you don't want tooltips to appear when you hover your cursor over data in a visual, you can hide them. Use the following procedure to learn how.
To hide tooltips in a visual

1. On the analysis page, choose the visual that you want to format.
2. On the menu in the upper-right corner of the visual, choose the Format visual icon.
3. In the Format visual pane that opens at left, choose Tooltip.
4. Choose Show tooltip.

Clearing the option hides tooltips for the visual. Selecting the option shows them.

Customizing Visual Labels

Use the following procedure to customize, display, or hide the labels for a visual.

1. On the analysis page, choose the visual that you want to format. You can change the labels by choosing the label directly on the visual, and choosing Rename. To revert to the default name, delete your entry.

2. To see more options, choose the on-visual menu from the down icon at the upper-right corner of the visual, and then choose Format visual.

For pivot tables, you can relabel row names, column names, and value names. Additionally, under Styling, you can choose to hide columns labels or metric labels (for single metrics only).

You can add the same value to the same visual multiple times. You can do so to show the same value with different aggregations or table calculations applied. By default, the fields all display the same label. You can edit the names by using the Format Visual panel, which you open by choosing the V-shaped icon at top right.

3. On the Format Visual pane, enable or disable Show title. This option removes the axis title.
4. Close the Format Visual pane by choosing the X icon in the upper-right corner of the pane.

Customizing Data Labels on Visuals

To customize data labels on a visual, you can use the Format Visual pane to show data labels, and then use the settings to configure them. Data label customization is supported on bar, line, combo, scatter, and pie charts.

You can customize the following options:
• Position, which determines where the label appears in relation to the data point (for bar, combo, and line charts):
  • For vertical bar charts, you can customize to set position:
    • Above bars
    • Inside of bars
    • Bottom of bars
    • Top of bars
  • For horizontal bar charts, you can customize to set position:
    • Right of bars
    • Inside of bars
  • For line charts, you can customize to set position:
    • Above lines
    • Left or right of points on lines
    • Below lines
  • For scatter charts, you can customize to set position:
    • Above points
    • Left or right of points
    • Below points
• Font size and color (for bar, combo, line, scatter, and pie charts)
• Label pattern, which determines how data is labeled (for bar, combo, line, and scatter charts):
  • For bar, combo, and scatter charts, you can label:
    • All
    • By group or color
  • For line charts, the following label options are available:
    • All
    • By group or color
    • Line ends
    • Minimum or maximum value only
    • Minimum and maximum values
  • For pie charts, the following label options are available:
    • Show category
    • Show metric
    • Choose to show the metric label as value, percent, or both
• Group selection (for bars and lines, when the label pattern is "by group/color")
• Allow labels to overlap (for bars and lines), for use with fewer data points
• For vertical bar, combo, and line charts, labels that are too long are angled by default. You can configure the degree of angle under the X-axis settings.

**Note**
If you add more than one measure to an axis, the data label displays the formatting for the first measure only.

Use the following procedure to configure data labels.

1. On the analysis page, choose the visual that you want to format.
2. Choose the on-visual menu from the down icon at the upper-right corner of the visual, and then choose **Format visual**.
3. On the **Format Visual** pane, choose **Data Labels**.
4. Enable **Show data labels** to show and customize labels. Disable this option to hide data labels.

5. Choose the settings that you want to use. The settings offered are slightly different for each chart type. To see all available options, see the list before this procedure.

   You can immediately view the effect of each change on the visual.

6. Close the **Format Visual** pane by choosing the X icon in the upper-right corner of the pane.

## Displaying Totals and Subtotals

On tables and pivot tables, you can configure the display of totals or subtotals. Tables can display totals at the top or the bottom of the visual. Pivot tables can display totals and subtotals on rows and columns.

### To display or hide totals and subtotals for a pivot table

2. On the analysis page, choose the pivot table that you want to format.
3. Choose **Format Visual** (Format Visual).
4. To display totals, choose **Total**:
   - To show totals on each row, enable **Show totals on row**.
   - To show totals on each column, enable **Show totals on column**.
   - By default, the total appears without a label. To change this, you can enter a custom name for **Row totals label** and **Column totals label**.
5. To display subtotals, choose **Subtotal**:
   - To show subtotals on each row, enable **Show subtotals on row**.
   - To show subtotals on each column, enable **Show subtotals on column**.
   - By default, the subtotal appears without a label. To change this, you can enter a custom name for **Row subtotals label** and **Column subtotals label**.

### To display or hide totals for a table chart

2. On the analysis page, choose the table that you want to format.
3. Choose **Format Visual** (Format Visual).
4. Enable **Show totals** to display a total.
5. For **Position**, choose where to display the total, **Top** or **Bottom**. By default, totals are displayed at the bottom of the table.
6. For **Totals font size**, choose the size of the total. The options range from extra small to extra large. By default, the font size is medium.
7. For **Total label**, enter a custom name for the total. By default, the total displays without a label.

## Adding Conditional Formatting to Visuals

In some visual types, you can add conditional formatting to highlight some of your data. The conditional formatting options currently supported include changing text or background color and using symbolic icons. You can use icons from the provided set or you can use Unicode icons instead.

Conditional formatting is available on the following visuals:
Conditional Formatting

- Gauge charts
- Key performance indicators (KPIs)
- Pivot tables
- Tables

For tables and pivot tables, you can set multiple conditions for fields or supported aggregations, along with format options to apply to a target cell. For KPIs and gauge charts, you can format the primary value based on conditions that are applied to any dimension in the dataset. For gauge charts, you can also format the foreground color of the arc based on conditions.

To use conditional formatting on a visual

1. On the analysis page, choose the visual that you want to format.
2. On the visual, open the context menu on the down icon at the upper-right. Then choose Conditional formatting.

Options for formatting display on the left. Choose one of the following:

- **For pivot tables** – Begin by choosing a measure that you want to use. You can set conditional formatting on one or more fields. The selection is limited to the measures that are in the Values field well.

- **For tables** – Begin by choosing a field that you want to use. You can set conditional formatting on one or more field. You can also choose to apply formatting to the entire row. Formatting the entire row adds an option to Apply on top, which applies the row formatting in addition to formatting added by other conditions.

- **For KPIs** – Apply formatting to the primary value or the progress bar or both.

3. For the remaining steps in this procedure, choose the features that you want to use. Not all options are available for all visuals.

4. (Optional) Choose Add background color to set a background color. If a background color is already added, choose Background.

- **Fill type** – The background color can be Solid or Gradient. If you choose to use a gradient, additional color options display, enabling you to choose a minimum and maximum value for the gradient scale. The minimum value defaults to the lowest value, and the maximum value defaults to the highest value.

- **Format field based on** – The field to use when applying the format.

- **Aggregation** – The aggregation to use (displays only the available aggregations).

- **Condition** – The comparison operator to use, for example "greater than".

- **Value** – The value to use.

- **Color** – The color to use.

- **Additional options**: In tables and pivot tables, you can set what you want to format by choosing options from the context menu (…): Values, Subtotals, and Totals.

5. (Optional) Choose Add text color to set a text color. If a text color is already added, choose Text.

- **Format field based on** – The field or item to use when applying the format.

- **Aggregation** – The aggregation to use (displays only the available aggregations). This option applies to tables and pivot tables.

- **Condition** – The comparison operator to use, for example "greater than".

- **Value** – The value to use.

- **Color** – The color to use.

- **Additional options**: In tables and pivot tables, you can set what you want to format by choosing options from the context menu (…): Values, Subtotals, and Totals.
6. (Optional) Choose Add icons to set an icon or icon set. If an icon is already added, choose Icon.
   - **Format field based on** – The field or item to use when applying the format.
   - **Aggregation** – The aggregation to use (displays only the available aggregations). This option applies to tables and pivot tables.
   - **Icon set** – The icon set to apply to field in **Format field based on**. This option applies to tables and pivot tables.
   - **Reverse colors** – Reverses the colors of the icons for tables and pivot tables.
   - **Custom conditions** – Provides more icon options for tables and pivot tables.
   - **Condition** – The comparison operator to use.
   - **Value** – The value to use.
   - **Icon** – The icon to use. To choose an icon set, use the Icon symbol to choose the icons to use. Choose from the provided icon sets. In some cases, you can add your own. To use your own icon, choose **Use custom unicode icon**. Paste in the Unicode glyph that you want to use as an icon. Choose **Apply** to save or choose **Cancel** to exit icon setup.
   - **Color** – The color to use.
   - **Show icon only** – Replaces the value with the icon for tables and pivot tables.
   - **Additional options:**
     - In tables and pivot tables, you can set what you want to format by choosing options from the context menu (...): **Values**, **Subtotals**, and **Totals**.
     - In pivot tables, enabling **Custom conditions** activates preset conditional formatting that you can keep, add to, or overwrite with your own settings.

7. (Optional) Choose Add foreground color to set the foreground color of a KPI progress bar. If a foreground color is already added, choose Foreground.
   - **Format field based on** – The field to use when applying the format.
   - **Condition** – The comparison operator to use.
   - **Value** – The value to use.
   - **Color** – The color to use.

8. When you are finished configuring conditional formatting, choose one or more of the following:
   - To save your work, choose **Apply**.
   - To cancel selections and return to the previous panel, choose **Cancel**.
   - To close the settings panel, choose **Close**.
   - To reset all settings on this panel, choose **Clear**.

### Customizing Style and Font
You can choose from several options for styling, including fitting the table to your current view, hiding column field names, changing font sizes. You can also choose to hide the metric label when you use a single metric, to avoid seeing the same metric label repeated on the pivot table.

**To customize the styling for a visualization**

1. On the analysis page, choose the chart that you want to format.
2. Choose the menu on the visualization (🔧), and then choose **Format visual** (⚙).
3. Choose **Styling**.
4. To prevent displaying a single metric label repeatedly, enable **Hide single metric**.
5. To hide labels for fields in the **Columns** field well, enable **Hide column field names**.
6. To hide collapse (Collapse) and expand icons (Expand), enable **Hide +/- buttons**.

7. To expand the table to fill your current view, choose **Fit table to view**. You can't undo this action.

To shrink the table to fit your current view, you can adjust the width of each column. To do this, grab the right edge of the column, near the column title. Drag the edge in either direction.

8. Choose your preferred font size for each of the following chart types:
   - For KPIs, choose the font sizes for the primary and secondary values.
   - For pivot tables and tables, choose the font sizes for table headers, cells, totals, and subtotals.
   - For other visuals, you can choose font sizes depending on which chart type you are using.

### Changing Range and Scale in Your Visuals

To change the scale of the values shown on the visual, you can use the **Format Visual** pane to set the range for one or both axes of the visual. This option is available for the value axes on bar charts, combo charts, line charts, and scatter plots.

By default, the axis range starts at 0 and ends with the highest value for the measure being displayed. For the group-by axis, you can use the data zoom tool on the visual to dynamically adjust the scale.

Use the following procedure to set the axis range for a visual.

1. On the analysis page, choose the visual that you want to format.
2. Choose the control menu at the upper-right corner of the visual, and then choose the cog icon.
3. On the **Format Visual** pane, choose **X-Axis** or **Y-Axis**, depending on what type of visual you are customizing. This is the **X-Axis** section for horizontal bar charts, the **Y-Axis** section for vertical bar charts and line charts, and both axes are available for scatter plots. On combo charts, use **Bars** and **Lines** instead.
4. Enter a new name in the box to rename the axis. To revert to the default name, delete your entry.
5. Set the range for the axis by choosing one of the following options:
   - Choose **Auto (starting at 0)** to have the range start at 0 and end around the highest value for the measure being displayed.
   - Choose **Auto (based on data range)** to have the range start at the lowest value for the measure being displayed and end around the highest value for the measure being displayed.
   - Choose **Custom** to have the range start and end at values that you specify.

If you choose **Custom**, enter the start and end values in the fields in that section. Typically, you use integers for the range values. For stacked 100 percent bar charts, use a decimal value to
indicate the percentage that you want. For example, if you want the range to be 0–30 percent instead of 0–100 percent, enter 0 for the start value and .3 for the end value.

6. For Scale, the default is linear scale. To show logarithmic scale, also called log scale, enable the logarithmic option. QuickSight chooses the axis labels to display based on the range of values in that axis.

- On a linear scale, the axis labels are evenly spaced to show the arithmetical difference between them. The labels display the numbers in sets like {1000, 2000, 3000...} or {0, 50 million, 100 million...}, but not {10 thousand, 1 million, 1 billion...}.

Use a linear scale for the following cases:
- All the numbers that display on the chart are in the same order of magnitude.
- You want the axis labels to be evenly spaced.
- The axis values have a similar number of digits, for example 100, 200, 300, and so on.
- The rate of change between numbers is relatively slow and steady—in other words, your trend line never approaches becoming vertical.

Examples:
- Profits in different regions of the same country
- Costs incurred for manufacture of an item

- On a logarithmic scale, the axis values are spaced to show the orders of magnitude as a way of comparing them. The log scale is often used to display very large ranges of values or percentages, or to show exponential growth.

Use logarithmic scale for the following cases:
- The numbers that display on the chart aren’t in the same order of magnitude.
- You want the axis labels to be flexibly spaced to reflect the wide range of values in that axis. This might mean that the axis values have a different number of digits, for example 10, 100, 1000, and so on. It might also mean that the axis labels are unevenly spaced.
- The rate of change between numbers is growing exponentially or is too large to display in a meaningful way.
- The customer of your chart understands how to interpret data on a log scale.
- The chart displays values that growing faster and faster. Moving given distance on the scale means the number has been multiplied by another number.

Examples:
- High yield stock prices over a long range of time
- Growth of pandemic infection rates

7. To customize the number of values to show on the axis labels, enter in an integer between 1 and 50.
8. For combo charts, choose Single Y Axis to synchronize the Y-axes for both bars and lines into a single axis.
9. Close the Format Visual pane by choosing the X icon in the upper-right corner of the pane.

Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight

When you create a chart in Amazon QuickSight, axis lines, axis labels, and grid lines are added to the chart automatically. You can format your visuals to show or hide these lines and labels if you want, as well as customize the axis label size and orientation.

You can format axis lines, grid lines, and axis labels for the following chart types:
• Bar charts
• Boxplot charts
• Combo charts
• Histograms
• Line charts
• Scatterplots
• Waterfall charts

Use the following procedure to learn how to format axis lines, axis labels, and grid lines in a chart.

1. On the analysis page, choose the visual that you want to format.
2. On the menu in the upper-right corner of the visual, select the format visual icon.

The **Format visual** pane opens at left.

**To show or hide axis lines**

1. In the **Format visual** pane, choose the axis that you want to format.
2. Choose **Show axis line**. Clear the check box to hide the axis line for the chosen axis. Select the check box to show it.

**To show or hide axis labels**

1. In the **Format visual** pane, choose the axis that you want to format.
2. Choose **Show labels**. Clear the check box to hide the axis labels for the chosen axis. Select the check box to show it.

**To change the label size**

1. In the **Format visual** pane, choose the axis that you want to format.
2. For **Label size**, choose a size.

**To change the label orientation**

1. In the **Format visual** pane, choose the axis that you want to format.
2. For **Label orientation**, choose an orientation.

**To show or hide grid lines**

1. In the **Format visual** pane, choose the axis that you want to format.
2. Choose **Show grid lines**. Clear the check box to hide grid lines for the chosen axis. Select the check box to show it.

**Displaying, Customizing, and Removing Reference Lines**

*Reference lines* are visual markings in a visual, similar to ruler lines. You typically use a reference line for a value that needs to be displayed with the data. You use the reference line to communicate thresholds or limits in values. The reference line isn't part of the data that's used to build a chart. Instead, it's based on a value that you enter or a field that you identify in the dataset used by a chart.

Amazon QuickSight supports reference lines in the following:

- Bar charts
- Line charts
- Combo charts
You can create, change, and delete reference lines while designing an analysis. You can customize the line pattern, the label font, and the colors for each of those separately. You can show numeric values as numbers, currency, or percent. You can also customize a value's numerical format in the same way that you can customize a field in the field well.

There are two types of reference lines:

• A constant line displays at a position that's based on a value that you specify in the format settings. This value doesn't need to relate to any field. You can customize the formatting of the line.

• A calculated line displays at a position that's based on a value that is the result of a function. During configuration, you specify which measure (metric) you want to use and which aggregation to apply. These are the same aggregations you can apply to in the field wells. Then, you need to provide an aggregation to apply to the field calculation for the reference line, for example: average, minimum, maximum, or percentile. The field needs to be in the dataset used by the chart, although it doesn't need to be displayed in the chart's field wells.

Calculated reference lines aren't supported in 100% stacked charts.

To add or edit a reference line (console)

1. Choose your visualization so that it's highlighted and its menu appears. To open the formatting options, choose the cog icon (🔧) icon on the visualization menu (🔧).

2. Open the Reference lines section.

3. Add or edit a reference line. To add a reference line, choose Add new line. To edit a reference line, choose the line to edit.

4. With the reference line settings open in the Format pane at left, you can modify its properties:

   • Data
     • Type – The type of reference line that you want to use. Choose one of the following options:
       • To create a constant line based on a single value that you enter, choose Constant line.
       • To create a calculated line based on a field, choose Calculated line.
     • Value – (For constant lines only) The value that you want to use. This becomes the location of the line on the visual. It appears immediately, so you can experiment with the setting.
     • Column – (For calculated lines only) The column that you want to use for the reference line.
     • Aggregated as (column) – (For calculated lines only) The aggregation that you want to apply to the selected column.
     • Calculate – (For calculated lines only) The calculation that you want to apply to the aggregation.
     • Percentile value – (Only if you set Calculate to Percentile) Enter a number from 1 through 100.
     • Chart type – (For combo charts) Choose Bars or Lines.

   • Line style
     • Pattern – The pattern used for the line. Valid options include Dashed, Dotted, and Solid.
     • Color – The color used for the line.

   • Label
     • Type – The type of label to display. Valid options include Value only, Custom text, Custom text and value, No label. If you choose an option that includes custom text, enter the label text that you want to appear on the line.
     • Enter custom text (text box) – (Only if you set Type to Custom text and value) Choose where to show the value in relation to the label. Valid options are Left or Right.
     • Position – The position of the label in relation to the line. Valid options include a combination of the following: left, middle, right, above, and below.
• **Value format** – The format to use for the value. Choose one of the following:
  • **Same as value** – Uses the formatting that’s already selected for this field in the visualization.
  • **Show as** – Choose from the available options, for example number, currency, or percent.
  • **Format** – Choose from the available formatting options.
• **Font size** – The font size to use for the label text.
• **Color** – The color to use for the label text.

5. Choose **Done** to save your selections.

### To list existing reference lines (console)

1. Choose your visualization so that it’s highlighted and its menu appears. To open the formatting options, choose the cog icon (⚙️) icon on the visualization menu (🔧).
2. Open the **Reference lines** section.
   
   Existing reference lines appear in a list, followed by an **Add new line** button.

### To disable a reference line (console)

1. Choose your visualization so that it’s highlighted and its menu appears. To open the formatting options, choose the cog icon (⚙️) icon on the visualization menu (🔧).
2. Open the **Reference lines** section.
3. Choose **Disable** from the context menu (…) for the reference line that you want to disable.

### To delete a reference line (console)

1. Choose your visualization so that it’s highlighted and its menu appears. To open the formatting options, choose the cog icon (⚙️) icon on the visualization menu (🔧).
2. Open the **Reference lines** section.
3. Choose **Delete** from the context menu (…) for the reference line that you want to delete.

### Format Options Available in Analytics

Use the following list to see what type of formatting works in a visualization during analysis.

• Bar charts (both horizontal and vertical) support the following formatting:
  • Customize, display, or hide title, field labels, and data labels
  • Customize, display, or hide legend (exception: simple charts without clustering or multiple measures don’t show a legend)
  • Specify axis range and steps on the x-axis for horizontal bar charts, and on the y-axis for vertical bar charts
  • Choose how many data points to display on the x-axis for vertical bar charts, and on the y-axis for horizontal bar charts
  • Show or hide axis lines, axis labels, and grid lines
  • Customize, display, or remove reference lines
  • Show or hide the “other” category
Horizontal bar charts support sorting on the y-axis and **Value**. Vertical bar charts support sorting on the x-axis and **Value**.

- Box plots support the following formatting:
  - Customize, display, or hide title
  - Customize, display, or hide legend
  - Specify axis range and label tick on the x-axis and axis range and step on the y-axis
  - Show or hide axis lines, axis labels, and grid lines
  - Choose how many data points to display on the y-axis.
  - Show or hide the “other” category
  - Add reference lines

  Box plots support sorting on **Group by**.

- Combo charts support the following formatting:
  - Customize, display, or hide title, field labels, and data labels
  - Customize, display, or hide legend (exception: simple charts without clustering, stacking, or multiple measures don’t show a legend)
  - Specify axis range on bars and lines
  - Synchronize the Y axes for both bars and lines into a single axis.
  - Choose how many data points to display on the x-axis
  - Show or hide axis lines, axis labels, and grid lines
  - Customize, display, or remove reference lines
  - Show or hide the “other” category

  Combo charts support sorting on the x-axis, **Bars**, and **Lines**.

- Donut charts support the following formatting:
  - Customize, display, or hide title, data labels, and legend
  - Customize, display, or hide the labels for group or color and value fields
  - Choose how many slices to display from **Group/Color**
  - Show or hide the “other” category

  Donut charts support sorting on **Group/Color** and **Value**.

- Filled maps support the following formatting:
  - Customize, display, or hide title.
  - Customize, display, or hide the legend

  Filled maps support sorting on **Location** and **Color**.

- Funnel charts support the following formatting:
  - Customize, display, or hide title, and data labels
  - Customize, display, or hide the labels for group or color and value fields
  - Choose how many stages to display in the **Group by** field
  - Show or hide the "other" category

  Funnel charts support sorting on **Group by** and **Value**.

- Gauge charts support the following formatting:
  - Customize, display, or hide title. Display or hide axis labels.
  - Customize how to display the value or values: hidden, actual value, comparison
  - Choose the comparison method (available when you use two measures)

  - Choose the axis range and padding to display in the gauge chart
• Choose the arc style (degrees from 180 to 360) and arc thickness

Gauge charts don't support sorting.
• Geospatial charts (maps) support the following formatting:
  • Customize, display, or hide title and legend

Geospatial charts don't support sorting.
• Heat maps support the following formatting:
  • Customize, display, or hide title, legend, and labels
  • Choose how many rows and columns to display
  • Choose colors or gradients.
  • Show or hide the "other" category

Heat maps support sorting on **Values** and **Columns**.
• Histogram charts support the following formatting:
  • Customize, display, or hide title, field labels, and data labels
  • Specify axis range, scale, and steps on the y-axis
  • Choose how many data points to display on the x-axis
  • Show or hide axis lines, axis labels, and grid lines

Histogram charts don't support sorting.
• Key performance indicators (KPIs) support the following formatting:
  • Customize, display, or hide title
  • Display or hide trend arrows and progress bar
  • Customize comparison method as auto, difference, percent (%), or difference as percent (%)
  • Customize primary value displayed to be comparison or actual
  • Conditional formatting

KPIs don't support sorting.
• Line charts support the following formatting:
  • Customize, display, or hide title, field labels, and data labels
  • Customize, display, or hide legend (exception: simple charts don't show a legend)
  • Specify axis range and steps (on y-axis)
  • Choose how many data points to display on the x-axis
  • Show or hide axis lines, axis labels, and grid lines
  • Customize, display, or remove reference lines
  • Show or hide the "other" category, except when the x-axis is a date

Line charts support sorting on the x-axis and **Value** for numeric purposes only.
• Pie charts support the following formatting:
  • Customize, display, or hide title, data labels, and legend
  • Customize, display, or hide the labels for group or color and value fields
  • Show metrics as values, percentages, or both
  • Choose how many slices to display from the **Group/Color** field
  • Show or hide the "other" category

Pie charts support sorting on **Value** and **Group/Color**.
• Pivot tables support the following formatting:
  • Customize, display, or hide title
• Customize, display, or hide the labels for column, row, and value fields
• Customize the font sizes for table headers and cells/body
• Display or hide totals and subtotals on rows or columns
• Custom labels for totals or subtotals
• Choose additional styling options: fit table to view, hide +/- buttons, hide column field names, hide duplicate label when using single metric
• Conditional formatting

Pivot tables support sorting on **Column** and **Row**. For more information on sorting pivot table data, see *Sorting Pivot Tables in Amazon QuickSight* (p. 372).

• Scatter plots support the following formatting:
  • Customize, display, or hide title, legend, field labels, and data labels
  • Customize, display, or remove reference lines
  • Specify axis range (on x-axis and y-axis)
  • Show or hide axis lines, axis labels, and grid lines

Scatter plots don't support sorting.

• Tables support the following formatting:
  • Customize, display, or hide title, legend, and columns
  • Customize, display, or hide the column names for group-by and value fields
  • Customize the font sizes for table headers and cells/body
  • Display or hide totals at the top or bottom of the table
  • Provide a custom label for totals
  • Add conditional formatting

Tables support sorting on **Group by** and **Value**.

• Tree maps support the following formatting:
  • Customize, display, or hide title and legend
  • Customize, display, or hide the labels for group-by, size, and color fields
  • Choose colors or gradients.
  • Choose how many squares to display from the **Group by** field
  • Show or hide the “other” category

Line charts support sorting on **Size**, **Group by** and **Color**.

• Waterfall charts support the following formatting:
  • Customize, display, or hide title or subtitle
  • Customize the total label
  • Specify x-axis label size and orientation and y-axis label range and orientation.
  • Show or hide axis lines, axis labels, and grid lines
  • Show or hide the “other” category
  • Customize the legend size and position.
  • Customize and display or hide data labels.

Waterfall charts support sorting on **Category** and **Value**.

• Word clouds support the following formatting:
  • Customize, display, or hide title
  • Customize the word color, and the number of words to display from the **Group by** field
  • Show or hide the “other” category
Changing the Fields Used by a Visual in Amazon QuickSight

You can add or modify fields for a visual by using the Fields list pane, the field wells, or the on-visual editors or drop targets on the visual.

The field wells, on-visual editors, and drop targets available for a specific visual depends on the visual type selected. Refer to the appropriate visual type topic in the Working with Visual Types in Amazon QuickSight (p. 325) section for details.

**Important**
You can also change the data type and format of numeric fields by using field wells and on-visual editors. If you change a field in this way, it changes for the selected visual only. For more information about changing numeric field data types and formats, see Modifying Data Set Fields in an Analysis (p. 187).

Use the following topics to learn more about adding, removing, and modifying fields on a visual.

**Topics**
- Using Visual Field Controls (p. 275)
- Adding or Removing a Field (p. 279)
- Changing the Field Associated with a Visual Element (p. 281)
- Changing Field Aggregation (p. 282)
- Changing Date Field Granularity (p. 285)

**Using Visual Field Controls**

You can edit the fields used by a visual by using the following user interface (UI) controls:

- The Fields list pane.
• The field wells. The following screenshot shows the field wells in the default closed state.

Click anywhere on the Field wells to open the field wells. The following screenshot shows the field wells in the open state.

• The on-visual editors.
• The drop targets on the visual.
You can use these controls as follows:

- You can create a visual and assign fields to different elements on it by selecting fields in the **Fields list** pane, or dragging fields to field wells or drop targets.
- You can change the field associated with a visual element by dragging a field to a drop target or field well, or selecting a different field in a field well or on-visual editor.
- You can change field aggregation or date granularity by using the field wells or the on-visual editors.

The field wells, on-visual editors, and drop targets available on a specific visual depends on the visual type selected.

**Dragging Fields to Drop Targets or Field Wells**

When you drag a field to either a drop target or field well, Amazon QuickSight provides you with information about whether the target element expects a measure or a dimension. Amazon QuickSight also provides you with information about whether that element is available for field assignment.

For example, when you drag a measure to the value drop target on a new single-measure line chart, you see the drop target color-coded green. That green color coding indicates that the drop target expects a measure. The drag label indicates that the target is available to add a field.
Adding or Removing a Field

You can add a field to a visual by choosing it on the Fields list pane. You can also drag it to a drop target on the visual or to a field well. There is a 1:1 correspondence of drop targets to field wells for each visual type, so you can use whichever method you prefer.

To remove a field from a visual, deselect it in the Fields list pane. Or choose an on-visual editor or field well that uses that field, and then choose Remove from the pop-up menu.
Adding a Field by Selecting It in the Fields List Pane

You can also let Amazon QuickSight map the field to the most appropriate visual element. To do so, simply choose the field in the **Fields list** pane. Amazon QuickSight adds the field to the visual by populating the first empty field well that corresponds with that field type (either measure or dimension). If all of the visual elements are already populated, Amazon QuickSight determines the most appropriate field well and replaces the field in it with the field you selected.

Adding a Field by Using a Drop Target

To add a field to a visual by using a drop target, first choose a field in the **Fields list** pane. Then drag the field to your chosen drop target on the visual, making sure the drop indicator shows that the field is being added.

![Add a field using a drop target](image)

Adding a Field by Using a Field Well

To add a field to a visual by using a field well, choose a field in the **Fields list** pane. Then drag the field to the target field well, making sure that the drop indicator shows that the field is being added.

1. Click anywhere on the **Field wells** to expand them.
Changing the Field Associated with a Visual Element

You can change the field assigned to an element in a visual by using the field wells, drop targets, or the on-visual editors on the visual. For pivot tables, you must use field wells or drop targets as this visual type does not provide on-visual editors.

Change a Field Mapping by Using an On-Visual Editor

Use the following procedure to modify the mapping of a field to a visual element.

1. On the visual, choose the on-visual editor for the visual element for which you want to change the field.
2. On the on-visual editor menu, choose the field that you want to associate with that visual element.

Changing a Field Mapping by Using a Drop Target

To modify the mapping of a field to a visual element by using a drop target, choose a field in the Fields list pane. Then drag the field to a drop target on the visual, making sure that the drop indicator shows that the field is being replaced.

Changing a Field Mapping by Using a Field Well

Use the following procedure to modify the mapping of a field to a visual element.

1. Click anywhere on the Field wells to expand them.

Note
You can add the same value to the same visual multiple times. You can do so to show the same value with different aggregations or table calculations applied. By default, the fields all display the same label. You can edit the names by using the Format Visual panel, which you open by choosing the V-shaped icon at top right.
2. Choose the field well that represents the element that you want to remap, and then choose a new field from the menu that displays.

Changing Field Aggregation

You can apply functions to fields to display aggregate information, like the sum of the sales for a given product. You can apply an aggregate function by using the options in either an on-visual editor or a field well. The following aggregate functions are available in Amazon QuickSight:

- **Average** – Calculates the average value for the selected field.
- **Count** – Provides a count of the number of records containing the selected measure for a given dimension. An example is a count of Order ID by State.
- **Distinct Count** – Provides a count of how many different values are in the selected measure, for the selected dimension or dimensions. An example is a count of Product by Region. A simple count can show how many products are sold for each region. A distinct count can show how many different
products are sold for each region. You might have sold 2000 items, but only two different types of items.

- **Max** – Calculates the maximum value for the selected field.
- **Min** – Calculates the minimum value for the selected field.
- **Median** – Calculates the median value of the specified measure, grouped by the chosen dimension or dimensions.
- **Sum** – Totals all of the values for the selected field.
- **Standard Deviation** – Calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample or on a biased population.
- **Variance** – Calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample or on a biased population.
- **Percentile** – Computes the $n$th percentile of the specified measure, grouped by the chosen dimension or dimensions.

All aggregate functions can be applied to numeric fields. **Count** is automatically applied to a dimension if you choose to use it in a field well that expects a measure. If you have used a dimension in that way, you can also change the aggregate function applied to it. You can't apply aggregate functions to fields in dimension field wells.

The visual elements that support aggregated fields varies by visual type.

**Changing or Adding Aggregation on a Field by Using an On-Visual Editor**

Use the following procedure to change or add aggregation on a field.

1. On the visual, choose the on-visual editor for the field that you want to apply aggregation to.
2. On the on-visual editor menu, choose **Aggregate**, then choose the aggregate function that you want to apply.
Changing or Adding Aggregation to a Field by Using a Field Well

Use the following procedure to add aggregation to a field for a pivot table visual.

1. Click anywhere on the **Field wells** to expand them.

2. Choose the field well containing the field that you want to apply an aggregate function to.
3. On the field well menu, choose **Aggregate**, then choose the aggregate function that you want to apply.

### Changing Date Field Granularity

You can change the granularity for a date field on a visual to determine the intervals for which item values are shown. You can set the date field granularity to one of the following values:

- Year (this is the default).
- Quarter
- Month
- Week
- Day
- Hour
- Minute
- Second

Hour and minute are only available if the field contains time data.

### Changing Date Field Granularity by Using an On-Visual Editor

Use the following procedure to change date field granularity by using an on-visual editor.

1. On the visual, choose the field well for the date field whose granularity you want to change.
2. On the field well menu, choose **Aggregate**, then choose the time interval that you want to apply, as shown following:
Changing Date Field Granularity by Using a Field Well

Use the following procedure to change date field granularity by using a field well.

1. Click anywhere on the Field wells to expand them.

2. Choose the field well containing the date field, and then choose **Aggregate**. Choose the date granularity that you want to use.
Changing Colors on Visuals in Amazon QuickSight

You can change the color of one, some, or all elements on the following types of charts:

- Bar charts
- Donut charts
- Gauge charts
- Heat maps
- Line charts
- Scatter plots
- Tree maps

To change colors on bar charts, donut charts, gauge charts, line charts, and scatter plots, see Changing Colors on Charts (p. 287).

To change colors on heat maps and tree maps, see Changing Colors on Heat Maps and Tree Maps (p. 293).

Changing Colors on Charts

You can change the chart color used by all elements on the chart, and also change the color of individual elements. When you set the color for an individual element, it overrides the chart color.

For example, suppose that you set the chart color to green.

All of the bars turn green. Even though you choose the first bar, the chart color applies to all the bars. Then you set the color for the SMB bar to blue.
Looking at the result, you decide that you need more contrast between the green and blue bars, so you change the chart color to orange. If you are changing the chart color, it doesn't matter which bar you choose to open the context menu from.
The **SMB** bar remains blue. This is because it was directly configured. The remaining bars turn orange.
When you change the color of an element that is grouped, the color for that element is changed in all of the groups. An example is a bar in a clustered bar chart. In the following example, Customer Segment is moved out of the Y-axis and into the Group/Color field well. Customer Region is added as the Y-axis. The chart color stays orange, and SMB stays blue for all Customer Regions.
If your visual has a legend that shows categories (dimensions), you can click on the values in the legend to see a menu of available actions. For example, suppose that your bar chart has a field in the Color or Group/Color field well. The bar chart menu displays the actions that you can choose by clicking or right-clicking on a bar, such as the following:

- Focusing on, or excluding, visual elements
- Changing colors of visual elements
- Drilling down into a hierarchy
- Custom actions activated from the menu, including filtering or URL actions

Following is an example of using the legend to change the color for a dimension.
Setting New Colors for a Visual

Use the following procedure to change the colors for a visual.

1. On the analysis page, choose the visual that you want to modify.
2. To change the chart color, choose any element on the visual, and then choose **Chart Color**.

   To select elements, do the following:
   - On a bar chart, choose any bar.
   - On a line chart, choose the end of a line.
   - On a scatter plot, choose an element. The field must be in the **Group/Color** section of Field wells.
3. Choose the color that you want to use. You can choose a color from the existing palette, or you can choose a custom color. To use a custom color, enter the hexadecimal code for that color.

   All elements on the visual are changed to use this color, except for any that have previously had their color individually set. In that case, the element color overrides the chart color.
4. To change the color for a single element on the visual, choose that element, choose Color `<fieldname>`, and then choose the color that you want to use. You can choose a color from the existing palette, or you can choose a custom color. To use a custom color, enter the hexadecimal code for that color.

Repeat this step until you have set the color on all elements that you want to modify. To change the color back to the color it was originally, choose Reset to default.

**Setting Visual Colors Back to Defaults**

Use the following procedure to return to using the default colors on a visual.

1. On the analysis page, choose the visual that you want to modify.
2. Choose Chart Color, choose any element on the visual, and then choose Reset to Default. Doing this changes the chart color back to the default color for that visual type.

   All elements on the visual are changed to the default color for the visual type, except for any that have previously had their color individually set. In that case, the element color setting overrides the chart color setting.
3. To change the color for a single element back to the default, choose that element, choose Color `<fieldname>`, and then choose Reset to Default.

   The default color for individual elements is the chart color if you have specified one, or the default color for the visual type otherwise.

**Changing Colors on Heat Maps and Tree Maps**

**To change the colors that display on a heat map or a tree map**

1. Choose the heat map or tree map that you want to edit.
2. Choose **Expand** for the settings menu, and choose the cog icon to open the **Format visual** panel.

3. For **Color**, choose the settings that you want to use:

4. For **Gradient color** or **Discrete color**, choose the color square next to the color bar, and then choose the color that you want to use. Repeat for each color square. The bar holds two colors by default.

5. Select the **Enable 3 colors** check box if you want to add a third color. A new square appears in the middle of the color bar.

You can enter a number that defines the midpoint between the two main gradient colors. If you add a value, the middle color represents the number you entered. If you leave this blank, the middle color acts like the other colors in the gradient.

6. Select the **Enable steps** check box if you want to limit the chart to the colors that you chose. Doing this changes the label on the color bar from **Gradient color** to **Discrete color**.

7. For **Color for Null Value**, choose a color to depict NULL values. This option is only available on heat maps.

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**Sorting Visual Data in Amazon QuickSight**

You can sort data using multiple methods for most visual types. You can choose the sort order of on-visual data by using the quick sort option or field wells. You can also use field wells to sort data by an off-visual metric. The visual element you can sort by depends on the visual type and whether sorting is supported for that visual. For more information on which visual types support sorting, see Format Options Available in Analytics (p. 271).

Pivot tables behave differently than tables when sorting values. For more information about sorting pivot tables, see Sorting Pivot Tables in Amazon QuickSight (p. 372).

For SPICE datasets, you can sort text strings of sizes up to the following limitations:

- Up to two million (2,000,000) unique values
- Up to 16 columns

When you exceed the limitations, the visual displays a notification at the upper right.

You can sort any visual type that supports sorting. If a visual type supports sorting, you can sort by using either the quick sort option or a field well.

**To quickly sort dimensions and measures**

- Do one of the following:
  - Choose the sort icon that appears near the field name on either axis. In direct queries, this icon appears for any data type. For SPICE, this icon is available only for datetime, numeric, and decimal data types.
  - Choose the field name and then choose the sort option from the menu. If the label doesn't display on the axis, check the visual format to see if the axis is set to display labels. The display labels are automatically hidden on smaller visuals. You might need to make the visual large enough to display labels.
To sort by using an off-visual metric

1. Open the analysis with the visual that you want to sort and click anywhere on Field wells to expand the field wells.

2. Choose a field well that supports sorting, then choose Sort by, Sort options.
3. On the Sort options pane, sort by specific fields, choose an aggregation, or sort ascending or descending, or do a combination of these. 
Amazon QuickSight Sort options pane to sort by off-visual fields.

4. Choose Apply to save your changes. Or choose Clear to start over or Cancel to go back.

To sort by using a field well

1. Open the analysis with the visual you want to sort and click anywhere on Field wells to expand the field wells.

2. Choose a field well that supports sorting.

3. On the field well menu, choose Sort, and then choose the ascending or descending sort order icon.

Filtering Data

You can use filters to refine the data displayed in a visual or insight. By default, a filter applies only to the item that was selected when the filter was created. You can set the scope of a filter to one or more visualizations or insights. If you need to, you can change the scope of a filter after you create it. Each filter can apply to multiple datasets, provided that the field has the same name and type in each dataset.

Each filter applies only to a single field or calculation. Filters are applied to the data before any aggregate functions that you specify. If you create multiple filters, all top-level filters apply together using AND. If you group filters by adding them inside a top-level filter, the filters in the group apply using OR.

Amazon QuickSight applies all of the enabled filters to the field. For example, suppose that there is one filter of state = WA and another filter of sales >= 500. In this case, the dataset only contains
Amazon QuickSight uses filters to focus on or exclude a visual element representing a particular value. For more information about focusing on a visual element, see Focusing on Visual Elements (p. 253). For more information about excluding a visual element, see Excluding Visual Elements (p. 255).

**Topics**
- Viewing Filters (p. 297)
- Adding a Filter (p. 298)
- Editing a Filter (p. 312)
- Deleting a Filter (p. 314)
- Using Filter Controls (p. 315)

**Viewing Filters**

To see the filters for a visual, choose **Filter** on the on-visual menu, then choose to view filters. The filters that apply to the selected visual display. They appear in the **Applied filters** pane in order of creation, with the oldest filter on top.

**Understanding Filter Icons**

Filters in the **Applied filters** pane display icons to indicate how they are scoped, and whether or not they are enabled.

A disabled filter is grayed out, and its check box is disabled.

The scope that’s enabled on a filter indicates how many visualizations that the filter applies to. The scope icon displays to the right of the filter name. The scope icon resembles four boxes in a square. The following options are available:

- **Only this visual** – The filter applies to the selected item only.
- **Some visuals** – The filter applies to visuals with valid column mappings.
- **All visuals of this dataset** – The filter applies to all the items based on this dataset.
- **All applicable visuals** – The filter applies to any visuals that have valid column mappings.

The option **View field mapping** is available on the filter. The mapping establishes matching fields between datasets. To see matching between different datasets, choose a different dataset from the list. For more information, see Mapping Fields (p. 146).

The scope icons match the ones that display on the filter menu when you are choosing the scope for the filter.

**Viewing Filter Details**

To see filter details, choose **Filter** on the left. The filter view retains your last selection. So when you open **Filter**, you see either the **Applied filters** or the **Edit filter** view.

In the **Applied filters** view, you can choose any filter to view its details. The filters in this list can change depending on the scope of the filter, and which visual you currently have selected.
You can close the **Edit filter** view by choosing the selector on the right. Doing this resets the **Filter** view.

**Adding a Filter**

You can create a filter on any field in the currently selected visual. When you create a filter, it applies by default to the currently selected visual only.
After you apply a filter to a visual, a filter icon appears on the top right of the visual. This icon shows you at a glance that the data is filtered.

Depending on the data type of the field that you choose, you see different filtering options, as described in the following topics.

**Topics**
- Adding a Text Filter (p. 300)
- Adding a Numeric Filter (p. 306)
- Adding a Date Filter (p. 307)
- Adding a Compound Filter with And/Or Operators (p. 310)
- Using Cascading Filters (p. 311)
Adding a Text Filter

You can filter text fields by either choosing field values from a list or by specifying field values.

Use the Filter list filter type to filter by choosing field values. To narrow down the values displayed, type a search term into the box above the checklist and choose Search. Search terms for most comparison types are case-insensitive. Filtering is case sensitive for the following comparison types: contains, does not contain, begins with, or ends with. Wildcards aren't supported.

To return to viewing the full set of field values rather than just those that match the search term, choose Search again.

For filter lists, you can refresh the list of field values by choosing the refresh icon.

The values display alphabetically in the control, unless there are more than 1,000 distinct values. Then the control displays a search box instead. Each time you search for the value you want to use, it initiates a new query. If the results contain more than 1,000 values, you can scroll through the values with pagination.

You can also use the Custom filter list filter type to specify one or more field values to filter on. A custom filter also lets you choose whether you want to include or exclude records that contain those values. You can also choose whether to exclude or include nulls, or show only rows with nulls in this field. The specified value and actual field value must match exactly for the filter to be applied to a given record.

With the Custom filter filter type, you specify a single value that the field value must equal or not equal. If you choose an equal comparison, the specified value and actual field value must match exactly in order for the filter to be applied to a given record. Custom filters also allow you the option to attach a parameter. To use a preexisting parameter, enable the Use parameters setting. For more information about parameters, see Using Filter Controls (p. 315).

Use a Top and bottom filter filter type to show the top or bottom $n$ value for the field that you choose, based on values in another field. For example, you can choose to show the top five salespeople based on revenue. To dynamically control the number of results to show, you can use an integer parameter as the $n$ value.

You can find details on how to create each type of text field filter in the following sections.

Topics
- Using a Filter List to Select Field Values (p. 300)
- Using a Custom Filter List to Specify Multiple Values with Additional Options (p. 302)
- Using a Custom Filter to Specify a Single Value or Parameter (p. 303)
- Using a Top and Bottom Text Filter (p. 304)

Using a Filter List to Select Field Values

Use the following procedure to create a text field filter by selecting field values.
**Important**
You can only filter by choosing field values in cases where Amazon QuickSight can quickly retrieve the full set of values. In cases where you are working with very large record sets and this is not possible, filter by specifying field values instead. For more information about filtering with specified field values, see Using a Custom Filter List to Specify Multiple Values with Additional Options (p. 302) and Using a Custom Filter to Specify a Single Value or Parameter (p. 303).

1. Choose **Filter** on the tool bar.
2. On the **Applied filters** pane, choose the add filter icon ( + ), and then choose a text field to filter on.

   Doing this creates a new filter with no criteria.

3. The filter is added to the list of filters. Choose the new filter to expand it.
4. Choose **Filter list** for the filter type.
5. Choose Include or Exclude. This option controls whether or not the data you select is included in the visual.

6. Choose the field values that you want to filter on. To do this, turn on the check box in front of each value.

   To there are too many values to choose from, type a search term into the box above the checklist and choose Search. Search terms are case-insensitive and wildcards aren't supported. Any field value that contains the search term is returned. For example, searching on L returns al, AL, la, and LA.

   Choose X in the search box to clear the search term.

   The values display alphabetically in the control, unless there are more than 1,000 distinct values. Then the control displays a search box instead. Each time you search for the value you want to use, it initiates a new query. If the results contain more than 1,000 values, you can scroll through the values with pagination.

Using a Custom Filter List to Specify Multiple Values with Additional Options

You can use the Custom filter list filter type to specify one or more field values to filter on. You can then choose whether you want to include or exclude records that contain those values. You can also choose whether to exclude or include nulls, or show only rows with nulls in this field.

Use the following procedure to create a text field filter by specifying exact field values. The specified value and actual field value must match exactly for the filter to be applied to a given record.

1. Choose Filter on the tool bar.
2. On the Applied filters pane, choose the new filter icon, and then choose a text field to filter on.
3. Choose the new filter to expand it.
4. Choose Custom filter list for the filter type.
5. Enter a field value in Enter a value to add, and then choose the add icon.

   To remove a field value from the criteria, choose its delete icon.
6. (Optional) Repeat Step 5 until you have all of the field values that you want to filter on.
7. For Current list, choose whether to include or exclude records that contain the field values that you selected.
8. Choose how to handle null values in the filtered field. You can choose to include or exclude the values you listed. Or you can choose to show nulls only.

9. Choose **Apply**.

**Using a Custom Filter to Specify a Single Value or Parameter**

With the **Custom filter** filter type, you specify a single value that the field value must equal or not equal. If you choose an equal comparison, the specified value and actual field value must match exactly for the filter to be applied to a given record. You can also choose how to handle null values in the filtered field. You can choose to include or exclude nulls, or show only rows containing nulls. Or you can use a parameter with a custom filter.

Use the following procedure to create a text field filter by specifying one field value or parameter.

1. Choose **Filter** on the tool bar.
2. On the **Applied filters** pane, choose the new filter icon, and then choose a text field to filter on.
3. Choose the new filter to expand it.
4. Choose **Custom filter** for the **Filter type**.
5. Then choose a comparison type (case sensitive). The options include:
   - **Equals or Does not equal** – Exact text
   - **Starts with or Ends with** – Text at the beginning or end of the field value
   - **Contains or Does not contain** – Text within the field value

6. Choose one of the following.
   - To use a literal value, type a field value in the **value** field. Then choose how to handle null values in the filtered field. You can choose to include or exclude the values you listed. Or you can choose to show nulls only.
   - To use an existing parameter, enable **Use parameters**, then choose your parameter from the list. You must create your parameters first for them to appear in this list. Usually, you create a parameter, add a control for it, and then add a filter for it. For more information, see **Parameters in Amazon QuickSight** (p. 217). The values display alphabetically in the control, unless there are more than 1,000 distinct values. Then the control displays a search box instead. Each time you search for the value you want to use, it initiates a new query. If the results contain more than 1,000 values, you can scroll through the values with pagination.

7. Choose **Apply**.

**Using a Top and Bottom Text Filter**

You can use a **Top and bottom filter** to show the top or bottom $n$ value of one field ranked by the values in another field. For example, you might show the top 5 sales people based on revenue. You can also use
a parameter to allow dashboard users to dynamically choose how many top or bottom ranking values to show.

Use the following procedure to create a top and bottom text filter.

1. Choose Filter on the tool bar.
2. On the Applied filters pane, choose the new filter icon, and then choose a text field to filter on.
3. Choose the new filter to expand it.
4. Choose Top and bottom for the filter type.

5. Choose Top or Bottom.
6. For Show top (or Show bottom), do one of the following:
• Enter the number of top or bottom items to show.
• To use a parameter for the number of top or bottom items to show, enable **Use parameters**. Then choose an existing integer parameter.

For example, let's say you want to show the top 3 salespersons by default, but you want the dashboard viewer to be able to choose whether to show between 1 and 10 top salespersons. In this case, take the following actions:
• Create an integer parameter with a default value.
• To link the number of displayed items to a parameter control, create a control for the integer parameter. Then you make the control a slider with a step size of 1, a minimum value of 1, and a maximum value of 10.
• To make the control work, link it to a filter by creating a top and bottom filter on Salesperson by Weighted Revenue, enable Use parameters, and choose your integer parameter.

7. For **By**, choose a field to base the ranking on. If you want to show the top 5 sales people per revenue, choose the revenue field. You can also set the aggregate that you want to perform on the field.

8. (Optional) Add one or more aggregations as tie breakers, in case there are more than 5 results returned for the top 5 sales people per revenue. This situation can happen if multiple salespeople have the same revenue amount.

To create a tie breaker, choose **+Tie breaker**, and then choose another field. To remove a tie breaker, use the delete icon.

9. Choose **Apply**.

### Adding a Numeric Filter

Fields with decimal or int data types are considered numeric fields. You create filters on numeric fields by specifying a comparison type, for example **Greater than** or **Between**, and a comparison value or values as appropriate to the comparison type. Comparison values must be positive integers and should not contain commas.

You can use the following comparison types in numeric filters:

• Equals
• Does not equal
• Greater than
• Less than
• Greater than or equal to
• Less than or equal to
• Between

**Note**
To use a top and bottom filter for numeric data, first change the field from a measure to a dimension. Doing this converts the data to text. Then you can use a text filter. For more information, see **Adding a Text Filter** (p. 300).

For datasets based on database queries, you can also optionally apply an aggregate function to the comparison value or values, for example **Sum** or **Average**.

You can use the following aggregate functions in numeric filters:

• Average
• Count
• Max
• Min
• Sum

Creating a Numeric Filter

Use the following procedure to create a numeric field filter.

1. Choose Filter on the tool bar.
2. On the Applied filters pane, choose the new filter icon, and then choose a numeric field to filter on.
   
   This creates a new filter with no criteria.

3. Choose the new filter to expand it.
4. If you want to aggregate, choose the aggregation type.
5. Choose a comparison type.
6. Choose one of the following:
   
   • To use literal values, enter the comparison value or values. If you chose a comparison type other than Between, enter one comparison value. If you chose a comparison type of Between, enter the beginning of the value range in Minimum value and the end of the value range in Maximum value.
   
   • To use an existing parameter, enable Use parameters, then choose your parameter from the list.

   You must create your parameters first before they can appear in this list. Usually, you create a parameter, add a control for it, and then add a filter for it. For more information, see Parameters in Amazon QuickSight (p. 217). The values display alphabetically in the control, unless there are more than 1,000 distinct values. Then the control displays a search box instead. Each time you search for the value that you want to use, it initiates a new query. If the results contain more than 1,000 values, you can scroll through the values with pagination.
7. Choose Apply.

Adding a Date Filter

You create filters on date fields by selecting the filter conditions and date values that you want to use. There are two filter types for dates:
• **Range** – A series of dates based on a time range and comparison type. You can filter records based on whether the date field value is before or after a specified date, or within a date range. You enter date values in the format MM/DD/YYYY. You can use the following comparison types:
  - **Between** – Between a start date and an end date
  - **After** – After a specified date
  - **Before** – Before a specified date
  - **Equals** – On a specified date

• **Relative** – A series of date/time elements based on the current date. You can filter records based on the current date and your selected unit of measure (UOM). Date filter units include years, quarters, months, weeks, days, hours, and minutes. You can exclude current period, add support for Next N filters similar to Last N with an added capability to allow for Anchor date. You can use the following comparison types:
  - **Previous** – The previous UOM—for example, the previous year.
  - **This** – This UOM, which includes all dates and times that fall within the select UOM, even if they occur in the future.
  - **To date or up to now** – UOM to date, or UOM up to now. The displayed phrase adapts to the UOM you choose. However, in all cases this option filters out data that is not between the beginning of the current UOM and the current moment.
  - **Last n** – The last specified number of the given UOM, which includes all of this UOM and all of the last \( n - 1 \) UOM. For example, let’s say today is May 10, 2017. You choose to use **years** as your UOM, and set Last \( n \) years to 3. The filtered data includes data for all of 2017, plus all of 2016, and all of 2015. If you have any data for the future dates of the current year (2017 in this example), these records are included in your dataset.
  - **Top and bottom** – A number of date entries ranked by another field. You can show the top or bottom \( n \) for the type of date or time UOM you choose, based on values in another field. For example, you can choose to show the top 5 sales days based on revenue.

Comparisons are applied inclusive to the date specified. For example, if you apply the filter **Before** 1/1/16, the records returned include all rows with date values through 1/1/16 23:59:59. If you don't want to include the date specified, you can clear the option to **Include this date**. If you want to omit a time range, you can use the **Exclude the last N periods** option to specify the number and type of time periods (minutes, days, and so on) to filter out.

You can also choose to include or exclude nulls, or exclusively show rows that contain nulls in this field. If you pass in a null date parameter (one without a default value), it doesn't filter the data until you provide a value.

**Note**

If a column or attribute has no time zone information, then the client query engine sets the default interpretation of that datetime data. For example, suppose that a column contains a timestamp, rather than a timestamptz, and you are in a different time zone than the data's origin. In this case, the engine can render the timestamp differently than you expect. Amazon QuickSight and SPICE (p. 78) both use Universal Coordinated Time (UTC) times.

**Creating a Date Filter**

Use the following procedure to create a filter for a date field.

1. Choose Filter on the tool bar.
2. On the Applied filters pane, choose Create one, and then choose a date field to filter on.
3. Choose the new filter to expand it.
4. Choose a filter type.
5. Choose one of the following:
   - If you are creating a time range filter, choose a comparison type: Between, After, Before, or Equals.
   - If you are creating a relative date filter, choose a unit of measure for time (years, quarters, and so on). Then choose how you want the filter to relate to the time frame. For example, if you choose to report on months, your options are previous month, this month, month to date, last N months, and next N months.
   - If you are creating a top and bottom filter, choose Top or Bottom.
6. Choose one of the following:
   - **Time Range**: If you are filtering on a time range, enter date values.
     
     To use Between as a comparison, enter a start and end date, or choose the Start date or End date field to bring up the date picker control and choose dates.
     
     You can choose if you want to include either or both the start and end dates in the range.
     
     To use Before, After, or Equals comparisons, enter a date or choose the date field to bring up the date picker control and choose a date instead. You have the option to include this date (the one you chose), to exclude the last N time periods, and specify how to handle nulls.
   - **Relative Dates**: If you are filtering on relative dates, choose a unit of time. If you choose Last n UOM, specify a number for your range—for example, last 3 years, or last 2 hours.
     
     You can choose how you want to handle nulls, with options for exclude nulls, include nulls, or display nulls only.
     
     Also, choose what you want to Set dates relative to. If you choose Current date time, you can set it to Exclude last, and then specify the number and type of time periods. If you choose Date and time from a parameter, you can select your existing datetime parameter.
   - **Top and bottom**: If you are filtering for top or bottom:
     
     Choose Top or Bottom.
     
     If you want to use a parameter, enable Use parameters and select your existing datetime parameter.
     
     For Show, enter the number of top or bottom items you want to show and choose a unit of time.
     
     For By, choose a field to base the ranking on.
Optionally, you can add another field as a tie breaker, if the field for By has duplicates. Choose +Tie breaker, and choose another field. To remove a tie breaker, use the delete icon.

7. (Optional) If you are filtering by using an existing parameter, instead of specific dates, enable Use parameters, then choose your parameter or parameters from the list. To use Before, After, or Equals comparisons, choose one date parameter. You have the option to include this date in the range.

To use Between, enter both the start date and end date parameters separately. You can include the start date, the end date, or both in the range.

To use a parameter for Top and bottom, choose an integer parameter for the number of top or bottom items to show.

You must create your parameters first, before you can use them in a filter. Usually, you create a parameter, add a control for it, and then add a filter for it. For more information, see Parameters in Amazon QuickSight (p. 217).

8. (Optional) If you are not using parameters, at the bottom of the filter view, choose how to handle null values in the filtered field. You can choose to include or exclude the values you listed. Or you can choose to show nulls only. The options for how to handle nulls don't appear for top and bottom filters.

9. Choose Apply.

Adding a Compound Filter with And/Or Operators

When you add multiple filters to a visual, Amazon QuickSight uses the AND operator to combine them.

To add multiple filters using the OR operator, you must create a filter group. This lets you combine multiple conditions in a single filter with the OR operator. You can think of this as grouping filters in parentheses. Filter grouping is available for all types of filters.

When you filter on multiple measures (green fields marked with #), you can apply the filter conditions to an aggregate of that field. Filters in a group can contain either aggregated or non-aggregated fields, but not both.

To create a filter group, follow these steps.

1. Edit or create a filter.
2. Scroll to the bottom of the filter, where there is a dividing line labeled OR. Choose Add filter condition.
3. A new blank filter appears below the first one. Choose the next field and the conditions to filter on.
4. (Optional) You can add additional filter conditions to the filter group.
5. (Optional) To remove a filter from the filter group, choose the trash-can icon near the field name.
6. When you are finished, choose **Apply**.

**Using Cascading Filters**

The idea behind cascading any action, such as a filter, is that choices in the higher levels of a hierarchy affect the lower levels of a hierarchy. The term *cascading* comes from the way a cascade waterfall flows from one tier to the next.
To set up cascading filters, you need a trigger point where the filter is activated, and target points where the filter is applied. In Amazon QuickSight, the trigger and target points are included in visuals. To create a cascading filter, you set up an action, not a filter. This approach is because you need to define how the cascading filter is activated, which fields are involved, and which visuals are filtered when someone activates it. For more information, including step-by-step instructions, see Using Custom Actions for Filtering and Navigating (p. 320).

There are two other ways to activate a filter across multiple visuals:

- **For a filter that is activated from a widget on a dashboard** – The widget is called a *sheet control*, which is a custom menu that item you can add to the top of your analysis or dashboard. The most common sheet control is a drop-down list, which displays a list of options to choose from when you open it. To add one of these to your analysis, create a parameter, add a control to the parameter, and then add a filter that uses the parameter. For more information, see Setting Up Parameters in Amazon QuickSight (p. 218), Using a Control with a Parameter in Amazon QuickSight (p. 220), and Using Filter Controls (p. 315).

- **For a filter that always applies to multiple visuals** – This is a regular filter, except that you set its scope to apply to multiple (or all) visuals. This type of filter doesn't really cascade, because there is no trigger point. It always filters all the visuals that it's configured to filter. To add this type of filter to your analysis, create or edit a filter and then choose its scope: All visuals, Some visuals, or Only this visual. For more information, see Changing Filter Scope (p. 313).

### Editing a Filter

You can edit a filter by enabling or disabling the filter or changing the filter criteria. You can also edit a filter by changing the filter scope to include or exclude other visuals in the analysis that use the same dataset.

You can't change the field a filter applies to. To apply a filter to a different field, create a new filter instead.

### Enabling or Disabling a Filter

You can use the filter menu to enable or disable a filter. When you create a filter, it is enabled by default.

1. On the analysis page, choose Filter on the tool bar.
2. On the Applied filters pane, use the check box to enable or disable the filter. A disabled filter is grayed out.
Editing a Filter

Changing Filter Criteria

Use the following procedure to modify a filter.

1. On the analysis page, choose Filter on the tool bar.
2. On the Applied filters pane, choose the filter that you want to modify. Doing this displays the filter details.
3. Change the settings that you want to modify.
4. Choose Apply.

Changing Filter Scope

You can use the filter menu to set the scope of a filter to one, several, or all visuals in the analysis that use the dataset that filter is based on. By default, a filter applies only to the visual that was selected when the filter was created.

1. On the analysis page, choose Filter on the tool bar.
2. On the Applied filters pane, choose the filter that you want to change.
Deleting a Filter

Use the following procedures to delete a filter.

1. On the analysis page, choose Filter on the tool bar.
2. On the Applied filters pane, choose the filter that you want to delete.

3. Choose one of the following:
   - To delete a filter, choose the trash-can icon. If the filter is part of a filter group, scroll down to the filter that you want to delete, then choose the trash-can icon.
   - To delete all filters from a filter group, choose Delete all at the bottom.
Using Filter Controls

When you’re designing an analysis, you can add a filter control near the visuals that you want to filter. The control uses the theme settings so it looks like it’s part of the sheet.

To add a filter control

1. On the navigation pane, choose Filter to open the analysis that you want to work on. A list of existing filters appears.
2. If you don’t already have some filters available, use the following steps to create one:
   a. Choose a field by using the plus sign (+) to access the Create a new filter list.
   b. The filter that’s added has the default settings for the data type that you selected.
   c. For this example, you don’t need to change the settings. When you’re ready to customize a filter, see Adding a Filter (p. 152) for more information on the available options.
3. Choose one of the existing filters and choose Add to sheet from the options menu (…) on the filter.

After you add a filter control to your analysis, you can resize it or drag it to different positions on the screen (sheet).

To pin a control to the top of a sheet

1. On the filter control that you want to move, choose the options menu (…).
2. Choose Pin to top to move the control to the top of the sheet, just below the field wells.
3. (Optional) To unpin the control, choose Move to sheet from the options menu (…) on the control.

A filter control shares some settings with its filter. It applies to one, some, or all of the objects on the same page or sheet. Filter controls have a shortcut menu option that opens their source filter. You can use this to edit the filter settings or to learn what filter settings apply. For more information on available settings, see Adding a Filter (p. 152).

To view or edit a filter

1. On the filter control, choose Go to filter from the options menu (…).
2. Do any of the following:
   • To identify which filter you’re working with, observe which filter displays in the filter pane.
   • To view or edit the filter settings, open the filter by choosing its name.
   • To see other available filters, choose a different widget on the screen, for example a chart or an insight.

   Note
   Lists show up to 1,000 values. If there are more than 1,000 distinct values, a search box appears so you can filter the list. When the filtered list contains less than 1,001 values, the contents of the list appear as line items.

Depending on the data type of the field and the type of filter, the filter control has different settings available. Use these to customize the appearance of the filter control widget.

To alter the display settings of a filter control

1. Choose the filter control so that it’s highlighted on the screen.
2. Open the control settings by choosing the Edit icon.
3. For Display name, enter a name for the filter control.
4. (Optional) To hide the display name from the filter control, clear the check box for Show title.
5. For Title font size, choose the title font size that you want to use. The options range from extra small to extra large. The default setting is medium.
6. For text fields with a filter control, for example dimensions, categories, or labels, you can choose from the following:
   - Text box – Displays a box where you can enter an entry.
   - Dropdown – Displays a dropdown list with buttons that you can use to select a single value.
   - Dropdown - multiselect – Displays a dropdown list with boxes that you can use to select multiple values.
   - List – Displays a list with buttons that you can use to select a single value.
   - List - multiselect – Displays a list with boxes that you can use to select multiple values.

For lists, you can specify the following:
   - Filter – Displays all the values that are available in the filter.
   - Specific values – Provides a way to enter the values to display, one entry per line.
   - Hide [ALL] option from the control values – Hides the keyword ALL so that it doesn't display in the list of values. Turn this toggle ON to hide ALL, and turn it OFF to show ALL.

7. For dates or times with a filter control, you can choose from the following:
   - Date range picker – Displays a set of two fields to define a time range. You can enter a date or time. Or you can choose a date from the calendar control.
   - Relative date picker – Displays settings like the time period, its relation to the current date and time, and the option to exclude time periods.
   - Text box – Displays a box where you can enter the top or bottom $N$ date.

8. For numeric values with a filter control, you can choose from the following:
   - Dropdown – Displays a list where you can select a single value. For lists, you can specify the following options:
     - Filter – Displays all the values that are available in the filter.
     - Specific values – Enables you to enter the values to display, one entry per line.
     - Hide [ALL] option from the control values - Hides the keyword ALL so that it doesn't display in the list of values. Turn this toggle ON to hide ALL, and turn it OFF to show ALL.
     - List – Displays a list with buttons that enable selecting a single value.
     - Slider – Displays a horizontal bar with a toggle that you can slide to change the value. If you have a ranged filter for values between a minimum and a maximum, the slider provides a toggle for each number. For sliders, you can specify the following options:
       - Minimum value – Displays the smaller value at the left of the slider.
       - Maximum value – Displays the larger value at the right of the slider.
       - Step size – Allows you to set the number of increments that the bar is divided into.
     - Text box – Displays a box where you can enter the value.
Adding Drill-Downs to Visual Data in Amazon QuickSight

All visual types except pivot tables offer the ability to create a hierarchy of fields for a visual element. The hierarchy lets you drill down to see data at different levels of the hierarchy. For example, you could associate the country, state, and city fields with the x-axis on a bar chart. Then, you could drill down or up to see data at each of those levels. As you drill down each level, the data displayed is refined by the value in the field you drill down on. For example, if you drill down on the state of California, you see data on all of the cities in California.

The field wells you can use to create drill-downs varies by visual type. Refer to the topic on each visual type to learn more about its drill-down support.

Drill-down functionality is added automatically for dates when you associate a date field with the drill-down field well of a visual. In this case, you can always drill up and down through the levels of date granularity. Drill-down functionality is also added automatically for geospatial groupings, after you define these in the dataset.

Use the following table to identify the field wells/on-visual editors that support drill-down for each visual type.

<table>
<thead>
<tr>
<th>Visual type</th>
<th>Field well or on-visual editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar charts (all Horizontal)</td>
<td>Y axis and Group/Color</td>
</tr>
<tr>
<td>Bar charts (all Vertical)</td>
<td>X axis and Group/Color</td>
</tr>
<tr>
<td>Combo charts (all)</td>
<td>X axis and Group/Color</td>
</tr>
<tr>
<td>Geospatial charts</td>
<td>Geospatial and Color</td>
</tr>
<tr>
<td>Heat map</td>
<td>Rows and Columns</td>
</tr>
<tr>
<td>KPIs</td>
<td>Trend Group</td>
</tr>
<tr>
<td>Line charts (all)</td>
<td>X axis and Color</td>
</tr>
<tr>
<td>Pie chart</td>
<td>Group/Color</td>
</tr>
<tr>
<td>Pivot table</td>
<td>Drill-down not supported</td>
</tr>
<tr>
<td>Scatter plot</td>
<td>Group/Color</td>
</tr>
<tr>
<td>Tabular Reports</td>
<td>Drill-down not supported</td>
</tr>
<tr>
<td>Tree map</td>
<td>Group by</td>
</tr>
</tbody>
</table>

Adding a Drill-Down

Use the following procedure to add drill-down levels to a visual.

1. On the analysis page, choose the visual that you want to add drill-downs to.
   - **Note**
     - You can’t add drill-downs to pivot tables.

2. Click anywhere on the **Field wells** to expand them.
3. If your dataset has a defined hierarchy, for example for geospatial or coordinate data, you can drag the entire hierarchy into the field well as one. In this case, you don't need to follow the remaining steps.

If you don't have a predefined hierarchy, you can create one in your analysis, as described in the remaining steps.

4. Drag a field that you want to use in the drill-down hierarchy to an appropriate field well, depending on the visual type. Make sure that the label for the dragged field says Add drill-down layer. Position the dragged field above or below the existing field based on where you want it to be in the hierarchy you're creating.
5. Continue until you have added all of the levels of hierarchy that you want. To remove a field from the hierarchy, choose the field, and then choose Remove.

6. To drill down or up to see data at a different level of the hierarchy, choose an element on the visual (like a line or bar), and then choose Drill down to <lower level> or Drill up to <higher level>. In this example, from the car-make level you can drill down to car-model to see data at that level. If you drill down to car-model from the Ford car-make, you see only car-models in that car-make.

After you drill down to the car-model level, you can then drill down further to see make-year data, or go back up to car-make. If you drill down to make-year from the bar representing Ranger, you see only years for that model of car.
Using Custom Actions for Filtering and Navigating

To add interactive options for dashboard subscribers (QuickSight readers), you create custom actions on one or more visuals in your analysis. Enhancing dashboards with custom actions helps people explore data by adding more context from within the dataset. It can make it easier to drill into the details and to find new insights in the same dashboard, a different dashboard, or a different application.

Before you begin, it's helpful to do some planning. For example, identify fields that are good candidates for filtering, for opening a different sheet, for opening a URL, or for sending email. For each sheet, identify the widgets that display these fields. Then decide which widgets are going to contain actions. It's also a good idea to create a naming scheme so the names of the actions are consistent throughout the entire analysis. Consistent names make it easier for the person using your analysis to figure out what the action will do, plus they make it easier for you to maintain actions that you might be duplicating throughout the analysis.

Actions only exist on the dashboard widget where you create them and they work in the context of that widget's parent sheet and child fields that it displays. You can create actions only on specific types of widget: visuals and insights. You can't add them to other widgets, for example filter or list controls. Custom actions can only be activated from the widget where you create them.

To activate an action, the person using the analysis can left-click (select) or right-click (use the context menu) on a data point. A data point is an item in the dataset, for example a point on a line chart, a cell in a pivot table, a slice on a pie chart, and so on. If the person clicks a visual element, the select action is activated. This is the action that is currently a member of the On select category of the Actions in an analysis. If the person instead right-clicks a visual element, they can choose from a list of menu actions. Any action listed is currently a member of the Menu option category of the Actions in an analysis. The On select category can contain one and only one member action. By default, the first action you create becomes the select action—the one activated by left-clicking. To remove an action from the On select category, change the action's Activation setting to Menu option. After you save that change, you can set a different action's Activation setting to Select.

You can choose from three Action types when you configure an action:

- **Filter action** – Filter data included in visual or in the entire sheet. By default, filters are available for all fields in the parent visual. Cascading filters are enabled by default. Filter actions work across multiple datasets by using automatically generated field mappings.

  If the analysis uses more than one dataset, you can view the automatically generated field mappings for fields that exist in multiple datasets. To do this, choose View field mapping at the end of the action settings, while you're editing an action. If you are viewing a list of actions, choose View field mapping from the menu for each action. The field mappings appear in a new screen that shows the mapping between the initial dataset and all the other datasets in the visual. If no fields are automatically mapped, a message displays with a link to Mapping and Joining Fields (p. 145).

- **Navigation actions** – Perform enable navigation between different sheets in the same analysis.

- **URL actions** – Open a link to another web page. If you want to open a different dashboard, use a URL action. You can use a URL action to send data points and parameters to other URLs. You can include any available field or parameter.

  If the URL uses the mailto scheme, running the action opens your default email editor.

**Topics**

- Adding One-Click Interactive Filters (p. 321)
- Creating and Editing Custom Actions in Amazon QuickSight (p. 321)
- Repairing Custom Actions (p. 323)
Adding One-Click Interactive Filters

One-click interactive filtering provides point-and-click filtering that cascades from the clickable visual to all the other visuals and insights on a sheet. Add this to your analysis to start with summaries and drill down into the metrics, all within the same dashboard sheet.

After you set this up, when you click a data point (for example, a point in a line chart), you instantly filter using all mapped fields on all the other visuals on that sheet. If you have multiple datasets, all target fields must be mapped for this to work. Also, you can only have one action that works by clicking a data point; all other actions work from the context menu.

Use the following procedure to create a one-click filter in an analysis.

To create a one-click filter on a visual or insight

1. In your analysis, choose a visual or insight that you want to add interactive filtering to.
2. Choose Actions at left.
3. Choose Filter same-sheet visuals. Doing this immediately adds one-click filtering.
4. Repeat this process for each visual that you wish to make interactive.

Creating and Editing Custom Actions in Amazon QuickSight

You create one action for each task that you want to be able to add to a visual. The actions you create become part of the functionality of each visual or insight.

The following table defines when to use each type of action.

<table>
<thead>
<tr>
<th>Action to perform</th>
<th>Type of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add or customize an interactive filter action, including one-click filters</td>
<td>Filter action</td>
</tr>
<tr>
<td>Open another sheet in the same dashboard</td>
<td>Navigation action</td>
</tr>
<tr>
<td>Open a sheet in a different dashboard in the same AWS account</td>
<td>URL action</td>
</tr>
<tr>
<td>Open a URL (https, http)</td>
<td>URL action</td>
</tr>
<tr>
<td>Send an email (mailto)</td>
<td>URL action</td>
</tr>
</tbody>
</table>

You can set the following attributes and options for a custom action:

- **Action name** – This is a descriptive name that you choose for the action. By default, actions are named Action 1, Action 2, and so on. If your custom action is activated from a context menu, this name displays in the menu when you right-click on a data point.

  To make the action name dynamic, you can parameterize it. Use the + near the action name header to display a list of available variables. Variables are enclosed in angle brackets << >>. Parameters are prefixed with a $, for example <<$parameterName>>. Field names have no prefix, for example <<fieldName>>.
Creating and Editing Custom Actions

- **Activation** – Available options are **Select** or **Menu option**. To use an action, you can *select* the data point (left-click) or navigate to the *menu option* in the context menu (right-click). Navigation actions and URL actions listed in the middle of the context menu, just above **Color** options. Actions that are activated by menu are also available from the legend on a visual.

- **Action type** – The type of action that you want. Settings that are specific to an action type only display after you choose the action type.
  - **Filter action** settings include the following:
    - **Filter scope** – The fields to filter on. To filter on all fields, choose **All fields**. Otherwise, choose **Select fields** and then turn off the items you don't want to target.
      
      The default is **All fields**.
    - **Target visuals** – The dashboard widgets to target. To apply the filter to all of them, choose **All visuals**. Otherwise, choose **Select visuals** and then turn off the items you don't want to target.
      
      When you apply a filter action to other visuals, the effect is called *cascading filters*.
      
      The default is **All visuals**.

      A cascading filter applies all the visuals that are set up in the **Target visuals** section of a specific filter action. Amazon QuickSight initially evaluates your visuals and preconfigures the settings for you. But you can change the defaults if you wish to do so. You can set up multiple cascading filters on multiple visuals in the same sheet or analysis. When you are using the analysis or dashboard, you can use multiple cascading filters at the same time, although you activate each of these one at a time.

      A filter action requires at least one target visual, because a filter action requires a source and a target. To filter only the current visual, create a regular filter instead by choosing **Filter** at left.

  - **Navigation action** settings include the following:
    - **Target sheet** – The sheet to target.
    - **Parameters** – The parameters to send to the target sheet. Choose + to add an existing parameter.

  - **URL action** settings include the following:
    - **URL** – The URL to open. URL actions can be deep links into another application. Valid URL schemes include: https, http, or mailto.
    - **+ (Values)** – (Optional) The parameters to send to the target URL. Parameter names start with a $. The parameters on both the sending and the receiving end must match in name and data type.
    - **Open in** – Where to open the URL. You can choose **New browser tab**, **Same browser tab**, or **New browser window**.

Some types of actions enable you to include values from parameters or fields that are available in the visual or insight. You can type these in manually or choose + to select from a list. For the custom action to work, every field and parameter it references must be actively in use in the parent widget.

Use the following procedure to create, view, or edit a custom action in an analysis.

1. With your analysis open, choose **Actions** at left.

   The existing actions, if any, display by activation type. To turn an existing action on or off, use the box to the right of the action's name.

2. (Optional) To edit or view an existing action, choose the menu icon (✓) next to the name of the action.

   To edit the action, choose **Edit**.
To delete it, choose **Delete**.

3. If you want to create a new action, choose either one of the following:
   - The add (➕) icon near the **Actions** heading
   - The **Define a custom action** button

4. For **Action name**, define an action name. To make the action name dynamic, use ➕ to add parameter or field values.

5. For **Activation**, choose how the action runs.

6. For **Action type**, choose the action type you want to use.

7. For a **Filter action**, do the following:
   a. For **Filter scope**, choose the scope of the filter.
   b. For **Target visuals**, choose how far the filter cascades

8. For a **Navigation action**, do the following:
   a. For **Target sheet**, choose the target sheet.
   b. For **Parameters**, choose ➕ near the **Parameters** heading, select a parameter, and then choose a parameter value. You can choose all values, enter custom values, or select specific fields.

9. For a **URL action**, do the following:
   a. For **URL**, enter the hyperlink.
   b. Choose ➕ near the **URL** heading. Then, add variables from the list.
   c. For **Open in**, choose how to open the URL.

10. After you are finished with the action, choose one of the following at the bottom of the **Actions** panel (you might need to scroll down):
   - **Save** – Save your selections, and create the custom action.
   - **Close** – Close this custom action and discard your changes.
   - **Delete** – Delete this action.

### Repairing Custom Actions

For a custom action to work, every field and parameter it references must be active in the parent widget. If a field is missing from the source widget, or if a parameter is missing from the analysis, the action for that field or parameter becomes unavailable. Menu actions are no longer included in the context menu. Select actions no longer respond to attempts to interact. However, in all other ways, the widget continues to function. No error displays to the end user. You can fix broken filter actions and URL actions by adding the missing fields back to the broken visual or insight.

The following procedures explains how to fix an action that broke because someone removed a field or parameter without updating the action. These steps provide basic guidance how to fix this issue. However, use your own judgment on how or if you should make changes to the analysis. If you’re not sure, it’s better to ask a QuickSight administrator for assistance before you change anything. For example, there might be a way to restore a previous version of the analysis, which might be safer if you aren’t sure what happened to it.

#### To remove a field from a broken action (UI)

1. From the start page, choose **Analyses**. Then choose the analysis to fix.
2. Choose the visual or insight where the action no longer works. Make sure it is highlighted on the sheet.

3. Choose Actions.

4. Locate the action you want to fix, and choose ✅, Edit.

5. If the action type is Filter action, and you see an error that says the field used by this action was removed, check the settings for Filter scope. Selected fields can only display fields that are in the visual. To disable selected fields that are removed, choose one of the following:
   - Change the Filter scope setting to All fields. Doing this enables the widget to filter on every field.
   - If you want to use a list of Selected fields, verify the list of fields. If you need to include another field, you need to add it to the visual first.

6. If the action type is Navigation action, follow the guidance on the error message, which reflects the type of change that caused the error.

7. If the action type is URL action, check the URL setting for variables marked with double angle brackets (<<FIELD-OR-$PARAMETER>>). Open the list of available variables by choosing +. Remove any fields or parameters that aren't in the list. Be sure you also remove the matching URL parameter and its separator (? for the first URL parameter, or & for subsequent parameters). The following examples show (in bold) which part is removed if you were removing the field named Product from the visual.

   ![Example URLs](https://www.example.com/examplefunction?q=<<Product>>

   ![Example URLs](https://www.example.com/examplefunction?q=<<Product>>&uact=<<$CSN>>

   ![Example URLs](https://www.example.com/examplefunction?pass=yes&q=<<Product>>+<<City>>&oq=<<Product>>+<<City>>&uact=<<$CSN>>

   Make sure to test the new URL.

8. (Optional) If you want to delete the action, scroll to the end and choose Delete.

9. When you are finished, confirm your changes to the action. Scroll to the bottom of the Action pane and choose Save.

   If the error also exists in an associated dashboard, share and publish the dashboard again to propagate the fix.

Understanding Field Mapping for Custom Actions in Amazon QuickSight

Automated field mapping is based on identical fields. Fields with the same name and data type map automatically across datasets. Their field names and data types must be an exact match. This works similar to a join, except that it is automatically generated based on names and data types for every matching field. If you are missing fields, you can create them by using calculated fields in the dataset that's missing a field. If you don't want to have some of the fields mapped to each other, you can rename or remove them from the dataset.

It's important to make sure that all target fields are mapped if they are enabled for use with a filter action (in the Filter scope). Doing this allows filtering to apply automatically. If some target fields aren't mapped, the automatic filtering doesn't work.
Mapping is generated only when you create or save a custom action. So after every change that effects the mapping, you must return to it and save it again. When you create an action, mapping is based on the fields as they exist at that point. When you save an action, any mapped fields that you renamed since you created the custom action stay mapped. However, if you alter the data type of a mapped field, the mapping is removed.

If your mapping is missing some fields, you can do one of the following to fix it:

- Only target the mapped fields, by removing the unmapped fields from the Filter scope.
- Remove the visual in question from the target visuals.
- Create calculated fields to supply the missing fields for the mapping, and then save your custom action.
- Edit the dataset and rename the fields or change their data types, and then save your custom action.
- Edit the dataset and rename the fields or change their data types, and then resave your custom action.

**Note**

The information that displays on the mapping screen shows the configuration from the most recent time you saved it. To refresh or update the view, save the action again.

If you add or edit datasets, they aren't automatically mapped or remapped. This causes the filtering to work incorrectly. For example, suppose that you add a new dataset, then create visuals for it. The new visuals won't respond to filter actions, because there is no field mapping to connect them. When you make changes, remember to save your custom actions again to redo the field mappings.

If you remove a parameterized field or any other targeted field from the source visual, the action that uses it breaks. The action for the missing field either doesn't work when you select a data point, or it's hidden from the context menu.

For information about preparing your dataset for automated field mapping, see Mapping Fields (p. 146).

---

**Working with Visual Types in Amazon QuickSight**

Amazon QuickSight offers a range of visual types that you can use to display your data. Use the topics in this section to learn more about the capabilities of each visual type.

**Topics**

- Measures and Dimensions in Visuals (p. 326)
- Display Limits in Visuals (p. 326)
- Using AutoGraph (p. 329)
- Using Bar Charts (p. 330)
- Using Box Plots (p. 335)
- Using Combo Charts (p. 335)
- Using Donut Charts (p. 339)
- Using Filled Maps (p. 342)
- Using Funnel Charts (p. 342)
- Using Gauge Charts (p. 343)
- Using Geospatial Charts (Maps) (p. 346)
- Using Heat Maps (p. 347)
- Using Histograms (p. 349)
- Using KPIs (p. 355)
- Using Line Charts (p. 357)
Measures and Dimensions in Visuals

When we describe how to use the different visual types, we use the term *measure* to refer to numeric values that you use for measurement, comparison, and aggregation in visuals. A measure can be either a numeric field, like product cost, or a numeric aggregate on a field of any data type, like count of transaction IDs.

We use the term *dimension* to refer to text or date fields that can be items, like products, or attributes that are related to measures and can be used to partition them. Examples are sales date for sales figures or product manufacturer for customer satisfaction numbers. Amazon QuickSight automatically identifies a field as a measure or a dimension based on its data type.

Numeric fields can act as dimensions, for example ZIP codes and most ID numbers. It's helpful to give such fields a string data type during data preparation. This way, Amazon QuickSight understands that they are to be treated as dimensions and are not useful for performing mathematical calculations.

You can change whether a field is displayed as a dimension or measure on an analysis-by-analysis basis instead. For more information, see Fields as Dimensions and Measures (p. 244).

Display Limits in Visuals

All visual types limit the number of data points they display, so that the visual elements (like lines, bars, or bubbles) are still easy to view and analyze. The visual selects the first $n$ number of rows for display up to the limit for that visual type. The selection is either according to sort order, if one has been applied, or in default order otherwise.

The number of data points supported varies by visual type. To learn more about display limits for a particular visual type, see the topic for that type.

The visual title identifies the number of data points displayed if you have reached the display limit for that visual type. If you have a large dataset and want to avoid running into the visual display limit, use one or more filters to reduce the amount of data displayed. For more information about using filters with visuals, see Filtering Data (p. 296).

For dashboards and analyses, Amazon QuickSight supports the following:

- 50 datasets per dashboard
- 20 sheets per dashboard
- 30 visualization objects per sheet

You can also choose to limit how many data points you want to display in your visual, before they are added to the *other* category. This category contains the aggregated data for all the data beyond the cutoff limit for the visual type you are using—either the one you impose, or the one based on display limits. You can use the on-visual menu to choose whether to display the *other* category. The *other*
category doesn't show on scatter plots, heat maps, maps, tables (tabular reports), or KPIs. It also doesn't show on line charts when the x-axis is a date. Drilling down into the other category is not supported.

The following image shows the other category on a bar chart.

**Sum of Weighted Revenue by Opportunity Stage and Salesperson**

SHOWING TOP 3 IN OPPORTUNITY STAGE AND TOP 5 IN SALESPERSON

The following image shows the other category on a pivot table.

**Sum of Weighted Revenue by Salesperson and Opportunity...**

Hiding or Displaying the other Category

Use the following procedure to hide or display the other category.
1. On the analysis page, choose the visual that you want to modify.
2. Choose the on-visual menu at the upper-right corner of the visual, and then choose **Hide "other" category** or **Show "other" category**, as appropriate.

### Customizing the Number of Data Points to Display

You can choose the number of data points to display on the main axis of some visuals. After this number is displayed in the chart, any additional data points are included in the "other" category. For example, if you choose to include 10 data points out of 200, 10 display in the chart and 190 become part of the "other" category.

To find this setting, choose the v-shaped on-visual menu, then choose **Format visual**. You can use the following table to determine which field well contains the data point setting and what number of data points the visual type displays by default.

<table>
<thead>
<tr>
<th>Visual Type</th>
<th>Where to Find the Data Point Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar chart, horizontal</td>
<td>Y-axis – <strong>Number of data points displayed</strong></td>
</tr>
<tr>
<td>Bar chart, vertical</td>
<td>X-axis – <strong>Number of data points displayed</strong></td>
</tr>
<tr>
<td>Combo chart</td>
<td>X-axis – <strong>Number of data points displayed</strong></td>
</tr>
</tbody>
</table>
Amazon QuickSight User Guide
Using AutoGraph

<table>
<thead>
<tr>
<th>Visual Type</th>
<th>Where to Find the Data Point Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat map</td>
<td>Rows – Number of rows displayed</td>
</tr>
<tr>
<td></td>
<td>Columns – Number of columns displayed</td>
</tr>
<tr>
<td>Line chart</td>
<td>X-axis – Number of data points displayed</td>
</tr>
<tr>
<td>Pie chart</td>
<td>Group/Color – Number of slices displayed</td>
</tr>
<tr>
<td>Tree map</td>
<td>Group by – Number of squares displayed</td>
</tr>
</tbody>
</table>

Topics

- Using AutoGraph (p. 329)
- Using Bar Charts (p. 330)
- Using Box Plots (p. 335)
- Using Combo Charts (p. 335)
- Using Donut Charts (p. 339)
- Using Filled Maps (p. 342)
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- Using Histograms (p. 349)
- Using KPIs (p. 355)
- Using Line Charts (p. 357)
- Using Pie Charts (p. 366)
- Using Pivot Tables (p. 367)
- Using Sankey Diagrams in Amazon QuickSight (p. 398)
- Using Scatter Plots (p. 406)
- Using Tables as Visuals (p. 408)
- Using Tree Maps (p. 409)
- Using Waterfall Charts (p. 411)
- Using Word Clouds (p. 412)

Using AutoGraph

AutoGraph isn't a visual type itself, but instead lets you tell Amazon QuickSight to choose the visual type for you. When you create a visual by choosing AutoGraph and then selecting fields, Amazon QuickSight uses the most appropriate visual type for the number and data types of the fields you select.

The icon for AutoGraph is as follows.
Creating a Visual Using AutoGraph

Use the following procedure to create a visual using AutoGraph.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the AutoGraph icon.
4. On the **Fields list** pane, choose the fields that you want to use.

Using Bar Charts

Amazon QuickSight supports the following types of bar charts, with either horizontal or vertical orientation:

- Single-measure
- Multi-measure
- Clustered
- Stacked
- Stacked 100 percent

You use these as follows:

- Use the horizontal or vertical bar chart visual types to create single-measure, multi-measure, or clustered bar charts.
- Use a single-measure bar chart to show values for a single measure for a dimension.
- Use a multi-measure bar chart to show values for a two or more measures for a dimension.
- Use a clustered bar chart to show values for a single measure for a dimension that is then grouped by another dimension, for example sales total by state, grouped by region.
- Use any of the stacked bar chart visual types to create stacked bar charts. A **stacked bar chart** is similar to a clustered bar chart in that it displays a measure for two dimensions. However, instead of clustering bars for each child dimension by the parent dimension, it displays one bar per parent dimension. It uses color blocks within the bars to show the relative values of each item in the child dimension.

Amazon QuickSight offers both regular stacked bar charts and stacked 100 percent bar charts. A regular stacked bar chart differs from a stacked 100 percent bar chart in that the color blocks reflect the value of each item in the child dimension relative to the total for the measure. In contrast, a stacked 100 percent bar chart shows them by their percentage.

For example, the following stacked bar chart shows that total sales in the southern region were $2735.51, with $1474.96 from Texas and $1260.55 from Florida.
The following stacked 100 percent bar chart shows this same data by percentage, which is 100 percent for the southern region. The color block for Florida represents the approximately 46 percent of revenue from that state. The color block for Texas represents the remaining 54 percent.
You can use the bar chart visual type to create a single-measure, multi-measure, or clustered bar chart. A single-measure bar chart shows one measure for one dimension, for example average delay time by flight number. A multi-measure bar chart shows two or more measures for one dimension, for example sales total and profit total by automobile mode. A clustered bar chart shows values for a dimension grouped by a related dimension, for example sales totals by automobile model, grouped by car maker.

To create a bar chart, use a dimension for the x-axis or y-axis and a measure for the value. The dimension is typically a text field that is related to the measure in some way and can be used to segment it to see more detailed information. You can also use a date field in this way, but in that case we recommend using a line chart because it's better suited to showing changes in a measure over time. Each bar in the chart represents a measure value for an item in the dimension you chose.
Use a *stacked bar chart* to show values for hierarchical data, for example sales total by car model, stacked by car maker. A stacked bar chart uses a scale based on the maximum value for the selected measure.

Use a *100 percent bar chart* to show values for hierarchical data, where you want to emphasize the percentage in relation to a total of 100. A stacked 100 percent bar chart uses a scale of 100 percent.

Bar charts show up to 2500 data points on the axis for visuals that don’t use group or color. For visuals that do use group or color, they show up to 50 data points on the axis and up to 50 data points for group or color. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icons for horizontal bar charts are as follows:

The icons for vertical bar charts are as follows:

**Bar Chart Features**

To understand the features supported by bar charts, use the following table.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes, with exceptions</td>
<td>Multi-measure and clustered bar charts display a legend, while single-measure horizontal bar charts don't.</td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td></td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Showing or hiding axis lines, grid lines, and axis labels</td>
<td>Yes</td>
<td>You can focus on or exclude any bar on the chart, except when you are using a date field as the dimension for the axis. In that case, you can only focus on a bar, not exclude it.</td>
<td>Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>You can focus on or exclude any bar on the chart, except when you are using a date field as the dimension for the axis. In that case, you can only focus on a bar, not exclude it.</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td>You can sort on the fields you choose for the axis and the values.</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 294)</td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>You must apply aggregation to the field or fields you choose for the value, and can't apply aggregation to the fields you choose for the axis or group/color.</td>
<td>Changing Field Aggregation (p. 282)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>Yes</td>
<td>You can add drill-down levels to the axis and Group/Color field wells.</td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)</td>
</tr>
</tbody>
</table>

### Creating a Bar Chart

Use the following procedure to create a bar chart.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the bar chart icon for the type of bar chart you want to create.
4. From the **Fields list** pane, choose the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.
   - To create a single-measure bar chart, use one measure in the **Value** field well.
Using Box Plots

Use a box plot to visualize how data is distributed across an axis or over time, for example flights delayed over a 7 day time period. Box plots, also known as box and whisker plots, display data pooled from multiple sources into one visual, helping you make data-driven decisions. Typically, a box plot details information in quarters: the minimum value, lower quartile, median, upper quartile, and the maximum value.

The icon for a box plot is as follows.

Use the following procedure to create a box plot visual.

To create a basic box plot visual

2. Open Amazon QuickSight and choose Analyses on the navigation pane at left.
3. Choose one of the following:
   - To create a new analysis, choose New analysis at upper right. For more information, see Creating an Analysis (p. 179).
   - To use an existing analysis, choose the analyses that you want to edit.
4. Choose Add, Add visual.
5. At lower left, choose the box plot icon from Visual types.
6. On the Fields list pane, choose the fields that you want to use for the appropriate field wells. Box plots require at least one unique measure field.
7. (Optional) Add drill-down layers by dragging one or more additional fields to the Group/Color field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

To understand the features supported by box plots, see Format Options Available in Analytics (p. 271). For customization options, see Formatting a Visual in Amazon QuickSight (p. 256).

Using Combo Charts

Using a combo chart, you can create one visualization that shows two different types of data, for example trends and categories. Combo charts are also known as line and column (bar) charts, because they combine a line chart with a bar chart. Bar charts are useful for comparing categories. Both bar charts and Line charts are useful for displaying changes over time, although bar charts should show a greater difference between changes.
Amazon QuickSight supports the following types of combo charts:

- **Clustered bar combo charts** – display sets of single-color bars where each set represents a parent dimension and each bar represents a child dimension. Use this chart to make it easy to determine values for each bar.

- **Stacked bar combo charts** – display multi-color bars where each bar represents a parent dimension and each color represents a child dimension. Use this chart to make it easy to see relationships between child dimensions within a parent dimension. This chart shows the total value for the parent dimension and how each child adds to the total value. To determine the value for each child dimension, the chart reader must compare the size of the color section to the data labels for that axis.

Both types of combo chart require only one dimension on the **X axis**, but are usually more effective when also displaying at least one measure under **Lines**.

You should only use a combo chart if you want to show a relationship between the bars and the lines. A good rule of thumb is that if you need to explain how the two chart types relate, you should probably use two separate charts instead.

Because each chart works differently, it can be helpful to understand the following points before you begin:

- The data points in each series render on different scales. Combo charts use a scale based on the maximum value for the selected measure.
- The distance between the numbers on the axis won't match between the lines and bars, even if you select the same scale for each chart type.
- For clarity, try to use different units for the measure in each data series.

The combo chart is like using two different types of visualization at the same time. You should make sure the data in the bars (or columns) directly relates to the data in the line or lines. This relationship is not technically enforced by the tool, so it's essential that you determine this relationship yourself. Without some relation between the lines and bars, the visual loses meaning.

You can use the combo chart visual type to create a single-measure or single-line chart. A single-measure combo chart shows one measure for one dimension.
To create a multi-measure chart, you can choose to add multiple lines, or multiple bars. A multi-measure bar chart shows two or more measures for one dimension. You can group the bars in clusters, or stack them.

For the bars, use a dimension for the axis and a measure for the value. The dimension is typically a text field that is related to the measure in some way and can be used to segment it to see more detailed information. Each bar in the chart represents a measure value for an item in the dimension you chose.

Bars and lines show up to 2500 data points on the axis for visuals that don't use group or color. For visuals that do use group or color, bars show up to 50 data points on the axis and up to 50 data points for group or color, while lines show 200 data points on the axis and up to 25 data points for group or color. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icons for combo charts are as follows.

![Combo Chart Features](image)

### Combo Chart Features

To understand the features supported by combo charts, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes, with exceptions</td>
<td>Multi-measure combo charts display a legend, and single-measure combo charts don't.</td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td>You can set the range for the axis.</td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Showing or hiding axis lines, grid lines, and axis labels</td>
<td>Yes</td>
<td></td>
<td>Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>You can focus on or exclude any bar on the chart, except when you are using a date field</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
</tbody>
</table>
## Creating a Combo Chart

Use the following procedure to create a combo chart.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose one of the combo chart icons.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value. You can create combo charts as follows:
   - Choose a dimension for the **X axis**.
   - To create a single-measure combo chart, choose one measure for either **Bars** or **Lines**.
   - To create a multi-measure combo chart, choose two or more measures for the **Bars** or **Lines** field well.
   - Optionally, add a dimension to the **Group/Color** field well. If you have a field in **Group/Color**, you can't have more than one field under **Bars**.

### Feature | Supported? | Comments | For More Information
--- | --- | --- | ---
Excluding Visual Elements (p. 255)
Sorting Visual Data in Amazon QuickSight (p. 294)
Changing Field Aggregation (p. 282)
Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)
Changing Range and Scale in Your Visuals (p. 266)
5. (Optional) Add drill-down layers by dragging one or more additional fields to the X axis or Group/Color field wells. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

Using Donut Charts

Use donut charts to compare values for items in a dimension. The best use for this type of chart is to show a percentage of a total amount.

Each wedge in a donut chart represents one value in a dimension. The size of the wedge represents the proportion of the value for the selected measure that the item represents compared to the whole for the dimension. Donut charts are best when precision isn't important and there are few items in the dimension.
The following screenshot shows an example of a donut chart.

To learn how to use donut charts in Amazon QuickSight, you can watch this video:

**Using Donut Charts**

To create a donut chart, use one dimension in the **Group/Color** field well. With only one field, the chart displays the division of values by row count. To display the division of dimension values by a metric value, you can add a metric field to the **Value** field well.

Donut charts show up to 20 data points for group or color. For more information about how Amazon QuickSight handles data that falls outside display limits, see [Display Limits in Visuals](p. 326).

The icon for a donut chart is as follows.

### Donut Chart Features

To understand the features supported by donut charts, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
</tbody>
</table>
## Creating a Donut Chart

Use the following procedure to create a donut chart.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the donut chart icon.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.

To create a donut chart, drag a dimension to the **Group/Color** field well. Optionally, drag a measure to the **Value** field well.
5. (Optional) Add drill-down layers by dragging one or more additional fields to the **Group/Color** field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

### Using Filled Maps

A filled map, also known as *choropleth map*, is used to visualize data over a geographical area. In a filled map, regions are represented in varying shades, colors, or patterns in relation to a data variable. The data must show a clear regional pattern.

Filled maps are often useful for representing statistical data across a geographical region. For example, a map of the average family size in a neighborhood.

The icon for a filled map is as follows.

![Filled Map Icon]

**To create a basic filled map visual**

1. Open Amazon QuickSight and choose **Analyses** on the navigation pane at left.
2. Choose one of the following:
   - To create a new analysis, choose **New analysis** at upper right. For more information, see Creating an Analysis (p. 179).
   - To use an existing analysis, choose the analysis that you want to edit.
3. Choose **Add (＋), Add Visual**.
4. At lower left, choose the filled map icon from **Visual types**.
5. On the **Fields list** pane, choose the fields that you want to use for the appropriate field wells. Filled maps require one geospatial field in **Location**, for example, State, County, or Zip Code.
6. (Optional) Add drill-down layers by dragging one or more additional fields to the **Group/Color** field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

To understand the features supported by filled maps, see Format Options Available in Analytics (p. 271). For customization options, see Formatting a Visual in Amazon QuickSight (p. 256).

### Using Funnel Charts

Use a funnel chart to visualize data that moves across multiple stages in a linear process. In a funnel chart, each stage of a process is represented in blocks of different shapes and colors. The first stage, known as the **head**, is the largest block and is followed by the smaller stages, known as the **neck**, in a funnel shape. The size of the block representing each stage in a funnel chart is a percentage of the total, and is proportionate to its value. The bigger the size of the block, the bigger its value.

Funnel charts are often useful in business contexts because you can view trends or potential problem areas in each stage, such as bottlenecks. For example, they can help you visualize the amount of the potential revenue in each stage of a sale, from first contact to final sale and on through maintenance.

The icon for a funnel chart is as follows.
To create a basic funnel chart visual

1. Open Amazon QuickSight and choose Analyses on the navigation pane at left.
2. Choose one of the following:
   - To create a new analysis, choose New analysis at upper right. For more information, see Creating an Analysis (p. 179).
   - To use an existing analysis, choose the analysis that you want to edit.
3. Choose Add (+), Add Visual.
4. At lower left, choose the funnel chart icon from Visual types.
5. On the Fields list pane, choose the fields that you want to use for the appropriate field wells. Funnel charts require one dimension in Group.
6. (Optional) Add drill-down layers by dragging one or more additional fields to the Group/Color field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

To understand the features supported by funnel charts, see Format Options Available in Analytics (p. 271). For customization options, see Formatting a Visual in Amazon QuickSight (p. 256).

Using Gauge Charts

Use gauge charts to compare values for items in a measure. You can compare them to another measure or to a custom amount.

A gauge chart is similar to a non-digital gauge, for example a gas gauge in an automobile. It displays how much there is of the thing you are measuring. In a gauge chart, this measurement can exist alone or in relation to another measurement. Each color section in a gauge chart represents one value. In the following example, we are comparing actual sales to the sales goal, and the gauge shows that we must sell an additional 33.27% to meet the goal.

The following screenshot shows an example of a gauge chart.
To learn how to use gauge charts in Amazon QuickSight, you can watch this video:

Using Gauge Charts

To create a gauge chart, you need to use at least one measure. Put the measure in the Value field well. If you want to compare two measures, put the additional measure in the Target value field well. If you want to compare a single measure to a target value that isn't in your dataset, you can use a calculated field that contains a fixed value.

You can choose a variety of formatting options for the gauge chart, including the following settings in Format visual.

- **Value displayed** – Hide value, display actual value, or display a comparison of two values
- **Comparison method** – Compare values as a percent, the actual difference between values, or difference as a percent
- **Axis style** –
  - **Show axis label** – Show or hide the axis label
  - **Range** – The numeric minimum and maximum range to display in the gauge chart
  - **Reserve padding (%)** – Added to the top of the range (target, actual value, or max)
- **Arc style** – Degrees the arc displays (180° to 360°)
- **Thickness** – Thickness of the arc (small, medial, or large)

The icon for a gauge chart is as follows.
Gauge Chart Features

To understand the features supported by gauge charts, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formatting gauge</td>
<td>Yes</td>
<td>You can customize the value displayed, the comparison method, the axis style, the arc style, and the thickness of the gauge.</td>
<td></td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td>The foreground color the filled area; it represents the <strong>Value</strong>. The background color the unfilled area; it represents the <strong>Target value</strong> if one is selected.</td>
<td></td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Creating a Gauge Chart

Use the following procedure to create a gauge chart.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the gauge chart icon.
4. From the Fields list pane, drag the fields that you want to use to the appropriate field wells. To create a gauge chart, drag a measure to the Value field well. To add a comparison value, drag a different measure to the Target value field well.

Using Geospatial Charts (Maps)

Use geospatial charts to show differences in data values across a geographical map. The map allows you to zoom in and out. As you zoom in closer, you can see more geographical features. The map retains the chosen zoom level and size.

Each circle represents a geographical location on the map chart. This can be latitude and longitude, or geographical components such as state or city. The size of the circles represents the magnitude of the field in the Size well, in relation to other values in the same field. The color of the circles represents the values in the Color well. The field in the Color well displays in the legend, if you choose to display one.

Here is a sample of a map chart. The latitude, longitude, country, state, and city are identified by a place marker icon, showing that they are a geospatial data type. State and city are inside of a hierarchy named Geo. Data types must be correctly configured in the dataset before geospatial mapping can work. Predefined hierarchies, called geospatial groupings, are optional. They allow Amazon QuickSight to resolve locations on the map, in case of any ambiguities. If the data types are correct, the mapping can work for supported geographies without geospatial groupings.

For more information about setting up geospatial data types and hierarchies, see Adding Geospatial Data (p. 163).

Important
Geospatial charts in Amazon QuickSight currently aren't supported in some geographies, including India and China. We are working on adding support for more regions. For now, automatic geocoding works only for US locations. However, you can add latitude and longitude coordinates to your data to make geospatial charts. For help with geospatial issues, see Geospatial Troubleshooting (p. 169).
To understand the features supported by geospatial maps, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displaying a legend</td>
<td>Yes</td>
<td>Displays contents of the field in the Color well</td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Partial</td>
<td>You can change the color of the circles on the map, but not for individual values.</td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>Yes</td>
<td>You can add drill-down levels to the Geospatial and Color field wells.</td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)</td>
</tr>
</tbody>
</table>

**Using Heat Maps**

Use heat maps to show a measure for the intersection of two dimensions, with color-coding to easily differentiate where values fall in the range. Heat maps can also be used to show the count of values for the intersection of the two dimensions.

Each rectangle on a heat map represents the value for the specified measure for the intersection of the selected dimensions. Rectangle color represents where the value falls in the range for the measure, with darker colors indicating higher values and lighter colors indicating lower ones.

Heat maps and pivot tables display data in a similar tabular fashion. Use a heat map if you want to identify trends and outliers, because the use of color makes these easier to spot. Use a pivot table if you want to further analyze data on the visual, for example by changing column sort order or applying aggregate functions across rows or columns.

To create a heat map, choose at least two fields of any data type. Amazon QuickSight populates the rectangle values with the count of the x-axis value for the intersecting y-axis value. Typically, you choose a measure and two dimensions.

For example, the following heat map shows which products are most used by the customers in these countries, measured by a simple count.
Heat maps show up to 50 data points for rows and up to 50 data points for columns. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icon for a heat map is as follows.

**Heat Map Features**

To understand the features supported by heat maps, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
</tbody>
</table>
### Creating a Heat Map

Use the following procedure to create a heat map.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the heat map icon.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.

   To create a heat map, drag a dimension to the **Rows** field well, a dimension to the **Columns** field well, and a measure to the **Values** field well.

5. (Optional) Add drill-down layers by dragging one or more additional fields to the **Rows** or **Columns** field wells. For more information about adding drill-downs, see [Adding Drill-Downs to Visual Data in Amazon QuickSight](p. 317).

### Using Histograms

Use a histogram chart in Amazon QuickSight to display the distribution of continuous numerical values in your data. Amazon QuickSight uses un-normalized histograms, which use an absolute count of the data points or events in each bin.

To create a histogram, you use one measure. A new histogram initially displays ten *bins* (also called *buckets*) across the X-axis. These appear as bars on the chart. You can customize the bins to suit your dataset. The Y-axis displays the absolute count of the values in each bin.
Make sure that you adjust the format settings so that you have a clearly identifiable shape. If your data contains outliers, this becomes clear if you spot one or more values off to the side of the X-axis. For information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icon for histograms is as follows.

![Histogram Icon](image)

### Histogram Features

To understand the features supported by histograms, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>No</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>No</td>
<td>However, you can change the bin count or the bin interval width (range of distribution).</td>
<td></td>
</tr>
<tr>
<td>Showing or hiding axis lines, grid</td>
<td>Yes</td>
<td></td>
<td>Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)</td>
</tr>
</tbody>
</table>
## Using Histograms

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>lines, and axis labels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>No</td>
<td>Histograms use only the count aggregation.</td>
<td></td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Creating a Histogram

Use the following procedure to create a histogram.

**To create a histogram**

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the histogram icon:

![Histogram Icon](image)

4. On the **Fields list** pane, choose the field that you want to use in the **Value** field well. A **Count** aggregate is automatically applied to the value.

   The resulting histogram shows the following:

   - The X-axis displays 10 bins by default, representing the intervals in the measure that you choose. You can customize the bins in the next step.
   - The Y-axis displays the absolute count of individual values in each bin.

5. (Optional) Choose **Format** on the visual control to change the histogram format. You can format the bins either by count or width, not both together. The count setting changes how many bins display. The width setting changes how wide or long of an interval each bin contains.

### Formatting a Histogram

Use the following procedure to format a histogram.
To format a histogram

1. Choose the histogram chart that you want to work with. It should be the highlighted selection. The visual controls display on the top right of the histogram.
2. Choose the cog icon on the visual control menu to view the Format visual options.
3. On the Format visual pane, set the following options to control the display of the histogram:
   - **Histogram** settings. Chose one of the following settings:
     - Bin count (option 1): The number of bins that display on the X-axis.
     - Bin width (option 1): The width (or length) of each interval. This setting controls the number of items or events to include in each bin. For example, if your data is in minutes, you can set this to 10 to show 10-minute intervals.
   - With the following settings, you can explore the best way to format the histogram for your dataset. For example, in some cases, you might have a tall peak in one bin, while most of the other bins look sparse. This isn't a useful view. You can use the following settings individually or together:
     - Change the **Number of data points displayed** in the X-axis settings.
     - Enable **Logarithmic scale** in the Y-axis settings.
     - Display **Data labels**.

   Amazon QuickSight displays up to 100 bins (buckets) by default. If you want to display more (up to 1,000), change the X-axis setting for Number of data points displayed.
   - Enable **Logarithmic scale** in the Y-axis settings.

   Sometimes your data doesn't fit the shape that you want and this can provide misleading results. For example, if the shape is skewed so far to the right that you can't read it properly, you can apply a log scale to it. Doing this doesn't normalize your data; however, it does reduce the skew.
   - Display **Data labels**.

   You can enable the display of data labels to see the absolute counts in the chart. Even if you don't want to display these in most cases, you can enable them while you're developing an analysis. The labels can help you decide on formatting and filtering options because they reveal counts in bins that are too small to stand out.

   To see all the data labels, even if they overlap, enable Allow labels to overlap.
4. (Optional) Change other visual settings. For more information, see Formatting a Visual in Amazon QuickSight (p. 256).

Understanding Histograms

Although histograms look similar to bar charts, they are very different. In fact, the only similarity is their appearance because they use bars. On a histogram, each bar is called a **bin** or a **bucket**.

Each bin contains a range of values called an interval. When you pause on one of the bins, details about the interval appear in a tooltip that shows two numbers enclosed in glyphs. The type of enclosing glyphs indicates if the numbers inside them are part of the interval that's inside the selected bin, as follows:

- A square bracket next to a number means that the number is included.
- A parenthesis next to a number means that the number is excluded.

For example, let's say that the first bar in a histogram displays the following notation.

```
[1, 10)
```
The square bracket means that the number 1 is included in the first interval. The parenthesis means that the number 10 is excluded.

In the same histogram, a second bar displays the following notation.

\[ [10, 20) \]

In this case, 10 is included in the second interval, and 20 is excluded. The number 10 can't exist in both intervals, so the notation shows us which one includes it.

**Note**

The pattern used for marking intervals in a histogram comes from standard mathematical notation. The following examples show the possible patterns, using a set of numbers that includes 10, 20, and every number in between.

- \([10, 20]\) – This set is closed. It has hard boundaries on both ends.
- \([10, 21)\) – This set is half open. It has a hard boundary on the left and a soft boundary on the right.
- \((9, 20]\) – This set is half open. It has a soft boundary on the left and a hard boundary on the right.
- \((9, 21)\) – This set is open. It has soft boundaries on both ends.

Because the histogram uses quantitative data (numbers) rather than qualitative data, there's a logical order to the distribution of the data. This is called a *shape*. The shape is often described the qualities the shape possesses, based on the count in each bin. Bins that contain a higher number of values form a *peak*. Bins that contain a lower number of values form a *tail* on the edge of a chart, and a *valley* between peaks. Most histograms fall into one of the following shapes:

- Asymmetrical or *skewed* distributions have values that cluster near the left or the right—the low or high end of the X-axis. The direction of skewness is defined by where the longer tail of the data is, not by where the peak is. It's defined this way because this direction also describes the location of the mean (average). In skewed distributions, the mean and the median are two different numbers. The different types of skewed distribution are as follows:
  - *Negatively skewed* or *left* skewed – A chart that has the mean to the left of the peak. It has a longer tail to the left and a peak to the right, sometimes followed by a shorter tail. The following histogram displays a left skewed distribution.
  
  ![Left Skewed Distribution](image)

  - *Positively skewed* or *right* skewed – A chart that has the mean to the right of the peak. It has a longer tail to the right and a peak to the left, sometimes preceded by a shorter tail. The following histogram displays a right skewed distribution.
Symmetrical or normal distributions have a shape that's mirrored on each side of a center point (for example, a bell curve). In a normal distribution, the mean and the median are the same value. The different types of normal distribution are as follows:

- Normal distribution, aka unimodal – A chart that has one central peak representing the most common value. This is commonly called a bell curve, or a Gaussian distribution. The following histogram displays a normal distribution.

- Bimodal – A chart that has two peaks representing the most common values. The following histogram displays a bimodal distribution.

- Multimodal – A chart that has three or more peaks representing the most common values. The following histogram displays a multimodal distribution.

- Uniform – A chart that has no peaks or valleys, with a relatively equal distribution of data. The following histogram displays a uniform distribution.
The following table shows how a histogram differs from a bar chart.

<table>
<thead>
<tr>
<th><strong>Histogram</strong></th>
<th><strong>Bar chart</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A histogram displays the distribution of values in one field.</td>
<td>A bar chart compares the values in one field, grouped by dimension.</td>
</tr>
<tr>
<td>A histogram sorts values into bins that represent a range of values, for example 1–10, 10–20, and so on.</td>
<td>A bar chart plots values that are grouped into categories.</td>
</tr>
<tr>
<td>The sum of all bins equals exactly 100% of the values in the filtered data.</td>
<td>A bar chart isn't required to display all of the available data. You can change display settings at the visual level. For example, a bar chart might show only the top 10 categories of data.</td>
</tr>
<tr>
<td>Rearranging bars detracts from the meaning of the chart as a whole.</td>
<td>Bars can be in any order without changing the meaning of the chart as a whole.</td>
</tr>
<tr>
<td>There are no spaces between the bars, to represent the fact this is continuous data.</td>
<td>There are spaces between the bars, to represent the fact that this is categorical data.</td>
</tr>
<tr>
<td>If a line is included in a histogram, it represents the general shape of the data.</td>
<td>If a line is included in a bar chart, it's called a combo chart, and the line represents a different measure than the bars.</td>
</tr>
</tbody>
</table>

**Using KPIs**

Use a key performance indicator (KPI) to visualize a comparison between a key value and its target value.

A KPI displays a value comparison, the two values being compared, and a progress bar. For example, the following KPI shows how closely revenue is meeting its forecast.
The icon for a KPI is as follows.

```
```

**KPI Features**

To understand the features supported by the KPI visual type in Amazon QuickSight, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td>You can choose not to display a title.</td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Removing the title</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changing comparison method</td>
<td>Yes</td>
<td>By default, Amazon QuickSight automatically chooses a method. The settings are auto, difference, percent, and difference as percent.</td>
<td></td>
</tr>
<tr>
<td>Changing the primary value displayed</td>
<td>Yes</td>
<td>You can choose comparison (default) or actual.</td>
<td></td>
</tr>
</tbody>
</table>
Creating a KPI

Use the following procedure to create a KPI.

1. Create a new analysis for your dataset.
2. In the **Visual types** pane, choose the KPI icon.
3. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. You must use measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.

   To create a KPI, drag a measure to the **Value** field well. To compare that value to a target value, drag a different measure to the **Target value** field well.

4. (Optional) Choose formatting options by selecting the on-visual menu at the upper-right corner of the visual, then choosing **Format visual**.

Using Line Charts

Use line charts to compare changes in measure values over period of time, for the following scenarios:

- One measure over a period of time, for example gross sales by month.
- Multiple measures over a period of time, for example gross sales and net sales by month.
- One measure for a dimension over a period of time, for example number of flight delays per day by airline.

Line charts show the individual values of a set of measures or dimensions against the range displayed by the Y axis. Area line charts differ from regular line charts in that each value is represented by a colored area of the chart instead of just a line, to make it easier to evaluate item values relative to each other.

The following screenshot shows a line chart.
The following screenshot shows an area line chart. In this version of a line chart, the area between the line and the x-axis is filled with color.

The following screenshot shows a stacked area line chart. In this version of a line chart, the area between the line and the X axis is filled with color. Also, the individual lines are layered to more clearly show the relationships between them. The values on the y-axis show the scale of the differences between data points.
Because a stacked area line chart works differently than other line charts, simplify it if you can. Then the audience won’t try to interpret the numbers. Instead, they can focus on the relationships of each set of values to the whole. One way to simplify is to remove the numbers down the left side of the screen by reducing the step size for the axis. To do this, choose the Options icon from the on-visual menu. In Format Options under Y-axis, enter 2 as the Step size. The following screenshot shows the result.
Each line on the chart represents a measure value over a period of time. You can interactively view the values on the chart, as shown in the following screenshot. Hover over any line (1 in the screenshot) to see a pop-up legend that shows the values for each line on the X axis. If you hover over a data point (2), you can see the Value for that specific point on the X axis.

Use line charts to compare changes in values for one or more measures or dimensions over a period of time.

In regular line charts, each value is represented by a line, and in area line charts each value is represented by a colored area of the chart.

Use stacked area line charts to compare changes in values for one or more groups of measures or dimensions over a period of time. Stacked area line charts show the total value for each group on the x-axis. They use color segments to show the values of each measure or dimension in the group.

Line charts show up to 2,500 data points on the x-axis when no color field is selected. When color is populated, line charts show up to 200 data points on the x-axis and up to 25 data points for color. For more information about data that falls outside the display limit for this visual type, see Display Limits in Visuals (p. 326).

The icons for line charts are as follows.
## Line Chart Features

To understand the features supported by line charts, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td>You can set the range for the Y axis.</td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Showing or hiding axis lines,</td>
<td>Yes</td>
<td></td>
<td>Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)</td>
</tr>
<tr>
<td>grid lines, and axis labels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adding a second Y-axis</td>
<td>Yes</td>
<td></td>
<td>Creating a Dual-Axis Line Chart (p. 362)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding</td>
<td>Yes, with</td>
<td>You can focus on or exclude any line on the chart, except in the following</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
<tr>
<td>elements</td>
<td>exceptions</td>
<td>cases:</td>
<td>Excluding Visual Elements (p. 255)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• You create a multi-dimension line chart and use a date field as the</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dimension for the line color.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• You create a measure or multi-measure line chart and use a date field</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>as the dimension for the X axis.</td>
<td></td>
</tr>
</tbody>
</table>
Creating a Line Chart

Use the following procedure to create a line chart.

1. On the analysis page, choose Visualize on the tool bar.
2. Choose Add on the application bar, and then choose Add visual.
3. On the Visual types pane, choose one of the line chart icons.
4. From the Fields list pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the Count aggregate function is automatically applied to it to create a numeric value.
   - To create a single-measure line chart, drag a dimension to the X axis field well and one measure to the Value field well.
   - To create a multi-measure line chart, drag a dimension to the X axis field well and two or more measures to the Value field well. Leave the Color field well empty.
   - To create a multi-dimension line chart, drag a dimension to the X axis field well, one measure to the Value field well, and one dimension to the Color field well.
5. (Optional) Add drill-down layers by dragging one or more additional fields to the X axis or Color field wells. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

Creating a Dual-Axis Line Chart

If you have two or more metrics that you want to display in the same line chart, you can create a dual-axis line chart.

A dual-axis chart is a chart with two Y-axes (one axis at the left of the chart, and one axis at the right of the chart). For example, let's say you create a line chart. It shows the number of visitors who signed up for a mailing list and for a free service over a period of time. If the scale between those two measures varies widely over time, your chart might look something like the following line chart. Because the scale between measures varies so greatly, the measure with the smaller scale appears nearly flat at zero.
If you want to show these measures in the same chart, you can create a dual-axis line chart. The following is an example of the same line chart with two Y-axes.

Use the following procedure to create a dual-axis line chart.

**To create a dual-axis line chart**

1. In your analysis, create a line chart. For more information about creating line charts, see Creating a Line Chart (p. 362).
2. In the **Value field well**, choose a field drop-down menu, choose **Show on: Left Y-axis**, and then choose **Right Y-axis**.
Alternatively, you can create a dual-axis line chart using the **Format Visual** pane:

a. On the menu in the upper-right corner of the line chart, choose the **Format visual** icon.

b. In the **Format visual** pane that opens at left, choose **Data series**.

c. In the **Data series** section, choose the **Show on right axis** icon for the value that you want to place on a separate axis. Use the search bar to quickly find a value if you need to.
The icon updates to indicate that the value is being shown on the right axis. The chart updates with two axes.

The **Format visual** pane updates with the following options:

- To synchronize the Y-axes for both lines back into a single axis, choose **Single Y-axis** at the top of the **Format visual** pane.
- To format the axis at the left of the chart, choose **Left Y-axis**.
- To format the axis at the right of the chart, choose **Right Y-axis**.
For more information about formatting axis lines, see Axis Lines, Axis Labels, and Grid Lines (p. 267). For more information about adjusting the range and scale of an axis, see Range and Scale (p. 266).

Using Pie Charts

Use pie charts to compare values for items in a dimension. The best use for this type of chart is to show a percentage of a total amount.

Each wedge in a pie chart represents one item in the dimension. Wedge size represents the proportion of the value for the selected measure that the item represents compared to the whole for the dimension. Pie charts are best when precision isn’t important and there are few items in the dimension.

To create a donut chart, use one dimension in the Group/Color field well. With only one field, the chart displays the division of values by row count. To display the division of dimension values by a metric value, you can add a metric field to the Value field well.

Pie charts show up to 20 data points for group or color. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icon for a pie chart is as follows.

![Pie Chart Icon](image)

Pie Chart Features

To understand the features supported by pie charts, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding</td>
<td>Yes, with</td>
<td>You can focus on or exclude a wedge in a pie chart, except when you are</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
<tr>
<td>elements</td>
<td>exceptions</td>
<td>using a date field as a dimension. In that case, you can only focus on</td>
<td>Excluding Visual Elements (p. 255)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a wedge, not exclude it.</td>
<td></td>
</tr>
</tbody>
</table>
Creating a Pie Chart

Use the following procedure to create a pie chart.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the pie chart icon.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.

   To create a pie chart, drag a dimension to the **Group/Color** field well. Optionally, drag a measure to the **Value** field well.

5. (Optional) Add drill-down layers by dragging one or more additional fields to the **Group/Color** field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

Using Pivot Tables

Use pivot tables to show measure values for the intersection of two dimensions.

Heat maps and pivot tables display data in a similar tabular fashion. Use a heat map if you want to identify trends and outliers, because the use of color makes these easier to spot. Use a pivot table if you want to analyze data on the visual.

To create a pivot table, choose at least one field of any data type, and choose the pivot table icon. Amazon QuickSight creates the table and populates the cell values with the count of the column value for the intersecting row value. Typically, you choose a measure and two dimensions measurable by that measure.

Pivot tables support infinite scroll down and right. You can add up to 20 fields as rows and 20 fields as columns.

Using a pivot table, you can do the following:

- Specify multiple measures to populate the cell values of the table, so that you can see a range of data
- Cluster pivot table columns and rows to show values for subcategories grouped by related dimension
• Sort values in pivot table rows or columns
• Apply statistical functions
• Add totals and subtotals to rows and columns
• Use infinite scroll
• Transpose fields used by rows and columns

To easily transpose the fields used by the rows and columns of the pivot table, choose the orientation icon near the top right of the visual. To see options for showing and hiding totals and subtotals, formatting the visual, or exporting data to a CSV file, choose the V-shaped icon at top right.

As with all visual types, you can add and remove fields. You can also change the field associated with a visual element, change field aggregation, and change date field granularity. In addition, you can focus on or exclude rows or columns. For more information about how to make these changes to a pivot table, see Changing the Fields Used by a Visual in Amazon QuickSight (p. 275).

For information on formatting pivot tables, see Formatting a Visual in Amazon QuickSight (p. 256).

The icon for a pivot table is as follows.

![Pivot Table Icon]

### Topics

- Pivot Table Features (p. 368)
- Creating a Pivot Table (p. 370)
- Orienting Pivot Table Values (p. 370)
- Expanding and Collapsing Pivot Table Clusters (p. 372)
- Sorting Pivot Tables in Amazon QuickSight (p. 372)
- Using Table Calculations in Pivot Tables (p. 377)
- Pivot Table Limitations (p. 397)
- Pivot Table Best Practices (p. 397)

### Pivot Table Features

Pivot tables don't display a legend.

To understand the features supported by pivot tables, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>No</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Feature</td>
<td>Supported?</td>
<td>Comments</td>
<td>For More Information</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>You can focus on or exclude any column or row, except when you are using a date field as one of the dimensions. In that case, you can only focus on the column or row that uses the date dimension, not exclude it.</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
<tr>
<td>Focusing on Visual Elements (p. 253)</td>
<td>No</td>
<td></td>
<td>Excluding Visual Elements (p. 255)</td>
</tr>
<tr>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td>You can sort fields in the Rows or Columns field wells alphabetically or by a metric in ascending or descending order.</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 294)</td>
</tr>
<tr>
<td>Sorting Pivot Tables in Amazon QuickSight (p. 372)</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>You must apply aggregation to the field or fields you choose for the value. You can't apply aggregation to the fields that you choose for the rows or columns.</td>
<td>Changing Field Aggregation (p. 282)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td></td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)</td>
</tr>
<tr>
<td>Showing and hiding totals and subtotals</td>
<td>Yes</td>
<td>You can show or hide totals and subtotals for rows and columns. Metrics automatically roll up to show subtotals when you collapse a row or column. If you use a table calculation, use aggregates to display roll-ups.</td>
<td></td>
</tr>
<tr>
<td>Exporting or copying data</td>
<td>Yes</td>
<td>You can export all of the data to a CSV file. You can select and copy the content of the cells.</td>
<td>Exporting Data (p. 247)</td>
</tr>
</tbody>
</table>
Creating a Pivot Table

Use the following procedure to create a pivot table.

1. On the analysis page, choose Visualize on the tool bar.
2. Choose Add on the application bar, and then choose Add visual.
3. On the Visual types pane, choose the pivot table icon.
4. From the Fields list pane, choose the fields that you want to include. Amazon QuickSight automatically places these into the field wells.

To change the placement of a field, drag it to the appropriate field wells. Typically, you use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the Count aggregate function is automatically applied to it to create a numeric value.

- To create a single-measure pivot table, drag a dimension to the Rows field well, a dimension to the Columns field well, and a measure to the Values field well.
- To create a multi-measure pivot table, drag a dimension to the Rows field well, a dimension to the Columns field well, and two or more measures to the Values field well.
- To create a clustered pivot table, drag one or more dimensions to the Rows field well, one or more dimensions to the Columns field well, and a measure to the Values field well.

You can also select multiple fields for all of the pivot table field wells if you want to. Doing this combines the multi-measure and clustered pivot table approaches.

Note
To view roll-ups for calculated fields, make sure that you are using aggregates. For example, a calculated field with field-1 / field-2 doesn't display a summary when rolled up. However, sum(field-1) / sum(field-2) does display a roll-up summary.

Orienting Pivot Table Values

You can choose to display a pivot table in a columnar or row-based format. Columnar is the default. When you change to a row-based format, a column with the value name is added to the right of the row header column.

Use the following procedure to change a pivot table format.

1. On the analysis page, choose the pivot table visual that you want to edit.
2. Expand the Field wells pane by choosing the field wells at the top of the visual.

3. On the Values field well, choose one of the following options:
   - Choose Column for a columnar format.
• Choose **Row** for a row format.

**Note**
If you use only one metric, you can eliminate the repeated header by formatting the visual and styling it with the **Hide single metric** option. For more information, see Customizing Style and Font (p. 265).
Expanding and Collapsing Pivot Table Clusters

If you are using grouped columns or rows in a pivot table, you can expand or collapse a group to show or hide its data in the visual.

Use the following procedure to expand or collapse a pivot table group.

1. On the analysis page, choose the pivot table visual that you want to edit.
2. Choose one of the following:
   • To collapse a group, choose the collapse icon near the name of the field.
   • To expand a group, choose the expand icon near the name of the field. The collapse icon shows a minus sign. The expand icon shows a plus sign.

In the following screenshot, Customer Region and the Enterprise segment are expanded, and SMB and Startup are collapsed. When a group is collapsed, its data is summarized in the row or column.

Sorting Pivot Tables in Amazon QuickSight

In Amazon QuickSight, you can sort values in a pivot table by fields in the Rows and Columns field wells or quickly by column headers in the pivot table. In pivot tables, you can sort rows and columns independently of each other in alphabetical order, or by a measure.

**Note**
You can't run Total, Difference, and Percent Difference table calculations when a pivot table is being sorted by a measure. For more information about using table calculations in pivot tables, see Using Table Calculations in Pivot Tables (p. 377).

Understanding Sorting in Pivot Tables

When you have multiple panes in a pivot table, sorting is applied to each pane independently. For example, the Segment column in the pivot table on the left is being sorted in ascending order by Cost. Given that there are multiple panes, the sort starts over for each pane and the rows within each pane (for Segment) are ordered by lowest to highest cost. The table on the right has the same sort applied, but the sort is being applied across the entire table, as shown following.
When you apply multiple sorts to a pivot table, sorting is applied from the outside dimension to the inside dimension. Consider the following example image of a pivot table. The Customer Region column is sorted by Cost in descending order (as shown in orange). The Channel column is sorted by Revenue Goal in ascending order (as shown in blue).
Sorting Pivot Tables Using Row or Column Headers

Use the following procedure to sort a pivot table using Row or Column headers.

**To sort values in a pivot table using table headers**

1. In a pivot table chart, choose the header that you want to sort.
2. For **Sort by**, choose a field to sort by and a sort order.

   You can sort dimension fields alphabetically a–z or z–a, or you can sort them by a measure in ascending or descending order.

   ![Pivot Table: Segment sorted by Cost in ascending order](image)

**Sorting Pivot Tables Using Value Headers**

Use the following procedure to sort a pivot table using value headers.

**To sort a pivot table using value headers**

1. In a pivot table chart, choose the value header that you want to sort.
2. Choose **Ascending** or **Descending**.
Sorting by value headers in a pivot table also works on subtotals.

**Sorting Pivot Tables Using the Field Wells**

Use the following procedure to sort values in a pivot table using the Field wells.

**To sort values in a pivot table using the Field wells**

1. On the analysis page, choose the pivot table that you want to sort.
2. Expand the **Field wells**.
3. In the **Rows** or **Columns** field well, choose the field that you want to sort, and then choose how you want to sort the field for **Sort by**.

You can sort dimension fields in the **Rows** or **Columns** field wells alphabetically from a–z or z–a, or you can sort them by a measure in ascending or descending order. You also have the option to collapse all or expand all rows or columns for the field you choose in the field well. You can also remove the field, or to replace it with another field.

- To sort a dimension field alphabetically, hover your cursor over the field in the **Rows** or **Columns** field well, and then choose the a–z or z–a sort icon.
To sort a dimension field by a measure, hover your cursor over the field in the **Rows** or **Columns** field well. Then choose a measure from the list, and then choose the ascending or descending sort icon.

Or, if you want more control over how the sort is applied to the pivot table, customize the sort options.

**To create a sort using the sort options**

1. On the analysis page, choose the pivot table that you want to sort.
2. Expand **Field wells**.
3. Choose the field that you want to sort in the **Rows** or **Columns** field well, and then choose **Sort options**.
4. In the **Sort options** pane that opens at left, specify the following options:
   a. For **Sort by**, choose a field from the drop-down list.
   b. For **Aggregation**, choose an aggregation from the list.
   c. For **Sort order**, select **Ascending** or **Descending**.
   d. Choose **Apply**.
Using Table Calculations in Pivot Tables

You can use table calculations to apply statistical functions to pivot table cells that contain measures (numeric values). Use the following sections to understand which functions you can use in calculations, and how to apply or remove them.

The data type of the cell value automatically changes to work for your calculation. For example, say that you apply the Rank function to a currency data type. The values display as integers rather than currency, because rank isn't measured as currency. Similarly, if you apply the Percent difference function instead, the cell values display as percentages.

Topics
- Adding and Deleting Pivot Table Calculations (p. 377)
- Functions for Pivot Table Calculations (p. 380)
- Ways to Apply Pivot Table Calculations (p. 386)

Adding and Deleting Pivot Table Calculations

Use the following procedures to add, modify, and remove table calculation on a pivot table.

Topics
- Adding a Pivot Table Calculation (p. 377)
- Changing How a Calculation Is Applied (p. 378)
- Removing a Calculation (p. 379)

Adding a Pivot Table Calculation

Use the following procedure to add a table calculation to a pivot table.

1. Expand the Field wells pane by choosing the field wells at the top of the visual.

2. Choose the field in the Values well that you want to apply a table calculation to, choose Add table calculation, and then choose the function to apply.
Note
You can’t run Total, Difference, and Percent Difference table calculations when a pivot table is being sorted by a measure. To use these table calculations, remove the sort from the pivot table.

Changing How a Calculation Is Applied

Use the following procedure to change the way a table calculation is applied to a pivot table.

1. Expand the Field wells pane by choosing field wells at the top of the visual.

2. Choose the field in the Values well that has the table calculation that you want to change, choose Calculate as, and then choose the way that you want the calculation applied.
Removing a Calculation

Use the following procedure to remove a table calculation from a pivot table.

1. Expand the Field wells pane by choosing the field wells at the top of the visual.

2. Choose the field in the Values well that you want to remove the table calculation from, and then choose Remove calculation.
You can use the following functions in pivot table calculations.

**Topics**
- Running Total (p. 380)
- Difference (p. 381)
- Percentage Difference (p. 382)
- Percent of Total (p. 383)
- Rank (p. 384)
- Percentile (p. 385)

**Running Total**

The *Running total* function calculates the sum of a given cell value and the values of all cells prior to it. This sum is calculated as $Cell_1 = Cell_1$, $Cell_2 = Cell_1 + Cell_2$, $Cell_3 = Cell_1 + Cell_2 + Cell_3$, and so on. For example, suppose that you have the following data.
Applying the **Running total** function across the table rows, using **Table across** for **Calculate as**, gives you the following results.

**Difference**

The **Difference** function calculates the difference between a cell value and value of the cell prior to it. This difference is calculated as $Cell1=Cell1-null$, $Cell2=Cell2-Cell1$, $Cell3=Cell3-Cell2$, and so on. Because $Cell1-null = null$, the $Cell1$ value is always empty. For example, suppose that you have the following data.
Applying the Difference function across the table rows, using Table across for Calculate as, gives you the following results.

Percentage Difference

The Percentage Difference function calculates the percent difference between a cell value and the value of the cell prior to it, divided by the value of the cell prior to it. This value is calculated as Cell1=(Cell1-null)/null, Cell2=(Cell2-Cell1)/Cell1, Cell3=(Cell3/Cell2)/Cell2, and so on. Because (Cell1-null)/null = null, the Cell1 value is always empty. For example, take the following rows.
Applying the **Percentage Difference** function across the table rows, using **Table across** for **Calculate as**, gives you the following results.

**Percent of Total**

The **Percent of Total** function calculates the percentage the given cell represents of the sum of all of the cells included in the calculation. This percentage is calculated as $\text{Cell1} = \text{Cell1} / (\text{sum of all cells})$, $\text{Cell2} = \text{Cell2} / (\text{sum of all cells})$, and so on. For example, suppose that you have the following data.
Applying the **Percent of Total** function across the table rows, using **Table across** for **Calculate as**, gives you the following results.

**Rank**

The **Rank** function calculates the rank of the cell value compared to the values of the other cells included in the calculation. Rank always shows the highest value equal to 1 and lowest value equal to the count of cells included in the calculation. If there are two or more cells with equal values, they receive the same rank but are considered to take up their own spots in the ranking. Thus, the next highest value is pushed down in rank by the number of cells at the rank above it, minus one. For example, if you rank the values 5,3,3,4,3,2, their ranks are 1,3,3,2,3,6.

For example, suppose that you have the following data.
Applying the **Rank** function across the table rows, using **Table across** for **Calculate as**, gives you the following results.

**Percentile**

The **Percentile** function calculates the percent of the values of the cells included in the calculation that are at or below the value for the given cell.

This percent is calculated as follows.

\[
\text{percentile rank}(x) = 100 \times \frac{B}{N}
\]

Where:
- \( B \) = number of scores below \( x \)
- \( N \) = number of scores

For example, suppose that you have the following data.
Applying the Percentile function across the table rows, using Table across for Calculate as, gives you the following results.

Ways to Apply Pivot Table Calculations

You can apply table calculations in the ways described following. Table calculations are applied to only one field at a time. Thus, if you have a pivot table with multiple values, calculations are only applied to the cells representing the field that you applied the calculation to.

Topics
- Table Across (p. 387)
- Table Down (p. 387)
- Table Across Down (p. 388)
- Table Down Across (p. 390)
- Group Across (p. 391)
- Group Down (p. 393)
- Group Across Down (p. 394)
- Group Down Across (p. 395)
Table Across

Using **Table across** applies the calculation across the rows of the pivot table, regardless of any grouping. This application is the default. For example, take the following pivot table.

![Sum of Billed Amount by Customer Region, Date, and Consumption Channel](image)

Applying the **Running total** function using **Table across** gives you the following results, with row totals in the last column.

![Sum of Billed Amount by Customer Region, Date, and Consumption Channel](image)

Table Down

Using **Table down** applies the calculation down the columns of the pivot table, regardless of any grouping. For example, take the following pivot table.
Applying the **Running total** function using **Table down** gives you the following results, with column totals in the last row.

![Table Down Example](image)

**Table Across Down**

Using **Table across down** applies the calculation across the rows of the pivot table, and then takes the results and reapplies the calculation down the columns of the pivot table. For example, take the following pivot table.
Applying the **Running total** function using **Table across down** gives you the following results. In this case, totals are summed both down and across, with the grand total in the lower-right cell.

In this case, suppose that you apply the **Rank** function using **Table across down**. Doing so means that the initial ranks are determined across the table rows and then those ranks are in turn ranked down the columns. This approach gives you the following results.
**Table Down Across**

Using **Table down across** applies the calculation down the columns of the pivot table. It then takes the results and reapplyes the calculation across the rows of the pivot table. For example, take the following pivot table.

You can apply the **Running total** function using **Table down across** to get the following results. In this case, totals are summed both down and across, with the grand total in the bottom right cell.
You can apply the Rank function using **Table down across** to get the following results. In this case, the initial ranks are determined down the table columns. Then those ranks are in turn ranked across the rows.

**Group Across**

Using **Group across** applies the calculation across the rows of the pivot table within group boundaries, as determined by the second level of grouping applied to the columns. For example, if you group by field-2 and then by field-1, grouping is applied at the field-2 level. If you group by field-3, field-2, and field-1, grouping is again applied at the field-2 level. When there is no grouping, **Group across** returns the same results as **Table across**.
For example, take the following pivot table where columns are grouped by Service Line and then by Consumption Channel.

![Sum of Billed Amount by Customer Region, Date, and Consumption Channel](image)

You can apply the Running total function using Group across to get the following results. In this case, the function is applied across the rows, bounded by the columns for each service category group. The Mobile columns display the total for both Consumption Channel values for the given Service Line, for the Customer Region and Date (year) represented by the given row. For example, the highlighted cell represents the total for the APAC region for 2012, for all Consumption Channel values in the Service Line named Billing.

![Sum of Billed Amount by Customer Region, Date, Service Line, and Consumption Channel](image)
Group Down

Using **Group down** applies the calculation down the columns of the pivot table within group boundaries, as determined by the second level of grouping applied to the rows. For example, if you group by field-2 and then by field-1, grouping is applied at the field-2 level. If you group by field-3, field-2, and field-1, grouping is again applied at the field-2 level. When there is no grouping, **Group down** returns the same results as **Table down**.

For example, take the following pivot table where rows are grouped by Customer Region and then by Date (year).

![Pivot Table Example](image)

You can apply the **Running total** function using **Group down** to get the following results. In this case, the function is applied down the columns, bounded by the rows for each Customer Region group. The 2014 rows display the total for all years for the given Customer Region, for the Service Line and Consumption Channel represented by the given column. For example, the highlighted cell represents the total the APAC region, for the Billing service for the Mobile channel, for all the Date values (years) that display in the report.
### Group Across Down

Using **Group across down** applies the calculation across the rows within group boundaries, as determined by the second level of grouping applied to the columns. Then the function takes the results and reapplies the calculation down the columns of the pivot table. It does so within group boundaries as determined by the second level of grouping applied to the rows.

For example, if you group a row or column by field-2 and then by field-1, grouping is applied at the field-2 level. If you group by field-3, field-2, and field-1, grouping is again applied at the field-2 level. When there is no grouping, **Group across down** returns the same results as **Table across down**.

For example, take the following pivot table where columns are grouped by **Service Line** and then by **Consumption Channel**. Rows are grouped by **Customer Region** and then by **Date (year)**.

![Sum of Billed Amount by Customer Region, Date, Service Line, and Consumption Channel](image1)

### Sum of Billed Amount by Customer Region, Date, Service Line, and Consumption Channel

<table>
<thead>
<tr>
<th>Customer Region</th>
<th>Date</th>
<th>Service Line</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Billing</strong></td>
<td><strong>API</strong></td>
<td><strong>Mobile</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Marketing</strong></td>
<td><strong>API</strong></td>
<td><strong>Mobile</strong></td>
</tr>
<tr>
<td><strong>APAC</strong></td>
<td>2012</td>
<td>$23K</td>
<td>$5K</td>
<td>$158K</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>$68K</td>
<td>$158K</td>
<td>$3K</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>$149K</td>
<td><strong>$337K</strong></td>
<td>$34K</td>
</tr>
<tr>
<td><strong>EMEA</strong></td>
<td>2012</td>
<td>$22K</td>
<td>$68K</td>
<td>$178K</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>$72K</td>
<td>$178K</td>
<td>$4K</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>$194K</td>
<td>$438K</td>
<td>$70K</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td>2012</td>
<td>$43K</td>
<td>$97K</td>
<td>$148K</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>$157K</td>
<td>$868K</td>
<td>$14K</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>$570K</td>
<td>$861K</td>
<td>$124K</td>
</tr>
</tbody>
</table>

![Sum of Billed Amount by Customer Region, Date, and Consumption Channel](image2)

### Sum of Billed Amount by Customer Region, Date, and Consumption Channel

<table>
<thead>
<tr>
<th>Customer Region</th>
<th>Date</th>
<th>Consumption Channel</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Web</strong></td>
<td><strong>Mobile</strong></td>
<td><strong>API</strong></td>
</tr>
<tr>
<td><strong>APAC</strong></td>
<td>2014</td>
<td>$589K</td>
<td>$410K</td>
<td>$186K</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>$1,137K</td>
<td>$796K</td>
<td>$361K</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>$1,997K</td>
<td>$1,379K</td>
<td>$639K</td>
</tr>
<tr>
<td><strong>EMEA</strong></td>
<td>2014</td>
<td>$932K</td>
<td>$646K</td>
<td>$302K</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>$1,511K</td>
<td>$1,046K</td>
<td>$531K</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>$2,461K</td>
<td>$1,702K</td>
<td>$848K</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td>2014</td>
<td>$1,816K</td>
<td>$1,257K</td>
<td>$539K</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>$3,230K</td>
<td>$2,272K</td>
<td>$963K</td>
</tr>
<tr>
<td></td>
<td>2016</td>
<td>$5,613K</td>
<td>$3,671K</td>
<td>$1,669K</td>
</tr>
</tbody>
</table>
You can apply the **Running total** function using **Group across down** to get the following results. In this case, totals are summed both down and across within the group boundaries. Here, these boundaries are **Service Line** for the columns and **Customer Region** for the rows. The grand total appears in the lower-right cell for the group.

![Sum of Billed Amount by Customer Region, Date, Service Line, and Consumption Channel](image)

You can apply the **Rank** function using **Group across down** to get the following results. In this case, the function is first applied across the rows bounded by each **Service Line** group. The function is then applied again to the results of that first calculation, this time applied down the columns bounded by each **Customer Region** group.

![Sum of Billed Amount by Customer Region, Date, Service Line, and Consumption Channel](image)

**Group Down Across**

*Using **Group down across** applies a calculation down the columns within group boundaries, as determined by the second level of grouping applied to the rows. Then Amazon QuickSight takes the results and reapply the calculation across the rows of the pivot table. Again, it reapply the calculation within group boundaries as determined by the second level of grouping applied to the columns.*
For example, if you group a row or column by field-2 and then by field-1, grouping is applied at the field-2 level. If you group by field-3, field-2, and field-1, grouping is again applied at the field-2 level. When there is no grouping, **Group down across** returns the same results as **Table down across**.

For example, take the following pivot table. Columns are grouped by **Service Line** and then by **Consumption Channel**. Rows are grouped by **Customer Region** and then by **Date (year)**.

You can apply the **Running total** function using **Group down across** to get the following results. In this case, totals are summed both down and across within the group boundaries. In this case, these are **Service Category** for the columns and **Customer Region** for the rows. The grand total is in the lower-right cell for the group.
You can apply the **Rank** function using **Group down across** to get the following results. In this case, the function is first applied down the columns bounded by each **Customer Region** group. The function is then applied again to the results of that first calculation, this time applied across the rows bounded by each **Service Line** group.

<table>
<thead>
<tr>
<th>Service Line</th>
<th>Consumption Channel</th>
<th>API</th>
<th>Mobile</th>
<th>API</th>
<th>Mobile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Customer Region</strong></td>
<td><strong>Date</strong></td>
<td><strong>2012</strong></td>
<td><strong>2013</strong></td>
<td><strong>2014</strong></td>
<td><strong>2012</strong></td>
</tr>
<tr>
<td>APAC</td>
<td></td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EMEA</td>
<td></td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>US</td>
<td></td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

### Pivot Table Limitations

The following limitations apply to pivot tables:

- You can create pivot table calculations only on nonaggregated values. For example, if you create a calculated field that is a sum of a measure, you can't also add a pivot table calculation to it.
- If you are sorting by a custom metric, you can't add a table calculation until you remove the custom metric sort.
- If you are using a table calculation and then add a custom metric, you can't sort by the custom metric.
- Totals and subtotals are blank for table calculations on metrics aggregated by distinct count.

### Pivot Table Best Practices

It's best to deploy a minimal set of rows, columns, metrics, and table calculations, rather than offering all possible combinations in one pivot table. If you include too many, you risk overwhelming the viewer and you can also run into the computational limitations of the underlying database.

To reduce the level of complexity and reduce the potential for errors, you can take the following actions:

- Apply filters to reduce the data included in for the visual.
- Use fewer fields in the **Row** and **Column** field wells.
- Use as few fields as possible in the **Values** field well.
- Create additional pivot tables so that each displays fewer metrics.

In some cases, there's a business need to examine many metrics in relation to each other. In these cases, it can be better to use multiple visuals on the same dashboard, each showing a single metric. You can reduce the size of the visuals on the dashboard, and colocate them to form a grouping. If a decision
the viewer makes based on one visual creates the need for a different view, you can deploy custom URL actions to launch another dashboard according to the choices made by the user.

It's best to think of visuals as building blocks. Rather than using one visual for multiple purposes, use each visual to facilitate one aspect of a larger business decision. The viewer should have enough data to make a well-informed decision, without being overwhelmed by the inclusion of all possibilities.

Using Sankey Diagrams in Amazon QuickSight

Use Sankey diagrams to show flows from one category to another, or paths from one stage to the next.

For example, a Sankey diagram can show the number of people migrating from one country to another. A Sankey diagram can also show the path a web visitor takes from one page to the next on a company website, with possible stops along the way.

Data for Sankey Diagrams

To create Sankey diagrams in QuickSight, your dataset should contain a measure and two dimensions (one dimension containing source categories and another containing destination categories).

The following table is a simple example of data for a Sankey diagram.

<table>
<thead>
<tr>
<th>Dimension (Source)</th>
<th>Dimension (Destination)</th>
<th>Measure (Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>W</td>
<td>500</td>
</tr>
<tr>
<td>A</td>
<td>X</td>
<td>23</td>
</tr>
<tr>
<td>A</td>
<td>Y</td>
<td>147</td>
</tr>
</tbody>
</table>

The following Sankey diagram is created when the dimensions and measure are added to the field well, with the A node on the left linking to the W, Y, and X nodes on the right. The width of each link between nodes is determined by the value in the Measure (Weight) column. The nodes are automatically ordered.
To create multilevel Sankey diagrams in Amazon QuickSight, your dataset should still contain a measure and two dimensions (one for source and one for destination), but in this case your data values differ.

The following table is a simple example of data for a multilevel Sankey diagram with two stages.

<table>
<thead>
<tr>
<th>Dimension (Source)</th>
<th>Dimension (Destination)</th>
<th>Measure (Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>W</td>
<td>500</td>
</tr>
<tr>
<td>A</td>
<td>X</td>
<td>23</td>
</tr>
<tr>
<td>A</td>
<td>Y</td>
<td>147</td>
</tr>
<tr>
<td>W</td>
<td>Z</td>
<td>300</td>
</tr>
<tr>
<td>X</td>
<td>Z</td>
<td>5</td>
</tr>
<tr>
<td>Y</td>
<td>Z</td>
<td>50</td>
</tr>
</tbody>
</table>

The following Sankey diagram is created when the dimensions and measure are added to the field well. Here, the A node on the left links to the W, Y, and X nodes in the middle, and the W, Y, and X nodes then link to the Z node on the right. The width of each link between nodes is determined by the value in the Measure (Weight) column.
Working with Cyclical Data

Sometimes, the data that you use for a Sankey diagram contains cycles. For example, suppose that you're visualizing user traffic flows between pages on a website. You might discover that users who come to page A move to page E, and then come back to page A. An entire flow might look something like A-E-A-B-A-E-A.

When your data contains cycles, the nodes in each cycle are repeated in QuickSight. For example, if your data contains the flow A-E-A-B-A-E-A, the following Sankey diagram is created.
Preparing Data for Sankey Diagrams

If your dataset doesn’t contain Source or Destination columns, prepare your data to include them. You can prepare data when creating a new dataset, or when editing an existing dataset. For more information about creating a new dataset and preparing it, see Creating Datasets (p. 99). For more information about opening an existing dataset for data preparation, see Editing a Dataset (p. 116).

The following procedure uses an example table (illustrated in following) to demonstrate how to prepare your data for Sankey diagrams in QuickSight. The table includes three columns: Customer ID, Time, and Action.

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Time</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9:05 am</td>
<td>Step 1</td>
</tr>
<tr>
<td>1</td>
<td>9:06 am</td>
<td>Step 2</td>
</tr>
<tr>
<td>1</td>
<td>9:08 am</td>
<td>Step 3</td>
</tr>
<tr>
<td>2</td>
<td>11:44 am</td>
<td>Step 1</td>
</tr>
<tr>
<td>2</td>
<td>11:47 am</td>
<td>Step 2</td>
</tr>
<tr>
<td>2</td>
<td>11:48 am</td>
<td>Step 3</td>
</tr>
</tbody>
</table>

To create a Sankey diagram in QuickSight using this data, first add Source and Destination columns to the table. Use the following procedure to learn how.
To add Source and Destination columns to your table

1. Add a Step Number column to the table to number or rank each row.

There are multiple ways to compute the Step Number column. If your data source is compatible with SQL and your database supports \texttt{ROW\_NUMBER} or \texttt{RANK} functions, you can use custom SQL in QuickSight to order the rows in the Step Number column. For more information about using custom SQL in QuickSight, see Using the Query Editor (p. 137).

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Time</th>
<th>Action</th>
<th>Step Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9:05 am</td>
<td>Step 1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>9:06 am</td>
<td>Step 2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>9:08 am</td>
<td>Step 3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>11:44 am</td>
<td>Step 1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>11:47 am</td>
<td>Step 2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>11:48 am</td>
<td>Step 3</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Add a Next Row Number column to the table with values equal to Step Number plus one.

For example, in the first data row of the table, the value for Step Number is 1. To compute the value for Next Step Number for that row, add 1 to that value.

\[ 1 + 1 = 2 \]

The value for Step Number in the second data row of the table is 2; therefore, the value for Next Step Number is 3.

\[ 2 + 1 = 3 \]

<table>
<thead>
<tr>
<th>Customer ID</th>
<th>Time</th>
<th>Action</th>
<th>Step Number</th>
<th>Next Step Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9:05 am</td>
<td>Step 1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>9:06 am</td>
<td>Step 2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>9:08 am</td>
<td>Step 3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>11:44 am</td>
<td>Step 1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>11:47 am</td>
<td>Step 2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>11:48 am</td>
<td>Step 3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

3. Join the table with itself:

   a. For Join type, choose Inner.

   b. For Join clauses, do the following:

      i. Choose Customer ID = Customer ID

      ii. Choose Next Step Number = Step Number

For more information about joining data in QuickSight, see Joining Data (p. 131).
Joining the two tables creates two columns for Customer ID, Time, Action, Step Number and Next Step Number. The columns from the table at the left of the join are Source columns. The columns from the table at the right of the join are Destination columns.

4. (Optional) Rename columns to indicate sources and destinations.

The following is an example:

1. Rename the **Action** column on the left to **Source**.
2. Rename the **Action [copy]** column on the right to **Destination**.
3. Rename the **Time** column on the left to **Start Time**.
4. Rename the **Time [copy]** column on the right to **End Time**.

Your data is now ready to visualize.

**Creating Sankey Diagrams**

Use the following procedure to create a Sankey diagram.

**To create a Sankey diagram**

1. On the analysis screen, choose **Visualize** on the left toolbar.
2. On the application bar, choose **Add**, and then choose **Add visual**.
3. On the **Visual types** pane, choose the Sankey diagram icon.
4. From the Fields list pane, drag the fields that you want to use to the appropriate field wells.

Sankey diagrams are made of a source dimension, a destination dimension, and a measure.

To create a Sankey diagram, drag a dimension to the Source field well, a dimension to the Destination field well, and a measure to the Weight field well.

Customizing the Number of Nodes

Use the following procedure to customize the number of nodes that appear in a Sankey diagram.

To customize the number of nodes that appear in a Sankey diagram

1. On the analysis page, choose the Sankey diagram visual that you want to format.
2. On the menu in the upper-right corner of the visual, select the Format Visual icon.
3. In the Format visual pane that opens at left, choose either the Source or Destination tab.
4. For Number of nodes displayed, enter a number.
The nodes in the diagram update to the number that you specified. The top nodes are automatically shown. All other nodes are placed in an **Other** category.

**Note**
Specifying the number of Source nodes controls how many Source nodes can appear overall in the diagram. Specifying the number of Destination nodes controls how many Destination nodes can appear per Source node. This means that if there is more than one Source node in your diagram, the overall number of Destination nodes will be higher than the number specified.

For example, the following Sankey diagram has a limit of three source nodes (out of five), so the top three are shown in the diagram. The other two source nodes are placed in the Other category.

To remove the **Other** category from the diagram, select it in the view and choose **Hide “other” categories**.

---

**Sankey Diagram Features**

To understand the features supported by Sankey diagrams, use the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td>[Customizing a Visual Title](p. 256)</td>
</tr>
</tbody>
</table>
Amazon QuickSight User Guide
Using Scatter Plots

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the axis range</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes</td>
<td>Focusing on Visual Elements (p. 253)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excluding Visual Elements (p. 255)</td>
</tr>
<tr>
<td>Sorting</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>Changing Field Aggregation (p. 282)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Conditional formatting</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

**Using Scatter Plots**

Use scatter plots to visualize two or three measures for a dimension.

Each bubble on the scatter plot represents one item in the dimension. The X and Y axes represent two different measures that apply to the dimension. A bubble appears on the chart at the point where the values for the two measures for an item in the dimension intersect. Optionally, you can also use bubble size to represent an additional measure.

Scatter plots show up to 50 data points for the intersection of the X and Y axis values for visuals that don't use group or color. For visuals that do use group or color, scatter plots show up to 2500 data points. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icon for a scatter plot is as follows.

![Scatter Plot Icon](image)

**Scatter Plot Features**

To understand the features supported by scatter plots, use the following table.
## Creating a Scatter Plot

Use the following procedure to create a scatter plot.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the scatter plot icon.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is automatically applied to it to create a numeric value.

   To create a scatter plot, drag a measure to the **X axis** field well, a measure to the **Y axis** field well, and a dimension to the **Group/Color** field well. To represent another measure with bubble size, drag that measure to the **Size** field well.

### Feature | Supported? | Comments | For More Information
--- | --- | --- | ---
Changing the legend display | Yes, with exceptions | Scatter plots display a legend if you have the **Group/Color** field well populated. | Customizing a Visual Legend (p. 257)
Changing the title display | Yes | | Customizing a Visual Title (p. 256)
Changing the axis range | Yes | You can set the range for both the X and Y axes. | Changing Range and Scale in Your Visuals (p. 266)
Showing or hiding axis lines, grid lines, and axis labels | Yes | | Formatting Axis Lines, Axis Labels, and Grid Lines in Amazon QuickSight (p. 267)
Changing the visual colors | Yes | | Changing Colors on Visuals in Amazon QuickSight (p. 287)
Focusing on or excluding elements | Yes, with exceptions | You can focus on or exclude a bubble in a scatter plot, except when you are using a date field as a dimension. In that case, you can only focus on a bubble, not exclude it. | Focusing on Visual Elements (p. 253) Excluding Visual Elements (p. 255)
Sorting | No | | Sorting Visual Data in Amazon QuickSight (p. 294)
Performing field aggregation | Yes | You must apply aggregation to the fields you choose for the X axis, Y axis, and size, and can't apply aggregation to the field that you choose for the group or color. | Changing Field Aggregation (p. 282)
Adding drill-downs | Yes | You can add drill-down levels to the **Group/Color** field well. | Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)
5. (Optional) Add drill-down layers by dragging one or more additional fields to the Group/Color field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

Using Tables as Visuals

Use a table visual to see a customized table view of your data. To create a table visual, choose at least one field of any data type. You can add as many columns as you need, up to 200. You can also add calculated columns.

Table visuals don’t display a legend. You can hide or display the title on a table. You can also hide or display totals, and choose to show totals at the top or the bottom of the table. For more information, see Format Options Available in Analytics (p. 271).

The icon for a table is as follows.

To create a table visual

1. Open Amazon QuickSight and choose Analyses on the navigation pane at left.
2. Choose one of the following:
   - To create a new analysis, choose New analysis at upper right. For more information, see Creating an Analysis (p. 179).
   - To use an existing analysis, choose the analysis that you want to edit.
3. Choose Add (+), Add Visual.
4. At lower left, choose the table icon from Visual types.
5. On the Fields list pane, choose the fields that you want to use. If you want to add a calculated field, choose Add (+), Add calculated field.
   - To create a nonaggregated view of the data, add fields only to the Value field well. Doing this shows data without any aggregations.
   - To create an aggregated view of the data, choose the fields that you want to aggregate by, and then add them to the Group by field well.
6. (Optional). Add drill-down layers by dragging one or more additional fields to the Group/Color field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).

To show or hide columns on a table

1. On your visual, choose the field that you want to hide, then choose Hide column.
2. To display hidden columns, choose any column, then choose Show all hidden columns.
To transpose columns to rows and rows to columns

• Choose the transpose icon ( ) near the top right of the visual. It has two arrows at a 90 degree angle.

To vertically align columns

1. On your visual, choose the Format visual icon ( ) near the top right of the visual.
2. In the Format visual pane, choose Table options, and choose your table’s vertical alignment.

To wrap the text for headers

1. On your visual, choose the Format visual icon ( ) near the top right of the visual.
2. In the Format visual pane, choose Table options, and select Wrap header text.

To rearrange columns in a table chart

1. Open the analysis that holds your table and click anywhere on Field wells to expand the field wells.
2. Do one of the following:
   • Drag and drop one or more fields in Field wells to rearrange their order.
   • Select a field directly in the table and choose the left or right arrow on Move column.

Using Tree Maps

To visualize one or two measures for a dimension, use tree maps.

Each rectangle on the tree map represents one item in the dimension. Rectangle size represents the proportion of the value for the selected measure that the item represents compared to the whole for the dimension. You can optionally use rectangle color to represent another measure for the item. Rectangle color represents where the value for the item falls in the range for the measure, with darker colors indicating higher values and lighter colors indicating lower ones.

Tree maps show up to 100 data points for the Group by field. For more information about how Amazon QuickSight handles data that falls outside display limits, see Display Limits in Visuals (p. 326).

The icon for a tree map is as follows.

Tree Map Features

To understand the features supported by tree maps, use the following table.
Using Tree Maps

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Legend (p. 257)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 256)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing Range and Scale in Your Visuals (p. 266)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
<td>Changing Colors on Visuals in Amazon QuickSight (p. 287)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>You can focus on or exclude a rectangle from a tree map, except when you are using a date field as the dimension. In that case, you can only focus on a rectangle, not exclude it.</td>
<td>Focusing on Visual Elements (p. 253) Excluding Visual Elements (p. 255)</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td>You can sort on the fields you choose for size, color, or to group by.</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 294)</td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>You must apply aggregation to the fields you choose for size and color, and can't apply aggregation to the field that you choose to group by.</td>
<td>Changing Field Aggregation (p. 282)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>Yes</td>
<td>You can add drill-down levels to the Group by field well.</td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)</td>
</tr>
</tbody>
</table>

Creating a Tree Map

Use the following procedure to create a tree map.

1. On the analysis page, choose Visualize on the tool bar.
2. Choose Add on the application bar, and then choose Add visual.
3. On the Visual types pane, choose the tree map icon.
4. From the Fields list pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the Count aggregate function is automatically applied to it to create a numeric value.

   To create a tree map, drag a measure to the Size field well and a dimension to the Group by field well. Optionally, drag another measure to the Color field well.

5. (Optional) Add drill-down layers by dragging one or more additional fields to the Group by field well. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317).
Using Waterfall Charts

Use a waterfall chart to visualize a sequential summation as values are added or subtracted. In a waterfall chart, the initial value goes through a (positive or negative) change, with each change represented as a bar. The final total is represented by the last bar. Waterfall charts are also known as *bridges* because the connectors between the bars bridge the bars together, showing that they visually belong to the same story.

Waterfall charts are most commonly used to present financial data, because you can show change within one time period or from one time period to another. This way, you can visualize the different factors that have an impact on your project cost. For example, you can use a waterfall chart to show gross sales to net income within the same month, or the difference in net income from last year to this year, and the factors that were responsible for this change.

You can also use waterfall charts to present statistical data, for example how many new employees you hired and how many employees left your company within a year.

The icon for a waterfall chart is as follows.

![Waterfall chart icon](image)

The following screenshot shows a waterfall chart.

To create a basic waterfall chart visual

1. Open Amazon QuickSight and choose *Analyses* on the navigation pane at left.
2. Choose one of the following:
   - To create a new analysis, choose *New analysis* at upper right. For more information, see Creating an Analysis (p. 179).
   - To use an existing analysis, choose the analysis that you want to edit.
3. Choose *Add (+), Add Visual*. 
Using Word Clouds

As an engaging way to display how often a word is used in relation to other words in a dataset, use word clouds. The best use for this type of visual is to show word or phrase frequency. It can also make a fun addition to show trending items or actions. You can use a fixed dataset for creative purposes. For example, you might make one of team goals, motivational phrases, various translations of a specific word, or anything else that you want to draw attention to.

Each word in a word cloud represents one or more values in a dimension. The size of the word represents the frequency of a value’s occurrence in a selected dimension, in proportion to the occurrences of other values in the same dimension. Word clouds are best when precision isn’t important and there aren’t a large number of distinct values.

The following screenshot shows an example of a word cloud.

To create a word cloud, use one dimension in the **Group** by field well. Optionally, you can add a metric to the **Size** field well.
Word clouds usually look better with 20–100 words or phrases, but the format settings offer a wide range of flexibility. If you choose too many words, they can become too small to be legible, depending on the size of your display. By default, word clouds display 100 distinct words. To show more, change the format setting for **Number of words**.

Word clouds are limited to 500 unique values for **Group by**. To avoid displaying the word **Other**, format the visual to hide the **Other** category. For more information about how Amazon QuickSight handles data that falls outside display limits, see [Display Limits in Visuals (p. 326)](#).

The icon for a word cloud is as follows.

![Word Cloud Icon](image)

### Word Cloud Features

To understand the features supported by word clouds, see the following table.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing the legend display</td>
<td>No</td>
<td></td>
<td>[Customizing a Visual Legend (p. 257)]</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>[Customizing a Visual Title (p. 256)]</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>[Changing Range and Scale in Your Visuals (p. 266)]</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td>To change the color, choose a word and then choose a color.</td>
<td>[Changing Colors on Visuals in Amazon QuickSight (p. 287)]</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes</td>
<td></td>
<td>[Focusing on Visual Elements (p. 253)]</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td></td>
<td>[Sorting Visual Data in Amazon QuickSight (p. 294)]</td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>You can't apply aggregation to the field that you choose for <strong>Group by</strong>. You must apply an aggregation to the field that you choose for <strong>Size</strong>.</td>
<td>[Changing Field Aggregation (p. 282)]</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>Yes</td>
<td>You can add drill-down levels to the <strong>Group by</strong> field well.</td>
<td>[Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 317)]</td>
</tr>
<tr>
<td>Using format options</td>
<td>Yes</td>
<td>You can choose to allow vertical words, emphasize scale, use a fluid layout, use</td>
<td>[Formatting a Visual in Amazon QuickSight (p. 256)]</td>
</tr>
</tbody>
</table>
Creating a Word Cloud

Use the following procedure to create a word cloud.

1. On the analysis page, choose **Visualize** on the tool bar.
2. Choose **Add** on the application bar, and then choose **Add visual**.
3. On the **Visual types** pane, choose the word cloud icon.
4. From the **Fields list** pane, drag the fields that you want to use to the appropriate field wells. Typically, you want to use dimension or measure fields as indicated by the target field well. If you choose to use a dimension field as a measure, the **Count** aggregate function is applied by default.
   
   To create a word cloud, add a dimension to the **Group by** field well. Optionally, add a measure to the **Size** field well.
5. (Optional) Add drill-down layers by dragging one or more additional fields to the **Group by** field well. For more information about adding drill-downs, see *Adding Drill-Downs to Visual Data in Amazon QuickSight* (p. 317).
Working with ML Insights

Amazon QuickSight uses machine learning to help you uncover hidden insights and trends in your data, identify key drivers, and forecast business metrics. You can also consume these insights in natural language narratives embedded in dashboards.

Using machine learning (ML) and natural language capabilities, Amazon QuickSight Enterprise Edition takes you beyond descriptive and diagnostic analysis, and launches you into forecasting and decision-making. You can understand your data at a glance, share your findings, and discover the best decisions to achieve your goals. You can do this without developing teams and technology to create the necessary machine learning models and algorithms.

You likely have already built visualizations that answer questions about what happened, when, where, and provide drill down for investigation and identification of patterns. With ML insights, you can avoid spending hours manually analyzing and investigating. You can select from a list of customized context-sensitive narratives, called autonarratives, and add them to your analysis. In addition to choosing autonarratives, you can choose to view forecasts, anomalies, and factors contributing to these. You can also add autonarratives that explain the key takeaways in plain language, providing a single data-driven truth for your company.

As time passes and data flows through the system, Amazon QuickSight continually learns so it can deliver ever more pertinent insights. Instead of deciding what the data means, you can decide what to do with the information it provides.

With a shared foundation based on machine learning, all of your analysts and stakeholders can see trends, anomalies, forecasts, and custom narratives built on millions of metrics. They can see root causes, consider forecasts, evaluate risks, and make well-informed, justifiable decisions.

You can create a dashboard like this with no manual analysis, no custom development skills, and no understanding of machine learning modeling or algorithms. All this capability is built into Amazon QuickSight Enterprise Edition.

**Note**

Machine learning capabilities are used as needed throughout the product. Features that actively use machine learning are labeled as such.

With ML Insights, Amazon QuickSight provides three major features:

- **ML-powered anomaly detection** – Amazon QuickSight uses Amazon’s proven machine learning technology to continuously analyze all your data to detect anomalies (outliers). You can identify the top drivers that contribute to any significant change in your business metrics, such as higher-than-expected sales or a dip in your website traffic. Amazon QuickSight uses the Random Cut Forest algorithm on millions of metrics and billions of data points. Doing this enables you to get deep insights that are often buried in the aggregates, inaccessible through manual analysis.

- **ML-powered forecasting** – Amazon QuickSight enables nontechnical users to confidently forecast their key business metrics. The built-in ML Random Cut Forest algorithm automatically handles complex real-world scenarios such as detecting seasonality and trends, excluding outliers, and imputing missing values. You can interact with the data with point-and-click simplicity.

- **Autonarratives** – By using automatic narratives in Amazon QuickSight, you can build rich dashboards with embedded narratives to tell the story of your data in plain language. Doing this can save hours of sifting through charts and tables to extract the key insights for reporting. It also creates a shared understanding of the data within your organization so you make decisions faster. You can use the suggested autonarrative, or you can customize the computations and language to meet your unique requirements. Amazon QuickSight is like providing a personal data analyst to all of your users.
Understanding the ML Algorithm Used by Amazon QuickSight

You don't need any technical experience in machine learning to use the ML-powered features in Amazon QuickSight. This section dives into the technical aspects of the algorithm, for those who want the details about how it works. This information isn't required reading to use the features.

Amazon QuickSight uses a built-in version of the Random Cut Forest (RCF) algorithm. The following sections explain what that means and how it is used in Amazon QuickSight.

First, let's look at some of the terminology involved:

- Anomaly – Something that is characterized by its difference from the majority of the other things in the same sample. Also known as an outlier, an exception, a deviation, and so on.
- Data point – A discrete unit—or simply put, a row—in a dataset. However, a row can have multiple data points if you use a measure over different dimensions.
- Decision Tree – A way of visualizing the decision process of the algorithm that evaluates patterns in the data.
- Forecast – A prediction of future behavior based on current and past behavior.
- Model – A mathematical representation of the algorithm or what the algorithm learns.
- Seasonality – The repeating patterns of behavior that occur cyclically in time series data.
- Time series – An ordered set of date or time data in one field or column.

What's the Difference Between Anomaly Detection and Forecasting?

Anomaly detection identifies outliers and their contributing drivers to answer the question "What happened that doesn't usually happen?" Forecasting answers the question "If everything continues to
happen as expected, what happens in the future?" The math that allows forecasting also enables us to ask "If a few things change, what happens then?"

Both anomaly detection and forecasting begin by examining the current known data points. Amazon QuickSight anomaly detection begins with what is known so it can establish what is outside the known set, and identify those data points as anomalous (outliers). Amazon QuickSight forecasting excludes the anomalous data points, and sticks with the known pattern. Forecasting focuses on the established pattern of data distribution. In contrast, anomaly detection focuses on the data points that deviate from what is expected. Each method approaches decision-making from a different direction.

### What RCF Is and What It Does

A random cut forest (RCF) is a special type of random forest (RF) algorithm, a widely used and successful technique in machine learning. It takes a set of random data points, cuts them down to the same number of points, and then builds a collection of models. In contrast, a model corresponds to a decision tree—thus the name forest. Because RFs can't be easily updated in an incremental manner, RCFs were invented with variables in tree construction that were designed to allow incremental updates.

As an unsupervised algorithm, RCF uses cluster analysis to detect spikes in time series data, breaks in periodicity or seasonality, and data point exceptions. Random cut forests can work as a synopsis or sketch of a dynamic data stream (or a time-indexed sequence of numbers). The answers to our questions about the stream come out of that synopsis. The following characteristics address the stream and how we make connections to anomaly detection and forecasting:

- A streaming algorithm is an online algorithm with a small memory footprint. An online algorithm makes its decision about the input point indexed by time \( t \) before it sees the \( (t+1) \)-st point. The small memory allows nimble algorithms that can produce answers with low latency and allow a user to interact with the data.
- Respecting the ordering imposed by time, as in an online algorithm, is necessary in anomaly detection and forecasting. If we already know what will happen the day after tomorrow, then predicting what happens tomorrow isn't a forecast—it's just interpolating an unknown missing value. Similarly, a new product introduced today can be an anomaly, but it doesn't necessarily remain an anomaly at the end of the next quarter.

### How RCF Is Applied to Detect Anomalies

A human can easily distinguish a data point that stands out from the rest of the data. RCF does the same thing by building a “forest” of decision trees, and then monitoring how new data points change the forest.

An anomaly is a data point that draws your attention away from normal points—think of an image of a red flower in a field of yellow flowers. This "displacement of attention" is encoded in the (expected) position of a tree (that is, a model in RCF) that would be occupied by the input point. The idea is to create a forest where each decision tree grows out of a partition of the data sampled for training the algorithm. In more technical terms, each tree builds a specific type of binary space partitioning tree on the samples. As Amazon QuickSight samples the data, RCF assigns each data point an anomaly score. It gives higher scores to data points that look anomalous. The score is, in approximation, inversely proportional to the resulting depth of the point in the tree. The random cut forest assigns an anomaly score by computing the average score from each constituent tree and scaling the result with respect to the sample size.

The votes or scores of the different models are aggregated because each of the models by itself is a weak predictor. Amazon QuickSight identifies a data point as anomalous when its score is significantly different from the recent points. What qualifies as an anomaly depends on the application.

The paper Random Cut Forest Based Anomaly Detection On Streams provides multiple examples of this state-of-the-art online anomaly detection (time-series anomaly detection). RCFs are used on contiguous
segments or "shingles" of data, where the data in the immediate segment acts as a context for the most recent one. Previous versions of RCF-based anomaly-detection algorithms score an entire shingle. The algorithm in Amazon QuickSight also provides an approximate location of the anomaly in the current extended context. This approximate location can be useful in the scenario where there is delay in detecting the anomaly. Delays occur because any algorithm needs to characterize "previously seen deviations" to "anomalous deviations," which can unfold over some time.

How RCF Is Applied to Generate Forecasts

To forecast the next value in a stationary time sequence, the RCF algorithm answers the question "What would be the most likely completion, after we have a candidate value?" It uses a single tree in RCF to perform a search for the best candidate. The candidates across different trees are aggregated, because each tree by itself a weak predictor. The aggregation also allows the generation of quantile errors. This process is repeated $t$ times to predict the $t$–th value in the future.

The algorithm in Amazon QuickSight is called BIFOCAL. It uses two RCFs to create a CALibrated BI-FOrest architecture. The first RCF is used to filter out anomalies and provide a weak forecast, which is corrected by the second. Overall, this approach provides significantly more robust forecasts in comparison to other widely available algorithms such as ETS.

The number of parameters in the Amazon QuickSight forecasting algorithm is significantly fewer than for other widely available algorithms. This allows it to be useful out of the box, without human adjustment for a larger number of time series data points. As more data accumulates in a particular time series, the forecasts in Amazon QuickSight can adjust to data drifts and changes of pattern. For time series that show trends, trend detection is performed first to make the series stationary. The forecast of that stationary sequence is projected back with the trend.

Because the algorithm relies on an efficient online algorithm (RCF), it can support interactive "what-if" queries. In these, some of the forecasts can be altered and treated as hypotheticals to provide conditional forecasts. This is the origin of the ability to explore "what-if" scenarios during analysis.

References for Machine Learning and RCF

To learn more about machine learning and this algorithm, we suggest the following resources:

- The article Robust Random Cut Forest (RCF): A No Math Explanation provides a lucid explanation without the mathematical equations.
- Random Cut Forest Based Anomaly Detection On Streams, a scholarly paper that dives deep into the technicalities of both anomaly detection and forecasting, with examples.

A different approach to RCF appears in other AWS services. If you want to explore how RCF is used in other services, see the following:

- Amazon Kinesis Data Analytics SQL Reference: RANDOM_CUT_FOREST and RANDOM_CUT_FOREST_WITH_EXPLANATION
- Amazon SageMaker Developer Guide: Random Cut Forest (RCF) Algorithm. This approach is also explained in The Random Cut Forest Algorithm, a chapter in Machine Learning for Business (October 2018).
Dataset Requirements for Using ML Insights with Amazon QuickSight

To begin using the machine learning capabilities of Amazon QuickSight, you need to connect to or import your data. You can use an existing Amazon QuickSight dataset or create a new one. You can directly query your SQL-compatible source, or ingest the data into SPICE.

The data must have the following properties:

• At least one metric (for example, sales, orders, shipped units, sign ups, and so on).
• At least one category dimension (for example, product category, channel, segment, industry, and so on). Categories with NULL values are ignored.
• Anomaly detection requires a minimum of 15 data points for training. For example, if the grain of your data is daily, you need at least 15 days of data. If the grain is monthly, you need at least 15 months of data.
• Forecasting work best with more data. Make sure that your dataset has enough historical data for optimal results. For example, if the grain of your data is daily, you need at least 38 days of data. If the grain is monthly, you need at least 43 months of data. Following are the requirements for each time grain:
  • Years: 32 data points
  • Quarters: 35 data points
  • Months: 43 data points
  • Weeks: 35 data points
  • Days: 38 data points
  • Hours: 39 data points
  • Minutes: 46 data points
• If you want to analyze anomalies or forecasts, you also need at least one date dimension.

If you don’t have a dataset to get started, you can download this sample dataset: ML Insights Sample Dataset VI. After you have a dataset ready, create a new analysis from the dataset.

Working with Insights in Amazon QuickSight

In Amazon QuickSight, you can add ready-to-use analytical computations to your analysis as widgets. You can work with insights in two ways:

• Suggested insights

Amazon QuickSight creates a list of suggested insights based on its interpretation of the data you put into your visuals. The list changes based on context. In other words, you can see different suggestions depending on what fields you add to your visual and what type of visual you choose. For example, if you have a time-series visualization, your insights might include period-over-period changes, anomalies, and forecasts. As you add more visualizations to your analysis, you generate more suggested insights.

• Custom insights

Custom insights enable you to create your own computation, using your own words to give context to the fields that appear in the widget. When you create a custom insight, you add it to the analysis, and then choose what type of calculation that you want to use. Then, you can add text and formatting to make it look how you want. You can also add more fields, calculations, and parameters.
You can add any combination of suggested and custom insights to your analysis, to create the decision-making environment that best serves your purposes.

Topics
- Adding Suggested Insights (p. 420)
- Adding Custom Insights to Your Analysis (p. 423)

Adding Suggested Insights

Use the following procedure to add suggested insights to your analysis.

Before you begin, make sure that your dataset meets the criteria outlined in Dataset Requirements for Using ML Insights with Amazon QuickSight (p. 419).

1. Begin with an analysis that has a few fields added to a visual.
2. On the left, choose Insights. The Insights panel opens and displays a list of ready-to-use suggested insights.
Each visual also displays a small box on its top border to display how many insights are available for that visual. You can choose this box to open the **Insights** panel, and it opens to whatever view you most recently had open.

Scroll down to preview more insights.
The insights that appear are controlled by the data type of the fields you choose to include in your visual. This list is generated each time you change your visual. If you make changes, check Insights to see what is new. To get a specific insight, see Adding Custom Insights to Your Analysis (p. 423).

3. (Optional) Open the context menu with more options for one of the insights. To do this, choose the ellipses on the top right of the insight (…).

The options are different for each type of insight. The options that you can interact with include the following:

- **Change the time series aggregation** – To year, quarter, month, week, day, hour, or minute.
- **Analyze contributions to metrics** – Choose contributors and a time frame to analyze.
- **Show all anomalies** – Browse anomalies in this time frame.
- **Edit forecast** – Choose forecast length, prediction interval, and seasonality.
- **Focus on** or **Exclude** – Zoom in or zoom out on your dimensional data.
- **Show details** – View more information about a recent anomaly (outlier).
- **Provide feedback** on the usefulness of the insight in your analysis.

4. Add a suggested insight to your analysis by choosing the plus sign (+) near the insight title.
5. (Optional) After you add an insight to your analysis, customize the narrative that you want it to display. To do this, choose the v-shaped on-visual menu, then choose **Customize narrative**. For more information, see Creating Autonarratives with Amazon QuickSight (p. 424).

If your insight is for anomalies (outliers), you can also change the settings for the anomaly detection job. To do this, choose **Configure anomaly**. For more information, see Setting Up ML-Powered Anomaly Detection for Outlier Analysis (p. 448).

6. (Optional) To remove the insight from your analysis, choose the v-shaped on-visual menu at the top right of the visual. Then choose **Delete**.

### Adding Custom Insights to Your Analysis

If you don't want to use any of the suggested insights, you can create your own custom insight. Use the following procedure to create a custom computational insight.

1. Start with an existing analysis. On the top menu bar, choose **Add+**. Then choose **Add Insight**.

   A container for the new insight is added to the analysis. The following screen appears.
2. Do one of the following:

- Choose the computation that you want to use from the list. As you choose each item, an example of that insight's output displays. When you find the one that you want to use, choose Select.
- Exit this screen and customize the insight manually. An unconfigured insight has a Customize insight button. Choose the button to open the Configure narrative screen. For more information on using the expression editor, see Creating Autonarratives with Amazon QuickSight (p. 424).

Because you are initiating the creation of the insight, it’s not based on an existing visual. When the insight is added to the analysis, it displays a note showing what kind of data it needs to complete your request. For example, it might ask for 1 dimension in Time. In this case, you add a dimension to the Time field well.

3. After you have the correct data, follow any remaining screen prompts to finish creating the custom insight.

4. (Optional) To remove the insight from your analysis, choose the v-shaped on-visual menu at the top right of the visual. Then choose Delete.

Creating Autonarratives with Amazon QuickSight

An autonarrative is a natural-language summary widget that displays descriptive text instead of charts. You can embed these widgets throughout your analysis to highlight key insights and callouts. You don’t have to sift through the visual, drilling down, comparing values, and rechecking ideas to extract a conclusion. You also don’t have to try to understand what the data means, or discuss different interpretations with your colleagues. Instead, you can extrapolate the conclusion from the data, and display it in the analysis, stated plainly. A single interpretation can be shared by everyone.

Amazon QuickSight automatically interprets the charts and tables in your dashboard and provides a number of suggested insights in natural language. The suggested insights that you can choose from are ready-made and come with words, calculations, and functions. But you can change them if you want to.
You can also design your own. As the author of the dashboard, you have complete flexibility to customize the computations and language for your needs. You can use narratives to effectively tell the story of your data in plain language.

**Note**
Narratives are separate from machine learning. They only use ML if you add forecast or anomaly (outlier) computations to them.

**Topics**
- Insights That Include Autonarratives (p. 425)
- Working with the Expression Editor Screen and Menus (p. 426)
- Adding URLs (p. 427)
- Walkthrough: Use the Narrative Expression Editor (p. 428)
- Working with Autonarrative Computations (p. 431)

**Insights That Include Autonarratives**

When you are adding an insight, also known as an autonarrative, to your analysis, you can choose from the following templates. In the following list, they defined by example. Each definition includes a list of the minimum required fields for the autonarrative to work. If you are using only the suggested insights on the Insights tab, choose the appropriate fields to get an insight to show up in the suggested insights list.

For more information on customizing autonarratives, see Working with Autonarrative Computations (p. 431).

- **Bottom ranked** – For example, the bottom three states by sales revenue. Requires that you have at least one dimension in the Categories field well.
- **Bottom movers** – For example, the bottom three products sold, by sales revenue. Requires that you have at least one dimension in the Time field well and at least one dimension in the Categories field well.
- **Forecast** *(ML-powered insight)* – For example, "Total sales are forecasted to be $58,613 for Jan 2016." Requires that you have at least one dimension in the Time field well.
- **Growth rate** – For example, "The 3-month compounded growth rate for sales is 22.23%." Requires that you have at least one dimension in the Time field well.
- **Maximum** – For example, "Highest month is Nov 2014 with sales of $112,326." Requires that you have at least one dimension in the Time field well.
- **Metric comparison** – For example, "Total sales for Dec 2014 is $90,474, 10% higher than target of $81,426." Requires that you have at least one dimension in the Time field well and at least two measures in the Values field well.
- **Minimum** – For example, "Lowest month is Feb 2011 with sales of $4,810." Requires that you have at least one dimension in the Time field well.
- **Anomaly detection** *(ML-powered insight)* – For example, top three outliers and their contributing drivers for total sales on January 3, 2019. Requires that you have at least one dimension in the Time field well, at least one measure in the Values field well, and at least one dimension in the Categories field well.
- **Period over period** – For example, "Total sales for Nov 2014 increased by 44.39% ($34,532) from $77,793 to $112,326." Requires that you have at least one dimension in the Time field well.
- **Period to date** – For example, "Year-to-date sales for Nov 30, 2014 increased by 25.87% ($132,236) from $511,236 to $643,472." Requires that you have at least one dimension in the Time field well.
- **Top ranked** – For example, top three states by sales revenue. Requires that you have at least one dimension in the Categories field well.
• **Top movers** – For example, top products by sales revenue for November 2014. Requires that you have at least one dimension in the **Time** field well and at least one dimension in the **Categories** field well.

• **Total aggregation** – For example, "Total revenue is $2,297,200." Requires that you have at least one dimension in the **Time** field well and at least one measure in the **Values** field well.

• **Unique values** – For example, "There are 793 unique values in **Customer_IDs**." Requires that you have at least one dimension in the **Categories** field well.

### Working with the Expression Editor Screen and Menus

The following screenshot shows a new blank narrative. In this image, the browser window is smaller than usual, so you can see the icons on the menu bar. You can maximize the browser to make the editor as large as your screen.

On the right side of the screen, there's a list of items that you can add to the narrative:

• **Computations** – Use this to choose from the computations that are available in this insight. You can expand this list.

• **Parameters** – Use this to choose from the parameters that exist in your analysis. You can expand this list.

• **Functions** – Use this to choose from functions that you can add to a narrative. You can expand this list.

• **Add computation** – Use this button to create another computation. New computations appear in the **Computations** list, ready to add to the insight.

At the bottom of the narrative expression editor, there's a preview of the narrative that updates as you work. This area also shows an alert if you introduce an error into the narrative or if the narrative is empty. To see a preview of ML-powered insights like anomaly detection or forecasting, run your insight calculation at least once before customizing the narrative.

Editing tools are located across the top of the screen. They offer the following options:

• **Insert code** – You can insert the following code blocks from this menu:
  - **Expressions** – Add a free-form expression.
  - **Inline IF** – Add an IF statement that displays inline with the existing block of text.
• **Inline FOR** – Add a FOR statement that displays inline with the existing block of text.
• **Block IF** – Add an IF statement that displays in a separate block of text.
• **Block FOR** – Add a FOR statement that displays in a separate block of text.

The IF and FOR statements enable you to create content that is conditionally formatted. For example, you might add a **block IF** statement, then configure it to compare an integer to a value from a calculation. To do this, you use the following steps, also demonstrated in *Walkthrough: Use the Narrative Expression Editor (p. 428)*:

1. Open the calculations menu at right, and choose one of the blue highlighted items from one of the calculations. Doing this adds the item to the narrative.
2. Click once on the item to open it.
3. Enter the comparison that you want to make. The expression looks something like this: `PeriodOverPeriod.currentMetricValue.value>0`.
4. Save this expression in the pop-up editor, which prompts you for **Conditional content**.
5. Enter what you want to display in the insight, and format it as you want it to appear. Or if you prefer, you can add an image or a URL—or add a URL to an image.

**Paragraph** – This menu offers options for changes to the font size:

• **H1 Large header**
• **H2 Header**
• **H3 Small header**
• **¶1 Large paragraph**
• **¶2 Paragraph**
• **¶3 Small paragraph**

• **Font** – Use this menu tray to choose options for text formatting. These include bold, italic, underline, strikethrough, foreground color of the text (the letters themselves), and background color of the text. Choose the icon to turn on an option; choose it again to toggle the option off.

• **Formatting** – Use this menu tray to choose options for paragraph formatting, including bulleted list, left justify, center, and right justify. Choose the icon to turn on an option, choose it again to toggle the option off.

• **Image** – Use this icon add an image URL. The image displays in your insight, provided the link is accessible. You can resize images. To display an image based on a condition, put the image inside an IF block.

• **URL** – Use this icon to add a static or dynamic URL. You can also add URLs to images. For example, you can add traffic light indicator images to an insight for an executive dashboard, with links to a new sheet for red, amber, and green conditions.

**Adding URLs**

Using the **URL** button on the editing menu of the narrative expression editor, you can add static and dynamic URLs (hyperlinks) into a narrative. You can also use the following keyboard shortcuts: `⌘+⇧+L` or `Ctrl+⇧+L`.

A static URL is a link that doesn't change; it always opens the same URL. A dynamic URL is a link that changes based on the expressions or parameters that you provide when you set it up. It's built with dynamically evaluated expressions or parameters.

Following are of examples of when you might add a static link in your narrative:

• In an IF statement, you might use the URL in the conditional content. If you do and a metric fails to meet an expected value, your link might send the user to a wiki with a list of best practices to improve the metric.
• You might use a static URL to create a link to another sheet in the same dashboard, by using the following steps:
  1. Go to the sheet that you want to make the link to.
  2. Copy that sheet's URL.
  3. Return to the narrative editor and create a link using the URL that you just copied.

Following are examples of when you might add a dynamic link in your narrative:

• To search a website with a query, by using the following steps.
  1. Create a URL with the following link.

    https://google.com?q=<formatDate(now(),'yyyy-MM-dd')>

    This link sends a query to Google with search text that is the evaluated value of the following.

    formatDate(now(), 'yyyy-MM-dd')

    If the value of now() is 02/02/2020, then the link on your narrative contains https://google.com?q=2020-02-02.

• To create a link that updates a parameter. To do this, create or edit a link and set the URL to the current dashboard or analysis URL. Then add the expression that sets the parameter value to at the end, for example #p.myParameter=12345.

Suppose that the following is the dashboard link that you start with.

https://us-east-1.quicksight.aws.amazon.com/sn/analyses/00000000-1111-2222-3333-44444444

If you add a parameter value assignment to it, it looks like the following.

https://us-east-1.quicksight.aws.amazon.com/sn/analyses/00000000-1111-2222-3333-44444444#p.myParameter=12345

For more information on parameters in URLs, see Using Parameters in a URL (p. 233).

Walkthrough: Use the Narrative Expression Editor

The following walkthrough shows an example of how to customize a narrative. For this example, we use a period over period computation type.

1. Begin with an existing analysis. Add a period over period insight to it. The easiest way to do this is to choose the + icon, then Add insight, then choose a type of insight from the list. To learn what type of computational insights you can add as autonarratives, see Insights That Include Autonarratives (p. 425).

After you choose a type of insight, choose Select to create the widget. To create an empty narrative, close this screen without choosing a template. To follow this example, choose Period over period.

If you had a visual selected when you added the insight, the field wells have preconfigured fields for the date, metric, and category. These come from the visualization that you chose when you created the insight. You can customize the fields as needed.
You can only customize a narrative for a new or existing insight (text-based) widget. You can't add one to an existing visual (chart based), because it's a different type of widget.

2. Edit the narrative in the expressions editor by choosing the on-visual menu, then choosing Customize narrative. The following screen appears, filling the entire browser window except for the Amazon QuickSight menu.

![Narrative Expression Editor Screen](image)

In this context, **Computations** are predefined calculations (period-over-period, period-to-date, growth rate, max, min, top movers, and so on) that you can reference in your template to describe your data. Currently, Amazon QuickSight supports 13 different types of computations that you can add to your insight. In this example, **PeriodOverPeriod** is added by default because we chose the Period Over Period template from the suggested insights panel.

3. Choose Add computation at bottom right to add a new computation, and then choose one from the list. For this walkthrough, choose Growth rate, and then choose Next.

4. Configure the computation by choosing the number of periods that you want to compute over. The default is four, and that works for our example. Optionally, you can change the name of the computation at the top of the screen. However, for our purposes, leave the name unchanged.

   **Note**
   The computation names that you create are unique within the insight. You can reference multiple computations of the same type in your narrative template. For example, suppose that you have two metrics, sales revenue and units sold. You can create growth rate computations for each metric if they have different names. However, anomaly computations aren't compatible with any other computation type in the same widget. Anomaly detection must exist in an insight by itself. To use other computations in the same analysis, put them into insights separate from anomalies.

   To proceed, choose Add.

5. Expand Computations on the right. The computations that are part of the narrative display in the list. In this case, it's PeriodOverPeriod and GrowthRate.

6. In the workspace, add the following text after the final period: Compounded growth rate for the last, then add a space.

7. Next, to add the computation leave your cursor after the space after the word last. On the right, under GrowthRate, choose the expression named timePeriods (click only once to add it).

   Doing this inserts the expression GrowthRate.timePeriods, which is the number of periods you set in the configuration for GrowthRate.

8. Complete the sentence with days is (a space before and afterwards), and add the expression GrowthRate.compoundedGrowthRate.formattedValue, followed by a period (.). Choose the expression from the list, rather than typing it in. However, you can edit the contents of the expression after you add it.

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The formattedValue expression returns a string that is formatted based on the formatting applied for the metric on the field. To perform metric math, use value instead, which returns the raw value as an integer or decimal.

9. Add a conditional statement and formatting. Place your cursor at the end of the template, after the formattedValue expression. Add a space if necessary. On the Edit narrative menu bar, choose Insert code, and then choose Inline IF from the list. An expression block opens.

10. With the expression block open, choose GrowthRate, compoundedGrowthRate, value from the expression list. Enter \( >0 \) at the end of the expression. Choose Save. Don't move your cursor yet.

A prompt appears for the conditional content; enter better than expected! Then select the text you just entered, and use the formatting toolbar at the top to turn it green and bold.

11. Add another expression block for the case when the growth rate wasn't that great by repeating the previous step. But this time, make it \( <0 \) and enter the text worse than expected. Make it red instead of green.

12. Choose Save. The customized narrative that we just created should look similar to the following.

The expression editor provides you with a sophisticated tool to customize your narratives. You can also reference the parameters you create for your analysis or dashboard, and use a set of built-in functions for further customization.

**Tip**
To create an empty narrative, add an insight using the + icon and then Add insights. But instead of choosing a template, simply close the screen.

The best way to get started with customizing narratives is to use the existing templates to learn the syntax.
Working with Autonarrative Computations

Use this section to help you understand what functions are available to you when you are customizing an autonarrative. You only need to customize a narrative if you want to change or build on the default computation.

After you create an autonarrative, the expression editor opens. You can also activate the expression editor by choosing the on-visual menu, and then Customize Narrative. To add a computation while using the expression editor, choose + Add computation.

You can use the following code expression to build your autonarrative. These are available from the list that's labeled Insert code. Code statements can display inline (in a sentence) or as a block (in a list).

- **Expression** – Create your own code expression.
- **IF** – An IF statement that includes an expression after evaluating a condition.
- **FOR** – A FOR statement that loops through values.

You can use the following computations to build your autonarrative. You can use the expression editor without editing any syntax, but you can also customize it if you want to. To interact with the syntax, open the computational widget in the autonarrative expression editor.

**Topics**

- ML-Powered Anomaly Detection for Outliers (p. 431)
- Bottom Movers Computation (p. 432)
- Bottom Ranked Computation (p. 434)
- ML-Powered Forecasting (p. 435)
- Growth Rate Computation (p. 437)
- Maximum Computation (p. 438)
- Metric Comparison Computation (p. 439)
- Minimum Computation (p. 440)
- Period over Period Computation (p. 441)
- Period to Date Computation (p. 442)
- Top Movers Computation (p. 443)
- Top Ranked Computation (p. 445)
- Total Aggregation Computation (p. 446)
- Unique Values Computation (p. 447)

**ML-Powered Anomaly Detection for Outliers**

The ML-powered anomaly detection computation searches your data for outliers. For example, you can detect the top three outliers for total sales on January 3, 2019. If you enable contribution analysis, you can also detect the key drivers for each outlier.

To use this function, you need at least one dimension in the Time field well, at least one measure in the Values field well, and at least one dimension in the Categories field well. The configuration screen provides an option to analyze the contribution of other fields as key drivers, even if those fields aren't in the field wells.

For more information, see Detecting Outliers with ML-Powered Anomaly Detection (p. 447).
Note
You can't add ML-powered anomaly detection to another computation, and you can't add another computation to an anomaly detection.

Computation Outputs

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the Computations tab on the right, and locate the computation that you want to use. The names of the computations come from the name that you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. You can use items displayed in bold monospace font following in the narrative.

- `timeField` – From the Time field well.
  - `name` – The formatted display name of the field.
  - `timeGranularity` – The time field granularity (DAY, YEAR, and so on).
- `categoryFields` – From the Categories field well.
  - `name` – The formatted display name of the field.
- `metricField` – From the Values field well.
  - `name` – The formatted display name of the field.
  - `aggregationFunction` – The aggregation used for the metric (SUM, AVG, and so on).
- `itemsCount` – The number of items included in this computation.
- `items` – Anomalous items.
  - `timeValue` – The values in the date dimension.
  - `value` – The date/time field at the point of the anomaly (outlier).
  - `formattedValue` – The formatted value in the date/time field at the point of the anomaly.
  - `categoryName` – The actual name of the category (cat1, cat2, and so on).
  - `direction` – The direction on the x-axis or y-axis that's identified as anomalous: HIGH or LOW. HIGH means "higher than expected." LOW means "lower than expected."

When iterating on items, AnomalyDetection.items[index].direction can contain either HIGH or LOW. For example, AnomalyDetection.items[index].direction='HIGH' or AnomalyDetection.items[index].direction=LOW. AnomalyDetection.direction can have an empty string for ALL. An example is AnomalyDetection.direction=''.

- `actualValue` – The metric's actual value at the point of the anomaly or outlier.
  - `value` – The raw value.
  - `formattedValue` – The value formatted by the metric field.
  - `formattedAbsoluteValue` – The absolute value formatted by the metric field.
- `expectedValue` – The metric's expected value at the point of the anomaly (outlier).
  - `value` – The raw value.
  - `formattedValue` – The value formatted by the metric field.
  - `formattedAbsoluteValue` – The absolute value formatted by the metric field.

Bottom Movers Computation

The bottom movers computation counts the requested number of categories by date that rank in the bottom of the autonarrative's dataset. For example, you can create a computation to find the bottom three products sold, by sales revenue.
To use this function, at least one dimension in the **Time** field well and at least one dimension in the **Categories** field well.

### Parameters

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Date**

The date dimension that you want to rank.

**Category**

The category dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Number of movers**

The number of ranked results that you want to display.

**Order by**

The order that you want to use, percent difference or absolute difference.

### Computation Outputs

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

**Note**

These are the same output parameters as the ones that are returned by the top movers computation.

- **timeField** – From the **Time** field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (**DAY**, **YEAR**, and so on).
- **categoryField** – From the **Categories** field well.
- **name** – The formatted display name of the field.
- **metricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
- **startTimeValue** – The value in the date dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the datetime field.
- **endTimeValue** – The value in the date dimension.
- **value** – The raw value.
• **formattedValue** – The absolute value formatted by the datetime field.
• **itemsCount** – The number of items included in this computation.
• **items** – Bottom moving items.
  • **categoryField** – The category field.
    • **value** – The value (contents) of the category field.
    • **formattedValue** – The formatted value (contents) of the category field. If the field is null, this displays 'NULL'. If the field is empty, it displays 'empty'.
  • **currentMetricValue** – The current value for the metric field.
    • **value** – The raw value.
    • **formattedValue** – The value formatted by the metric field
    • **formattedAbsoluteValue** – The absolute value formatted by the metric field.
  • **previousMetricValue** – The previous value for the metric field.
    • **value** – The raw value.
    • **formattedValue** – The value formatted by the metric field
    • **formattedAbsoluteValue** – The absolute value formatted by the metric field.
  • **percentDifference** – The percent difference between the current and previous values of the metric field.
    • **value** – The raw value of the calculation of the percent difference.
    • **formattedValue** – The formatted value of the percent difference (for example, -42%).
    • **formattedAbsoluteValue** – The formatted absolute value of the percent difference (for example, 42%).
  • **absoluteDifference** – The absolute difference between the current and previous values of the metric field.
    • **value** – The raw value of the calculation of the absolute difference.
    • **formattedValue** – The absolute difference formatted by the settings in the metric field's format preferences.
    • **formattedAbsoluteValue** – The absolute value of the difference formatted by the metric field.

**Bottom Ranked Computation**

The bottom ranked computation calculates the requested number of categories by value that rank in the bottom of the autonarrative's dataset. For example, you can create a computation to find the bottom three states by sales revenue.

To use this function, you need at least one dimension in the **Categories** field well.

**Parameters**

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Category**

The category dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Number of results**

The number of ranked results that you want to display.
Computation Outputs

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the Computations tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

*Note*
These are the same output parameters as the ones that are returned by the top ranked computation.

- **categoryField** – From the **Categories** field well.
- **name** – The formatted display name of the field.
- **metricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (SUM, AVG, and so on).
- **itemsCount** – The number of items included in this computation.
- **items**: Bottom ranked items.
  - **categoryField** – The category field.
  - **value** – The value (contents) of the category field.
  - **formattedValue** – The formatted value (contents) of the category field. If the field is null, this displays ‘NULL’. If the field is empty, it displays ‘(empty)’.
  - **metricValue** – The metric field.
  - **value** – The raw value.
  - **formattedValue** – The value formatted by the metric field.
  - **formattedAbsoluteValue** – The absolute value formatted by the metric field.

Example

The following screenshot shows the default configuration for the bottom ranked computation.

ML-Powered Forecasting

The ML-powered forecast computation forecasts future metrics based on patterns of previous metrics by seasonality. For example, you can create a computation to forecast total revenue for the next six months.

To use this function, you need at least one dimension in the **Time** field well.

For more information about working with forecasts, see Forecasting and Creating What-If Scenarios with Amazon QuickSight (p. 458).
**Parameters**

*name*

A unique descriptive name that you assign or change. A name is assigned if you don’t create your own. You can edit this later.

*Date*

The date dimension that you want to rank.

*Value*

The aggregated measure that the computation is based on.

*Periods forward*

The number of time periods in the future that you want to forecast. Ranges from 1 to 1,000.

*Periods backward*

The number of time periods in the past that you want to base your forecast on. Ranges from 0 to 1,000.

*Seasonality*

The number of seasons included in the calendar year. The default setting, automatic detects this for you. Ranges from 1 to 180.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in bold can be used in the narrative.

- **timeField** – From the **Time** field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (**DAY**, **YEAR**, and so on).
- **metricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
- **metricValue** – The value in the metric dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the metric field.
- **formattedAbsoluteValue** – The absolute value formatted by the metric field.
- **timeValue** – The value in the date dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the date field.
- **relativePeriodsToForecast** – The relative number of periods between latest datetime record and last forecast record.
Growth Rate Computation

The growth rate computation compares values over time periods. For example, you can create a computation to find the three-month compounded growth rate for sales, expressed as a percentage.

To use this function, you need at least one dimension in the Time field well.

Parameters

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Date**

The date dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Number of periods**

The number of time periods in the future that you want to use to compute the growth rate.

Computation Outputs

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the Computations tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

- **timeField** – From the Time field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (DAY, YEAR, and so on).
- **metricField** – From the Values field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (SUM, AVG, and so on).
- **previousMetricValue** – The previous value in the metric dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the metric field.
- **formattedAbsouluteValue** – The absolute value formatted by the metric field.
- **previousTimeValue** – The previous value in the datetime dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the datetime field.
- **compoundedGrowthRate** – The percent difference between the current and previous values of the metric field.
- **value** – The raw value of the calculation of the percent difference.
- **formattedValue** – The formatted value of the percent difference (for example, -42%).
- **formattedAbsoluteValue** – The formatted absolute value of the percent difference (for example, 42%).
• **absoluteDifference** – The absolute difference between the current and previous values of the metric field.
  • **value** – The raw value of the calculation of the absolute difference.
  • **formattedValue** – The absolute difference formatted by the settings in the metric field’s format preferences.
  • **formattedAbsoluteValue** – The absolute value of the difference formatted by the metric field.

### Maximum Computation

The maximum computation finds the maximum dimension by value. For example, you can create a computation to find the month with the highest revenue.

To use this function, you need at least one dimension in the **Time** field well.

**Parameters**

- **name**
  
  A unique descriptive name that you assign or change. A name is assigned if you don’t create your own. You can edit this later.

- **Date**
  
  The date dimension that you want to rank.

- **Value**
  
  The aggregated measure that the computation is based on.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

**Note**

These are the same output parameters as the ones that are returned by the minimum computation.

- **timeField** – From the **Time** field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (**DAY, YEAR**, and so on).
- **metricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (**SUM, AVG**, and so on).
- **metricValue** – The value in the metric dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the metric field.
- **formattedAbsoluteValue** – The absolute value formatted by the metric field.
- **timeValue** – The value in the datetime dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the datetime field.
Metric Comparison Computation

The metric comparison computation compares values in different measures. For example, you can create a computation to compare two values, such as actual sales compared to sales goals.

To use this function, you need at least one dimension in the **Time** field well and at least two measures in the **Values** field well.

**Parameters**

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Date**

The date dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Target value**

The field that you want to compare to the value.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

- **timeField** – From the **Time** field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (**DAY**, **YEAR**, and so on).
- **fromMetricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
- **fromMetricValue** – The value in the metric dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the metric field.
- **formattedAbsoluteValue** – The absolute value formatted by the metric field.
- **toMetricField** – From the **Values** field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
- **toMetricValue** – The current value in the metric dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the metric field.
- **formattedAbsoluteValue** – The absolute value formatted by the metric field.
- **timeValue** – The value in the datetime dimension.
- **value** – The raw value.
• **formattedValue** – The value formatted by the datetime field.
• **percentDifference** – The percent difference between the current and previous values of the metric field.
• **value** – The raw value of the calculation of the percent difference.
• **formattedValue** – The formatted value of the percent difference (for example, -42%).
• **formattedAbsoluteValue** – The formatted absolute value of the percent difference (for example, 42%).
• **absoluteDifference** – The absolute difference between the current and previous values of the metric field.
• **value** – The raw value of the calculation of the absolute difference.
• **formattedValue** – The absolute difference formatted by the settings in the metric field's format preferences.
• **formattedAbsoluteValue** – The absolute value of the difference formatted by the metric field.

**Minimum Computation**

The minimum computation finds the minimum dimension by value. For example, you can create a computation to find the month with the lowest revenue.

To use this function, you need at least one dimension in the **Time** field well.

**Parameters**

* **name**
  
  A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

* **Date**
  
  The date dimension that you want to rank.

* **Value**
  
  The aggregated measure that the computation is based on.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

**Note**

These are the same output parameters as the ones that are returned by the maximum computation.

* **timeField** – From the **Time** field well.
* **name** – The formatted display name of the field.
* **timeGranularity** – The time field granularity (**DAY**, **YEAR**, and so on).
* **metricField** – From the **Values** field well.
* **name** – The formatted display name of the field.
* **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
• **metricValue** – The value in the metric dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the metric field.
  • **formattedAbsoluteValue** – The absolute value formatted by the metric field.
• **timeValue** – The value in the datetime dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the datetime field.

**Period over Period Computation**

The period over period computation compares values from two different time periods. For example, you can create a computation to find out how much sales increased or decreased since the previous time period.

To use this function, you need at least one dimension in the **Time** field well.

**Parameters**

*name*

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

*Date*

The date dimension that you want to rank.

*Value*

The aggregated measure that the computation is based on.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

• **timeField** – From the **Time** field well.
  • **name** – The formatted display name of the field.
  • **timeGranularity** – The time field granularity (**DAY**, **YEAR**, and so on).
• **metricField** – From the **Values** field well.
  • **name** – The formatted display name of the field.
  • **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
• **previousMetricValue** – The previous value in the metric dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the metric field.
• **previousTimeValue** – The previous value in the datetime dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the datetime field.
• **currentMetricValue** – The current value in the metric dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the metric field.
  • **formattedAbsoluteValue** – The absolute value formatted by the metric field.
• **currentTimeValue** – The current value in the datetime dimension.
  • **value** – The raw value.
  • **formattedValue** – The value formatted by the datetime field.
• **percentDifference** – The percent difference between the current and previous values of the metric field.
  • **value** – The raw value of the calculation of the percent difference.
  • **formattedValue** – The formatted value of the percent difference (for example, -42%).
  • **formattedAbsoluteValue** – The formatted absolute value of the percent difference (for example, 42%).
• **absoluteDifference** – The absolute difference between the current and previous values of the metric field.
  • **value** – The raw value of the calculation of the absolute difference.
  • **formattedValue** – The absolute difference formatted by the settings in the metric field's format preferences.
  • **formattedAbsoluteValue** – The absolute value of the difference formatted by the metric field.

**Period to Date Computation**

The period to date computation evaluates values for a specified period to date. For example, you can create a computation to find out how much you’ve earned in year-to-date sales.

To use this function, you need at least one dimension in the **Time** field well.

**Parameters**

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Date**

The date dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Time granularity**

The date granularity that you want to use for the computation, for example year to date.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.
Computations

- `timeField` – From the Time field well.
  - `name` – The formatted display name of the field.
  - `timeGranularity` – The time field granularity (DAY, YEAR, and so on).

- `metricField` – From the Values field well.
  - `name` – The formatted display name of the field.
  - `aggregationFunction` – The aggregation used for the metric (SUM, AVG, and so on).

- `previousMetricValue` – The previous value in the metric dimension.
  - `value` – The raw value.
  - `formattedValue` – The value formatted by the metric field.
  - `formattedAbsoluteValue` – The absolute value formatted by the metric field.

- `previousTimeValue` – The previous value in the datetime dimension.
  - `value` – The raw value.
  - `formattedValue` – The value formatted by the datetime field.

- `currentTimeValue` – The current value in the datetime dimension.
  - `value` – The raw value.
  - `formattedValue` – The value formatted by the datetime field.

- `periodGranularity` – The period granularity for this computation (MONTH, YEAR, and so on).

- `percentDifference` – The percent difference between the current and previous values of the metric field.
  - `value` – The raw value of the calculation of the percent difference.
  - `formattedValue` – The formatted value of the percent difference (for example, -42%).
  - `formattedAbsoluteValue` – The formatted absolute value of the percent difference (for example, 42%).

- `absoluteDifference` – The absolute difference between the current and previous values of the metric field.
  - `value` – The raw value of the calculation of the absolute difference.
  - `formattedValue` – The absolute difference formatted by the settings in the metric field's format preferences.
  - `formattedAbsoluteValue` – The absolute value of the difference formatted by the metric field.

**Top Movers Computation**

The top movers computation counts the requested number of categories by date that rank in the top of the autonarrative's dataset. For example, you can create a computation to find the top products by sales revenue for a time period.

To use this function, you need at least one dimension in the Time field well and at least one dimension in the Categories field well.

**Parameters**

- `name`

  A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.
Category

The category dimension you want to rank.

Value

The aggregated measure that the computation is based on.

Number of results

The number of top ranking items you want to find.

Computation Outputs

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the Computations tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in bold can be used in the narrative.

**Note**

These are the same output parameters as the ones that are returned by the bottom movers computation.

- **timeField** – From the Time field well.
- **name** – The formatted display name of the field.
- **timeGranularity** – The time field granularity (DAY, YEAR, and so on).
- **categoryField** – From the Categories field well.
- **name** – The formatted display name of the field.
- **metricField** – From the Values field well.
- **name** – The formatted display name of the field.
- **aggregationFunction** – The aggregation used for the metric (SUM, AVG, and so on).
- **startTimeValue** – The value in the date dimension.
- **value** – The raw value.
- **formattedValue** – The value formatted by the datetime field.
- **endTimeValue** – The value in the date dimension.
- **value** – The raw value.
- **formattedValue** – The absolute value formatted by the datetime field.
- **itemsCount** – The number of items included in this computation.
- **items**: Top moving items.
  - **categoryField** – The category field.
  - **value** – The value (contents) of the category field.
  - **formattedValue** – The formatted value (contents) of the category field. If the field is null, this displays 'NULL'. If the field is empty, it displays '(empty)'.
  - **currentMetricValue** – The current value for the metric field.
  - **value** – The raw value.
  - **formattedValue** – The value formatted by the metric field.
  - **formattedAbsoluteValue** – The absolute value formatted by the metric field.
  - **previousMetricValue** – The previous value for the metric field.
  - **value** – The raw value.
• **formattedValue** – The value formatted by the metric field.
• **formattedAbsoluteValue** – The absolute value formatted by the metric field.
• **percentDifference** – The percent difference between the current and previous values of the metric field.
• **value** – The raw value of the calculation of the percent difference.
• **formattedValue** – The formatted value of the percent difference (for example, -42%).
• **formattedAbsoluteValue** – The formatted absolute value of the percent difference (for example, 42%).
• **absoluteDifference** – The absolute difference between the current and previous values of the metric field.
• **value** – The raw value of the calculation of the absolute difference.
• **formattedValue** – The absolute difference formatted by the settings in the metric field's format preferences.
• **formattedAbsoluteValue** – The absolute value of the difference formatted by the metric field.

**Top Ranked Computation**

The top ranked computation finds the top ranking dimensions by value. For example, you can create a computation to find the top three states by sales revenue.

To use this function, you need at least one dimension in the **Categories** field well.

**Parameters**

**name**

A unique descriptive name that you assign or change. A name is assigned if you don’t create your own. You can edit this later.

**Category**

The category dimension that you want to rank.

**Value**

The aggregated measure that the computation is based on.

**Number of results**

The number of top ranking items that you want to find.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

**Note**

These are the same output parameters as the ones that are returned by the bottom ranked computation.

• **categoryField** – From the **Categories** field well.
* **name** – The formatted display name of the field.
* **metricField** – From the **Values** field well.
* **name** – The formatted display name of the field.
* **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
* **itemsCount** – The number of items included in this computation.
* **items**: Top ranked items.
  * **categoryField** – The category field.
    * **value** – The value (contents) of the category field.
    * **formattedValue** – The formatted value (contents) of the category field. If the field is null, this displays 'NULL'. If the field is empty, it displays '{empty}'.
  * **metricValue** – The metric field.
    * **value** – The raw value.
    * **formattedValue** – The value formatted by the metric field.
    * **formattedAbsoluteValue** – The absolute value formatted by the metric field.

### Total Aggregation Computation

The total aggregation computation creates a grand total of the value. For example, you can create a computation to find the total revenue.

To use this function, you need at least one dimension in the **Time** field well and at least one measure in the **Values** field well.

**Parameters**

**name**

A unique descriptive name that you assign or change. A name is assigned if you don't create your own. You can edit this later.

**Value**

The aggregated measure that the computation is based on.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

* **categoryField** – The category field.
* **name** – The display name of the category field.
* **metricField** – From the **Values** field well.
* **name** – The formatted display name of the field.
* **aggregationFunction** – The aggregation used for the metric (**SUM**, **AVG**, and so on).
* **totalAggregate** – The total value of the metric aggregation.
* **value** – The raw value.
* **formattedValue** – The value formatted by the metric field.
• **formattedAbsoluteValue** – The absolute value formatted by the metric field.

**Unique Values Computation**

The unique values computation counts the unique values in a category field. For example, you can create a computation to count the number of unique values in a dimension, such as how many customers you have.

To use this function, you need at least one dimension in the **Categories** field well.

**Parameters**

* **name**

  A unique descriptive name that you assign or change. A name is assigned if you don’t create your own. You can edit this later.

* **Category**

  The category dimension that you want to rank.

**Computation Outputs**

Each function generates a set of output parameters. You can add these outputs to the autonarrative to customize what it displays. You can also add your own custom text.

To locate the output parameters, open the **Computations** tab on the right, and locate the computation that you want to use. The names of the computations come from the name you provide when you create the insight. Choose the output parameter by clicking on it only once. If you click twice, you add the same output twice. Items displayed in **bold** can be used in the narrative.

* **categoryField** – The category field.
* **name** – The display name of the category field.
* **uniqueGroupValuesCount** – The number of unique values included in this computation.

**Detecting Outliers with ML-Powered Anomaly Detection**

Amazon QuickSight uses proven Amazon technology to continuously run ML-powered anomaly detection across millions of metrics to discover hidden trends and outliers in your data. This anomaly detection enables you to get deep insights that are often buried in the aggregates and not scalable with manual analysis. With ML-powered anomaly detection, you can find outliers in your data without the need for manual analysis, custom development, or ML domain expertise.

Amazon QuickSight notifies you on your visuals if it detects that you can analyze an anomaly or do some forecasting on your data.

**Important**

ML-powered anomaly detection is a compute-intensive task. Before you start using it, you can get an idea of costs by analyzing the amount of data that you want to use. We offer a tiered pricing model that is based on the number of metrics you process per month. To learn more about usage-based pricing, see [Amazon QuickSight Pricing](#).

**Topics**
Concepts for Anomaly or Outlier Detection

Amazon QuickSight uses the word *anomaly* to describe data points that fall outside an overall pattern of distribution. There are many other words for anomalies, which is a scientific term, including outliers, deviations, oddities, exceptions, irregularities, quirks, and many more. The term that you use might be based on the type of analysis you do, or the type of data you use, or even just the preference of your group. These outlying data points represent an entity—a person, place, thing, or time—which is exceptional in some way.

Humans easily recognize patterns and spot things that aren't like the others. Our senses provide this information for us. If the pattern is simple, and there is only a little data, you can easily make a graph to highlight the outliers in your data. Some simple examples include the following:

- A red balloon in a group of blue ones
- A racehorse that is far ahead of the others
- A kid who isn't paying attention during class
- A day when online orders are up, but shipping is down
- A person who got well, where others didn't

Some data points represent a significant event, and others represent a random occurrence. Analysis uncovers which data is worth investigating, based on what driving factors (key drivers) contributed to the event. Questions are essential to data analysis. Why did it happen? What's it related to? Did it happen only once or many times? What can you do to encourage or discourage more like it?

Understanding how and why a variation exists, and whether there is a pattern in the variations, requires more thought. Without the assistance of machine learning, each person might come to a different conclusion, because they have different experience and information. Therefore, each person might make a slightly different business decision. If there is a lot of data or variables to consider, it can require an overwhelming amount of analysis.

ML-powered anomaly detection identifies the causations and correlations to enable you to make data-driven decisions. You still have control over defining how you want the job to work on your data. You can specify your own parameters, and choose additional options, such as identifying key drivers in a contribution analysis. Or you can use the default settings. The following section walks you through the setup process, and provides explanations for the options available.

Setting Up ML-Powered Anomaly Detection for Outlier Analysis

Use procedures in the following sections to start detecting outliers, detecting anomalies, and identifying the key drivers that contribute to them.

**Topics**

- Viewing Anomaly and Forecast Notifications (p. 449)
- Adding an ML Insight to Detect Outliers and Key Drivers (p. 450)
- Using Contribution Analysis for Key Drivers (p. 453)
Viewing Anomaly and Forecast Notifications

Amazon QuickSight notifies you on a visual where it detects an anomaly, key drivers, or a forecasting opportunity. You can follow the prompts to set up anomaly detection or forecasting based on the data in that visual.

1. In an existing line chart, look for an insight notification in the menu on the visual widget.
2. Choose the lightbulb icon to display the notification, as shown in the following screenshot.
3. If you want more information about the ML insight, you can follow the screen prompts to add an ML insight.

**Adding an ML Insight to Detect Outliers and Key Drivers**

You can add an ML insight that detects *anomalies*, which are outliers that seem significant. To get started, you create for your insight a widget, also known as an *autonarrative*. As you configure your options, you can view a limited screenshot of your insight in the **Preview** pane at screen right.

In your insight widget, you can add up to five dimension fields that are not calculated fields. In the field wells, values for **Categories** represent the dimensional values that Amazon QuickSight uses to split the metric. For example, let's say that you are analyzing revenue across all product categories and product SKUs. There are 10 product categories, each with 10 product SKUs. Amazon QuickSight splits the metric by the 100 unique combinations and runs anomaly detection on each combination for the split.

The following procedure shows how to do this, and also how to add contribution analysis to detect the key drivers that are causing each anomaly. You can add contribution analysis later, as described in Using Contribution Analysis for Key Drivers (p. 453).

**To set up outlier analysis, including key drivers**

1. Open your analysis and, on the top menu, choose **Add**, then **Add insight**. From the list, choose **Anomaly detection** and **Select**.
2. Follow the screen prompt on the new widget, which tells you to choose fields for the insight. Add at least one date, one measure, and one dimension.
3. Choose **Get started** on the widget. The configuration screen appears.
4. Under **Compute options**, choose values for the following options.
   a. For **Combinations to be analysed**, choose one of the following options:
      i. **Hierarchical**
         Choose this option if you want to analyze the fields hierarchically. For example, if you chose a date (T), a measure (N), and three dimension categories (C1, C2, and C3), QuickSight analyses the fields hierarchically, as shown following.

         \[ T-N, T-C1-N, T-C1-C2-N, T-C1-C2-C3-N \]

      ii. **Exact**
         Choose this option if you want to analyze only the exact combination of fields in the Category field well, as they are listed. For example, if you chose a date (T), a measure (N), and three dimension categories (C1, C2, and C3), QuickSight analyses only the exact combination of category fields in the order they are listed, as shown following.

         \[ T-C1-C2-C3-N \]

      iii. **All**
         Choose this option if you want to analyze all field combinations in the Category field well. For example, if you chose a date (T), a measure (N), and three dimension categories (C1, C2, and C3), QuickSight analyses all combinations of fields, as shown following.

         \[ T-N, T-C1-N, T-C1-C2-N, T-C1-C2-C3-N, T-C1-C3-N, T-C2-N, T-C2-C3-N, T-C3-N \]
If you chose a date and a measure only, QuickSight analyses the fields by date and then by measure.

In the **Fields to be analyzed** section, you can see a list of fields from the field wells for reference.

b. For **Name**, enter a descriptive alphanumeric name with no spaces, or choose the default value. This provides a name for the computation.

If you plan on editing the narrative that automatically displays on the widget, you can use the name to identify this widget’s calculation. Customize the name if you plan to edit the autonarrative and if you have other similar calculations in your analysis.

5. In the **Display options** section, choose the following options to customize what is displayed in your insight widget. You can still explore all your results, no matter what you display.

a. **Maximum number of anomalies to show** – The number of outliers you want to display in the narrative widget.

b. **Severity** – The minimum level of severity for anomalies that you want to display in the insight widget.

A *level of severity* is a range of anomaly scores that is characterized by the lowest actual anomaly score included in the range. All anomalies that score higher are included in the range. If you set severity to **Low**, the insight displays all of the anomalies that rank between low and very high. If you set the severity to **Very high**, the insight displays only the anomalies that have the highest anomaly scores.

You can use the following options:

- **Very high**
- **High and above**
- **Medium and above**
- **Low and above**

c. **Direction** – The direction on the x-axis or y-axis that you want to identify as anomalous. You can choose from the following:

- **Higher than expected** to identify higher values as anomalies.
- **Lower than expected** to identify lower values as anomalies.
- **[ALL]** to identify all anomalous values, high and low (default setting).

d. **Delta** – Enter a custom value to use to identify anomalies. Any amount higher than the threshold value counts as an anomaly. The values here change how the insight works in your analysis. In this section, you can set the following:

- **Absolute value** – The actual value to use. For example, suppose this is 48. Amazon QuickSight then identifies values as anomalous when the difference between a value and the expected value is greater than 48.
- **Percentage** – The percentage threshold to use. For example, suppose this is 12.5%. Amazon QuickSight then identifies values as anomalous when the difference between a value and the expected value is greater than 12.5%.

e. **Sort by** – Choose a sort method for your results. Some methods are based on the anomaly score that Amazon QuickSight generates. Amazon QuickSight gives higher scores to data points that look anomalous. You can use any of the following options:

- **Weighted anomaly score** – The anomaly score multiplied by the log of the absolute value of the difference between the actual value and the expected value. This score is always a positive number.
• **Anomaly score** – The actual anomaly score assigned to this data point.
• **Weighted difference from expected value** – The anomaly score multiplied by the difference between the actual value and the expected value (default).
• **Difference from expected value** – The actual difference between the actual value and the expected value (that is, actual−expected).
• **Actual value** – The actual value with no formula applied.

6. In the **Schedule options** section, set the schedule for automatically running the insight recalculation. The schedule runs only for published dashboards. In the analysis, you can run it manually as needed. Scheduling includes the following settings:

• **Occurrence** – How often that you want the recalculation to run: every hour, every day, every week, or every month.
• **Start schedule on** – The date and time to start running this schedule.
• **Timezone** – The time zone that the schedule runs in. To view a list, delete the current entry.

7. In the **Top contributors** section, set Amazon QuickSight to analyze the key drivers when an outlier (anomaly) is detected.

For example, Amazon QuickSight can show the top customers that contributed to a spike in sales in the US for home improvement products. You can add up to four dimensions from your dataset. These include dimensions that you didn’t add to the field wells of this insight widget.

For a list of dimensions available for contribution analysis, choose **Select fields**.

8. Choose **Save** to confirm your choices. Choose **Cancel** to exit without saving.

9. From the insight widget, choose **Run now** to run the anomaly detection and view your insight.

The amount of time that anomaly detection takes to complete varies depending on how many unique data points you are analyzing. The process can take a few minutes for a minimum number of points, or it can take many hours.

While it’s running in the background, you can do other work in your analysis. Make sure to wait for it to complete before you change the configuration, edit the narrative, or open the **Explore anomalies** page for this insight.

The insight widget needs to run at least once before you can see results. If you think the status might be out of date, you can refresh the page. The insight can have the following states.

<table>
<thead>
<tr>
<th>Appears on the Page</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run now button</td>
<td>The job has not yet started.</td>
</tr>
<tr>
<td>Message about <strong>Analyzing for anomalies</strong></td>
<td>The job is currently running.</td>
</tr>
<tr>
<td>Narrative about the detected anomalies (outliers)</td>
<td>The job has run successfully. The message says when this widget's calculation was last updated.</td>
</tr>
<tr>
<td>Alert icon with an exclamation point (!)</td>
<td>This icon indicates there was an error during the last run. If the narrative also displays, you can still use <strong>Explore anomalies</strong> to use data from the previous successful run.</td>
</tr>
</tbody>
</table>
Using Contribution Analysis for Key Drivers

Amazon QuickSight can identify the dimensions (categories) that contribute to outliers in measures (metrics) between two points in time. The key driver that contributes to an outlier helps you to answer the question: What happened to cause this anomaly?

If you are already using anomaly detection without contribution analysis, you can enable the existing ML insight to find key drivers. Use the following procedure to add contribution analysis and identify the key drivers behind outliers. Your insight for anomaly detection needs to include a time field and at least one aggregated metric (SUM, AVERAGE, or COUNT). You can include multiple categories (dimension fields) if you wish, but you can also run contribution analysis without specifying any category or dimension field.

You can also use this procedure to change or remove fields as key drivers in your anomaly detection.

To add contribution analysis to identify key drivers

1. Open your analysis and locate an existing ML insight for anomaly detection. Select the insight widget to highlight it.
2. Choose Menu Options (...) from the menu on the visual.
3. Choose Configure anomaly to edit the settings.
4. The Contribution analysis (optional) setting allows Amazon QuickSight to analyze the key drivers when an outlier (anomaly) is detected. For example, Amazon QuickSight can show you the top customers that contributed to a spike in sales in the US for home improvement products. You can add up to four dimensions from your dataset, including dimensions that you didn't add to the field wells of this insight widget.

To view a list of dimensions available for contribution analysis, choose Select fields.

If you want to change the fields you're using as key drivers, change the fields that are enabled in this list. If you disable all of them, QuickSight won't perform any contribution analysis in this insight.

5. To save your changes, scroll to the bottom of the configuration options, and choose Save. To exit without saving, choose Cancel. To completely remove these settings, choose Delete.

Exploring Outliers and Key Drivers with ML-powered Anomaly Detection and Contribution Analysis

You can interactively explore the anomalies (also known as outliers) in your analysis, along with the contributors (key drivers). The exploratory analysis is available after ML-powered anomaly detection runs. The changes you make in this screen aren't saved when you go back to the analysis.

To begin, choose Explore anomalies on the insight widget. The following screenshot shows the anomaly exploration screen as it appears when you first open it. In this example, contribution analysis is set up and displays two key drivers.
The sections of the screen include the following, from top left to bottom right:

- **Contributors** displays key drivers. To see this section, you need to have contributors set up in your anomaly configuration.
- **Controls** contains settings for anomaly exploration.
- **Number of anomalies** displays outliers detected over time. You can hide or show this chart section.
- **Your field names** for category or dimension fields function as titles for charts that display anomalies for each category or dimension.

The following sections provide detailed information for each aspect of exploring anomalies.

**Exploring Contributors (Key Drivers)**

If your anomaly insight is configured to detect key drivers, QuickSight runs contribution analysis to determine which categories (dimensions) are influencing the outliers. The **Contributors** section displays on the left.
Contributors contains the following components:

- **Narrative** – At top left, a narrative displays to describe any change in the metrics.
- **Top contributors configuration** – Choose **Configure** to change the contributors and the date range to use in this section.
- **Sort by** – Sets the sort applied to the results that display below. You can choose from the following:
  - **Absolute difference**
  - **Contribution percentage** (default)
• Deviation from expected
• Percentage difference
• Top contributor results – Displays the results of the top contributor analysis for the point in time selected on the timeline at right.

Contribution analysis identifies up to four of the topmost contributing factors or key drivers of an anomaly. For example, Amazon QuickSight can show you the top customers that contributed to a spike in sale in the US for health products. This panel appears only if you chose fields to include in contribution analysis when you configured the anomaly.

If you don’t see this panel and you want to display it, you can enable it. To do this, return to the analysis, choose anomaly configuration from the insight's menu, and choose up to four fields to analyze for contributions. Keep in mind that if you make changes in the sheet controls that exclude the contributing drivers, the Contributions panel closes.

Setting Controls for Anomaly Detection

The settings for anomaly detection are located in the Controls section of the screen. You can open and close this section by clicking near the word Controls.

The settings include the following:

• Controls – The current settings display at the top of the workspace. You can expand this by using the double arrow icon on the far right. The following settings are available for exploring outliers generated by ML-powered anomaly detection:
  • Severity – Sets how sensitive your detector is to detected anomalies (outliers). You should expect to see more anomalies with the threshold set to Low and above, and fewer anomalies when the threshold is set to High and above. This sensitivity is determined based on standard deviations of the anomaly score generated by the RCF algorithm. The default is Medium and above.
  • Direction – The direction on the x-axis or y-axis that you want to identify as anomalous. The default is [ALL]. You can choose the following:
    • Set to Higher than expected to identify higher values as anomalies.
    • Set to Lower than expected to identify lower values as anomalies.
    • Set to [ALL] to identify all anomalous values, high and low.
  • Minimum Delta - absolute value – enter a custom value to use to as the absolute threshold to identify anomalies. Any amount higher than this value counts as an anomaly.
  • Minimum Delta - percentage – enter a custom value to use to as the percentage threshold to identify anomalies. Any amount higher than this value counts as an anomaly.
• **Sort by** – Choose the method that you want to apply to sorting anomalies. These are listed in preferred order on the screen. Following, they are listed alphabetically:
  
  • **Weighted anomaly score** – The anomaly score multiplied by the log of the absolute value of the difference between the actual value and the expected value. This score is always a positive number.
  
  • **Anomaly score** – The actual anomaly score assigned to this data point.
  
  • **Weighted difference from expected value** – (Default) The anomaly score multiplied by the difference between the actual value and the expected value.
  
  • **Difference from expected value** – The actual difference between the actual value and the expected value (actual−expected).
  
  • **Actual value** – The actual value with no formula applied.
  
  • **Categories** – One or more settings can appear at the end of the other settings. There is one for each category field that you added to the category field well. You can use category settings to limit the data that displays in the screen.

**Showing and Hiding Anomalies by Date**

The **Number of anomalies** chart displays outliers detected over time. If you don't see this chart, you can display it by choosing **SHOW ANOMALIES BY DATE**.

This chart shows anomalies (outliers) for the most recent data point in the time series. When expanded, it displays the following components:

• **Anomalies** – The center of the screen displays the anomalies for the most recent data point in the time series. One or more graphs display with a chart showing variations in a metric over time. To use this graph, you select a point along the time line. The currently selected point in time is highlighted in the graph, and has a context menu offering you the option to analyze contributions to the current metric. You can also drag the cursor over the time line without choosing a specific point, to display the metric value for that point in time.

• **Anomalies by date** – If you choose **SHOW ANOMALIES BY DATE**, another graph appears that shows how many significant anomalies there were for each time point. You can see details in this chart on each bar’s context menu.

• **Timeline adjustment** – Each graph has a timeline adjustor tool below the dates, which you can use to compress, expand, or choose a period of time to view.

**Exploring Anomalies per Category or Dimension**

The main section of the **Explore anomalies** screen is anchored to the lower right of the screen. It remains on the lower right no matter how many other sections of the screen are open. If multiple anomalies exist,
you can scroll out to highlight them. The chart displays anomalies in color ranges and shows where they occur over a period of time.

Each category or dimension has a separate chart that uses the field name as the chart title. Each chart contains the following components:

- **Configure alerts** – If you are exploring anomalies from a dashboard, you can use this button to subscribe to alerts and contribution analysis (if it's configured). You can set up the alerts for the level of severity (medium, high, and so on). You can get the top five alerts for **Higher than expected**, **Lower than expected**, or ALL. Dashboard readers can configure alerts for themselves. The Explore Anomalies page doesn't display this button if you opened the page from an analysis.

  **Note**

  The ability to configure alerts is available only in published dashboards.

- **Status** – Under the Anomalies header, the status label displays information on the last run, for example “Anomalies for Revenue on November 17, 2018.” This label tells you how many metrics were processed and how long ago. You can choose the link to learn more about the details, for example how many metrics were ignored.

### Forecasting and Creating What-If Scenarios with Amazon QuickSight

Using ML-powered forecasting, you can forecast your key business metrics with point-and-click simplicity. No machine learning expertise is required. The built-in ML algorithm in Amazon QuickSight is designed to handle complex real-world scenarios. Amazon QuickSight uses machine learning to help provide more reliable forecasts than available by traditional means.

For example, suppose that you are a business manager. Suppose that you want to forecast sales to see if you are going to meet your goal by the end of the year. Or, suppose that you expect a large deal to come through in two weeks and you want to know how it's going to affect your overall forecast.

You can forecast your business revenue with multiple levels of seasonality (for example, sales with both weekly and quarterly trends). Amazon QuickSight automatically excludes anomalies in the data (for example, a spike in sales due to price drop or promotion) from influencing the forecast. You also don't have to clean and reprep the data with missing values because Amazon QuickSight automatically handles that. In addition, with ML-powered forecasting, you can perform interactive what-if analyses to determine the growth trajectory you need to meet business goals.
Using Forecasts and What-If Scenarios

You can add a forecasting widget to your existing analysis, and publish it as a dashboard. To analyze what-if scenarios, use an analysis, not a dashboard. With ML-powered forecasting, Amazon QuickSight enables you to forecast complex, real-world scenarios such as data with multiple seasonality. It automatically excludes outliers that it identifies and imputes missing values.

Use the following procedure to add a graphical forecast to your analysis, and explore what-if scenarios.

1. Create a visual that uses a single date field and a revenue field. Choose the v-shaped on-visual menu, then choose Add forecast. Amazon QuickSight automatically analyzes the historical data using ML, and displays a graphical forecast for the next 14 periods.

   Although this procedure is for graphical forecasting, you can also add a forecast as a narrative in an insight widget. To learn more, see Creating Autonarratives with Amazon QuickSight (p. 424).

2. On the Forecast properties panel that opens at left, customize one or more of the following settings:
   - Forecast length – Set Periods forward to forecast, and Periods backward to look for patterns to base the forecast on.
   - Prediction interval – Set the estimated range for the forecast. Doing this changes how wide the band of possibility is around the predicted line.
   - Seasonality – Set the number of time periods involved in the predictable seasonal pattern of data. The range is 1–180, and the default setting is Automatic.

   To save your changes, choose Apply.

3. Analyze what-if scenarios by choosing a forecasted data point (in the orange band) on the chart, and then choosing What-if analysis from the context menu. The What-if analysis panel opens on the left. Set the following options:
   - Scenario – Set a target for a date, or set a target for a time range.
   - Dates – If you are setting a target for a specific date, enter that date here. If you are using a time range, set the start and end dates.
   - Target – Set a target value for the metric.

   Amazon QuickSight adjusts the forecast to meet the target.

4. Keep your changes by choosing Apply. To discard them, close the What-if analysis panel.
If you keep your changes, you see the new forecast adjusted for the target, alongside the original forecast without the what-if.

The what-if analysis is represented on the visual as a dot on the metric line. You can hover over the data points on the forecasting line to see the details.

Here are other things you can do:

• To interact with or remove a what-if analysis, choose the dot on the metric line.
• To create additional what-if scenarios, close the what-if analysis before choosing a new point on the line.

**Note**
What-if analyses can exist inside an analysis only, not inside a dashboard.
Working with Dashboards

A dashboard is a read-only snapshot of an analysis that you can share with other Amazon QuickSight users for reporting purposes. A dashboard preserves the configuration of the analysis at the time you publish it, including such things as filtering, parameters, controls, and sort order. The data used for the analysis isn't captured as part of the dashboard. When you view the dashboard, it reflects the current data in the data sets used by the analysis.

When you share a dashboard, you specify which users have access to it. Users who are dashboard viewers can view and filter the dashboard data. Any selections to filters, controls, or sorting that users apply while viewing the dashboard exist only while the user is viewing the dashboard, and aren't saved once it's closed. Users who are dashboard owners can edit and share the dashboard, and optionally can edit and share the analysis. If you want them to also edit and share the data set, you can set that up in the analysis.

A shared dashboard can also be embedded in a website or app, if you are using Enterprise edition. For more information about embedded dashboards, see Working with Embedded Analytics (p. 575).

Use the following sections to learn how to publish, share, and view dashboards.

Topics
- Publishing a Dashboard (p. 461)
- Copying a Dashboard (p. 462)
- Deleting a Dashboard (p. 463)
- Sharing Dashboards (p. 463)
- Sending Reports by Email (p. 466)
- Subscribing to Reports (p. 468)
- Printing a Dashboard or Analysis (p. 469)

Publishing a Dashboard

Use the following procedure to publish and optionally share a dashboard. You can also use this procedure to rename a published dashboard. A renamed dashboard retains its security and emailed report settings.

1. Open the analysis that you want to use. Choose Share on the application bar, and then choose Publish dashboard.
2. Do one of the following:
   - To create a new dashboard, choose Publish new dashboard as, and then type a dashboard name.
   - To replace an existing dashboard, do one of the following. Replacing a dashboard updates it without altering security or emailed report settings.
     - To update it with your changes, choose Replace an existing dashboard and then choose a dashboard from the list.
     - To rename it, choose Replace an existing dashboard, choose a dashboard from the list, and then choose Rename. Enter a new name to rename the existing dashboard. When you rename a dashboard, it also saves any changes you made to the analysis.
3. (Optional) Open the Advanced publish options.

   Note
   This is a scrollable window. Scroll down in the Publish a dashboard window to view all available options.
There are some options that you can disable to simplify the experience for this dashboard, as follows:

- **For Dashboard options:**
  - Leave *Expand on-sheet controls by default* cleared to show a simplified view. This is disabled by default. To show the controls by default, enable this option.
  - Clear *Enable advanced filtering on the left pane* to remove the ability for dashboard viewers to filter the data themselves. If they create their own filters, the filters exist only while the user is viewing the dashboard. Filters can't be saved or reused.
  - Clear *Enable on-hover tooltip* to disable tooltips.

- **For Visual options:**
  - Clear *Enable visual menu*, to disable the on-visual menu entirely.
  - Clear *Enable CSV downloads* if your dashboard viewers don't need to be able to download data from the visuals in the dashboard. The CSV file includes only what is currently visible in the visual at the time they download it. The viewer downloads data by using the on-visual menu on each individual visual.
  - Clear *Enable maximize visual option* to disable the ability to enlarge visuals to fill the screen.

- **For Data point options:**
  - Clear *Enable drill up/down* if your dashboard doesn't offer drillable field hierarchies.
  - Clear *Enable on-click tooltip* to disable tooltips that appear when the reader chooses (clicks on) a data point.
  - Clear *Enable sort options* to disable sorting controls.

4. Choose *Publish dashboard*.

If you renamed the existing dashboard, the top of the screen refreshes to show the new name.

5. (Optional) Do one of the following:

- To publish a dashboard without sharing, choose x at the upper right of the *Share dashboard with users* screen when it appears. You can always share the dashboard later by choosing *Share* from the application bar.
- To share the dashboard, follow the procedure in *Sharing Dashboards* (p. 463).

After you complete these steps, you complete creating and sharing the dashboard. Subscribers of the dashboard receive email that contains a link to the dashboard. Groups don't receive invitation emails.

### Copying a Dashboard

If you have co-owner access or *Save as* privileges on an existing dashboard, you can copy it. To do this, create a new analysis from the dashboard and then create a new dashboard from the analysis that you copied.

After you save the original dashboard as a new analysis, you can collaborate on it by sharing the new analysis with other users. For example, you can use this workflow to preserve a production version of the dashboard, while also developing or testing a new version of it.

Use the following procedure to copy a dashboard.

**To copy a dashboard**

1. Sign in to Amazon QuickSight at [https://quicksight.aws.amazon.com/](https://quicksight.aws.amazon.com/) and choose *Dashboards* from the start page.
2. Open the dashboard that you want to duplicate.
3. At upper right, choose **Save As**, and then enter a name for the new analysis. When you save an existing dashboard using **Save As**, it creates an analysis based on the dashboard.

   **Note**
   If you can't see **Save as**, check with your administrator that you have the right permissions.
4. (Optional) Make changes to the new analysis.
5. (Optional) Share the analysis with other users so you can collaborate on changes. All users who have access can make changes to the new analysis.

   To share the analysis with other users, choose **Share** from the top right corner of the page, and then choose **Share analysis**.
6. (Optional) Create a new dashboard with your changes to the new analysis by choosing **Share**, and then choosing **Publish Dashboard**.

For more information, see the following:
- Sharing Dashboards (p. 463)
- Sharing Analyses (p. 240)

### Deleting a Dashboard

You can only delete dashboards that you own or co-own. Use the following procedure to delete a dashboard.

1. On the **Dashboards** tab of the Amazon QuickSight start page, choose the details icon (vertical dots \(\vdots\)) on the dashboard that you want to delete.
2. Choose **Delete**. Then choose **Delete** again to confirm that you want to delete it.

### Sharing Dashboards

After you publish a dashboard, you can share it with other users or groups, and choose the level of access to grant them. You can also choose to share with all users in your Amazon QuickSight subscription.

After you share a dashboard, you can review the other users or groups that have access to it. You can also revoke access to the dashboard, or remove yourself from it.

You can also embed interactive dashboards in websites and apps. For more information, see **Working with Embedded Analytics** (p. 575).

**Topics**
- Viewing the Users Sharing the Dashboard (p. 463)
- Sharing an Existing Dashboard (p. 464)
- Revoking Access to a Dashboard (p. 466)

### Viewing the Users Sharing the Dashboard

Use the following procedure to see which users or groups have access to the dashboard.
1. Open the dashboard and choose **Share** from the application bar. Then choose **Manage dashboard access**.

2. Review the users and groups, and their roles and settings.

You can search to locate a specific user or group by typing in their name, or any part of their name. Searching is case-sensitive, and wildcards are not supported. Delete the search term to return view all user accounts.

---

**Sharing an Existing Dashboard**

Use the following procedure to share a dashboard. You can use the same procedure to reshare a dashboard to send a new notification email. However, confirmation emails are not sent to groups.

1. On the dashboard page, choose **Share** on the application bar.

2. Do one of the following:

   - Before adding any users, you can check what permissions already exist by choosing **Manage dashboard access**. Then choose **Add users** to return to this screen.

   - You have the option to share with all the users in your Amazon QuickSight subscription. To do this, select the option **Share with all users in this account**. When you manage dashboard access through the **Managed dashboard sharing** screen, you see that the option **Share with all users in this account** is enabled. The individual users aren't listed in this screen.

   - To share with an individual user or group, type the user or group into the search box. Then choose the user or group from the list that appears. Only active users and groups appear in the list.

     **Important**

     Users who have access to the dashboard can also see the data used in the analysis.
To add more users, type in another user or group. You can remove users or groups by choosing the delete icon near the user that you want to remove.

3. After you have entered everyone that you want to share with, choose Share to confirm your choices. In the next screen, you can see the user name, email, permission level, user role, and privileges. You can also remove a user by using the delete icon.

4. Choose permissions for each user. Users in the reader role don't have any options for permissions or Save as privileges.

- **Viewer**

  Viewers can view, filter, and sort the dashboard data. They can also use any controls or custom actions that are on the dashboard. Any changes they make to the dashboard exist only while they are viewing it, and aren't saved once they close the dashboard.

- **Co-owner**

  Co-owners can edit and share the dashboard. You have the option to provide them with the same permissions to the analysis. If you want them to also edit and share the data set, you can set that up inside the analysis.

Choose whether to enable a user's privilege to **Save as** to create a new dashboard from a copy of this one. This privilege grants read-only access to the data sets, so the user or group can create new analyses from it.
Removing Users

Revoking Access to a Dashboard

Use the following procedure to revoke user access to a dashboard.

1. On the dashboard page, choose Share on the application bar.
2. Choose Manage dashboard sharing.
3. Locate the user you want to remove. Under Action, choose the delete icon for that user.

Sending Reports by Email

In Enterprise edition, you can send a dashboard in report form either once or on a schedule (daily, weekly, or monthly). You can email the reports to users or groups who share your Amazon QuickSight subscription. To receive email reports, the users or group members must meet the following conditions:

- They are part of your Amazon QuickSight subscription.
- You already shared the dashboard with them.
- They have completed sign-up process to activate their subscription as Amazon QuickSight readers, authors, or admins.
- Amazon QuickSight can’t send scheduled emails to any groups that contain more than 5,000 members.

Amazon QuickSight generates a custom email snapshot for each user or group based on their data permissions, which are defined in the dashboard. RLS for email reports works for both scheduled and ad-hoc emails.

Subscribers who are readers see an option for Reports on the dashboard when an email report is available for that dashboard. They can use the Reports option to subscribe to or unsubscribe from the emails. They can also change their preferred report layout. For more information, see Subscribing to Reports (p. 468).

Note
Email reports use only the static default value for parameters. Any dynamic default values for parameter controls are ignored.
Geospatial (map) charts aren’t supported for email reports.

How Billing Works for Email Reports

Authors and admins can receive any number of email reports at no extra charge.
For readers (users in the reader role), it costs one session per report, up to the monthly maximum. After receiving an email report, the reader gets a session credit to access the interactive dashboard at no additional cost during the same month. Reader session credits don’t carry over to the next billing month.

For a reader, charges for email reports and interactive sessions both accrue up to the monthly maximum charge. For readers who hit the monthly max charge, there are no further charges, and they can receive as many additional email reports as they need.

### Configuring Email Report Settings for a Dashboard in Amazon QuickSight Enterprise edition

**Applies to:** Enterprise Edition

In Amazon QuickSight Enterprise edition, you can email a report from each dashboard. Reports include settings for when to send them, the contents to include, and who receives the email. You can view a sample report and a list of the datasets used in the report. To set up or change the report sent from a dashboard, make sure that you’re an owner or co-owner of the dashboard.

If you have access to the dashboard, you can change your subscription options by opening your view of the dashboard. For more information on how this works, see Subscribing to Reports (p. 468).

Scheduling options that are available for an email report include the following:

- **Send once (Does not repeat)** – Sends the report only once at the date and time that you choose.
- **Repeat once a day** – Reports daily at the same time.
- **Repeat once a week** – Reports each week on the same day at the same time.
- **Repeat once a month** – Repeats each month on the same day of the month at the same time.

If you choose to repeat the report, the schedule recurs at the same time and day based on the interval that you choose. For example, suppose that you choose to send your first report August 1 at 9 AM, and you choose that the report repeat once a month. In this case, the second report is sent September 1 at 9 AM. If you choose once a week, the day of the week August 1 falls on is the day that the report repeats, at the same time the first one sends.

You can customize the title of the report, the optional email subject, and the body text. You can also optimize the report layout, so you can set the initial display width to one of the following:

- **Viewing on a desktop** – (Default wide layout) One or more columns, as originally designed.
- **Viewing on a mobile device** – (Narrow layout) One column only, with visuals aligned at left.

Although it's easy to configure the report so that everyone who has access receives a copy, this is not usually the best plan. We recommend to limit automated emails, especially those sent to groups. You can do this by starting with a small number of subscribers by choosing specific people from the access list. Verify your company's policy before subscribing anyone to a subscription.

You can directly add people to a report subscription in these ways:

- Choose recipients from the provided access list to specify and maintain a list of people who you want to email reports to. You can use the search box to find people by email or group name. (Recommended)
- To send reports to all of this dashboard's subscribers, choose **Send email report to all users with access to dashboard** when prompted.
Anyone else who wants to get the emails can open the dashboard and set their own subscription options to either opt in or opt out.

**Important**
When you share the dashboard with new QuickSight user names or groups, they automatically start receiving the email reports. If you don't want this to happen, you need to edit the report settings each time you add people to the dashboard.

For existing email reports, you can pause your schedule in Amazon QuickSight while you make changes. If you edit an existing report, the **Pause this report** button appears. Using this option, you can pause the current schedule without deleting it. If the report has already been paused, the **Resume this report** button appears instead, so you can continue with the existing schedule. The schedule is paused or resumed after you save your changes by choosing to update the report (at the bottom of the email report configuration screen).

Before you begin, make sure that you are using Amazon QuickSight Enterprise edition and that you have shared the dashboard with intended recipients.

**To create or change an email report**

1. Open Amazon QuickSight and choose **Dashboard** on the navigation pane at left.
2. Open a dashboard to configure its email report.
3. At top right, choose **Share**, **Email report**.
4. For **Schedule**, choose the frequency for the report. If you're not sure, choose **Send once (Does not repeat)**.
5. For **Send first report on**, choose a date and time.
6. For **Time zone**, choose the time zone.
7. For **Report title**, enter a custom title for the report.
8. (Optional) For **(Optional) E-mail subject line**, leave it blank to use the report title or enter a custom subject.
9. (Optional) For **(Optional) E-mail body text**, leave it blank or enter a custom message to display at the beginning of the email.
10. (Optional) For **Optimize report for**, choose a default layout option for new users.
11. Choose specific recipients from the list (recommended), or choose **Send email report to all users with access to dashboard**.
12. (Optional, recommended) To send a sample of the report before you save changes, choose **Send test report**. This option displays beside the user name of the owner of the dashboard.
13. (Optional) To view a list of the data sets used by this report, choose **View dataset list** at the bottom of the screen.
14. Do one of the following:
   - (Recommended) Choose **Save report** or **Update report**. A "Report scheduled" message briefly appears at upper right to confirm your entries.
   - To immediately send a report, choose **Update & send a report now**. The report is sent immediately, even if your schedule's start date is in the future.
   - To delete the settings, choose **Delete**.

---

**Subscribing to Reports**

In Enterprise edition, you can subscribe to a dashboard in report form. You can also adjust your report settings.

Use the following procedure to change your subscription and report settings for a specific dashboard.
1. First, open a dashboard that is shared with you, or a dashboard that you own or co-own.
2. Choose the Reports icon at top right.
3. The Change report preferences screen appears. This screen shows the current report schedule, in addition to the subscription and optimization options.

   For Subscription, choose Subscribe to start receiving reports, or Unsubscribe to stop receiving reports.

   Under Optimize, choose the device you prefer to view the report on.

   • If you usually use a mobile device or you prefer to view reports in a portrait format, choose Viewing on a mobile device. When you receive the report, the visuals display in a single vertical column.

   • If you usually use a desktop or you prefer to view reports in a landscape format, choose Viewing on a desktop. When you receive the report, the visuals display in the same layout shown in your dashboard on your desktop.

4. Choose Update to confirm your choices, or choose Cancel to discard your changes.

Printing a Dashboard or Analysis

You can print a dashboard or an analysis.

Use the following procedure to print.

1. Open the dashboard or the analysis that you want to print.
2. Choose the **Print** icon at top right.
3. On the **Prepare for printing** screen, choose the paper size and orientation that you want to use.
4. Choose **Go to Preview**.
5. Do one of the following:
   - To proceed to printing, choose **Print** to open your operating system's print dialog.
   - To make changes to the paper size or orientation, choose **Configure**.
6. To exit the preview screen, choose **Exit preview**.
Calculated Field Function and Operator Reference for Amazon QuickSight

You can use the following functions and operators to create calculated fields. For information on aggregating calculated fields, see Using Aggregate Functions in Calculated Fields (p. 201).

Topics
- Operators (p. 471)
- Functions by Category (p. 474)
- Function Index (p. 478)
- Table Calculation Functions Index (p. 515)

Operators

You can use the following operators in calculated fields. Amazon QuickSight uses the standard order of operations: parentheses, exponents, multiplication, division, addition, subtraction (PEMDAS). Equal (=) and not equal (<>) comparisons are case-sensitive.

- Addition (+)
- Subtraction (−)
- Multiplication (*)
- Division (/)
- Modulo (%) – See also mod() in the following list.
- Power (^) – See also exp() in the following list.
- Equal (=)
- Not equal (<>)
- Greater than (>)
- Greater than or equal to (>=)
- Less than (<)
- Less than or equal to (<=)
- AND
- OR
- NOT

Amazon QuickSight supports applying the following mathematical functions to an expression.

- mod (p. 497)(number, divisor) – Finds the remainder after dividing a number by a divisor.
- log (p. 496)(expression) – Returns the base 10 logarithm of a given expression.
- ln (p. 496)(expression) – Returns the natural logarithm of a given expression.
• **abs** (p. 481)\((expression)\) – Returns the absolute value of a given expression.
• **sqrt** (p. 510)\((expression)\) – Returns the square root of a given expression.
• **exp** (p. 486)\((expression)\) – Returns the base of natural log \(e\) raised to the power of a given expression.

To make lengthy calculations easier to read, you can use parenthesis to clarify groupings and precedence in calculations. In the following statement, you don't need parentheses. The multiplication statement is processed first, and then the result is added to five, returning a value of 26. However, parentheses make the statement easier to read and thus maintain.

\[ 5 + (7 \times 3) \]

Because parenthesis are first in the order of operations, you can change the order in which other operators are applied. For example, in the following statement the addition statement is processed first, and then the result is multiplied by three, returning a value of 36.

\[ (5 + 7) \times 3 \]

**Example: Arithmetic Operators**

The following example uses multiple arithmetic operators to determine a sales total after discount.

\[(\text{Quantity} \times \text{Amount}) - \text{Discount}\]

**Example: (=) Equal**

Using = performs a case-sensitive comparison of values. Rows where the comparison is TRUE are included in the result set.

In the following example, rows where the **Region** field is **South** are included in the results. If the **Region** is **south**, these rows are excluded.

\[ \text{Region} = '\text{South}' \]

In the following example, the comparison evaluates to FALSE.

\[ \text{Region} = '\text{south}' \]

The following example shows a comparison that converts **Region** to all uppercase (**SOUTH**), and compares it to **SOUTH**. This returns rows where the region is **south**, **South**, or **SOUTH**.

\[ \text{toUpperCase} (\text{Region}) = '\text{SOUTH}' \]

**Example: (<>)**

The not equal symbol <> means *less than or greater than*. So, if we say \(x<>1\), then we are saying *if \(x\) is less than 1 OR if \(x\) is greater than 1*. Both < and > are evaluated together. In other words, *if \(x\) is any value except 1.* Or, \(x\) is not equal to 1.
**Note**

Use `<>`, not `!=`.

The following example compares `Status Code` to a numeric value. This returns rows where the `Status Code` is not equal to 1.

```
statusCode <> 1
```

The following example compares multiple `statusCode` values. In this case, active records have `activeFlag = 1`. This example returns rows where one of the following applies:

- For active records, show rows where the status isn't 1 or 2
- For inactive records, show rows where the status is 99 or -1

```
( activeFlag = 1 AND (statusCode <> 1 AND statusCode <> 2) )
OR
( activeFlag = 0 AND (statusCode= 99 OR statusCode= -1) )
```

**Example: (^)**

The power symbol `^` means *to the power of*. You can use the power operator with any numeric field, with any valid exponent.

The following example is a simple expression of 2 to the power of 4 or `(2 * 2 * 2 * 2)`. This returns a value of 16.

```
2^4
```

The following example computes the square root of the `revenue` field.

```
revenue^0.5
```

**Example: AND, OR, and NOT**

The following example uses AND, OR, and NOT to compare multiple expressions using conditional operators to tag top customers NOT in Washington or Oregon with a special promotion, who made more than 10 orders. If no values are returned, the value 'n/a' is used.

```
ifelse( ( NOT (State = 'WA' OR State = 'OR') ) AND Orders > 10), 'Special Promotion XYZ', 'n/a')
```

**Example: Creating Comparison Lists Like "in" or "not in"**

This example uses operators to create a comparison to find values that exist, or don't exist, in a specified list of values.

The following example compares `promoCode` a specified list of values. This example returns rows where the `promoCode` is in the list `{1, 2, 3}`.

```
promoCode    = 1
```
The following example compares `promoCode` a specified list of values. This example returns rows where the `promoCode` is NOT in the list \( (1, 2, 3) \).

\[
\text{NOT}(\text{promoCode} = 1 \\
\text{OR promoCode} = 2 \\
\text{OR promoCode} = 3)
\]

Another way to express this is to provide a list where the `promoCode` is not equal to any items in the list.

\[
\text{promoCode} \neq 1 \\
\text{AND promoCode} \neq 2 \\
\text{AND promoCode} \neq 3
\]

**Example: Creating a "between" Comparison**

This example uses comparison operators to create a comparison showing values that exist between one value and another.

The following example examines `OrderDate` and returns rows where the `OrderDate` is between the first day and last day of 2016. In this case, we want the first and last day included, so we use "or equal to" on the comparison operators.

\[
\text{OrderDate} \geq \text{"1/1/2016" AND OrderDate} \leq \text{"12/31/2016"}
\]

**Functions by Category**

In this section, you can find a list of the functions available in Amazon QuickSight, sorted by category.

**Topics**
- Aggregate Functions (p. 474)
- Conditional Functions (p. 475)
- Date Functions (p. 476)
- Numeric Functions (p. 476)
- Mathematical Functions (p. 476)
- String Functions (p. 476)
- Table Calculations (p. 477)

**Aggregate Functions**

The aggregate functions for calculated fields in Amazon QuickSight include the following. These are only available during analysis and visualization. Each of these functions returns values grouped by the chosen dimension or dimensions. For each aggregation, there is also a conditional aggregation. These perform the same type of aggregation, based on a condition.

- \( \text{avg} \) (p. 203) averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
- \( \text{avgIf} \) (p. 203) calculates the average based on a conditional statement.
Conditional Functions

The conditional functions for calculated fields in Amazon QuickSight include the following:

- **count** (p. 204) calculates the number of values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **countIf** (p. 204) calculates the count based on a conditional statement.
- **distinct_count** (p. 205) calculates the number of distinct values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **distinct_countIf** (p. 205) calculates the distinct count based on a conditional statement.
- **max** (p. 206) returns the maximum value of the specified measure, grouped by the chosen dimension or dimensions.
- **maxIf** (p. 206) calculates the maximum based on a conditional statement.
- **median** (p. 206) returns the median value of the specified measure, grouped by the chosen dimension or dimensions.
- **medianIf** (p. 207) calculates the median based on a conditional statement.
- **min** (p. 207) returns the minimum value of the specified measure, grouped by the chosen dimension or dimensions.
- **minIf** (p. 207) calculates the minimum based on a conditional statement.
- **percentile** (p. 208) (alias of percentileDisc) computes the \( n \)th percentile of the specified measure, grouped by the chosen dimension or dimensions.
- **percentileCont** (p. 208) calculates the \( n \)th percentile based on a continuous distribution of the numbers of the specified measure, grouped by the chosen dimension or dimensions.
- **percentileDisc** (percentile) (p. 209) calculates the \( n \)th percentile based on the actual numbers of the specified measure, grouped by the chosen dimension or dimensions.
- **stdev** (p. 211) calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
- **stdevIf** (p. 211) calculates the sample standard deviation based on a conditional statement.
- **stdevp** (p. 211) calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.
- **stdevpIf** (p. 212) calculates the population deviation based on a conditional statement.
- **var** (p. 213) calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
- **varIf** (p. 213) calculates the sample variance based on a conditional statement.
- **varp** (p. 214) calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.
- **varpIf** (p. 214) calculates the population variance based on a conditional statement.
- **sum** (p. 212) adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
- **sumIf** (p. 213) calculates the sum based on a conditional statement.

Conditional Functions

The conditional functions for calculated fields in Amazon QuickSight include the following:

- **coalesce** (p. 482) returns the value of the first argument that is not null.
- **ifelse** (p. 489) evaluates a set of if, then expression pairings, and returns the value of the then argument for the first if argument that evaluates to true.
- **isNotNull** (p. 493) evaluates an expression to see if it is not null.
- **isNull** (p. 494) evaluates an expression to see if it is null. If the expression is null, **isNull** returns true, and otherwise it returns false.
- **nullIf** (p. 498) compares two expressions. If they are equal, the function returns null. If they are not equal, the function returns the first expression.
Date Functions

The date functions for calculated fields in Amazon QuickSight include the following:

- `addDateTime` (p. 479) adds or subtracts a unit of time to the date or time provided.
- `dateDiff` (p. 484) returns the difference in days between two date fields.
- `epochDate` (p. 485) converts an epoch date into a standard date.
- `extract` (p. 486) returns a specified portion of a date value.
- `formatDate` (p. 488) formats a date using a pattern you specify.
- `now` (p. 498) returns the current date and time, using either settings for a database, or UTC for file and Salesforce.
- `truncDate` (p. 514) returns a date value that represents a specified portion of a date.

Numeric Functions

The numeric functions for calculated fields in Amazon QuickSight include the following:

- `ceil` (p. 481) rounds a decimal value to the next highest integer.
- `decimalToInt` (p. 483) converts a decimal value to an integer.
- `floor` (p. 487) decrements a decimal value to the next lowest integer.
- `intToDecimal` (p. 492) converts an integer value to a decimal.
- `round` (p. 508) rounds a decimal value to the closest integer or, if scale is specified, to the closest decimal place.

Mathematical Functions

The mathematical functions for calculated fields in Amazon QuickSight include the following:

- `mod` (p. 497)`(number, divisor)` – Finds the remainder after dividing a number by a divisor.
- `log` (p. 496)`(expression)` – Returns the base 10 logarithm of a given expression.
- `ln` (p. 496)`(expression)` – Returns the natural logarithm of a given expression.
- `abs` (p. 481)`(expression)` – Returns the absolute value of a given expression.
- `sqrt` (p. 510)`(expression)` – Returns the square root of a given expression.
- `exp` (p. 486)`(expression)` – Returns the base of natural log $e$ raised to the power of a given expression.

String Functions

The string (text) functions for calculated fields in Amazon QuickSight include the following:

- `concat` (p. 482) concatenates two or more strings.
- `left` (p. 495) returns the specified number of leftmost characters from a string.
- `locate` (p. 495) locates a substring within another string, and returns the number of characters before the substring.
- `ltrim` (p. 497) removes preceding blank space from a string.
- `parseDate` (p. 499) parses a string to determine if it contains a date value, and returns the date if found.
parseDecimal (p. 503) parses a string to determine if it contains a decimal value.
parseInt (p. 504) parses a string to determine if it contains an integer value.
parseJson (p. 504) parses values from a native JSON or from a JSON object in a text field.
replace (p. 506) replaces part of a string with a new string.
right (p. 507) returns the specified number of rightmost characters from a string.
rtrim (p. 508) removes following blank space from a string.
split (p. 509) splits a string into an array of substrings, based on a delimiter that you choose, and returns the item specified by the position.
strlen (p. 510) returns the number of characters in a string.
substring (p. 511) returns the specified number of characters in a string, starting at the specified location.
toLower (p. 512) formats a string in all lowercase.
toString (p. 512) formats the input expression as a string.
toUpper (p. 513) formats a string in all uppercase.
trim (p. 514) removes both preceding and following blank space from a string.

Table Calculations

Table calculations form a group of functions that provide context in an analysis. They provide support for enriched aggregated analysis. By using these calculations, you can address common business scenarios such as calculating percentage of total, running sum, difference, common baseline, and rank.

When you are analyzing data in a specific visual, you can apply table calculations to the current set of data to discover how dimensions influence measures or each other. Visualized data is your result set based on your current data set, with all the filters, field selections, and customizations applied. To see exactly what this result set is, you can export your visual to a file. A table calculation function performs operations on the data to reveal relationships between fields.

Lookup-based functions:

difference (p. 516) calculates the difference between a measure based on one set of partitions and sorts, and a measure based on another.
lag (p. 518) calculates the lag (previous) value for a measure.
lead (p. 520) calculates the lead (following) value for a measure.
percentDifference (p. 522) calculates the percentage difference between the current value and a comparison value.

Over functions:

avgOver (p. 524) calculates the average of a measure over one or more dimensions.
countOver (p. 526) calculates the count of a field over one or more dimensions.
maxOver (p. 529) calculates the maximum of a measure over one or more dimensions.
minOver (p. 531) the minimum of a measure over one or more dimensions.
percentileOver (p. 533) (alias of percentileDiscOver) calculates the \( n \)th percentile of a measure partitioned by a list of dimensions.
percentileContOver (p. 533) calculates the \( n \)th percentile based on a continuous distribution of the numbers of a measure partitioned by a list of dimensions.
percentileDiscOver (p. 535) calculates the \( n \)th percentile based on the actual numbers of a measure partitioned by a list of dimensions.
percentOfTotal (p. 537) calculates the percentage that a measure contributes to the total.
• sumOver (p. 543) calculates the sum of a measure over one or more dimensions.
• stdevOver (p. 538) calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.
• stdevpOver (p. 539) calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.
• varOver (p. 540) calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.
• varpOver (p. 542) calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.

Ranking functions:
• rank (p. 545) calculates the rank of a measure or a dimension.
• denseRank (p. 544) calculates the rank of a measure or a dimension, ignoring duplicates.
• percentileRank (p. 547) calculates the rank of a measure or a dimension, based on percentile.

Running functions:
• runningAvg (p. 549) calculates a running average for a measure.
• runningCount (p. 550) calculates a running count for a measure.
• runningMax (p. 551) calculates a running maximum for a measure.
• runningMin (p. 552) calculates a running minimum for a measure.
• runningSum (p. 553) calculates a running sum for a measure.

Window functions:
• firstValue (p. 554) calculates the first value of the aggregated measure or dimension partitioned and sorted by specified attributes.
• lastValue (p. 555) calculates the last value of the aggregated measure or dimension partitioned and sorted by specified attributes.
• windowAvg (p. 556) calculates the average of the aggregated measure in a custom window that is partitioned and sorted by specified attributes.
• windowCount (p. 558) calculates the count of the aggregated measure in a custom window that is partitioned and sorted by specified attributes.
• windowMax (p. 559) calculates the maximum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes.
• windowMin (p. 561) calculates the minimum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes.
• windowSum (p. 563) calculates the sum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes.

Function Index

In this section, you can find a list of functions available in Amazon QuickSight. To view a list of functions sorted by category, with brief definitions, see Functions by Category (p. 474).

Topics
• addDateTime (p. 479)
• abs (p. 481)
addDateTime adds or subtracts a unit of time from a datetime value. For example,
addDateTime(2, 'YYYY', parseDate('02-JUL-2018', 'dd-MMM-yyyy') ) returns 02-JUL-2020. You can use this function to perform date math on your date and time data.
Syntax

```
addDateTime(amount, period, datetime)
```

Arguments

`amount`

A positive or negative integer value that represents the amount of time that you want to add or subtract from the provided datetime field.

`period`

A positive or negative value that represents the amount of time that you want to add or subtract from the provided datetime field. Valid periods are as follows:

- `YYYY`: This returns the year portion of the date.
- `Q`: This returns the quarter that the date belongs to (1–4).
- `MM`: This returns the month portion of the date.
- `DD`: This returns the day portion of the date.
- `WK`: This returns the week portion of the date. The week starts on Sunday in Amazon QuickSight.
- `HH`: This returns the hour portion of the date.
- `MI`: This returns the minute portion of the date.
- `SS`: This returns the second portion of the date.

`datetime`

The date or time that you want to perform date math on.

Return Type

`Datetime`

Example

Let's say you have a field called `purchase_date` that has the following values.

```
2018 May 13 13:24
2017 Jan 31 23:06
2016 Dec 28 06:45
```

Using the following calculations, `addDateTime` modifies the values as shown following.

```
addDateTime(-2, 'YYYY', purchaseDate)
2016 May 13 13:24
2015 Jan 31 23:06
2014 Dec 28 06:45

addDateTime(4, 'DD', purchaseDate)
2018 May 17 13:24
2017 Feb 4 23:06
2017 Jan 1 06:45
```
addDateTime(20, 'MI', purchaseDate)

2018 May 13 13:44
2017 Jan 31 23:26
2016 Dec 28 07:05

abs

abs returns the absolute value of a given expression.

Syntax

abs(expression)

Arguments

eexpression

The expression must be numeric. It can be a field name, a literal value, or another function.

ceil

ceil rounds a decimal value to the next highest integer. For example, ceil(29.02) returns 30.

Syntax

ceil(decimal)

Arguments

decimal

A field that uses the decimal data type, a literal value like 17.62, or a call to another function that outputs a decimal.

Return Type

Integer

Example

The following example rounds a decimal field to the next highest integer.

ceil(salesAmount)

The following are the given field values.

20.13
892.03
coalesce

coalesce returns the value of the first argument that is not null. When a non-null value is found, the remaining arguments in the list are not evaluated. If all arguments are null, the result is null. 0-length strings are valid values and are not considered equivalent to null.

Syntax

```
coalesce(expression1, expression2 [, expression3, ...])
```

Arguments

coalesce takes two or more expressions as arguments. All of the expressions must have the same data type or be able to be implicitly cast to the same data type.

expression

The expression can be numeric, datetime, or string. It can be a field name, a literal value, or another function.

Return Type

coalesce returns a value of the same data type as the input arguments.

Example

The following example retrieves a customer's billing address if it exists, her street address if there is no billing address, or returns "No address listed" if neither address is available.

```
coalesce(billingAddress, streetAddress, 'No address listed')
```

concat

concat concatenates two or more strings.

Syntax

```
concat(expression1, expression2 [, expression3 ...])
```

Arguments

concat takes two or more string expressions as arguments.
**expression**

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '12 Main Street', or a call to another function that outputs a string.

**Return Type**

String

**Examples**

The following example concatenates three string fields and adds appropriate spacing.

```plaintext
concat(salutation, ' ', firstName, ' ', lastName)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>salutation</th>
<th>firstName</th>
<th>lastName</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms.</td>
<td>Li</td>
<td>Juan</td>
</tr>
<tr>
<td>Dr.</td>
<td>Ana Carolina</td>
<td>Silva</td>
</tr>
<tr>
<td>Mr.</td>
<td>Nikhil</td>
<td>Jayashankar</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

- Ms. Li Juan
- Dr. Ana Carolina Silva
- Mr. Nikhil Jayashankar

The following example concatenates two string literals.

```plaintext
concat('Hello', 'world')
```

The following value is returned.

Helloworld

**decimalToInt**

decimalToInt converts a decimal value to the integer data type by stripping off the decimal point and any numbers after it. decimalToInt does not round up. For example, decimalToInt(29.99) returns 29.

**Syntax**

```plaintext
decimalToInt(decimal)
```

**Arguments**

- **decimal**
  
  A field that uses the decimal data type, a literal value like 17.62, or a call to another function that outputs a decimal.
Return Type

Integer

Example

The following example converts a decimal field to an integer.

\[
\text{decimalToInt(salesAmount)}
\]

The following are the given field values.

\[
\begin{align*}
20.13 \\
892.03 \\
57.54
\end{align*}
\]

For these field values, the following values are returned.

\[
\begin{align*}
20 \\
892 \\
58
\end{align*}
\]

dateDiff

dateDiff returns the difference in days between two date fields. If you include a value for the period, dateDiff returns the difference in the period interval, rather than in days.

Syntax

\[
dateDiff(date1, date2[, period])
\]

Arguments

dateDiff takes two dates as arguments. Specifying a period is optional.

date

The first date in the comparison. A date field or a call to another function that outputs a date.

date

The second date in the comparison. A date field or a call to another function that outputs a date.

period

The period of difference that you want returned, enclosed in quotes. Valid periods are as follows:

- YYYY: This returns the year portion of the date.
- Q: This returns the date of the first day of the quarter that the date belongs to.
- MM: This returns the month portion of the date.
- DD: This returns the day portion of the date.
- WK: This returns the week portion of the date. The week starts on Sunday in Amazon QuickSight.
- HH: This returns the hour portion of the date.
- MI: This returns the minute portion of the date.
- SS: This returns the second portion of the date.
Return Type

Integer

Example

The following example returns the difference between two dates.

```
dateDiff(orderDate, shipDate, "MM")
```

The following are the given field values.

<table>
<thead>
<tr>
<th>orderDate</th>
<th>shipdate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/18</td>
<td>03/05/18</td>
</tr>
<tr>
<td>09/13/17</td>
<td>10/20/17</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

```
2
1
```

epochDate

epochDate converts an epoch date into a standard date in the format yyyy-MM-ddTkk:mm:ss.SSSZ, using the format pattern syntax specified in Class DateTimeFormat in the Joda project documentation. An example is 2015-10-15T19:11:51.003Z.

epochDate is supported for use with analyses based on datasets stored in QuickSight (SPICE).

Syntax

```
epochDate(epochdate)
```

Arguments

epochdate

An epoch date, which is an integer representation of a date as the number of seconds since 00:00:00 UTC on January 1, 1970.

epochdate must be an integer. It can be the name of a field that uses the integer data type, a literal integer value, or a call to another function that outputs an integer. If the integer value is longer than 10 digits, the digits after the tenth place are discarded.

Return Type

Date

Example

The following example converts an epoch date to a standard date.
epochDate(3100768000)

The following value is returned.

2068-04-04T12:26:40.000Z

exp

exp returns the base of natural log e raised to the power of a given expression.

Syntax

exp(expression)

Arguments

expression

The expression must be numeric. It can be a field name, a literal value, or another function.

extract

extract returns a specified portion of a date value. Requesting a time-related portion of a date that doesn't contain time information returns 0.

Syntax

extract(period, date)

Arguments

period

The period that you want extracted from the date value. Valid periods are as follows:

• YYYY: This returns the year portion of the date.
• Q: This returns the quarter that the date belongs to (1–4).
• MM: This returns the month portion of the date.
• DD: This returns the day portion of the date.
• WD: This returns the day of the week as an integer, with Sunday as 1.
• HH: This returns the hour portion of the date.
• MI: This returns the minute portion of the date.
• SS: This returns the second portion of the date.

date

A date field or a call to another function that outputs a date.

Return Type

Integer
**Example**

The following example extracts the day from a date value.

```
extract('DD', orderDate)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>orderDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/14</td>
</tr>
<tr>
<td>09/13/16</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
</tr>
<tr>
<td>13</td>
</tr>
</tbody>
</table>

**floor**

`floor` decrements a decimal value to the next lowest integer. For example, `floor(29.08)` returns 29.

**Syntax**

```
floor(decimal)
```

**Arguments**

`decimal`

A field that uses the decimal data type, a literal value like 17.62, or a call to another function that outputs a decimal.

**Return Type**

Integer

**Example**

The following example decrements a decimal field to the next lowest integer.

```
floor(salesAmount)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>salesAmount</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.13</td>
</tr>
<tr>
<td>892.03</td>
</tr>
<tr>
<td>57.54</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
</tbody>
</table>
**formatDate**

formatDate formats a date using a pattern you specify. When you are preparing data, you can use formatDate to reformat the date. To reformat a date in an analysis, you choose the format option from the context menu on the date field.

**Syntax**

```
formatDate(date, ['format'])
```

**Arguments**

date

A date field or a call to another function that outputs a date.

format

(Optional) A string containing the format pattern to apply. This argument accepts the format patterns specified in Supported Date Formats (p. 76).

If you don't specify a format, this string defaults to yyyy-MM-dd'T'kk:mm:ss:SSS.

**Return Type**

String

**Example**

The following example formats a UTC date.

```
formatDate(orderDate, 'dd MMM yyyy')
```

The following are the given field values.

```
order date
==========
2012-12-14T00:00:00.000Z
2013-12-29T00:00:00.000Z
2012-11-15T00:00:00.000Z
```

For these field values, the following values are returned.

```
13 Dec 2012
28 Dec 2013
14 Nov 2012
```

**Example**

If the date contains single quotes or apostrophes, for example yyyyMMdd’ T ’HHmmss, you can handle this date format by using one of the following methods.
• Enclose the entire date in double quotes, as shown in the following example:

```sql
formatDate({myDateField}, "yyyyMMdd'T'HHmmss")
```

• Escape the single quotes or apostrophes by adding a backslash (\) to the left of them, as shown in the following example:

```sql
formatDate({myDateField}, 'yyyyMMdd'T'HHmmss')
```

### ifelse

ifelse evaluates a set of if, then expression pairings, and returns the value of the then argument for the first if argument that evaluates to true. The remaining arguments in the list are not evaluated. If none of the if arguments evaluate to true, then the value of the else argument is returned.

#### Syntax

```sql
ifelse(if-expression-1, then-expression-1 [, if-expression-n, then-expression-n ...], else-expression)
```

#### Arguments

ifelse requires one or more if, then expression pairings, and requires exactly one expression for the else argument.

**if-expression**

The expression to be evaluated as true or not. It can be a field name like `address1`, a literal value like 'Unknown', or another function like `toString(salesAmount)`. An example is `isNull(FieldName)`.

If you use multiple AND and OR operators in the if argument, enclose statements in parentheses to identify processing order. For example, the following if argument returns records with a month of 1, 2, or 5 and a year of 2000.

```sql
ifelse((month = 5 OR month < 3) AND year = 2000, 'yes', 'no')
```

The next if argument uses the same operators, but returns records with a month of 5 and any year, or with a month of 1 or 2 and a year of 2000.

```sql
ifelse(month = 5 OR (month < 3 AND year = 2000), 'yes', 'no')
```

**then-expression**

The expression to return if its if argument is evaluated as true. It can be a field name like `address1`, a literal value like 'Unknown', or a call to another function. The expression must have the same data type as the other then arguments and the else argument.

**else-expression**

The expression to return if none of the if arguments evaluate as true. It can be a field name like `address1`, a literal value like 'Unknown', or another function like `toString(salesAmount)`. The expression must have the same data type as all of the then arguments.
Return Type

\texttt{ifelse} returns a value of the same data type as the values in \textit{then-expression}. All data returned \textit{then} and \textit{else} expressions must be of the same data type or be converted to the same data type.

Examples

The following example categorizes sales per customer into human-readable levels.

\begin{verbatim}
ifelse(salesPerCustomer < 1000, "VERY_LOW", salesPerCustomer < 10000, "LOW",
salesPerCustomer < 100000, "MEDIUM", "HIGH")
\end{verbatim}

The following example uses AND, OR, and NOT to compare multiple expressions using conditional operators to tag top customers NOT in Washington or Oregon with a special promotion, who made more than 10 orders. If no values are returned, the value \textit{'n/a'} is used.

\begin{verbatim}
ifelse( (NOT (State = 'WA' OR State = 'OR')) AND Orders > 10), 'Special Promotion XYZ',
'n/a')
\end{verbatim}

The following example assigns a group to a sales record based on the sales total. The structure of each \textit{if-then} phrase mimics the behavior of \textit{between}, a keyword that doesn't currently work in calculated field expressions. For example, the result of the comparison \textit{salesTotal >= 0 AND salesTotal < 500} returns the same values as the SQL comparison \textit{salesTotal between 0 and 499}.

\begin{verbatim}
ifelse(salesTotal >= 0 AND salesTotal < 500, 'Group 1', salesTotal >= 500 AND salesTotal <
1000, 'Group 2', 'Group 3')
\end{verbatim}

The following example tests for a NULL value by using \textit{coalesce} to return the first non-NULL value. Instead of needing to remember the meaning of a NULL in a date field, you can use a readable description instead. If the disconnect date is NULL, the example returns the suspend date, unless both of those are NULL. Then \textit{coalesce(DiscoDate, SuspendDate, '12/31/2491')} returns \textit{'12/31/2491'}. The return value must match the other data types. This date might seem like an unusual value, but a date in the 25th century reasonably simulates the "end of time," defined as the highest date in a data mart.

\begin{verbatim}
ifelse( (coalesce(DiscoDate, SuspendDate, '12/31/2491') = '12/31/2491'),  'Active
subscriber', 'Inactive subscriber')
\end{verbatim}

The following shows a more complex example in a more readable format, just to show that you don't need to compress your code all into one long line. This example provides for multiple comparisons of the value a survey result. It handles potential NULL values for this field and categorizes two acceptable ranges. It also labels one range that needs more testing and another that's not valid (out of range). For all remaining values, it applies the \textit{else} condition, and labels the row as needing a retest three years after the date on that row.

\begin{verbatim}
ifelse ( (isNull({SurveyResult}), 'Untested',
(SurveyResult)=1, 'Range 1',
(SurveyResult)=2, 'Range 2',
(SurveyResult)=3, 'Need more testing',
(SurveyResult)=99, 'Out of Range',
concat ( 'Retest by ',
toString
cat
\end{verbatim}
The following example assigns a "manually" created region name to a group of states. It also uses spacing and comments, wrapped in /* */, to make it easier to maintain the code.

```plaintext
ifelse
  (    /* NE REGION*/
      locate('New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire',{State}) > 0,
        'Northeast',
      /* SE REGION*/
      locate('Georgia, Alabama, South Carolina, Louisiana',{State}) > 0,
        'Southeast',
      'Other Region'
  )
```

The logic for the region tagging breaks down as follows:

1. We list the states that we want for each region, enclosing each list in quotation marks to make each list a string, as follows:
   - 'New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire'
   - 'Georgia, Alabama, South Carolina, Louisiana'
   - You can add more sets, or use countries, cities, provinces, or What3Words if you want.

2. We ask if the value for State (for each row) is found in the list, by using the locate function to return a nonzero value if the state is found in the list, as follows.

```plaintext
locate('New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire',{State})
and
locate('Georgia, Alabama, South Carolina, Louisiana',{State})
```

3. The locate function returns a number instead of a TRUE or FALSE, but ifelse requires the TRUE/FALSE Boolean value. To get around this, we can compare the result of locate to a number. If the state is in the list, the return value is greater than zero.
   a. Ask if the state is present.

```plaintext
locate('New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire',{State}) > 0
```

   b. If it's present the region, label it as the specific region, in this case a Northeast region.

```plaintext
/*The if expression:*/ locate('New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire',{State}) > 0,
/*The then expression:*/  'Northeast',
```

4. Because we have states that aren't in a list, and because ifelse requires a single else expression, we provide 'Other Region' as the label for the leftover states.

```plaintext
/*The if expression:*/ locate('New York, New Jersey, Connecticut, Vermont, Maine, Rhode Island, New Hampshire',{State}) > 0,
```

```plaintext
'Other Region'
```
5. We wrap all that in the `ifelse( )` function to get the final version. The following example leaves out the Southeast region states that were in the original. You can add them back in place of the `<insert more regions here>` tag.

If you want to add more regions, you can construct more copies of those two lines and alter the list of states to suit your purpose. You can change the region name to something that suits you, and change the field name from `State` to anything that you need.

```sql
ifelse
{
/*The if expression:* /
locate('New York, New Jersey, Connecticut, Vermont, Maine,
Rhode Island, New Hampshire',{State}) > 0,
/*The then expression:* /
'Northeast',
/*<insert more regions here>*/
/*The else expression:* /
'Other Region'
}
```

**Note**

There are other ways to do the initial comparison for the if expression. For example, suppose that you pose the question "What states are not missing from this list?" rather than "Which states are on the list?" If you do, you might phrase it differently. You might compare the `locate` statement to zero to find values that are missing from the list, and then use the NOT operator to classify them as "not missing," as follows.

```sql
/*The if expression:* /
NOT (locate('New York, New Jersey, Connecticut,
Vermont, Maine, Rhode Island, New Hampshire',{State}) = 0),
```

Both versions are correct. The version that you choose should make the most sense to you and your team, so you can maintain it easily. If all the options seem equal, choose the simplest.

**intToDecimal**

`intToDecimal` converts an integer value to the decimal data type.

**Syntax**

```sql
intToDecimal(integer)
```

**Arguments**

`int`

A field that uses the integer data type, a literal value like `14`, or a call to another function that outputs an integer.

**Return Type**

Decimal
Example

The following example converts an integer field to a decimal.

\[
\text{intToDecimal(price)}
\]

The following are the given field values.

\[
\begin{array}{l}
20 \\
892 \\
57
\end{array}
\]

For these field values, the following values are returned.

\[
\begin{array}{l}
20.0 \\
892.0 \\
58.0
\end{array}
\]

You can apply formatting inside an analysis, for example to format \textit{price} as currency.

\textbf{isNull}

\text{isNull} evaluates an expression to see if it is not null. If the expression is not null, \text{isNull} returns true, and otherwise it returns false.

\textbf{Syntax}

\[
\text{isNull(expression)}
\]

\textbf{Arguments}

\textit{expression}

The expression to be evaluated as null or not. It can be a field name like \textit{address1} or a call to another function that outputs a string.

\textbf{Return Type}

Boolean

\textbf{Example}

The following example evaluates the sales\_amount field for null values.

\[
\text{isNull(salesAmount)}
\]

The following are the given field values.

\[
\begin{array}{l}
20.13 \\
(null)
\end{array}
\]
For these field values, the following values are returned.

| true | false | true |

**isNull**

isNull evaluates an expression to see if it is null. If the expression is null, isNull returns true, and otherwise it returns false.

**Syntax**

```sql
isNull(expression)
```

**Arguments**

*expression*

The expression to be evaluated as null or not. It can be a field name like `address1` or a call to another function that outputs a string.

**Return Type**

Boolean

**Example**

The following example evaluates the sales_amount field for null values.

```sql
isNull(salesAmount)
```

The following are the given field values.

| 20.13 | (null) | 57.54 |

For these field values, the following values are returned.

| false | true | false |

The following example tests for a NULL value in an `ifelse` statement, and returns a human-readable value instead.

```sql
ifelse( isNull({ActiveFlag}) , 'Inactive', 'Active')
```
**left**

`left` returns the leftmost characters from a string, including spaces. You specify the number of characters to be returned.

**Syntax**

```
left(expression, limit)
```

**Arguments**

- `expression`
  
  The expression must be a string. It can be the name of a field that uses the string data type, a literal value like `'12 Main Street'`, or a call to another function that outputs a string.

- `limit`
  
  The number of characters to be returned from `expression`, starting from the first character in the string.

**Return Type**

String

**Example**

The following example returns the first 3 characters from a string.

```
left('Seattle Store #14', 3)
```

The following value is returned.

```
Sea
```

**locate**

`locate` locates a substring that you specify within another string, and returns the number of characters until the first character in the substring. The function returns 0 if it doesn't find the substring.

**Syntax**

```
locate(expression, substring, start)
```

**Arguments**

- `expression`
  
  The expression must be a string. It can be the name of a field that uses the string data type, a literal value like `'12 Main Street'`, or a call to another function that outputs a string.
substring

The set of characters in expression that you want to locate. The substring can occur one or more times in expression.

start

(Optional) If substring occurs more than once, use start to identify where in the string the function should start looking for the substring. For example, suppose that you want to find the second example of a substring and you think it typically occurs after the first 10 characters. You specify a start value of 10.

Return Type

Integer

Examples

The following example returns information about where the first occurrence of the substring 'and' appears in a string.

```
locate('1 and 2 and 3 and 4', 'and')
```

The following value is returned.

3

The following example returns information about where the first occurrence of the substring 'and' appears in a string after the fourth character.

```
locate('1 and 2 and 3 and 4', 'and', 4)
```

The following value is returned.

9

log

log returns the base 10 logarithm of a given expression.

Syntax

```
log(expression)
```

Arguments

expression

The expression must be numeric. It can be a field name, a literal value, or another function.

ln

ln returns the natural logarithm of a given expression.
Syntax

```
ltrim(expression)
```

**Arguments**

`expression`

The expression must be numeric. It can be a field name, a literal value, or another function.

**ltrim**

`ltrim` removes preceding blank space from a string.

**Syntax**

```
ltrim(expression)
```

**Arguments**

`expression`

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like `'12 Main Street'`, or a call to another function that outputs a string.

**Return Type**

String

**Example**

The following example removes the preceding spaces from a string.

```
ltrim('   Seattle Store #14')
```

The following value is returned.

```
Seattle Store #14
```

**mod**

Use the `mod` function to find the remainder after dividing the number by the divisor. You can use the `mod` function or the modulo operator (%) interchangeably.

**Syntax**

```
mod(number, divisor)
```

```
number % divisor
```
Arguments

*number*

The number is the positive integer that you want to divide and find the remainder for.

*divisor*

The divisor is the positive integer that you are dividing by. If the divisor is zero, this function returns an error on dividing by 0.

Example

The following examples return the modulo of 17 when dividing by 6. The first example uses the % operator, and the second example uses the mod function.

17%6

mod( 17, 6 )

The following value is returned.

5

**NOW**

For database data sets that directly query the database, `now` returns the current date and time using the settings and format specified by the database server. For SPICE and Salesforce data sets, `now` returns the UTC date and time, in the format `yyyy-MM-ddThh:mm:ss:SSSZ` (for example, 2015-10-15T19:11:51:003Z).

Syntax

```sql
now()
```

Return Type

Date

**nullIf**

`nullIf` compares two expressions. If they are equal, the function returns null. If they are not equal, the function returns the first expression.

Syntax

```sql
nullIf(expression1, expression2)
```

Arguments

`nullIf` takes two expressions as arguments.
parseDate

expression

The expression can be numeric, datetime, or string. It can be a field name, a literal value, or another function.

Return Type

String

Example

The following example returns nulls if the reason for a shipment delay is unknown.

nullIf(delayReason, 'unknown')

The following are the given field values.

delayReason

unknown
back ordered
weather delay

For these field values, the following values are returned.

(null)
back ordered
weather delay

parseDate

parseDate parses a string to determine if it contains a date value, and returns a standard date in the format yyyy-MM-dd'T'kk:mm:ss.SSSZ (using the format pattern syntax specified in Class DateTimeFormat in the Joda project documentation), for example 2015-10-15T19:11:51.003Z. This function returns all rows that contain a date in a valid format and skips any rows that don't, including rows that contain null values.

Amazon QuickSight supports dates in the range from Jan 1, 1900 00:00:00 UTC to Dec 31, 2037 23:59:59 UTC. For more information, see Supported Date Formats (p. 76).

Syntax

parseDate(expression, ['format'])

Arguments

expression

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '1/1/2016', or a call to another function that outputs a string.

format

(Optional) A string containing the format pattern that date_string must match. For example, if you are using a field with data like 01/03/2016, you specify the format 'MM/dd/yyyy'. If you don't
specify a format, it defaults to `yyyy-MM-dd`. Rows whose data doesn't conform to `format` are skipped.

Different date formats are supported based on the type of data set used. Use the following table to see details of supported date formats.

<table>
<thead>
<tr>
<th>Date Source Type</th>
<th>Supported Date Formats</th>
</tr>
</thead>
<tbody>
<tr>
<td>File, Amazon Athena, and Salesforce data sets</td>
<td>All date format patterns specified in Supported Date Formats (p. 76).</td>
</tr>
</tbody>
</table>
| Direct query of Amazon Aurora, MariaDB, and MySQL databases | • MM/dd/yyyy  
• dd/MM/yyyy  
• yyy/MM/dd  
• MMM/dd/yyyy  
• dd/MM/yyyy HH:mm:ss  
• MMM/dd/yyyy HH:mm:ss |
| Direct query of Snowflake | • dd/MM/yyyy  
• dd/MM/yyyy HH:mm:ss  
• MM/dd/yyyy  
• MM/dd/yyyy HH:mm:ss |

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<table>
<thead>
<tr>
<th>Date Source Type</th>
<th>Supported Date Formats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct query of Microsoft SQL Server databases</td>
<td>• dd-MM-yyyy</td>
</tr>
<tr>
<td></td>
<td>• MM/dd/yyyy</td>
</tr>
<tr>
<td></td>
<td>• dd/MM/yyyy</td>
</tr>
<tr>
<td></td>
<td>• yyyy/MM/dd</td>
</tr>
<tr>
<td></td>
<td>• MMM/dd/yyyy</td>
</tr>
<tr>
<td></td>
<td>• dd/MMM/yyyy</td>
</tr>
<tr>
<td></td>
<td>• yyyy/MMM/dd</td>
</tr>
<tr>
<td></td>
<td>• dd/MM/yyyy HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy/MM/dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• MMM/dd/yyyy HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• dd/MMM/yyyy HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy/MMM/dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• MM-dd-yyyy</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd</td>
</tr>
<tr>
<td></td>
<td>• MMM-dd-yyyy</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd</td>
</tr>
<tr>
<td></td>
<td>• MMM-dd-yyyy HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• dd-MM-yyyy HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
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<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
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<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
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<td>• yyyy-MM-dd HH:mm:ss</td>
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<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
<tr>
<td></td>
<td>• yyyy-MM-dd HH:mm:ss</td>
</tr>
</tbody>
</table>

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### Date Source Type

- Direct query of Amazon Redshift or PostgreSQL databases
- Also, datasets from any DBMS that are stored in QuickSight SPICE (p. 78)

### Supported Date Formats

- MM/dd/yyyy
- dd/MM/yyyy
- yyyy/MM/dd
- MMM/dd/yyyy
- dd/MMM/yyyy
- yyyy/MMM/dd
- MM/dd/yyyy HH:mm:ss
- dd/MM/yyyy HH:mm:ss
- yyyy/MM/dd HH:mm:ss
- MMM/dd/yyyy HH:mm:ss
- dd/MMM/yyyy HH:mm:ss
- yyyy/MMM/dd HH:mm:ss
- MM-dd-yyyy
- dd-MM-yyyy
- yyyy-MM-dd
- MMM-dd-yyyy
- dd-MMM-yyyy
- yyyy-MMM-dd
- MM-dd-yyyy HH:mm:ss
- dd-MM-yyyy HH:mm:ss
- yyyy-MM-dd HH:mm:ss
- MMM-dd-yyyy HH:mm:ss
- dd-MMM-yyyy HH:mm:ss
- yyyy-MMM-dd HH:mm:ss
- yyyyMMdd'T'HHmmss
- yyyy-MM-dd'T'HH:mm:ss

### Return Type

**Date**

### Example

The following example evaluates `prodDate` to determine if it contains date values.

```plaintext
parseDate(prodDate, 'MM/dd/yyyy')
```

The following are the given field values.

<table>
<thead>
<tr>
<th>prodDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>01-01-1999</td>
</tr>
<tr>
<td>12/31/2006</td>
</tr>
<tr>
<td>1/18/1982</td>
</tr>
<tr>
<td>7/4/2010</td>
</tr>
</tbody>
</table>

For these field values, the following rows are returned.
parseDecimal

parseDecimal parses a string to determine if it contains a decimal value. This function returns all rows that contain a decimal, integer, or null value, and skips any rows that don’t. If the row contains an integer value, it is returned as a decimal. For example, a value of ‘2’ is returned as ‘2.0’.

Syntax

```
parseDecimal(expression)
```

Arguments

`expression`

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like ‘9.62’, or a call to another function that outputs a string.

Return Type

Decimal

Example

The following example evaluates `fee` to determine if it contains decimal values.

```
parseDecimal(fee)
```

The following are the given field values.

```
fee
--------
2
2a
12.13
3b
3.9
(null)
198.353398
```

For these field values, the following rows are returned.

```
2.0
12.13
3.9
(null)
198.353398
```
parseInt

parseInt parses a string to determine if it contains an integer value. This function returns all rows that contain a decimal, integer, or null value, and skips any rows that don't. If the row contains a decimal value, it is returned as the nearest integer, rounded down. For example, a value of '2.99' is returned as '2'.

Syntax

```javascript
parseInt(expression)
```

Arguments

`expression`

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '3', or a call to another function that outputs a string.

Return Type

Integer

Example

The following example evaluates `feeType` to determine if it contains integer values.

```javascript
parseInt(feeType)
```

The following are the given field values.

```text
feeType
--------
 2
 2.1
 2a
 3
 3b
(null)
 5
```

For these field values, the following rows are returned.

```text
 2
 2
 3
(null)
 5
```

parseJson

Use `parseJson` to extract values from a JSON object.

If your dataset is stored in QuickSight SPICE, you can use `parseJson` when you are preparing a data set, but not in calculated fields during analysis.
For direct query, you can use `parseJson` both during data preparation and analysis. The `parseJson` function applies to either strings or to JSON native data types, depending on the dialect, as shown in the following table.

<table>
<thead>
<tr>
<th>Dialect</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PostgreSQL</td>
<td>JSON</td>
</tr>
<tr>
<td>Amazon Redshift</td>
<td>String</td>
</tr>
<tr>
<td>Microsoft SQL Server</td>
<td>String</td>
</tr>
<tr>
<td>MySQL</td>
<td>JSON</td>
</tr>
<tr>
<td>Teradata</td>
<td>JSON</td>
</tr>
<tr>
<td>Oracle</td>
<td>String</td>
</tr>
<tr>
<td>Presto</td>
<td>String</td>
</tr>
<tr>
<td>Snowflake</td>
<td>Semistructured data type object and array</td>
</tr>
<tr>
<td>Hive</td>
<td>String</td>
</tr>
</tbody>
</table>

**Syntax**

`parseJson(fieldName, path)`

**Arguments**

*fieldName*

The field containing the JSON object that you want to parse.

*path*

The path to the data element you want to parse from the JSON object. Valid path syntax includes:

- `$` – Root object
- `.` – Child operator
- `[]` – Subscript operator for array

**Return Type**

String

**Example**

The following example evaluates incoming JSON to retrieve a value for item quantity. By using this during data preparation, you can create a table out of the JSON.

```sql
parseJson({jsonField}, ".items.qty")
```

The following shows the JSON.

```json
{
```

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```
"customer": "John Doe",
"items": {
    "product": "Beer",
    "qty": 6
},
"list1": [
    "val1",
    "val2"
],
"list2": [
    {
        "list2key1": "list1value1"
    }
]
```

For this example, the following value is returned.

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**Example**

The following example evaluates `JSONObject1` to extract the first key value pair (KVP), labelled "State", and assign the value to the calculated field that you are creating.

```java
parseJson(JSONObject1, ".state")
```

The following are the given field values.

```
JSONObject1
-------------
{"State":"New York","Product":"Produce","Date Sold":"1/16/2018","Sales Amount":"$3423.39"}
{"State":"North Carolina","Product":"Bakery Products","Date Sold":"2/1/2018","Sales Amount":"$3226.42"}
{"State":"Utah","Product":"Water","Date Sold":"4/24/2018","Sales Amount":"$7001.52"}
```

For these field values, the following rows are returned.

```
New York
North Carolina
Utah
```

**replace**

`replace` replaces part of a string with another string that you specify.

**Syntax**

```java
replace(expression, substring, replacement)
```

**Arguments**

- `expression`

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '12 Main Street', or a call to another function that outputs a string.
substring

The set of characters in expression that you want to replace. The substring can occur one or more times in expression.

replacement

The string you want to have substituted for substring.

Return Type

String

Example

The following example replaces the substring 'and' with 'or'.

```
replace('1 and 2 and 3', 'and', 'or')
```

The following string is returned.

```
1 or 2 or 3
```

right

right returns the rightmost characters from a string, including spaces. You specify the number of characters to be returned.

Syntax

```
right(expression, limit)
```

Arguments

expression

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '12 Main Street', or a call to another function that outputs a string.

limit

The number of characters to be returned from expression, starting from the last character in the string.

Return Type

String

Example

The following example returns the last five characters from a string.
The following value is returned.

tle Store#14

**round**

round rounds a decimal value to the closest integer if no scale is specified, or to the closest decimal place if scale is specified.

**Syntax**

```
round(decimal, scale)
```

**Arguments**

- **decimal**
  
  A field that uses the decimal data type, a literal value like `17.62`, or a call to another function that outputs a decimal.

- **scale**
  
  The number of decimal places to use for the return values.

**Return Type**

Decimal

**Example**

The following example rounds a decimal field to the closest second decimal place.

```
round(salesAmount, 2)
```

The following are the given field values.

```
20.1307
892.0388
57.5447
```

For these field values, the following values are returned.

```
20.13
892.04
58.54
```

**rtrim**

**rtrim** removes following blank space from a string.
Syntax

\texttt{rtrim(expression)}

Arguments

\textit{expression}

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like \texttt{'12 Main Street'}, or a call to another function that outputs a string.

Return Type

String

Example

The following example removes the following spaces from a string.

\texttt{rtrim('Seattle Store #14   ')}

For these field values, the following values are returned.

\begin{verbatim}
Seattle Store #14
\end{verbatim}

\textbf{split}

\texttt{split} splits a string into an array of substrings, based on a delimiter that you choose, and returns the item specified by the position.

You can only add \texttt{split} to a calculated field during data preparation, not to an analysis. This function is not supported in direct queries to Microsoft SQL Server.

Syntax

\texttt{split(expression, delimiter, position)}

Arguments

\textit{expression}

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like \texttt{'12 Main Street;1402 35th Ave;1818 Elm Ct;11 Janes Lane'}, or a call to another function that outputs a string.

\textit{delimiter}

The character that delimits where the string is broken into substrings. For example, \texttt{split('one|two|three', '|', 2)} becomes the following.

\begin{verbatim}
one
\end{verbatim}
If you choose position = 2, split returns 'two'.

**position**

(Required) The position of the item to return from the array. The position of the first item in the array is 1.

**Return Type**

String array

**Example**

The following example splits a string into an array, using the semicolon character (:) as the delimiter, and returns the third element of the array.

```
split('123 Test St;1402 35th Ave;1818 Elm Ct;11 Janes Lane', ';', 3)
```

The following item is returned.

```
1818 Elm Ct
```

This function skips items containing null values or empty strings.

**sqrt**

sqrt returns the square root of a given expression.

**Syntax**

```
sqrt(expression)
```

**Arguments**

*expression*

The expression must be numeric. It can be a field name, a literal value, or another function.

**strlen**

(strlen) returns the number of characters in a string, including spaces.

**Syntax**

```
strlen(expression)
```
Arguments

expression

An expression can be the name of a field that uses the string data type like `address1`, a literal value like `'Unknown'`, or another function like `substring(field_name,0,5)`.

Return Type

Integer

Example

The following example returns the length of the specified string.

```sql
strlen('1421 Main Street')
```

The following value is returned.

```
16
```

substring

`substring` returns the characters in a string, starting at the location specified by the `start` argument and proceeding for the number of characters specified by the `length` arguments.

Syntax

```
substring(expression, start, length)
```

Arguments

expression

An expression can be the name of a field that uses the string data type like `address1`, a literal value like `'Unknown'`, or another function like `substring(field_name,1,5)`.

start

The character location to start from. `start` is inclusive, so the character at the starting position is the first character in the returned value. The minimum value for `start` is 1.

length

The number of additional characters to include after `start`. `length` is inclusive of `start`, so the last character returned is `(length - 1)` after the starting character.

Return Type

String

Example

The following example returns the thirteenth through nineteenth characters in a string. The beginning of the string is index 1, so you begin counting at the first character.
substring('Fantasy and Science Fiction',13,7)

The following value is returned.

Science

toLower

toLower formats a string in all lowercase. toLower skips rows containing null values.

Syntax

toLower(expression)

Arguments

expression

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '12 Main Street', or a call to another function that outputs a string.

Return Type

String

Example

The following example converts a string value into lowercase.

toLower('Seattle Store #14')

The following value is returned.

seattle store #14

toString

toString formats the input expression as a string. toString skips rows containing null values.

Syntax

toString(expression)

Arguments

expression

An expression can be a field of any data type, a literal value like 14.62, or a call to another function that returns any data type.
Return Type

String

Example

The following example returns the values from `payDate` (which uses the `date` data type) as strings.

```
toString(payDate)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>payDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992-11-14T00:00:00.000Z</td>
</tr>
<tr>
<td>2012-10-12T00:00:00.000Z</td>
</tr>
<tr>
<td>1973-04-08T00:00:00.000Z</td>
</tr>
</tbody>
</table>

For these field values, the following rows are returned.

| 1992-11-14T00:00:00.000Z |
| 2012-10-12T00:00:00.000Z |
| 1973-04-08T00:00:00.000Z |

toUpper

toUpper formats a string in all uppercase. `toUpper` skips rows containing null values.

Syntax

```
toUpper(expression)
```

Arguments

`expression`

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like `'12 Main Street'`, or a call to another function that outputs a string.

Return Type

String

Example

The following example converts a string value into uppercase.

```
toUpper('Seattle Store #14')
```

The following value is returned.
trim

trim removes both preceding and following blank space from a string.

Syntax

trim(expression)

Arguments

expression

The expression must be a string. It can be the name of a field that uses the string data type, a literal value like '12 Main Street', or a call to another function that outputs a string.

Return Type

String

Example

The following example removes the following spaces from a string.

trim('   Seattle Store #14   ')

For these field values, the following values are returned.

Seattle Store #14

truncDate

truncDate returns a date value that represents a specified portion of a date. For example, requesting the year portion of the value 2012-09-02T00:00:00.000Z returns 2012-01-01T00:00:00.000Z. Specifying a time-related period for a date that doesn't contain time information returns the initial date value unchanged.

Syntax

truncDate('period', date)

Arguments

period

The period of the date that you want returned. Valid periods are as follows:

• YYYY: This returns the year portion of the date.
• Q: This returns the date of the first day of the quarter that the date belongs to.
• MM: This returns the month portion of the date.
• DD: This returns the day portion of the date.
• WK: This returns the week portion of the date. The week starts on Sunday in Amazon QuickSight.
• HH: This returns the hour portion of the date.
• MI: This returns the minute portion of the date.
• SS: This returns the second portion of the date.

date
A date field or a call to another function that outputs a date.

Return Type
Date

Example
The following example returns a date representing the month of the order date.

```
truncDate('MM', orderDate)
```

The following are the given field values.

```
orderDate
=========
2012-12-14T00:00:00.000Z
2013-12-29T00:00:00.000Z
2012-11-15T00:00:00.000Z
```

For these field values, the following values are returned.

```
2012-12-01T00:00:00.000Z
2013-12-01T00:00:00.000Z
2012-11-01T00:00:00.000Z
```

Table Calculation Functions Index

When you are analyzing data in a specific visual, you can apply table calculations to the current set of data to discover how dimensions influence measures or each other. *Visualized data* is your result set based on your current data set, with all the filters, field selections, and customizations applied. To see exactly what this result set is, you can export your visual to a file. A *table calculation function* performs operations on the data to reveal relationships between fields.

In this section, you can find a list of the functions available in table calculations that you can perform on visualized data in Amazon QuickSight.

To view a list of functions sorted by category, with brief definitions, see [Functions by Category (p. 474)](#).

**Topics**
- [difference (p. 516)](#)
difference

difference calculates the difference between a measure based on one set of partitions and sorts, and a measure based on another.

difference is supported for use with analyses based on SPICE and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.
(  
  measure
  , [ sortorder_field ASC_or_DESC, ... ]
  , lookup_index,
  , [ partition_field, ... ]
)

**Arguments**

*measure*

An aggregated measure that you want to see the difference for.

*sort order field*

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending *(ASC)* or descending *(DESC)* sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

*lookup index*

The lookup index can be positive or negative, indicating a following row in the sort (positive) or a previous row in the sort (negative). The lookup index can be 1–2,147,483,647. For the engines MySQL, MariaDB and Aurora MySQL-Compatible Edition, the lookup index is limited to just 1.

*partition field*

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**Example**

The following example calculates the difference between of \(\text{sum} (\{\text{Billed Amount}\})\), sorted by \{Customer Region\} ascending, compared to the next row, and partitioned by \{Service Line\}.

```sql
difference(
  \(\text{sum} (\{\text{Billed Amount}\})\),
  \{Customer Region\} ASC,
  1,
  \{Service Line\}
)
```

The following example calculates the difference between Billed Amount compared to the next line, partitioned by \{Customer Region\}. The fields in the table calculation are in the field wells of the visual.

```sql
difference(
  \(\text{sum} (\{\text{Billed Amount}\})\),
  \{Customer Region\} ASC,
  1
)
```

The red highlights show how each amount is added (\(a + b = c\)) to show the difference between amounts a and c.
lag calculates the lag (previous) value for a measure based on specified partitions and sorts.

lag is supported for use with analyses based on SPICE and direct query data sets.

Syntax
The brackets are required. To see which arguments are optional, see the following descriptions.

```
lag(
    measure,
    [ sortorder_field ASC_or_DESC, ... ]
    ,lookup_index,
    [ partition_field, ... ]
)
```

Arguments

**measure**

The measure that you want to get the lag for. This can include an aggregate, for example `sum(Sales Amt)`.

**sort order field**

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.
Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**lookup index**

The lookup index can be positive or negative, indicating a following row in the sort (positive) or a previous row in the sort (negative). The lookup index can be 1–2,147,483,647. For the engines MySQL, MariaDB, and Amazon Aurora MySQL-Compatible Edition, the lookup index is limited to just 1.

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**Example**

The following example calculates the previous sum(sales), partitioned by the state of origin, in the ascending sort order on cancellation_code.

```
lag
(
    sum(Sales),
    [cancellation_code ASC],
    1,
    [origin_state_nm]
)
```

The following example uses a calculated field with lag to display the amount for the previous row next to the amount for the current row, sorted by Customer Segment. The fields in the table calculation are in the field wells of the visual.

```
lag(
    sum({Billed Amount}),
    [{Customer Segment} ASC],
    1
)
```

The following screenshot shows the results of the example.
lead calculates the lead (following) value for a measure based on specified partitions and sorts.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
lead
(
    measure
    ,[, sortorder_field ASC_or_DESC, ... ]
    ,lookup_index,
    ,[, partition_field, ... ]
)
```

Arguments

measure

The measure that you want to get the lead for. This can include an aggregate, for example `sum({Sales Amt})`.

sort order field

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.
Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

**lookup index**

The lookup index can be positive or negative, indicating a following row in the sort (positive) or a previous row in the sort (negative). The lookup index can be 1–2,147,483,647. For the engines MySQL, MariaDB, and Amazon Aurora MySQL-Compatible Edition, the lookup index is limited to just 1.

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

**Example**

The following example calculates the next \( \text{sum(sales)} \), partitioned by the state of origin, in the ascending sort order on \( \text{cancellation_code} \).

```sql
lead
(  
  \text{sum(sales)},
  \text{[cancellation_code ASC]},
  1,
  \text{[origin_state_nm]}
)
```

The following example uses a calculated field with lead to display the amount for the next row beside the amount for the current row, sorted by Customer Segment. The fields in the table calculation are in the field wells of the visual.

```sql
lead(
  \text{sum({Billed Amount})},
  \text{[{Customer Segment} ASC]},
  1
)
```

The following screenshot shows the results of the example.
percentDifference

percentDifference calculates the percentage difference between the current value and a comparison value, based on partitions, sorts, and lookup index.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
percentDifference
(
    measure,
    [ sortorder_field ASC_or_DESC, ... ],
    lookup index,
    [ partition_field, ... ]
)
```

Arguments

`measure`

An aggregated measure that you want to see the percent difference for.

`sort order field`

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.
percentDifference

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

lookup index

The lookup index can be positive or negative, indicating a following row in the sort (positive) or a previous row in the sort (negative). The lookup index can be 1–2,147,483,647. For the engines MySQL, MariaDB and Aurora MySQL-Compatible Edition, the lookup index is limited to just 1.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

Example

The following example calculates the percentage of difference between the sum(Sales) for the current and the previous State, sorted by Sales.

```sql
percentDifference
{
  sum(amount),
  [sum(amount) ASC],
  -1,
  [State]
}
```

The following example calculates the percent that a specific Billed Amount is of another Billed Amount, sorted by ({{Customer Region} ASC}). The fields in the table calculation are in the field wells of the visual.

```sql
percentDifference
{
  sum( {Billed Amount} ),
  [{Customer Region} ASC],
  1
}
```

The following screenshot shows the results of the example. The red letters show that the total Billed Amount for the Customer Region APAC is 24 percent less than the amount for the EMEA region.
avgOver

avgOver calculates the average of a measure partitioned by a list of dimensions.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```python
avgOver
{
    measure
    ,#partition_field, ...
    ,calculation level
}
```

The following example shows the average Billed Amount over Customer Region. The fields in the table calculation are in the field wells of the visual.

```python
avgOver
{
    sum({Billed Amount}),
    [{Customer Region}]
}
```

The following screenshot shows the results of the example. With the addition of Service Line, the total amount billed for each is displayed, and the average of these three values displays in the calculated field.
Arguments

*measure*

The measure that you want to do the calculation for, for example `sum({Sales Amt})`. Use an aggregation if the calculation level is set to `NULL` or `POST_AGG_FILTER`. Don't use an aggregation if the calculation level is set to `PRE_FILTER` or `PRE_AGG`.

*partition field*

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in `{}` (curly braces), if it is more than one word. The entire list is enclosed in `[]` (square brackets).

*calculation level*

(Optional) Specifies the calculation level to use:

- `PRE_FILTER` – Prefilter calculations are computed before the dataset filters.
- `PRE_AGG` – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- `POST_AGG_FILTER` – (Default) Table calculations are computed when the visuals display.

This value defaults to `POST_AGG_FILTER` when blank. For more information, see Using Level-Aware Aggregations (p. 216).
Example

The following example gets the average $\text{sum}(\text{Sales})$ partitioned over City and State.

```
avgOver
(  
    sum(Sales),
    [City, State]
)
```

countOver

countOver calculates the count of a dimension or measure partitioned by a list of dimensions.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
countOver
(  
    measure or dimension field
    , [ partition_field, ... ]
    , calculation level
)
```

Arguments

measure or dimension field

The measure or dimension that you want to do the calculation for, for example $\text{sum}((\text{Sales Amt}))$. Use an aggregation if the calculation level is set to NULL or POST_AGG_FILTER. Don't use an aggregation if the calculation level is set to PRE_FILTER or PRE_AGG.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

calculation level

(Optional) Specifies the calculation level to use:

- PRE_FILTER – Prefilter calculations are computed before the dataset filters.
- PRE_AGG – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- POST_AGG_FILTER – (Default) Table calculations are computed when the visuals display.

This value defaults to POST_AGG_FILTER when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example gets the count of Sales partitioned over City and State.
countOver
{
  Sales,
  [City, State]
}

The following example gets the count of \{County\} partitioned over City and State.

countOver
{
  \{County\},
  [City, State]
}

The following example shows the count of Billed Amount over Customer Region. The fields in the table calculation are in the field wells of the visual.

countOver
{
  sum(\{Billed Amount\}),
  \{Customer Region\}
}

The following screenshot shows the results of the example. Because there are no other fields involved, the count is one for each region.

If you add additional fields, the count changes. In the following screenshot, we add Customer Segment and Service Line. Each of those fields contains three unique values. With 3 segments, 3 service lines, and 3 regions, the calculated field shows 9.
If you add the two additional fields to the partitioning fields in the calculated field, `countOver( sum({Billed Amount}), [{Customer Region}, {Customer Segment}, {Service Line}]`, then the count is again 1 for each row.
**maxOver**

`maxOver` calculates the maximum of a measure or date partitioned by a list of dimensions.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
maxOver
{
    measure
    ,[ partition_field, ... ]
    ,calculation_level
}
```

**Arguments**

**measure**

The measure that you want to do the calculation for, for example `sum({Sales Amt})`. Use an aggregation if the calculation level is set to `NULL` or `POST_AGG_FILTER`. Don't use an aggregation if the calculation level is set to `PRE_FILTER` or `PRE_AGG`.

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.
Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

*calculation level*

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to **POST_AGG_FILTER** when blank. For more information, see Using Level-Aware Aggregations (p. 216).

**Example**

The following example calculates the maximum `sum(Sales)`, partitioned by City and State.

```plaintext
maxOver
  { sum(Sales),
    [City, State]
  }
```

The following example shows the maximum `Billed Amount` over `Customer Region`. The fields in the table calculation are in the field wells of the visual.

```plaintext
maxOver
  { sum({Billed Amount}),
    [{Customer Region}]
  }
```

The following screenshot shows the results of the example. With the addition of `Service Line`, the total amount billed for each is displayed, and the maximum of these three values displays in the calculated field.
**minOver**

minOver calculates the minimum of a measure or date partitioned by a list of dimensions.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
minOver
(
    measure
    , [ partition_field, ... ]
    , calculation_level
)
```

**Arguments**

*measure*

The measure that you want to do the calculation for, for example `sum(Sales_Amt)`. Use an aggregation if the calculation level is set to `NULL` or `POST_AGG_FILTER`. Don't use an aggregation if the calculation level is set to `PRE_FILTER` or `PRE_AGG`.

*partition field*

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
**calculation level**

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to **POST_AGG_FILTER** when blank. For more information, see Using Level-Aware Aggregations (p. 216).

**Example**

The following example calculates the min \( \sum(\text{Sales}) \), partitioned by City and State.

```sql
minOver
(  
  sum(Sales),
  [City, State]
)
```

The following example shows the minimum Billed Amount over Customer Region. The fields in the table calculation are in the field wells of the visual.

```sql
minOver
(  
  sum({Billed Amount}),
  [{Customer Region}]
)
```

The followins screenshot shows the results of the example. With the addition of Service Line, the total amount billed for each is displayed, and the minimum of these three values displays in the calculated field.
percentileOver

The `percentileOver` function calculates the \( n \)th percentile of a measure partitioned by a list of dimensions. There are two varieties of the `percentileOver` calculation available in QuickSight:

- `percentileContOver` (p. 533) uses linear interpolation to determine result.
- `percentileDiscOver` (p. 535) uses actual values to determine result.

The `percentileOver` function is an alias of `percentileDiscOver`.

**percentileContOver**

The `percentileContOver` function calculates the percentile based on the actual numbers in measure. It uses the grouping and sorting that are applied in the field wells. The result is partitioned by the specified dimension at the specified calculation level.

Use this function to answer the following question: Which actual data points are present in this percentile? To return the nearest percentile value that is present in your dataset, use `percentileDiscOver`. To return an exact percentile value that might not be present in your dataset, use `percentileContOver` instead.

**Syntax**

```plaintext
percentileDiscOver (measure)
```
Arguments

measure

Specifies a numeric value to use to compute the percentile. The argument must be a measure or metric. Nulls are ignored in the calculation.

percentile-n

The percentile value can be any numeric constant 0–100. A percentile value of 50 computes the median value of the measure.

partition-by

(Optional) One or more dimensions that you want to partition by, separated by commas. Each field in the list is enclosed in { } (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

calculation-level

Specifies where to perform the calculation in relation to the order of evaluation. There are three supported calculation levels:

- PRE_FILTER
- PRE_AGG
- POST_AGG_FILTER (default) - To use this calculation level, you need to specify an aggregation on measure, for example sum(measure).

PRE_FILTER and PRE_AGG are applied before the aggregation occurs in a visualization. For these two calculation levels, you can't specify an aggregation on measure in the calculated field expression. To learn more about calculation levels and when they apply, see Order of Evaluation in Amazon QuickSight (p. 214) and Using Level-Aware Aggregations (p. 216).

Returns

The result of the function is a number.

Example of percentileContOver

The following example helps explain how percentileContOver works.

Example Comparing calculation levels for the median

The following example shows the median for a dimension (category) by using different calculation levels with the percentileContOver function. The percentile is 50. The dataset is filtered by a region field. The code for each calculated field is as follows:

- example = left( category, 1 ) (A simplified example.)
- pre_agg = percentileContOver ( {Revenue}, 50, [ example ], PRE_AGG)
- pre_filter = percentileContOver ( {Revenue}, 50, [ example ], PRE_FILTER)
- post_agg_filter = percentileContOver ( sum ( {Revenue} ), 50, [ example ], POST_AGG_FILTER )
**percentileDiscOver**

The **percentileDiscOver** function calculates the percentile based on the actual numbers in measure. It uses the grouping and sorting that are applied in the field wells. The result is partitioned by the specified dimension at the specified calculation level. The **percentileOver** function is an alias of **percentileDiscOver**.

Use this function to answer the following question: Which actual data points are present in this percentile? To return the nearest percentile value that is present in your dataset, use **percentileDiscOver**. To return an exact percentile value that might not be present in your dataset, use **percentileContOver** instead.

**Syntax**

```
percentileDiscOver (  
    measure  
    , percentile-n  
    , [partition-by, ...]  
    , calculation-level  
)
```

**Arguments**

**measure**

Specifies a numeric value to use to compute the percentile. The argument must be a measure or metric. Nulls are ignored in the calculation.

**percentile-n**

The percentile value can be any numeric constant 0–100. A percentile value of 50 computes the median value of the measure.

**partition-by**

(Optional) One or more dimensions that you want to partition by, separated by commas. Each field in the list is enclosed in { } (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

**calculation-level**

Specifies where to perform the calculation in relation to the order of evaluation. There are three supported calculation levels:

- **PRE_FILTER**
- **PRE_AGG**
- **POST_AGG_FILTER** (default) - To use this calculation level, you need to specify an aggregation on measure, for example `sum(measure)`. 

---

<table>
<thead>
<tr>
<th>example</th>
<th>pre_filter</th>
<th>pre_agg</th>
<th>post_agg_filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>106,728</td>
<td>119,667</td>
<td>4,117,579</td>
</tr>
<tr>
<td>1</td>
<td>102,898</td>
<td>95,946</td>
<td>2,307,547</td>
</tr>
<tr>
<td>2</td>
<td>97,807</td>
<td>93,963</td>
<td>554,570</td>
</tr>
<tr>
<td>3</td>
<td>101,043</td>
<td>112,585</td>
<td>2,709,057</td>
</tr>
<tr>
<td>4</td>
<td>96,533</td>
<td>99,214</td>
<td>3,598,358</td>
</tr>
<tr>
<td>5</td>
<td>106,293</td>
<td>97,296</td>
<td>1,875,648</td>
</tr>
<tr>
<td>6</td>
<td>97,118</td>
<td>69,159</td>
<td>1,320,672</td>
</tr>
<tr>
<td>7</td>
<td>100,201</td>
<td>90,557</td>
<td>969,807</td>
</tr>
</tbody>
</table>
PRE_FILTER and PRE_AGG are applied before the aggregation occurs in a visualization. For these two calculation levels, you can't specify an aggregation on measure in the calculated field expression. To learn more about calculation levels and when they apply, see Order of Evaluation in Amazon QuickSight (p. 214) and Using Level-Aware Aggregations (p. 216).

**Returns**

The result of the function is a number.

**Example of percentileDiscOver**

The following example helps explain how percentileDiscOver works.

**Example Comparing calculation levels for the median**

The following example shows the median for a dimension (category) by using different calculation levels with the percentileDiscOver function. The percentile is 50. The dataset is filtered by a region field. The code for each calculated field is as follows:

- example = left( category, 1 ) (A simplified example.)
- pre_agg = percentileDiscOver ( {Revenue}, 50 , [ example ], PRE_AGG)
- pre_filter = percentileDiscOver ( {Revenue}, 50 , [ example ], PRE_FILTER)
- post_agg_filter = percentileDiscOver ( sum ( {Revenue} ), 50 , [ example ], POST_AGG_FILTER )

```
example  pre_filter  pre_agg  post_agg_filter
----------  -----------  -------  ------------------
  0          106,728    119,667   4,117,579
  1          102,898    95,946    2,307,547
  2           97,629    92,046    554,570
  3          100,867    112,585   2,709,057
  4           96,416    96,649    3,598,358
  5          106,293    97,296    1,875,648
  6           97,118    64,395    1,320,672
  7           99,915    90,557    969,807
```

**Example The median**

The following example calculates the median (the 50th percentile) of Sales partitioned by City and State.

```
percentileDiscOver
  ( Sales,
    50,
    [City, State]
  )
```

The following example calculates the 98th percentile of sum( {Billed Amount} ) partitioned by Customer Region. The fields in the table calculation are in the field wells of the visual.

```
percentileDiscOver
  ( sum( {Billed Amount} ),
    98,
    [{Customer Region}] )
```
percentOfTotal

percentOfTotal calculates the percentage a measure contributes to the total, based on the dimensions specified.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
percentOfTotal
{
    measure
    ,[ partition_field, ... ]
}
```

Arguments

measure

An aggregated measure that you want to see the percent of total for. (Currently, the distinct count aggregation is not supported for percentOfTotal.)

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

Example

The following example creates a calculation for the percent of total Sales contributed by each State.

```
percentOfTotal
{
    sum(Sales),
    [State]
}
```
The following example calculates the percent that a specific Billed Amount is when compared to the total Billed Amount, partitioned by ([{Service Line} ASC]). The fields in the table calculation are in the field wells of the visual.

```plaintext
percentOfTotal
   (sum( {Billed Amount} ),
   [{Service Line}])
```

The following screenshot shows the results of the example. The red highlights show that the partition field with the value "Billing" has three entries, one for each region. The total billed amount for this service line is divided into three percentages, which total 100 percent. Percentages are rounded and might not always add up to exactly 100 percent.

**stdevOver**

stdevOver calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
stdevOver
   (measure
   ,[ partition_field, ... ]
   ,calculation level

```
Arguments

measure

The measure that you want to do the calculation for, for example `sum({Sales Amt})`. Use an aggregation if the calculation level is set to `NULL` or `POST_AGG_FILTER`. Don't use an aggregation if the calculation level is set to `PRE_FILTER` or `PRE_AGG`.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in `{}` (curly braces), if it is more than one word. The entire list is enclosed in `[ ]` (square brackets).

calculation level

(Optional) Specifies the calculation level to use:

- `PRE_FILTER` – Prefilter calculations are computed before the dataset filters.
- `PRE_AGG` – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- `POST_AGG_FILTER` – (default) table calculations are computed when the visuals display.

This value defaults to `POST_AGG_FILTER` when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example calculates the standard deviation of `sum(Sales)`, partitioned by `City` and `State`, based on a sample.

```sql
stdevOver
{
    sum(Sales),
    [City, State]
}
```

The following example calculates the standard deviation of `Billed Amount` over `Customer Region`, based on a sample. The fields in the table calculation are in the field wells of the visual.

```sql
stdevOver
{
    sum({Billed Amount}),
    [{Customer Region}]
}
```

stdevpOver

`stdevpOver` calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.
varOver

varOver calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.
Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
varOver
(
    measure
    ,[ partition_field, ... ]
    ,calculation_level
)
```

Arguments

**measure**

The measure that you want to do the calculation for, for example `sum({Sales Amt})`. Use an aggregation if the calculation level is set to NULL or POST_AGG_FILTER. Don't use an aggregation if the calculation level is set to PRE_FILTER or PRE_AGG.

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**calculation level**

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to POST_AGG_FILTER when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example calculates the variance of `sum(Sales)`, partitioned by `City` and `State`, based on a sample.

```
varOver
(
    sum(Sales),
    [City, State]
)
```

The following example calculates the variance of `Billed Amount` over `Customer Region`, based on a sample. The fields in the table calculation are in the field wells of the visual.

```
varOver
(
    sum({Billed Amount}),
    [{Customer Region}]
)
varpOver

varpOver calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
varpOver
(
    measure
    ,[ partition_field, ... ]
    ,calculation level
)
```

Arguments

**measure**

The measure that you want to do the calculation for, for example `sum({Sales Amt})`. Use an aggregation if the calculation level is set to `NULL` or `POST_AGG_FILTER`. Don't use an aggregation if the calculation level is set to `PRE_FILTER` or `PRE_AGG`.

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**calculation level**

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to `POST_AGG_FILTER` when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example calculates the variance of `sum(Sales)`, partitioned by `City` and `State`, based on a biased population.

```
varpOver
(
    sum(Sales),
    [City, State]
)
```

The following example calculates the variance of `Billed Amount` over `Customer Region`, based on a biased population. The fields in the table calculation are in the field wells of the visual.
sumOver

sumOver calculates the sum of a measure partitioned by a list of dimensions.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

Arguments

measure

The measure that you want to do the calculation for, for example sum({Sales Amt}). Use an aggregation if the calculation level is set to NULL or POST_AGG_FILTER. Don't use an aggregation if the calculation level is set to PRE_FILTER or PRE_AGG.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

calculation level

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (default) table calculations are computed when the visuals display.

This value defaults to POST_AGG_FILTER when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example calculates the sum of sum(Sales), partitioned by City and State.
The following example sums Billed Amount over Customer Region. The fields in the table calculation are in the field wells of the visual.

```sql
sumOver
(
    sum({Billed Amount}),
    [{Customer Region}]
)
```

The following screenshot shows the results of the example. With the addition of Customer Segment, the total amount billed for each is summed for the Customer Region, and displays in the calculated field.

DenseRank

denseRank calculates the rank of a measure or a dimension in comparison to the specified partitions. It counts each item only once, ignoring duplicates, and assigns a rank "without holes" so that duplicate values share the same rank.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```sql
denseRank
(
    [ sort_order_field ASC_or_DESC, ... ]
    , [ partition_field, ... ]
)
```
Arguments

sort order field

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

calculation level

(Optional) Specifies the calculation level to use:
• PRE_FILTER – Prefilter calculations are computed before the dataset filters.
• PRE_AGG – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
• POST_AGG_FILTER – (Default) Table calculations are computed when the visuals display.

This value defaults to POST_AGG_FILTER when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example densely ranks \( \text{max}(\text{Sales}) \), based on a descending sort order, by State and City. Any cities with the same \( \text{max}(\text{Sales}) \) are assigned the same rank, and the next city is ranked consecutively after them. For example, if three cities share the same ranking, the fourth city is ranked as second.

```
denseRank
  (  
    [\text{max}(\text{Sales}) \text{ DESC}],
    [\text{State}, \text{City}]
  )
```

The following example densely ranks \( \text{max}(\text{Sales}) \), based on a descending sort order, by State. Any states with the same \( \text{max}(\text{Sales}) \) are assigned the same rank, and the next is ranked consecutively after them. For example, if three states share the same ranking, the fourth state is ranked as second.

```
denseRank
  (  
    [\text{max}(\text{Sales}) \text{ DESC}],
    [\text{State}]
  )
```

rank

rank calculates the rank of a measure or a dimension in comparison to the specified partitions. It counts each item, even duplicates, once and assigns a rank “with holes” to make up for duplicate values.
Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
rank
{
  [ sort_order_field ASC_or_DESC, ... ]
 , [ partition_field, ... ]
}
```

Arguments

**sort order field**

One or more aggregated measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (**ASC**) or descending (**DESC**) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**calculation level**

(Optional) Specifies the calculation level to use:
- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to **POST_AGG_FILTER** when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example ranks `max(Sales)`, based on a descending sort order, by State and City, within the State of **WA**. Any cities with the same `max(Sales)` are assigned the same rank, but the next rank includes the count of all previously existing ranks. For example, if three cities share the same ranking, the fourth city is ranked as fourth.

```plaintext
rank
{
  [max(Sales) DESC],
  [State, City]
}
```

The following example ranks `max(Sales)`, based on an ascending sort order, by State. Any states with the same `max(Sales)` are assigned the same rank, but the next rank includes the count of all previously existing ranks. For example, if three states share the same ranking, the fourth state is ranked as fourth.

```plaintext
rank
```
percentileRank

percentileRank calculates the percentile rank of a measure or a dimension in comparison to the specified partitions. The percentile rank value \( x \) indicates that the current item is above \( x\% \) of values in the specified partition. The percentile rank value ranges from 0 (inclusive) to 100 (exclusive).

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
percentileRank
()
  ([ sort_order_field ASC_or_DESC, ... ]
  ,[ {partition_field}, ... ]
)
```
Arguments

*sort order field*

One or more aggregated measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (**ASC**) or descending (**DESC**) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

*partition field*

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

*calculation level*

(Optional) Specifies the calculation level to use:

- **PRE_FILTER** – Prefilter calculations are computed before the dataset filters.
- **PRE_AGG** – Preaggregate calculations are computed before applying aggregations and top and bottom N filters to the visuals.
- **POST_AGG_FILTER** – (Default) Table calculations are computed when the visuals display.

This value defaults to **POST_AGG_FILTER** when blank. For more information, see Using Level-Aware Aggregations (p. 216).

Example

The following example does a percentile ranking of \( \max(Sales) \) in descending order, by State.

```sql
percentileRank
(
    [max(Sales) DESC],
    [State]
)
```

The following example does a percentile ranking of Customer Region by total Billed Amount. The fields in the table calculation are in the field wells of the visual.

```sql
percentileRank(  
    [sum({Billed Amount}) DESC],
    [{Customer Region}]
)
```

The following screenshot shows the results of the example, along with the total Billed Amount so you can see how each region compares.
runningAvg

runningAvg calculates a running average for a measure based on the specified dimensions and sort orders.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningAvg
  (  
    measure  
    ,[ sortorder_field ASC_or_DESC, ... ]  
    ,[ partition_field, ... ]  
  )
```

Arguments

`measure`

An aggregated measure that you want to see the running average for.

`sororder_field`

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

Example

The following example calculates a running average of \( \text{sum(Sales)} \), sorted by Sales, partitioned by City and State.

```
runningAvg
(  
  \text{sum(Sales)},
  [\text{Sales ASC} ],
  [\text{City, State}]
)
```

The following example calculates a running average of Billed Amount, sorted by month \([\text{truncDate("MM", Date) ASC}]\). The fields in the table calculation are in the field wells of the visual.

```
runningAvg
(  
  \text{sum({Billed Amount})},
  [\text{truncDate("MM", Date) ASC}]
)
```

runningCount

runningCount calculates a running count for a measure or dimension, based on the specified dimensions and sort orders.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningCount
(  
  measure_or_dimension 
  ,[ sortorder_field ASC_or_DESC, ... ] 
  ,[ partition_field, ... ]
)
```

Arguments

measure or dimension

An aggregated measure or dimension that you want to see the running count for.

sort order field

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas. Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**Example**

The following example calculates a running count of \( \text{sum}(Sales) \), sorted by Sales, partitioned by City and State.

```plaintext
runningCount (
    sum(Sales),
    [Sales ASC],
    [City, State]
)
```

The following example calculates a running count of Billed Amount, sorted by month \([\text{truncDate("MM", Date) ASC}]\). The fields in the table calculation are in the field wells of the visual.

```plaintext
runningCount (
    sum({Billed Amount}),
    [truncDate("MM", Date) ASC]
)
```

**runningMax**

`runningMax` calculates a running maximum for a measure based on the specified dimensions and sort orders.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
runningMax (
    measure
    , [ sortOrder_field ASC_or_DESC, ... ]
    , [ partition_field, ... ]
)
```

**Arguments**

*measure*

An aggregated measure that you want to see the running maximum for.

*sort order field*

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (`ASC`) or descending (`DESC`) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
**runningMin**

runningMin calculates a running minimum for a measure based on the specified dimensions and sort orders.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningMin
(
    measure
    ,[ sortorder_field ASC_or_DESC, ... ]
    ,[ partition_field, ... ]
)
```

**Arguments**

*measure*

An aggregated measure that you want to see the running minimum for.

*sort order field*

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**Example**

The following example calculates a running minimum of $\text{sum}(\text{Sales})$, sorted by $\text{Sales}$, partitioned by $\text{City}$ and $\text{State}$.

```
runningMin
{
  sum(Sales),
  [Sales ASC],
  [City, State]
}
```

The following example calculates a running minimum of $\text{Billed Amount}$, sorted by month `([\text{truncDate("MM"},\text{Date}) \text{ ASC}])`. The fields in the table calculation are in the field wells of the visual.

```
runningMin
{
  sum({Billed Amount}),
  [truncDate("MM",Date) ASC]
}
```

**runningSum**

`runningSum` calculates a running sum for a measure based on the specified dimensions and sort orders.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningSum
{
  measure
  , [ sortorder_field \text{ ASC} or \text{ DESC}, ... ]
  , [ partition_field, ... ]
}
```

**Arguments**

**measure**

An aggregated measure that you want to see the running sum for.

**sort order field**

One or more measures and dimensions that you want to sort the data by, separated by commas. You can specify either ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).
**partition field**

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [] (square brackets).

**Example**

The following example calculates a running sum of \( \text{sum}(Sales) \), sorted by Sales, partitioned by City and State.

```plaintext
runningSum
(
  \text{sum}(Sales),
  [Sales ASC],
  [City, State]
)
```

The following example calculates a running sum of Billed Amount, sorted by month (`[truncDate("MM", Date) ASC]`). The fields in the table calculation are in the field wells of the visual.

```plaintext
runningSum
(
  \text{sum}({Billed Amount}),
  [truncDate("MM", Date) ASC]
)
```

The following screenshot shows the results of the example. The red labels show how each amount is added \( a + b = c \) to the next amount, resulting in a new total.

**firstValue**

`firstValue` calculates the first value of the aggregated measure or dimension partitioned and sorted by specified attributes.
Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
firstValue
(
    aggregated measure or dimension,
    [ sort_attribute ASC_or_DESC, ... ],
    [ partition_by_attribute, ... ]
)
```

Arguments

*aggregated measure or dimension*

An aggregated measure or dimension that you want to see the first value for.

*sort attribute*

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (`ASC`) or descending (`DESC`) sort order.

Each field in the list is enclosed in `{}` (curly braces), if it's more than one word. The entire list is enclosed in `[ ]` (square brackets).

*partition by attribute*

(Optional) One or more measure or dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in `{}` (curly braces), if it is more than one word. The entire list is enclosed in `[ ]` (square brackets).

Example

The following example calculates the first `Destination Airport`, sorted by `Flight Date`, partitioned by `Flight Date` ascending and `Origin Airport`.

```plaintext
firstValue(
    [{Destination Airport}],
    [{Flight Date} ASC],
    [{Origin Airport},
     {Flight Date}
    ]
)
```

lastValue

lastValue calculates the last value of the aggregated measure or dimension partitioned and sorted by specified attributes.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
lastValue
```
(  
  aggregated measure or dimension,
  [ sort_attribute ASC_or_DESC, ... ],
  [ partition_by_attribute, ... ]
)

Arguments

aggregated measure or dimension

An aggregated measure or dimension that you want to see the last value for.

sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it’s more than one word. The entire list is enclosed in [ ] (square brackets).

partition by attribute

(Optional) One or more measures or dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it is more than one word. The entire list is enclosed in [ ] (square brackets).

Example

The following example calculates the last value for Destination Airport. This calculation is sorted by the Flight Date value and partitioned by the Flight Date value sorted in ascending order and the Origin Airport value.

```
lastValue(
  [{Destination Airport}],
  [{Flight Date} ASC],
  [
    {Origin Airport},
    truncDate('DAY', {Flight Date})
  ]
)
```

windowAvg

windowAvg calculates the average of the aggregated measure in a custom window that is partitioned and sorted by specified attributes. Usually, you use custom window functions on a time series, where your visual shows a metric and a date field. For example, you can use windowAvg to calculate a moving average, which is often used to smooth out the noise in a line chart.

Window functions aren’t supported for MySQL versions earlier than 8 and MariaDB versions earlier than 10.2.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.
windowAvg

(  
  measure
  , [sort_order_field ASC/DESC, ...]
  , start_index
  , end_index
  ,[ partition_field, ... ]
)

Arguments

measure

The aggregated metric that you want to get the average for, for example \( \text{sum}({Revenue}) \).

sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in \{ \} (curly braces), if it's more than one word. The entire list is enclosed in \[ \] (square brackets).

start index

The start index is a positive integer, indicating \( n \) rows above the current row. The start index counts the available data points above the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

desc index

The end index is a positive integer, indicating \( n \) rows below the current row. The end index counts the available data points below the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in \{ \} (curly braces), if it's more than one word. The entire list is enclosed in \[ \] (square brackets).

Example

The following example calculates the moving average of \( \text{sum}(\text{Revenue}) \), partitioned by \( \text{SaleDate} \). The calculation includes three rows above and two row below of the current row.

```
windowAvg

(  
  \text{sum}(\text{Revenue}),
  \ [\text{SaleDate ASC}],
  3,
  2
  )

```

The following screenshot shows the results of this moving average example. The \( \text{sum}(\text{Revenue}) \) field is added to the chart to show the difference between the revenue and the moving average of revenue.
windowCount

windowCount calculates the count of the aggregated measure or dimension in a custom window that is partitioned and sorted by specified attributes. Usually, you use custom window functions on a time series, where your visual shows a metric and a date field.

Window functions aren’t supported for MySQL versions earlier than 8 and MariaDB versions earlier than 10.2.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
windowCount
(
    measure_or_dimension
    , [sort_order_field ASC/DESC, ...]
    , start_index
    , end_index
    , [ partition_field, ... ]
)
```

Arguments

*measure or dimension*

The aggregated metric that you want to get the average for, for example `sum({Revenue})`. 
sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it's more than one word. The entire list is enclosed in [ ] (square brackets).

start index

The start index is a positive integer, indicating n rows above the current row. The start index counts the available data points above the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

end index

The end index is a positive integer, indicating n rows below the current row. The end index counts the available data points below the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it's more than one word. The entire list is enclosed in [ ] (square brackets).

Example

The following example calculates the moving count of sum(Revenue), partitioned by SaleDate. The calculation includes three rows above and two row below of the current row.

```
windowCount
(   sum(Revenue),
    [SaleDate ASC],
    3,
    2
)
```

windowMax

windowMax calculates the maximum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes. Usually, you use custom window functions on a time series, where your visual shows a metric and a date field. You can use windowMax to help you identify the maximum of the metric over a period time.

Window functions aren't supported for MySQL versions earlier than 8 and MariaDB versions earlier than 10.2.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
windowMax
```
Arguments

measure

The aggregated metric that you want to get the average for, for example `sum({Revenue})`.

sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {curly braces}, if it's more than one word. The entire list is enclosed in [square brackets].

start index

The start index is a positive integer, indicating \( n \) rows above the current row. The start index counts the available data points above the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

end index

The end index is a positive integer, indicating \( n \) rows below the current row. The end index counts the available data points below the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {curly braces}, if it is more than one word. The entire list is enclosed in [square brackets].

Example

The following example calculates the trailing twelve month maximum of \( \text{sum(Revenue)} \), partitioned by SaleDate. The calculation includes 12 rows above and 0 row below of the current row.

```plaintext
windowMax
(
    measure 
    , [sort_order_field ASC/DESC, ...]
    , start_index
    , end_index
    ,[ partition_field, ... ]
)
```

The following screenshot shows the results of this trailing twelve month example. The sum(Revenue) field is added to the chart to show the difference between the revenue and the trailing twelve month maximum revenue.
windowMin

windowMin calculates the minimum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes. Usually, you use custom window functions on a time series, where your visual shows a metric and a date field. You can use windowMin to help you identify the minimum of the metric over a period time.

Window functions aren't supported for MySQL versions earlier than 8 and MariaDB versions earlier than 10.2.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
windowMin
(
    measure,
    [sort_order_field ASC/DESC, ...],
    start_index,
    end_index,
    [ partition_field, ... ]
)
```

Arguments

measure

The aggregated metric that you want to get the average for, for example `sum({Revenue})`. 
sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort order.

Each field in the list is enclosed in {} (curly braces), if it’s more than one word. The entire list is enclosed in [] (square brackets).

start index

The start index is a positive integer, indicating n rows above the current row. The start index counts the available data points above the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

end index

The end index is a positive integer, indicating n rows below the current row. The end index counts the available data points below the current row, rather than counting actual time periods. If your data is sparse (missing months or years, for example), adjust the indexes accordingly.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it’s more than one word. The entire list is enclosed in [] (square brackets).

Example

The following example calculates the trailing twelve month minimum of sum(Revenue), partitioned by SaleDate. The calculation includes 12 rows above and 0 row below of the current row.

```sql
windowMin
(
    sum(Revenue),
    [SaleDate ASC],
    12,
    0
)
```

The following screenshot shows the results of this trailing twelve month example. The sum(Revenue) field is added to the chart to show the difference between the revenue and the trailing twelve month minimum revenue.
windowSum calculates the sum of the aggregated measure in a custom window that is partitioned and sorted by specified attributes. Usually, you use custom window functions on a time series, where your visual shows a metric and a date field.

Window functions aren't supported for MySQL versions earlier than 8 and MariaDB versions earlier than 10.2.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
windowSum
{
    measure
    , [sort_order_field ASC/DESC, ...]
    , start_index
    , end_index
    , [ partition_field, ... ]
}
```

**Arguments**

`measure`

The aggregated metric that you want to get the sum for, for example `sum({Revenue})`.

For the engines MySQL, MariaDB, and Amazon Aurora with MySQL compatibility, the lookup index is limited to just 1. Window functions aren't supported for MySQL versions below 8 and MariaDB versions earlier than 10.2.
sort attribute

One or more aggregated fields, either measures or dimensions or both, that you want to sort the
data by, separated by commas. You can either specify ascending (ASC) or descending (DESC) sort
order.

Each field in the list is enclosed in {} (curly braces), if it's more than one word. The entire list is
enclosed in [ ] (square brackets).

start index

The start index is a positive integer, indicating \( n \) rows above the current row. The start index counts
the available data points above the current row, rather than counting actual time periods. If your
data is sparse (missing months or years, for example), adjust the indexes accordingly.

end index

The end index is a positive integer, indicating \( n \) rows below the current row. The end index counts
the available data points below the current row, rather than counting actual time periods. If your
data is sparse (missing months or years, for example), adjust the indexes accordingly.

partition field

(Optional) One or more dimensions that you want to partition by, separated by commas.

Each field in the list is enclosed in {} (curly braces), if it's more than one word. The entire list is
enclosed in [ ] (square brackets).

Example

The following example calculates the moving sum of \( \text{sum(Revenue)} \), sorted by \( \text{SaleDate} \). The
calculation includes two rows above and one row ahead of the current row.

```plaintext
windowSum( 
    sum(Revenue),
    [SaleDate ASC],
    2,
    1
)
```

The following example show a trailing 12-month sum.

```plaintext
windowSum(sum(Revenue),[SaleDate ASC],12,0)
```

The following screenshot shows the results of this trailing 12-month sum example. The \( \text{sum(Revenue)} \)
field is added to the chart to show the difference between the revenue and the trailing 12-month sum of
revenue.
Developing with Amazon QuickSight

We provide API operations for Amazon QuickSight, and also software development kits (SDKs) for AWS that enable you to access Amazon QuickSight from your preferred programming language. Currently, you can manage users and groups. In Enterprise edition, you can also embed dashboards in your webpage or app.

To monitor the calls made to the Amazon QuickSight API for your account, including calls made by the AWS Management Console, command line tools, and other services, use AWS CloudTrail. For more information, see the AWS CloudTrail User Guide.

Required Knowledge

If you plan to access Amazon QuickSight through an API, you should be familiar with the following:

- JSON
- Web services
- HTTP requests
- One or more programming languages, such as JavaScript, Java, Python, or C#.

We recommend visiting the AWS Getting Started Resource Center for a tour of what AWS SDKs and toolkits have to offer.

Although you can use a terminal and your favorite text editor, you might benefit from the more visual UI experience you get in an integrated development environment (IDE). We provide a list of IDEs in the AWS Getting Started Resource Center in the IDE and IDE Toolkits section. This site provides AWS toolkits that you can download for your preferred IDE. Some IDEs also offer tutorials to help you learn more about programming languages.

Available API Operations for Amazon QuickSight

AWS provides libraries, sample code, tutorials, and other resources for software developers who prefer to build applications using language-specific API operations instead of submitting a request over HTTPS. These libraries provide basic functions that automatically take care of tasks such as cryptographically signing your requests, retrying requests, and handling error responses. These libraries help make it easier for you to get started.

For more information about downloading the AWS SDKs, see AWS SDKs and Tools. The following links are a sample of the language-specific API documentation available.

AWS Command Line Interface

- AWS CLI QuickSight Command Reference
- AWS CLI User Guide
- AWS CLI Command Reference
This section provides a list of terms for development in Amazon QuickSight.

**Caller identity:** – The identity of the AWS Identity and Access Management (IAM) user making an API request. The identity of the caller is determined by Amazon QuickSight using the signature attached to the request. Through the use of our provided SDK clients, no manual steps are necessary to generate the signature or attach it to the requests. However, you can do it manually if you want to.

**Invoker identity:** – In addition to the caller identity, but not as a replacement for it, you can assume a caller’s identity through the IAM `AssumeRole` API when making calls to Amazon QuickSight. AWS approves callers through their invoker’s identity. This is done to avoid having to explicitly add multiple accounts belonging to the same Amazon QuickSight subscription.

**QuickSight ARN:** – Amazon Resource Name (ARN). Amazon QuickSight resources are identified using their name or ARN. For example, these are the ARNs for a group named `MyGroup1`, a user named `User1`, and a dashboard with the ID `1a1ac2b2-3fc3-4b44-5e5d-c6db6778df89`: 
The following examples show ARNs for a template named MyTemplate and a dashboard named MyDashboard.

1. Sample ARN for a template

```
arn:aws:quicksight:us-east-1:111122223333:template/MyTemplate
```

2. Sample ARN for a template, referencing a specific version of the template

```
arn:aws:quicksight:us-east-1:111122223333:template/MyTemplate/version/10
```

3. Sample ARN for a template alias

```
arn:aws:quicksight:us-east-1:111122223333:template/MyTemplate/alias/STAGING
```

4. Sample ARN for a dashboard

```
```

5. Sample ARN for a dashboard, referencing a specific version of the dashboard

```
```

Depending on the scenario, you might need to provide an entity’s name, ID, or ARN. You can retrieve the ARN if you have the name, using some of the QuickSight API operations.

**QuickSight dashboard**: An entity which identifies QuickSight reports, created from analyses or templates. QuickSight dashboards are sharable. With the right permissions, scheduled email reports can be created from them. The CreateDashboard and DescribeDashboard API Operations act on the dashboard entity.

**QuickSight template**: An entity which encapsulates the metadata required to create an analysis or a dashboard. It abstracts the dataset associated with the analysis by replacing it with placeholders. Templates can be used to create dashboards by replacing dataset placeholders with datasets that follow the same schema that was used to create the source analysis and template.

**QuickSight user**: This is an Amazon QuickSight user identity acted upon by your API call. This user isn't identical to the caller identity but might be the one that maps to the user within Amazon QuickSight.

---

**Using the Amazon QuickSight Developer Portal**

The QuickSight Dev Portal helps you learn by example how to use the QuickSight API in your web site or application. In this initial offering, the dev portal focuses on API operations for embedded analytics.
The dev portal provides easy-to-use code samples to get you started. You can choose from the following three different use cases:

- Displaying embedded dashboards to everyone (non-authenticated users)
- Personalizing dashboards for your users
- Embedding dashboard authoring

The portal itself displays dashboards by using embedding for everyone.

To get started with the dev portal

1. Open QuickSight Dev Portal and choose Try it on the use case you want to view.
2. To view code examples, choose How to embed it in the menu bar. Then choose each of the following from the navigation pane at left:
   - Configure permissions
   - Get embedding URL (code samples in Java, JavaScript, and Python)
   - Embed URL in your application
3. To download all of the code in a zip file, choose Download all code.
4. To customize the dashboard, choose How to customize it. This screen is interactive, so you can choose any item in the navigation pane to view the changes live.
5. You can also view and download the html code at bottom left.
6. To return to the start page, click on the QuickSight icon, top left.
Developing Applications with the Amazon QuickSight API

You can manage most aspects of your deployment by using the AWS SDKs to access an API that's tailored to the programming language or platform that you're using. For more information, see AWS SDKs.

For more information on the API operations, see Amazon QuickSight API Reference.

Before you can call the Amazon QuickSight API operations, you need the quicksight:operation-name permission in a policy attached to your IAM identity. For example, to call list-users, you need the permission quicksight:ListUsers. The same pattern applies to all operations.

If you're not sure what the necessary permission is, you can attempt to make a call. The client then tells you what the missing permission is. You can use asterisk (*) in the Resource field of your permission policy instead of specifying explicit resources. However, we recommended that you restrict each permission as much as possible. You can restrict user access by specifying or excluding resources in the policy, using their Amazon QuickSight Amazon Resource Name (ARN) identifier.

For more information, see the following:

- IAM Policy Examples for Amazon QuickSight (p. 682)
- Actions, Resources, and Condition Keys
- IAM JSON Policy Elements

To retrieve the ARN of a user or a group, use the Describe operation on the relevant resource. You can also add conditions in IAM to further restrict access to an API in some scenarios. For instance, when adding User1 to Group1, the main resource is Group1, so you can allow or deny access to certain groups, but you can also add a condition by using the IAM Amazon QuickSight key quicksight:UserName to allow or prevent certain users from being added to that group.

Following is an example policy. It means that the caller with this policy attached, is able to invoke the CreateGroupMembership operation on any group, provided that the user name they are adding to the group is not user1.

```json
{
    "Effect": "Allow",
    "Action": "quicksight:CreateGroupMembership",
    "Condition": {
        "StringNotEquals": {
            "quicksight:UserName": "user1"
        }
    }
}
```

AWS CLI

The following procedure explains how to interact with Amazon QuickSight API operations through the AWS CLI. The following instructions have been tested in Bash but should be identical or similar in other command-line environments.

1. Install AWS SDK in your environment. Instructions on how to do that are located here: AWS Command line Interface.
2. Set up your AWS CLI identity and region using the following command and follow-up instructions. Use the credentials for an IAM identity or role that has the proper permissions.
3. Look at the Amazon QuickSight SDK help by issuing the following command:

   ```shell
   aws quicksight help
   ```

4. To get detailed instructions on how to use an API, enter its name followed by help, like so:

   ```shell
   aws quicksight list-users help
   ```

5. Now you can call an Amazon QuickSight API operation. This example returns a list of Amazon QuickSight users in your account.

   ```shell
   aws quicksight list-users --aws-account-id aws-account-id --namespace default --region us-east-1
   ```

Java SDK

Use the following procedure to set up a Java app that interacts with Amazon QuickSight.

1. To get started, create a Java project in your IDE.
2. Import the Amazon QuickSight SDK into your new project, for example:

   ```java
   AWSQuickSightJavaClient-1.11.x.jar
   ```

3. Once your IDE indexes the Amazon QuickSight SDK, you should be able to add an import line as follows:

   ```java
   import com.amazonaws.services.quicksight.AmazonQuickSight;
   ```

   If you IDE doesn't recognize this as valid, verify that you imported the SDK.

4. Like other AWS SDKs, Amazon QuickSight SDK requires external dependencies to perform many of its functions. You need to download and import those into the same project. The following dependencies are required:

   - **aws-java-sdk-1.11.402.jar** (AWS Java SDK and credentials setup) — See [Set up the AWS SDK for Java](https://docs.aws.amazon.com/sdk-for-java/v1/developer-guide/java-sdk-download.html)
   - **commons-logging-1.2.jar** — See [https://commons.apache.org/proper/commons-logging/download_logging.cgi](https://commons.apache.org/proper/commons-logging/download_logging.cgi)
   - **httpclient-4.5.6.jar, httpcore-4.4.10.jar** — See [https://hc.apache.org/downloads.cgi](https://hc.apache.org/downloads.cgi)
   - **joda-time-2.1.jar** — See [https://mvnrepository.com/artifact/joda-time/joda-time/2.1](https://mvnrepository.com/artifact/joda-time/joda-time/2.1)

5. Now, you are ready to create an Amazon QuickSight client. You can use a default public endpoint that the client can communicate with or you can reference the endpoint explicitly. There are multiple ways to provide your AWS credentials. In the following example, we provide a direct, simple approach. The following client method is used to make all the API calls that follow:

   ```java
   private static AmazonQuickSight getClient() {
   final AWSCredentialsProvider credsProvider = new AWSCredentialsProvider() {
   @Override
   ```
public AWSCredentials getCredentials() {
    // provide actual IAM access key and secret key here
    return new BasicAWSCredentials("access-key", "secret-key");
}

@Override
public void refresh() {};

return AmazonQuickSightClientBuilder
    .standard()
    .withRegion(Regions.US_EAST_1.getName())
    .withCredentials(credsProvider)
    .build();

6. Now, we can use the above client to list all the users in our Amazon QuickSight account.

   **Note**
   You have to provide the AWS account ID that you used to subscribe to Amazon QuickSight. This must match the AWS account ID of the caller's identity. Cross-account calls aren't supported at this time. Furthermore, the required parameter namespace should always be set to `default`.

   ```java
   getClient().listUsers(new ListUsersRequest()
       .withAwsAccountId("relevant_AWS_account_ID")
       .withNamespace("default")
       .getUserList().forEach(user -> {
           System.out.println(user.getArn());
       });
   
   7. To see a list of all possible API operations and the request objects they use, you can CTRL-click on the client object in your IDE in order to view the Amazon QuickSight interface. Alternatively, find it within the `com.amazonaws.services.quicksight` package in the Amazon QuickSight JavaClient JAR file.

JavaScript (Node.js) SDK

Use the following procedure to interact with Amazon QuickSight using Node.js.

1. Set up your node environment using the following commands:
   - `npm install aws-sdk`
   - `npm install aws4`
   - `npm install request`
   - `npm install url`

2. For information on configuring the Node.js with AWS SDK and setting your credentials, see the [AWS SDK for JavaScript Developer Guide for SDK v2](https://docs.aws.amazon.com/sdk-for-javascript/v2/developer-guide/).

3. Use the following code sample to test your setup. HTTPS is required. The sample displays a full listing of Amazon QuickSight operations along with their URL request parameters, followed by a list of Amazon QuickSight users in your account.

   ```javascript
   const AWS = require('aws-sdk');
   const https = require('https');

   var quicksight = new AWS.Service({
       apiConfig: require('./quicksight-2018-04-01.min.json'),
       region: 'us-east-1',
   });
   ```
```javascript
console.log(quicksight.config.apiConfig.operations);

quicksight.listUsers({
  // Enter your actual AWS account ID
  'AwsAccountId': 'relevant_AWS_account_ID',
  'Namespace': 'default',
}, function(err, data) {
  console.log('---
  Errors: 
  ' + err);
  console.log('---
  Response: 
  ' + data);
});
```

**Python3 SDK**

Use the following procedure to create a custom built `botocore` package to interact with Amazon QuickSight.

1. Create a credentials file in the AWS directory for your environment. In a Linux/Mac-based environment, that file is called `~/.aws/credentials` and looks like this:

   ```
   [default]
   aws_access_key_id = Your_IAM_access_key
   aws_secret_access_key = Your_IAM_secret_key
   ```

2. Unzip the folder `botocore-1.12.10`. Change directory into `botocore-1.12.10` and enter the Python3 interpreter environment.

3. Responses come back as a dictionary object. They each have a `ResponseMetadata` entry that contains request IDs and response status. Other entries are based on what type of operation you run.

4. The following example is a sample app that first creates, deletes, and lists groups. Then, it lists users in a Quicksight account:

   ```python
   import botocore.session
   default_namespace = 'default'
   account_id = 'relevant_AWS_Account'

   session = botocore.session.get_session()
   client = session.create_client("quicksight", region_name='us-east-1')

   print('Creating three groups: ')
   client.create_group(AwsAccountId = account_id, Namespace=default_namespace,
                       GroupName='MyGroup1')
   client.create_group(AwsAccountId = account_id, Namespace=default_namespace,
                       GroupName='MyGroup2')
   client.create_group(AwsAccountId = account_id, Namespace=default_namespace,
                       GroupName='MyGroup3')

   print('Retrieving the groups and listing them: ')
   response = client.list_groups(AwsAccountId = account_id,
                                  Namespace=default_namespace)
   for group in response['GroupList']:
       print(group)

   print('Deleting our groups: ')
   client.delete_group(AwsAccountId = account_id, Namespace=default_namespace,
                       GroupName='MyGroup1')
   client.delete_group(AwsAccountId = account_id, Namespace=default_namespace,
                       GroupName='MyGroup2')
   ```
client.delete_group(AwsAccountId = account_id, Namespace=default_namespace, 
GroupName='MyGroup3')

response = client.list_users(AwsAccountId = account_id, 
Namespace=default_namespace)
for user in response['UserList']:
    print(user)

.NET/C# SDK

Use the following procedure to interact with Amazon QuickSight using C#.NET. This example is constructed on Microsoft Visual for Mac; the instructions can vary slightly based on your IDE and platform. However, they should be similar.

1. Unzip the nuget.zip file into a folder called nuget.
2. Create a new Console app project in Visual Studio.
3. Under your solution, locate app Dependencies, then open the context (right-click menu and choose Add Packages).
4. In the sources list, choose Configure Sources.
5. Choose Add, and name the source QuickSightSDK. Browse to the nuget folder and choose Add Source.
6. Choose OK. Then, with QuickSightSDK selected, select all three Amazon QuickSight packages:
   • AWSSDK.QuickSight
   • AWSSDK.Extensions.NETCore.Setup
   • AWSSDK.Extensions.CognitoAuthentication
7. Click Add Package.
8. Copy and paste the following sample app into your console app editor.

```csharp
using System;
using Amazon.QuickSight.Model;
using Amazon.QuickSight;
namespace DotNetQuickSightSDKTest
{
    class Program
    {
        private static readonly string AccessKey = "insert_your_access_key";
        private static readonly string SecretAccessKey = "insert_your_secret_key";
        private static readonly string AccountID = "AWS_account_ID";
        private static readonly string Namespace = "default"; // leave this as default

        static void Main(string[] args)
        {
            var client = new AmazonQuickSightClient(
                AccessKey,
                SecretAccessKey,
                Amazon.RegionEndpoint.USEast1);

            var listUsersRequest = new ListUsersRequest
            {
                AwsAccountId = AccountID,
                Namespace = Namespace
            };

            client.ListUsersAsync(listUsersRequest).Result.UserList.ForEach(
                user => Console.WriteLine(user.Arn))
        }
    }
}
```
Working with Embedded Analytics

Applies to: Enterprise Edition

With embedded analytics from Amazon QuickSight, your users can perform advanced analytics on demand. By incorporating branded analytics directly into your web portals or applications, you provide interactive analytical tools without changing the user's current context. Improving the user experience by reducing cognitive complexity gives users a better opportunity for deeper understanding and effectiveness.

QuickSight supports two types of embedding: one for the QuickSight console and one for QuickSight dashboards. You can embed the full QuickSight experience to enable using QuickSight authoring tools as part of your application rather than in the context of the AWS console or a standalone website. People who are using the QuickSight console through an embedded portal need to be registered as QuickSight authors or admins in your AWS account. They need to be authenticated into the same AWS account by any QuickSight-supported authentication methods. You can also embed interactive dashboards, which provide the same functionality as published dashboards. Viewers of embedded dashboards can include any of the following:

- Unauthenticated visitors to a website or application – This option requires session packs with capacity pricing. For more information, see Pricing on the Amazon QuickSight website.
- Programmatic access for display on large screens or monitors for consumption by multiple end users.
- Any type of QuickSight users who are authenticated in your AWS account by any method supported by QuickSight.

Before you can embed content, make sure that you're using QuickSight Enterprise edition in the AWS account where you plan to use embedding. If your app also resides in AWS, the app doesn't need to reside on the same AWS account as the QuickSight subscription. However, the app needs to be able to assume the AWS Identity and Access Management (IAM) role that you use for the API calls.

QuickSight embedding is available in all supported AWS Regions.

Topics
- Embedding Overview (p. 576)
- Customizing Embedded Analytics (p. 577)
- Embedding QuickSight Data Dashboards for Everyone (p. 577)
- Embedding QuickSight Data Dashboards for Authenticated Users (p. 585)
Embedding Overview

Applies to: Enterprise Edition

To embed analytics, you use the following API operations:

- The `GetDashboardEmbedUrl` API operation embeds interactive dashboards.
- The `GetSessionEmbedUrl` API operation embeds the QuickSight console.

There are only a few steps involved in the actual process of embedding analytics. Before you begin, make sure to have the following items in place:

- To authenticate users, have an IAM role to add a reader in QuickSight and an IAM role to retrieve the specific embedded dashboard.
- Know the `IdentityType` that you plan to use with the `GetDashboardEmbedUrl` API operation. The `GetSessionEmbedUrl` API operation doesn't need a value for `IdentityType`.
- For existing users, share QuickSight assets with them beforehand. For new authenticating users, know how to grant access to the assets. One way to do this is by adding all the assets to a QuickSight folder. If you prefer to use the QuickSight API, use the `DescribeDashboardPermissions` and `UpdateDashboardPermissions` API operations.
- If you’re embedding dashboards, make sure to have the ID of the dashboards to embed. The dashboard ID is the code in the URL of the dashboard. You can also get it from a scripted copy of the dashboard created with the `DescribeDashboard` API operation. If you use the API, check that you have the correct `VersionNumber` value for the dashboard.
- A QuickSight administrator must explicitly enable domains where you plan to embed your QuickSight. You do this by using `Manage QuickSight, Domains and Embedding` from the profile menu. This option is only visible to QuickSight administrators. You can also add subdomains as part of a domain. For more information, see Adding Domains for Embedded Users (p. 636). All domains in use (such as development, staging, and production) must be explicitly allowed, and they must use HTTPS. You can add up to 100 domains to the allow list.

After all the prerequisites are complete, embedding QuickSight involves the following steps, which are explained in greater detail later:

1. For authentication, use your application server to authenticate the user and get the embedded dashboard URL by using one of the AWS SDKs. For users with `IdentityType = Anonymous`, no authentication is needed.
2. In your web portal or application, embed QuickSight. To simplify this process, you can use the Amazon QuickSight Embedding SDK, available on NPMJS and GitHub. This customized JavaScript SDK is designed to help you efficiently integrate QuickSight dashboards into your application pages, set defaults, connect controls, and handle errors.

You can use AWS CloudTrail auditing logs to get information about the number of dashboards embedded, access rates, and domains where they are embedded.
Customizing Embedded Analytics

The Amazon QuickSight embedded experience is designed to be the same as the experience of using QuickSight as a standalone web application. For embedded dashboards, this means you can provide the same experience in either embedded or published dashboards. The design and the level of interactivity is determined by the person who publishes the dashboard. The designer of the dashboard can determine whether to enable specific functionality, for example the ability to download to comma-separated value (CSV) format or to use the advanced filtering panel.

When you embed the full QuickSight experience, you're embedding the full functionality of QuickSight. The only difference is that users see QuickSight as part of your application.

To complete the effect that the embedded analytics are just another part of the service you provide, you can design and use a custom theme with your own branding. You can hide QuickSight elements and replace them with your own. For example, you can hide and replace the top navigation bar, the filters, the controls, and the logo. If your subscription to QuickSight includes an annual session pack, you can also hide the Powered by QuickSight label. To further customize the view of the data, you can pass in fragments by using the dashboard URL.

With QuickSight, you can provide a personalized user experience by using, for example, dynamic defaults with filters and controls. You can add personalization by using standard customization options, or create your own customization by using the SDKs.

Embedding QuickSight Data Dashboards for Everyone

Applies to: Enterprise Edition

Intended audience: Amazon QuickSight developers

In the following sections, you can find detailed information on how to set up embedded Amazon QuickSight dashboards for everyone (nonauthenticated users).

Topics

- Step 1: Set Up Permissions (p. 577)
- Step 2: Get the URL with the Authentication Code Attached (p. 578)
- Step 3: Embed the Dashboard URL (p. 583)

Step 1: Set Up Permissions

In the following section, you can find out how to set up permissions for the backend application or web server. This task requires administrative access to IAM.

Each user who accesses a dashboard assumes a role that gives them Amazon QuickSight access and permissions to the dashboard. To make this possible, create an IAM role in your AWS account. Associate an IAM policy with the role to provide permissions to any user who assumes it.

The following sample policy provides these permissions for use with IdentityType=ANONYMOUS. For this approach to work, you also need a session pack, or session capacity pricing, on your AWS account.
Otherwise, when a user tries to access the dashboard, the error `UnsupportedPricingPlanException` is returned.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "quicksight:GetDashboardEmbedUrl",
                "quickSight:GetAnonymousUserEmbedUrl"
            ],
            "Resource": "*"
        }
    ]
}
```

Your application's IAM identity must have a trust policy associated with it to allow access to the role that you just created. This means that when a user accesses your application, your application can assume the role on the user's behalf to open the dashboard. The following example shows a role called `QuickSightEmbeddingAnonymousPolicy`, which has the sample policy preceding as its resource.

```json
{
    "Version": "2012-10-17",
    "Statement": {
        "Effect": "Allow",
        "Action": "sts:AssumeRole",
        "Resource": "arn:aws:iam::11112222333:role/QuickSightEmbeddingAnonymousPolicy"
    }
}
```

For more information regarding trust policies, see Temporary security credentials in IAM in the IAM User Guide.

**Step 2: Get the URL with the Authentication Code Attached**

In the following section, you can find how to authenticate on behalf of the anonymous visitor and get the embeddable dashboard URL on your application server.

When a user accesses your app, the app assumes the IAM role on the user's behalf. Then it adds the user to QuickSight, if that user doesn't already exist. Next, it passes an identifier as the unique role session ID.

The following examples perform the IAM authentication on the user's behalf. It passes an identifier as the unique role session ID. This code runs on your app server.

**Java**

```java
import com.amazonaws.auth.AWSCredentials;
import com.amazonaws.auth.BasicAWSCredentials;
import com.amazonaws.auth.AWSCredentialsProvider;
import com.amazonaws.regions.Regions;
import com.amazonaws.services.quicksight.AmazonQuickSight;
import com.amazonaws.services.quicksight.AmazonQuickSightClientBuilder;
import com.amazonaws.services.quicksight.model.GetDashboardEmbedUrlRequest;
import com.amazonaws.services.quicksight.model.GetDashboardEmbedUrlResult;

/**
 * Class to call QuickSight AWS SDK to get url for dashboard embedding.
 */
public class GetQuicksightEmbedUrlNoAuth {
```
private static String ANONYMOUS = "ANONYMOUS";

private final AmazonQuickSight quickSightClient;

public GetQuicksightEmbedUrlNoAuth() {
    this.quickSightClient = AmazonQuickSightClientBuilder
            .standard()
            .withRegion(Regions.US_EAST_1.getName())
            .withCredentials(new AWSCredentialsProvider() {
                @Override
                public AWSCredentials getCredentials() {
                    // provide actual IAM access key and secret
                    key here
                    "secret-key");
                }
                @Override
                public void refresh() {}
            })
            .build();

    public String getQuicksightEmbedUrl(
            final String accountId, // YOUR AWS ACCOUNT ID
            final String dashboardId, // YOUR DASHBOARD ID TO EMBED
            final String addtionalDashboardIds, // ADDITIONAL DASHBOARD-1 ADDITIONAL DASHBOARD-2
            final boolean resetDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE RESET BUTTON IN EMBEDDED DASHBAORD
            final boolean undoRedoDisabled // OPTIONAL PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN EMBEDDED DASHBAORD
    ) throws Exception {
        GetDashboardEmbedUrlRequest getDashboardEmbedUrlRequest = new GetDashboardEmbedUrlRequest()
                .withDashboardId(dashboardId)
                .withAdditionalDashboardIds(addtionalDashboardIds)
                .withAwsAccountId(accountId)
                .withNamespace("default") // Anonymous embedding requires specifying a valid namespace for which you want the embedding url
                .withIdentityType(ANONYMOUS)
                .withResetDisabled(resetDisabled)
                .withUndoRedoDisabled(undoRedoDisabled);

        GetDashboardEmbedUrlResult dashboardEmbedUrl = quickSightClient.getDashboardEmbedUrl(getDashboardEmbedUrlRequest);

        return dashboardEmbedUrl.getEmbedUrl();
    }
}

JavaScript

global.fetch = require('node-fetch');
const AWS = require('aws-sdk');

function getDashboardEmbedURL(
    accountId, // YOUR AWS ACCOUNT ID
    dashboardId, // YOUR DASHBOARD ID TO EMBED
    additionalDashboardIds, // ADDITIONAL DASHBOARD-1 ADDITIONAL DASHBOARD-2
    quicksightNamespace, // VALID NAMESPACE WHERE YOU WANT TO DO NOAUTH EMBEDDING
    resetDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE RESET BUTTON IN EMBEDDED DASHBAORD
    undoRedoDisabled // OPTIONAL PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN EMBEDDED DASHBAORD
) throws Exception {
    GetDashboardEmbedUrlRequest getDashboardEmbedUrlRequest = new GetDashboardEmbedUrlRequest()
            .withDashboardId(dashboardId)
            .withAdditionalDashboardIds(additionalDashboardIds)
            .withAwsAccountId(accountId)
            .withNamespace("default") // Anonymous embedding requires specifying a valid namespace for which you want the embedding url
            .withIdentityType(ANONYMOUS)
            .withResetDisabled(resetDisabled)
            .withUndoRedoDisabled(undoRedoDisabled);

    GetDashboardEmbedUrlResult dashboardEmbedUrl = quickSightClient.getDashboardEmbedUrl(getDashboardEmbedUrlRequest);

    return dashboardEmbedUrl.getEmbedUrl();
}
undoRedoDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN EMBEDDED DASHBAORD
getEmbedUrlCallback, // GETEMBEDURL SUCCESS CALLBACK METHOD
errorCallback // GETEMBEDURL ERROR CALLBACK METHOD
} {
const getDashboardParams = {
  AwsAccountId: accountId,
  DashboardId: dashboardId,
  AdditionalDashboardIds: additionalDashboardIds,
  Namespace: quicksightNamespace,
  IdentityType: 'ANONYMOUS',
  ResetDisabled: resetDisabled,
  SessionLifetimeInMinutes: 600,
  UndoRedoDisabled: undoRedoDisabled
};

const quicksightGetDashboard = new AWS.QuickSight({
  region: process.env.AWS_REGION,
});

quicksightGetDashboard.getDashboardEmbedUrl(getDashboardParams, function(err, data) {
  if (err) {
    console.log(err, err.stack);
    errorCallback(err);
  } else {
    const result = {
      "statusCode": 200,
      "headers": {
        "Access-Control-Allow-Origin": "*", // USE YOUR WEBSITE DOMAIN TO SECURE ACCESS TO GETEMBEDURL API
        "Access-Control-Allow-Headers": "Content-Type"
      },
      "body": JSON.stringify(data),
      "isBase64Encoded": false
    }
    getEmbedUrlCallback(result);
  }
});

Python3

import json
import boto3
from botocore.exceptions import ClientError
import time

# Create QuickSight and STS clients
qs = boto3.client('quicksight',region_name='us-east-1')
sts = boto3.client('sts')

# Function to generate embedded URL
# accountId: YOUR AWS ACCOUNT ID
# dashboardId: YOUR DASHBOARD ID TO EMBED
# additionalDashboardIds: ADDITIONAL DASHBOARD-1 ADDITIONAL DASHBOARD-2 WITHOUT COMMAS
# quicksightNamespace: VALID NAMESPACE WHERE YOU WANT TO DO NOAUTH EMBEDDING
# resetDisabled: PARAMETER TO ENABLE DISABLE RESET BUTTON IN EMBEDDED DASHBAORD
# undoRedoDisabled: OPTIONAL PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN EMBEDDED DASHBAORD
def getDashboardURL(accountId, dashboardId, quicksightNamespace, resetDisabled, undoRedoDisabled):
  try:
    response = qs.get_dashboard_embed_url(
      AwsAccountId = accountId,
DashboardId = dashboardId,
AdditionalDashboardIds = additionalDashboardIds,
Namespace = quicksightNamespace,
IdentityType = 'ANONYMOUS',
SessionLifetimeInMinutes = 600,
UndoRedoDisabled = undoRedoDisabled,
ResetDisabled = resetDisabled
)
return {
    'statusCode': 200,
    'headers': {'Access-Control-Allow-Origin': '*', 'Access-Control-Allow-Headers': 'Content-Type'},
    'body': json.dumps(response),
    'isBase64Encoded': bool('false')
} except ClientError as e:
    print(e)
    return "Error generating embeddedURL: " + str(e)

Node.js

The following example shows the JavaScript (Node.js) that you can use on the app server to get the URL for the embedded dashboard. You can use this URL in your website or app to display the dashboard.

Example

const AWS = require('aws-sdk');
const https = require('https');

var quicksight = new AWS.Service({
    apiConfig: require('./quicksight-2018-04-01.min.json'),
    region: 'us-east-1',
});

quicksight.getDashboardEmbedUrl(
    'AwsAccountId': '111122223333',
    'DashboardId': 'dashboard-id',
    'AdditionalDashboardIds': 'added-dashboard-id-1 added-dashboard-id-2 added-dashboard-id-3',
    'Namespace': 'default',
    'IdentityType': 'ANONYMOUS',
    'SessionLifetimeInMinutes': 100,
    'UndoRedoDisabled': false,
    'ResetDisabled': true
}, function(err, data) {
    console.log('Errors: ');
    console.log(err);
    console.log('Response: ');
    console.log(data);
});

Example

//The URL returned is over 900 characters. For this example, we've shortened the string for
//readability and added ellipsis to indicate that it's incomplete.
{ Status: 200,
  EmbedUrl: 'https://dashboards.example.com/embed/620bef10822743fab529fb3751187d2d..'
The following example shows the .NET/C# code that you can use on the app server to get the URL for the embedded dashboard. You can use this URL in your website or app to display the dashboard.

**Example**

```csharp
var client = new AmazonQuickSightClient(
    AccessKey,
    SecretAccessKey,
    sessionToken,
    Amazon.RegionEndpoint.USEast1);
try
{
    Console.WriteLine(
        client.GetDashboardEmbedUrlAsync(new GetDashboardEmbedUrlRequest
        {
            AwsAccountId = 111122223333,
            DashboardId = "dashboard-id",
            AdditionalDashboardIds = "added-dashboard-id-1 added-dashboard-id-2 added-dashboard-id-3",
            Namespace = default,
            IdentityType = IdentityType.ANONYMOUS,
            SessionLifetimeInMinutes = 600,
            UndoRedoDisabled = false,
            ResetDisabled = true
        }).Result.EmbedUrl
    );
} catch (Exception ex) {
    Console.WriteLine(ex.Message);
}
```

**AWS CLI**

To assume the role, choose one of the following AWS Security Token Service (AWS STS) API operations:

- **AssumeRole** – Use this operation when you are using an IAM identity to assume the role.
- **AssumeRoleWithWebIdentity** – Use this operation when you are using a web identity provider to authenticate your user.
- **AssumeRoleWithSaml** – Use this operation when you are using Security Assertion Markup Language (SAML) to authenticate your users.

The following example shows the CLI command to set the IAM role. The role needs to have permissions enabled for quicksight:GetDashboardEmbedURL.

```bash
aws sts assume-role \
    --role-arn "arn:aws:iam::11112222333:role/QuickSightEmbeddingAnonymousPolicy" \
    --role-session-name anonymous caller
```

The `assume-role` operation returns three output parameters: the access key, the secret key, and the session token.

**Note**

If you get an ExpiredToken error when calling the AssumeRole operation, this is probably because the previous SESSION_TOKEN is still in the environment variables. Clear this by setting the following variables:
• **AWS_ACCESS_KEY_ID**
• **AWS_SECRET_ACCESS_KEY**
• **AWS_SESSION_TOKEN**

The following example shows how to set these three parameters in the CLI. If you are using a Microsoft Windows machine, use `set` instead of `export`.

```
export AWS_ACCESS_KEY_ID     = "access_key_from_assume_role"
export AWS_SECRET_ACCESS_KEY = "secret_key_from_assume_role"
export AWS_SESSION_TOKEN     = "session_token_from_assume_role"
```

Running these commands sets the role session ID of the user visiting your website to `embedding_quicksight_dashboard_role/QuickSightEmbeddingAnonymousPolicy`. The role session ID is made up of the role name from `role-arn` and the `role-session-name` value. Using the unique role session ID for each user ensures that appropriate permissions are set for each visiting user. It also keeps each session separate and distinct. If you're using an array of web servers, for example for load balancing, and a session is reconnected to a different server, a new session begins.

To get a signed URL for the dashboard, call `get-dashboard-embed-url` from the app server. This returns the embeddable dashboard URL. The following example shows how to get the URL for an embedded dashboard using a server-side call for users who are making anonymous visits to your web portal or app.

```
aws quicksight get-dashboard-embed-url \
    --aws-account-id 111122223333 \
    --dashboard-id dashboard-id \
    --additional-dashboard-ids added-dashboard-id-1 added-dashboard-id-2 added-dashboard-id-3 \
    --namespace default-or-something-else \
    --identity-type ANONYMOUS \
    --session-lifetime-in-minutes 30 \
    --undo-redo-disabled true \
    --reset-disabled true \
    --user-arn arn:aws:quicksight:us-east-1:111122223333:user/
    default/QuickSightEmbeddingAnonymousPolicy/embeddingsession
```

For more information on using this operation, see `GetDashboardEmbedUrl`. You can use this and other API operations in your own code.

### Step 3: Embed the Dashboard URL

In the following section, you can find out how you can use the QuickSight Embedding SDK (JavaScript) to embed the dashboard URL from step 2 in your website or application page. With the SDK, you can do the following:

• Place the dashboard on an HTML page.
• Pass parameters into the dashboard.
• Handle error states with messages that are customized to your application.

Call the `GetDashboardEmbedUrl` API operation to get the URL that you can embed in your app. This URL is valid for 5 minutes, and the resulting session is valid for 10 hours. The API operation provides the URL with an `auth_code` that enables a single-sign on session.

The following shows an example response from `get-dashboard-embed-url`. 

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//The URL returned is over 900 characters. For this example, we've shortened the string for
//readability and added ellipsis to indicate that it's incomplete.
{
"Status": "200",
"EmbedUrl": "https: //dashboards.example.com/
embed/620bef10822743fab329fb3751187d2d...",
"RequestId": "7bee030e-f191-45c4-97fe-d9faf0e03713"
}

Embed this dashboard in your web page by using the QuickSight Embedding SDK or by adding this URL
into an iframe. If you set a ﬁxed height and width number (in pixels), QuickSight uses those and doesn't
change your visual as your window resizes. If you set a relative percent height and width, QuickSight
provides a responsive layout that is modiﬁed as your window size changes. By using the QuickSight
Embedding SDK, you can also control parameters within the dashboard and receive callbacks in terms of
page load completion and errors.
The following example shows how to use the generated URL. This code resides on your app server.
<!DOCTYPE html>
<html>
<head>
<title>Basic Embed</title>
<!-- You can download the latest QuickSight embedding SDK version from https://
www.npmjs.com/package/amazon-quicksight-embedding-sdk -->
<!-- Or you can do "npm install amazon-quicksight-embedding-sdk", if you use npm for
javascript dependencies -->
<script src="./quicksight-embedding-js-sdk.min.js"></script>
<script type="text/javascript">
var dashboard;
function embedDashboard() {
var containerDiv = document.getElementById("embeddingContainer");
var options = {
// replace this dummy url with the one generated via embedding API
url: "https://us-east-1.quicksight.aws.amazon.com/sn/dashboards/
dashboardId?isauthcode=true&identityprovider=quicksight&code=authcode",
container: containerDiv,
scrolling: "no",
height: "700px",
width: "1000px",
footerPaddingEnabled: true
};
dashboard = QuickSightEmbedding.embedDashboard(options);
}
</script>
</head>
<body onload="embedDashboard()">
<div id="embeddingContainer"></div>
</body>
</html>

For this example to work, make sure to use the Amazon QuickSight Embedding SDK to load the
embedded dashboard on your website using JavaScript. To get your copy, do one of the following:
• Download the Amazon QuickSight Embedding SDK from GitHub. This repository is maintained by a
group of QuickSight developers.
• Download the latest QuickSight embedding SDK version from https://www.npmjs.com/package/
amazon-quicksight-embedding-sdk.

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Embedding QuickSight Data Dashboards for Authenticated Users

**Applies to:** Enterprise Edition

**Intended audience:** Amazon QuickSight developers

In the following sections, you can find detailed information on how to set up embedded Amazon QuickSight dashboards for authenticated users.

**Topics**
- Step 1: Set Up Permissions (p. 585)
- Step 2: Get the URL with the Authentication Code Attached (p. 586)
- Step 3: Embed the Dashboard URL (p. 593)

**Step 1: Set Up Permissions**

In the following section, you can find out how to set up permissions for the backend application or web server. This task requires administrative access to IAM.

Each user who accesses a dashboard assumes a role that gives them Amazon QuickSight access and permissions to the dashboard. To make this possible, create an IAM role in your AWS account. Associate an IAM policy with the role to provide permissions to any user who assumes it. The IAM role needs to provide permissions to retrieve dashboard URLs. For this, you add `quicksight:GetDashboardEmbedUrl`.

The following sample policy provides these permissions for use with `IdentityType=IAM`.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "quicksight:GetDashboardEmbedUrl"
            ],
            "Resource": "*"
        }
    ]
}
```

The following sample policy provides permission to retrieve a dashboard URL. You use the policy with `quicksight:RegisterUser` if you are creating first-time users who are to be QuickSight readers.
If you use QUICKSIGHT as your identityType and provide the user's Amazon Resource Name (ARN), you also need to allow the quicksight:GetAuthCode action in your policy. The following sample policy provides this permission.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": ["quicksight:GetDashboardEmbedUrl", "quicksight:GetAuthCode"],
      "Resource": "*"
    }
  ]
}
```

Your application's IAM identity must have a trust policy associated with it to allow access to the role that you just created. This means that when a user accesses your application, your application can assume the role on the user's behalf and provision the user in QuickSight. The following example shows a role called embedding_quicksight_dashboard_role, which has the sample policy preceding as its resource.

```json
{
  "Version": "2012-10-17",
  "Statement": {
    "Effect": "Allow",
    "Action": ["sts:AssumeRole"],
    "Resource": "arn:aws:iam::11112222333:role/embedding_quicksight_dashboard_role"
  }
}
```

For more information regarding trust policies for OpenID Connect or SAML authentication, see the following sections of the IAM User Guide:

- Creating a Role for Web Identity or OpenID Connect Federation (Console)
- Creating a Role for SAML 2.0 Federation (Console)

## Step 2: Get the URL with the Authentication Code Attached

In the following section, you can find out how to authenticate your user and get the embeddable dashboard URL on your application server.
When a user accesses your app, the app assumes the IAM role on the user’s behalf. Then it adds the user to QuickSight, if that user doesn't already exist. Next, it passes an identifier as the unique role session ID.

Performing the described steps ensures that each viewer of the dashboard is uniquely provisioned in QuickSight. It also enforces per-user settings, such as the row-level security and dynamic defaults for parameters.

The following examples perform the IAM authentication on the user’s behalf. This code runs on your app server.

Java

```java
import com.amazonaws.auth.AWSCredentials;
import com.amazonaws.auth.AWSStaticCredentialsProvider;
import com.amazonaws.auth.BasicSessionCredentials;
import com.amazonaws.auth.BasicAWSCredentials;
import com.amazonaws.auth.AWSCredentialsProvider;
import com.amazonaws.regions.Regions;
import com.amazonaws.services.quicksight.AmazonQuickSight;
import com.amazonaws.services.quicksight.AmazonQuickSightClientBuilder;
import com.amazonaws.services.quicksight.model.GetDashboardEmbedUrlRequest;
import com.amazonaws.services.quicksight.model.GetDashboardEmbedUrlResult;
import com.amazonaws.services.securitytoken.AWSSecurityTokenService;
import com.amazonaws.services.securitytoken.model.AssumeRoleRequest;
import com.amazonaws.services.securitytoken.model.AssumeRoleResult;

/**
 * Class to call QuickSight AWS SDK to get url for dashboard embedding.
 */
public class GetQuicksightEmbedUrlIAMAuth {
    private static String IAM = "IAM";
    private final AmazonQuickSight quickSightClient;
    private final AWSSecurityTokenService awsSecurityTokenService;
    public GetQuicksightEmbedUrlIAMAuth(final AWSSecurityTokenService awsSecurityTokenService) {
        this.quickSightClient = AmazonQuickSightClientBuilder.standard()
            .withRegion(Regions.US_EAST_1.getName())
            .withCredentials(new AWSCredentialsProvider() {
                @Override
                public AWSCredentials getCredentials() {
                    // provide actual IAM access key and secret key here
                    return new BasicAWSCredentials("access-key", "secret-key");
                }
                @Override
                public void refresh() {} 
            })
            .build();
        this.awsSecurityTokenService = awsSecurityTokenService;
    }

    public String getQuicksightEmbedUrlUrl(
        final String accountId, // YOUR AWS ACCOUNT ID
        final String dashboardId, // YOUR DASHBOARD ID TO EMBED
        final String openIdToken, // TOKEN TO_ASSUME ROLE WITH ROLEARN
        final String roleArn, // IAM USER ROLE TO USE FOR EMBEDDING
```
final String sessionName, // SESSION NAME FOR THE ROLEARN ASSUME ROLE
final boolean resetDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE RESET
BUTTON IN EMBEDDED DASHBOARD
final boolean undoRedoDisabled // OPTIONAL PARAMETER TO ENABLE DISABLE UNDO
REDO BUTTONS IN EMBEDDED DASHBOARD
) throws Exception {
    AssumeRoleRequest request = new AssumeRoleRequest()
        .withRoleArn(roleArn)
        .withRoleSessionName(sessionName)
        .withTokenCode(openIdToken)
        .withDurationSeconds(3600);
    AssumeRoleResult assumeRoleResult =
        awsSecurityTokenService.assumeRole(request);

    AWSCredentials temporaryCredentials = new BasicSessionCredentials(
        assumeRoleResult.getCredentials().getAccessKeyId(),
        assumeRoleResult.getCredentials().getSecretAccessKey(),
        assumeRoleResult.getCredentials().getSessionToken());
    AWSStaticCredentialsProvider awsStaticCredentialsProvider = new
        AWSStaticCredentialsProvider(temporaryCredentials);

    GetDashboardEmbedUrlRequest getDashboardEmbedUrlRequest = new
        GetDashboardEmbedUrlRequest()
        .withDashboardId(dashboardId)
        .withAwsAccountId(accountId)
        .withIdentityType(IAM)
        .withResetDisabled(resetDisabled)
        .withUndoRedoDisabled(undoRedoDisabled)
        .withRequestCredentialsProvider(awsStaticCredentialsProvider);

    GetDashboardEmbedUrlResult dashboardEmbedUrl =
        quickSightClient.getDashboardEmbedUrl(getDashboardEmbedUrlRequest);

    return dashboardEmbedUrl.getEmbedUrl();
}

JavaScript

```javascript
global.fetch = require('node-fetch');
const AWS = require('aws-sdk');

function getDashboardEmbedURL(  
    accountId, // YOUR AWS ACCOUNT ID
    dashboardId, // YOUR DASHBOARD ID TO EMBED
    openIdToken, // TOKEN TO ASSUME ROLE WITH ROLEARN
    roleArn, // IAM USER ROLE TO USE FOR EMBEDDING
    sessionName, // SESSION NAME FOR THE ROLEARN ASSUME ROLE
    resetDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE RESET BUTTON IN EMBEDDED
    DASHBOARD
    undoRedoDisabled, // OPTIONAL PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN
    EMBEDDED DASHBOARD
    getEmbedUrlCallback, // GETEMBEDURL SUCCESS CALLBACK METHOD
    errorCallback // GETEMBEDURL ERROR CALLBACK METHOD
) {
    const stsClient = new AWS_STS();
    let stsParams = {
        RoleSessionName: sessionName,
        WebIdentityToken: openIdToken,
        RoleArn: roleArn
    }

    stsClient.assumeRoleWithWebIdentity(stsParams, function(err, data) {
        if (err) {
            console.log('Error assuming role');
        }
    });
}
```
```python
import json
import boto3
from botocore.exceptions import ClientError

# Create QuickSight and STS clients
qs = boto3.client('quicksight', region_name='us-east-1')
sts = boto3.client('sts')

# Function to generate embedded URL
# accountId: YOUR AWS ACCOUNT ID
# dashboardId: YOUR DASHBOARD ID TO EMBED
# openIdToken: TOKEN TO ASSUME ROLE WITH ROLEARN
# roleArn: IAM USER ROLE TO USE FOR EMBEDDING
# sessionName: SESSION NAME FOR THE ROLEARN ASSUME ROLE
# resetDisabled: PARAMETER TO ENABLE DISABLE RESET BUTTON IN EMBEDDED DASHBOARD
# undoRedoDisabled: PARAMETER TO ENABLE DISABLE UNDO REDO BUTTONS IN EMBEDDED DASHBOARD
def getDashboardURL(accountId, dashboardId, openIdToken, roleArn, sessionName, resetDisabled, undoRedoDisabled):
```
try:
    assumedRole = sts.assume_role(
        RoleArn = roleArn,
        RoleSessionName = sessionName,
        WebIdentityToken = openIdToken
    )
except ClientError as e:
    return "Error assuming role: " + str(e)
else:
    assumedRoleSession = boto3.Session(
        aws_access_key_id = assumedRole['Credentials']['AccessKeyId'],
        aws_secret_access_key = assumedRole['Credentials']['SecretAccessKey'],
        aws_session_token = assumedRole['Credentials']['SessionToken'],
    )
try:
    quickSight = assumedRoleSession.client('quicksight',region_name='us-east-1')
response = quickSight.get_dashboard_embed_url(
    AwsAccountId = accountId,
    DashboardId = dashboardId,
    IdentityType = 'IAM',
    SessionLifetimeInMinutes = 600,
    UndoRedoDisabled = undoRedoDisabled,
    ResetDisabled = resetDisabled
)
return {
    'statusCode': 200,
    'headers': {'Access-Control-Allow-Origin': '*', 'Access-Control-Allow-Headers': 'Content-Type'},
    'body': json.dumps(response),
    'isBase64Encoded': bool('false')
} except ClientError as e:
    return "Error generating embeddedURL: " + str(e)

Node.js

The following example shows the JavaScript (Node.js) that you can use on the app server to get the URL for the embedded dashboard. You can use this URL in your website or app to display the dashboard.

**Example**

```javascript
const AWS = require('aws-sdk');
const https = require('https');

var quicksight = new AWS.Service({
    apiConfig: require('./quicksight-2018-04-01.min.json'),
    region: 'us-east-1',
});
quicksight.getDashboardEmbedUrl({
    'AwsAccountId': '111122223333',
    'DashboardId': '1c1fe111-e2d2-3b30-44ef-a0e111111cde',
    'IdentityType': 'IAM',
    'ResetDisabled': true,
    'SessionLifetimeInMinutes': 100,
    'UndoRedoDisabled': false,
    'StatePersistenceEnabled': true
}, function(err, data) {
    console.log('Errors: ');
});
```
Example

//The URL returned is over 900 characters. For this example, we’ve shortened the string for
//readability and added ellipsis to indicate that it’s incomplete.
{
  Status: 200,
  EmbedUrl: 'https://dashboards.example.com/embed/620bef10822743fab329fb3751187d2d…
  RequestId: '7bee030e-f191-45c4-97fe-d9faf0e03713' 
}

.NET/C#

The following example shows the .NET/C# code that you can use on the app server to get the URL for the embedded dashboard. You can use this URL in your website or app to display the dashboard.

Example

```csharp
var client = new AmazonQuickSightClient(
    AccessKey,
    SecretAccessKey,
    sessionToken,
    Amazon.RegionEndpoint.USEast1);
try {
    Console.WriteLine(
        client.GetDashboardEmbedUrlAsync(new GetDashboardEmbedUrlRequest
        {
            AwsAccountId = 111122223333,
            DashboardId = "1c1fe111-e2d2-3b30-44ef-a0e111111cde",
            IdentityType = IdentityType.IAM,
            ResetDisabled = true,
            SessionLifetimeInMinutes = 100,
            UndoRedoDisabled = false,
            StatePersistenceEnabled = true
        }).Result.EmbedUrl
    );
} catch (Exception ex) {
    Console.WriteLine(ex.Message);
}
```

AWS CLI

To assume the role, choose one of the following AWS Security Token Service (AWS STS) API operations:

- **AssumeRole** – Use this operation when you are using an IAM identity to assume the role.
- **AssumeRoleWithWebIdentity** – Use this operation when you are using a web identity provider to authenticate your user.
- **AssumeRoleWithSaml** – Use this operation when you are using SAML to authenticate your users.

The following example shows the CLI command to set the IAM role. The role needs to have permissions enabled for quicksight:GetDashboardEmbedURL. If you are taking a just-in-time approach to add users when they first open a dashboard, the role also needs permissions enabled for quicksight:RegisterUser.
aws sts assume-role \  
   --role-arn "arn:aws:iam::111122223333:role/embedding_quicksight_dashboard_role" \  
   --role-session-name john.doe@example.com

The `assume-role` operation returns three output parameters: the access key, the secret key, and the session token.

**Note**

If you get an `ExpiredToken` error when calling the `AssumeRole` operation, this is probably because the previous `SESSION TOKEN` is still in the environment variables. Clear this by setting the following variables:

- `AWS_ACCESS_KEY_ID`
- `AWS_SECRET_ACCESS_KEY`
- `AWS_SESSION_TOKEN`

The following example shows how to set these three parameters in the CLI. If you are using a Microsoft Windows machine, use `set` instead of `export`.

```
export AWS_ACCESS_KEY_ID     = "access_key_from_assume_role"
export AWS_SECRET_ACCESS_KEY = "secret_key_from_assume_role"
export AWS_SESSION_TOKEN     = "session_token_from_assume_role"
```

Running these commands sets the role session ID of the user visiting your website to embedding_quicksight_dashboard_role/john.doe@example.com. The role session ID is made up of the role name from role-arn and the role-session-name value. Using the unique role session ID for each user ensures that appropriate permissions are set for each user. It also prevents any throttling of user access. **Throttling** is a security feature that prevents the same user from accessing QuickSight from multiple locations.

The role session ID also becomes the user name in QuickSight. You can use this pattern to provision your users in QuickSight ahead of time, or to provision them the first time they access the dashboard.

The following example shows the CLI command that you can use to provision a user. For more information about `RegisterUser`, `DescribeUser`, and other QuickSight API operations, see the QuickSight API Reference.

```
aws quicksight register-user \  
   --aws-account-id 111122223333 \  
   --namespace default \  
   --identity-type IAM \  
   --iam-arn "arn:aws:iam::111122223333:role/embedding_quicksight_dashboard_role" \  
   --user-role READER \  
   --user-name jhnd \  
   --session-name "john.doe@example.com" \  
   --email john.doe@example.com \  
   --region us-east-1 \  
   --custom-permissions-name TeamA1
```

If the user is authenticated through Microsoft AD, you don’t need to use `RegisterUser` to set them up. Instead, they should be automatically subscribed the first time they access QuickSight. For Microsoft AD users, you can use `DescribeUser` to get the user ARN.

The first time a user accesses QuickSight, you can also add this user to the group that the dashboard is shared with. The following example shows the CLI command to add a user to a group.
aws quicksight create-group-membership
  --aws-account-id=111122223333
  --namespace=default
  --group-name=financeusers
  --member-name="embedding_quicksight_dashboard_role/john.doe@example.com"

You now have a user of your app who is also a user of QuickSight, and who has access to the dashboard.

Finally, to get a signed URL for the dashboard, call get-dashboard-embed-url from the app server. This returns the embeddable dashboard URL. The following example shows how to get the URL for an embedded dashboard using a server-side call for users authenticated through AWS Managed Microsoft AD or SSO.

aws quicksight get-dashboard-embed-url
  --aws-account-id=111122223333
  --dashboard-id=1a1ac2b2-3fc3-4b44-5e5d-c6db6778df89
  --identity-type=IAM
  --session-lifetime-in-minutes=30
  --undo-redo-disabled=true
  --reset-disabled=true
  --state-persistence-enabled=true
  --user-arn=arn:aws:quicksight:us-east-1:111122223333:user/default/embedding_quicksight_dashboard_role/embeddingsession

For more information on using this operation, see GetDashboardEmbedUrl. You can use this and other API operations in your own code.

Step 3: Embed the Dashboard URL

In the following section, you can find out how you can use the Amazon QuickSight Embedding SDK (JavaScript) to embed the dashboard URL from step 3 in your website or application page. With the SDK, you can do the following:

- Place the dashboard on an HTML page.
- Pass parameters into the dashboard.
- Handle error states with messages that are customized to your application.

Call the GetDashboardEmbedUrl API operation to get the URL that you can embed in your app. This URL is valid for 5 minutes, and the resulting session is valid for 10 hours. The API operation provides the URL with an auth_code that enables a single-sign on session.

The following shows an example response from get-dashboard-embed-url.

```
//The URL returned is over 900 characters. For this example, we've shortened the string for readability and added ellipsis to indicate that it's incomplete.
{
  "Status": "200",
  "EmbedUrl": "https://dashboards.example.com/embed/620bef10822743fab329f73751187d2d...",
  "RequestId": "7bee030e-f191-45c4-97fe-d9faf0e03713"
}
```

Embed this dashboard in your webpage by using the QuickSight Embedding SDK or by adding this URL into an iframe. If you set a fixed height and width number (in pixels), QuickSight uses those and doesn't
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change your visual as your window resizes. If you set a relative percent height and width, QuickSight
provides a responsive layout that is modiﬁed as your window size changes. By using the Amazon
QuickSight Embedding SDK, you can also control parameters within the dashboard and receive callbacks
in terms of page load completion and errors.
The following example shows how to use the generated URL. This code is generated on your app server.
<!DOCTYPE html>
<html>
<head>
<title>Basic Embed</title>
<script src="./quicksight-embedding-js-sdk.min.js"></script>
<script type="text/javascript">
var dashboard;
function embedDashboard() {
var containerDiv = document.getElementById("embeddingContainer");
var options = {
// replace this dummy url with the one generated via embedding API
url: "https://us-east-1.quicksight.aws.amazon.com/sn/dashboards/
dashboardId?isauthcode=true&identityprovider=quicksight&code=authcode",
container: containerDiv,
scrolling: "no",
height: "700px",
width: "1000px",
footerPaddingEnabled: true
};
dashboard = QuickSightEmbedding.embedDashboard(options);
}
</script>
</head>
<body onload="embedDashboard()">
<div id="embeddingContainer"></div>
</body>
</html>

For this example to work, make sure to use the Amazon QuickSight Embedding SDK to load the
embedded dashboard on your website using JavaScript. To get your copy, do one of the following:
• Download the Amazon QuickSight Embedding SDK from GitHub. This repository is maintained by a
group of QuickSight developers.
• Download the latest embedding SDK version from https://www.npmjs.com/package/amazonquicksight-embedding-sdk.
• If you use npm for JavaScript dependencies, download and install it by running the following
command.
npm install amazon-quicksight-embedding-sdk

Embedding the Full Functionality of the Amazon
QuickSight Console for Authenticated Users
Applies to: Enterprise Edition

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With Enterprise edition, in addition to providing read-only dashboards you can also provide the Amazon QuickSight console experience in a custom-branded authoring portal. Using this approach, you allow your users to create data sources, datasets, and analyses. In the same interface, they can create, publish, and view dashboards. If you want to restrict some of those permissions, you can also do that.

Users who access QuickSight through an embedded console need to belong to the author or admin security cohort. Readers don't have enough access to use the QuickSight console for authoring, regardless of whether it's embedded or part of the AWS console. However, authors and admins can still access embedded dashboards. If you want to restrict permissions to some of the authoring features, you can add a custom permissions profile to the user with the UpdateUser API operation. Use the RegisterUser API operation to add a new user with a custom permission profile attached. For more information, see the following sections:

- For information on creating custom roles by defining custom console permissions, see Customizing Access to the QuickSight Console.
- For information on using namespaces to isolate multitenancy users, groups, and QuickSight assets, see QuickSight Namespaces.
- For information on adding your own branding to an embedded QuickSight console, see Using Themes in QuickSight and the QuickSight Theme API Operations.

In the following sections, you can find detailed information on how to set up embedded Amazon QuickSight dashboards for authenticated users.

**Topics**

- Step 1: Set Up Permissions (p. 595)
- Step 2: Get the URL with the Authentication Code Attached (p. 597)
- Step 3: Embed the Console Session URL (p. 602)

**Step 1: Set Up Permissions**

In the following section, you can find out how to set up permissions for the backend application or web server. This task requires administrative access to IAM.

Each user who accesses a QuickSight assumes a role that gives them Amazon QuickSight access and permissions to the console session. To make this possible, create an IAM role in your AWS account. Associate an IAM policy with the role to provide permissions to any user who assumes it. Add quicksight:RegisterUser permissions to ensure that the reader can access QuickSight in a read-only fashion, and not have access to any other data or creation capability. The IAM role also needs to provide permissions to retrieve console session URLs. For this, you add quicksight:GetSessionEmbedUrl.

The following sample policy provides these permissions for use with IdentityType=IAM.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "quicksight:RegisterUser",
      "Resource": "*",
      "Effect": "Allow"
    },
    {
      "Action": "quicksight:GetSessionEmbedUrl",
      "Resource": "*",
      "Effect": "Allow"
    }
  ]
}
```
The following sample policy provides permission to retrieve a console session URL. You use the policy without `quicksight:RegisterUser` if you are creating users before they access an embedded session.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "quicksight:GetSessionEmbedUrl"
            ],
            "Resource": "*"
        }
    ]
}
```

If you use `QUICKSIGHT` as your `identityType` and provide the user's Amazon Resource Name (ARN), you also need to allow the `quicksight:GetAuthCode` action in your policy. The following sample policy provides this permission.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "quicksight:GetSessionEmbedUrl",
                "quicksight:GetAuthCode"
            ],
            "Resource": "*"
        }
    ]
}
```

Your application's IAM identity must have a trust policy associated with it to allow access to the role that you just created. This means that when a user accesses your application, your application can assume the role on the user's behalf and provision the user in QuickSight. The following example shows a role called `embedding_quicksight_console_session_role`, which has the sample policy preceding as its resource.

```json
{
    "Version": "2012-10-17",
    "Statement": {
        "Effect": "Allow",
        "Action": "sts:AssumeRole",
        "Resource": "arn:aws:iam::11112222333:role/embedding_quicksight_console_session_role"
    }
}
```

For more information regarding trust policies for OpenID Connect or SAML authentication, see the following sections of the *IAM User Guide*:

- Creating a Role for Web Identity or OpenID Connect Federation (Console)
- Creating a Role for SAML 2.0 Federation (Console)
Step 2: Get the URL with the Authentication Code Attached

In the following section, you can find out how to authenticate your user and get the embeddable console session URL on your application server.

When a user accesses your app, the app assumes the IAM role on the user’s behalf. Then it adds the user to QuickSight, if that user doesn’t already exist. Next, it passes an identifier as the unique role session ID.

Performing the described steps ensures that each viewer of the console session is uniquely provisioned in QuickSight. It also enforces per-user settings, such as the row-level security and dynamic defaults for parameters.

The following examples perform the IAM authentication on the user’s behalf. This code runs on your app server.

Java

```java
import com.amazonaws.auth.AWSCredentials;
import com.amazonaws.auth.BasicAWSCredentials;
import com.amazonaws.auth.AWSCredentialsProvider;
import com.amazonaws.regions.Regions;
import com.amazonaws.services.quicksight.AmazonQuickSight;
import com.amazonaws.services.quicksight.AmazonQuickSightClientBuilder;
import com.amazonaws.services.quicksight.model.GetSessionEmbedUrlRequest;
import com.amazonaws.services.quicksight.model.GetSessionEmbedUrlResult;

/**
 * Class to call QuickSight AWS SDK to get url for session embedding.
 */
public class GetSessionEmbedUrlQSAuth {
    private final AmazonQuickSight quickSightClient;

    public GetSessionEmbedUrlQSAuth() {
        this.quickSightClient = AmazonQuickSightClientBuilder
            .standard()
            .withRegion(Regions.US_EAST_1.getName())
            .withCredentials(new AWSCredentialsProvider() {
                @Override
                public AWSCredentials getCredentials() {
                    // provide actual IAM access key and secret key here
                    return new BasicAWSCredentials("access-key", "secret-key");
                }
                @Override
                public void refresh() {} // Override
            }).build();

    }

    public String getQuicksightEmbedUrl(final String accountId, // YOUR AWS ACCOUNT ID
                                          final String userArn // REGISTERED USER ARN TO USE FOR EMBEDDING. REFER TO
                                          GETEMBEDURL SECTION IN DEV PORTAL TO FIND OUT HOW TO GET USER ARN FOR A QUICKSIGHT USER
                                          ) throws Exception {
            GetSessionEmbedUrlRequest getSessionEmbedUrlRequest = new GetSessionEmbedUrlRequest()
                .withAwsAccountId(accountId)
                .withEntryPoint("/start")
        }
```

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JavaScript

```javascript
const AWS = require('aws-sdk');

function getSessionEmbedURL(
    accountId, // YOUR AWS ACCOUNT ID
    userArn, // REGISTERED USER ARN TO USE FOR EMBEDDING. REFER TO GETEMBEDURL SECTION IN DEV PORTAL TO FIND OUT HOW TO GET USER ARN FOR A QUICKSIGHT USER
    getEmbedUrlCallback, // GETEMBEDURL SUCCESS CALLBACK METHOD
    errorCallback // GETEMBEDURL ERROR CALLBACK METHOD
) {
    const getSessionParams = {
        AwsAccountId: accountId,
        EntryPoint: '/start',
        UserArn: userArn,
        SessionLifetimeInMinutes: 600,
    };

    const quicksightGetSession = new AWS.QuickSight({
        region: process.env.AWS_REGION,
    });

    quicksightGetSession.getSessionEmbedUrl(getSessionParams, function(err, data) {
        if (err) {
            console.log(err, err.stack);
            errorCallback(err);
        } else {
            const result = {
                "statusCode": 200,
                "headers": {
                    "Access-Control-Allow-Origin": "*", // USE YOUR WEBSITE DOMAIN TO SECURE ACCESS TO GETEMBEDURL API
                    "Access-Control-Allow-Headers": "Content-Type"
                },
                "body": JSON.stringify(data),
                "isBase64Encoded": false
            }
            getEmbedUrlCallback(result);
        }
    });
}
```

Python

```python
import boto3
from botocore.exceptions import ClientError
import time

# Create QuickSight and STS clients
qs = boto3.client('quicksight', region_name='us-east-1')
sts = boto3.client('sts')

# Function to generate embedded URL
```
def getSessionEmbedURL(accountId, userArn):
    try:
        response = qs.get_session_embed_url(
            AwsAccountId = accountId,
            EntryPoint = "/*",
            UserArn = userArn,
            SessionLifetimeInMinutes = 600
        )
        return {
            'statusCode': 200,
            'headers': {'Content-Type': ''},
            'body': json.dumps(response)
        }
    except ClientError as e:
        print(e)
        return "Error generating embeddedURL: " + str(e)

Node.js

The following example shows the JavaScript (Node.js) that you can use on the app server to get the URL for the embedded console session. You can use this URL in your website or app to display the console session.

Example

```javascript
const AWS = require('aws-sdk');
const https = require('https');

var quicksight = new AWS.Service({
    apiConfig: require('./quicksight-2018-04-01.min.json'),
    region: 'us-east-1',
});

quicksight.GetSessionEmbedUrl({
    'AwsAccountId': '111122223333',
    'EntryPoint': 'https://url-for-console-page-to-open',
    'SessionLifetimeInMinutes': 600,
    'UserArn': 'USER_ARN'
}, function(err, data) {
    console.log('Errors: ');
    console.log(err);
    console.log('Response: ');
    console.log(data);
});
```

Example

//The URL returned is over 900 characters. For this example, we’ve shortened the string for
//readability and added ellipsis to indicate that it’s incomplete.

```javascript
{ Status: 200,
  EmbedUrl: 'https://dashboards.example.com/embed/620bef10822743fab329fb3751187d2d...
  RequestId: '7bee030e-f191-45c4-97fe-d9fafa0e03713' }```
The following example shows the .NET/C# code that you can use on the app server to get the URL for the embedded console session. You can use this URL in your website or app to display the console.

Example

```csharp
var client = new AmazonQuickSightClient(
    AccessKey,
    SecretAccessKey,
    sessionToken,
    Amazon.RegionEndpoint.USEast1);
try
{
    Console.WriteLine(
        client.GetSessionEmbedUrlAsync(new GetSessionEmbedUrlRequest
        {
            'AwsAccountId': '111122223333',
            'EntryPoint': 'https://url-for-console-page-to-open',
            'SessionLifetimeInMinutes': 600,
            'UserArn': 'USER_ARN'
        }).Result.EmbedUrl
    );
} catch (Exception ex) {
    Console.WriteLine(ex.Message);
}
```

AWS CLI

To assume the role, choose one of the following AWS Security Token Service (AWS STS) API operations:

- **AssumeRole** – Use this operation when you are using an IAM identity to assume the role.
- **AssumeRoleWithWebIdentity** – Use this operation when you are using a web identity provider to authenticate your user.
- **AssumeRoleWithSaml** – Use this operation when you are using SAML to authenticate your users.

The following example shows the CLI command to set the IAM role. The role needs to have permissions enabled for quicksight:GetSessionEmbedUrl. If you are taking a just-in-time approach to add users when they first open QuickSight, the role also needs permissions enabled for quicksight:RegisterUser.

```
aws sts assume-role \
--role-arn "arn:aws:iam::111122223333:role/embedding_quicksight_dashboard_role" \
--role-session-name john.doe@example.com
```

The assume-role operation returns three output parameters: the access key, the secret key, and the session token.

**Note**

If you get an ExpiredToken error when calling the AssumeRole operation, this is probably because the previous SESSION_TOKEN is still in the environment variables. Clear this by setting the following variables:
Amazon QuickSight User Guide
Embedding the QuickSight Console for Authenticated Users

- **AWS_ACCESS_KEY_ID**
- **AWS_SECRET_ACCESS_KEY**
- **AWS_SESSION_TOKEN**

The following example shows how to set these three parameters in the CLI. If you are using a Microsoft Windows machine, use `set` instead of `export`.

```bash
export AWS_ACCESS_KEY_ID     = "access_key_from_assume_role"
export AWS_SECRET_ACCESS_KEY = "secret_key_from_assume_role"
export AWS_SESSION_TOKEN     = "session_token_from_assume_role"
```

Running these commands sets the role session ID of the user visiting your website to `embedding_quicksight_console_session_role/john.doe@example.com`. The role session ID is made up of the role name from `role-arn` and the `role-session-name` value. Using the unique role session ID for each user ensures that appropriate permissions are set for each user. It also prevents any throttling of user access. Throttling is a security feature that prevents the same user from accessing QuickSight from multiple locations.

The role session ID also becomes the user name in QuickSight. You can use this pattern to provision your users in QuickSight ahead of time, or to provision them the first time they access a console session.

The following example shows the CLI command that you can use to provision a user. For more information about `RegisterUser`, `DescribeUser`, and other QuickSight API operations, see the QuickSight API Reference.

```bash
aws quicksight register-user \
  --aws-account-id 111122223333  \
  --namespace default  \
  --identity-type IAM  \
  --iam-arn "arn:aws:iam::111122223333:role/embedding_quicksight_dashboard_role"  \
  --user-role READER  \
  --user-name jhnd  \
  --session-name "john.doe@example.com"  \
  --email john.doe@example.com  \
  --region us-east-1  \
  --custom-permissions-name TeamA1
```

If the user is authenticated through Microsoft AD, you don't need to use `RegisterUser` to set them up. Instead, they should be automatically subscribed the first time they access QuickSight. For Microsoft AD users, you can use `DescribeUser` to get the user ARN.

The first time a user accesses QuickSight, you can also add this user to the appropriate group. The following example shows the CLI command to add a user to a group.

```bash
aws quicksight create-group-membership \
  --aws-account-id=111122223333  \
  --namespace=default  \
  --group-name=financeusers  \
  --member-name="embedding_quicksight_dashboard_role/john.doe@example.com"
```

You now have a user of your app who is also a user of QuickSight, and who has access to the QuickSight console session.

Finally, to get a signed URL for the console session, call `get-session-embed-url` from the app server. This returns the embeddable console session URL. The following example shows how to get the URL for an embedded console session using a server-side call for users authenticated through AWS Managed Microsoft AD or Single Sign-on (SSO).
aws quicksight get-dashboard-embed-url
   --aws-account-id 111122223333
   --entry-point the-url-for--the-console-session
   --session-lifetime-in-minutes 600
   --user-arn arn:aws:quicksight:us-east-1:11112222333:user/default/embedding_quicksight_dashboard_role/embeddingsession

For more information on using this operation, see GetSessionEmbedUrl. You can use this and other API operations in your own code.

Step 3: Embed the Console Session URL

In the following section, you can find out how you can use the Amazon QuickSight Embedding SDK (JavaScript) to embed the console session URL from step 3 in your website or application page. With the SDK, you can do the following:

- Place the console session on an HTML page.
- Pass parameters into the console session.
- Handle error states with messages that are customized to your application.

Call the GetSessionEmbedUrl API operation to get the URL that you can embed in your app. This URL is valid for 5 minutes, and the resulting session is valid for 10 hours. The API operation provides the URL with an auth_code that enables a single-sign on session.

The following shows an example response from get-dashboard-embed-url.

```json
{
   "Status": "200",
   "EmbedUrl": "https://dashboards.example.com/embed/620bef10822743fab329fb3751187d2d...",
   "RequestId": "7bee030e-f191-45ce-97fe-d9fa90e03713"
}
```

Embed this console session in your webpage by using the QuickSight Embedding SDK or by adding this URL into an iframe. If you set a fixed height and width number (in pixels), QuickSight uses those and doesn't change your visual as your window resizes. If you set a relative percent height and width, QuickSight provides a responsive layout that is modified as your window size changes. By using the Amazon QuickSight Embedding SDK, you can also control parameters within the console session and receive callbacks in terms of page load completion and errors.

The following example shows how to use the generated URL. This code is generated on your app server.

```html
<!DOCTYPE html>
<html>
<head>
   <title>Basic Embed</title>
   <script src="/quicksight-embedding-js-sdk.min.js"></script>
   <script type="text/javascript">
      var dashboard;
      function embedDashboard() {
         var containerDiv = document.getElementById("embeddingContainer");
         var options = {
```
For this example to work, make sure to use the Amazon QuickSight Embedding SDK to load the embedded console session on your website using JavaScript. To get your copy, do one of the following:

- Download the Amazon QuickSight Embedding SDK from GitHub. This repository is maintained by a group of QuickSight developers.
- If you use npm for JavaScript dependencies, download and install it by running the following command.

```
npm install amazon-quicksight-embedding-sdk
```
Troubleshooting Amazon QuickSight

Use this information to help you diagnose and fix common issues that you can encounter when using Amazon QuickSight.

**Note**

Need more help? You can visit the Amazon QuickSight User Community or the AWS forums. See also the Amazon QuickSight Resource Library.

**Topics**

- Resolving Amazon QuickSight Issues and Error Messages (p. 604)
- I Can't Connect to My Data Source (p. 604)
- My Visual Can't Find Missing Columns (p. 612)
- My Visual Can't Find the Query Table (p. 613)
- I Can't Add a Visual to My Analysis (p. 613)
- I Get a Feedback Bar Across My Printed Docs (p. 614)
- How Do I Delete My Amazon QuickSight Account? (p. 614)
- My Map Charts Don't Show Locations (p. 614)
- Amazon QuickSight Isn't Working in My Browser (p. 614)
- Troubleshooting Issues When Using Athena with Amazon QuickSight (p. 615)
- My Pivot Table Stops Working (p. 623)
- My Email Sign-in Stopped Working (p. 623)

## Resolving Amazon QuickSight Issues and Error Messages

If you are having difficulties or receiving an error message, there's a few ways that you can go about resolving the issue. Following are some resources that can help:

- For errors during dataset ingestion (importing data), see SPICE Ingestion Error Codes (p. 85).
- For technical user questions, visit the User Community.
- For administrator questions, visit the AWS Forums.
- If you need more customized assistance, contact AWS Support. To do this while you are signed in to your AWS account, choose Support at upper right, and then choose Support Center.

## I Can't Connect to My Data Source

Use the following section to help you troubleshoot connections to data sources. Before you continue, verify that your database is currently available. Also, verify that you have the correct connection information and valid credentials.

**Topics**

- I Need to Validate the Connection to My Data Source, or Change Data Source Settings (p. 605)
I Need to Validate the Connection to My Data Source, or Change Data Source Settings

In some cases, you might need to update your data source, or you got a connection error and need to check your settings. If so, take the following steps.

To validate your connection to the data source

1. From the QuickSight home screen, choose Manage data.
2. Choose New dataset.
3. Scroll to FROM EXISTING DATA SOURCES.
4. Choose the data source that you want to test or change.
5. If the option is offered, choose Edit/Preview data.
6. Choose Validate connection.
7. Make any changes that you want to make, then choose Update data source.

I Can't Connect to Amazon Athena

Intended audience: Amazon QuickSight administrators

Use this section to help troubleshoot connecting to Athena.

If you can't connect to Amazon Athena, you might get an insufficient permissions error when you run a query, showing that the permissions aren't configured. To verify that you can connect Amazon QuickSight to Athena, check the following settings:

- AWS resource permissions inside of Amazon QuickSight
- AWS Identity and Access Management (IAM) policies
- Amazon S3 location
- Query results location
- AWS KMS key policy (for encrypted datasets only)

For details, see following. For information about troubleshooting other Athena issues, see Troubleshooting Issues When Using Athena with Amazon QuickSight (p. 615).

Make Sure That You Authorized Amazon QuickSight to Use Athena

Intended audience: Amazon QuickSight administrators
Use the following procedure to make sure that you successfully authorized Amazon QuickSight to use Athena. Permissions to AWS resources apply to all Amazon QuickSight users.

To perform this action, you must be an Amazon QuickSight administrator. To check if you have access, verify that you see the Manage QuickSight option when you open the menu from your profile at upper right.

**To authorize Amazon QuickSight to access Athena**

1. Choose your profile name (upper right). Choose Manage QuickSight, and then choose Security & permissions.
2. Under QuickSight access to AWS services, choose Add or remove.
3. Find Athena in the list. Clear the check box by Athena, then select it again to enable Athena.
   
   Then choose Connect both.
4. Choose the buckets that you want to access from Amazon QuickSight.
   
   The settings for S3 buckets that you access here are the same ones that you access by choosing Amazon S3 from the list of AWS services. Be careful that you don't inadvertently disable a bucket that someone else uses.
5. Choose Finish to confirm your selection. Or choose Cancel to exit without saving.
6. Choose Update to save your new settings for Amazon QuickSight access to AWS services. Or choose Cancel to exit without making any changes.
7. Make sure that you are using the correct AWS Region when you are finished.
   
   If you had to change your AWS Region as part of the first step of this process, change it back to the AWS Region that you were using before you started this procedure.

**Make Sure That Your IAM Policies Grant the Right Permissions**

**Intended audience:** System administrators

Your AWS Identity and Access Management (IAM) policies must grant permissions to specific actions. Your IAM user or role must be able to read and write both the input and the output of the S3 buckets that Athena uses for your query.

If the dataset is encrypted, the IAM user needs to be a key user in the specified AWS KMS key's policy.

**To verify that your IAM policies have permission to use S3 buckets for your query**

1. Open the IAM console at https://console.aws.amazon.com/iam/.
2. Locate the IAM user or role you are using. Choose the user or role name to see the associated policies.
3. Verify that your policy has the correct permissions. Choose a policy that you want to verify, and then choose Edit policy. Use the visual editor, which opens by default. If you have the JSON editor open instead, choose the Visual editor tab.
4. Choose the S3 entry in the list to see its contents. The policy needs to grant permissions to list, read, and write. If S3 is not in the list, or it doesn't have the correct permissions, you can add them here.

For examples of IAM policies that work with Amazon QuickSight, see IAM Policy Examples for Amazon QuickSight (p. 682).

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Make Sure That the IAM User Has Read/Write Access to Your S3 Location

**Intended audience:** Amazon QuickSight administrators

To access Athena data from Amazon QuickSight, first make sure that Athena and its S3 location are authorized in Manage QuickSight screen. For more information, see Make Sure That You Authorized Amazon QuickSight to Use Athena (p. 605).

Next, verify the relevant IAM permissions. The IAM user for your Athena connection needs read/write access to the location where your results go in S3. Start by verifying that the IAM user has an attached policy that allows access to Athena, such as AmazonAthenaFullAccess. Let Athena create the bucket using the name that it requires, and then add this bucket to the list of buckets that QuickSight can access. If you change the default location of the results bucket (aws-athena-query-results-*), be sure that the IAM user has permission to read and write to the new location.

Verify that you don't include the AWS Region code in the S3 URL. For example, use s3://awsexamplebucket/path and not s3://us-east-1.amazonaws.com/awsexamplebucket/path. Using the wrong S3 URL causes an Access Denied error.

Also verify the bucket policies and object ACLs allow the IAM user to access the objects in the buckets. If the IAM user is in a different AWS account, see Cross-account Access in the Amazon Athena User Guide.

If the dataset is encrypted, verify that the IAM user is a key user in the specified AWS KMS key’s policy. You can do this in the AWS KMS console at https://console.aws.amazon.com/kms.

**To set permissions to your Athena query results location**

2. Verify that you have selected the workgroup you want to use:
   - Examine the Workgroup option at the top. It has the format Workgroup: group-name. If the group name is the one that you want to use, skip to the next step.
   - To choose a different workgroup, chose Workgroup at the top. Choose the workgroup that you want to use, and choose Switch workgroup.
3. Choose Settings at upper right.
   (Not common) If you get an error that your workgroup is not found, use these steps to fix it:
   a. Ignore the error message for now, and instead find Workgroup: group-name on the Settings page. Your workgroup's name is a hyperlink. Open it.
   b. On the Workgroup: <groupname> page, choose Edit workgroup at left. Now close the error message.
   c. Near Query result location, open the S3 location selector by choosing the Select button that has the file folder icon.
   d. Choose the small arrow at the end of the name of the S3 location for Athena. The name must begin with aws-athena-query-results.
   e. (Optional) Encrypt query results by selecting the Encrypt results stored in S3 check box.
   f. Choose Save to confirm your choices.
   g. If the error doesn't reappear, return to Settings.
   Occasionally, the error might appear again. If so, take the following steps:
   1. Choose the workgroup and then choose View details.
2. (Optional) To preserve your settings, take notes or a screenshot of the workgroup configuration.

3. Choose **Create workgroup**.

4. Replace the workgroup with a new one. Configure the correct S3 location and encryption options. Note the S3 location because you need it later.

5. Choose **Save** to proceed.

6. When you no longer need the original workgroup, disable it. Make sure to carefully read the warning that appears, because it tells you what you lose if you choose to disable it.

4. If you didn't get this by troubleshooting in the previous step, choose **Settings** at upper right and get the S3 location value shown as **Query result location**.

5. If **Encrypt query results** is enabled, check whether it uses SSE-KMS or CSE-KMS. Note the key.

6. Open the S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/), open the correct bucket, and then choose the **Permissions** tab.

7. Check that your IAM user has access by viewing **Bucket Policy**.

   If you manage access with ACLs, make sure that the access control lists (ACLs) are set up by viewing **Access Control List**.

8. If your dataset is encrypted (**Encrypt query results** is selected in the workgroup settings), make sure that the IAM user or role is added as a key user in that AWS KMS key's policy. You can access KMS settings at [https://console.aws.amazon.com/kms](https://console.aws.amazon.com/kms).

**To grant access to the S3 bucket used by Athena**

1. Open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).
2. Choose the S3 bucket used by Athena in the **Query result location**.
3. On the **Permissions** tab, verify the permissions.

For more information, see the AWS support article *When I run an Athena query, I get an "Access Denied" error.*

**I Can't Connect Although My Data Source Connection Options Look Right (SSL)**

Problems connecting can occur when Secure Sockets Layer (SSL) is incorrectly configured. The symptoms can include the following:

- You can connect to your database in other ways or from other locations but not in this case.
- You can connect to a similar database but not this one.

Rule out the following circumstances:

- Permissions issues
- Availability issues
- An expired or invalid certificate
- A self-signed certificate
- Certificate chain in the wrong order
- Ports not enabled
- Firewall blocking an IP address
- Web Sockets are blocked
• A VPC or security group not configured correctly.

To help find issues with SSL, you can use an online SSL checker, or a tool like OpenSSL.

The following steps walk through troubleshooting a connection where SSL is suspect. The administrator in this example has already installed OpenSSL.

**Example**

1. The user finds an issue connecting to the database. The user verifies that they can connect a different database in another AWS Region. They check other versions of the same database and can connect easily.

2. The administrator reviews the issue and decides to verify that the certificates are working correctly. The administrator searches online for an article on using OpenSSL to troubleshoot or debug SSL connections.

3. Using OpenSSL, the administrator verifies the SSL configuration in the terminal.

```bash
echo quit
openssl s_client -connect <host>:port
```

The result shows that the certificate is not working.

```
... ... ... CONNECTED(00000003)
012345678901234:error:140770FC:SSL routines:SSL23_GET_SERVER_HELLO:unknown protocol:s23_clnt.c:782:
---
no peer certificate available
---
No client certificate CA names sent
---
SSL handshake has read 7 bytes and written 278 bytes
---
New, (NONE), Cipher is (NONE)
Secure Renegotiation IS NOT supported
SSL-Session:
    Protocol : TLSv1.2
    Cipher   : 0000
    Session-ID: 
    Session-ID-ctx: 
    Master-Key: 
    Key-Arg   : None
    PSK identity: None
    PSK identity hint: None
    Start Time: 1497569068
    Timeout   : 300 (sec)
    Verify return code: 0 (ok)
---
```

4. The administrator corrects the problem by installing the SSL certificate on the user's database server.

For more detail on the solution in this example, see Using SSL to Encrypt a Connection to a DB Instance in the Amazon RDS User Guide.
I Can't Connect to MySQL (Issues with SSL and Authorization)

To check on some common connection issues in MySQL, use the following steps. This procedure helps you find out if you have enabled SSL and granted usage rights.

**To find solutions for some common connection issues in MySQL**

1. Check `/etc/my.cnf` to make sure SSL is enabled for MySQL.
2. In MySQL, run the following command.

   ```sql
   show status like 'Ssl%';
   ```

If SSL is working, you see results like the following:

```
+--------------------------------+----------------------+
| Variable_name                  | Value                |
| +--------------------------------+----------------------+
| Ssl_accept_renegotiates        | 0                    |
| Ssl_accepts                    | 1                    |
| Ssl_callback_cache_hits        | 0                    |
| Ssl_cipher                     |                      |
| Ssl_cipher_list                |                      |
| Ssl_client_connects            | 0                    |
| Ssl_connect_renegotiates       | 0                    |
| Ssl_ctx_verify_depth           | 18446744073709551615 |
| Ssl_ctx_verify_mode            | 5                    |
| Ssl_default_timeout            | 0                    |
| Ssl_finished_accepts           | 0                    |
| Ssl_finished_connects          | 0                    |
| Ssl_session_cache_hits         | 0                    |
| Ssl_session_cache_misses       | 0                    |
| Ssl_session_cache_mode         | SERVER               |
| Ssl_session_cache_overflows    | 0                    |
| Ssl_session_cache_size         | 128                  |
| Ssl_session_cache_timeouts     | 0                    |
| Ssl_sessions_reused            | 0                    |
| Ssl_used_session_cache_entries | 0                    |
| Ssl_verify_depth               | 0                    |
| Ssl_verify_mode                | 0                    |
| Ssl_version                    |                      |
+--------------------------------+----------------------+
```

If SSL is disabled, you see results like the following:

```
+------------------------+--------+
| Variable_name          | Value  |
| +------------------------+--------+
| Ssl_accept_renegotiates| 0      |
| Ssl_accepts            | 0      |
| Ssl_callback_cache_hits| 0      |
| Ssl_cipher             |        |
| Ssl_cipher_list        |        |
| Ssl_client_connects    | 0      |
| Ssl_connect_renegotiates| 0     |
| Ssl_ctx_verify_depth   |        |
| Ssl_ctx_verify_mode    |        |
| Ssl_default_timeout    |        |
| Ssl_finished_accepts   | 0      |
| Ssl_finished_connects  | 0      |
| Ssl_session_cache_hits | 0      |
| Ssl_session_cache_misses| 0   |
| Ssl_session_cache_mode |        |
| Ssl_session_cache_overflows| 0  |
| Ssl_session_cache_size |        |
| Ssl_session_cache_timeouts| 0  |
| Ssl_sessions_reused    | 0      |
| Ssl_used_session_cache_entries| 0 |
| Ssl_verify_depth       | 0      |
| Ssl_verify_mode        | 0      |
| Ssl_version            |        |
+------------------------+--------+
```
3. Make sure that you have installed a supported SSL certificate on the database server.
4. Grant usage for the specific user to connect using SSL.

```
GRANT USAGE ON *.* TO 'encrypted_user'@'%' REQUIRE SSL;
```

For more detail on the solution in this example, see the following:
- SSL Support for MySQL DB Instances in the Amazon RDS User Guide.
- Using SSL to Encrypt a Connection to a DB Instance in the Amazon RDS User Guide.
- MySQL documentation

## I Can't Connect to Amazon S3

To successfully connect to Amazon S3, make sure that you configure authentication and create a valid manifest file inside the bucket you are trying to access. Also, make sure that the file described by the manifest is available.

To verify authentication, make sure that you authorized Amazon QuickSight to access the S3 account. It's not enough that you, the user, are authorized. Amazon QuickSight must be authorized separately.

### To authorize Amazon QuickSight to access your Amazon S3 bucket

1. In the AWS Region list at upper right, choose the US East (N. Virginia) Region. You use this AWS Region temporarily while you edit your account permissions.
2. Inside of Amazon QuickSight, choose your profile name (upper right). Choose Manage QuickSight, and then choose Security & permissions.
3. Choose Add or remove.
4. Locate Amazon S3 in the list. Choose one of the following. These actions open the screen where you can choose S3 buckets.
   - If the check box is clear, enable the check box next to Amazon S3.
   - If the check box is already enabled, choose Details, and then choose Select S3 buckets.
5. Choose the buckets that you want to access from Amazon QuickSight. Then choose Select.
I Can't Connect to RDS

For details on troubleshooting connections to Amazon RDS, see Creating Datasets from New Database Data Sources (p. 110).

You can also refer to the Amazon RDS documentation on troubleshooting connections, Cannot Connect to Amazon RDS DB Instance.

My Visual Can’t Find Missing Columns

The visuals in my analysis aren't working as expected. The error message says “The column(s) used in this visual do not exist”.

The most common cause of this error is that your data source schema changed. For example, it's possible a column name changed from "a_column" to "b_column".

Depending on how your dataset accesses the data source, choose one of the following:
My Visual Can't Find the Query Table

The visuals in my analysis aren't working as expected. The error message says “Amazon QuickSight can't find the query table.”

The most common cause of this error is that your data source schema changed. For example, it's possible a table name changed from `x_table` to `y_table`.

Depending on how the dataset access the data source, choose one of the following:

- **If the dataset is based on custom SQL:**
  - Edit the dataset.
  - Edit the SQL statement.
    
      For example, if the table name changed from `a_column` to `b_column`, you can update the SQL statement to create an alias: `SELECT b_column as a_column`. By using the alias to maintain the same field name in the dataset, you avoid having to add the column to your visuals as a new entity.
  
    - Choose **Save & visualize**.

- **If the dataset is not based on custom SQL:**
  - Edit the dataset.
  - For fields that now have different names, rename them in the dataset. You can use the field names from your original dataset.
  - Open your analysis. Add the renamed fields to the affected visuals.
  - Choose **Save & visualize**.

I Can't Add a Visual to My Analysis

First, check that you aren't trying to add more objects than the quota allows. Amazon QuickSight supports up to 30 datasets in a single analysis, and up to 30 visuals in a single sheet, and a limit of 20 sheets per analysis.

If you are editing an analysis for a selected data source and the connection to the data source ends unexpectedly, this error state can prevent further changes to the analysis. In this case, you can't add more visuals to the analysis.
To fix this issue, do the following:

- Verify that you still have access to the data source.
- If you are using a proxy server, verify that *.quicksight.aws.amazon.com is added to the list of approved domains (allow list).

I Get a Feedback Bar Across My Printed Docs

The browser sometimes prints the document feedback bar across the page, blocking some printed content.

To avoid this problem, use the twirl-down icon on the bottom left of the screen to minimize the feedback bar. Then print your document.

We always welcome your feedback on our documentation!

How Do I Delete My Amazon QuickSight Account?

If you need to delete your Amazon QuickSight account, even when you can't access Amazon QuickSight to unsubscribe, sign in to AWS and use the following link to open the unsubscribe screen: https://us-east-1.quicksight.aws.amazon.com/sn/console/unsubscribe. This approach works no matter what AWS Regions you use. It deletes all data, analyses, Amazon QuickSight users, and Amazon QuickSight administrators. If you have further difficulty, contact support.

My Map Charts Don't Show Locations

For automatic mapping, called geocoding, to work on map charts, your data must be prepared following specific rules. For help with geospatial issues, see Geospatial Troubleshooting (p. 169). For help with preparing data for geospatial charts, see Adding Geospatial Data (p. 163).

Amazon QuickSight Isn't Working in My Browser

If you can't view Amazon QuickSight correctly in your Chrome browser, take the following steps to fix the problem.

To view Amazon QuickSight in your Chrome browser

1. Open Chrome and navigate to chrome://flags/#touch-events.
2. If the option is set to Automatic, change it to Disabled
3. Close and reopen Chrome.

Troubleshooting Issues When Using Athena with Amazon QuickSight

The following sections cover troubleshooting certain issues that you might encounter when using Athena with Amazon QuickSight. This list came from support calls frequently made by Amazon QuickSight customers.

It's important to make sure you can connect to Athena before you try other troubleshooting anything else. For information about troubleshooting Athena connection issues, see I Can't Connect to Amazon Athena (p. 605).

If you can connect but have other issues, it can be useful to run your query in the https://console.aws.amazon.com/athena/ before adding it to Amazon QuickSight. For additional troubleshooting information, see Troubleshooting in the Athena User Guide.

Topics

• Insufficient Permissions When Using Athena with Amazon QuickSight (p. 615)
• Table Not Found When Using Athena with Amazon QuickSight (p. 616)
• Column Not Found When Using Athena with Amazon QuickSight (p. 617)
• Staging Bucket No Longer Exists When Using Athena with Amazon QuickSight (p. 617)
• Query Timeout When Using Athena with Amazon QuickSight (p. 617)
• Invalid Data When Using Athena with Amazon QuickSight (p. 617)
• Table Incompatible When Using AWS Glue with Athena in Amazon QuickSight (p. 618)
• Workgroup or Output Errors When Using Amazon Athena with Amazon QuickSight (p. 622)

Insufficient Permissions When Using Athena with Amazon QuickSight

If you receive an error message that says you have insufficient permissions, try the following steps to resolve your problem.

To resolve an insufficient permissions error

1. Make sure that Amazon QuickSight can access the Amazon S3 buckets used by Athena:
   a. To do this, choose your profile name (upper right). Choose Manage QuickSight, and then choose Security & permissions.
   b. Choose Add or remove.
   c. Locate Athena in the list. Clear the check box by Athena, then select it again to enable Athena.
   
   Choose Connect both.
   d. Choose the buckets that you want to access from Amazon QuickSight.

   The settings for S3 buckets that you access here are the same ones that you access by choosing Amazon S3 from the list of AWS services. Be careful that you don't inadvertently disable a bucket that someone else uses.
   e. Choose Select to save your S3 buckets.
f. Choose **Update** to save your new settings for Amazon QuickSight access to AWS services. Or, choose **Cancel** to exit without making any changes.

2. If your data file is encrypted with an AWS KMS key, grant permissions to the Amazon QuickSight IAM role to decrypt the key. The easiest way to do this is to use the AWS CLI.

You can run the `create-grant` command in AWS CLI to do this.

```bash
aws kms create-grant --key-id <KMS key ARN> --grantee-principal <Your Amazon QuickSight Role ARN> --operations Decrypt
```

The Amazon Resource Name (ARN) for the Amazon QuickSight role has the format `arn:aws:iam::<account id>:role/service-role/aws-quicksight-service-role-v<version number>` and can be accessed from the IAM console. To find your KMS key ARN, use the S3 console. Go to the bucket that contains your data file and choose the **Overview** tab. The key is located near **KMS key ID**.

By default, connections use the following IAM roles:

- For connections using Athena:

  ```bash
  arn:aws:iam::<AWS-ACCOUNT-ID>:role/service-role/aws-quicksight-service-role-v0
  ```

- For connections using Athena Federated Query:

  ```bash
  arn:aws:iam::<AWS-ACCOUNT-ID>:role/service-role/aws-quicksight-s3-consumers-role-v0
  ```

**Table Not Found When Using Athena with Amazon QuickSight**

If you receive a "table not found" error, this can happen if the tables in an analysis are missing from the Athena data source.

In the [https://console.aws.amazon.com/athena/](https://console.aws.amazon.com/athena/), check for your table under the corresponding schema. You can recreate the table in Athena and then create a new dataset in Amazon QuickSight on that table. To investigate how the table was lost in the first place, you can use the Athena console to check the query history. This helps you find the queries that dropped the table.

If this error happened when you were editing a custom SQL query in preview, verify the name of the table in the query, and check for any other syntax errors. Amazon QuickSight can't infer the schema from the query. The schema must be specified in the query.

For example, the following statement works.

```sql
select from my_schema.my_table
```

The following statement fails because it's missing the schema.

```sql
select from my_table
```

If you still have an issue, verify that your tables, columns, and queries comply with Athena's requirements. For more information, see Names for Tables, Databases, and Columns and Troubleshooting in the Athena User Guide.
Column Not Found When Using Athena with Amazon QuickSight

If you receive a "column not found" error, this can happen if the columns in an analysis are missing from the Athena data source.

In Amazon QuickSight, open your analysis. In the Visualize tab, Choose Choose dataset..., then Edit analysis data sets.

In the Data sets in this analysis screen, choose Edit near your dataset to refresh the dataset. Amazon QuickSight caches the schema for 2 minutes. So it can take 2 minutes before the latest changes display.

To investigate how the column was lost in the first place, you can go to https://console.aws.amazon.com/athena/ and check the query history to find queries that edited the table.

If this error happened when you were editing a custom SQL query in preview, verify the name of the column in the query, and check for any other syntax errors. For example, check that the column name isn't enclosed in single quotes, which are reserved for strings.

If you still have an issue, verify that your tables, columns, and queries comply with Athena's requirements. For more information, see Names for Tables, Databases, and Columns and Troubleshooting in the Athena User Guide.

Staging Bucket No Longer Exists When Using Athena with Amazon QuickSight

Use this section to help solve this error: "The staging bucket for this query result no longer exists in the underlying data source."

When you create a dataset using Athena, Amazon QuickSight creates an S3 bucket. By default, this bucket has a name similar to "aws-athena-query-results--<ACCOUNTID>--<REGION>". If you remove this bucket, then your next Athena query might fail with an error saying the staging bucket no longer exists.

To fix this error, create a new bucket with the same name in the correct AWS Region.

Query Timeout When Using Athena with Amazon QuickSight

If your query times out, you can try these options to resolve your problem.

If the failure was generated while working on an analysis, remember that the Amazon QuickSight timeout for generating any visual is 2 minutes. If you're using a custom SQL query, you can simplify your query to optimize execution time.

If you are in direct query mode (not using SPICE), you can try importing your data to SPICE. However, if your query exceeds the Athena 30-minute timeout, you might get another timeout while importing data into SPICE. For the most current information on Athena limits, see Amazon Athena Limits.

Invalid Data When Using Athena with Amazon QuickSight

An "Invalid Data" error can occur when you use any operator or function in a calculated field. Verify that the data in the table is consistent with the format you supplied to the function.
For example, if you are using the function `parseDate(expression, ['format'], ['time_zone'])` as `parseDate(date_column, 'MM/dd/yyyy')`, all values in `date_column` must conform to 'MM/dd/yyyy' format ('05/12/2016'). Any value that isn't in this format ('2016/12/05') can cause an error.

Table Incompatible When Using AWS Glue with Athena in Amazon QuickSight

If you are getting errors when using AWS Glue tables in Athena with Amazon QuickSight, it might be because you're missing some metadata. Follow these steps to find out if your tables don't have the `TableType` attribute that Amazon QuickSight needs for the Athena connector to work. Usually, the metadata for these tables wasn't migrated to the AWS Glue Data Catalog. For more information, see Upgrading to the AWS Glue Data Catalog Step-by-Step in the AWS Glue Developer Guide.

If you don't want to migrate to the AWS Glue data catalog at this time, you have two options. You can recreate each AWS Glue table through the AWS Glue Management Console. Or you can use the AWS CLI scripts listed in the following procedure to identify and update tables with missing `TableType` attributes.

If you prefer to use the CLI to do this, use the following procedure to help you design your scripts.

**To use the CLI to design scripts**

1. Use the CLI to learn which AWS Glue tables have no `TableType` attributes.

   ```bash
   aws glue get-tables --database-name <your_database_name>;
   ```

   For example, you can run the following command in the CLI.

   ```bash
   aws glue get-table --database-name "test_database" --name "table_missing_table_type"
   ```

   Following is a sample of what the output looks like. You can see that the table "table_missing_table_type" doesn't have the `TableType` attribute declared.

   ```json
   {
       "TableList": [
           {
               "Retention": 0,
               "UpdateTime": 1522368588.0,
               "PartitionKeys": [
                   {
                       "Name": "year",
                       "Type": "string"
                   },
                   {
                       "Name": "month",
                       "Type": "string"
                   },
                   {
                       "Name": "day",
                       "Type": "string"
                   }
               ],
               "LastAccessTime": 1513804142.0,
               "Owner": "owner",
               "Name": "table_missing_table_type",
               "Parameters": {
                   "delimiter": ",",
               }
           }
       ]
   }
   ```
2. Edit the table definition in your editor to add "TableType": "EXTERNAL_TABLE" to the table definition, as shown in the following example.

```json
{
    "Table": {
        "TableType": "EXTERNAL_TABLE"
    }
}
```
"Retention": 0,
"TableType": "EXTERNAL_TABLE",
"PartitionKeys": [
  {
    "Name": "year",
    "Type": "string"
  },
  {
    "Name": "month",
    "Type": "string"
  },
  {
    "Name": "day",
    "Type": "string"
  }
],
"UpdateTime": 1522368588.0,
"Name": "table_missing_table_type",
"StorageDescriptor": {
  "BucketColumns": [],
  "SortColumns": [],
  "StoredAsSubDirectories": false,
  "OutputFormat": "org.apache.hadoop.hive.ql.io.HiveIgnoreKeyTextOutputFormat",
  "SerdeInfo": {
    "SerializationLibrary": "org.apache.hadoop.hive.serde2.lazy.LazySimpleSerDe",
    "Parameters": {
      "field.delim": ",",
    }
  },
  "Parameters": {
    "classification": "csv",
    "CrawlerSchemaSerializerVersion": "1.0",
    "UPDATED_BY_CRAWLER": "crawl_date_table",
    "columnsOrdered": "true",
    "averageRecordSize": "7",
    "objectCount": "1",
    "sizeKey": "75",
    "delimiter": ",",
    "compressionType": "none",
    "recordCount": "9",
    "CrawlerSchemaDeserializerVersion": "1.0",
    "typeOfData": "file",
    "skip.header.line.count": "1"
  },
  "Columns": [
    {
      "Name": "col1",
      "Type": "string"
    },
    {
      "Name": "col2",
      "Type": "bigint"
    }
  ],
  "Compressed": false,
  "InputFormat": "org.apache.hadoop.mapred.TextInputFormat",
  "NumberOfBuckets": -1,
  "Location": "s3://myAthenatest/test_date_part/"
},
"Owner": "owner",
"Parameters": {
  "classification": "csv",
  "CrawlerSchemaSerializerVersion": "1.0",
  "UPDATED_BY_CRAWLER": "crawl_date_table",
  "columnsOrdered": "true",
  "CrawlerSchemaDeserializerVersion": "1.0",
  "typeOfData": "file",
  "skip.header.line.count": "1"}
"averageRecordSize": "7",
"objectCount": "1",
"sizeKey": "75",
"delimiter": ",",
"compressionType": "none",
"recordCount": "9",
"CrawlerSchemaDeserializerVersion": "1.0",
"typeOfData": "file",
"skip.header.line.count": "1",
"LastAccessTime": 1513804142.0
}
}

3. You can adapt the following script to update the table input, so that it includes the `TableType` attribute.

```bash
aws glue update-table --database-name <your_database_name> --table-input <updated_table_input>
```

The following shows an example.

```bash
aws glue update-table --database-name test_database --table-input '{
  "Retention": 0,
  "TableType": "EXTERNAL_TABLE",
  "PartitionKeys": [
    {
      "Name": "year",
      "Type": "string"
    },
    {
      "Name": "month",
      "Type": "string"
    },
    {
      "Name": "day",
      "Type": "string"
    }
  ],
  "Name": "table_missing_table_type",
  "StorageDescriptor": {
    "BucketColumns": [],
    "SortColumns": [],
    "StoredAsSubDirectories": false,
    "OutputFormat": "org.apache.hadoop.hive.ql.io.HiveIgnoreKeyTextOutputFormat",
    "SerdeInfo": {
      "SerializationLibrary": "org.apache.hadoop.hive.serde2.lazy.LazySimpleSerDe",
      "Parameters": {
        "field.delim": ","
      }
    },
    "Parameters": {
      "classification": "csv",
      "CrawlerSchemaSerializerVersion": "1.0",
      "UPDATED_BY_CRAWLER": "crawl_date_table",
      "columnsOrdered": "true",
      "averageRecordSize": "7",
      "objectCount": "1",
      "sizeKey": "75",
      "delimiter": ","
    }
  }
}'
```
Workgroup or Output Errors When Using Amazon Athena with Amazon QuickSight

To verify that workgroups are set up properly, check the following settings:

- **The Athena workgroup that's associated with the data source must exist.**

  To fix this, you can return to the Athena data source settings and choose a different workgroup. For more information, see Setting Up Workgroups in the Athena User Guide.

  Another solution is to have the AWS account admin recreate the workgroup in the Athena console.

- **The Athena workgroup that's associated with the data source must be enabled.**

  An AWS account admin needs to enable the workgroup in the Athena console. Open the Athena console by using this direct link: https://console.aws.amazon.com/athena/. Then choose the appropriate workgroup in the **Workgroup** panel and view its settings. Choose **Enable workgroup**.

- **You must have access to the Amazon S3 output location that's associated with the Athena workgroup.**
To grant Amazon QuickSight permissions to access the S3 output location, the Amazon QuickSight admin can edit **Security & Permissions** in the **Manage QuickSight** screen.

- **The Athena workgroup must have an associated S3 output location.**

An AWS account admin needs to associate an S3 bucket with the workgroup in the Athena console. Open the Athena console by using this direct link: https://console.aws.amazon.com/athena/. Then choose the appropriate workgroup in the **Workgroup** panel and view its settings. Set **Query result location**.

---

**My Pivot Table Stops Working**

If your pivot table exceeds the computational limitations of the underlying database, this is usually caused by the combination of items in the field wells: rows, columns, metrics, and table calculations. You can reduce the level of complexity and reduce the potential for errors by simplifying your pivot table. For more information see Pivot Table Best Practices (p. 397).

---

**My Email Sign-in Stopped Working**

Currently, emails are case-sensitive. If yours isn't working, ask your administrator to check it for a mix of upper and lowercase letters. Use your email as it was entered.
Administration

Use the following section to learn about Amazon QuickSight administrative tasks. This section contains information about controlling access, managing accounts, and choosing AWS Regions.

Topics
- Different Editions of Amazon QuickSight (p. 624)
- AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626)
- Supported Browsers (p. 627)
- Managing Amazon QuickSight Usage (p. 628)
- Supporting Multitenancy with Isolated Namespaces (p. 637)
- Customizing the QuickSight Console (p. 640)

Different Editions of Amazon QuickSight

Amazon QuickSight offers Standard and Enterprise editions. To learn more about the differences in availability, user management, permissions, and security between the two versions, see the following topic.

Both editions offer a full set of features for creating and sharing data visualizations. Enterprise edition additionally offers encryption at rest and Microsoft Active Directory integration. In Enterprise edition, you select a Microsoft Active Directory directory in AWS Directory Service. You use that active directory to identify and manage your Amazon QuickSight users and administrators.

For more information about the different features offered by the Amazon QuickSight editions and about pricing, see Amazon QuickSight Pricing.

Availability of Editions

All editions are available in any AWS Region that is currently supported by Amazon QuickSight.

The capacity region in which you start your Amazon QuickSight subscription is where your account's default SPICE (p. 78) capacity is allocated. However, you can purchase additional SPICE capacity and access your AWS resources in any other supported AWS Region.

You can start a new Amazon QuickSight subscription using Standard edition, choosing any default capacity region. You can then upgrade it to Enterprise edition at any time.

To manage Enterprise account settings, you must temporarily change your region for your session to US East (N. Virginia) Region. You can change it back when you have finished editing your account settings. These settings include changing your subscription's notification email, enabling IAM access requests, editing access to AWS resources, and unsubscribing from Amazon QuickSight.

User Management Between Editions

User management is different between the Amazon QuickSight Standard and Enterprise editions. However, both editions support identity federation, or Federated Single Sign-On (SSO), through Security Assertion Markup Language 2.0 (SAML 2.0).
User Management for Standard Edition

In Standard edition, you can invite an AWS Identity and Access Management (IAM) user and allow that user to use their credentials to access Amazon QuickSight. Alternatively, you can invite any person with an email address to create an Amazon QuickSight–only user account. When you create a user account, Amazon QuickSight sends email to that user inviting them to activate their account.

When you create a user account, you also choose to assign it either an administrative or a user role. This role assignment determines the user's permissions in Amazon QuickSight. You perform all management of users by adding, changing, and deleting user accounts in Amazon QuickSight.

User Management for Enterprise Edition

In Enterprise edition, you can select one or more Microsoft Active Directory active directory groups in AWS Directory Service for administrative access. All users in these groups are authorized to sign in to Amazon QuickSight as administrators. You can also select one or more Microsoft Active Directory active directory groups in AWS Directory Service for user access. All users in these groups are authorized to sign in to Amazon QuickSight as users.

Important
Amazon QuickSight administrators and users added in this way aren't automatically notified of their access to Amazon QuickSight. You must email users with the sign-in URL, the account name, and their credentials.

You can only add or remove Enterprise edition user accounts by adding or removing a person from a Microsoft Active Directory group that you associated with Amazon QuickSight. When you add a user account, the permissions it gets rely on whether the Microsoft Active Directory group is an administrative group or a user group in Amazon QuickSight.

You can also bulk add or remove user accounts by integrating Microsoft Active Directory groups with, or removing Microsoft Active Directory groups from, Amazon QuickSight.

Deactivating a user by removing the user from a Microsoft Active Directory group, or by removing their Microsoft Active Directory group from integration with Amazon QuickSight, doesn't delete the associated Amazon QuickSight user account for that person.

Permissions for the Different Editions

In Standard edition, all Amazon QuickSight administrators can manage subscriptions and SPICE capacity. They can also add, modify, and delete user accounts.

Additional AWS permissions are required to manage Amazon QuickSight permissions to AWS resources and to unsubscribe from Amazon QuickSight. These tasks can only be performed by an IAM user who also has administrative permissions in Amazon QuickSight, or by the IAM user or AWS account that created the Amazon QuickSight account.

To manage access to AWS resources from Amazon QuickSight, you must be logged in as one of the following:

- Any IAM user who is an Amazon QuickSight administrator
- The IAM user or AWS root account that created the Amazon QuickSight account

In Enterprise edition, you must add AD users or groups to an IAM role that has Amazon QuickSight permissions, rather than adding IAM users individually. All Microsoft Active Directory users that are Amazon QuickSight administrators can to manage subscriptions and SPICE capacity.

Additional AWS permissions are required to manage Microsoft Active Directory groups, manage access to AWS resources, or unsubscribe from Amazon QuickSight. Administrators are prompted for AWS or IAM credentials to perform these tasks.
AWS Regions, Websites, IP Address Ranges, and Endpoints

AWS cloud-computing resources are housed in highly available facilities in different areas of the world (for example, North America, Europe, and Asia). These facilities are each part of an AWS Region. For more information about AWS Regions and AZs, see Global Infrastructure.

Amazon QuickSight is currently supported in the following AWS Regions. The following list provides websites, IP address ranges, and endpoints for Amazon QuickSight in each AWS Region.

- **US East (Ohio) (us-east-2)**
  - Website for user access – https://us-east-2.quicksight.amazonaws.com
  - IP address range – 52.15.247.160/27
  - Endpoint (HTTPS) – quicksight.us-east-2.amazonaws.com

- **US East (N. Virginia) (us-east-1)**
  - Website for user access – https://us-east-1.quicksight.amazonaws.com
  - IP address range – 52.23.63.224/27
  - Endpoint (HTTPS) – quicksight.us-east-1.amazonaws.com

- **US West (Oregon) (us-west-2)**
  - Website for user access – https://us-west-2.quicksight.amazonaws.com
  - IP address range – 54.70.204.128/27
  - Endpoint (HTTPS) – quicksight.us-west-2.amazonaws.com

- **Asia Pacific (Mumbai) (ap-south-1)**
  - Website for user access – https://ap-south-1.quicksight.amazonaws.com
  - IP address range – 52.66.193.64/27
  - Endpoint (HTTPS) – quicksight.ap-south-1.amazonaws.com

- **Asia Pacific (Seoul) (ap-northeast-2)**
  - Website for user access – https://ap-northeast-2.quicksight.aws.amazon.com
  - IP address range – 13.124.145.32/27
  - Endpoint (HTTPS) – quicksight.ap-northeast-2.amazonaws.com

- **Asia Pacific (Singapore) (ap-southeast-1)**
  - Website for user access – https://ap-southeast-1.quicksight.aws.amazon.com
  - IP address range – 13.229.254.0/27
  - Endpoint (HTTPS) – quicksight.ap-southeast-1.amazonaws.com

- **Asia Pacific (Sydney) (ap-southeast-2)**
  - Website for user access – https://ap-southeast-2.quicksight.amazonaws.com
  - IP address range – 54.153.249.96/27
  - Endpoint (HTTPS) – quicksight.ap-southeast-2.amazonaws.com

- **Asia Pacific (Tokyo) (ap-northeast-1)**
  - Website for user access – https://ap-northeast-1.quicksight.amazonaws.com
  - IP address range – 13.113.244.32/27
  - Endpoint (HTTPS) – quicksight.ap-northeast-1.amazonaws.com

- **Canada (Central) (ca-central-1)**
  - Website for user access – https://ca-central-1.quicksight.amazonaws.com
  - IP address range – 15.223.73.0/27
  - Endpoint (HTTPS) – quicksight.ca-central-1.amazonaws.com
Supported Browsers

Before you start working with Amazon QuickSight, use the following table to verify that your browser is supported for Amazon QuickSight access.

<table>
<thead>
<tr>
<th>Browser</th>
<th>Version</th>
<th>Check Your Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Safari</td>
<td>7 or later</td>
<td>Open Safari. On the menu, choose Safari, and then choose About Safari. The version number is shown in the dialog box that displays.</td>
</tr>
<tr>
<td>Google Chrome</td>
<td>Last three versions</td>
<td>Open Chrome and type chrome://version in your address bar. The version is in the Google Chrome field at the top of the results.</td>
</tr>
<tr>
<td>Microsoft Edge</td>
<td>Latest version</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Microsoft Internet Explorer</td>
<td>11 or later</td>
<td>Open Internet Explorer, choose the Tools icon, and then choose About Internet Explorer.</td>
</tr>
<tr>
<td>Mozilla Firefox</td>
<td>Last three versions</td>
<td>Open Firefox. On the menu, choose the Help icon, and then choose About Firefox. The version number is listed underneath the Firefox name.</td>
</tr>
</tbody>
</table>
Managing Amazon QuickSight Usage

If your Amazon QuickSight user account has administrative privileges, you can manage user account subscriptions and SPICE capacity.

Use the following topics to manage subscriptions and SPICE capacity.

**Topics**
- Managing Subscriptions (p. 628)
- Managing SPICE Capacity (p. 629)
- Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 632)
- Changing Your Notification Email (p. 634)
- Canceling Your Amazon QuickSight Subscription and Closing the Account (p. 634)
- Adding Domains for Embedded Users (p. 636)

**Managing Subscriptions**

You can purchase standard user subscriptions to get discounted pricing on Amazon QuickSight. When you invite additional users to Amazon QuickSight, you’re charged for those user accounts on a month-by-month basis. If you have Enterprise edition, you have the option to take advantage of pay-per-session pricing for reader accounts. These are users who only view data dashboards, and don’t need author or admin access. When you purchase a subscription, you pay for a user account on an annual rather than monthly basis. With a subscription, you receive a discounted price in return for the extended time commitment. For more information about pricing, see Amazon QuickSight.

When you purchase a set of standard user subscriptions, you choose the number of user accounts you want to cover. You also choose when the subscriptions should start (any time from the month following the current month, to one year in the future) and whether the subscriptions autorenew. All subscriptions that you purchase together must use the same values for these settings.

You can edit an existing set of user subscriptions to change whether it autorenews. If the set is not yet active, you can also change the number of subscriptions it covers, or delete it entirely.

**Viewing Current Subscriptions**

Use the following procedure to view your current user subscriptions.

**To view your current user subscriptions**

1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Your Subscriptions.
3. Use the subscription meter to see how many user accounts you have and how they are billed. In the following example, the account has 21 users total:
   - 7 users with annual subscriptions. Only currently active subscriptions are shown here.
   - 13 month-to-month users.

   Pause over any section of the meter bar to display details about that user segment.
4. Use the information in the subscriptions table to see what current and future subscriptions you have.
Purchasing Subscriptions

Use the following procedure to purchase subscriptions.

To purchase subscriptions
1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Your Subscriptions.
3. Choose Purchase subscription.
4. Choose or enter the number of subscriptions you want.
5. Choose the month and year when the subscriptions will start.
6. Choose whether the subscriptions autorenew.
7. Choose Purchase subscription.

Editing Subscriptions

Use the following procedure to edit subscriptions.

To edit subscriptions
1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Your Subscriptions.
3. Next to the set of subscriptions you want to change, choose Edit.
4. (Optional) If the subscriptions haven't started yet, change the number of subscriptions you want.
5. Choose whether the subscriptions autorenew.
6. Choose Save changes.

Deleting Subscriptions

Use the following procedure to delete subscriptions. You can only delete subscriptions that haven't started yet.

To delete subscriptions
1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Your Subscriptions.
3. Next to the set of subscriptions you want to delete, choose Edit.
4. Choose Delete Subscription.

Managing SPICE Capacity

SPICE is the Amazon QuickSight Super-fast, Parallel, In-memory Calculation Engine. It's engineered to rapidly perform advanced calculations and serve data. In Enterprise edition, data stored in SPICE is encrypted at rest. For more information, see Data Encryption in Amazon QuickSight (p. 644).

SPICE capacity is allocated separately per AWS Region. For each AWS account, SPICE capacity is shared by all the people using QuickSight in a single AWS Region. The other AWS Regions have no SPICE capacity unless you choose to purchase some.

QuickSight administrators can view how much SPICE (p. 78) capacity you have in each AWS Region and how much of it is currently in use. Administrators can also purchase additional SPICE capacity or
release unused SPICE capacity. You can only release SPICE capacity that isn't currently used by a dataset. Datasets in SPICE stay there until someone remove them from SPICE. To change that, you can either delete the datasets or change them so they aren't stored in SPICE.

Purchasing or releasing SPICE capacity only affects the capacity for the currently selected AWS Region. Each AWS account can have a separate QuickSight subscription and can be used in multiple AWS Regions. For information about additional SPICE pricing, see Amazon QuickSight.

Before you make any changes to SPICE capacity, make sure that you're using the correct AWS account and AWS Region. It's possible to be using different AWS accounts or AWS Regions at the same time in different contexts, as follows:

- If you open QuickSight using the http://quicksight.aws.amazon.com URL, QuickSight automatically selects your account and AWS Region. You can't view your AWS account from QuickSight. We recommend using a different method to open QuickSight when you want to work with SPICE capacity.

- If you open QuickSight from the AWS Management Console, QuickSight opens in the account that you used to sign in to that console. However, it opens in last AWS Region that you had selected in QuickSight. The AWS console and the QuickSight console each have an AWS Region selector that works independently from the other. Changing the selected AWS Region in the AWS console doesn't change the AWS Region in QuickSight.

- If you use the AWS Command Line Interface (AWS CLI) to run QuickSight commands, make sure to provide the relevant AWS account for each QuickSight API operation you use. The AWS Region isn't always required, and if you don't provide it, the AWS CLI uses your default AWS Region from your AWS configuration. We recommend that you always explicitly provide the AWS Region, to make sure you apply the command to the correct AWS Region.

You need to be signed in as a QuickSight administrator to view or manage SPICE capacity.

**Finding Your Current AWS Account and AWS Region**

**To select the correct AWS account and AWS Region (console)**

1. Open the AWS console, using the AWS account that you want to view SPICE information for. If you have only one AWS account, you can skip this step.

   You can verify the account number by following these steps:

   a. On the navigation bar at the top of the page, choose the account name or number at right. If a number displays, this might be your AWS account ID.

   b. Choose My Security Credentials to display your credential-related information and options. Your AWS account ID displays near the top of the page.

   To return to the original page, choose the AWS logo at upper left.

2. Open QuickSight by first entering "quicksight" into the Find Services search box. When the word QuickSight appears below the search box, choose it from the list.

3. In QuickSight, open the profile menu by choosing your profile icon at top right. The AWS name of the AWS Region that QuickSight is using displays in the menu.

   The same AWS Region also displays in the URL, for example: https://us-east-1.quicksight.aws.amazon.com/sn/admin. If this is your URL, the profile menu displays the name N. Virginia.

   To switch AWS Regions, display the list of supported Regions by choosing the Region name from the profile menu. Then choose the Region that you want to use. Switching to a different AWS Region
changes the SPICE usage information that you can view. It also changes the QuickSight assets that you can use, for example data sources and dashboards.

Viewing SPICE Capacity and Usage in an AWS Region

To view current SPICE capacity and usage (console)

1. Open QuickSight. Make sure that you're using the correct AWS account and AWS Region as described previously in Finding Your Current AWS Account and AWS Region (p. 630).
2. Open the administration page by choosing Manage QuickSight from your profile menu.
3. Choose SPICE capacity from the navigation pane at left. The following information displays:
   - The Total SPICE capacity section displays the total amount of used and unused SPICE capacity. A bar graph shows how much of this storage space is in each of the following categories for this AWS account in the AWS Region that's currently selected in QuickSight:
     - Purchased SPICE capacity – This is the additional SPICE capacity you previously purchased.
     - Free SPICE capacity bundled with QuickSight – This is the total default capacity associated with your paid users.
   - Hover over any section of the meter to see details on that capacity type.
   - The SPICE usage section displays the total amount of the used and unused SPICE capacity. A bar graph shows how much of this storage space is in each of the following categories for this AWS account in the AWS Region that's currently selected in QuickSight:
     - Used SPICE capacity – This is the used portion of the default SPICE capacity that you get for each user.
     - Unused SPICE capacity – This is the unused portion of the default SPICE capacity that you get for each user.
     - Releasable unused capacity – This is the purchased capacity that isn't in use, and so can be released to reduce costs.

Purchasing SPICE Capacity in an AWS Region

To purchase more SPICE capacity (console)

1. Open QuickSight. Make sure that you're using the correct AWS account and AWS Region as described previously in Finding Your Current AWS Account and AWS Region (p. 630).
2. Open the administration page by choosing Manage QuickSight from your profile menu.
3. Choose SPICE capacity from the navigation pane at left.
4. Choose the Purchase more capacity button.
5. Enter a number of gigabytes of SPICE capacity to purchase for the AWS Region that is currently selected in QuickSight.
6. To confirm your choice, choose Purchase SPICE capacity. To exit without making any changes, choose Cancel.

Releasing SPICE Capacity in an AWS Region

To release unused SPICE capacity (console)

1. Open QuickSight. Make sure that you're using the correct AWS account and AWS Region as described previously in Finding Your Current AWS Account and AWS Region (p. 630).
2. Open the administration page by choosing Manage QuickSight from your profile menu.
3. Choose **SPICE capacity** from the navigation pane at left.
4. Choose **Release unused purchased capacity**.
5. Do one of the following:
   - To release all SPICE capacity from the AWS Region that is currently selected in QuickSight, choose **Release all**.
   - To release a certain number of gigabytes of SPICE capacity from the AWS Region that is currently selected in QuickSight, enter the number of gigabytes to release.
6. To confirm your choice, choose **Release SPICE capacity**. To exit without making any changes, choose **Cancel**.

### Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition

You can upgrade from Amazon QuickSight Standard edition to Amazon QuickSight Enterprise edition. In Enterprise edition, Amazon QuickSight supports the following additional features:

- Reader role with pay-per-session pricing—maximum of $5/reader/month; for more pricing details, see following.
- Email reports for offline delivery of insights.
- Larger SPICE datasets with up to 250 million rows per SPICE dataset.
- Hourly refresh of SPICE data (using the QuickSight console).
- **ML Insights** to make the most of your data, including the following:
  - Anomaly detection that can run on billions of rows of data on a schedule.
  - Contribution analysis to help you figure out key drivers.
  - One-click forecasting.
  - Customizable natural language narratives that you can use to add business context to a dashboard.
  - SageMaker integration.
- **Embedded analytics** in applications and portals:
  - Embed dashboards with row level security.
  - Namespaces with multitenant support for creating dashboards with embedded analytics.
  - Templates for repeatable dashboard creation and management.
  - Capacity pricing for embedding.
- **Security and governance**
  - Row-level security.
  - Private virtual private cloud (VPC) support based on Amazon VPC.
  - Folders for organization and sharing.
  - Fine-grained access control over Amazon S3, Amazon Athena, and other AWS services and resources.
  - AWS Lake Formation support.
- **User authentication and management options**
  - Integration with Microsoft Active Directory with support for Active Directory groups.
  - Group support for user management.

To see a full comparison of Standard edition with Enterprise edition, see [Amazon QuickSight Editions](#).

When you upgrade your account, your administrators and authors are billed at the Amazon QuickSight Enterprise edition rates. For up-to-date information on rates, see [Pricing](#). For pay-per-session pricing,
you can add additional users as readers. Before you reprovision existing users as readers, you transfer or delete their resources, and then delete the users from your subscription.

Users who are in the reader role can view and manipulate shared dashboards, and receive emailed updates. However, readers can’t add or change data sources, datasets, analyses, visuals, or administrative settings. Billing for readers is significantly lower in cost than regular user pricing. It’s based on 30-minute sessions, and it’s capped at a maximum amount per month for each reader. Billing for upgrades is prorated for the month of the upgrade. Upgrades to users are also prorated. If you have an annual subscription to Standard edition, it’s converted to Enterprise edition and stays in place for the remaining term.

Warning
Downgrading from Enterprise edition to Standard edition isn’t currently possible due to the enhanced feature set available in Enterprise edition. To perform this downgrade, unsubscribe from Amazon QuickSight, and then start a new subscription. Also, you can’t transfer users or assets between subscriptions.
Upgrading to Enterprise edition to use Active Directory connectivity isn’t supported. This is because of the differences in the user identity mechanisms between Amazon QuickSight password-based users and existing Active Directory users. However, you can upgrade to Enterprise and still use password-based users. If you want to upgrade and change how users sign in, you can unsubscribe and start a new subscription.

Use the following procedure to upgrade to Enterprise edition. To perform the upgrade, you need administrative access to Amazon QuickSight, with security permissions to subscribe. The person performing the upgrade is usually an AWS administrator who is also an Amazon QuickSight administrator.

To upgrade to Enterprise edition

1. Open the administrative settings page by clicking on your profile icon at top right.
2. At top left, choose Upgrade now.

   The following screen appears. For the latest prices, see Amazon QuickSight Pricing.

   ![Upgrade to Enterprise Edition]

   Additional features available in Amazon QuickSight Enterprise Edition include
   
   - Readers with Pay-per-Session pricing: Provide read-only access to everyone
   - Row-level security: Control exactly what data each user can see
   - Private VPC access: Connect to your databases in private VPCs
   - Hourly refresh: Refresh your datasets more frequently

   Existing users will be charged at $2.5/user/month (w/annual commitment) or $5/user/month (month-to-month). SPICE capacity will be charged at $0.1/GB/month. Readers are charged at $0.05/session (max charge of $1/reader/month). More details

   3. Be sure that you want to upgrade.
Important
You can't undo this action.

Choose **Upgrade** to upgrade. The upgrade is instantaneous.

Billing for the upgrade to your subscription is prorated for the month of upgrade. Upgrades to Amazon QuickSight users are also prorated.

4. (Optional) Downgrade users to readers:
   - Before you start, make sure to transfer any assets your users own that you want to keep.
   - Delete the users and add them back to your subscription as readers.

     If you're using Active Directory, delete the authors, move them to the new reader group, then recreate them as readers in Amazon QuickSight.

When you upgrade to Enterprise edition, your admin and author users retain their roles.

### Changing Your Notification Email

You can change the notification email address for access requests and service notifications.

Use the following procedure to change your Amazon QuickSight notification email and to enable or disable IAM user access requests.

**To change your notification email and enable or disable IAM user access requests**

1. Choose your user name on the application bar, and then choose **Manage QuickSight**.
2. Choose **Account settings**.
3. Under **Notification email address**, enter the email address you want to use.

   Choose whether to send IAM user access requests to the same email address. Choose **Enable IAM user access requests to this account** to enable this setting.

### Canceling Your Amazon QuickSight Subscription and Closing the Account

If you want to close your Amazon QuickSight account, you can unsubscribe from the service. To unsubscribe, you must be signed in using the IAM account or AWS root account that was used to create your Amazon QuickSight account.

Use the following procedure to unsubscribe from Amazon QuickSight.

**unsubscribe from Amazon QuickSight**

1. Choose your user name on the application bar, and then choose **Manage QuickSight**.
2. Choose **Account settings**.
3. Choose **Unsubscribe**.
4. (For Amazon QuickSight Enterprise edition accounts only) On the AWS sign-in page, enter your AWS or IAM credentials.
5. **Note**

   This step applies only to early adopters of Amazon QuickSight. If your Amazon QuickSight account was created after the preview period, you don't see these options.
(Optional) If you prefer to use the AWS Management Console to manually delete the Simple AD directory or VPC that Amazon QuickSight used for user management, clear **Delete Simple AD directory** or **Delete VPC**.

However, we recommend leaving these options selected (checked) so that these resources are automatically removed.

6. Choose **Unsubscribe**.
Note
You can delete your Amazon QuickSight account even when you can't access Amazon QuickSight to unsubscribe. do this, sign in to AWS and use the following link to open the unsubscribe screen: https://us-east-1.quicksight.aws.amazon.com/sn/console/unsubscribe. This approach works no matter which AWS Regions you use. It deletes all data, analyses, Amazon QuickSight users, and Amazon QuickSight administrators. If you have difficulties, contact AWS Support.
Unsubscribing deletes all users, data, and assets (for example, data sets, data sources, queries, dashboards, analyses, settings, and so on). You can't undo this action. However, after your account is unsubscribed, you can create a new Amazon QuickSight account using any edition and user authorization method.
Closing your Amazon QuickSight account, also called unsubscribing, doesn't close your AWS account. If you also want to close the associated AWS account, see Closing an AWS Account.

Adding Domains for Embedded Users

**Applies to:** Enterprise Edition

**Intended audience:** Amazon QuickSight administrators

In Amazon QuickSight Enterprise edition, you can embed dashboards in an app or webpage. The domain that is going to host embedded dashboards must be on the *allow list*, the list of approved domains for your Amazon QuickSight subscription. This requirement protects your data by keeping unapproved domains from hosting embedded dashboards.

You can only embed dashboards after you perform the following steps:

- Approve the hosting domains and subdomains for embedding.
- Publish the dashboard.
- Share the dashboard with users or groups so they can see the embedded version of it.

Use the following procedure to view or edit the list of approved domains.

**To view or edit the list of approved domains**

1. Choose the profile icon at top right.
2. Choose *Manage QuickSight*. You must be an Amazon QuickSight admin to access this screen.
3. Choose *Domains and Embedding* on the left. The domains that you can embed a dashboard in are listed at the bottom of the page.
4. (Optional) You can add a new domain here by entering it in the *Domain* box. You can also choose *Include subdomains* to allow embedded dashboards on all subdomains. Choose *Add* to add the domain.

You can edit or delete existing domain by choosing the icons next to each domain in the list at the bottom of the page.

Make sure that you use a valid HTTPS URL. The following list shows examples of URLs that are valid for embedded dashboards:

- https://example-1.com
The following list shows examples of URLs that are not valid for embedded dashboards:

- `http://example`
- `https://example.com.*.example-1.co.uk`
- `https://co.uk`
- `https://111.222.33.44.55:1234`
- `https://111.222.33.44`

For more information about embedded dashboards, see Working with Embedded Analytics (p. 575).

**Supporting Multitenancy with Isolated Namespaces**

Amazon QuickSight Enterprise edition supports multitenancy through namespaces. A QuickSight namespace is a logical container that you can use to organize clients, subsidiaries, teams, and so on. Namespaces can help you achieve the following goals:

- You can allow the users of your QuickSight subscription to discover shared content and share with other users. At the same time, you can be sure that users in one namespace can’t see or interact with users in another namespace.
- You can securely isolate data and also support diverse workloads without adding additional AWS accounts. Access to data is still strictly controlled by AWS security features. Users can see assets (like data and dashboards) only if they have the correct resource permissions. Also, users who have permissions can’t inadvertently expose content to people who outside of their namespace. For more information, see AWS Security in Amazon QuickSight (p. 643).
- You can monitor data flows and usage reports, neatly partitioned by namespace. Categorizing data and reports by namespace can help simplify cost and security analysis.
- After you’ve registered users into your namespace, there’s no additional administrative complexity or overhead.
- Namespaces are designed to span AWS Regions, so the use containment doesn’t change even if a person signs in to a different AWS Region.

Namespaces currently have the following limitations:

- Custom namespaces—those that are not the default namespace—are only accessible to Federated Single-Sign On users.
- Use default namespaces instead of custom namespaces if you need to support the following:
  - Password-based logins
  - Credential-based Active Directory logins
  - Datasets that use row-level security (RLS)
- You can’t transfer users directly from one namespace to another. You can choose to do some or all of this work programmatically. For more information, see the Amazon QuickSight API Reference. At the bottom of the page of each API operation, there’s a list of links to the same operation in the SDKs for...
other languages. To see what SDKs are available, see SDKs and Toolkits in the AWS Getting Started Resource Center.

If you don’t have an existing AWS account or you need to sign up for QuickSight, read the following guidelines, then follow the applicable instructions in Signing Up for an Amazon QuickSight Subscription (p. 21):

- Sign up for Enterprise edition.
- When asked which method that you want to connect with, choose Role Based Federation (SSO). Namespaces currently support only customers who use an AWS Identity and Access Management (IAM) role with a web identity federation. For more information, see Creating a Role for a Third-Party Identity Provider (Federation)
- Complete the process of signing up.
- Use the QuickSight CreateNamespace API operation to create one or more namespaces.
- To start adding users, first follow the instructions in Setting Up IdP Federation Using IAM and QuickSight (p. 691). Then use the RegisterUser API operation to add users to the appropriate namespace.

If you already signed up for Standard edition, you can easily upgrade your subscription to Enterprise edition. The person performing the upgrade must be a QuickSight user with administrator privileges. For more information, see Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 632).

If you have an Enterprise edition subscription that you've been using for some time, it's also possible to migrate your users into namespaces. When you sign up for QuickSight and add users, all of them reside in the default namespace. All of the users can interact directly with each other and share data and dashboards with each other. To isolate your users from each other, you can create one or more additional namespaces.

Important
QuickSight assets and resources, including datasets, data sources, dashboards, analyses, and so on, exist outside of any namespace. They are visible only to users who have resource permissions granted to them.

To implement namespaces, you use the following QuickSight API operations:

- CreateNamespace
- DescribeNamespace
- ListNamespaces
- DeleteNamespace

Note
If you need to install the AWS CLI, see Installing the AWS CLI version 2 in the AWS Command Line Interface User Guide.

To add users to a namespace, you use the RegisterUser API operation. Each namespace has a completely independent set of users. Therefore, you can create the same user name in multiple namespaces, for example in the case of common names. The user ARNs include the namespace qualifier to distinguish them, as shown in the following examples:

- QuickSight considers these two entities to be different persons:
  - arn:aws:quicksight:us-east-1:111122223333:user/namespace-123/username123
- QuickSight considers these two entities to be the same person:
When you use `RegisterUser`, you select an access level for each user. After a person's user name is assigned to one of the security cohorts, their access to the console and API is restricted. People using QuickSight can have a single access level, as follows:

- Reader access, for read-only subscribers of a dashboard
- Author access, for analysts and dashboard designers
- Admin access, for QuickSight administrators

To migrate existing users in one namespace to a different namespace

1. Identify the users that you want to transfer to a different namespace by using the QuickSight user and group API operations. For more information, see API Operations for Controlling Access in the Amazon QuickSight API Reference.

2. Create users in the new namespace by using the `RegisterUser` API operation. You can reuse the same user names in different namespaces, even in the same AWS Region. However, within a namespace, user names are unique.

   If a namespace user starts using the QuickSight console or API in a new AWS Region, that user is still constrained to the namespace that you added them to. Each namespace represents a user directory of an identity provider. As such, it originates in the primary AWS Region where QuickSight is set up. However, because the user directory is propagated globally in your AWS account, the namespace is accessible from any AWS Region where your users are using QuickSight.

3. To identify the asset and resource permissions that the new namespace users need, use the QuickSight API operations associated with each type of asset (dashboards, datasets, and so on). For more information, see QuickSight API Operations to Control Assets in the Amazon QuickSight API Reference.

   For example, let's say you are focusing on dashboards. You can use `ListDashboards` to list all the dashboard IDs in your AWS account. Then, to determine which users or groups can access these dashboards, you can use `DescribeDashboardPermissions` on the result set generated by `ListDashboards`. If you need to identify specific versions of a dashboard, you can `ListDashboardVersions` for that. You can also collect information about the location of the data that's used in the dashboard with the data source and dataset API operations. For more information, see QuickSight API Operations to Control Data Resources in the Amazon QuickSight API Reference.

   For more information about filtering API response output, see the SDK documentation for the language you're using. For information relating to the AWS Command Line Interface (AWS CLI), see Controlling command output from the AWS CLI in the AWS Command Line Interface User Guide.

4. For QuickSight assets and resources, copy the permissions that the source namespace user has for each asset. Then use, for example, `UpdateDashboardPermissions` to apply the same permissions to the target namespace user. Each asset type has its own separate set of API operations for controlling the permissions that users have to use it. For more information, see QuickSight API Operations for Asset and Resource Permissions in the Amazon QuickSight API Reference.

5. When you are finished adding users and permissions, it's a good practice to allow some time for user acceptance testing. Doing this ensures that everyone is successfully using the new namespace. It also ensures that all assets and resources are accessible in the new namespace.

   After you're certain that you no longer need the original user names, you can begin to deprecate their permissions in the original namespace. Finally, when the users are ready, you can remove the unused group and user names in the source namespace. Do this in each AWS Region where your users were previously active.
Customizing the QuickSight Console

Using Amazon QuickSight, you can create a customized experience for people using either the AWS Management Console or QuickSight consoles embedded in your application.

Currently, different options for customizing QuickSight are available separately in the console and the QuickSight API. Following, you can find information about the available options.

The following customization options are currently available:

- You can accept or decline the sample assets. These assets include sample datasets and analyses that are added when a person signs in for the first time.
- You can show or hide default videos. These videos include the animation that displays for new users and also the tutorial videos shown on the QuickSight home page.
- You can create and specify a default theme.

Important
All customizations apply only to the AWS Region that you are using in the API or that is selected in the QuickSight console.

To check your Region setting, you can use one of the following procedures.

To check your AWS Region on the QuickSight console
1. Choose your profile icon at upper right to open the menu.
2. View your current AWS Region, listed next to a location icon.
3. (Optional) Choose another AWS Region from the menu to change to that Region. Remember to change back after you are finished with customizations.

To check your AWS Region using the AWS CLI
- On the command line, enter the following command and press Enter to view the current settings.

```bash
aws configure list
```

To reconfigure your default Region, use the `aws configure` command.

To keep your default Region, you can add the `--region` parameter to most CLI commands.

To customize QuickSight by using the console
1. Choose your profile icon at upper right to open the menu.
2. Choose Manage QuickSight to open the administration page.
3. On the navigation pane, choose Account customization to open the customization options.
4. Select the Show introductory videos check box to show the default tutorial videos and the introductory animation. Clear the check box to hide QuickSight videos and the intro animation for all users in your current AWS Region.
5. Select the Create sample datasets and analyses check box to accept sample datasets and analyses for new users. Doing this also applies to existing users who open QuickSight in a new AWS Region. Clear the check box if you want to decline sample datasets and analyses. You can also provide your own versions of these to your users.
To set a default theme by using the API

1. Identify the custom theme that you want to use as the default, and locate its theme ID. If you want to use one of the QuickSight starter themes, skip this step.

To get the theme ID of a custom theme, use the ListThemes API operation for the Region where the theme is. Make sure that the theme is in the same Region with the users or groups that need to use it.

The following example shows a shell script that uses the list-themes command in the AWS CLI. It sets the AWS Account ID and the AWS Region as variables. If you previously used aws configure to set a default Region, adding the --region variable to your command overrides your default setting.

```bash
#declare variables
awsacct1='111122223333'
region='us-west-2'
aws quicksight list-themes \
--region $region \
--aws-account-id $awsacct1 \
--type 'CUSTOM'
```

2. Use the ListUsers or ListGroups API operation to collect the Amazon Resource Names (ARNs) for users or groups that need to use the theme as a default. You need only the top-level ARN. If all your users are part of the same group, use the group ARN.

For more information on QuickSight ARNs, see ARN Formats in the Amazon QuickSight API Reference.

3. If you're using a custom theme, grant access to the theme for the ARNs that you collected in the previous step. If you're using a starter theme, skip this step because all users have access to starter themes.

The following example shows a shell script that uses the update-theme-permissions command. The grant-permissions parameter is shown using shorthand syntax. You can use JSON or YAML instead. For more information, see Specifying Parameter Values in the AWS Command Line Interface User Guide.

```bash
#declare variables
awsacct1='111122223333'
namespace='default'
region='us-west-2'
theme-id='bdb844d0-0fe9-4d9d-b520-0fe602d93639' #Find this with list-themes
aws quicksight update-theme-permissions \
#Specify region if necessary: --region $region \
--aws-account-id $awsacct1 \
--theme-id $theme-id \
--grant-permissions
Principal="arn:aws:quicksight:$region:$awsacct1:group/$namespace/QuickSight_Group_Name",Actions="quicksight:DescribeTheme","quicksight:ListThemeVersions","quicksight:DescribeThemeAlias"
```

4. Assign the theme as the default for the same ARN or ARNs.

```bash
#declare variables
awsacct1='111122223333'
namespace='default'
region='us-west-2'
theme-id='bdb844d0-0fe9-4d9d-b520-0fe602d93639'
```
Currently, there are three starter themes: Classic, Midnight, and Seaside. Their ARNs are the capitalized spelling of their theme name. If you are using a starter theme instead of a custom theme, use one of the following theme ARNs:

- arn:aws:quicksight::aws:theme/CLASSIC
- arn:aws:quicksight::aws:theme/MIDNIGHT
- arn:aws:quicksight::aws:theme/SEASIDE
AWS Security in Amazon QuickSight

Amazon QuickSight provides a secure platform that enables you to distribute dashboards and insights to tens of thousands of users, with multiple-region availability and built-in redundancy.

Cloud security at AWS is the highest priority. As an AWS customer, you benefit from a data center and network architecture that is built to meet the requirements of the most security-sensitive organizations.

Security is a shared responsibility between AWS and you. The shared responsibility model describes this as security **of** the cloud and security **in** the cloud:

- **Security of the cloud** – AWS is responsible for protecting the infrastructure that runs AWS services in the AWS Cloud. AWS also provides you with services that you can use securely. The effectiveness of our security is regularly tested and verified by third-party auditors as part of the AWS compliance programs. To learn about the compliance programs that apply to Amazon QuickSight, see AWS Services in Scope by Compliance Program.

- **Security in the cloud** – Your responsibility is determined by the AWS service that you use. You are also responsible for other factors, including the sensitivity of your data, your organization's requirements, and applicable laws and regulations.

This documentation helps you understand how to apply the shared responsibility model when using Amazon QuickSight. The following topics show you how to configure Amazon QuickSight to meet your security and compliance objectives. You also learn how to use other AWS services that can help you to monitor and secure your Amazon QuickSight resources.

Amazon QuickSight enables you to manage your users and content using a comprehensive set of security features. These include role-based access control, Microsoft Active Directory integration, AWS CloudTrail auditing, single sign-on using AWS Identity and Access Management (IAM) and third-party solutions, private VPC subnets, and data backup. Amazon QuickSight can also support FedRAMP, HIPAA, PCI DSS, ISO, and SOC compliance to help you meet industry-specific or regulatory requirements.

Data Protection in Amazon QuickSight

The AWS shared responsibility model applies to data protection in Amazon QuickSight. As described in this model, AWS is responsible for protecting the global infrastructure that runs all of the AWS Cloud. You are responsible for maintaining control over your content that is hosted on this infrastructure. This content includes the security configuration and management tasks for the AWS services that you use. For more information about data privacy, see the Data Privacy FAQ. For information about data protection in Europe, see the AWS Shared Responsibility Model and GDPR blog post on the AWS Security Blog.

For data protection purposes, we recommend that you protect AWS account credentials and set up individual user accounts with AWS Identity and Access Management (IAM). That way each user is given only the permissions necessary to fulfill their job duties. We also recommend that you secure your data in the following ways:

- Use multi-factor authentication (MFA) with each account.
- Use SSL/TLS to communicate with AWS resources. We recommend TLS 1.2 or later.
- Set up API and user activity logging with AWS CloudTrail.
- Use AWS encryption solutions, along with all default security controls within AWS services.
• Use advanced managed security services such as Amazon Macie, which assists in discovering and securing personal data that is stored in Amazon S3.
• If you require FIPS 140-2 validated cryptographic modules when accessing AWS through a command line interface or an API, use a FIPS endpoint. For more information about the available FIPS endpoints, see Federal Information Processing Standard (FIPS) 140-2.

We strongly recommend that you never put sensitive identifying information, such as your customers' account numbers, into free-form fields such as a Name field. This includes when you work with Amazon QuickSight or other AWS services using the console, API, AWS CLI, or AWS SDKs. Any data that you enter into Amazon QuickSight or other services might get picked up for inclusion in diagnostic logs. When you provide a URL to an external server, don't include credentials information in the URL to validate your request to that server.

Topics
• Data Encryption in Amazon QuickSight (p. 644)
• Inter-network Traffic Privacy in Amazon QuickSight (p. 645)
• Accessing Data Sources (p. 646)

Data Encryption in Amazon QuickSight

Amazon QuickSight uses the following data encryption features:
• Encryption at rest (Enterprise edition only)
• Encryption in transit
• Key management

You can find more detail on these topics in the following sections.

Topics
• Encryption at Rest (p. 644)
• Encryption in Transit (p. 645)
• Key Management (p. 645)

Encryption at Rest

Amazon QuickSight securely stores your Amazon QuickSight metadata. This includes the following:
• Amazon QuickSight user data, including Amazon QuickSight user names, email addresses, and passwords. Amazon QuickSight administrators can view user names and emails, but each user's password is completely private to each user.
• Minimal data necessary to coordinate user identification with your Microsoft Active Directory or identity federation implementation (Federated Single Sign-On (SSO) through Security Assertion Markup Language 2.0 (SAML 2.0)).
• Data source connection data
• Names of your uploaded files, data source names, and data set names.
• Statistics that Amazon QuickSight uses to populate machine learning (ML) insights

Encryption for each source that you use for data is controlled by that data source or file system. Amazon QuickSight doesn't store any actual data except metadata and data that you upload into SPICE. In
Enterprise edition, data at rest in SPICE is encrypted using block-level encryption with AWS-managed keys. In Standard edition, data at rest in SPICE is securely stored, but not encrypted. For information about upgrading to Enterprise edition, see Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 632).

When you delete a user, all of that user's metadata is permanently deleted. If you don't transfer that user's Amazon QuickSight objects to another user, all of the deleted user's Amazon QuickSight objects (data sources, datasets, analyses, and so on) are also deleted. When you unsubscribe from Amazon QuickSight, all metadata and any data you have in SPICE is completely and permanently deleted.

**Encryption in Transit**

Amazon QuickSight supports encryption for all data transfers. This includes transfers from the data source to SPICE, or from SPICE to the user interface. However, encryption isn't mandatory. For some databases, you can choose whether transfers from the data source are encrypted or not. Amazon QuickSight secures all encrypted transfers by using Secure Sockets Layer (SSL).

**Key Management**

All keys associated with Amazon QuickSight are managed by AWS.

Database server certificates that are not managed by AWS are the responsibility of the customer and should be signed by a trusted CA. For more information, see Network and Database Configuration Requirements (p. 724).

**Inter-network Traffic Privacy in Amazon QuickSight**

To use Amazon QuickSight, users need access to the internet. They also need access to a compatible browser or a mobile device with the Amazon QuickSight mobile app installed. They don't need access to the data sources they want to analyze. This access is handled inside Amazon QuickSight. User connections to Amazon QuickSight are protected through the use of SSL. So that users can access Amazon QuickSight, allow access to HTTPS and WebSockets Secure (wss://) protocol.

You can use a Microsoft AD connector and single sign-on (SSO) in a corporate network environment. You can further restrict access through the identity provider. Optionally, you can also use MFA.

Amazon QuickSight accesses data sources by using connection information supplied by the data source owner in Amazon QuickSight. Connections are protected both between Amazon QuickSight and on-premises applications and between Amazon QuickSight and other AWS resources within the same AWS Region. For connections to any source, the data source must allow connections from Amazon QuickSight.

**Traffic Between Service and On-Premises Clients and Applications**

You have two connectivity options between your private network and AWS:

- An AWS Site-to-Site VPN connection. For more information, see What is AWS Site-to-Site VPN?
- An AWS Direct Connect connection. For more information, see What is AWS Direct Connect?

If you are using AWS API operations to interact with Amazon QuickSight through the network, clients must support Transport Layer Security (TLS) 1.0. We recommend TLS 1.2. Clients must also support cipher suites with Perfect Forward Secrecy (PFS), such as Ephemeral Diffie-Hellman (DHE) or Elliptic Curve Diffie-Hellman Ephemeral (ECDHE). Most modern systems such as Java 7 and later support these modes. You must sign requests using an access key ID and a secret access key that are associated with
an IAM principal, or you can use the **AWS Security Token Service (STS)** to generate temporary security credentials to sign requests.

## Traffic Between AWS Resources in the Same Region

An Amazon Virtual Private Cloud (Amazon VPC) endpoint for Amazon QuickSight is a logical entity within a VPC that allows connectivity only to Amazon QuickSight. The Amazon VPC routes requests to Amazon QuickSight and routes responses back to the VPC. For more information, see the following:

- **VPC Endpoints** in the *Amazon VPC User Guide*
- **Connecting to a VPC with Amazon QuickSight** (p. 727)

## Accessing Data Sources

*Applies to:* Enterprise Edition and Standard Edition

*Intended audience:* System administrators and Amazon QuickSight administrators

Use this section to help you configure access to resources in other AWS services.

We recommend that you use SSL to secure Amazon QuickSight connections to your data sources. To use SSL, you must have a certificate signed by a recognized certificate authority (CA). Amazon QuickSight doesn't accept certificates that are self-signed or issued from a nonpublic CA. For more information, see [QuickSight SSL and CA Certificates](p. 726).

### Topics
- **Required Permissions** (p. 646)
- **Allowing Autodiscovery of AWS Resources** (p. 647)
- **Authorizing Connections to AWS Data Stores** (p. 648)
- **Accessing AWS Resources** (p. 669)
- **Exploring Your AWS Data in Amazon QuickSight** (p. 672)

## Required Permissions

*Applies to:* Enterprise Edition and Standard Edition

*Intended audience:* System administrators

When you connect to a data source that requires a user name, the user name must have **SELECT** permissions on some system tables to allow Amazon QuickSight to do things like discover table schemas and estimate table size.

The following table identifies the tables that the user account must have **SELECT** permissions for, depending on the type of database you are connecting to. These requirements apply for all database instances you connect to, regardless of their environment. In other words, they apply whether your database instances are on-premises, in Amazon RDS, in Amazon EC2, or elsewhere.
### Accessing Data Sources

<table>
<thead>
<tr>
<th>Instance Type</th>
<th>Tables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Aurora</td>
<td>INFORMATION_SCHEMA.STATISTICS</td>
</tr>
<tr>
<td></td>
<td>INFORMATION_SCHEMA.TABLES</td>
</tr>
<tr>
<td>Amazon Redshift</td>
<td>pg_stats</td>
</tr>
<tr>
<td></td>
<td>pg_class</td>
</tr>
<tr>
<td></td>
<td>pg_namespace</td>
</tr>
<tr>
<td>MariaDB</td>
<td>INFORMATION_SCHEMA.STATISTICS</td>
</tr>
<tr>
<td></td>
<td>INFORMATION_SCHEMA.TABLES</td>
</tr>
<tr>
<td>Microsoft SQL Server</td>
<td>DBCC SHOW_STATISTICS</td>
</tr>
<tr>
<td></td>
<td>sp_statistics</td>
</tr>
<tr>
<td>MySQL</td>
<td>INFORMATION_SCHEMA.STATISTICS</td>
</tr>
<tr>
<td></td>
<td>INFORMATION_SCHEMA.TABLES</td>
</tr>
<tr>
<td>Oracle</td>
<td>DBA_TAB_COLS</td>
</tr>
<tr>
<td></td>
<td>ALL_TABLES</td>
</tr>
<tr>
<td></td>
<td>dba_segments</td>
</tr>
<tr>
<td></td>
<td>all_segments</td>
</tr>
<tr>
<td></td>
<td>user_segments</td>
</tr>
<tr>
<td>PostgreSQL</td>
<td>pg_stats</td>
</tr>
<tr>
<td></td>
<td>pg_class</td>
</tr>
<tr>
<td></td>
<td>pg_namespace</td>
</tr>
<tr>
<td>ServiceNow</td>
<td>sys_dictionary (column metadata)</td>
</tr>
<tr>
<td></td>
<td>sys_db_object (table metadata)</td>
</tr>
<tr>
<td></td>
<td>sys_glide_object (field type metadata)</td>
</tr>
</tbody>
</table>

**Note**
If you are using MySQL or PostgreSQL, verify that you are connecting from an allowed host or IP address. For more detail, see Database Configuration Requirements for Self-Administered Instances (p. 727).

## Allowing Autodiscovery of AWS Resources

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators
Each AWS service that you access from Amazon QuickSight needs to allow traffic from QuickSight. Instead of opening each service console separately to add permissions, a QuickSight administrator can do this in the administration screen. Before you begin, make sure that you have addressed the following prerequisites.

If you choose to enable autodiscovery of AWS resources for your Amazon QuickSight account, Amazon QuickSight creates an AWS Identity and Access Management (IAM) role in your AWS account. This IAM role that grants your account permission to identify and retrieve data from your AWS data sources.

Because AWS limits the number of IAM roles you can create, make sure that you have at least one free role. You need this role for Amazon QuickSight to use if you want Amazon QuickSight to autodiscover your AWS resources.

You can have Amazon QuickSight autodiscover Amazon RDS DB instances or Amazon Redshift clusters that are associated with your AWS account. These resources must be located in the same AWS Region as your Amazon QuickSight account.

If you choose to enable autodiscovery, choose one of the following options to make the AWS resource accessible:

- For Amazon RDS DB instances that you created in a default VPC and didn't choose to make private, or that aren't in a VPC (that is, are EC2-Classic instances), see Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances (p. 649). In this topic, you can find information on creating a security group to allow connections from Amazon QuickSight servers.
- For Amazon Redshift clusters that you created in a default VPC and didn't choose to make private, or that aren't in a VPC (that is, EC2-Classic instances), see Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 652). In this topic, you can find information on creating a security group to allow connections from Amazon QuickSight servers.
- For an Amazon RDS DB instance or Amazon Redshift cluster that is in a nondefault VPC, see Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances (p. 649) or Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 652). In these topics, you can find information on first creating a security group to allow connections from Amazon QuickSight servers. In addition, you can find information on then verifying that the VPC meets the requirements described in Network Configuration for an AWS Instance in a Nondefault VPC (p. 725).
- If you don't use a private VPC, set up the Amazon RDS instance to allow connections from the Amazon QuickSight Region's public IP address.

Enabling autodiscovery is the easiest way to make this data available in Amazon QuickSight. You can still manually create data connections whether or not you enable autodiscovery.

**Authorizing Connections to AWS Data Stores**

<table>
<thead>
<tr>
<th>Applies to: Enterprise Edition and Standard Edition</th>
</tr>
</thead>
</table>

| Intended audience: System administrators |

For Amazon QuickSight to access your AWS resources, you must create security groups for them that authorize connections from the IP address ranges used by Amazon QuickSight servers. You must have AWS credentials that permit you to access these AWS resources to modify their security groups.

Use the procedures in the following sections to enable Amazon QuickSight connections.
Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

For Amazon QuickSight to connect to an Amazon RDS DB instance, you must create a new security group for that DB instance. This security group contains an inbound rule authorizing access from the appropriate IP address range for the Amazon QuickSight servers in that AWS Region. To learn more about authorizing Amazon QuickSight connections, see Manually Enabling Access to an Amazon RDS Instance in a VPC (p. 649) or Manually Enabling Access to an Amazon RDS Instance That Is Not in a VPC (p. 651).

To create and assign a security group for an Amazon RDS DB instance, you must have AWS credentials that permit access to that DB instance.

Enabling connection from Amazon QuickSight servers to your instance is just one of several prerequisites for creating a data set based on an AWS database data source. For more information about what is required, see Creating Datasets from New Database Data Sources (p. 110).

**Manually Enabling Access to an Amazon RDS Instance in a VPC**

Use the following procedure to enable Amazon QuickSight access to an Amazon RDS DB instance in a VPC. If your Amazon RDS DB instance is in subnet that is private (in relation to Amazon QuickSight) or that has Internet Gateways attached, see Connecting to a VPC with Amazon QuickSight (p. 727).

**To enable Amazon QuickSight access to an Amazon RDS DB instance in a VPC**

1. Sign in to the AWS Management Console and open the Amazon RDS console at https://console.aws.amazon.com/rds/.
2. Choose Databases, locate the DB instance, and view its details. To do this, you click directly on its name (a hyperlink in the DB identifier column).
3. Locate Port and note the Port value. This can be a number or a range.
4. Locate VPC and note the VPC value.
5. Choose the VPC value to open the VPC console. In the Amazon VPC Management Console, choose Security Groups in the navigation pane.
7. On the Create Security Group page, enter the security group information as follows:
   - For Name tag and Group name, enter Amazon-QuickSight-access.
For Description, enter Amazon-QuickSight-access.

For VPC, choose the VPC for your instance. This VPC is the one with the VPC ID that you noted previously.

8. Choose Create. On the confirmation page, note the Security Group ID. Choose Close to exit this screen.

9. Choose your new security group from the list, and then choose Inbound Rules from the tab list below.

10. Choose Edit rules to create a new rule.

11. On the Edit inbound rules page, choose Add rule to create a new rule.

Use the following values:

- For Type, choose Custom TCP Rule.
- For Protocol, choose TCP.
- For Port Range, enter the port number or range of the Amazon RDS cluster. This port number (or range) is the one that you noted previously.
- For Source, choose Custom from the list. Next to the word "Custom", enter the CIDR address block for the AWS Region where you plan to use Amazon QuickSight.

For example, for Europe (Ireland) you would enter Europe (Ireland)’s CIDR address block: 52.210.255.224/27. For more information on the IP address ranges for Amazon QuickSight in supported AWS Regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626).

Note

If you have activated Amazon QuickSight in multiple AWS Regions, you can create inbound rules for each Amazon QuickSight endpoint CIDR. Doing this allows Amazon QuickSight to have access to the Amazon RDS DB instance from any AWS Region defined in the inbound rules.

Anyone who uses Amazon QuickSight in multiple AWS Regions is treated as a single user. In other words, even if you are using Amazon QuickSight in every AWS Region, both your Amazon QuickSight subscription (sometimes called an 'account') and your users are global.

12. For Description, enter a useful description, for example "Europe (Ireland) QuickSight".

13. Choose Save rules to save your new inbound rule. Then choose Close.


15. Choose the DB identifier for the relevant RDS instance. Choose Modify. The same screen displays whether you choose Modify from the databases screen or the DB instance screen: Modify DB Instance.

16. Locate the Network & Security section (the third section from the top).

The currently assigned security group or groups are already chosen for Security Group. Don't remove any of the existing ones unless you are sure.

Instead, choose your new security group to add it to the other groups that are selected. If you followed the name suggested previously, this group might be named something similar to Amazon-QuickSight-access.

17. Scroll to the bottom of the screen. Choose Continue. and then choose Modify DB Instance.

18. Choose Apply during the next scheduled maintenance (the screen indicates when this will occur).

Don't choose Apply immediately. Doing this also applies any additional changes that are in the pending modifications queue. Some of these changes might require downtime. If you bring the server down outside the maintenance window, this can cause a problem for users of this DB instance. Consult your system administrators before applying immediate changes.
19. Choose Modify DB Instance to confirm your changes. Then, wait for the next maintenance window to pass.

Manually Enabling Access to an Amazon RDS Instance That Is Not in a VPC

Use the following procedure to access an Amazon RDS DB instance that is not in a VPC. You can associate a security group with a DB instance by using Modify on the RDS console, the ModifyDBInstance Amazon RDS API, or the modify-db-instance AWS CLI command.

**Note**
This section included for backwards compatibility purposes.

To use the console to access an Amazon RDS DB instance that is not in a VPC

1. Sign in to the AWS Management Console and open the Amazon RDS console at https://console.aws.amazon.com/rds/.
2. Choose Databases, select the DB instance, and choose Modify.
5. Enter Amazon-QuickSight-access for the Name and Description values, and then choose Create.
6. The new security group is selected by default. Select the details icon next to the security group, as shown following.

7. For Connection Type, choose CIDR/IP.
8. For CIDR/IP to Authorize, enter the appropriate CIDR address block. For more information on the IP address ranges for Amazon QuickSight in supported AWS Regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626).

9. Choose Authorize.
10. Return to the Instances page of the Amazon RDS Management Console, choose the instance that you want to enable access to, choose Instance Actions, and then choose Modify.
11. In the Network & Security section, the currently assigned security group or groups already is chosen for Security Group. Press CTRL and choose Amazon-QuickSight-access in addition to the other selected groups.
12. Choose **Continue**, and then choose **Modify DB Instance**.

**Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters**

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

For Amazon QuickSight to connect to an Amazon Redshift instance, you must create a new security group for that instance. This security group contains an inbound rule authorizing access from the appropriate IP address range for the Amazon QuickSight servers in that AWS Region. To learn more about authorizing Amazon QuickSight connections, see [Manually Enabling Access to an Amazon Redshift Cluster in a VPC](p. 652) or [Manually Enabling Access to an Amazon Redshift Cluster That Is Not in a VPC](p. 656).

To create and assign a security group for an Amazon Redshift cluster, you must have AWS credentials that permit access to that cluster.

Enabling connection from Amazon QuickSight servers to your cluster is just one of several prerequisites for creating a data set based on an AWS database data source. For more information about what is required, see [Creating Datasets from New Database Data Sources](p. 110).

**Manually Enabling Access to an Amazon Redshift Cluster in a VPC**

Use the following procedure to enable Amazon QuickSight access to an Amazon Redshift cluster in a VPC.

**To enable Amazon QuickSight access to an Amazon Redshift cluster in a VPC**

1. Sign in to the AWS Management Console and open the Amazon Redshift console at [https://console.aws.amazon.com/redshift/](https://console.aws.amazon.com/redshift/).
2. Choose the details page icon next to the cluster you want to make available, as shown following.
3. In the **Cluster Database Properties** section, find **Port**. Note the **Port** value.
4. In the **Cluster Properties** section, find **VPC ID** and note the **VPC ID** value. Choose **View VPCs** to open the Amazon VPC Management Console.

5. On the Amazon VPC Management Console, choose **Security Groups** in the navigation pane.
6. Choose **Create Security Group**.
7. On the **Create Security Group** page, enter the security group information as follows:
   - For **Name tag** and **Group name**, enter **Amazon-QuickSight-access**.
   - For **Description**, enter **Amazon-QuickSight-access**.
   - For **VPC**, choose the VPC for your instance. This is the VPC with the VPC ID that you noted.
8. Choose **Yes, Create**.

Your new security group should appear on the screen.

9. Choose your new security group, and choose the **Inbound Rules** tab.

Choose **Edit** to create a new rule. Use the following values:

- For **Type**, choose **Custom TCP Rule**.
- For **Protocol**, choose **TCP (6)**.
- For **Port Range**, enter the port number of the Amazon Redshift cluster to which you are providing access. This is the port number that you noted in an earlier step.
- For **Source**, enter the CIDR address block for the AWS Region where you plan to use Amazon QuickSight. For example, here is the CIDR address block for Europe (Ireland): 52.210.255.224/27. For more information on the IP address ranges for Amazon QuickSight in supported AWS Regions, see [AWS Regions, Websites, IP Address Ranges, and Endpoints](p. 626).

**Note**
If you activated Amazon QuickSight in multiple AWS Regions, you can create inbound rules for each Amazon QuickSight endpoint CIDR. Doing this allows Amazon QuickSight to have access to the Amazon RDS DB instance from any AWS Region defined in the inbound rules.
An Amazon QuickSight user or administrator who uses Amazon QuickSight in multiple AWS Regions is treated as a single user. In other words, even if you are using Amazon QuickSight in every AWS Region, both your Amazon QuickSight account and your users are global.
10. Choose **Save** to save your new inbound rule.

11. Return to the **Clusters** page of the Amazon Redshift Management Console, and then open the details page for the cluster that you want to enable access to.

Choose **Cluster**, and then choose **Modify**.
12. The currently assigned security groups are already chosen for VPC Security Groups. Press CTRL and choose Amazon-QuickSight-access in addition to the other selected groups.

13. Choose Modify.

Manually Enabling Access to an Amazon Redshift Cluster That Is Not in a VPC

Use the following procedure to access an Amazon Redshift cluster that is not in a VPC.

To access an Amazon Redshift cluster that is not in a VPC

1. Sign in to the AWS Management Console and open the Amazon Redshift console at https://console.aws.amazon.com/redshift/.
2. Choose Security in the navigation pane.
4. Enter Amazon-QuickSight-access for the Cluster Security Group Name and Description values, and then choose Create.
5. Choose the details icon next to the security group, as shown following.

6. Choose Add Connection Type.
7. Enter the connection information:
   - For Connection Type, choose CIDR/IP.
   - For CIDR/IP to Authorize, enter the appropriate CIDR address block. For the supported IP address ranges for Amazon QuickSight Regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626).
8. Choose Authorize.

9. Return to the Clusters page of the Amazon Redshift console, open the details page for the cluster that you want to enable access to, choose Cluster, and then choose Modify.

10. The currently assigned security groups are already chosen for Cluster Security Group. Press CTRL and choose Amazon-QuickSight-access in addition to the other selected groups.

11. Choose Modify.

**Enabling Access to Amazon Redshift Spectrum**

Using Amazon Redshift Spectrum, you can connect Amazon QuickSight to an external catalog with Amazon Redshift. For example, you can access the Amazon Athena catalog. You can then query unstructured data on your Amazon S3 data lake using an Amazon Redshift cluster instead of the Athena query engine.

You can also combine data sets that include data stored in Amazon Redshift and in S3. Then you can access them using the SQL syntax in Amazon Redshift.

After you've registered your data catalog (for Athena) or external schema (for a Hive metastore), you can use Amazon QuickSight to choose the external schema and Amazon Redshift Spectrum tables. This process works just as for any other Amazon Redshift tables in your cluster. You don't need to load or transform your data.

For more information on using Amazon Redshift Spectrum, see Using Amazon Redshift Spectrum to Query External Data in the Amazon Redshift Database Developer Guide.

To connect using Redshift Spectrum, do the following:

- Create or identify an IAM role associated with the Amazon Redshift cluster.
- Add the IAM policies AmazonS3ReadOnlyAccess and AmazonAthenaFullAccess to the IAM role.
- Register an external schema or data catalog for the tables that you plan to use.

Redshift Spectrum lets you separate storage from compute, so you can scale them separately. You only pay for the queries that you run.
To connect to Redshift Spectrum tables, you don't need to grant Amazon QuickSight access to Amazon S3 or Athena. Amazon QuickSight needs access only to the Amazon Redshift cluster. For full details on configuring Redshift Spectrum, see Getting Started with Amazon Redshift Spectrum in the Amazon Redshift Database Developer Guide.

**Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances**

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

For Amazon QuickSight to connect to an Amazon EC2 instance, you must create a new security group for that instance. This security group contains an inbound rule authorizing access from the appropriate IP address range for the Amazon QuickSight servers in that AWS Region.

To modify the security groups for these Amazon EC2 instances, you must have AWS credentials that permit you to access to the instances.

Enabling connection from Amazon QuickSight servers to your instance is just one of several prerequisites for creating a data set based on an AWS database data source. For more information about what is required, see Creating Datasets from New Database Data Sources (p. 110).

**To enable Amazon QuickSight access to an Amazon EC2 instance**

1. Sign in to the AWS Management Console and open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.

2. If your EC2 instance is in a VPC, choose the instance to view the instance details pane. Find its VPC ID and note that ID for later use.

3. Choose Security Groups in the NETWORK & SECURITY section of the navigation pane. Then choose Create Security Group, as shown following.
4. Enter the security group information as follows:
   - For **Security group name**, enter *Amazon-QuickSight-access*.
   - For **Description**, enter *Amazon-QuickSight-access*.
   - For **VPC**, choose the VPC ID that you noted in step 2 if your Amazon EC2 instance is in a VPC. Otherwise, choose **No VPC**.

5. Choose **Add Rule** on the **Inbound** tab.

6. Create a new rule with the following values:
   - For **Type**, choose **Custom TCP Rule**.
   - For **Protocol**, choose **TCP**.
   - (Optional) For **Port Range**, enter the port number used by the instance on this Amazon EC2 instance to which you are providing access.
   - For **Source**, enter the CIDR address block for the AWS Region where you plan to use Amazon QuickSight. For example, here is the CIDR address block for Europe (Ireland): 52.210.255.224/27. For more information on the IP address ranges for Amazon QuickSight in supported AWS Regions, see [AWS Regions, Websites, IP Address Ranges, and Endpoints](p. 626).

**Note**
If you have activated Amazon QuickSight in multiple AWS Regions, you can create inbound rules for each Amazon QuickSight endpoint CIDR. Doing this allows Amazon QuickSight to have access to the Amazon RDS DB instance from any AWS Region defined in the inbound rules.

An Amazon QuickSight user or administrator who uses Amazon QuickSight in multiple AWS Regions is treated as a single user. In other words, even if you are using Amazon
QuickSight in every AWS Region, both your Amazon QuickSight account and your users are global.

7. Choose Create.
8. Choose Instances in the INSTANCES section of the navigation pane, and then choose the instance that you want to enable access to.
9. Choose Actions, then Networking, and then Change Security Groups.
10. In Change Security Groups, choose the Amazon-QuickSight-access security group.

Then choose Assign Security Groups, as shown following.
Authorizing Connections Through AWS Lake Formation

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

If you are querying data with Amazon Athena, you can use AWS Lake Formation to simplify how you secure and connect to your data from Amazon QuickSight. Lake Formation adds to the AWS Identity and Access Management (IAM) permissions model by providing its own permissions model that is applied to AWS analytics and machine learning services. This centrally defined permissions model controls data access at a granular level through a simple grant and revoke mechanism. You can use Lake Formation instead of, or in addition to, using scoped-down policies with IAM.

When you set up Lake Formation, you register your data sources to allow it to move the data into a new data lake in Amazon S3. Lake Formation and Athena both work seamlessly with AWS Glue Data Catalog, making it easy to use them together. Athena databases and tables are metadata containers. These containers describe the underlying schema of the data, the data definition language (DDL) statements, and the location of the data in Amazon S3.

The following diagram shows the relationships of the AWS services involved.
AfterLakeFormationisconfigured,youcanuseAmazonQuickSighttoaccesstdatabasesandtableson
nameorthroughSQLqueries.AmazonQuickSightprovidesfull-featurededitorwhereyoucancowrite
SQLqueries.OryoucanusetheAthenaconsole,thAWSCLI,oryourfavoritequeryeditor.Foremorer
information,seeAccessingAthenaintheAmazonAthenaUserGuide.

EnablingConnectionfromLakeFormation

BeforeyoubeginthissolutionwithAmazonQuickSight,makesurethatyoucanaccesyourdata
usingAthenawithLakeFormation.AfteryouverifythatthecollectionisworkingthroughAthena,you
needtoverifyonlythatAmazonQuickSightcanconnecttoAthena.Doingthismeanstodon'thavetroubleshoot
connectionsthroughallthreeproductsatonce.Onewaytortesttheconnectionistousethe
AthenaqueryconsoletorunasimpleSQLcommand,forexampleSELECT1FROMtable.
To setup Lake Formation, the person or team who works on it needs access to create a new IAM role and
to Lake Formation. They also need the information shown in the following list. For more information, see
Setting up Lake Formation in theAWS Lake Formation Developer Guide.

• Collect the Amazon Resource Names (ARNs) of the Amazon QuickSight users and groups that
need to access the data in Lake Formation. These users should be Amazon QuickSight authors or
administrators.

To find Amazon QuickSight user and group ARNs

1. Use the AWS CLI to find user ARNs for Amazon QuickSight authors and admins. To do this, run
the following list-users command in your terminal (Linux or Mac) or at your command prompt
(Windows).

```
aws quicksight list-users --aws-account-id 111122223333 --namespace default --region us-east-1
```

The response returns information for each user. We show the Amazon Resource Name (ARN) in
bold in the following example.

```
RequestId: a2704cef-4716-48c8-8d34-7d3196e76468
Status: 200
UserList:
  - Active: true
    Email: SaanviSarkar@example.com
    PrincipalId: federated/iam/AIDAJVCZOVSR3DES7TA
    Role: ADMIN
    UserName: SaanviSarkar
```

To avoid using the AWS CLI, you can construct the ARNs for each user manually.

2. (Optional) Use the AWS CLI to find ARNs for Amazon QuickSight groups by running the following
list-group command in your terminal (Linux or Mac) or at your command prompt (Windows).

```
aws quicksight list-groups --aws-account-id 111122223333 --namespace default --region us-east-1
```

The response returns information for each group. The ARN appears in bold in the following
example.

```
GroupList:
    Description: Data Lake for CXO Balanced Scorecard
    GroupName: DataLake-Scorecard
    PrincipalId: group/d-90671c9c13/6f9083c2-8400-4389-8477-97ef05e3f7db
```
If you don't have any Amazon QuickSight groups, add a group by using the AWS CLI to run the `create-group` command. There currently isn't an option to do this from the Amazon QuickSight console. For more information, see Creating a Group in Amazon QuickSight (p. 710).

To avoid using the AWS CLI, you can construct the ARNs for each group manually.

### Enabling Connection from Amazon QuickSight

To work with Lake Formation and Athena, make sure that you have AWS resource permissions configured in Amazon QuickSight:

- Enable access to Amazon Athena.
- Enable access to the correct buckets in Amazon S3. Usually S3 access is enabled when you enable Athena. However, because you can change S3 permissions outside of that process, it's a good idea to verify them separately.

For information about how to verify or change AWS resource permissions in Amazon QuickSight, see Allowing Autodiscovery of AWS Resources (p. 647) and Accessing Data Sources (p. 646).

### Authorizing Connections to Amazon Elasticsearch

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

Before you can use Elasticsearch in a QuickSight dataset, there are a few tasks for the QuickSight administrator to complete with the cooperation of a person who has access to the Elasticsearch console.

To get started, identify each Elasticsearch domain that you want to connect to. Then gather the following information for each domain:

- The name of the Elasticsearch domain.
- The Elasticsearch version used by this domain.
- The Amazon Resource Name (ARN) of the Elasticsearch domain.
- The https endpoint
- The Kibana URL, if you use Kibana - You can extrapolate the Kibana URL by appending "/_plugin/kibana/" to an endpoint.
- If the domain has a VPC endpoint, gather all the information on the VPC tab of the Elasticsearch console: VPC ID, security groups, IAM role, AZs and subnets.
- If the domain has a regular endpoint (no VPC endpoint), record that it uses the public network.
- Start hour for the daily automated snapshot (if your business users want to know).

Before you proceed, the QuickSight administrator enables authorized connections from QuickSight to Elasticsearch. This process is required for every AWS service that you connect to from QuickSight. You need to do this only once per AWS account for each AWS service you're using as a data source. For Elasticsearch, the authorization process adds the AWS managed policy `AWSQuickSightElasticsearchPolicy` to your AWS account.
Important
Make sure the IAM policy for your Elasticsearch domain doesn't conflict with the permissions in AWSQuickSightElasticsearchPolicy. You can find the domain access policy in the Amazon Elasticsearch console. For more information, see Configuring Access Policies in the Amazon Elasticsearch Service Developer Guide.

To enable or disable connections from QuickSight to Amazon Elasticsearch
1. Choose your profile icon, Manage QuickSight.
2. Choose Security & permissions, Add or remove.
3. To enable connections, select the Amazon Elasticsearch check box.
   To disable connections, clear the Amazon Elasticsearch check box.
4. Choose Update to confirm your choices.

Using a VPC Connection
If the Elasticsearch domain is in an Amazon VPC, you need to determine if QuickSight is already connected to the VPC ID that the Elasticsearch domain uses. You can reuse an existing VPC connection. If you're not sure if it's working, you can test it. For more information, see Testing the Connection to Your VPC Data Source (p. 741).

If a connection isn't already defined in QuickSight for the Amazon VPC that you want to use, you can create one. This task is a multi-step process that you need to complete before you proceed. To learn how to add QuickSight to a VPC and add a connection from QuickSight to the VPC, see Connecting to a VPC with Amazon QuickSight (p. 727).

Using Elasticsearch Permissions
After you configure QuickSight to connect to Elasticsearch, you might need to enable permissions in Elasticsearch. For this part of the setup process, you can use the Kibana link for each Elasticsearch domain. Use the following list to help determine what permissions you need to enable:

1. For the domains that use the fine-grained access control (FGAC) available in Elasticsearch, you need to configure permissions in the form of a role. This is similar to using scoped-down policies in QuickSight.
2. For each domain that you create a role for, add a role mapping.
3. If you plan to import Elasticsearch data into QuickSight (SPICE), configure Elasticsearch to enable queries that use cursors. For more information, see Enabling Imports for Elasticsearch (p. 666).

Each configuration task is described as a procedure in the remainder of this page.

If your Elasticsearch domain has Fine-Grained-Access-Control (FGAC) enabled, there are some permissions that you need to configure to enable the domain to be accessible from QuickSight. Do this for each domain that you want to use. We use Kibana for the following procedures. Kibana is an open-source tool that works with Elasticsearch. You can find a link to Kibana on the domain dashboard on the Amazon Elasticsearch console.

To add permissions to a domain to allow access from QuickSight
1. Open Kibana for the Elasticsearch domain that you want to work with. The URL is HTTPS-ENDPOINT-OF-Elasticsearch-DOMAIN/_plugin/kibana/.
2. Choose Security from the menu at left.
   If you don't see the navigation pane, open it by using the menu icon at upper left. To keep the menu open, choose Dock navigation at lower left.
3. Choose Roles, Add (+).
4. Name the role `quicksight_role`.
   
   You can choose a different name, but we recommend this one because we use it in our documentation and it's thus easier to support.

5. Choose the **Cluster Permissions** tab.

6. Enable **Show Advanced**.

7. In the **Permissions: Single Permissions** section, add the following permissions by choosing **Add Single Permission**:
   
   - cluster:monitor/main
   - cluster:monitor/health
   - cluster:monitor/state
   - indices:data/read/scroll
   - indices:data/read/scroll/clear

8. Choose the **Index Permissions** tab.

9. Display the options by choosing **Add index permissions**.

10. In the **Index patterns** section, enter an asterisk as the pattern: `*`.

11. Near **Permissions: Action Groups**, enable **Show Advanced**.

12. In the **Permissions: Single Permissions** section, add the following permissions by choosing **Add Single Permission**:
   
   - indices:admin/get
   - indices:admin/mappings/fields/get*
   - indices:data/read/search*

13. Choose **Save Role Definition**, at the bottom of any tab.

14. Verify that you have the minimum required permissions by using the following steps:

   a. Return to the list of roles by choosing **Security, Roles**.
   b. Search for "quick", and choose **quicksight_role** from the list.
   c. Choose `</> Show JSON`.
   d. The generated JSON should look something like the following.

```json
{
  "index_permissions": [
    {
      "index_patterns": [
        
      ],
      "dls": ",",
      "fls": [],
      "masked_fields": [],
      "allowed_actions": [
        "indices:admin/get",
        "indices:admin/mappings/fields/get*",
        "indices:data/read/search*"
      ]
    }
  ],
  "tenant_permissions": [],
  "cluster_permissions": [
    "cluster:monitor/main",
    "cluster:monitor/health",
    "indices:data/read/scroll",
    "indices:data/read/scroll/clear"
  ]
}
```
15. Repeat this procedure for each Elasticsearch domain you are planning to use.

The following procedure describes how to add a role mapping for the permissions that you added in the previous procedure. You might find it more efficient to add the permissions and the role mapping as part of a single process. The instructions are separate here for clarity.

**To create a role mapping for the IAM role you added**

1. Open Kibana for the Elasticsearch domain that you want to work with. The URL is HTTPS-ENDPOINT-OF-Elasticsearch-DOMAIN/_plugin/kibana/.
2. Open the menu at upper left and choose Security.
3. Choose Role Mappings, Add (+).
4. At the top, choose quicksight_role from the list.
5. In the Backend roles section, enter the ARN of the AWS-managed IAM role for QuickSight. Following is an example.

   arn:aws:iam::AWS-ACCOUNT-ID:role/service-role/aws-quicksight-service-role-v0

6. Choose Submit to save your choices.
7. Verify that you configured the role mapping correctly:
   a. Return to the list of roles by choosing Security, Role Mappings.
   b. Choose quicksight_role from the list.
   c. Choose </> Show JSON.
   d. The generated JSON should look something like the following.

   ```json
   {
     "hosts": [],
     "users": [],
     "backend_roles": [
       "arn:aws:iam::AWS-ACCOUNT-ID:role/service-role/aws-quicksight-service-role-v0"
     ]
   }
   ```

8. Repeat this procedure for each Elasticsearch domain that you want to use.

**Enabling Imports for Elasticsearch**

QuickSight uses a SQL cursor pagination query to retrieve data from Elasticsearch. The default settings in Elasticsearch work well for direct query. However, to import Elasticsearch data into QuickSight, you need to enable opendistro.sql.cursor.enabled. The following procedure describes how to do this in Kibana. If you prefer to use curl, see opendistro.sql.cursor.enabled in the Open Distro for Elasticsearch SQL Plugin repo on GitHub.

**To enable SQL cursors in Amazon Elasticsearch (Kibana)**

1. Open Kibana for the Elasticsearch domain that you want to work with. The URL is HTTPS-ENDPOINT-OF-Elasticsearch-DOMAIN/_plugin/kibana/.
2. Open the menu at upper left and choose Dev Tools. The dev console should open automatically. If it doesn't, wait a moment and try again.
3. Paste the following PUT command into the dev console in Kibana.
4. Select the entire command (Ctrl-A) and click the play button to send the request.
5. To verify that the setting is configured, use the following GET command.

```
GET /_cluster/settings
```

The correct results contain the following snippet under both persistent and transient settings.

```
},
"opendistro" : {
  "sql" : {
    "cursor" : {
      "enabled" : "true"
    }
  }
}
```


**Authorizing Connections to Amazon Athena**

If you need to use Amazon QuickSight with Amazon Athena or Amazon Athena Federated Query, you first need to authorize connections to Athena and the associated buckets in Amazon Simple Storage Service (Amazon S3). Amazon Athena is an interactive query service that makes it easy to analyze data directly in Amazon S3 using standard SQL. Athena Federated Query provides access to more types of data by using AWS Lambda. Using a connection from QuickSight to Athena, you can write SQL queries to interrogate data that's stored in relational, non-relational, object, and custom data sources. For more information, see [Using Amazon Athena Federated Query](#) in the Amazon Athena User Guide.

Review the following considerations when setting up access to Athena from QuickSight:

- Athena stores query results from QuickSight in a bucket. By default, this bucket has a name similar to `aws-athena-query-results-AWSACCOUNTID-AWSREGION`, for example `aws-athena-query-results-111111111111-us-east-2`. Therefore, it's important to make sure QuickSight has permissions to access the bucket Athena is currently using.
- If your data file is encrypted with an AWS KMS key, grant permissions to the Amazon QuickSight IAM role to decrypt the key. The easiest way to do this is to use the AWS CLI.

You can run the KMS `create-grant` API operation in AWS CLI to do this.

```
aws kms create-grant --key-id <KMS_KEY_ARN> / 
--grantee-principal <QS_ROLE_ARN> --operations Decrypt
```

The Amazon Resource Name (ARN) for the Amazon QuickSight role has the format `arn:aws:iam::<account id>:role/service-role/aws-quicksight-service-role-`
and can be accessed from the IAM console. To find your KMS key ARN, use the S3 console. Go to the bucket that contains your data file and choose the **Overview** tab. The key is located near **KMS key ID**.

- By default, connections use the following IAM roles:
  - For connections using Athena with Lambda functions:
    ```
    arn:aws:iam::AWS-ACCOUNT-ID:role/service-role/aws-quicksight-s3-consumers-role-v0
    ```
  - For all other Athena connections:
    ```
    arn:aws:iam::AWS-ACCOUNT-ID:role/service-role/aws-quicksight-service-role-v0
    ```

**To authorize QuickSight to connect to Athena or Athena Federated Data Sources**

1. (Optional) If you are using AWS Lake Formation with Athena, you also need to enable Lake Formation. For more information, see [Authorizing Connections Through AWS Lake Formation](#).
2. Open your profile menu at top right and choose **Manage QuickSight**. You must be a QuickSight administrator to do this. If you don't see **Manage QuickSight** on the profile menu, you don't have sufficient permissions.
3. Choose **Security & permissions, Add or remove**.
4. Choose the box near Amazon Athena, **Next**.
   
   If it was already enabled, you might have to double-click it. Do this even if Amazon Athena is already enabled, so you can view the settings. No changes are saved until you choose **Update** at the end of this procedure.
5. Enable the S3 buckets you want to access.
6. (Optional) To enable Athena federated queries, select the Lambda functions you want to use.
7. To confirm your changes, choose **Finish**.
   
   To cancel, choose **Cancel**.
8. To save changes to security and permissions, choose **Update**.

**To test the connection authorization settings**

1. From the QuickSight start page, choose **Datasets, New dataset**.
2. Choose the Athena card.
3. Follow the screen prompts to create a new Athena data source using the resources you need to connect to. Choose **Validate connection** to test the connection.
4. If the connection validates, you have successfully configured an Athena or Athena Federated Query connection.
   
   If you don't have sufficient permissions to connect to an Athena dataset or run an Athena query, an error displays directing you to contact a QuickSight administrator. This error means need to recheck your connection authorization settings to find the discrepancy.
5. After you can connect successfully, you or your QuickSight authors can create data sources connections and share them with other QuickSight authors. The authors can then create multiple datasets from the connections, to use in QuickSight dashboards.

For troubleshooting information on Athena, see [Troubleshooting Issues When Using Athena with Amazon QuickSight](#).
Accessing AWS Resources

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

You can control the AWS resources that Amazon QuickSight can access and scope down access to these resources at a more granular level. In Enterprise edition, you can also set up general access defaults for everyone in your account, and you can set up specific access for individual users and groups.

Use the following sections to help you configure your AWS resources to work with Amazon QuickSight.

Before you begin, make sure that you have the correct permissions; your system administrator can give you these. To do so, your system administrator creates a policy that enables you to use certain IAM actions. Your system administrator then associates that policy with your user or group in IAM. The required actions are the following:

- `quicksight:AccountConfigurations` – To enable setting default access to AWS resources
- `quicksight:ScopeDownPolicy` – Scoping policies for permissions to AWS resources

**To enable or disable the AWS services that Amazon QuickSight can access**

2. At the upper right, choose your user name, and then choose **Manage QuickSight**.
3. Choose **Security & permissions**.
4. Under **QuickSight access to AWS services**, choose **Add or remove**.

   A screen appears where you can enable all available AWS services.

   **Note**
   If you see a permissions error, and you're an authorized Amazon QuickSight administrator, contact your system administrator for assistance.

5. Select the check boxes for the services that you want to allow. Clear check boxes for services that you don't want to allow.

   If you have already enabled an AWS service, the check box for that service is already selected. If Amazon QuickSight can't access a particular AWS service, its check box is not selected.

   In some cases, you might see a message like the following.

   This policy used by Amazon QuickSight for AWS resource access was modified outside of Amazon QuickSight, so you can no longer edit this policy to provide AWS resource permission to Amazon QuickSight. To edit this policy permissions, go to IAM console and delete this policy permission with policy arn - arn:aws:iam::111122233333:policy/service-role/AWSQuickSightS3Policy.

   This type of message means that one of the IAM policies that Amazon QuickSight uses was manually altered. To fix this, the system administrator needs to delete the IAM policy listed in the error message and reload the **Security & permissions** screen before you try again.

6. Choose **Update** to confirm, or **Cancel** to return to the previous screen.
Setting Default Resource Access to AWS Services

Applies to: Enterprise Edition

Intended audience: System administrators and Amazon QuickSight administrators

In Enterprise edition, you can configure specific permissions for the AWS services that an Amazon QuickSight user can access. If no such configuration occurs, Amazon QuickSight uses a default set of permissions based on the user's settings. The current behavior is displayed in a blue information box.

To change the default resource access for all users (to use when no other permissions are configured)

2. At upper left, choose your user name, and then choose Manage QuickSight.
4. Under Default resource access, choose Change.
5. Choose one of the following:
   - Allow access to all AWS data and resources.
   - Deny access to all AWS data and resources.

Setting Granular Access to AWS Services Through IAM

Applies to: Enterprise Edition

Intended audience: System administrators and Amazon QuickSight administrators

In Enterprise edition, Amazon QuickSight provides a way for you to set up detailed access to resources in AWS services. Like every other AWS service, Amazon QuickSight uses IAM policies to control access for users and groups.

Before you begin, ask an IAM administrator to set up the necessary IAM policies ahead of time. If these are set up, you can select them as part of the procedure in this section. For information about creating IAM policies to use with Amazon QuickSight, see Identity and Access Management in Amazon QuickSight (p. 674).

To assign an IAM policy to a user or group

2. At upper left, choose your user name, and then choose **Manage QuickSight**.
3. Choose **Security & permissions**.
4. Under **Resource access for individual users and groups**, choose **IAM policy assignments**.

The remaining steps at this point involve choosing an IAM policy to assign to the user or group. You can assign multiple IAM policies to one Amazon QuickSight user or group. To determine permissions, Amazon QuickSight performs a union and an intersection with the AWS account–level policies.

If you already have active IAM policy assignments, they are listed on this page. You can search for existing assignments by using the search box. If you have drafts that aren't active yet, they are listed under **Assignment drafts**.

5. Choose one of the following:
   - To create an IAM policy assignment, choose **Add new assignment**.
   - To edit an existing assignment, choose the **Edit assignment** icon for that assignment.
   - To enable or disable a policy, select the check box for that policy, and then choose **Enable** or **Disable**. You can select multiple policy assignments at a time.
   - To delete an existing assignment, choose the **Remove assignment** icon near the name of the assignment. To confirm your choice, choose **Delete** on the confirmation screen. Or choose **Back** to cancel deletion.

If you are creating or editing an assignment, continue to the next step. Otherwise, skip to the end of this procedure.

6. On the next screen, you perform the policy assignment process, which is divided into steps. As you work through the steps, you can go forward or backward to make changes. When you exit the screen, your changes from all of the steps are saved.

   a. **Step 1: Name assignment** – If this is a new assignment, enter a name for the assignment, and then choose **Next** to continue. If you want to change the name, choose **Step 1** at left.

   b. **Step 2: Select an IAM policy** – Choose an IAM policy that you want to use. From this screen, you can interact with the policies as follows:
      - Choose a policy that you want to use.
      - Search for a policy name.
      - Filter the list to see all IAM policies, AWS-managed policies, or customer-managed policies.
      - View a policy, by choosing **View policy**.

      To choose a policy, choose the button beside it, and then choose **Next** to continue.

   c. **Step 3: Assign users and groups** – Choose specific users or groups. Or choose to use the selected IAM policy for all users and groups.

      Choose one of the following.
      - **Assign to all users and groups**, select the check box to assign the IAM policy to all Amazon QuickSight users and groups. Choosing this option assigns the policy to all current and future users and groups.
      - Choose the users and groups you want to assign to this IAM policy. You can search for them by name, email address, or group name.

      When you are finished selecting users and groups, choose **Next** to continue.

   d. **Step 4: Review and enable changes** – Save your changes.

      Choose one of the following.
Exploring Your AWS Data in Amazon QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

Use this section to learn how to explore AWS data in Amazon QuickSight using the AWS Management Console. Using the **Explore in QuickSight** shortcut, you can access a customizable dashboard template showing your data. Just as with any Amazon QuickSight dashboard, this dashboard can be refreshed on a schedule, published, and shared with other users in your organization.

**Topics**
- Exploring Amazon S3 Analytics Data (p. 672)

**Exploring Amazon S3 Analytics Data**

Amazon QuickSight contains a dashboard designed to provide insight into your Amazon S3 analytics data. To use this feature, you must first enable S3 analytics storage class analysis for your S3 buckets. For more on enabling storage class analysis in S3, see Amazon S3 Analytics – Storage Class Analysis in the Amazon S3 Developer Guide.

After you have enabled storage class analysis, you can use Amazon QuickSight to explore your S3 analytics data.

**To explore S3 analytics data in Amazon QuickSight**

1. Open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).
2. Choose a bucket to explore. The bucket must have storage class analysis enabled, with at least one filter.
3. Choose the Management tab.
4. Then choose Analytics.
5. Choose **Explore in QuickSight**.

**Note**
If you don't have an Amazon QuickSight account, you're prompted to create one before you can use the dashboard.
When you choose the option to explore in Amazon QuickSight, your S3 analytics data is automatically loaded into the dashboard template. The dashboard contains multiple visualizations to help you to understand the storage access pattern of your bucket.

Use the template as is, or customize it to suit your needs. For example, one visual on the default template helps you identify infrequently accessed data. It compares the amount of data retrieved to the amount of storage consumed, for objects of different ages.

You can also add your own visualizations to the dashboard. For example, you can break down the data access patterns, using filters for storage class analysis that you already have defined in S3 analytics.

To learn more about using S3 analytics and storage class analysis, see Amazon S3 Analytics – Storage Class Analysis in the Amazon S3 Developer Guide.
Identity and Access Management in Amazon QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

Amazon QuickSight Enterprise edition integrates with your existing directories, using either Active Directory or single sign-on (SSO) using SAML. You can use AWS Identity and Access Management (IAM) to further enhance your security, or for custom options such as embedding dashboards.

Amazon QuickSight Standard edition enables you to manage users entirely within Amazon QuickSight. If you prefer, you can integrate with your existing users, groups, and roles in IAM.

You can use the following tools for identity and access to Amazon QuickSight.

- Using IAM (p. 674) (Standard and Enterprise editions)
- AWS Active Directory (p. 703) (Enterprise edition only)
- Multi-Factor Authentication (MFA) (p. 704) (Standard and Enterprise edition)

**Using IAM**

This section introduces the concepts involved in using AWS Identity and Access Management (IAM). It also covers how to use IAM with Amazon QuickSight.

AWS Identity and Access Management (IAM) is an AWS service that helps an administrator securely control access to AWS resources. IAM administrators control who can be authenticated (signed in) and authorized (have permissions) to use Amazon QuickSight resources. IAM is an AWS service that you can use with no additional charge.

**Topics**

- Introduction to IAM Concepts (p. 674)
- Using Amazon QuickSight with IAM (p. 678)
- IAM Policy Examples for Amazon QuickSight (p. 682)
- Provisioning Users for Amazon QuickSight (p. 686)
- Troubleshooting Amazon QuickSight Identity and Access (p. 687)

**Introduction to IAM Concepts**

AWS Identity and Access Management (IAM) is an AWS service that helps an administrator securely control access to AWS resources. IAM administrators control who can be authenticated (signed in) and authorized (have permissions) to use Amazon QuickSight resources. IAM is an AWS service that you can use with no additional charge.

AWS Identity and Access Management (IAM) is used with Amazon QuickSight in several ways, including the following.
- If your company uses IAM for their identity management, people might have an IAM user name and password that they use to sign in to Amazon QuickSight.
- If you want your Amazon QuickSight users to be automatically created upon first sign-in, you use IAM to create a policy for users who are pre-authorized use of Amazon QuickSight.
- If you want to create specialized access for specific groups of users or to specific resources, you can use IAM policies to accomplish this.

**Audience**

Use this to understand the context of the information provided in this section, and how it applies to your role. How you use AWS Identity and Access Management (IAM) differs, depending on the work you do in Amazon QuickSight.

**Service user** – If you use Amazon QuickSight to interact with data, analyses, and dashboards through the Amazon QuickSight by using the browser interface, then this section only provides informational background for you. You won't directly interact with the IAM service, except if you are using IAM to sign into Amazon QuickSight.

**Amazon QuickSight administrator** – If you're in charge of Amazon QuickSight resources at your company, you probably have full access to Amazon QuickSight. It's your job to determine which Amazon QuickSight features and resources your team members should access. If you have specialized requirements that you can't solve by using the Amazon QuickSight admin panel, then you can work with your IAM administrator to create permissions policies for your Amazon QuickSight users. If you want to learn more about IAM, you can review the information on this page to understand the basic concepts of IAM. To learn more about how your company can use IAM with Amazon QuickSight, see Using Amazon QuickSight with IAM (p. 678).

**IAM administrator** – If you're an IAM administrator, you might want to learn details about how you can write policies to manage access to Amazon QuickSight. To view example Amazon QuickSight identity-based policies that you can use in IAM, see IAM Identity-Based Policies for Amazon QuickSight (p. 682).

**Authenticating With Identities**

Authentication is how you sign in to AWS using your identity credentials. For more information about signing in using the AWS Management Console, see Signing in to the AWS Management Console as an IAM user or root user in the IAM User Guide.

You must be authenticated (signed in to AWS) as the AWS account root user, an IAM user, or by assuming an IAM role. You can also use your company's single sign-on authentication or even sign in using Google or Facebook. In these cases, your administrator previously set up identity federation using IAM roles. When you access AWS using credentials from another company, you are assuming a role indirectly.

To sign in directly to the AWS Management Console, use your password with your root user email address or your IAM user name. You can access AWS programmatically using your root user or IAM users access keys. AWS provides SDK and command line tools to cryptographically sign your request using your credentials. If you don't use AWS tools, you must sign the request yourself. Do this using Signature Version 4, a protocol for authenticating inbound API requests. For more information about authenticating requests, see Signature Version 4 signing process in the AWS General Reference.

Regardless of the authentication method that you use, you might also be required to provide additional security information. For example, AWS recommends that you use multi-factor authentication (MFA) to increase the security of your account. To learn more, see Using multi-factor authentication (MFA) in AWS in the IAM User Guide.

**AWS account root user**

When you first create an AWS account, you begin with a single sign-in identity that has complete access to all AWS services and resources in the account. This identity is called the AWS account root user and is accessed by signing in with the email address and password that you used to create the account. We
strongly recommend that you do not use the root user for your everyday tasks, even the administrative ones. Instead, adhere to the best practice of using the root user only to create your first IAM user. Then securely lock away the root user credentials and use them to perform only a few account and service management tasks.

IAM Users and Groups

An IAM user is an identity within your AWS account that has specific permissions for a single person or application. An IAM user can have long-term credentials such as a user name and password or a set of access keys. To learn how to generate access keys, see Managing access keys for IAM users in the IAM User Guide. When you generate access keys for an IAM user, make sure you view and securely save the key pair. You cannot recover the secret access key in the future. Instead, you must generate a new access key pair.

An IAM group is an identity that specifies a collection of IAM users. You can't sign in as a group. You can use groups to specify permissions for multiple users at a time. Groups make permissions easier to manage for large sets of users. For example, you could have a group named IAMAdmins and give that group permissions to administer IAM resources.

Users are different from roles. A user is uniquely associated with one person or application, but a role is intended to be assumable by anyone who needs it. Users have permanent long-term credentials, but roles provide temporary credentials. To learn more, see When to create an IAM user (instead of a role) in the IAM User Guide.

IAM Roles

An IAM role is an identity within your AWS account that has specific permissions. It is similar to an IAM user, but is not associated with a specific person. You can temporarily assume an IAM role in the AWS Management Console by switching roles. You can assume a role by calling an AWS CLI or AWS API operation or by using a custom URL. For more information about methods for using roles, see Using IAM roles in the IAM User Guide.

IAM roles with temporary credentials are useful in the following situations:

- **Temporary IAM user permissions** – An IAM user can assume an IAM role to temporarily take on different permissions for a specific task.
- **Federated user access** – Instead of creating an IAM user, you can use existing identities from AWS Directory Service, your enterprise user directory, or a web identity provider. These are known as federated users. AWS assigns a role to a federated user when access is requested through an identity provider. For more information about federated users, see Federated users and roles in the IAM User Guide.
- **Cross-account access** – You can use an IAM role to allow someone (a trusted principal) in a different account to access resources in your account. Roles are the primary way to grant cross-account access. However, with some AWS services, you can attach a policy directly to a resource (instead of using a role as a proxy). To learn the difference between roles and resource-based policies for cross-account access, see How IAM roles differ from resource-based policies in the IAM User Guide.
- **Cross-service access** – Some AWS services use features in other AWS services. For example, when you make a call in a service, it's common for that service to run applications in Amazon EC2 or store objects in Amazon S3. A service might do this using the calling principal's permissions, using a service role, or using a service-linked role.
- **Principal permissions** – When you use an IAM user or role to perform actions in AWS, you are considered a principal. Policies grant permissions to a principal. When you use some services, you might perform an action that then triggers another action in a different service. In this case, you must have permissions to perform both actions. To see whether an action requires additional dependent actions in a policy, see Actions, Resources, and Condition Keys for Amazon QuickSight in the Service Authorization Reference.
- **Service role** – A service role is an IAM role that a service assumes to perform actions on your behalf. Service roles provide access only within your account and cannot be used to grant access to services
in other accounts. An IAM administrator can create, modify, and delete a service role from within IAM. For more information, see Creating a role to delegate permissions to an AWS service in the IAM User Guide.

- **Service-linked role** – A service-linked role is a type of service role that is linked to an AWS service. The service can assume the role to perform an action on your behalf. Service-linked roles appear in your IAM account and are owned by the service. An IAM administrator can view, but not edit the permissions for service-linked roles.

- **Applications running on Amazon EC2** – You can use an IAM role to manage temporary credentials for applications that are running on an EC2 instance and making AWS CLI or AWS API requests. This is preferable to storing access keys within the EC2 instance. To assign an AWS role to an EC2 instance and make it available to all of its applications, you create an instance profile that is attached to the instance. An instance profile contains the role and enables programs that are running on the EC2 instance to get temporary credentials. For more information, see Using an IAM role to grant permissions to applications running on Amazon EC2 instances in the IAM User Guide.

To learn whether to use IAM roles or IAM users, see When to create an IAM role (instead of a user) in the IAM User Guide.

### Managing Access Using Policies

You control access in AWS by creating policies and attaching them to IAM identities or AWS resources. A policy is an object in AWS that, when associated with an identity or resource, defines their permissions. You can sign in as the root user or an IAM user, or you can assume an IAM role. When you then make a request, AWS evaluates the related identity-based or resource-based policies. Permissions in the policies determine whether the request is allowed or denied. Most policies are stored in AWS as JSON documents. For more information about the structure and contents of JSON policy documents, see Overview of JSON policies in the IAM User Guide.

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

Every IAM entity (user or role) starts with no permissions. In other words, by default, users can do nothing, not even change their own password. To give a user permission to do something, an administrator must attach a permissions policy to a user. Or the administrator can add the user to a group that has the intended permissions. When an administrator gives permissions to a group, all users in that group are granted those permissions.

IAM policies define permissions for an action regardless of the method that you use to perform the operation. For example, suppose that you have a policy that allows the `iam:GetRole` action. A user with that policy can get role information from the AWS Management Console, the AWS CLI, or the AWS API.

#### Identity-Based Policies

Identity-based policies are JSON permissions policy documents that you can attach to an identity, such as an IAM user, group of users, or role. These policies control what actions users and roles can perform, on which resources, and under what conditions. To learn how to create an identity-based policy, see Creating IAM policies in the IAM User Guide.

Identity-based policies can be further categorized as inline policies or managed policies. Inline policies are embedded directly into a single user, group, or role. Managed policies are standalone policies that you can attach to multiple users, groups, and roles in your AWS account. Managed policies include AWS managed policies and customer managed policies. To learn how to choose between a managed policy or an inline policy, see Choosing between managed policies and inline policies in the IAM User Guide.

#### Resource-Based Policies

Resource-based policies are JSON policy documents that you attach to a resource. Examples of resource-based policies are IAM role trust policies and Amazon S3 bucket policies. In services that support resource-
based policies, service administrators can use them to control access to a specific resource. For the resource where the policy is attached, the policy defines what actions a specified principal can perform on that resource and under what conditions. You must specify a principal in a resource-based policy. Principals can include accounts, users, roles, federated users, or AWS services.

Resource-based policies are inline policies that are located in that service. You can't use AWS managed policies from IAM in a resource-based policy.

**Access Control Lists (ACLs)**

Access control lists (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they do not use the JSON policy document format.

Amazon S3, AWS WAF, and Amazon VPC are examples of services that support ACLs. To learn more about ACLs, see Access control list (ACL) overview in the Amazon Simple Storage Service Developer Guide.

**Other Policy Types**

AWS supports additional, less-common policy types. These policy types can set the maximum permissions granted to you by the more common policy types.

- **Permissions boundaries** – A permissions boundary is an advanced feature in which you set the maximum permissions that an identity-based policy can grant to an IAM entity (IAM user or role). You can set a permissions boundary for an entity. The resulting permissions are the intersection of entity's identity-based policies and its permissions boundaries. Resource-based policies that specify the user or role in the Principal field are not limited by the permissions boundary. An explicit deny in any of these policies overrides the allow. For more information about permissions boundaries, see Permissions boundaries for IAM entities in the IAM User Guide.

- **Service control policies (SCPs)** – SCPs are JSON policies that specify the maximum permissions for an organization or organizational unit (OU) in AWS Organizations. AWS Organizations is a service for grouping and centrally managing multiple AWS accounts that your business owns. If you enable all features in an organization, then you can apply service control policies (SCPs) to any or all of your accounts. The SCP limits permissions for entities in member accounts, including each AWS account root user. For more information about Organizations and SCPs, see How SCPs work in the AWS Organizations User Guide.

- **Session policies** – Session policies are advanced policies that you pass as a parameter when you programmatically create a temporary session for a role or federated user. The resulting session’s permissions are the intersection of the user or role's identity-based policies and the session policies. Permissions can also come from a resource-based policy. An explicit deny in any of these policies overrides the allow. For more information, see Session policies in the IAM User Guide.

**Multiple Policy Types**

When multiple types of policies apply to a request, the resulting permissions are more complicated to understand. To learn how AWS determines whether to allow a request when multiple policy types are involved, see Policy evaluation logic in the IAM User Guide.

**Using Amazon QuickSight with IAM**

<table>
<thead>
<tr>
<th>Applies to:</th>
<th>Enterprise Edition and Standard Edition</th>
</tr>
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| Intended audience: | System administrators |
Before you use IAM to manage access to Amazon QuickSight, you should understand what IAM features are available to use with Amazon QuickSight. To get a high-level view of how Amazon QuickSight and other AWS services work with IAM, see AWS Services That Work with IAM in the IAM User Guide.

Topics
- Amazon QuickSight Policies (Identity-Based) (p. 679)
- Amazon QuickSight Policies (Resource-Based) (p. 681)
- Authorization Based on Amazon QuickSight Tags (p. 681)
- Amazon QuickSight IAM Roles (p. 681)

Amazon QuickSight Policies (Identity-Based)

With IAM identity-based policies, you can specify allowed or denied actions and resources as well as the conditions under which actions are allowed or denied. Amazon QuickSight supports specific actions, resources, and condition keys. To learn about all of the elements that you use in a JSON policy, see IAM JSON Policy Elements Reference in the IAM User Guide.

You can use AWS root credentials or IAM user credentials to create an Amazon QuickSight account. AWS root and administrator credentials already have all of the required permissions for managing Amazon QuickSight access to AWS resources.

However, we recommend that you protect your root credentials, and instead use IAM user credentials. To do this, you can create a policy and attach it to the IAM user and roles that you plan to use for Amazon QuickSight. The policy must include the appropriate statements for the Amazon QuickSight administrative tasks you need to perform, as described in the following sections.

Important
Be aware of the following when working with Amazon QuickSight and IAM policies:

- Avoid directly modifying a policy that was created by Amazon QuickSight. When you modify it yourself, Amazon QuickSight can't edit it. This inability can cause an issue with the policy. To fix this issue, delete the previously modified policy.
- If you get an error on permissions when you try to create an Amazon QuickSight account, see Actions Defined by Amazon QuickSight in the IAM User Guide.
- In some cases, you might have an Amazon QuickSight account that you can't access even from the root account (for example, if you accidentally deleted its directory service). In this case, you can delete your old Amazon QuickSight account, then recreate it. For more information, see Canceling Your Amazon QuickSight Subscription and Closing the Account (p. 634).

Actions

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Action element of a JSON policy describes the actions that you can use to allow or deny access in a policy. Policy actions usually have the same name as the associated AWS API operation. There are some exceptions, such as permission-only actions that don't have a matching API operation. There are also some operations that require multiple actions in a policy. These additional actions are called dependent actions.

Include actions in a policy to grant permissions to perform the associated operation.

Policy actions in Amazon QuickSight use the following prefix before the action: quicksight:. For example, to grant someone permission to run an Amazon EC2 instance with the Amazon EC2 RunInstances API operation, you include the ec2:RunInstances action in their policy. Policy
statements must include either an Action or NotAction element. Amazon QuickSight defines its own set of actions that describe tasks that you can perform with this service.

To specify multiple actions in a single statement, separate them with commas as follows:

```
"Action": [
    "quicksight:action1",
    "quicksight:action2"
]
```

You can specify multiple actions using wildcards (*). For example, to specify all actions that begin with the word Create, include the following action:

```
"Action": "quicksight:Create*"
```

Amazon QuickSight provides a number of AWS Identity and Access Management (IAM) actions. All Amazon QuickSight actions are prefixed with quicksight:, such as quicksight:Subscribe. For information about using Amazon QuickSight actions in an IAM policy, see IAM Policy Examples for Amazon QuickSight (p. 682).

To see the most up-to-date list of Amazon QuickSight actions, see Actions Defined by Amazon QuickSight in the IAM User Guide.

Resources

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Resource JSON policy element specifies the object or objects to which the action applies. Statements must include either a Resource or a NotResource element. As a best practice, specify a resource using its Amazon Resource Name (ARN). You can do this for actions that support a specific resource type, known as resource-level permissions.

For actions that don't support resource-level permissions, such as listing operations, use a wildcard (*) to indicate that the statement applies to all resources.

```
"Resource": "*"
```

Following is an example policy. It means that the caller with this policy attached, is able to invoke the CreateGroupMembership operation on any group, provided that the user name they are adding to the group is not user1.

```
{
    "Effect": "Allow",
    "Action": "quicksight:CreateGroupMembership",
    "Condition": {
        "StringNotEquals": {
            "quicksight:UserName": "user1"
        }
    }
}
```

Some Amazon QuickSight actions, such as those for creating resources, cannot be performed on a specific resource. In those cases, you must use the wildcard (*).
"Resource": "*

Some API actions involve multiple resources. To specify multiple resources in a single statement, separate the ARNs with commas.

"Resource": [  "resource1",  "resource2"

To see a list of Amazon QuickSight resource types and their ARNs, see Resources Defined by Amazon QuickSight in the IAM User Guide. To learn with which actions you can specify the ARN of each resource, see Actions Defined by Amazon QuickSight.

Condition Keys

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Condition element (or Condition block) lets you specify conditions in which a statement is in effect. The Condition element is optional. You can create conditional expressions that use condition operators, such as equals or less than, to match the condition in the policy with values in the request.

If you specify multiple Condition elements in a statement, or multiple keys in a single Condition element, AWS evaluates them using a logical AND operation. If you specify multiple values for a single condition key, AWS evaluates the condition using a logical OR operation. All of the conditions must be met before the statement's permissions are granted.

You can also use placeholder variables when you specify conditions. For example, you can grant an IAM user permission to access a resource only if it is tagged with their IAM user name. For more information, see IAM policy elements: variables and tags in the IAM User Guide.

AWS supports global condition keys and service-specific condition keys. To see all AWS global condition keys, see AWS global condition context keys in the IAM User Guide.

Amazon QuickSight does not provide any service-specific condition keys, but it does support using some global condition keys. To see all AWS global condition keys, see AWS Global Condition Context Keys in the IAM User Guide.

Examples

To view examples of Amazon QuickSight identity-based policies, see IAM Identity-Based Policies for Amazon QuickSight (p. 682).

Amazon QuickSight Policies (Resource-Based)

Amazon QuickSight doesn’t support resource-based policies. However, you can use the Amazon QuickSight console to configure access to other AWS resources in your AWS account.

Authorization Based on Amazon QuickSight Tags

Amazon QuickSight does not support tagging resources or controlling access based on tags.

Amazon QuickSight IAM Roles

An IAM role is an entity within your AWS account that has specific permissions. You can use IAM roles to group permissions together to make it easier to manage user's access to Amazon QuickSight actions.
Amazon QuickSight does not support the following role features:

- Service-linked roles
- Service roles.
- Temporary credentials (direct use): However, Amazon QuickSight uses temporary credentials to allow users to assume an IAM role to access embedded dashboards. For more information, see Working with Embedded Analytics (p. 575).

For more information on how Amazon QuickSight uses IAM roles, see Using Amazon QuickSight with IAM (p. 678) and IAM Policy Examples for Amazon QuickSight (p. 682).

**IAM Policy Examples for Amazon QuickSight**

This section provides examples of IAM policies that you can use with Amazon QuickSight.

**IAM Identity-Based Policies for Amazon QuickSight**

This section shows examples of identity-based policies to use with Amazon QuickSight.

**Topics**

- IAM Identity-Based Policies for Amazon QuickSight: Dashboards (p. 682)
- IAM Identity-Based Policies for Amazon QuickSight: Custom Permissions (p. 682)
- IAM Identity-Based Policies for Amazon QuickSight: Creating Users (p. 683)
- IAM Identity-Based Policies for Amazon QuickSight: All Access for Standard Edition (p. 683)
- IAM Identity-Based Policies for Amazon QuickSight: All Access for Enterprise Edition (p. 684)
- IAM Identity-Based Policies for Amazon QuickSight: Active Directory Groups (p. 685)
- IAM Identity-Based Policies for Amazon QuickSight: Accessing AWS Resources (p. 685)
- IAM Identity-Based Policies for Amazon QuickSight: Scoping Policies in Enterprise Edition (p. 686)

**IAM Identity-Based Policies for Amazon QuickSight: Dashboards**

The following example shows an IAM policy that enables dashboard sharing and embedding for specific dashboards.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Action": "quicksight:RegisterUser",
      "Resource": "*",
      "Effect": "Allow"
    },
    {
      "Action": "quicksight:GetDashboardEmbedUrl",
      "Resource": "arn:aws:quicksight:us-west-2:111122222333:dashboard/1a1ac22b2-3jfe3-4b44-5e5d-c6db6778df89",
      "Effect": "Allow"
    }
  ]
}
```

**IAM Identity-Based Policies for Amazon QuickSight: Custom Permissions**

The following example shows an IAM policy that enables a QuickSight administrator or a developer to manage custom permissions.
IAM Identity-Based Policies for Amazon QuickSight: Creating Users

The following example shows a policy that enables creating Amazon QuickSight users only. For quicksight:CreateReader, quicksight:CreateUser, and quicksight:CreateAdmin, you can limit the permissions to "Resource": "arn:aws:quicksight::<YOUR_AWS_ACCOUNTID>::user/${aws:userid}". For all other permissions described in this guide, use "Resource": ". The resource you specify limits the scope of the permissions to the specified resource.

IAM Identity-Based Policies for Amazon QuickSight: All Access for Standard Edition

The following example for Amazon QuickSight Standard edition shows a policy that enables subscribing, creating authors and readers. This example explicitly denies permission to unsubscribe from Amazon QuickSight.
This example is provided

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "ds:AuthorizeApplication",
            "ds:UnauthorizeApplication",
            "ds:CheckAlias",
            "ds:CreateAlias",
            "ds:DescribeDirectories",
            "ds:DescribeTrusts",
            "ds:DeleteDirectory",
            "ds:CreateIdentityPoolDirectory",
            "iam:ListAccountAliases",
            "quicksight:CreateUser",
            "quicksight:Subscribe"
         ],
         "Resource": "*"
      },
      {
         "Effect": "Deny",
         "Action": "quicksight:Unsubscribe",
         "Resource": "*"
      }
   ]
}
```

IAM Identity-Based Policies for Amazon QuickSight: All Access for Enterprise Edition

The following example for Amazon QuickSight Enterprise edition shows a policy that enables subscribing, creating users, and managing Active Directory. This example explicitly denies permission to unsubscribe from Amazon QuickSight.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "ds:AuthorizeApplication",
            "ds:UnauthorizeApplication",
            "ds:CheckAlias",
            "ds:CreateAlias",
            "ds:DescribeDirectories",
            "ds:DescribeTrusts",
            "ds:DeleteDirectory",
            "ds:CreateIdentityPoolDirectory",
            "iam:ListAccountAliases",
            "quicksight:CreateAdmin",
            "quicksight:Subscribe",
            "quicksight:GetGroupMapping",
            "quicksight:SearchDirectoryGroups",
            "quicksight:SetGroupMapping"
         ],
         "Resource": "*"
      },
      {
         "Effect": "Deny",
         "Action": "quicksight:Unsubscribe",
         "Resource": "*"
      }
   ]
}
```
IAM Identity-Based Policies for Amazon QuickSight: Active Directory Groups

The following example shows an IAM policy that enables Active Directory group management for an Amazon QuickSight Enterprise edition account.

```
{
    "Statement": [
        {
            "Action": [
                "ds:DescribeTrusts",
                "quicksight:GetGroupMapping",
                "quicksight:SearchDirectoryGroups",
                "quicksight:SetGroupMapping"
            ],
            "Effect": "Allow",
            "Resource": "*"
        }
    ],
    "Version": "2012-10-17"
}
```

IAM Identity-Based Policies for Amazon QuickSight: Accessing AWS Resources

The following example for Amazon QuickSight Enterprise and Standard editions shows a policy that you can use to enable a user to manage access to AWS resources. This is an optional step during setup, and the user only needs this access while they are configuring access.

This example also shows an optional condition you can add to limit access to this policy to users a specific AWS account, and to a specific date and time range. To learn more about best practices for securing IAM policies, see IAM Best Practices.

```
{
    "Version": "2012-10-17",
    "Id": "PolicyToUseAWSResourcesFromQuickSight",
    "Statement": [
        {
            "Sid": "AttachOnlyWhileSettingUpAccessToAwsResources",
            "Effect": "Allow",
            "Action": [
                "iam:AttachRolePolicy",
                "iam:DetachRolePolicy",
                "iam:ListAttachedRolePolicies",
                "iam:GetPolicy",
                "iam:CreatePolicyVersion",
                "iam:DeletePolicyVersion",
                "iam:GetPolicyVersion",
                "iam:ListPolicyVersions",
                "iam:DeleteRole",
                "iam:GetRole",
                "iam:ListRoles",
                "iam:ListEntitiesForPolicy",
                "s3:ListAllMyBuckets"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {"AWS:SourceAccount": "444455556666"},
                "DateGreaterThan": {"aws:CurrentTime": "2019-07-01T00:00:00Z"}
            }
        }
    ]
}
```
IAM Identity-Based Policies for Amazon QuickSight: Scoping Policies in Enterprise Edition

The following example for Amazon QuickSight Enterprise edition shows a policy that enables setting default access to AWS resources and scoping policies for permissions to AWS resources.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "quicksight:ScopeDownPolicy",
                "quicksight:AccountConfigurations"
            ],
            "Effect": "Allow",
            "Resource": "*"
        }
    ]
}
```

Provisioning Users for Amazon QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

**Self-Provisioning an Amazon QuickSight Administrator**

Amazon QuickSight administrators are users who can also manage Amazon QuickSight features such as account settings and user accounts. They can also purchase additional Amazon QuickSight user subscriptions, purchase SPICE (p. 78) capacity, and cancel the subscription to Amazon QuickSight for your AWS account.

You can use an AWS user or group policy to give users the ability to add themselves as administrators of Amazon QuickSight. Their accounts become active and billable the first time that they open Amazon QuickSight. To set up self-provisioning, you need to give them permission to use the quicksight:CreateAdmin action.

Alternatively, you can use the following procedure to use the console to set or create the administrator for Amazon QuickSight.

**To make a user the Amazon QuickSight administrator**

1. Create the AWS user:
   - Use IAM to create the user that you want to be the administrator of Amazon QuickSight. Alternatively, identify an existing user in IAM for the administrator role. You can also put the user inside a new group, for manageability.
- Grant the user (or group) sufficient permissions.
- Sign in to your AWS Management Console with the target user's credentials.

On success, the target IAM user is now an administrator in Amazon QuickSight.

**Self-Provisioning an Amazon QuickSight Author**

Amazon QuickSight authors can create data sources, data sets, analyses, and dashboards. They can share analyses and dashboards with other Amazon QuickSight users in your Amazon QuickSight account. However, they don't have access to the Manage Amazon QuickSight menu. They can't change account settings, manage user accounts, purchase additional Amazon QuickSight user subscriptions or SPICE (p. 78) capacity, or cancel the subscription to Amazon QuickSight for your AWS account.

You can use an AWS user or group policy to give users the ability to create an Amazon QuickSight author account for themselves. Their accounts become active and billable the first time they open Amazon QuickSight. To set up self-provisioning, you need to give them permission to use the `quicksight:CreateUser` action.

**Self-Provisioning an Amazon QuickSight Read-Only User**

Amazon QuickSight read-only users or readers can view and manipulate dashboards that are shared with them, but they can't make any changes or save a dashboard for further analysis. Amazon QuickSight readers can't create data sources, data sets, analyses, or visuals. They can't do any administrative tasks. Choose this role for people who are consumers of the dashboards but don't author their own analysis, for example, executives.

If you are using Microsoft Active Directory with Amazon QuickSight, you can manage read-only permissions by using a group. Otherwise, you can bulk-invite users to use Amazon QuickSight. You can also use an AWS user or group policy to give people the ability to create an Amazon QuickSight reader account for themselves.

Reader accounts become active and billable the first time they open Amazon QuickSight. If you decide to upgrade or downgrade a user, billing for that user is prorated for the month. To set up self-provisioning, you need to give them permission to use the `quicksight:CreateReader` action.

**Troubleshooting Amazon QuickSight Identity and Access**

<table>
<thead>
<tr>
<th>Applies to:</th>
<th>Enterprise Edition and Standard Edition</th>
</tr>
</thead>
</table>

| Intended audience: | System administrators |

Use the following information to help you diagnose and fix common issues that you might encounter when working with Amazon QuickSight and IAM.

**Topics**
- I Am Not Authorized to Perform an Action in Amazon QuickSight (p. 688)
- I Am Not Authorized to Perform iam:PassRole (p. 688)
- I Want to View My Access Keys (p. 688)
I Am Not Authorized to Perform an Action in Amazon QuickSight

If the AWS Management Console tells you that you're not authorized to perform an action, then you must contact your administrator for assistance. Your administrator is the person that provided you with your user name and password.

The following example error occurs when the mateojackson IAM user tries to use the console to view details about a widget but does not have quicksight:GetWidget permissions.

```
User: arn:aws:iam::123456789012:user/mateojackson is not authorized to perform: quicksight:GetWidget on resource: my-example-widget
```

In this case, Mateo asks his administrator to update his policies to allow him to access the my-example-widget resource using the quicksight:GetWidget action.

I Am Not Authorized to Perform iam:PassRole

If you receive an error that you're not authorized to perform the iam:PassRole action, then you must contact your administrator for assistance. Your administrator is the person that provided you with your user name and password. Ask that person to update your policies to allow you to pass a role to Amazon QuickSight.

Some AWS services allow you to pass an existing role to that service, instead of creating a new service role or service-linked role. To do this, you must have permissions to pass the role to the service.

The following example error occurs when an IAM user named marymajor tries to use the console to perform an action in Amazon QuickSight. However, the action requires the service to have permissions granted by a service role. Mary does not have permissions to pass the role to the service.

```
User: arn:aws:iam::123456789012:user/marymajor is not authorized to perform: iam:PassRole
```

In this case, Mary asks her administrator to update her policies to allow her to perform the iam:PassRole action.

I Want to View My Access Keys

After you create your IAM user access keys, you can view your access key ID at any time. However, you can't view your secret access key again. If you lose your secret key, you must create a new access key pair.

Access keys consist of two parts: an access key ID (for example, AKIAIOSFODNN7EXAMPLE) and a secret access key (for example, wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY). Like a user name and password, you must use both the access key ID and secret access key together to authenticate your requests. Manage your access keys as securely as you do your user name and password.

**Important**

Do not provide your access keys to a third party, even to help find your canonical user ID. By doing this, you might give someone permanent access to your account.

When you create an access key pair, you are prompted to save the access key ID and secret access key in a secure location. The secret access key is available only at the time you create it. If you lose your secret access key, you must add new access keys to your IAM user. You can have a maximum of two access keys.
If you already have two, you must delete one key pair before creating a new one. To view instructions, see Managing access keys in the IAM User Guide.

I'm an Administrator and Want to Allow Others to Access Amazon QuickSight

To allow others to access Amazon QuickSight, you must create an IAM entity (user or role) for the person or application that needs access. They will use the credentials for that entity to access AWS. You must then attach a policy to the entity that grants them the correct permissions in Amazon QuickSight.

To get started right away, see Creating your first IAM delegated user and group in the IAM User Guide.

I Want to Allow People Outside of My AWS Account to Access My Amazon QuickSight Resources

You can create a role that users in other accounts or people outside of your organization can use to access your resources. You can specify who is trusted to assume the role. For services that support resource-based policies or access control lists (ACLs), you can use those policies to grant people access to your resources.

To learn more, consult the following:

- To learn whether Amazon QuickSight supports these features, see Using Amazon QuickSight with IAM (p. 678).
- To learn how to provide access to your resources across AWS accounts that you own, see Providing access to an IAM user in another AWS account that you own in the IAM User Guide.
- To learn how to provide access to your resources to third-party AWS accounts, see Providing access to AWS accounts owned by third parties in the IAM User Guide.
- To learn how to provide access through identity federation, see Providing access to externally authenticated users (identity federation) in the IAM User Guide.
- To learn the difference between using roles and resource-based policies for cross-account access, see How IAM roles differ from resource-based policies in the IAM User Guide.

Using Identity Federation and Single Sign-on (SSO) with Amazon QuickSight

Applies to: Enterprise Edition and Standard Edition

Intended audience: System administrators

Amazon QuickSight supports identity federation in both Standard and Enterprise editions. When you use federated identities, you can manage users with your enterprise identity provider (IdP) and use AWS Identity and Access Management (IAM) to authenticate users when they sign in to Amazon QuickSight.

You can use a third-party identity provider that supports through Security Assertion Markup Language 2.0 (SAML 2.0) to provide a simple onboarding flow for your Amazon QuickSight users. Such identity providers include Microsoft Active Directory Federation Services, Okta, and Ping One Federation Server.

With identity federation, your users get one-click access to their Amazon QuickSight applications using their existing identity credentials. You also have the security benefit of identity authentication by your
identity provider. You can control which users have access to Amazon QuickSight using your existing identity provider.

Use the following topics to understand using an existing federation with AWS:

- Identity federation in AWS on the AWS website
- Providing access to externally authenticated users (identity federation) in the IAM User Guide
- Enabling SAML 2.0 federated users to access the AWS Management Console in the IAM User Guide

For information from some common providers, see the following third-party documentation:

- CA – Enabling SAML 2.0 HTTP Post Binding
- Okta – Planning a SAML deployment
- Ping – Amazon integrations

**Topics**

- Initiating Sign-On from the Identity Provider (IdP) (p. 690)
- Setting Up IdP Federation Using IAM and QuickSight (p. 691)
- Initiating Sign-On from Amazon QuickSight (p. 694)
- Setting Up Service Provider–Initiated Federation with Amazon QuickSight Enterprise Edition (p. 695)
- Tutorial: Accessing Amazon QuickSight Using Okta SSO (p. 696)

### Initiating Sign-On from the Identity Provider (IdP)

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

In this scenario, your users initiate the sign-on process from the identity provider's portal. After the users are authenticated, they sign in to QuickSight. After QuickSight checks that they are authorized, your users can access QuickSight.

Beginning with a user signing into the IdP, authentication flows through these steps:

1. The user browses to https://applications.example.com and signs on to the IdP. At this point the user isn't signed in to the service provider.
2. The federation service and the IdP authenticate the user:
   a. The federation service requests authentication from the organization's identity store.
   b. The identity store authenticates the user and returns the authentication response to the federation service.
   c. When authentication is successful, the federation service posts the SAML assertion to the user's browser.
3. The user opens QuickSight:
   a. The user's browser posts the SAML assertion to the AWS Sign-In SAML endpoint (https://signin.aws.amazon.com/saml).
   b. AWS Sign-In receives the SAML request, processes the request, authenticates the user, and forwards the authentication token to the Amazon QuickSight service.
4. Amazon QuickSight accepts the authentication token from AWS and presents QuickSight to the user.

From the user's perspective, the process happens transparently. The user starts at your organization's internal portal and lands at an Amazon QuickSight application portal, without ever having to supply any AWS credentials.

In the following diagram, you can find an authentication flow between Amazon QuickSight and a third-party identity provider (IdP). In this example, the administrator has set up a sign-in page to access Amazon QuickSight, called applications.example.com. When a user signs in, the sign-in page posts a request to a federation service that complies with SAML 2.0. The end user initiates authentication from the sign-on page of the IdP.

![Authentication Flow Diagram](diagram.png)

### Setting Up IdP Federation Using IAM and QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

You can use an AWS Identity and Access Management (IAM) role and a relay state URL to configure an identity provider (IdP) that is compliant with SAML 2.0. The role grants users permissions to access Amazon QuickSight. The relay state is the portal that the user is forwarded to, after successful authentication by AWS.

**Topics**
- Prerequisites (p. 692)
- Step 1: Create a SAML Provider in AWS (p. 692)
- Step 2: Configure Permissions in AWS for Your Federated Users (p. 692)
- Step 3: Configure the SAML IdP (p. 694)
Step 4: Create Assertions for the SAML Authentication Response (p. 694)
Step 5: Configure the Relay State of Your Federation (p. 694)

Prerequisites

Before configuring your SAML 2.0 connection, do the following:

- Configure your IdP to establish a trust relationship with AWS:
  - Inside your organization's network, configure your identity store, such as Windows Active Directory, to work with a SAML-based IdP. SAML-based IdPs include Microsoft Windows Active Directory Federation Services, Shibboleth, and so on.
  - Using your IdP, generate a metadata document that describes your organization as an identity provider.
  - Set up SAML 2.0 authentication, using the same steps as for the AWS Management Console. When this process is complete, you can configure your relay state to match the relay state of Amazon QuickSight. For more information, see Step 5: Configure the Relay State of Your Federation (p. 694).
  - Create an Amazon QuickSight account and note the name to use when you configure your IAM policy and IdP. For more information on creating an Amazon QuickSight account, see Signing Up for an Amazon QuickSight Subscription (p. 21).

After you create the setup to federate to the AWS Management Console as outlined in the tutorial, you can edit the relay state provided in the tutorial. You do so with the relay state of Amazon QuickSight, described in step 5 following.

For more information, see the following resources:

- Integrating Third-Party SAML Solution Providers with AWS in the IAM User Guide.
- Troubleshooting SAML 2.0 federation with AWS, also in the IAM User Guide.
- Setting up trust between ADFS and AWS and using Active Directory credentials to connect to Amazon Athena with ODBC driver – This walkthrough article is helpful, although you don't need to set up Athena in order to use QuickSight.

Step 1: Create a SAML Provider in AWS

Your SAML identity provider defines your organization's IdP to AWS. It does so by using the metadata document that you previously generated using your IdP.

To create a SAML provider in AWS

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. Create a new SAML provider, which is an entity in IAM that holds information about your organization's identity provider. For more information, see Creating SAML Identity Providers in the IAM User Guide.
3. As part of this process, upload the metadata document produced by the IdP software in your organization noted in the previous section.

Step 2: Configure Permissions in AWS for Your Federated Users

Next, create an IAM role that establishes a trust relationship between IAM and your organization's IdP. This role identifies your IdP as a principal (trusted entity) for the purposes of federation. The role also
defines which users authenticated by your organization's IDP are allowed to access Amazon QuickSight. For more information about creating a role for a SAML IDP, see Creating a Role for SAML 2.0 Federation in the IAM User Guide.

After you have created the role, you can limit the role to have permissions only to Amazon QuickSight by attaching an inline policy to the role. The following sample policy document provides access to Amazon QuickSight. This policy allows the user access to Amazon QuickSight and allows them to create both author accounts and reader accounts.

**Note**

In the following example, replace `<YOUR_AWS_ACCOUNT_ID>` with your 12-digit AWS account ID (with no hyphens '-').

```
{
  "Statement": [
    {
      "Action": [
        "quicksight:CreateUser"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:quicksight::<YOUR_AWS_ACCOUNT_ID>:user/${aws:userid}"
      ]
    },
    "Version": "2012-10-17"
  ]
}
```

If you want to provide access to Amazon QuickSight and also the ability to create Amazon QuickSight admins, authors (standard users), and readers, you can use the following policy example.

```
{
  "Statement": [
    {
      "Action": [
        "quicksight:CreateAdmin"
      ],
      "Effect": "Allow",
      "Resource": [
        "arn:aws:quicksight::<YOUR_AWS_ACCOUNT_ID>:user/${aws:userid}"
      ]
    },
    "Version": "2012-10-17"
  ]
}
```

You can view account details in the AWS Management Console.

After you have set up SAML and the IAM policy or policies, you don't need to invite users manually. The first time that users open Amazon QuickSight, they are provisioned automatically, using the highest level permissions in the policy. For example, if they have permissions to both quicksight:CreateUser and quicksight:CreateReader, they are provisioned as authors. If they also have permissions to quicksight:CreateAdmin, they are provisioned as admins. Each permission level includes the ability to create the same level user and below. For example, an author can add other authors or readers.

Users who are invited manually are created in the role assigned by the person who invited them. They don't need to have policies that grant them permissions.
Step 3: Configure the SAML IdP

After you create the IAM role, update your SAML IdP about AWS as a service provider. To do so, install the saml-metadata.xml file found at https://signin.aws.amazon.com/static/saml-metadata.xml.

To update the IdP metadata, see the instructions provided by your IdP. Some providers give you the option to type the URL, after which the IdP gets and installs the file for you. Others require you to download the file from the URL and then provide it as a local file.

For more information, see your IdP documentation.

Step 4: Create Assertions for the SAML Authentication Response

Next, configure the information that the IdP passes as SAML attributes to AWS as part of the authentication response. For more information, see Configuring SAML Assertions for the Authentication Response in the IAM User Guide.

Step 5: Configure the Relay State of Your Federation

Finally, configure the relay state of your federation to point to the QuickSight relay state URL. After successful authentication by AWS, the user is directed to Amazon QuickSight, defined as the relay state in the SAML authentication response.

The relay state URL for Amazon QuickSight is as follows:

https://quicksight.aws.amazon.com

Initiating Sign-On from Amazon QuickSight

Applies to: Enterprise Edition

Intended audience: System administrators

In this scenario, your user initiates the sign-on process from an Amazon QuickSight application portal without being signed on to the identity provider. In this case, the user has a federated account managed by a third-party IdP. The user might have an account on QuickSight. QuickSight sends an authentication request to the IdP. After the user is authenticated, QuickSight opens.

Beginning with the user signing into QuickSight, authentication flows through these steps:

1. The user opens QuickSight. At this point, the user isn't signed in to the IdP.
2. The user attempts to sign in to QuickSight.
3. QuickSight redirects the user's input to the federation service and requests authentication.
4. The federation service and the IdP authenticate the user:
   a. The federation service requests authentication from the organization's identity store.
   b. The identity store authenticates the user and returns the authentication response to the federation service.
   c. When authentication is successful, the federation service posts the SAML assertion to the user's browser.
   d. The user's browser posts the SAML assertion to the AWS Sign-In SAML endpoint (https://signin.aws.amazon.com/saml).
e. AWS Sign-In receives the SAML request, processes the request, authenticates the user, and forwards the authentication token to the Amazon QuickSight service.

5. Amazon QuickSight accepts the authentication token from AWS and presents QuickSight to the user.

From the user's perspective, the process happens transparently. The user starts at an Amazon QuickSight application portal. Amazon QuickSight negotiates authentication with your organization's federation service and AWS. QuickSight opens, without the user needing to supply any additional credentials.

### Setting Up Service Provider–Initiated Federation with Amazon QuickSight Enterprise Edition

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

After you have finished configuring your identity provider with AWS Identity and Access Management (IAM), you can set up service provider–initiated sign in through Amazon QuickSight Enterprise Edition. For QuickSight-initiated SSO to work, you need to authorize QuickSight to send the authentication request to your IdP. A QuickSight administrator can configure this by adding the following information provided by the IdP:

- The IdP URL – QuickSight redirects users to this URL for authentication.
- The relay state parameter – This parameter relays the state that the browser session was in when it was redirected for authentication. The IdP redirects the user back to the original state after authentication. The state is provided in the form of a URL.

The following table shows the standard authentication URL and relay state parameter for redirecting the user to the QuickSight URL that you provide.

<table>
<thead>
<tr>
<th>Identity provider</th>
<th>Parameter</th>
<th>Authentication URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auth0</td>
<td>RelayState</td>
<td>https://&lt;sub_domain&gt;.auth0.com/samlp/&lt;app_id&gt;</td>
</tr>
<tr>
<td>Google accounts</td>
<td>RelayState</td>
<td><a href="https://accounts.google.com/o/saml2/initssoidpid=">https://accounts.google.com/o/saml2/initssoidpid=</a>&lt;idp_id&gt;&amp;spid=&lt;sp_id&gt;&amp;forceauthn=false</td>
</tr>
<tr>
<td>Microsoft Azure</td>
<td>RelayState</td>
<td><a href="https://myapps.microsoft.com/signin/">https://myapps.microsoft.com/signin/</a>&lt;app_name&gt;/app_id?tenantId=&lt;tenant_id&gt;</td>
</tr>
<tr>
<td>Okta</td>
<td>RelayState</td>
<td>https://&lt;sub_domain&gt;.okta.com/app/&lt;app_name&gt;/app_id/sso</td>
</tr>
<tr>
<td>PingFederate</td>
<td>TargetResource</td>
<td>https://&lt;host&gt;/idp/idp_id/startSSO.ping?PartnerSpId=&lt;sp_id&gt;</td>
</tr>
<tr>
<td>PingOne</td>
<td>TargetResource</td>
<td><a href="https://sso.connect.pingidentity.com/sso/sp/initssoidpid=">https://sso.connect.pingidentity.com/sso/sp/initssoidpid=</a>&lt;app_id&gt;&amp;idpid=&lt;idp_id&gt;</td>
</tr>
</tbody>
</table>

QuickSight supports connecting to one IdP per AWS account. The configuration page in QuickSight provides you with test URLs based on your entries, so you can test the settings before you turn the feature on. To make the process even more seamless, QuickSight provides a parameter (enable-sso=0) to temporarily turn off QuickSight initiated SSO, in case you need to disable it temporarily.
To set up QuickSight as a service provider that can initiate SSO for an existing IdP

1. Make sure that you already have SSO set up in your IdP, in IAM, and QuickSight. To test this setup, check if you can share a dashboard with another person in your company’s domain.
2. Open QuickSight, and choose Manage QuickSight from your profile menu at upper right.
   To perform this procedure, you need to be a QuickSight administrator. If you aren’t, you can’t see Manage QuickSight under your profile menu.
3. Choose Single sign-on (SSO) from the navigation pane.
4. For Configuration, IdP URL, enter the URL that your IdP provides to authenticate users.
5. For IdP URL, enter the parameter that your IdP provides to relay state, for example RelayState. The actual name of the parameter is provided by your IdP.
6. Test signing in:
   • To test signing in with your identity provider, use the custom URL provided in Test starting with your IdP. You should arrive at the start page for QuickSight, for example https://quicksight.aws.amazon.com/sn/start.
   • To test signing in with QuickSight first, use the custom URL provided in Test the end-to-end experience. The enable-sso parameter is appended to the URL. If enable-sso=1, SSO attempts to authenticate.
7. Choose Save to keep your settings.

To enable service provider-initiated SSO IdP

1. Make sure your SSO settings are configured and tested. If you’re not sure about the configuration, test the connection by using the URLs from the previous procedure.
2. Open QuickSight, and choose Manage QuickSight from your profile menu.
3. Choose Single sign-on (SSO) from the navigation pane.
4. For Status, choose ON.
5. Verify that it’s working by disconnecting from your IdP and opening QuickSight.

To disable service provider initiated SSO

1. Open QuickSight, and choose Manage QuickSight from your profile menu.
2. Choose Single sign-on (SSO) from the navigation pane.
3. For Status, choose OFF.

Tutorial: Accessing Amazon QuickSight Using Okta SSO

Applies to: Enterprise Edition and Standard Edition

Intended audience: Amazon QuickSight Administrators and Amazon QuickSight developers

In the following tutorial, you can find a walkthrough for setting up the IdP Okta as a federation service for Amazon QuickSight. Although this tutorial shows the integration of AWS Identity and Access Management (IAM) and Okta, you can also replicate this solution using your choice of SAML 2.0 IdPs.
In the following procedure, you create an app in the Okta IdP using their "AWS Account Federation" shortcut. Okta describes this integration app as follows:

"By federating Okta to Amazon Web Services (AWS) Identity and Access Management (IAM) accounts, end users get single sign-on access to all their assigned AWS roles with their Okta credentials. In each AWS account, administrators set up federation and configure AWS roles to trust Okta. When users sign in to AWS, they get Okta single sign-in experience to see their assigned AWS roles. They can then select a desired role, which defined their permissions for the duration of their authenticated session. Customers with large numbers of AWS Accounts, check out the AWS Single Sign-On app as an alternative." (https://www.okta.com/aws/)

To create an Okta app using Okta's "AWS Account Federation" application shortcut

1. Sign in to your Okta dashboard. If you don’t have one, create a free Okta Developer Edition account by using this QuickSight-branded URL. When you have activated your email, sign in to Okta.
2. On the Okta website, choose <> Developer Console at upper left, and then choose Classic UI.
3. Choose Add Applications, and choose Add app.
4. Enter aws for Search, and choose AWS Account Federation from the search results.
5. Choose Add to create an instance of this application.
6. For Application label, enter AWS Account Federation - QuickSight.
7. Choose Next.
9. Open the context (right-click) menu for Identity Provider metadata, and choose to save the file. Name the file metadata.xml. You need this file in the next procedure.

The contents of the file look similar to the following.

```xml
  <md:IDPSSODescriptor WantAuthnRequestsSigned="false" protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
    <md:KeyDescriptor use="signing">
      <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
        <ds:X509Data>
          <ds:X509Certificate>
            MIIDpjCCAo6gAwIBAgIGAXVjA82hMA0GCSqGSG1b3DQE8CvUMvMIGfMwEwJUsQGEMwJUVzETMBEG.
            . (certificate content omitted)
            .
            QE/6cRdPQ6v/eaPpUL6Asd6q3sBeq+giRG4=
          </ds:X509Certificate>
        </ds:X509Data>
      </ds:KeyInfo>
    </md:KeyDescriptor>
    <md:NameIDFormat>urn:oasis:names:tc:SAML:1.1:nameid-format:emailAddress</md:NameIDFormat>
    <md:NameIDFormat>urn:oasis:names:tc:SAML:2.0:nameid-format:unspecified</md:NameIDFormat>
  </md:IDPSSODescriptor>
</md:EntityDescriptor>
```

10. After you have the XML file saved, scroll to the bottom of the Okta page, and choose Done.
11. Leave this browser window open, if possible. You need it later in the tutorial.
Next, you create an identity provider in your AWS account.

**To create a SAML provider in AWS Identity and Access Management (IAM)**

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. In the navigation pane, choose **Identity providers, Create Provider**.
3. Enter the following settings:
   - **Provider Type** – Choose **SAML** from the list.
   - **Provider Name** – Enter **Okta**.
   - **Metadata Document** – Upload the XML file `manifest.xml` from the previous procedure.
4. Choose **Next Step, Create**.
5. Locate the IdP that you just created and choose it to view the settings. Note the **Provider ARN**. You need this to finish the tutorial.
6. Verify that the identity provider is created with your settings. In IAM, choose **Identity providers, Okta** (the IdP you just added), **Download metadata**. The file should be the one that you just uploaded.

Next, you create an IAM role to enable the SAML 2.0 federation to act as a trusted entity in your AWS account. For this step, you need to choose how you want to provision users in Amazon QuickSight. You can do one of the following:

- Grant permission to the IAM role so that first-time visitors become QuickSight users automatically.
- Provision QuickSight users in advance by using the QuickSight API. By choosing this option, you can provision users and add them to groups at the same time. For more information, see Creating a Group in Amazon QuickSight (p. 710).

**To create an IAM role for a SAML 2.0 federation as a trusted entity**

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. In the navigation pane, choose **Roles, Create Role**.
3. For **Select type of trusted entity**, choose the card labeled **SAML 2.0 federation**.
4. For **SAML provider**, select the IdP that you created in the previous procedure, for example **Okta**.
5. Enable the option **Allow programmatic and AWS Management Console access**.
6. Choose **Next: Permissions**.
7. Paste the following policy into the editor.

   In the policy editor, update the JSON with your provider's Amazon Resource Name (ARN).

   ```json
   {
   "Version": "2012-10-17",
   "Statement": [
   {
   "Effect": "Allow",
   "Action": "sts:AssumeRoleWithSAML",
   "Resource": "arn:aws:iam::111111111111:saml-provider/Okta",
   "Condition": {
   "StringEquals": {
   "saml:aud": "https://signin.aws.amazon.com/saml"
   }
   }
   ]
   }
   ```
9. For Name, enter QuicksightOktaFederatedPolicy, and then choose Create policy.
10. Choose Create policy, JSON a second time.
11. Paste the following policy into the editor.

   In the policy editor, update the JSON with your AWS account ID. It should be the same account ID that you used in the previous policy in the provider ARN.

   ```json
   {
   "Version": "2012-10-17",
   "Statement": [
   {
   "Action": [
   "quicksight:CreateReader"
   ],
   "Effect": "Allow",
   "Resource": [
   "arn:aws:quicksight::{account_id}:user/${aws:username}"
   ]
   }
   ]
   }
   ```

   If you wish to do so, you can omit the AWS Region name in the ARN, as shown following.

   ```json
   arn:aws:quicksight::{account_id}:user/${aws:username}
   ```

13. For Name, enter QuicksightCreateReader, and then choose Create policy.
14. Refresh the list of policies by choosing the refresh icon at right.
15. For Search, enter QuicksightOktaFederatedPolicy. Choose the policy to enable it.

   If you don't want to use automatic provisioning, you can skip the following step.

   To add a QuickSight user, use register-user. To add a QuickSight group, use create-group. To add users to the QuickSight group, use create-group-membership.

   16. (Optional) For Search, enter QuicksightCreateReader. Choose the policy to enable it.

   Do this step if you want to provision QuickSight users automatically, rather than using the QuickSight API.

   The QuicksightCreateReader policy enables automatic provisioning by allowing use of the quicksight:CreateReader action. Doing this grants dashboard subscriber (reader-level) access to first-time users. A QuickSight administrator can later upgrade them from the QuickSight profile menu, Manage QuickSight, Manage users.

   17. To continue attaching the IAM policy or policies, choose Next: Tags.
18. Choose Next: Review.
19. For Role name, enter QuicksightOktaFederatedRole, and choose Create role.
20. Verify that you completed this successfully by taking these steps:

   a. Return to the main page of the IAM console at https://console.aws.amazon.com/iam/. You can use your browser’s Back button.
b. Choose Roles.
c. For Search, enter Okta. Choose QuicksightOktaFederatedRole from the search results.
d. On the Summary page for the policy, examine the Permissions tab. Verify that the role has the policy or policies that you attached to it. It should have QuicksightOktaFederatedPolicy. If you chose to add the ability to create users, it should also have QuicksightCreateReader.
e. Use the icon to open each policy. Verify that the text matches what is shown in this procedure. Double-check that you added your own AWS account number in place of the example account number 111111111111.
f. On the Trust relationships tab, verify that the Trusted entities field contains the ARN for the identity provider. You can double-check the ARN in the IAM console by opening Identity providers, Okta.

g. To create an access key for Okta
1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. Add a policy that allows Okta to display a list of IAM roles to the user. To do this, choose Policy, Create policy.
3. Choose JSON, then enter the following policy.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "iam:ListRoles",
        "iam:ListAccountAliases"
      ],
      "Resource": "*"
    }
  ]
}
```
5. For Name, enter OktaListRolesPolicy. Then choose Create policy.
6. Add a user so you can provide Okta with an access key.

   In the navigation pane, choose Users, Add User.
7. Use the following settings:
   - For User name, enter OktaSSOUser.
   - For Access type, enable Programmatic access.
8. Choose Next: Permissions.
9. Choose Attach existing policies directly.
10. For Search, enter OktaListRolesPolicy, and choose OktaListRolesPolicy from the search results.
11. Choose Next: Tags, and then choose Next: Review.
12. Choose Create user. Now you can get the access key.
13. Download the key file by choosing Download .csv. The file contains the same access key ID and secret access key that displays on this screen. However, because AWS doesn't display this information a second time, make sure to download the file.
14. Verify that you completed this step correctly by doing the following:

   a. Open the IAM console, and choose Users. Search for OktaSSOUser, and open it by choosing the user name from the search results.
   b. On the Permissions tab, verify that the OktaListRolesPolicy is attached.
   c. Use the icon to open the policy. Verify that the text matches what is shown in this procedure.
   d. On the Security credentials tab, you can check the access key, although you already downloaded it. You can return to this tab to create an access key when you need a new one.

In the following procedure, you return to Okta to provide the access key. The access key works with your new security settings to enables AWS and the Okta IdP to work together.

To finish configuring the Okta application with AWS settings

1. Return to your Okta dashboard. If requested to do so, sign in. If the developer console is no longer open, choose Admin to reopen it.
2. If you have to reopen Okta, you can return to this section by following these steps:
   b. Choose AWS Account Federation - QuickSight—the application you created at the beginning of this tutorial.
   c. Choose the Sign On tab, between General and Mobile.
4. For Identity Provider ARN (Required only for SAML SSO), enter the provider ARN from the previous procedure, for example:

```
arn:aws:iam::111122223333:saml-provider/Okta
```
5. Choose Done or Save. The name of the button varies depending if you are creating or editing the application.
6. Choose the Provisioning tab, and at the lower part of the tab, choose Configure API Integration.
7. Turn on Enable API integration to display the settings.
8. For Access Key and Secret Key, provide the access key and secret key that you downloaded previously to a file named OktaSSOUser_credentials.csv.
9. Choose Test API Credentials. Look above the Enable API integration setting for a message confirming that "AWS Account Federation was verified successfully".
10. Choose Save.
11. Make sure that To App is highlighted at left, and choose Edit at right.
12. For Create Users, turn on the option Enable.
13. Choose Save.
14. On the Assignments tab, near Provisioning and Import, choose Assign.
15. Do one or more of the following to enable federated access:
   a. To work with individual users, choose Assign to People.
   b. To work with IAM groups, choose Assign to Groups. You can choose specific IAM groups or Everyone (All users in your organization).
16. For each IAM user or group, do the following:
   a. Choose Assign, Role.
   b. Select QuicksightOktaFederatedRole from the list of IAM roles.
c. For SAML User Roles, enable QuicksightOktaFederatedRole.

17. Choose Save and Go Back, and then choose Done.

18. Verify that you completed this step correctly by choosing the People or Groups filter at left, and checking the users or groups that you entered. If you can't complete this process because the role that you created doesn't appear in the list, return to the previous procedures to verify the settings.

To sign in to QuickSight using Okta (IdP to service provider sign-in)

1. If you are using an Okta administrator account, switch to user mode.
2. Sign in to your Okta Applications dashboard with a user that has been granted federated access. You should see a new application with your label, for example AWS Account Federation - QuickSight.
3. Choose the application icon to launch AWS Account Federation - QuickSight.

You can now manage identities using Okta and use federated access with Amazon QuickSight.

The following procedure is an optional part of this tutorial. If you follow its steps, you authorize QuickSight to forward authorizations requests to the IdP on behalf of your users. Using this method, users can sign in to QuickSight with no need to sign in using the IdP page first.

(Optional) To set up QuickSight to send authentication requests to Okta

1. Open QuickSight, and choose Manage QuickSight from your profile menu.
2. Choose Single sign-on (SSO) from the navigation pane.
3. For Configuration, IdP URL, enter the URL that your IdP provides to authenticate users, for example https://dev-1-----0.okta.com/home/amazon_aws/0oabababababaGQei5d5/282. You can find this in your Okta app page, on the General tab, in Embed Link.
4. For IdP URL, enter RelayState.
5. Do one of the following:
   • To test signing in with your identity provider first, use the custom URL provided in Test starting with your IdP. You should arrive at the start page for QuickSight, for example https://quicksight.aws.amazon.com/sn/start.
   • To test signing in with QuickSight first, use the custom URL provided in Test the end-to-end experience. The enable-sso parameter is appended to the URL. If enable-sso=1, SSO attempts to authenticate. If enable-sso=0, QuickSight doesn't send the authentication request, and you sign in to QuickSight as before.
6. For Status, choose ON.
7. Choose Save to keep your settings.

You can create a deep link to a QuickSight dashboard to enable users to use SSO to connect directly to specific dashboards. To do this, you append the relay state flag and dashboard URL to the Okta single sign-on URL, as described following.

To create a deep link to a QuickSight dashboard for single sign-on

1. Locate the Okta application's single sign-on (SSO) URL in the metadata.xml file that you downloaded beginning of the tutorial. You can find the URL near the bottom of the file, in the element named md:SingleSignOnService. The attribute is named Location and the value ends with /sso/saml, as shown in the following example.

2. Take the value of the SSO URL and append `?RelayState=` followed by the URL of your QuickSight dashboard. The RelayState parameter relays the state (the URL) that the user was in when they were redirected to the authentication URL.

3. To the new SSO with the relay state added, append the URL of your QuickSight dashboard. The resulting URL should resemble the following.

```
https://dev-1-----0.okta.com/app/amazon_aws/abcdef2hATwiVft645d5/sso/saml?RelayState=https://us-west-2.quicksight.aws.amazon.com/sn/analyses/12a12a2a-121a-212a-121a-abcd12abc1ab
```

4. If the link you create doesn't open, check that you are using the most recent SSO URL from the metadata.xml. Also check that the user name you use to sign in isn't assigned in more than one SSO Okta app.

## Using Active Directory with Amazon QuickSight

### Enterprise Edition

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

Amazon QuickSight Enterprise edition supports both AWS Directory Service for Microsoft Active Directory and Active Directory Connector.

To create a new directory to be your identity manager for Amazon QuickSight, use AWS Directory Service for Microsoft Active Directory, also known as AWS Managed Microsoft AD. This is an Active Directory host in the AWS Cloud that offers most of the same functionality of Active Directory. Currently, you can connect to Active Directory in any AWS Region supported by Amazon QuickSight, except for Asia Pacific (Singapore). When you create a directory, you use it with a virtual private cloud (VPC). For more information, see [VPC](p. 731).

If you have an existing directory that you want to use for Amazon QuickSight, you can use Active Directory Connector. This service redirects directory requests to your Active Directory—in another AWS Region or on-premises—without caching any information in the cloud.

For a walkthrough about creating and managing a directory with AWS Managed Microsoft AD, see [Use an AWS Managed Microsoft AD with Amazon QuickSight?](in the AWS Knowledge Center).

When you use AWS Directory Service to launch a directory, AWS creates an organizational unit (OU) with the same name as your domain. AWS also creates an administrative account with delegated administrative rights for the OU. You can create user accounts, groups, and policies within the OU by using Active Directory users and groups. For more information, see [Best Practices for AWS Managed Microsoft AD](in the Directory Service Administration Guide).

After you establish your directory, you use it with Amazon QuickSight by creating at least three groups for users:

- **Amazon QuickSight admins** – Admins can change account settings, manage user accounts. Admins can also purchase additional Amazon QuickSight user subscriptions or [SPICE](p. 78) capacity, or cancel the subscription to Amazon QuickSight for your AWS account.

- **Amazon QuickSight authors** – Amazon QuickSight authors can create data sources, data sets, analyses, and dashboards. They can share analyses and dashboards with other Amazon QuickSight users.
• **Amazon QuickSight readers** – Readers can view and interact with dashboards that were created by someone else.

You can add or refine access by applying IAM policies. For example, you can use IAM policies to allow users to subscribe themselves.

When you subscribe to Amazon QuickSight Enterprise edition and choose Active Directory as your identity provider, you can associate your AD groups with Amazon QuickSight. You can also add or change your AD groups later on.

**Directory Integration with Amazon QuickSight Enterprise Edition**

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

Amazon QuickSight Enterprise supports the following options:

- AWS Directory Service
- AWS Directory Service with AD Connector
- On-premises Active Directory with SSO or AD Connector
- SSO using AWS Single Sign-On service or another third-party federation service

If you want to use SSO with an on-premises Active Directory, you implement AWS Directory Service as a separate Active Directory with a trust relationship to the on-premises Active Directory.

If you want to avoid using a trust relationship, you can deploy a standalone domain for authentication within AWS. Then you could create users and groups in Active Directory, and map them to users and groups in Amazon QuickSight Users would authenticate using their Active Directory login credentials. To make access to Amazon QuickSight transparent to your users, you need to use SSO in this scenario.

**Using Multi-Factor Authentication (MFA) with Amazon QuickSight**

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

There are several ways you can use multi-factor authentication (MFA) with Amazon QuickSight. You can use it with AWS Identity and Access Management (IAM). You can use it with AD Connector or your AWS Directory Service for Microsoft Active Directory, also known as AWS Microsoft Active Directory or AWS Managed Microsoft Active Directory. And if you use an external identity provider (IdP), AWS doesn't need to have any information about MFA because that is part of the authentication handled by the IdP.
For more information, see the following:

- Using multi-factor authentication (MFA) in AWS in the IAM User Guide
- Enable Multi-Factor Authentication for AWS Managed Microsoft AD in the AWS Directory Service Administration Guide
- Enable Multi-Factor Authentication for AD Connector in the AWS Directory Service Administration Guide

If you’re a developer, see the following:

- How do I use an MFA token to authenticate access to my AWS resources through the AWS CLI in the AWS Knowledge Center
- Configuring MFA-protected API access in the IAM User Guide

Managing User Access Inside Amazon QuickSight

**Intended audience:** System administrators and Amazon QuickSight administrators

Amazon QuickSight administrators can use the following topics to manage user access to Amazon QuickSight and Amazon QuickSight access to AWS resources.

**Topics**

- Managing Users in Amazon QuickSight Standard Edition (p. 705)
- Inviting Users to Access Amazon QuickSight (p. 706)
- Viewing Amazon QuickSight User Account Details (p. 708)
- Deleting a User Account (p. 708)
- Creating a Group in Amazon QuickSight (p. 710)
- Managing User Accounts in Amazon QuickSight Enterprise Edition (p. 711)

Managing Users in Amazon QuickSight Standard Edition

**Applies to:** Standard Edition

**Intended audience:** Amazon QuickSight administrators

Use this topic to learn more about managing user accounts in Amazon QuickSight Standard edition.

If you have administrative privileges in Amazon QuickSight, you can create and delete user accounts. You can create user accounts based on AWS Identity and Access Management (IAM) credentials, or you can create Amazon QuickSight–only user accounts using the email address of the user.

You can't create Amazon QuickSight user accounts using AWS credentials that aren't IAM credentials. Federated logins work through IAM roles.

User names that contain a semicolon (;) aren't supported.

Each Amazon QuickSight Standard edition account can have up to 100 user accounts, including the AWS root account or IAM account that created the Amazon QuickSight account. If you need an exception to
this limit, follow the instructions in AWS Service Limits in the AWS General Reference to submit a limit increase request.

**Note**
Currently, email addresses are case-sensitive.

Inviting Users to Access Amazon QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** Amazon QuickSight administrators

In Standard edition, and in Enterprise edition using SSO, you can invite any person with a valid email address to use Amazon QuickSight. When they sign up, a new Amazon QuickSight-only user account is created for them. You can also invite IAM users in your AWS account to use Amazon QuickSight. In this case, they can use their IAM credentials to sign in to Amazon QuickSight. Any IAM user you invite must have a password associated with their IAM credentials, and you must also have an email address for them.

User accounts are created in two steps. First, you invite a user to join Amazon QuickSight. Doing this creates an inactive user account in Amazon QuickSight, and sends an invitation email to the user. When the user accepts the invitation and signs in for the first time, the user creates a password to activate the user account.

For information about signing in for the first time, see Signing In to Amazon QuickSight (p. 23).

Use the following procedure to invite a user to access Amazon QuickSight.

1. Choose your user name on the application bar and then choose **Manage QuickSight**.
2. Choose **Manage Users**. On this screen, you can manage users who already exist in your account.

![QuickSight](image)

3. Choose **Invite users**.
4. In the **Invite users to this account** screen, enter a new user name for a person to whom you want to grant access to Amazon QuickSight. If the user is an IAM user, enter their IAM user name. Then press +. A user's IAM user name can be the same as their email address.

Repeat this step until you have entered everyone who you want to invite. Then go to the next step to enter details.
5. For **Email**, enter an email address for the user account.

   **Note**
   Currently, email addresses are case-sensitive.

6. For **Role**, choose the role to assign to each person you're inviting. A *role* determines the permission level to grant to that user account.

   - Choose **ADMIN** if you want the user to be able to both use Amazon QuickSight for authoring and for performing administrative tasks like managing users or purchasing SPICE (p. 78) capacity.

   There are some differences in the administrative tasks that IAM admin users and Amazon QuickSight admin users can perform. These differences occur because some administrative tasks require permissions in AWS, which Amazon QuickSight–only users lack. The differences are these:

   - Admin users can manage users, SPICE capacity, and subscriptions.
   - Admin users who are also IAM admin users can also manage users, SPICE capacity, and subscriptions. In addition, they can manage Amazon QuickSight permissions to AWS resources, upgrade to Enterprise edition, and unsubscribe from Amazon QuickSight.

   If you want to create an admin user with IAM admin access, check with your AWS administrator. Make sure that the IAM user has the all necessary statements in their IAM permissions policy to work with Amazon QuickSight resources. For more information about what statements are required, see [IAM Policy Examples for Amazon QuickSight](p. 682).

   - To set the user to be able to author analyses and dashboards in Amazon QuickSight but not perform any administrative tasks, choose **AUTHOR**.

   - In Enterprise edition, you can set users to be able to interact with shared dashboards, but not author analyses or dashboards or perform any administrative tasks. To do this, choose **READER**.

7. For **IAM User**, verify that it says **Yes** for accounts that are associated with IAM users, and **No** for those that are Amazon QuickSight-only.

8. (Optional) To delete a user, choose the delete icon at the end of the relevant row.

9. Choose **Invite**.

**Resend an Invitation to a User**

The sign-up URL in the invitation email expires after 7 days. To resend an invitation to someone, use the following procedure.

1. Choose your user name on the application bar and then choose **Manage QuickSight**.
2. Choose Manage Users.
3. Find the entry for the person you want to re-invite, and choose Resend invitation for that user.
4. Choose Confirm.

Viewing Amazon QuickSight User Account Details

**Intended audience:** Amazon QuickSight administrators

You can view Amazon QuickSight user accounts on the Manage Users page. To view a user account, use the following procedure.

1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Manage Users to view details about people who are QuickSight users. The information that displays includes:
   - Username – The person's user name.
   - Email – The email associated with this user name.
   - Role – The security cohort that the person's user name belongs to: ADMIN, AUTHOR, or READER.
   - Last active – The last date and time that this person accessed the QuickSight console. Anyone who isn't an active user has a Last active status of User has no activity.

You can also see deleted or inactive users in this screen.
3. To find a user name, enter a part or all of a user's name or email the search box. Search is case-insensitive and wildcards aren't supported. To clear the search results and view all user names, delete your search entry.

Deleting a User Account

**Intended audience:** Amazon QuickSight administrators

User accounts can be deleted by either an AWS administrator or an Amazon QuickSight administrator. Deleting a user account works the same in both the Standard and Enterprise editions of Amazon QuickSight.

Deleting a user account removes or transfers their resources. In Enterprise edition, the network administrator can temporarily deactivate a user account by removing it from the network group that has access to Amazon QuickSight. If a user is deleted, but not deactivated, that user can still access Amazon QuickSight as a new user. For more information about deactivating an Enterprise user account, see Deactivating Active Directory User Accounts (p. 712).

Use the following procedure to delete a user account.

1. Choose your user name on the application bar and then choose Manage QuickSight.
2. Choose Manage Users.
3. Locate the user account you want to delete and then choose the delete icon at the end of that row.
4. Choose to either delete or transfer any resources owned by the user and then choose OK.
5. Do one of the following:

- If you chose to transfer user resources, enter the user name of the account to transfer them to and then choose **Delete and transfer resources**.

- If you chose to delete user resources, choose **Delete**. You can't undo this action.
Creating a Group in Amazon QuickSight

You can create user groups inside Amazon QuickSight so you don’t have to manage users individually. For example, you can create groups for specific dashboards so you can manage security.

Before you begin, you need to have the AWS CLI installed. For more information, see Installing the AWS CLI in the AWS CLI User Guide.

Use the following procedure to create an Amazon QuickSight user group.

1. Open a terminal window. If you are using Microsoft Windows, open a command prompt.
2. Enter the following command at the prompt to create a group. Substitute the correct values for your parameters.

   ```
   aws quicksight create-group
   --aws-account-id=111122223333
   --namespace=default
   --group-name="Sales-Management"
   --description="Sales Management - Forecasting"
   ```

   You might find it easier to create the command in a text editor before entering it at the prompt. For more information on create-group, and other available commands, see the Amazon QuickSight API Reference.

3. Verify that the group exists by using a command similar to one of the following. The following command lists all groups.

   ```
   aws quicksight list-groups
   --aws-account-id=111122223333
   --namespace=default
   ```

   The following command describes a specific group.

   ```
   aws quicksight describe-group
   --aws-account-id=111122223333
   --namespace=default
   --group-name=Sales
   ```

4. Add a member to the new group by using a command similar to the following.
Managing User Accounts in Amazon QuickSight Enterprise Edition

**Applies to:** Enterprise Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

AWS administrators can use this topic to learn more about managing user accounts in Amazon QuickSight Enterprise edition. For information about managing user accounts in Amazon QuickSight Standard edition, see Managing User Access Inside Amazon QuickSight (p. 705).

In Enterprise edition, you can manage users through any of the following:

- Microsoft Active Directory. You can add and remove Active Directory directory groups to create and deactivate user accounts. You can access the directory groups directly or by using the AD Connector.
- Federated logins.
- Inviting users by email.

To manage users in these ways, you must have both administrative privileges in Amazon QuickSight and also appropriate AWS permissions. For more information on the necessary AWS permissions, see IAM Policy Examples for Amazon QuickSight (p. 682). If you are using directory groups, you need to be a network administrator.

Each Amazon QuickSight Enterprise edition account can have an unlimited number of user accounts. User names that contain a semicolon ( ; ) aren't supported.

Use the following procedures to add, view, and deactivate Amazon QuickSight Enterprise edition user accounts.

**Important**

You can't remap Amazon QuickSight users or groups from one identity store to another. For example, if you are managing from an on-premises Active Directory to AWS Directory Service, or the other way around, you unsubscribe and resubscribe to Amazon QuickSight. You do this because even if the user's aliases remain the same, the underlying identity data changes. To make the transition easier, request in advance that your users document all their Amazon QuickSight assets and settings before the migration.

**Adding User Accounts**

Whether you are using federated logins or inviting users by email or using Microsoft Active Directory, an Amazon QuickSight administrator can directly add users to Amazon QuickSight. If you are using Active Directory, you can also manage users through groups. You can create multiple user accounts at once by choosing one or more Active Directory groups to integrate with Amazon QuickSight. All users in the selected groups are authorized to sign in to Amazon QuickSight. You can also add user accounts individually by adding those users to Active Directory groups that are already integrated with Amazon QuickSight.
To see what groups are integrated with your Amazon QuickSight account, use the procedure in Viewing User Account Details (p. 712). For more information about adding a user to an Active Directory directory group, see Add Users and Groups (Simple AD and Microsoft Active Directory). Or you can read more about how to connect to a directory using AD Connector.

Users who are invited by email are notified how to sign in. Other users aren't automatically notified of their access to Amazon QuickSight. You or your assigned Amazon QuickSight administrator must provide users with your Amazon QuickSight account name, the sign-in URL (https://quicksight.aws.amazon.com/), and instructions to sign in.

**Note**

Although you can manage users through Active Directory groups or as AWS Identity and Access Management (IAM) users, you don't have to do it this way. You can instead choose to invite Amazon QuickSight–only users by email. Choose the Manage Users feature of the Manage QuickSight page, and enter an email address to invite someone to join your Amazon QuickSight account. Each user gets an email containing a link to Amazon QuickSight. Using the invitation link, the user can then set up a user name and password in Amazon QuickSight. Users can also request access through self-provisioning. For more information on requesting access, see Provisioning Users for Amazon QuickSight (p. 686). Amazon QuickSight subscriptions based on Active Directory can only have users provisioned in Active Directory.

### Viewing User Account Details

Use the following procedure to view the users or groups that are integrated with Amazon QuickSight.

1. Choose Manage Users to view details about people who are QuickSight users. The information that displays includes:
   - Username – The person's user name.
   - Email – The email associated with this user name.
   - Role – The security cohort that the person's user name belongs to: ADMIN, AUTHOR, or READER.
   - Last active – The last date and time that this person accessed the QuickSight console. Anyone who isn't an active user has a Last active status of User has no activity.

   You can also see deleted or inactive users in this screen.

2. To find a user name, enter a part or all of a user's name or email the search box. Search is case-insensitive and wildcards aren't supported. To clear the search results and view all user names, delete your search entry.

3. (Optional) If you are using Microsoft Active Directory and you have the correct administrative permissions, you can view the directory groups integrated with Amazon QuickSight.

   Choose Manage groups.

4. (Optional) If you are managing groups, then enter your AWS or IAM credentials on the AWS sign-in page that appears.

### Deactivating Active Directory User Accounts

Deactivating a group or user account removes that group or user's access to Amazon QuickSight resources, like analyses or data sets. However, it doesn't delete resources they own and it doesn't release their SPICE capacity. After deactivating a user, you can delete the user from your Amazon QuickSight account. When you delete a user, Amazon QuickSight gives you the option to either delete the user's resources or transfer their resources to another user.
To deactivate a user account individually, remove that user from all Microsoft Active Directory directory groups that are integrated with Amazon QuickSight. To view the groups integrated with your Amazon QuickSight account, use the procedure in Viewing User Account Details (p. 712).

If you later need to reactivate a user account, put the user into a group with access to Amazon QuickSight. Doing this restores their access to Amazon QuickSight and to any existing resources that are still associated with that user account.

**Note**  
You can't upgrade or downgrade a user by transferring them between groups. For more information, see Updating Enterprise User Accounts (p. 714).

You can activate or deactivate multiple user accounts at once by adding or removing one or more Active Directory directory groups from integration with Amazon QuickSight.

**Important**  
Removing all groups and users doesn't remove any resources and doesn't cancel your subscription to Amazon QuickSight.

Use the following procedure to remove an Active Directory directory group from Amazon QuickSight.

1. Choose your user name on the application bar and then choose **Manage QuickSight**.
2. Choose **Manage Users**.
3. Choose **Manage groups**.
4. On the AWS sign-in page, enter your AWS or IAM credentials.
5. Locate the group that you want to remove under either the **Administrator groups** or the **User groups** section, and then choose the x-shaped delete icon.

6. In the **Manage users** screen, you can view each deactivated user in the **Deleted user** section. This is located beneath the **Active users this month** section.
To transfer the user's resources, click on the **Action** "x" button beside that user's name. You are prompted to decide what to do with resources owned solely by that user.

Choose one of the following:

- Transfer ownership of all orphaned resources to a different user in this account.
- Delete all orphaned resources. (This frees the user's SPICE capacity.)

**Warning**
You can't undo this action.

Whichever action you choose applies to all resources owned solely by that user. If you transfer the user's resources, Amazon QuickSight reassigns them to the user you choose. It doesn't make unnecessary duplicates of those resources.

### Updating Enterprise User Accounts

You can upgrade or downgrade between author and admin users in the **Manage users** tab of the Manage QuickSight screen. If you are using directory groups, you can instead move a user into the appropriate group. To do this, you need both administrative privileges in Amazon QuickSight and also appropriate AWS permissions. Some limitations apply on upgrading or downgrading user access in this automated way.

To downgrade authors to readers, you delete the users and then recreate them as readers. After you choose to remove a user, you are prompted to transfer or delete their assets. If you are using directory groups, also move that user into the appropriate group. Just moving them into another group doesn't change their access the way it does for transfers between admin and author.
You can change a user's name by first creating a new user and then deleting the original user. By using this approach, you can transfer their assets directly back to them. If you are using a directory service, you can temporarily transfer their assets to a different user. Then, make your changes in Active Directory. The next time the user signs in to Amazon QuickSight, they are asked to create a new account. After they create the new account, the user possessing their assets can transfer all assets back to them.

When you make changes to users or groups in Amazon QuickSight, it can take up to five minutes for the change to take effect. Examples of such changes are the following:

- Deleting a user
- Changing a user from an admin to an author
- Adding or removing group members

The five-minute time period allows changes to propagate throughout the system.

Deleting Enterprise User Accounts

Deleting a user account works the same way in both the Standard and Enterprise editions of Amazon QuickSight. User accounts can be deleted by an Amazon QuickSight administrator. To delete a user account, use the procedure in Deleting a User Account (p. 708).

Customizing Access to the Amazon QuickSight Console

**Applies to:** Enterprise Edition

**Intended audience:** Administrators and Amazon QuickSight developers

In Enterprise edition, you can select the functionality that people can access in the Amazon QuickSight console. Amazon QuickSight custom permissions are applied through IAM policies. They override the permissions that are typically granted by assigning QuickSight users to one of the default security cohorts in QuickSight (admin, author, reader).

The following limitations apply:

- For custom permissions to work, you need to be using AWS IAM federated users.
- Folder permissions override custom permissions in all cases.
- You can't grant permissions that are above someone's default security cohort. For example, you can't grant access to edit dashboards to someone who has reader access.
- To customize permissions, you need to be a QuickSight administrator with permissions to use "quicksight:*CustomPermissions".

By using custom permissions profiles, you can restrict access to any combination of the following operations:

<table>
<thead>
<tr>
<th>Asset</th>
<th>Customizable Permissions</th>
<th>Folder Override</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data sources and datasets</td>
<td>Create or update data source</td>
<td>Adding a dataset to a folder overrides custom permissions</td>
</tr>
<tr>
<td></td>
<td>Create or update dataset</td>
<td></td>
</tr>
</tbody>
</table>

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To create a named profile for a set of custom permissions

1. Open your profile menu at upper right, and choose Manage QuickSight. You need to be an Amazon QuickSight administrator to complete this process.
2. Choose Manage users at left to open the Manage users screen.
3. Choose Manage permissions. The Manage custom permissions screen appears.
4. Choose one of the following options:
   • To view or edit an existing custom permissions profile, choose View/Edit from the ellipsis (…) menu at right.
   • To create a new custom permissions profile, choose Create at the lower part of the screen.
5. Whether you are creating or updating, make selections for the following items:
   • Name – Enter a name for your custom permissions profile.
   • Restrictions – Choose any combination of options.
6. Choose Create or Update to confirm your choices. Choose Back at upper left to exit without making any changes. To see an example policy, see IAM Identity-Based Policies for Amazon QuickSight (p. 682).
7. After you are satisfied with your changes, record the name of the custom permissions profile. Provide this to whoever is to use the API to add the permissions for a new or existing user.

You use the API to add or change the permissions assigned to a user.

Before you begin, you need to set up and configure the AWS CLI. For more information, see installing the AWS CLI and Configuring the AWS CLI in AWS Command Line Interface User Guide. In addition, you need permissions to use the QuickSight API. For more information, see .

To assign or change a custom permissions profile at the command prompt:

1. Open a terminal window (Linux, Mac) or open a command prompt (Windows).
2. To add custom permissions to a user, choose one of the following:

- For a new user – Add a new user with a permissions profile by using a command like the following example:

```bash
aws quicksight register-user \
  --iam-arn arn:aws:iam::111122223333:user/JorjeSouza \
  --identity-type IAM \
  --user-role AUTHOR \
  --custom-permissions-name custom-permissions-profile-name \
  --email JorjeSouza@example.com \
  --aws-account-id 111122223333 \
  --namespace default \
```

- For an existing user – Associate an existing user with a permissions profile by using a command like the following example:

```bash
aws quicksight update-user \
  --user-name JorjeSouza \
  --role AUTHOR \
  --custom-permissions-name custom-permissions-profile-name \
  --email JorjeSouza@example.com \
  --aws-account-id 111122223333 \
  --namespace default 
```

3. (Optional) Remove an existing user from a permissions profile by using a command like the following example:

```bash
aws quicksight update-user \
  --user-name TestUser \
  --role AUTHOR \
  --unapply-custom-permissions \
  --email <email> \
  --aws-account-id 111122223333 \
  --namespace default 
```

Incident Response, Logging, and Monitoring in Amazon QuickSight

**Intended audience:** System administrators and Amazon QuickSight administrators

Amazon QuickSight is integrated with AWS CloudTrail, which creates a record of calls from the Amazon QuickSight console and code calls to Amazon QuickSight API operations. For more information, see Logging Operations with AWS CloudTrail (p. 718).

Amazon QuickSight doesn't natively support alerting with Amazon CloudWatch or other external systems. However, it's possible to develop a custom solution to process CloudTrail logs.

Amazon QuickSight service status can be viewed on the Service Health Dashboard.

**Topics**

- Logging Operations with AWS CloudTrail (p. 718)
Logging Operations with AWS CloudTrail

**Intended audience:** System administrators

Amazon QuickSight is integrated with AWS CloudTrail. This service provides a record of actions taken by a user, role, or an AWS service in Amazon QuickSight. CloudTrail captures all API calls for Amazon QuickSight as events. The calls captured include some calls from the Amazon QuickSight console and all code calls to Amazon QuickSight API operations. If you create a trail, you can enable continuous delivery of CloudTrail events to an Amazon S3 bucket, including events for Amazon QuickSight. If you don’t configure a trail, you can still view the most recent events in the CloudTrail console in Event history. Using the information collected by CloudTrail, you can determine the request that was made to Amazon QuickSight, the IP address from which the request was made, who made the request, when it was made, and additional details.

By default, the log files delivered by CloudTrail to your bucket are encrypted by Amazon server-side encryption with Amazon S3-managed encryption keys (SSE-S3). To provide a security layer that is directly manageable, you can instead use server-side encryption with AWS KMS–managed keys (SSE-KMS) for your CloudTrail log files. Enabling server-side encryption encrypts the log files but not the digest files with SSE-KMS. Digest files are encrypted with Amazon S3-managed encryption keys (SSE-S3).

To learn more about CloudTrail, including how to configure and enable it, see the AWS CloudTrail User Guide.

**Topics**

- Amazon QuickSight Information in CloudTrail (p. 718)
- Tracking Non-API Events by Using CloudTrail Logs (p. 719)
- Example: Amazon QuickSight Log File Entries (p. 721)

Amazon QuickSight Information in CloudTrail

**Intended audience:** System administrators

CloudTrail is enabled on your AWS account when you create the account. When supported event activity occurs in Amazon QuickSight, that activity is recorded in a CloudTrail event along with other AWS service events in Event history. You can view, search, and download recent events in your AWS account. For more information, see Viewing Events with CloudTrail Event History.

For an ongoing record of events in your AWS account, including events for Amazon QuickSight, create a trail. A trail enables CloudTrail to deliver log files to an Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all AWS Regions. The trail logs events from all Regions in the AWS partition and delivers the log files to the Amazon S3 bucket that you specify. Additionally, you can configure other AWS services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see the following:

- Overview for Creating a Trail
- CloudTrail Supported Services and Integrations
- Configuring Amazon SNS Notifications for CloudTrail
- Receiving CloudTrail Log Files from Multiple Regions and Receiving CloudTrail Log Files from Multiple Accounts
• Cross-Account CloudTrail Logging in the AWS Lake Formation Developer Guide – This topic includes instructions for including principal identities in cross-account CloudTrail logs.

Amazon QuickSight supports logging the following actions as events in CloudTrail log files:

• Whether the request was made with root or AWS Identity and Access Management (IAM) user credentials
• Whether the request was made with temporary security credentials for an IAM role or federated user
• Whether the request was made by another AWS service

For more information on user identity, see the CloudTrail userIdentity Element.

By default, each Amazon QuickSight log entry contains the following information:

• userIdentity – User identity
• eventTime – Event time
• eventId – Event Id
• readOnly – Read only
• awsRegion – AWS Region
• eventSource (quicksight) – Source of the event (Amazon QuickSight)
• eventType (AwsServiceEvent) – Event type (AWS service event)
• recipientAccountId (customer AWS account) – Recipient account ID (Customer AWS account)

Note
CloudTrail displays users as unknown if they were provisioned by Amazon QuickSight. This display is because these users aren’t a known IAM identity type.

Tracking Non-API Events by Using CloudTrail Logs

Following is a list of the non-API events you can track.

User Management

• CreateAccount – Create Account

• BatchCreateUser – Create User

• BatchResendUserInvite – Invite User

• UpdateGroups – Update Groups
  This event works with Enterprise edition only.

• UpdateSpiceCapacity – Update SPICE Capacity
• **DeleteUser** – Delete User

• **Unsubscribe** – Unsubscribe User

**Subscription**

• **CreateSubscription** – Create Subscription

• **UpdateSubscription** – Update Subscription

• **DeleteSubscription** – Delete Subscription

**Dashboard**

• **GetDashboard** – Get Dashboard

• **CreateDashboard** – Create Dashboard

• **UpdateDashboard** – Update Dashboard

• **UpdateDashboardAccess** – Update Dashboard Access

• **DeleteDashboard** – Delete Dashboard

**Analysis**

• **GetAnalysis** – Get Analysis

• **CreateAnalysis** – Create Analysis

• **UpdateAnalysisAccess** – Update Analysis Access

• **UpdateAnalysis** – Update Analysis

  • **RenameAnalysis** – Rename Analysis

  • **CreateVisual** – Create Visual

  • **RenameVisual** – Rename Visual

  • **DeleteVisual** – Delete Visual

  • **DeleteAnalysis** – Delete Analysis

**Data Source**

• **CreateDataSource** – Create Data Source

  • **FlatFile** – Flat file
Example: Amazon QuickSight Log File Entries

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files aren't an ordered stack trace of the public API calls, so they don't appear in any specific order.

The following example shows a CloudTrail log entry that demonstrates the BatchCreateUser action.

```json
{
    "eventVersion":"1.05",
    "userIdentity":
    {
        "type":"Root",
        "principalId":"123456789012",
        "arn":"arn:aws:iam::123456789012:root",
        "accountId":"123456789012",
        "userName":"test-username"
    },
    "eventTime":"2017-04-19T03:16:13Z"
}
```
Compliance Validation for Amazon QuickSight

Third-party auditors assess the security and compliance of Amazon QuickSight as part of multiple AWS compliance programs. These include FedRamp, HIPAA, PCI DSS, SOC, and ISO (9001, 27001, 27018, and 27019).

For information about this service and ISO 27001, a security management standard that specifies security management best practices, see ISO 27001 Overview.

For the most current list of AWS services in scope of specific compliance programs, see AWS Services in Scope by Compliance Program. For general information, see AWS Compliance Programs.

You can download third-party audit reports using AWS Artifact. For more information, see Downloading Reports in AWS Artifact.

Your compliance responsibility when using Amazon QuickSight is determined by the sensitivity of your data, your company's compliance objectives, and applicable laws and regulations. AWS provides the following resources to help with compliance:

- **Security and Compliance Quick Start Guides** – These deployment guides discuss architectural considerations and provide steps for deploying security- and compliance-focused baseline environments on AWS.
Resilience in Amazon QuickSight

Amazon QuickSight is built by AWS and runs on AWS-managed infrastructure. It takes full advantage of the high availability features provided by AWS.

The AWS global infrastructure is built around AWS Regions and Availability Zones. AWS Regions provide multiple physically separated and isolated Availability Zones, which are connected with low-latency, high-throughput, and highly redundant networking. With Availability Zones, you can design and operate applications and databases that automatically fail over between Availability Zones without interruption. Availability Zones are more highly available, fault tolerant, and scalable than traditional single or multiple data center infrastructures.

Because Amazon QuickSight is an AWS-managed application, all patches and updates are applied by AWS as needed.

For more information about AWS Regions and Availability Zones, see AWS Global Infrastructure.

Infrastructure Security in Amazon QuickSight

### Intended audience: Amazon QuickSight administrators

Amazon QuickSight is delivered as a web application, hosted on dedicated Amazon EC2 hosts, separate from AWS virtual private clouds (VPCs). Instead of deploying QuickSight on your own hosts, you access the QuickSight service through regional public endpoints. QuickSight accesses data sources over a secured internet connection from regional endpoints. To access data sources that are located inside a corporate network, configure the network to allow access from one of the QuickSight public IP address blocks. We recommend that you consider using a VPC (a virtual network dedicated to your AWS account).

For more information, see the following:

- Global Infrastructure: The Most Extensive, Reliable, and Secure Global Cloud Infrastructure
- AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626)
- Connecting to a VPC with Amazon QuickSight (p. 727)

As a managed service, Amazon QuickSight is protected by the AWS global network security procedures that are described in the Amazon Web Services: Overview of Security Processes paper.
If you use AWS published API calls to access QuickSight through the network, clients must support Transport Layer Security (TLS) 1.0 or later. We recommend TLS 1.2 or later. Clients must also support cipher suites with perfect forward secrecy (PFS) such as Ephemeral Diffie-Hellman (DHE) or Elliptic Curve Ephemeral Diffie-Hellman (ECDHE). Most modern systems such as Java 7 and later support these modes.

Additionally, requests must be signed by using an access key ID and a secret access key that is associated with an AWS Identity and Access Management (IAM) principal. Or you can use the AWS Security Token Service (AWS STS) to generate temporary security credentials to sign requests.

You can call these API operations from any network location, but QuickSight does support resource-based access policies, which can include restrictions based on the source IP address. You can also use QuickSight policies to control access from specific Amazon Virtual Private Cloud (Amazon VPC) endpoints or specific VPCs. Effectively, this isolates network access to a given QuickSight resource from only the specific VPC within the AWS network. For more information on using QuickSight in a VPC, see Connecting to a VPC with Amazon QuickSight (p. 727).

**Topics**

- Network and Database Configuration Requirements (p. 724)
- Connecting to a VPC with Amazon QuickSight (p. 727)

### Network and Database Configuration Requirements

To serve as data sources, databases need to be configured so that Amazon QuickSight can access them. Use the following sections to make sure that your database is configured appropriately.

**Important**

Because a database instance on Amazon EC2 is administered by you rather than AWS, it must meet both the Network Configuration Requirements (p. 724) as well as the Database Configuration Requirements for Self-Administered Instances (p. 727).

**Network Configuration Requirements**

**Intended audience:** System administrators

For you to use your database server from QuickSight, your server must be accessible from the internet. It must also allow inbound traffic from QuickSight servers.

If the database is on AWS and in the same AWS Region as your QuickSight account, you can auto-discover the instance to make connecting to it easier. To do this, you must grant QuickSight permissions to access it. For more information, see Accessing Data Sources (p. 646).

### Network Configuration for an AWS Instance in a Default VPC

In some cases, your database might be on an AWS cluster or instance that you created in a default VPC. Thus, it's publicly accessible (that is, you didn't choose to make it private). In such cases, your database is already appropriately configured to be accessible from the internet. However, you still need to enable access from QuickSight servers to your AWS cluster or instance. For further details on how to do this, choose the appropriate topic following:

- Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances (p. 649)
- Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 652)
- Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances (p. 658)
Network Configuration for an AWS Instance in a Nondefault VPC

If you are configuring an AWS instance in a nondefault VPC, make sure that the instance is publicly accessible and that the VPC has the following:

• An internet gateway.
• A public subnet.
• A route in the route table between the internet gateway and the AWS instance.
• Network access control lists (ACLs) in your VPC that allow traffic between the cluster or instance and QuickSight servers. These ACLs must do the following:
  • Allow inbound traffic from the appropriate QuickSight IP address range and all ports to the IP address and port that the database is listening on.
  • Allow outbound traffic from the database’s IP address and port to the appropriate QuickSight IP address range and all ports.

For more information about QuickSight IP address ranges, see IP Address Ranges for QuickSight (p. 727) following.

For more information about configuring VPC ACLs, see Network ACLs.

• Security group rules that allow traffic between the cluster or instance and QuickSight servers. For further details on how to create appropriate security group rules, see Authorizing Connections to AWS Data Stores (p. 648).

For more information about configuring a VPC in the Amazon VPC service, see Networking in Your VPC.

Network Configuration for an AWS Instance in a Private VPC

If your database is on an AWS cluster or instance that you created in a private VPC, you can use it with QuickSight. For more information, see Connecting to a VPC with Amazon QuickSight (p. 727).

For more information on Amazon VPC, see Amazon VPC and Amazon VPC Documentation.

Network Configuration for an AWS Instance That is Not in a VPC

If you are configuring an AWS instance that is not in a VPC, make sure that the instance is publicly accessible. Also, make sure that there is a security group rule that allows traffic between the cluster or instance and QuickSight servers. For further details on how to do this, choose the appropriate topic following:

• Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances (p. 649)
• Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 652)
• Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances (p. 658)

Network Configuration for a Non-AWS Database Instance

To use SSL to secure your connections to your database (recommended), make sure that you have a certificate signed by a recognized certificate authority (CA). QuickSight doesn't accept certificates that are self-signed or issued from a nonpublic CA. For more information, see QuickSight SSL and CA Certificates (p. 726).

If your database is on a non-AWS server, you must change that server's firewall configuration to accept traffic from the appropriate QuickSight IP address range. For more information about QuickSight IP address ranges, see IP Address Ranges for QuickSight (p. 727). For any other steps that you need to take to enable internet connectivity, see your operating system documentation.
QuickSight SSL and CA Certificates

Following is a list of accepted public certificate authorities. If you are using a non-AWS database instance, your certificate must be on this list, or it won’t work.

- AAA Certificate Services
- AddTrust Class 1 CA Root
- AddTrust External CA Root
- AddTrust Qualified CA Root
- AffirmTrust Commercial
- AffirmTrust Networking
- AffirmTrust Premium
- AffirmTrust Premium ECC
- America Online Root Certification Authority 1
- America Online Root Certification Authority 2
- Baltimore CyberTrust Code Signing Root
- Baltimore CyberTrust Root
- Buypass Class 2 Root CA
- Buypass Class 3 Root CA
- Certum CA
- Certum Trusted Network CA
- Chambers of Commerce Root
- Chambers of Commerce Root - 2008
- Class 2 Primary CA
- Class 3P Primary CA
- Deutsche Telekom Root CA 2
- DigiCert Assured ID Root CA
- DigiCert Global Root CA
- DigiCert High Assurance EV Root CA
- Entrust.net Certification Authority (2048)
- Entrust Root Certification Authority
- Entrust Root Certification Authority - G2
- Equifax Secure eBusiness CA-1
- Equifax Secure Global eBusiness CA-1
- GeoTrust Global CA
- GeoTrust Primary Certification Authority
- GeoTrust Primary Certification Authority - G2
- GeoTrust Primary Certification Authority - G3
- GeoTrust Universal CA
- QuoVadis Root CA 2
- QuoVadis Root CA 3
- QuoVadis Root Certification Authority
- SecureTrust CA
- Sonera Class1 CA
- Sonera Class2 CA
- Starfield Root Certificate Authority - G2
- Starfield Services Root Certificate Authority - G2
- SwissSign Gold CA - G2
- SwissSign Platinum CA - G2
- SwissSign Silver CA - G2
- TC TrustCenter Class 2 CA II
- TC TrustCenter Class 4 CA II
- TC TrustCenter Universal CA I
- Thawte Personal Freemail CA
- Thawte Premium Server CA
- thawte Primary Root CA
- thawte Primary Root CA - G2
- thawte Primary Root CA - G3
- Thawte Server CA
- Thawte Timestamping CA
- T-TeleSec GlobalRoot Class 2
- T-TeleSec GlobalRoot Class 3
- UTN - DATACorp SGC
- UTN-USERFirst-Client Authentication and Email
- UTN-USERFirst-Hardware
- UTN-USERFirst-Object
- Valicert
- VeriSign Class 1 Public Primary Certification Authority - G3
- VeriSign Class 2 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority - G3
- VeriSign Class 3 Public Primary Certification Authority - G4
- VeriSign Class 3 Public Primary Certification Authority - G5
- VeriSign Universal Root Certification Authority
• Global Chambersign Root - 2008
• GlobalSign
• GlobalSign Root CA
• Go Daddy Root Certificate Authority - G2
• GTE CyberTrust Global Root
• KEYNECTIS ROOT CA

IP Address Ranges for QuickSight

For more information on the IP address ranges for QuickSight in supported regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626).

Database Configuration Requirements for Self-Administered Instances

**Intended audience:** System administrators and Amazon QuickSight administrators

For a database to be accessible to QuickSight, it must meet the following criteria:

- It must be accessible from the internet. To enable internet connectivity, see your database management system documentation.
- It must be configured to accept connections and authenticate access using the user credentials that you provide as part of creating the data set.
- If you are connecting to MySQL or PostgreSQL, the database engine must be accessible from your host or IP range. This optional security limitation is specified in MySQL or PostgreSQL connection settings. If this limitation is in place, any attempt to connect from a nonspecified host or IP address is rejected, even if you have the correct user name and password.
- In MySQL, the server accepts the connection only if the user and host are verified in the user table. For more information, see Access Control, Stage 1: Connection Verification in the MySQL documentation.
- In PostgreSQL, you control client authentication by using the *pg_hba.conf* file in the database cluster's data directory. However, this file might be named and located differently on your system. For more information, see Client Authentication in the PostgreSQL documentation.

Connecting to a VPC with Amazon QuickSight

**Applies to:** Enterprise Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

Amazon QuickSight Enterprise edition is fully integrated with the Amazon VPC service. A VPC based on this service closely resembles a traditional network that you operate in your own data center. It enables you to secure and isolate traffic between resources. You define and control the network elements to suit your requirements, while still getting the benefit of cloud networking and the scalable infrastructure of AWS.
By creating a VPC connection in QuickSight, you're adding an elastic network interface in your VPC. This network interface allows QuickSight to exchange network traffic with a network instance within your VPC. You can provide all of the standard security controls for this network traffic, as you do with other traffic in your VPC. Route tables, network access control lists (ACLs), subnets, and security groups settings all apply to network traffic to and from QuickSight in the same way that they apply to traffic between other instances in your VPC.

When you register a VPC connection with QuickSight, you can securely connect to data that's available only in your VPC, for example:

- Data you can reach by IP address
- Data that isn't available on the public internet
- Private databases
- On-premises data

This works if you set up connectivity between the VPC and your on-premises network. For example, you might set up connectivity with AWS Direct Connect, a virtual private network (VPN), or a proxy.

After you connect to the data, you can use it to create data analyses and publish secure data dashboards.

**Note**
QuickSight connects only to data located in the same AWS Region where you're currently using QuickSight. You can't connect QuickSight to data in another AWS Region, even if your VPC is configured to work across AWS Regions.

To further increase security, consider logging data access operations with AWS CloudTrail, as described in [Logging Operations with AWS CloudTrail](p. 718). You can even create a dashboard to help you analyze your CloudTrail logs. By combining QuickSight logs with logs from your other AWS services, you can get a fuller view of how your data is being used.

You don't need to be an networking expert to connect and use a VPC with QuickSight, because QuickSight provides a user interface for adding your network information. However, the person who gathers the information that you need for setup should have some understanding of networking concepts and using VPCs. This person also needs read-only access to the services. If network changes are required, we recommend that you don't make changes to your networking configuration without expert assistance.

To use a command line interface to access your VPC, you can use the AWS Command Line Interface (AWS CLI). For more information on using the AWS CLI, see the AWS CLI User Guide.

**If you're a system administrator** – we recommend that you focus on [Setting Up a VPC to Use with Amazon QuickSight](p. 730) and [Finding Information to Connect to a VPC](p. 736). The sections after that deal with setting up the connections in QuickSight and testing them.

**If you're a QuickSight administrator** – if you have the information that you need to configure a VPC connection in the QuickSight console, focus on [Configuring the VPC Connection in the QuickSight Console](p. 739) and [Testing the Connection to Your VPC Data Source](p. 741).

**Topics**

- VPC Terminology (p. 729)
- Supported VPC Data Sources (p. 729)
- Setting Up a VPC to Use with Amazon QuickSight (p. 730)
- Finding Information to Connect to a VPC (p. 736)
- Configuring the VPC Connection in the QuickSight Console (p. 739)
- Testing the Connection to Your VPC Data Source (p. 741)
**VPC Terminology**

The following terminology can be useful when you work with a VPC and Amazon QuickSight.

A **VPC** is a virtual private cloud, which works like a private network to isolate the resources within it. The solution described in these topics uses an AWS service called Amazon VPC.

A **route table** contains a set of rules, called **routes**, that are used to determine where network traffic is directed. You can view the route table in the Amazon VPC console at [https://console.aws.amazon.com/vpc/](https://console.aws.amazon.com/vpc/). The VPC details display the route table that the VPC is using. You can also see **Route tables** listed in the Amazon VPC console.

A **subnet** is a defined set of network IP addresses that are used to increase the security and efficiency of network communications. You can think of them like postal codes, used for routing packages from one location to another. The **Subnets** list in the Amazon VPC console displays subnet IDs and also their associated VPC IDs, route tables, and network ACLs.

A **network interface** represents a virtual network card. The network interface automatically created by QuickSight is called a **QuickSight network interface**. You can view your QuickSight network interface in the Amazon EC2 console at [https://console.aws.amazon.com/ec2/](https://console.aws.amazon.com/ec2/). The network interface displays its network interface ID, subnet ID, VPC ID, security group, and the Availability Zone that it exists in. You can click on the security group name to see its group ID and its inbound and outbound rules. The term **network interface** in the following sections always means elastic network interface.

A **security group** is a set of rules that controls the network access to the resources it is associated with. Access is permitted only to and from the components defined in the security group's inbound and outbound rules. If no rules are defined, the security group prevents all access. You can view security groups from several different consoles, depending on which resource that a particular security group applies to. You can see all the security groups and their settings in one place in the VPC console. For the QuickSight VPC connection, create a new security group.

**Inbound and outbound rules** define the following:

- The type of traffic to allow, for example "**All TCP**" or "**RDS**".
- The protocol to allow (TCP, UDP, or ICMP).
- The range of ports to allow (0–65535, or a smaller range, or a specific port).
- The traffic source to allow for inbound rules, or the traffic destination to allow for outbound rules. When you work with a VPC and QuickSight, you specify the security group ID to use.
- An optional description. We recommend that you add the word **QuickSight** to the description for QuickSight VPC rules.

An **internet gateway** is a VPC component that allows communication between instances in your VPC and the internet. You don't need an internet gateway to use QuickSight VPC connections.

A **VPC endpoint** enables you to privately connect your VPC to supported AWS services without using public IP addresses. You don't need to set up a VPC endpoint to use QuickSight VPC connections.

**Supported VPC Data Sources**

The following data sources can connect to QuickSight through a VPC connection:

- Amazon Elasticsearch Service
- Amazon Redshift
- Amazon Relational Database Service
- Amazon Aurora
- MariaDB
Connecting to a VPC with QuickSight

- Microsoft SQL Server
- MySQL
- Oracle
- PostgreSQL
- Presto
- Snowflake

For a VPC data source to be accessed from QuickSight, the following statements must be true of your configuration:

1. The Domain Name System (DNS) name of the VPC data source can be resolved from outside of your VPC.
2. The connection returns the private IP address of your instance. Databases hosted by Amazon Redshift, Amazon RDS, and Aurora automatically meet this requirement.
3. There is a clearly defined network path from the data source to QuickSight.
4. You registered the VPC with QuickSight by creating or using a VPC connection with the QuickSight console.

Setting Up a VPC to Use with Amazon QuickSight

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

To set up a VPC to use with Amazon QuickSight Enterprise edition, you need access to Amazon VPC and Amazon EC2. You also need access to each AWS database service that you plan to add to QuickSight. You can use the console, or you can use the AWS Command Line Interface (AWS CLI). For more information about the CLI, see the AWS Command Line Interface User Guide. To work with the CLI, go to [https://aws.amazon.com/cli/](https://aws.amazon.com/cli/).

Before you begin to set up your VPC connection in QuickSight, make sure that you understand the components of a VPC deployment. As part of that, familiarize yourself with the VPC's subnets and security groups in relation to the destinations (databases) that you want to reach from QuickSight. To set up a successful VPC connection, make sure that the following components work together to allow network traffic to pass between QuickSight and your data source:

- The Amazon VPC service
- The subnet that your data source is using
- The QuickSight elastic network interface and the subnet it uses
- The route table
- Inbound and outbound rules for these security groups:
  - Security group for your VPC. We recommend you create a new security group to isolate the rules on the VPC security group from the rules on the QuickSight network interface's security group).
  - Security group attached to the QuickSight network interface.
  - Security group attached to the database server (for each database server that you want to use).

In the following topics, you can find the network components that are involved. You can also find descriptions of their roles in the network configuration of your VPC and your QuickSight VPC connection.
The network interface for QuickSight that is automatically created during setup is called the QuickSight network interface (QNI).

If your VPC is already completely configured, skip to the next section, Finding Information to Connect to a VPC (p. 736).

**Topics**
- VPC (p. 731)
- Subnets (p. 732)
- Security Groups: Inbound and Outbound Rules (p. 732)
- Sample Rules (p. 734)
- Route Table (p. 735)
- QuickSight Elastic Network Interface (p. 736)

**VPC**

A virtual private cloud (VPC) is a virtual network dedicated to your AWS account. The Amazon VPC service that provides it is a networking layer for your AWS resources. Using Amazon VPC, you can define a virtual network in your own logically isolated area within the AWS Cloud. A VPC closely resembles a traditional network that you might operate in your own data center, with the benefits of using the AWS scalable infrastructure. Amazon VPC for Amazon EC2 virtual computing environments, known as instances, but you can use a VPC for a variety of AWS resources.

VPCs offer options that allow for flexibility in a secure environment, for example:

- To configure your VPC, you can set its IP address range, create subnets, configure route tables, network gateways, network interfaces, and security settings.
- To make the AWS Cloud an extension of your data center, you can connect your VPC to your own corporate data center.
- You can connect your instances in the VPC to the internet, or keep your instances isolated on a private network.
- To protect the resources in each subnet, you can use multiple layers of security, including security groups and network access control lists (ACLs).

For more information, see the Amazon VPC User Guide.

If you have a default VPC and don’t specify a subnet when you launch an instance, the instance is launched into your default VPC. You can launch instances into your default VPC without needing to know anything about Amazon VPC.

If you don’t already have a VPC or want to use a new one, you can create one by following the instructions in Getting started with Amazon VPC in the Amazon VPC User Guide. This section offers guidance on how to set up your VPC. The guidance includes options for public and private subnets and for AWS Site-to-Site VPN access for your corporate network (known as on-premises access). You can also use VPC peering or AWS Direct Connect to reach an on-premises database instance.

**Using the AWS CLI**

You can start to set up a VPC by using the create-vpc command. To learn details about VPC settings for the AWS CLI, see Examples for VPC in the Amazon VPC User Guide.

**Using the Console**

To view your VPC or create a new one, sign in to the AWS Management Console and open the Amazon VPC console at https://console.aws.amazon.com/vpc/. To create a new VPC, choose Launch VPC Wizard and follow the instructions. Take note of your new VPC ID. To view VPCs, choose Your VPCs at left.
Amazon VPC Resources in VPC Guides and AWS Support Articles

For general information, see Working with VPCs and subnets.

For step-by-step instructions for setting up a VPC, see the following topics (choose the ones that relate to your scenario):

- Create an IPv4 VPC and subnets using the AWS CLI
- Sharing public subnets and private subnets
- Working with site-to-site VPN
- AWS Site-to-Site VPN Network Administrator Guide (choose your network device for specific instructions)
- Generic Customer Gateway Device Without Border Gateway Protocol (recommended for customer gateways)

If you want to migrate data source instances into the same VPC, see the following AWS Support articles:

- How do I change the VPC for an Amazon RDS DB instance?
- How do I move my EC2 instance to another subnet, Availability Zone, or VPC?
- How do I move my Amazon Redshift cluster from one VPC to another VPC?

For troubleshooting information, see How do I troubleshoot issues with VPC route tables?, an article with video created by AWS Support.

Subnets

A subnet is a range of IP addresses in your VPC. You can attach AWS resources, such as EC2 instances and RDS DB instances, to subnets. You can create subnets to group instances together according to your security and operational needs.

For Amazon QuickSight to connect to your database, the network needs to route traffic to the data sources that you want to reach from the subnet used by the QuickSight network interface. If the data sources are on different subnets, make sure that there is a route from the QuickSight network interface to your database instance. By default, each subnet in a VPC is associated with one main route table and can reach the other subnets. For more information, see VPC and Subnets and Network ACLs in the Amazon VPC User Guide.

If you use Amazon RDS, DB instances are associated with a subnet group that you can view either in the Amazon RDS console (https://console.aws.amazon.com/rds/) or in the VPC console. For troubleshooting connectivity to Amazon RDS, see the AWS Support article How can I troubleshoot connectivity to an Amazon RDS instance that uses a public or private subnet of a VPC?

Security Groups: Inbound and Outbound Rules

A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. For each security group, you add rules that control the inbound traffic to instances, and a separate set of rules that control the outbound traffic.

For your VPC connection, create a new security group with the description QuickSight-VPC. This security group must allow all inbound TCP traffic from the security groups of the data destinations that you want to reach. The following example creates a new security group in the VPC and returns the ID of the new security group.

```bash
aws ec2 create-security-group \
  --name QuickSight-VPC \
  --group-name quicksight-vpc \
```
--description "QuickSight-VPC" \
--vpc-id vpc-0daeb67adda59e0cd

**Important**

Network configuration is sufficiently complex that we strongly recommend that you create a new security group for use with QuickSight. It also makes it easier for AWS Support to help you if you need to contact them. Creating a new group isn't absolutely required. However, the following topics are based on the assumption that you follow this recommendation.

To enable Amazon QuickSight to successfully connect to an instance in your VPC, configure your security group rules to allow traffic between the QuickSight network interface and the instance that contains your data. To do this, configure the security group attached to your database's instance inbound rules to allow the following traffic:

- From the port that QuickSight is connecting to
- From one of the following options:
  - The security group ID that's associated with QuickSight network interface (recommended)
  - The private IP address of the QuickSight network interface

For more information, see [Security groups for your VPC](https://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/vpc-security-groups.html) and [VPCs and subnets](https://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/vpc-architecture.html) in the *Amazon VPC User Guide*.

**Inbound Rules**

When you create a security group, it has no inbound rules. No inbound traffic originating from another host to your instance is allowed until you add inbound rules to the security group.

The security group attached to the QuickSight network interface behaves differently than most security groups, because it isn't stateful. Other security groups are usually *stateful*. This means that, after they establish an outbound connection to a resource's security group, they automatically allow return traffic. In contrast, the QuickSight network interface security group doesn't automatically allow return traffic. Because of this, adding an egress rule to the QuickSight network interface security group doesn't work. To make it work for the QuickSight network interface security group, make sure to add an inbound rule that explicitly authorizes the return traffic from the database host.

The inbound rule in your security group must allow traffic on all ports. It needs to do this because the destination port number of any inbound return packets is set to a randomly allocated port number.

To restrict QuickSight to connect only to certain instances, you can specify the security group ID (recommended) or private IP address of the instances that you want to allow. In either case, your security group inbound rule still needs to allow traffic on all ports (0–65535).

To allow QuickSight to connect to any instance in the VPC, you can configure the QuickSight network interface security group. In this case, give it an inbound rule to allow traffic on 0.0.0.0/0 on all ports (0–65535). The security group used by the QuickSight network interface should be different than the security groups used for your databases. We recommend that you use separate security groups for VPC connection.

**Important**

If you are using a long-standing Amazon RDS DB instance, check your configuration to see if you're using a DB security group. DB security groups are used with DB instances that are not in a VPC and are on the EC2-Classic platform.

If this is your configuration, and you aren't moving your DB instance into the VPC for use with QuickSight, make sure to update your DB security group's inbound rules. Update them to allow inbound traffic from the VPC security group that you're using for QuickSight. For more information, see [Controlling Access with Security Groups](https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Concepts.SecurityGroups.html) in the *Amazon RDS User Guide*. 
Outbound Rules

By default, a security group includes an outbound rule that allows all outbound traffic. We recommend that you remove this default rule and add outbound rules that allow specific outbound traffic only.

**Warning**

Do not configure the security group on the QuickSight network interface with an outbound rule to allow traffic on all ports. For information on key considerations and recommendations for managing network egress traffic from VPCs, see Security best practices for your VPC in the Amazon VPC User Guide.

The security group attached to QuickSight network interface should have outbound rules that allow traffic to each of the database instances in your VPC that you want QuickSight to connect to. To restrict QuickSight to connect only to certain instances, specify the security group ID (recommended) or the private IP address of the instances to allow. You set this up, along with the appropriate port numbers for your instances (the port that the instances are listening on), in the outbound rule.

The VPC security group must also allow outbound traffic to the security groups of the data destinations, specifically on the port or ports that the database is listening on.

Sample Rules

Following, you can find some example configurations of inbound and outbound rules for Amazon RDS and Amazon Redshift.

**VPC Connection Rules: Amazon RDS for MySQL**

The following tables show rule settings for connecting QuickSight to Amazon RDS for MySQL.

<table>
<thead>
<tr>
<th>QuickSight Network Interface Security Group: Inbound Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
</tr>
<tr>
<td><strong>Port Range</strong></td>
</tr>
<tr>
<td><strong>Source</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QuickSight Network Interface Security Group: Outbound Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
</tr>
<tr>
<td><strong>Port Range</strong></td>
</tr>
<tr>
<td><strong>Source</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RDS MySQL: Inbound Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
</tr>
<tr>
<td><strong>Port Range</strong></td>
</tr>
</tbody>
</table>
VPC Connection Rules: Amazon Redshift

The following tables show rule settings for connecting QuickSight to Amazon Redshift.

**QuickSight network interface Security Group: Inbound Rule**

<table>
<thead>
<tr>
<th>Type</th>
<th>All TCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>TCP</td>
</tr>
<tr>
<td>Port Range</td>
<td>0 - 65535</td>
</tr>
<tr>
<td>Source</td>
<td>sg-RedSh222222</td>
</tr>
<tr>
<td>Description</td>
<td>QuickSight–Amazon Redshift</td>
</tr>
</tbody>
</table>

**QuickSight Network Interface Security Group: Outbound Rule**

<table>
<thead>
<tr>
<th>Type</th>
<th>Amazon Redshift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>TCP</td>
</tr>
<tr>
<td>Port Range</td>
<td>5439</td>
</tr>
<tr>
<td>Source</td>
<td>sg-RedSh222222</td>
</tr>
<tr>
<td>Description</td>
<td>QuickSight–Amazon Redshift</td>
</tr>
</tbody>
</table>

**Amazon Redshift: Inbound Rule**

<table>
<thead>
<tr>
<th>Type</th>
<th>Amazon Redshift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td>TCP</td>
</tr>
<tr>
<td>Port Range</td>
<td>5439</td>
</tr>
<tr>
<td>Source</td>
<td>sg-ENI3333333</td>
</tr>
<tr>
<td>Description</td>
<td>QuickSight–Amazon Redshift</td>
</tr>
</tbody>
</table>

**Route Table**

To use VPC peering or AWS Direct Connect to reach an on-premises database instance, update the route table that’s associated with the VPC you’re using with QuickSight. For more information on route tables, see Route tables in the Amazon VPC User Guide.

To learn more about VPC peering and view sample scenarios and configurations, see What is VPC peering? in the Amazon VPC Peering Guide. For an example configuration, see Example: Services using AWS PrivateLink and VPC peering in the Amazon VPC User Guide.

**Using the AWS CLI**

The following example creates a route table.
Then you can use the create-route command to create a route. For more information and examples, see create-route in the AWS CLI Command Reference.

For the following examples to work, make sure that you have a subnet in the VPC associated with the route table. The first example describes the route table with the specified VPC ID. The second one describes the route table with the specified route table ID.

```
aws ec2 create-route-table --vpc-id vpc-0daeb67adda59e0cd
```

```
aws ec2 describe-route-tables
  --filters "Name=vpc-id,Values=vpc-0daeb67adda59e0cd"
```

```
aws ec2 describe-route-tables
  --route-table-ids rtb-45ac473a
```

The following example describes the specified associations between a specific VPC and your local gateway route tables.

```
aws ec2 describe-local-gateway-route-table-vpc-associations
  --filters "Name=vpc-id,Values=vpc-0daeb67adda59e0cd"
```

**QuickSight Elastic Network Interface**

The QuickSight elastic network interface is a logical networking component in a VPC that represents a virtual network card. QuickSight creates one of these network interfaces to use with a VPC connection. Then you add the VPC connection to each QuickSight data source you create. The QuickSight network interface alone doesn't give QuickSight direct access to your databases. The VPC connection works only for the QuickSight data sources that are configured to use it.

When you use the QuickSight data source to query a database or other instance within your VPC, all the network traffic from QuickSight originates from this QuickSight network interface. Because the QuickSight network interface exists inside your VPC, traffic originating from it can reach destinations within your VPC by using their private IP addresses. Each QuickSight network interface gets its own private IP address that comes from the subnet you configure. The private IP address is unique for each AWS account, unlike the public IP range.

There is only one QuickSight network interface for each VPC. It is created on the subnet that you set up in the QuickSight VPC connection.

**Finding Information to Connect to a VPC**

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

To gather the information to have ready when you create a VPC connection in Amazon QuickSight Enterprise edition, take the steps listed following.

**Steps**
- Identify the Data Sources to Use (p. 737)
Identify the AWS Region to Use

For the connection to work, the data, the subnet, and the security group must be in the same VPC. Make sure also that you use Amazon QuickSight in the same AWS Region with the VPC.

You can't use QuickSight in one AWS Region and expect to connect to a VPC in a different AWS Region. If your team is already using QuickSight, you can see your current AWS Region displayed at the upper right of the QuickSight home screen. You can change the AWS Region you're using in QuickSight by changing the Region at the upper right of the QuickSight home screen. All the people who plan to use the data in the VPC must be using the same AWS Region in QuickSight.

Note

The AWS Region that displays in the QuickSight console doesn't have to match your AWS CLI configuration. Take care not to mistake your current QuickSight console settings with the settings that apply in any AWS CLI commands that you run or the settings in other consoles. Changing the current AWS Region in any console doesn't change the Region anywhere except for that page.

For example, let's say you have three tabs open in one browser window. You can have the QuickSight console open in one AWS Region, the Amazon VPC console open in a second Region, the Amazon RDS console open in a third Region, and the AWS CLI running in a fourth Region.

Identify the VPC ID to Use

The VPC ID is assigned when the VPC is created.

Using the AWS CLI

The following describe-vpcs example retrieves details for all of your VPCs.

```bash
aws ec2 describe-vpcs
```

The following describe-vpcs example retrieves details for the specified VPC.

```bash
aws ec2 describe-vpcs \ 
--vpc-ids vpc-06e4ab6c6cEXAMPLE
```

Using the Amazon VPC console
In the VPC console (https://console.aws.amazon.com/vpc/), choose Your VPCs at left. Choose the VPC-ID that you want to use. The correct one has Availability Zones in your AWS Region and also meets the requirements described in Setting Up a VPC to Use with Amazon QuickSight (p. 730). Also note the ID of Main Route Table, because you need this to identify related subnets.

**Tip**

In the Amazon VPC console, you can filter by VPC. This option is located at the top left of the console. If you filter by your VPC ID, all the other menus display only the network elements that are in your selected VPC.

### Identify the Subnet ID to Use

To locate the subnet ID for the subnet used by the VPC, open the VPC console. Locate the VPC you are using, and choose a subnet. QuickSight creates its QuickSight elastic network interface (QuickSight network interface) for the subnet that you choose. The QuickSight network interface gets created after you save your VPC connection settings, described in the following section.

Your database instances can reside in different subnets. However, make sure you can trace the route from this subnet to any data destinations that you want to reach.

**Using the AWS CLI**

The following example describes all existing subnets.

```
aws ec2 describe-subnets
```

The following `describe-subnets` example uses a filter to retrieve details for the subnets of the specified VPC.

```
aws ec2 describe-subnets \
--filters "Name=vpc-id,Values=vpc-06e4ab6c6cEXAMPLE"
```

**Using the Amazon VPC console**

In the VPC console (https://console.aws.amazon.com/vpc/), choose Subnets at left, and find the correct **Subnet ID**. Any subnet is correct if your database subnet has a route to the subnet that you choose at this point. In most cases, if you haven't configured the VPC network yourself, all subnets are connected.

### Identify the Security Group to Use

The security group contains rules that control the inbound and outbound network traffic on your data source instances. The security group you are using should have the description "QuickSight-VPC" to make it easier to identify.

When you locate the correct security group, copy its **Group ID** value.

**Using the AWS CLI**

The following example displays the security groups in a specific AWS Region. It displays only the group ID, name, and description. It filters the result to display only groups for a specific VPC ID that also have a description of "QuickSight-VPC".

```
aws ec2 describe-security-groups \
--region us-west-2 \
--query 'SecurityGroups[*].[GroupId, GroupName, Description]' \
--filters "Name=vpc-id,Values=vpc-06e4ab6c6cEXAMPLE" "Name=description,Values=QuickSight-VPC"
```
The following example displays information about the security group with the ID `sg-903004f8`. Note that you can’t reference a security group for EC2-VPC by name.

```
aws ec2 describe-security-groups --group-ids sg-903004f8 --region us-west-2
```

The following example queries the results to describe VPC the inbound and outbound rules of a security group with a specific ID (`sg-903004f8`), in a specific AWS Region (`us-west-2`).

```
aws ec2 describe-security-groups \
--region us-west-2 \
--group-ids sg-903004f8 \
--query 'SecurityGroups[\*.[GroupId, GroupName, Description, 
IpPermissions,IpPermissionsEgress]'
```

The following example uses filters to describe VPC security groups that have a specific rule that allows SQL Server traffic (port `1433`). The example also has a rule that allows traffic from all addresses (0.0.0.0/0). The output is filtered to display only the group IDs, names, and descriptions of the security groups. Security groups must match all filters to be returned in the results. However, a single rule doesn’t have to match all filters. (EC2-VPC only)

```
aws ec2 describe-security-groups \
--filters Name=ip-permission.from-port,Values=1433 \
Name=ip-permission.to-port,Values=1433 \
Name=ip-permission.cidr,Values='0.0.0.0/0' \
--query 'SecurityGroups[\*.[GroupId, GroupName, Description]'
```

Using the Amazon VPC console

In the VPC console (https://console.aws.amazon.com/vpc/), choose **Security groups** at left, and find the correct group ID. The correct one has your VPC ID on it. It should also have a tag or description that includes the word "QuickSight".

### Configuring the VPC Connection in the QuickSight Console

**Applies to:** Enterprise Edition

**Intended audience:** System administrators and Amazon QuickSight administrators

To create a secure private connection to the Amazon VPC service from Amazon QuickSight Enterprise edition, use the following procedure.

**Prerequisites**

- Sign in to QuickSight as an QuickSight admin to set up a VPC connection in QuickSight. To verify that you're an QuickSight administrator, choose your profile image at upper right. If your profile menu contains the option **Manage QuickSight**, then you're an QuickSight administrator.
- Before you begin, make sure that you have the following information available to copy and paste into the **VPC Connection** screen. For more information, see Finding Information to Connect to a VPC (p. 736).
- AWS Region – The AWS Region where you plan to create a connection to your data source.
• VPC ID – The ID of the VPC that contains the data, the subnets, and the security groups that you plan to use.
• Subnet ID – The ID of the subnet that the QuickSight network interface is using.
• Security group ID – The ID of the security group.

To create a secure private connection to the Amazon VPC service from Amazon QuickSight Enterprise edition

1. In QuickSight, choose your profile icon at the upper right of the screen, then choose Manage QuickSight.

   Only QuickSight administrators can view the Manage QuickSight option. If you don't see this option on your profile menu, you're not an administrator. In this case, contact your QuickSight account administrators for assistance.

2. On the menu at left, choose Manage VPC connections. Choose one of the following three options:

   1. Create a VPC connection

      To add a new VPC connection, choose Add VPC connection.

   2. Edit a VPC connection

      To change a VPC connection, you must delete it and then recreate it. You can reuse the same VPC connection name, to avoid having to reconnect your data sources.

   3. Delete a VPC connection

      To delete a VPC connection, use the delete icon.

3. For **VPC connection name**, enter a unique descriptive name of your choice. This name doesn't need to be an actual VPC ID or name.

4. Enter the subnet ID for **Subnet ID**, and enter the group ID for **Security group ID**.

5. (Optional) If you aren't using DNS resolver endpoints, skip to the next step.

   If your database host IP address must be resolved through private DNS servers in your AWS account, enter the DNS resolver endpoints (one per line).

   Make sure that you are entering an endpoint, rather than a database address like the one you plan to use in QuickSight. Most AWS-hosted databases don't need to resolve DNS queries between VPCs and a customer's network. For more information, see Resolving DNS queries between VPCs and your network in the Amazon Route 53 Developer Guide. You only need this if you can't resolve the IP address that connects to your database by using the public DNS server system.

6. Review your choices, then choose Create.

7. Verify that QuickSight has created an QuickSight elastic network interface in your AWS account. To do this, check that the network interface has Status in-use and Attachment Status attached. To locate the correct network interface, use the following steps:

   a. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/. Choose Network Interfaces at left. Find the network interface that has a description with a prefix of QuickSight. It is in the VPC, subnet, and security group that you choose in the previous steps.

   b. Choose this network interface, and view Details in the lower window.

   c. (Optional) If the network interface Status isn't in-use or Attachment Status isn't attached, then delete and recreate the VPC connection in QuickSight. If this happens more than once, contact AWS Support.

   To use the AWS CLI, use the following command to view QuickSight network interface information.
aws ec2 describe-network-interfaces \
  --filters Name=description,Values="QuickSight" \n  Name=status,Values=in-use \n  Name="attachment.status",Values=attached \
  --query 'NetworkInterfaces[*].\n    [Description,NetworkInterfaceId,Status,Attachment.Status,VpcId,Groups[0].GroupName,Groups[0].GroupId,SubnetId,PrivateIpAddresses[0].PrivateIpAddress]'

**Note**
When you create a new QuickSight VPC connection, QuickSight assumes an implicit IAM role with permissions to the following QuickSight and EC2 actions: `quicksight:CreateVPCConnection` and `ec2:CreateNetworkInterface`. However, these permissions aren't directly assigned to the person who configures the QuickSight VPC connection.

**Testing the Connection to Your VPC Data Source**

**Applies to:** Enterprise Edition

**Intended audience:** Amazon QuickSight administrators and authors

To test whether you can connect to your data source through an existing Amazon QuickSight VPC connection, use the following procedure.

Before you begin, collect the information you need to connect. If you plan to copy and paste settings from a file, make sure that it doesn't contain any of the following: formatting (list bullets or numbers), blank space (spaces, tabs), or invisible "gremlin" (non-ASCII, null (ASCII 0), or control) characters.

1. On the QuickSight start page, choose **Manage data**.
2. On the **Datasets** page, choose **New data set**.
3. In the **FROM NEW DATA SOURCES** section of the **Create a data set** page, choose a supported data source that you want to connect to. For a list of data sources that support VPC, see **Identify the Data Sources to Use** (p. 737).

   Your data source instance must use the same VPC that you used to create the VPC connection. Also, the associated security group must be properly configured. For more information, see **Setting Up a VPC to Use with Amazon QuickSight** (p. 730).

4. Enter the connection information for the data source. The fields for the data source are sometimes displayed in different order depending on which data source you choose. For more information, see **Creating a Data Source** (p. 88).

   - For **Data source name**, enter a descriptive name for the new data source. This name appears beside the data source logo on a tile on the **Create a data set** page. For testing purposes, name it "VPC test-" followed by the database name or location, whichever is unique.
   - For **Connection Type**, choose the name of the VPC connection that has a route to your data source. If the correct VPC is missing from the list, ask a QuickSight administrator to verify that the VPC connection is correct in QuickSight. If it looks correct, ask a system administrator to verify that the data source and VPC are set up for this purpose.
   - The name or other identifier for the server or instance to connect to. The descriptors vary depending on which one you're connecting to, but it's usually one or more of the following: hostname, IP address, cluster ID, instance ID, connector, or site based URL.
• **Database name** shows the default database for the **Instance ID** cluster or instance. If you want to use a different database on that cluster or instance, enter its name.

- The name of the collection of data that you want to use.

  The descriptor varies depending on the provider, but it’s usually one of the following: database, warehouse, or catalog. In this topic, we use the word “database” as a generic term.

- For **Credentials**, enter a user name and password to use for everyone who connects from QuickSight using this data source. The user name must have permissions to do the following:

  - Access the target database.
  - Read (perform a `SELECT` statement on) all of the tables that you want to use in that database.

5. Choose **Validate connection** to verify your connection information is correct. If your connection doesn't validate, correct the connection information and try again. If the information looks correct but doesn't validate, do one or all of the following:

- Contact your data source administrator to verify your connection settings.
- Contact your QuickSight administrator to verify the settings in the QuickSight VPC connection.
- Contact your AWS administrator to verify that the VPC is correctly configured for use with QuickSight.

6. After the connection validates, choose **Create data source** to save the connection profile. Or, choose **Cancel** if you don't need to save it (recommended) after testing is complete.

**Best Practices for Security in Amazon QuickSight**

Amazon QuickSight provides a number of security features to consider as you develop and implement your own security policies. The following best practices are general guidelines and don’t represent a complete security solution. Because these best practices might not be appropriate or sufficient for your environment, treat them as helpful considerations rather than prescriptions.

**Firewall** – To allow users to access Amazon QuickSight, allow access to HTTPS and WebSockets Secure (wss://) protocol. To allow Amazon QuickSight to reach a database that is on a non-AWS server, change that server's firewall configuration to accept traffic from the appropriate Amazon QuickSight IP address range.

**SSL** – Use SSL to connect to your databases, especially if you are using public networks. Using SSL with Amazon QuickSight requires the use of certificates signed by a publicly-recognized certificate authority (CA).

**Enhanced security** – Use Amazon QuickSight Enterprise edition to make use of its enhanced security capabilities, including the following.

- Store data in SPICE with encryption at rest
- Integrate Active Directory and SSO authentication
- Securely access data in private VPCs and on-premises
- Limit access to data with row level security

**VPC** – (Enterprise Edition) Use a virtual private cloud (VPC), for data in AWS data sources and for data in on-premises servers without public connectivity. For AWS sources, VPC access for Amazon QuickSight uses an elastic network interface for secure, private communication with data sources in a VPC. For your local data, VPC allows you to use AWS Direct Connect to create a secure, private link with your on-premises resources.
AWS glossary

For the latest AWS terminology, see the AWS glossary in the AWS General Reference.
Document History for the Amazon QuickSight User Guide

This page describes changes to the Amazon QuickSight User Guide. For notifications about these documentation changes, subscribe to the RSS feed using the icon near the top of this page.

New Amazon QuickSight releases appear in different AWS Regions over a period of time, beginning with the first Region on the initial release date. Documentation is released in coordination with this process. If you have questions, contact AWS Support or your technical account manager.

To find out about changes to the Amazon QuickSight service, see the Amazon QuickSight newsletter. For update announcements, see Recent Announcements for Amazon QuickSight.

**Note**
The following table describes important changes in each Amazon QuickSight User Guide release since March 4, 2019.
In the Kindle guide version, you can find the last change date above the table of contents. On the Kindle website, the original publication date is unchanged.

<table>
<thead>
<tr>
<th>update-history-change</th>
<th>update-history-description</th>
<th>update-history-date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds support for date fields (p. 744)</td>
<td>Amazon QuickSight now supports aggregating date fields at the second level. For more information, see Changing Date Field Granularity.</td>
<td>March 30, 2021</td>
</tr>
<tr>
<td>Pivot table sorting improvements (p. 744)</td>
<td>Amazon QuickSight now supports sorting values in pivots tables by fields in the Rows and Columns field wells or by column headers. For more information, see Sorting Pivot Tables.</td>
<td>March 30, 2021</td>
</tr>
<tr>
<td>New feature (p. 744)</td>
<td>Amazon QuickSight now supports customizing tooltips in visuals. For more information, see Customizing Tooltips in a Visual.</td>
<td>March 16, 2021</td>
</tr>
<tr>
<td>Feature improvements (p. 744)</td>
<td>In Enterprise edition, Amazon QuickSight now supports computing anomalies for a time and measure field only, and computing the exact combination of fields in the Category field well. For more information, see Adding an ML Insight to Detect Outliers and Key Drivers.</td>
<td>March 16, 2021</td>
</tr>
<tr>
<td>Line chart improvements (p. 744)</td>
<td>Amazon QuickSight now supports creating line charts</td>
<td>March 1, 2021</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
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<tr>
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</tr>
<tr>
<td>New formatting options for charts (p. 744)</td>
<td>Amazon QuickSight now supports hiding axis lines, axis labels, and grid lines, and also customizing the how axis labels appear in a chart. For more information, see Formatting Axis Lines, Axis Labels, and Grid Lines.</td>
<td>February 5, 2021</td>
</tr>
<tr>
<td>New chart type: Sankey diagrams (p. 744)</td>
<td>Amazon QuickSight now supports creating Sankey Diagrams. For more information, see Using Sankey Diagrams.</td>
<td>February 5, 2021</td>
</tr>
<tr>
<td>Field mapping improvements (p. 744)</td>
<td>Amazon QuickSight now supports updating field mapping between mismatched and missing fields when replacing a dataset in an analysis. For more information, see Replacing Datasets.</td>
<td>February 5, 2021</td>
</tr>
<tr>
<td>Data prep enhancements (p. 744)</td>
<td>Amazon QuickSight now supports organizing fields into folders and subfolders when preparing or editing datasets. For more information see, Organizing Fields into Folders.</td>
<td>February 5, 2021</td>
</tr>
<tr>
<td>New features (p. 744)</td>
<td>In Enterprise edition, Amazon QuickSight now supports displaying anomaly ranges and multiple anomalies when exploring anomalies. Line charts now display notifications when QuickSight detects an anomaly, key driver, or forecasting opportunity. For more information, see Detecting Outliers with ML-Powered Anomaly Detection.</td>
<td>February 3, 2021</td>
</tr>
<tr>
<td>New Region: South America (São Paulo) (p. 744)</td>
<td>Amazon QuickSight is now available in South America (São Paulo) (sa-east-1). For more information, see AWS Regions, Websites, IP Address Ranges, and Endpoints.</td>
<td>December 23, 2020</td>
</tr>
<tr>
<td>New Region: Canada (central) (p. 744)</td>
<td>Amazon QuickSight is now available in Canada (Central) (ca-central-1). For more information, see AWS Regions, Websites, IP Address Ranges, and Endpoints.</td>
<td>December 23, 2020</td>
</tr>
<tr>
<td>Change</td>
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<tr>
<td>Define an action to open a different sheet (p. 744)</td>
<td>QuickSight now supports navigation actions to enable you to open a different sheet with the included parameter values. For more information, see Using Custom Actions for Filtering and Navigating.</td>
<td>December 21, 2020</td>
</tr>
<tr>
<td>Data Source Enhancement: Athena Federated Query (p. 744)</td>
<td>QuickSight now supports connecting to Athena Federated Query. For more information, see Creating a Dataset Using Amazon Athena Data.</td>
<td>December 21, 2020</td>
</tr>
<tr>
<td>New list items sheet control type (p. 744)</td>
<td>Amazon QuickSight now supports single and multi-select list control on dashboards. For more information, see Parameter Controls.</td>
<td>December 18, 2020</td>
</tr>
<tr>
<td>New formatting options for tables (p. 744)</td>
<td>In Amazon QuickSight, you can now reorder columns in table charts. For more information, see Using Tables as Visuals.</td>
<td>December 17, 2020</td>
</tr>
<tr>
<td>Row-level security (RLS) now supports GRANT option only (p. 744)</td>
<td>To streamline and simplify RLS setup, Amazon QuickSight no longer supports using RLS in deny-access mode. To create a new RLS configurations, use the explicit grant-access model. Current RLS datasets and deny-access configurations should continue to work as expected. For more information, see Using Row-Level Security (RLS) to Restrict Access to a Dataset.</td>
<td>December 6, 2020</td>
</tr>
<tr>
<td>New percentile functions (p. 744)</td>
<td>Amazon QuickSight now supports variations on percentile calculations, including aggregate functions percentileCont and percentileDisc and OVER functions percentileContOver and percentileDiscOver. You can use all of these functions in the calculations editor in analysis mode. For more information, see Functions by Category.</td>
<td>December 6, 2020</td>
</tr>
<tr>
<td>Topic</td>
<td>Description</td>
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<tr>
<td>Dynamic queries, plus dataset editor improvements (p. 744)</td>
<td>Amazon QuickSight now enables you to improve performance for visuals based on direct queries by specifying unique keys for joined tables. There are also multiple interface improvements, such as settings for optional autopreviews, zoom in and out of data diagrams, join recommendations, and more. For more information, see Joining Data.</td>
<td>December 6, 2020</td>
</tr>
<tr>
<td>Developer Portal for Embedding (p. 744)</td>
<td>The QuickSight Dev Portal helps you learn how to use embedding by example in your web site or application. For more information, see Using the Dev Portal.</td>
<td>November 30, 2020</td>
</tr>
<tr>
<td>New data source: Amazon Elasticsearch (p. 744)</td>
<td>Amazon QuickSight now supports connecting to Amazon Elasticsearch. For more information, see Using Amazon Elasticsearch with Amazon QuickSight.</td>
<td>November 25, 2020</td>
</tr>
<tr>
<td>Format metrics on pie charts (p. 744)</td>
<td>Amazon QuickSight now supports formatting metrics on pie charts to display values, percentages, or both. For more information, see Customizing Data Labels.</td>
<td>November 25, 2020</td>
</tr>
<tr>
<td>New formatting options for tables (p. 744)</td>
<td>In Amazon QuickSight, you can now vertically align and wrap the text for headers in table charts. For more information, see Using Tables as Visuals.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>New chart type: Box Plots (p. 744)</td>
<td>Amazon QuickSight now supports using box plots so you can visualize how your data is distributed across an axis or over time. For more information, see Box Plots.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>Filled Maps (p. 744)</td>
<td>Amazon QuickSight now supports filled maps so you can visualize your data over a geographical area. For more information, see Filled Maps.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>Favorite folders (p. 744)</td>
<td>In Amazon QuickSight, you can now favorite your folders for easy access. For more information, see Organizing Assets into Folders.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>Change in Display Limits (p. 744)</td>
<td>For parameter controls and filters, Amazon QuickSight now displays up to 1,000 sample values. When you have more than that, you use the search box to locate a value. For more information, see Using a Control with a Parameter.</td>
<td>November 16, 2020</td>
</tr>
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</tr>
<tr>
<td>Null rendering (p. 744)</td>
<td>Amazon QuickSight now allows null values to be updated to a custom string. For more information, see Changing a Field Format.</td>
<td>November 9, 2020</td>
</tr>
<tr>
<td>New chart type: Waterfall charts (p. 744)</td>
<td>Amazon QuickSight now supports using waterfall charts so you can view your data sequentially. For more information, see Waterfall Charts.</td>
<td>November 9, 2020</td>
</tr>
<tr>
<td>Embedding for everyone (p. 744)</td>
<td>Amazon QuickSight Enterprise edition now supports embedding for everyone. When you purchase session packs with capacity pricing, you can enable visitors to use embedded dashboards without registering them as QuickSight users. For more information, see Embedded Analytics.</td>
<td>November 9, 2020</td>
</tr>
<tr>
<td>Column-level security (p. 744)</td>
<td>Amazon QuickSight now supports using column-level security to restrict access to a dataset. For more information, see Using Column-Level Security.</td>
<td>November 9, 2020</td>
</tr>
<tr>
<td>Service provider initiated federation (p. 744)</td>
<td>Amazon QuickSight Enterprise edition now supports service provider initiated federation, so you can sign on directly to QuickSight using your SSO login and password. For more information, see Setting Up Service Provider–Initiated Federation with Amazon QuickSight Enterprise Edition.</td>
<td>October 30, 2020</td>
</tr>
<tr>
<td>New chart type: Funnel charts (p. 744)</td>
<td>Amazon QuickSight now supports using funnel charts so you can display your data in a linear process. For more information, see Funnel Charts.</td>
<td>October 29, 2020</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Custom sorting (p. 744)</td>
<td>Amazon QuickSight now enables you to apply sort options on fields outside the field wells. This feature is available for all charts that support sorting. For more information, see Describing Data.</td>
<td>October 29, 2020</td>
</tr>
<tr>
<td>New Region: AWS GovCloud (US-West) (p. 744)</td>
<td>Amazon QuickSight is now available in AWS GovCloud (US-West) (gov-west-1). For more information, see Amazon QuickSight - AWS GovCloud (US).</td>
<td>October 28, 2020</td>
</tr>
<tr>
<td>New data source: Oracle (p. 744)</td>
<td>Amazon QuickSight now supports connecting to Oracle. For more information, see Supported Data Sources.</td>
<td>October 23, 2020</td>
</tr>
<tr>
<td>Filter across datasets (p. 744)</td>
<td>In Amazon QuickSight, you can now create filters that apply to multiple datasets in an analysis. For more information, see Filtering Data.</td>
<td>October 23, 2020</td>
</tr>
<tr>
<td>Add field descriptions to datasets (p. 744)</td>
<td>Amazon QuickSight now enables you to add column or field descriptions to datasets. This metadata is visible in both datasets and analyses, helping you make your data self-explanatory. For more information, see Describing Data.</td>
<td>October 23, 2020</td>
</tr>
<tr>
<td>Filter controls on analysis sheets (p. 744)</td>
<td>Amazon QuickSight now offers a filter control that you can add to your analysis with a single click. You can put filters beside dashboard visuals and resize them to fit. For more information, see Using Filter Controls.</td>
<td>October 5, 2020</td>
</tr>
<tr>
<td>New data source: Amazon Timestream (p. 744)</td>
<td>Amazon QuickSight now supports Amazon Timestream as a data source. For more information, see Using Amazon Timestream Data with QuickSight.</td>
<td>October 1, 2020</td>
</tr>
<tr>
<td>Export to Excel (p. 744)</td>
<td>Amazon QuickSight now supports exporting data from pivot tables and table charts to Microsoft Excel (.xlsx) format. For more information, see Exporting Data.</td>
<td>September 14, 2020</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Duplicate sheets (p. 744)</td>
<td>Amazon QuickSight now supports duplicating sheets. For more information, see Working with Multiple Sheets in an Amazon QuickSight Analysis.</td>
<td>September 14, 2020</td>
</tr>
<tr>
<td>Customize labels of totals and subtotals (p. 744)</td>
<td>In Amazon QuickSight, you can now add custom text to display beside totals and subtotals for pivot tables and table charts. For more information, see Displaying Totals and Subtotals.</td>
<td>September 14, 2020</td>
</tr>
<tr>
<td>Skipped row details (p. 744)</td>
<td>When you import data into Amazon QuickSight, you now get better error messages and row-by-row information on what caused rows to be skipped during ingestion into SPICE. For more information, see Troubleshooting Skipped Rows.</td>
<td>September 12, 2020</td>
</tr>
<tr>
<td>New configuration option for multivalue lists (p. 744)</td>
<td>Amazon QuickSight now supports a configuration option for multivalue lists to start with no values selected. For more information, see Setting Up Parameters in Amazon QuickSight.</td>
<td>September 11, 2020</td>
</tr>
<tr>
<td>Reference lines (p. 744)</td>
<td>Amazon QuickSight now supports using reference lines in bar, line, and combo charts. For more information, see Reference Lines.</td>
<td>September 3, 2020</td>
</tr>
<tr>
<td>New table calculations (p. 744)</td>
<td>Amazon QuickSight now supports using window functions firstValue and lastValue in analyses. For more information, see Table Calculations.</td>
<td>August 25, 2020</td>
</tr>
<tr>
<td>Multivalue default parameters (p. 744)</td>
<td>Amazon QuickSight now supports dynamic default values for multi-valued parameters. For more information, see Creating Parameter Defaults in Amazon QuickSight.</td>
<td>August 25, 2020</td>
</tr>
<tr>
<td>Last active status for users (p. 744)</td>
<td>Amazon QuickSight administrators can now see the last date and time that people accessed QuickSight. For more information, see Viewing User Details.</td>
<td>August 25, 2020</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Join SQL queries, tables, and files (p. 744)</td>
<td>Amazon QuickSight now supports using custom SQL queries in joins with other queries, tables, and files. For more information, see Joining Data.</td>
<td>August 25, 2020</td>
</tr>
<tr>
<td>Calculated expressions editor (p. 744)</td>
<td>The enhanced editor adds ease-of-use features to help you more easily create calculated expressions in Amazon QuickSight. With the new full-screen editor, you can add functions and values directly from the menu. For more information, see Adding a Calculated Field to an Analysis.</td>
<td>August 25, 2020</td>
</tr>
<tr>
<td>Personal and shared folders (p. 744)</td>
<td>Amazon QuickSight Enterprise edition now offers personal and shared folders to make it easier to discover, organize, share, and explore your available assets. For more information, see Organizing Amazon QuickSight Assets into Folders.</td>
<td>August 5, 2020</td>
</tr>
<tr>
<td>Embed the Amazon QuickSight console (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, you can now provide the full dashboard authoring experience of the QuickSight console in your own custom-branded authoring portal. For more information, see Embedding the Amazon QuickSight Console.</td>
<td>July 23, 2020</td>
</tr>
<tr>
<td>Datasets with 2,000 columns (p. 744)</td>
<td>Amazon QuickSight now supports datasets that have up to 2,000 columns. For more information, see Data Source Limits.</td>
<td>July 23, 2020</td>
</tr>
<tr>
<td>Customized permissions (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, you can now create custom roles to restrict a person from using specific functionality in the Amazon QuickSight console, for example to control who can manage data sources and datasets or who can manage or subscribe to email reports. For more information, see Customizing Access to the Amazon QuickSight Console.</td>
<td>July 23, 2020</td>
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<tr>
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<tr>
<td>Customize the console (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, you can now choose whether to show or hide QuickSight startup samples and videos. You can also create and specify a default theme to add branding to your experience of the QuickSight console. For more information, see Customizing the Amazon QuickSight Console.</td>
<td>July 23, 2020</td>
</tr>
<tr>
<td>Amazon QuickSight support for multitenancy (p. 744)</td>
<td>In Enterprise edition, QuickSight now offers an additional layer of security to support multitenancy. By creating users and groups in a QuickSight namespace, you can isolate them from users and groups in other namespaces. For more information, see Supporting Multitenancy with Isolated Namespaces.</td>
<td>July 23, 2020</td>
</tr>
<tr>
<td>Larger SPICE datasets (p. 744)</td>
<td>Amazon QuickSight Enterprise edition now supports SPICE datasets with up to 250 million (250,000,000) rows or 500 GB. For more information, see Data Source Limits.</td>
<td>July 9, 2020</td>
</tr>
<tr>
<td>Display width settings (p. 744)</td>
<td>In Amazon QuickSight, you can now choose between responsive and fixed layouts for your analyses and dashboards. You can also temporarily change your current view from the menu bar. For more information, see Display Settings.</td>
<td>July 9, 2020</td>
</tr>
<tr>
<td>Data refresh notifications (p. 744)</td>
<td>Amazon QuickSight now supports sending email to notify SPICE dataset owners when data refresh fails. For more information, see Refreshing Data.</td>
<td>July 9, 2020</td>
</tr>
<tr>
<td>Color settings for heat maps and tree maps (p. 744)</td>
<td>You can now customize gradient colors for your heat maps and tree maps in Amazon QuickSight. For more information, see Changing Colors on Heat Maps and Tree Maps.</td>
<td>July 9, 2020</td>
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<tr>
<td>Feature</td>
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<tr>
<td>Font choice (p. 744)</td>
<td>You can now customize your theme with a font. Choose from a selection of fonts supported by Amazon QuickSight. For more information, see Using Themes in Amazon QuickSight.</td>
<td>July 8, 2020</td>
</tr>
<tr>
<td>AWS Lake Formation (p. 744)</td>
<td>If you use Amazon QuickSight Enterprise edition to query Amazon Athena, you can simplify data access management by using AWS Lake Formation to control permissions to Athena. For more information, see Authorizing Connections through AWS Lake Formation.</td>
<td>June 29, 2020</td>
</tr>
<tr>
<td>New chart type (p. 744)</td>
<td>Amazon QuickSight now supports using histograms so you can display the distribution of values in your data. For more information, see Histogram charts.</td>
<td>June 12, 2020</td>
</tr>
<tr>
<td>Gauge chart update (p. 744)</td>
<td>You can now add conditional formatting to gauge charts in Amazon QuickSight. For more information, see Adding Conditional Formatting to Visuals.</td>
<td>June 12, 2020</td>
</tr>
<tr>
<td>Five new languages (p. 744)</td>
<td>Amazon QuickSight now supports Danish, Dutch, Finnish, Norwegian, and Swedish. These languages expand upon the existing 15 languages already available in Amazon QuickSight. For more information, see Choosing a Language in Amazon QuickSight.</td>
<td>June 12, 2020</td>
</tr>
<tr>
<td>New Region: Mumbai (p. 744)</td>
<td>Amazon QuickSight is now available in Asia Pacific (Mumbai) (ap-south-1). For more information, see AWS Regions, Websites, IP Address Ranges, and Endpoints.</td>
<td>June 3, 2020</td>
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<td>Feature</td>
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<tr>
<td>New SQL editor (p. 744)</td>
<td>Amazon QuickSight enhanced the SQL editor that you use to create datasets from SQL queries. The new SQL editor supports syntax highlighting, basic autocomplete, autoindent, and line numbering. Also, you can use the new schema explorer to interactively explore schemas, tables, fields, and data types. For more information, see Using a SQL Query.</td>
<td>May 20, 2020</td>
</tr>
<tr>
<td>SageMaker integration now generally available (p. 744)</td>
<td>The integration of SageMaker with Amazon QuickSight launched in preview just before AWS re:Invent 2019. Now, this feature is generally available in all AWS Regions that are supported by QuickSight. Amazon QuickSight and SageMaker together makes it faster, easier, and more cost-effective for customers to make use of their machine learning models for visualization and predictions. For more information, see Amazon QuickSight Integration with SageMaker.</td>
<td>May 19, 2020</td>
</tr>
<tr>
<td>Update to Presto data sources (p. 744)</td>
<td>You can now use nonauthenticated private Presto as a data source. For more information, see Creating a Data Source Using Presto.</td>
<td>May 18, 2020</td>
</tr>
<tr>
<td>Rewrite of Amazon QuickSight VPC connection section (p. 744)</td>
<td>Based on your feedback, we completely rewrote this documentation to better explain using Amazon VPC with Amazon QuickSight. It includes examples and AWS CLI commands to help you establish the path from Amazon QuickSight to your data source, even if you're using on-premises sources. For more information, see Amazon QuickSight VPC Connections.</td>
<td>May 18, 2020</td>
</tr>
<tr>
<td>Use logarithmic scale with Amazon QuickSight (p. 744)</td>
<td>You can now format visuals using log scale. For more information, see Changing the Visual Scale.</td>
<td>May 1, 2020</td>
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<tr>
<td>Severity levels for Amazon QuickSight anomaly detection insights (p. 744)</td>
<td>You can now choose the level of severity for anomalies that display in your insight widgets. For more information, see Using Anomaly Detection.</td>
<td>April 17, 2020</td>
</tr>
<tr>
<td>Improvements to visual controls in Amazon QuickSight (p. 744)</td>
<td>The on-visual menu can now float at the upper-right corner of the visual, moving inside or outside the border of the visual. Plus, you can make your visuals smaller and have more of them, as many as 36 across. For smaller visuals, the new visual controls have more viewing area for charts and insights. To see the new menu, choose one of your visuals. For more information, see Working with Visuals.</td>
<td>April 17, 2020</td>
</tr>
<tr>
<td>Amazon QuickSight adds a new visual type (p. 744)</td>
<td>The new visual type, stacked area line charts, is similar to area charts except that the stacked values indicate the relationship that each value contributes to the whole. Using stacked area charts, you can display cumulative totals over time while displaying the breakdown by the chosen category. For more information, see Line charts.</td>
<td>April 17, 2020</td>
</tr>
<tr>
<td>Amazon QuickSight activates legends by adding menus for quick feature access (p. 744)</td>
<td>Amazon QuickSight now supports clicking on legend items to quickly access features like filtering, drilling, chart colors, and custom actions for filtering and URLs. For more information, see Focusing on Visual Elements and Custom Actions in QuickSight.</td>
<td>April 17, 2020</td>
</tr>
<tr>
<td>Amazon QuickSight adds cascading filters (p. 744)</td>
<td>You can now create cascading filters by adding them to custom actions in your analyses and dashboards. Each custom filter action can target one or more visuals in the same sheet, creating a cascading filter effect. For more information, see Custom Actions in QuickSight.</td>
<td>April 2, 2020</td>
</tr>
<tr>
<td>Modulo operation available in Amazon QuickSight (p. 744)</td>
<td>You can now use modulo operation to find the remainder after dividing one number into another. For more information, see mod.</td>
<td>March 8, 2020</td>
</tr>
<tr>
<td>Amazon QuickSight User Guide</td>
<td>Images in Amazon QuickSight narratives (p. 744)</td>
<td>You can now insert images from URLs to be rendered as part of a narrative. Images can be resized, conditionally shown within an IF block, and also hyperlinked with the URL feature. For more information, see Expression Editor Screen and Menus.</td>
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<tr>
<td>Amazon QuickSight adds minimum and maximum dates (p. 744)</td>
<td>You can now use minimum and maximum date aggregations in tables and pivot tables. For more information, see max and min.</td>
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<tr>
<td>Now you can customize minimum delta values to enhance Amazon QuickSight ML-powered anomaly detection (p. 744)</td>
<td>Now you can control the minimum delta value that Amazon QuickSight uses to detect anomalies (also known as outliers). You can change this setting when you are configuring or exploring anomalies. For more information, see Detecting Outliers with ML-Powered Anomaly Detection.</td>
<td>February 4, 2020</td>
</tr>
<tr>
<td>Improvements in the Amazon QuickSight narrative expression editor (p. 744)</td>
<td>Amazon QuickSight now provides a much more spacious interface for editing narrative expressions. The interface now has instant feedback in a preview of your evaluated narrative before you save any changes. Plus, narratives now support both static and dynamic URLs in your custom narratives for links to searches, apps, other dashboards, other sheets in the same dashboard, and more. For more information, see Using Autonarratives.</td>
<td>February 4, 2020</td>
</tr>
<tr>
<td>SageMaker integration now available in more AWS Regions (p. 744)</td>
<td>The public preview for integrating SageMaker with Amazon QuickSight is now available in all of the AWS Regions that are supported by QuickSight. For more information, see Amazon QuickSight Integration with SageMaker.</td>
<td>January 10, 2020</td>
</tr>
<tr>
<td>Private VPC support for Presto in Amazon QuickSight (p. 744)</td>
<td>Now Presto can use a VPC connection. For more information, see Supported Data Sources for VPC.</td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>New mathematical functions in Amazon QuickSight (p. 744)</td>
<td>Amazon QuickSight now supports functions for base 10 logarithms ((\log)), natural logarithm ((\ln)), absolute value ((\text{abs})), square root ((\text{sqrt})), and base of natural log (e) raised to the power of ((\text{exp})). For more information, see <em>Functions and Operators.</em></td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>New LAA functions in Amazon QuickSight (p. 744)</td>
<td>Now you can use rank, denseRank, and percentileRank for level-aware aggregations. For more information, see <em>Using Level-Aware Aggregations.</em></td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now enables you to choose an Amazon Athena workgroup (p. 744)</td>
<td>By choosing an Athena workgroup, you can better manage your Athena datasets. Using this option, you can also allocate Athena costs to the workgroup that QuickSight is using, for better cost reporting. For more information, see <em>Creating a Dataset Using Amazon Athena.</em></td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>Integrate SageMaker ML models into your Amazon QuickSight analyses and dashboards (p. 744)</td>
<td>In this public preview, Amazon QuickSight launches the ability to integrate machine learning (ML) models created and trained in SageMaker. This new feature makes it easier to augment your business data with ML predictions. Add your data scientists' prebuilt inferences and predictions to your analysts' dashboards, and let the collaboration and decision-making begin. For more information, see <em>Amazon QuickSight Integration with SageMaker.</em></td>
<td>November 26, 2019</td>
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<tr>
<td><strong>New formatting options for visuals in Amazon QuickSight (p. 744)</strong></td>
<td>Amazon QuickSight launches more formatting for visuals and visuals titles, including font sizes from extra small to extra large. In key performance indicators (KPIs), you can set font sizes for primary and comparison values. In pivot tables and tables, you can see font sizes for table headers, cells, totals, and subtotals. Now your visuals render better even when smaller and with less padding between charts. For combo charts, you can now synchronize the Y-axes for both bars and lines into a single axis. For more information, see <a href="#">Formatting a Visual</a>.</td>
<td>November 23, 2019</td>
</tr>
<tr>
<td><strong>New Amazon QuickSight API operations (p. 744)</strong></td>
<td>Amazon QuickSight launches new API operations to programmatically manage your data, dashboards, and fine-grained access control capabilities linked with AWS Identity and Access Management (IAM). With new data API operations, you can create, update, and delete Amazon QuickSight data sources and datasets programmatically. You can also manage data refreshes on your SPICE data sets with API operations. Amazon QuickSight also introduces templates, which store the visual configuration and data schemas required for a dashboard. You can transfer templates across accounts or use them to instantiate dashboards with the same visual presentation but different data. For more information, see the <a href="#">Amazon QuickSight API Reference</a>.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td><strong>Amazon QuickSight supports the now function in SPICE (p. 744)</strong></td>
<td>For more information, see <a href="#">now</a>.</td>
<td>November 22, 2019</td>
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<tr>
<td>Amazon QuickSight now supports seconds in SPICE (p. 744)</td>
<td>Seconds are now supported in SPICE data sets. Datetime fields are no longer truncated to minutes. Now you can use the SS option for the period parameter in date functions including <code>addDateTime</code>, <code>dateDiff</code>, <code>extract</code>, and <code>truncDate</code>. For more information, see Date Functions.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now has themes (p. 744)</td>
<td>You can now create a collection of themes, and apply a theme to an analysis and all its dashboards. For more information, see Using Themes in Amazon QuickSight.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now supports conditional formatting for tables, pivot tables, and key performance indicators (KPIs). (p. 744)</td>
<td>For tables and pivot tables, you can set multiple conditions for fields or supported aggregations, along with format options to apply to a target cell. For KPIs, you can format the primary value based on conditions that are applied to any dimension in the dataset. The conditional formatting options now supported are text color, background color, and placement of supported icons. You can use icons from the provided set, or you can use Unicode icons instead. For more information, see Adding Conditional Formatting to Visuals.</td>
<td>November 18, 2019</td>
</tr>
<tr>
<td>View history for SPICE ingestion on your Amazon QuickSight datasets (p. 744)</td>
<td>You can now view the ingestion history for SPICE datasets in Amazon QuickSight. See information like when the latest ingestion started, how long it took, and what its status is. For more information, see View SPICE Ingestion History.</td>
<td>November 7, 2019</td>
</tr>
<tr>
<td>Add your own functionality to visuals with Amazon QuickSight actions (p. 744)</td>
<td>Amazon QuickSight enables you to add to the basic functionality for visuals by creating your own custom actions for filtering or opening URLs. For more information, see Custom Actions in Amazon QuickSight.</td>
<td>November 7, 2019</td>
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<tr>
<td>Amazon QuickSight now supports dynamic sheet titles (p. 744)</td>
<td>You can now use parameters in sheet titles to make the context of a dashboard clearer to the reader. For more information, see Formatting a Visual.</td>
<td>November 6, 2019</td>
</tr>
<tr>
<td>Use Amazon QuickSight to join data from multiple data sources (p. 744)</td>
<td>Amazon QuickSight now supports creating datasets that join multiple data sources. For more information, see Joining Data.</td>
<td>November 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight Mobile iOS update and a new Android app (p. 744)</td>
<td>Get access to insights from your data on the fly. Download the updated iOS app or the new Android app. You can browse, favorite, and interact with your dashboards and explore your data with drilldowns and filters. You can stay ahead of the curve by using forecasting. You can get email alerts when unexpected changes happen in your data, and you can share those insights with colleagues. For more information, see Amazon QuickSight Mobile.</td>
<td>November 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports printing (p. 744)</td>
<td>Now you can print a dashboard or an analysis. For more information, see Printing.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports a new AWS Region (p. 744)</td>
<td>Amazon QuickSight is now available in Asia Pacific (Seoul) (ap-northeast-2). For more information, see AWS Regions, Websites, IP Address Ranges, and Endpoints.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now supports visual-level formatting (p. 744)</td>
<td>Now, any formatting you apply from the field wells is applied only to the selected visual. For more information, see Formatting a Visual.</td>
<td>October 17, 2019</td>
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<tr>
<td>Transpose tables (p. 744)</td>
<td>In table visuals, you can now transpose columns and rows. For more information, see Tables.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td>Shared data sources (p. 744)</td>
<td>Share data sources with other users and groups. For more information, see Shared Data Sources.</td>
<td>October 10, 2019</td>
</tr>
</tbody>
</table>
SPICE enhancements (p. 744)  
SPICE dashboards now support new wildcard filters on dimensions. You can now filter your data using any of the available wildcard filters: 'contains', 'starts with', 'end with', 'equals'. Additionally, SPICE dashboards now support new string functions (toString and parseDecimal) and two new date functions (parseDate and formatDate). For more information, see Calculated Fields.

New publishing options for dashboards (p. 744)  
Control your user experience with more publishing options for your dashboards. These options include ability to toggle the filter pane, tooltips, drill up/down, and more. For more information, see Publish a Dashboard.

New median function (p. 744)  
Amazon QuickSight supports median as a new aggregation. For more information, see median.

New filter functionality (p. 744)  
Amazon QuickSight now supports additional relative date filter options. For more information, see Date Filters.

New aggregations for fields (p. 744)  
You can now use Nth percentile, median, standard deviation, and variance in field wells, filters, and ML Insights. For more information, see Field Aggregations.

Filter for context (p. 744)  
You can now filter text using the following wildcard comparison types: contains, does not contain, begins with, and ends with. For more information, see Text Filters.

October 10, 2019
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<tr>
<td>Use the power operator (^) in SPICE (p. 744)</td>
<td>Amazon QuickSight now supports using the power operator (^) on SPICE datasets. You can use the power operator with any numeric field, with any valid exponent. For example, &quot;revenue ^ 0.5&quot; computes the square root of the revenue field. For more information, see Arithmetic and Comparison Operators.</td>
<td>September 11, 2019</td>
</tr>
<tr>
<td>Use string functions in SPICE (p. 744)</td>
<td>Now you can use string functions for calculated fields in your analyses based on SPICE datasets. For more information, see Functions by Category.</td>
<td>September 11, 2019</td>
</tr>
<tr>
<td>Use level-aware aggregations to control your calculations (p. 744)</td>
<td>Amazon QuickSight now supports level-aware aggregation calculations. Using this feature, you can perform aggregations at prefilter and preaggregation levels, before aggregations that happen in the display. This helps you explore more advanced query-building strategies than ever before. For more information, see Level-Aware Aggregations.</td>
<td>September 11, 2019</td>
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<tr>
<td>Sort your anomalies (p. 744)</td>
<td>Now you can choose how to sort anomalies on the insight widget and in the anomaly exploration page. Choosing how to prioritize anomalies can help you identify the anomalies that are the most important to you. For more information, see Using ML-Powered Anomaly Detection.</td>
<td>September 11, 2019</td>
</tr>
<tr>
<td>Put 100 million rows into a SPICE dataset (p. 744)</td>
<td>We changed the SPICE dataset limit from 25GB to 100 million rows for Enterprise edition (and 25 million rows for Standard edition). For more information, see SPICE Data Source Limits.</td>
<td>September 11, 2019</td>
</tr>
<tr>
<td>Rename your dashboard, keep your settings (p. 744)</td>
<td>Amazon QuickSight now supports renaming your published dashboards in place. You can change the name and still keep your settings and subscribers. For more information, see Publishing a Dashboards.</td>
<td>September 6, 2019</td>
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<tr>
<td>New visual type: Word clouds (p. 744)</td>
<td>Amazon QuickSight supports word cloud visuals that are based on different aggregations over any dimension in your dataset. You can drill down, focus on specific data points, and apply specific colors to data points on the word cloud. For more information, see Word Clouds.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Filter out the last N time periods (p. 744)</td>
<td>Amazon QuickSight lets you exclude a specific number and type of time periods from a time range (after) filter. For more information, see Adding a Date Filter.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight new feature to mark favorites (p. 744)</td>
<td>Mark your favorite dashboards and analyses so you can come back to them quickly. For more information, see Using the Amazon QuickSight Start Page.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight Enterprise edition adds anomaly alerts (p. 744)</td>
<td>Your readers can subscribe themselves to anomaly alerts on dashboards to get the latest ML-powered anomaly detection and contribution analysis by email. For more information, see Using Data Dashboards.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Detect anomalies with less data (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, we lowered the required minimum data points to 15 for training anomaly detection. For more information, see Data Set Requirements for Using ML Insights with Amazon QuickSight.</td>
<td>August 1, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports new AWS Regions (p. 744)</td>
<td>Amazon QuickSight is available in Europe (London) and Europe (Frankfurt). Also, you can now connect to Active Directory in any AWS Region supported by Amazon QuickSight, except Asia Pacific (Singapore) and Asia Pacific (Sydney). For more information, see AWS Regions and IP Address Ranges.</td>
<td>August 1, 2019</td>
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<td>Amazon QuickSight adds custom colors for charts. (p. 744)</td>
<td>With the Amazon QuickSight enhanced color picker, you can choose custom colors for charts where color customization is supported. The enhanced color picker also retains the eight most recently used custom colors for easy selection across multiple charts. For more information, see Changing Visual Colors.</td>
<td>August 1, 2019</td>
</tr>
<tr>
<td>Embedding for Active Directory (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, you can now embed dashboards for users authenticated through Active Directory. For more information, see Embedding Dashboards.</td>
<td>July 11, 2019</td>
</tr>
<tr>
<td>Granular access control for using AWS services from Amazon QuickSight (p. 744)</td>
<td>In Amazon QuickSight Enterprise edition, you can scope down your security policies to allow specific people access to specific AWS resources. You can attach and detach IAM policies in the Amazon QuickSight interface, simplifying finer control over who can access your AWS data sources. For more information, see Controlling Access to AWS Resources.</td>
<td>June 14, 2019</td>
</tr>
<tr>
<td>Tabs for dashboards and analyses (p. 744)</td>
<td>Amazon QuickSight now supports multiple sheets inside of analyses and dashboards. You can add multiple tabs to your dashboards, utilize URL actions and on-screen controls to simplify navigation, and filter across all of your sheets. For more information, see Multiple Sheets.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>New functions (p. 744)</td>
<td>Amazon QuickSight now supports functions Variance and Standard Deviations as both aggregation and table calculation. You can create Sample and Population variants for both the functions. You can create these calculations through the calculations editor in analysis mode. Functions by Category</td>
<td>June 11, 2019</td>
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<tr>
<td>New Visual Types (p. 744)</td>
<td>You can now use Amazon QuickSight to chart your data on a customizable gauge and donut charts. For more information, see Visual Types.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Hide/Show columns in table visualizations (p. 744)</td>
<td>In Amazon QuickSight, you can hide or show columns in visualizations that use the table visual type. For more information, see Customizing a Visual.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Conditional String Functions on SPICE (p. 744)</td>
<td>We added support for ifelse in analyses that use SPICE. For more information, see ifelse.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Choose period granularity for date differences (p. 744)</td>
<td>We added an optional parameter to dateDiff so you can show differences between dates in the period you choose (years, months, and so on). For more information, see dateDiff.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Duplicate visuals (p. 744)</td>
<td>In Amazon QuickSight, you can now duplicate visuals. For more information, see Duplicating a Visual.</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>Angled data labels (p. 744)</td>
<td>In Amazon QuickSight, data labels that are too long are now angled by default on vertical bar, combo, and line charts. For more information, see Customizing Data Labels.</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>New languages added (p. 744)</td>
<td>Amazon QuickSight is now available in 10 languages: English, German, Spanish, French, Portuguese, Italian, Japanese, Korean, Simplified Chinese, and Traditional Chinese. For more information, see Choosing a Language in Amazon QuickSight.</td>
<td>April 8, 2019</td>
</tr>
<tr>
<td>New aggregation function (p. 744)</td>
<td>Amazon QuickSight supports aggregating by percentile. This function helps you understand the distribution of your data. For more information, see percentile.</td>
<td>April 8, 2019</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
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<tr>
<td>Customize how many data points to display</td>
<td>You can now format your visuals to display a custom number of data points or groups before showing the “other” category. This feature is available for bar charts, combo charts, line charts, pie charts, heat maps, and tree maps. For more information, see Customize a Visual.</td>
<td>April 8, 2019</td>
</tr>
<tr>
<td>ML-powered forecasting</td>
<td>With forecasting powered by machine learning and what-if analyses in Amazon QuickSight, nontechnical users can now easily forecast their key business metrics. No ML expertise or Microsoft Excel data modeling is required. The built-in ML algorithm in Amazon QuickSight is designed to handle complex real-world scenarios. Amazon QuickSight uses ML to provide more reliable forecasts than traditional means. For more information, see Forecasts and What-Ifs.</td>
<td>March 14, 2019</td>
</tr>
<tr>
<td>ML-powered anomaly detection</td>
<td>Amazon QuickSight uses proven Amazon technology to continuously run ML-powered anomaly detection on millions of metrics and billions of data points. This anomaly detection enables you to get deep insights that are often buried in the aggregates, not visible in plain sight, and not scalable with manual analysis. With ML-powered anomaly detection, there's no need for manual analysis, custom development, or ML domain expertise. For more information, see Anomaly Detection.</td>
<td>March 14, 2019</td>
</tr>
</tbody>
</table>
Automatic narratives (p. 744)  
Automatic narratives provide key insights in everyday language, embedded contextually in your dashboard, saving hours on manual analysis. With automatic narratives, Amazon QuickSight interprets the charts and tables in your dashboard and provides a number of suggested insights in natural language. Depending on the shape and form of your data, you might get different suggestions. For example, you might see what the day-over-day changes look like, what was the highest sales date, or what the growth rate is. Or you might see what the forecast looks like for the next seven days. As the author of the dashboard, you can customize the computations and business language for your needs. You can use automatic narratives to effectively tell the story of your data in plain language. For more information, see Narrative Insights.

March 14, 2019

Previous Updates

The following table describes the important changes in each release of the Amazon QuickSight User Guide before March 4, 2019.

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
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</table>
| New features    | Using custom window functions, you can calculate any aggregation for a defined window at the point of selection. You can define the window interval before and after any point in time. You can also do calculations for that window using the sum, average, minimum, maximum, and count functions. Doing this enables a moving window aggregation as you progress through your data points. For more information, see Table Calculation Functions Index (p. 515).  

Send email reports with data tailored to each of your users and groups. You can now create email reports for datasets that use row-level security. Amazon QuickSight generates a custom email snapshot for each user or group based on their data permission that is defined in the dashboard. RLS for email reports works for both scheduled and ad hoc emails. For more information, see Sending Reports by Email (p. 466). | March 4, 2019      |
<table>
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<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
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<tr>
<td>Change</td>
<td>Amazon QuickSight now supports unbounded cardinality. That means you can have more than 10,000 values in your control or filter. For more information, see Using a Control with a Parameter in Amazon QuickSight (p. 220). You can create a datetime parameter that has no static default value. Filters on these parameters become active after you choose a value. For more information, see Adding a Date Filter (p. 307).</td>
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</tbody>
</table>
| New features   | There are new table calculations available:  
  - percentileOver (p. 533)  
  - runningAvg (p. 549)  
  - runningCount (p. 550)  
  - runningMax (p. 551)  
  - runningMin (p. 552)                                                                                                                                                                                                                          | February 7, 2019 |
| New features   | Amazon QuickSight supports emailing reports that use row-level security, using controls with unbounded cardinality, and creating datetime parameters with no default values. For more information, see the following:  
  - Sending Reports by Email (p. 466)  
  - Using a Control with a Parameter in Amazon QuickSight (p. 220)  
  - Adding a Date Filter (p. 307)                                                                                                                                                                                                                  | January 22, 2019 |
| New features   | We added conditional aggregations, including `sumIf`, `countIf`, `minIf`, `maxIf`, `avgIf`, and `distinct_countIf`. Pivot tables now support infinite scrolling through millions of rows. You can add up to 20 fields for columns, and 20 fields for rows. Plus, you can add subtotals and totals to rows and columns. For more information, see the following:  
  - Using Aggregate Functions in Calculated Fields (p. 201)  
  - Using Pivot Tables (p. 367)                                                                                                                                                                                                                     | January 10, 2019 |
<p>| New feature    | We enhanced the join editor to increase usability and functionality. You can now add tables from one or more schemas on the same data source, or add the same table twice. For more information, see Joining Data (p. 131).                                                                                                                                   | January 3, 2019 |
| New SDK        | You can embed dashboards and manage users or groups by using the Amazon QuickSight SDKs. For more information, see Developing with Amazon QuickSight (p. 566).                                                                                                                                                                           | November 27, 2018 |</p>
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<tr>
<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
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<tbody>
<tr>
<td>New features</td>
<td>You can use groups with row-level security (RLS), and you can add cascading controls for parameters. For more information, see the following:</td>
<td>November 20, 2018</td>
</tr>
<tr>
<td></td>
<td>• Using Row-Level Security (RLS) to Restrict Access to a Dataset (p. 119)</td>
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<td></td>
<td>• Using a Control with a Parameter in Amazon QuickSight (p. 220)</td>
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<tr>
<td>Function renamed</td>
<td>We renamed the percentile function to make it more intuitive. Its new name is percentileRank. For more information, see percentileRank (p. 547).</td>
<td>November 12, 2018</td>
</tr>
<tr>
<td>New features</td>
<td>Use a top and bottom filter to show the top or bottom n for the field you choose, based on values in another field. For example, you could choose to show the top five sales people based on revenue. For more information, see Adding a Text Filter (p. 300).</td>
<td>November 1, 2018</td>
</tr>
<tr>
<td></td>
<td>Use cascading controls to limit the values displayed in the controls, so they only show values that are relevant to what is selected in other controls. For more information, see Setting Up Parameters in Amazon QuickSight (p. 218).</td>
<td></td>
</tr>
<tr>
<td>New feature</td>
<td>Use JSON native data types with parseJson. For more information see, parseJson (p. 504).</td>
<td>October 30, 2018</td>
</tr>
<tr>
<td>New features</td>
<td>Use date functions to find out what quarter a date is in:</td>
<td>September 10, 2018</td>
</tr>
<tr>
<td></td>
<td>• addDateTime (p. 479)</td>
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<td></td>
<td>• extract (p. 486)</td>
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<td>• truncDate (p. 514)</td>
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<td>Add parameters to URLs. For more information see, Using Parameters in a URL (p. 233).</td>
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<tr>
<td>New features</td>
<td>You can sort strings in SPICE datasets. For more information on these features, see Sorting Visual Data in Amazon QuickSight (p. 294)</td>
<td>August 20, 2018</td>
</tr>
<tr>
<td>New features</td>
<td>You can schedule emailed reports, and add data labels to your visuals.</td>
<td>August 15, 2018</td>
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<td>For more information on these features, see the following sections:</td>
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<tr>
<td></td>
<td>• Sending Reports by Email (p. 466)</td>
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<tr>
<td></td>
<td>• Subscribing to Reports (p. 468)</td>
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<tr>
<td></td>
<td>• Customizing Data Labels on Visuals (p. 261)</td>
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<td>Description</td>
<td>Date Changed</td>
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</table>
| New features    | You can create table calculations, using aggregated measures to discover how dimensions influence measures or each other. Also, you can visualize time data at granularities as low as one minute. For more information on these features, see the following sections:  
  • Table Calculations (p. 477)  
  • Changing Date Field Granularity (p. 285)                                                                                                                                                      | August 8, 2018 |
| New features    | You can replace datasets, customize labels, and format dimensions that are aggregated with count and count distinct. Also, new visuals start out smaller in size. For more information on these features, see the following sections:  
  • Replacing Datasets (p. 185)  
  • Customizing Visual Labels (p. 261)  
  • Customizing a Field Format (p. 188)  
  • Working with Amazon QuickSight Visuals (p. 243)                                                                                                                                                    | June 21, 2018  |
<table>
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<tr>
<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
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</table>
| New features and a new AWS Region | You can upgrade your Amazon QuickSight subscription from Standard edition to Enterprise edition. In Enterprise edition, Amazon QuickSight supports usage-based pricing for users in the reader role, sharing dashboards with all users in the reader role, and hourly refresh of datasets. Amazon QuickSight also supports private connections to data in a VPC with a private subnet in Enterprise edition. In both editions, Amazon QuickSight supports parameters with on-sheet controls, dashboard co-ownership, custom URL actions, and 25-GB SPICE datasets. Also, Amazon QuickSight is available in Asia Pacific (Tokyo). For more information on these features, see the following sections:  
- Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 632)  
- Self-Provisioning an Amazon QuickSight Read-Only User (p. 687)  
- Inviting Users to Access Amazon QuickSight (p. 706)  
- Sharing Dashboards (p. 463)  
- Connecting to a VPC with Amazon QuickSight (p. 727)  
- Refreshing a Dataset on a Schedule (p. 82)  
- Parameters in Amazon QuickSight (p. 217)  
- Exploring Interactive Dashboards in Amazon QuickSight (p. 5) (newly updated for read-only users)  
- Using Custom Actions for Filtering and Navigating (p. 320)  
- Data Source Quotas (p. 72)  
- AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626) | May 30, 2018 |
| New feature | Amazon QuickSight supports quick sorting from axis labels, duplicating datasets, and showing or hiding totals on tabular reports. Also, you can add custom SQL to a dataset earlier in the creation workflow. For more information on these features, see the following sections:  
- Sorting Visual Data in Amazon QuickSight (p. 294)  
- Duplicating a Dataset (p. 117)  
- Displaying Totals and Subtotals (p. 263)  
- Creating a Basic SQL Query (p. 138) | May 25, 2018 |
<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
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</thead>
<tbody>
<tr>
<td>New features</td>
<td>You can use Amazon QuickSight to connect to Software as a Service (SaaS) providers. For more information, see Software as a Service (SaaS) Data (p. 71). You can import JSON files to Amazon QuickSight. For more information, see JSON Data (p. 70). You can also parse JSON fields in a CSV file. For more information, see parseJson (p. 504).</td>
<td>April 9, 2018</td>
</tr>
<tr>
<td>New feature</td>
<td>You can use Amazon QuickSight with Amazon S3 files that are in a different AWS account. For more information, see Datasets Using S3 Files in Another AWS Account (p. 102).</td>
<td>November 20, 2017</td>
</tr>
<tr>
<td>New visual types</td>
<td>You can create visuals using maps. You can also view tabular data in a visual. For more information on preparing geospatial data for use in a visual, see Adding Geospatial Data (p. 163). For more information on creating a geospatial visual, see Using Geospatial Charts (Maps) (p. 346). For more information on using tabular reports, see Using Tables as Visuals (p. 408).</td>
<td>November 20, 2017</td>
</tr>
<tr>
<td>New features</td>
<td>Amazon QuickSight can support 1000 columns in a dataset. For more information, see Data Source Quotas (p. 72). Calculated fields are supported in SPICE datasets. For more information, see Adding a Calculated Field to an Analysis (p. 197). Also, high cardinality values, which often display as a long tail on a visual, are placed into a category called other. For more information, see Working with Visual Types in Amazon QuickSight (p. 325).</td>
<td>November 20, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>In Enterprise edition, you can restrict access to a dataset by adding row-level security. To learn more, see Using Row-Level Security (RLS) to Restrict Access to a Dataset (p. 119).</td>
<td>October 20, 2017</td>
</tr>
<tr>
<td>New visual type</td>
<td>You can create visuals using combo charts. To learn more about combo charts, see Using Combo Charts (p. 335).</td>
<td>October 20, 2017</td>
</tr>
<tr>
<td>New features</td>
<td>Amazon QuickSight supports creating custom aggregations for calculated fields in analyses, custom date formats, and copies of dashboards. For more information on aggregating calculated fields, see Using Aggregate Functions in Calculated Fields (p. 201). For more information on using unsupported dates by creating a custom date format, see Using Unsupported or Custom Dates (p. 146). For more information on duplicating dashboards, see Copying a Dashboard (p. 462).</td>
<td>September 25, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>You can combine multiple filters using the And/Or operators. To learn more about filter groups, see Adding a Compound Filter with And/Or Operators (p. 310).</td>
<td>August 31, 2017</td>
</tr>
<tr>
<td>New data source</td>
<td>Amazon QuickSight supports Amazon S3 Analytics.</td>
<td>August 31, 2017</td>
</tr>
<tr>
<td>Description</td>
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<tr>
<td>Amazon QuickSight supports importing ZIP files from Amazon S3. There is also a new search feature, to simplify finding analyses, datasets, and dashboards. For more information on the search feature, see Using the Amazon QuickSight Console (p. 58).</td>
<td>August 31, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight is now available in Asia Pacific (Singapore) and Asia Pacific (Sydney).</td>
<td>August 8, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports Snowflake cloud data warehouse.</td>
<td>July 31, 2017</td>
<td></td>
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<tr>
<td>Amazon QuickSight added a new aggregation: Count Distinct. To learn more, see Changing Field Aggregation (p. 282).</td>
<td>July 19, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports exploring Amazon S3 analytics data from an Amazon QuickSight dashboard that you reach from the AWS Management Console. To learn more, see Exploring Your AWS Data in Amazon QuickSight (p. 672).</td>
<td>July 5, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports Federated Single Sign-On (SSO) in Enterprise Edition. To learn more, see Using Identity Federation and Single Sign-on (SSO) with Amazon QuickSight (p. 689).</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports Amazon Redshift Spectrum. To learn more, see Enabling Access to Amazon Redshift Spectrum (p. 657).</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports Federated Single Sign-On (SSO) in Standard Edition. To learn more, see Using Identity Federation and Single Sign-on (SSO) with Amazon QuickSight (p. 689).</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports just-in-time (JIT) user provisioning through the following policy actions: quicksight:CreateUser and quicksight:CreateAdmin. To learn more, see IAM Policy Examples for Amazon QuickSight (p. 682).</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports direct connections to Teradata 14.0 and later.</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight added relative date filters for datasets and visuals. To learn more, see Adding a Date Filter (p. 156).</td>
<td>May 25, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports connecting to Apache Spark and Presto. To learn more, see Creating a Data Source Using Apache Spark (p. 92) and Creating a Data Source Using Presto (p. 91).</td>
<td>May 3, 2017</td>
<td></td>
</tr>
<tr>
<td>Amazon QuickSight supports operational logging with AWS CloudTrail. To learn more, see Logging Operations with AWS CloudTrail (p. 718).</td>
<td>April 28, 2017</td>
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<tr>
<td>Change</td>
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<tr>
<td>New feature</td>
<td>Amazon QuickSight is available in US East (Ohio). To learn more about AWS Regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 626).</td>
<td>April 11, 2017</td>
</tr>
</tbody>
</table>
| New feature     | • You can use the AD Connector with Amazon QuickSight. To learn more about managing Enterprise users, see Managing User Access Inside Amazon QuickSight (p. 705).  
• You can add key performance indicators (KPIs) to your visualizations. To learn more, see Using KPIs (p. 355).  
• You can import .xlsx files with headers and footers, comments, formatting, filter header, sort, frozen panel/header, hidden columns, groups, and formulas / references. You can also limit your import to a specific range. To learn more about importing ranges, see Choosing File Upload Settings (p. 130). | April 6, 2017      |
| New feature     | You can now export to a comma-separated value (CSV) format file using Amazon QuickSight. To learn more, see Exporting Data (p. 247).                                                                           | March 21, 2017     |
| New feature     | You can now schedule data refreshes for SPICE datasets. To learn more, see Refreshing Data (p. 80).                                                                                                         | February 14, 2017  |
| New feature     | You can now connect to Amazon Athena databases and use them as data sources in Amazon QuickSight. To learn more, see Creating a Dataset Using Amazon Athena Data (p. 108).                                               | December 22, 2016  |
| New edition     | Amazon QuickSight now offers an Enterprise edition as well as a Standard edition. Both editions offer a full set of features for creating and sharing data visualizations, and Enterprise edition additionally offers encryption at rest and Active Directory integration. When you choose to use Enterprise edition, you select a Microsoft Active Directory directory in AWS Directory Service and use that active directory to identify and manage your Amazon QuickSight users and administrators. To learn more, see Different Editions of Amazon QuickSight (p. 624). | December 15, 2016  |
| New guide       | This is the first release of Amazon QuickSight User Guide.                                                                                                                                                    | November 15, 2016  |
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** Microsoft Sample Databases: World Wide Importers; version latest -- https://tinyurl.com/ybat5d8k

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** Microsoft Sample Databases: AdventureWorks; version last -- https://github.com/Microsoft/sql-server-samples/releases/tag/adventureworks2014

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