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What Is Amazon QuickSight?

Amazon QuickSight is a business analytics service you can use to build visualizations, perform ad hoc analysis, and get business insights from your data. It can automatically discover AWS data sources and also works with your data sources. Amazon QuickSight enables organizations to scale to hundreds of thousands of users, and delivers responsive performance by using a robust in-memory engine (SPICE).

Using Amazon QuickSight, you can do the following:

- **Get started quickly** – Sign in, choose a data source, and create your first visualization in minutes
- **Access data from multiple sources** – Upload files, connect to AWS data sources, or use your own external data sources
- **Take advantage of dynamic visualizations** – Smart visualizations are dynamically created based on the fields that you select
- **Get answers fast** – Generate fast, interactive visualizations on large data sets
- **Tell a story with your data** – Create data dashboards and point-in-time visuals, share insights and collaborate with others

Amazon QuickSight offers Standard and Enterprise editions. For more information about Amazon QuickSight editions and pricing, see Different Editions of Amazon QuickSight (p. 585) and Amazon QuickSight.

You can create Amazon QuickSight data sets by using your own data sources or other data sources that are shared with you. Then you can create Data Analyses (p. 2), visualize the data, and share it through data dashboards. To get a first look at how it works, you can explore Amazon QuickSight using the sample data sets we provide. These can be downloaded from the following links, in case you don’t already have them:

- Business overview (revenue data)
- People overview—human resources (HR) data
- Sales pipeline
- Web and social media analytics (marketing data)

There are also a variety of data sets available free online that you can use with Amazon QuickSight, for example:

- AWS public datasets
- Eighteen places to find data sets for data science projects
- Search for BI sample data
- Search for sample data for visualization
- Search for Free Sample Databases

These data sets come in a variety of formats. Some may require you to import them into a database engine before you can access their data.

To learn more about the major components and processes of Amazon QuickSight and the typical workflow for creating data visualizations, see the following sections.

**Topics**

- Data Sources and Data Preparation (p. 2)
Data Sources and Data Preparation

You can use a variety of sources for data analysis, including files, AWS services, and on-premises databases. To learn more about what data sources work with Amazon QuickSight, see Supported Data Sources (p. 67).

To get ready to create analyses, you create data sets based on your data sources. A data set identifies the specific fields and rows that you want to use. In addition to raw data, a data set stores any changes you make, so it’s ready the next time you want to analyze the data. For example, you can rename fields, change data types, and add calculated fields.

You can create multiple analyses using the same data set. You can also use multiple data sets in a single analysis.

To learn more about creating data sets, see Creating Data Sets (p. 85).

Data Preparation

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

- Filtering out data so you can focus on what's important to you
- Renaming fields to make them easier to read
- Changing data types so they are more useful
- Adding calculated fields to enhance analysis
- Creating SQL queries to refine data

To learn more about data preparation, see Preparing Data (p. 121).

SPICE

SPICE is Amazon QuickSight’s Super-fast, Parallel, In-memory Calculation Engine. 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 you change an analysis or update a visual.

To learn more about using SPICE, see Managing SPICE Capacity (p. 603).

Data Analyses

A data analysis is the basic workspace for creating and interacting with visuals, which are graphical representations of your data. Each analysis contains a collection of visuals that you assemble and arrange for your purposes, such as a sales analysis, cost analysis, or tracking key performance indicators. Each analysis can contain stories, which you can use to save a sequential slide show of different iterations of the analysis. This is useful if you want to show changes over time or provide visual comparisons of your data.
To learn more about Amazon QuickSight analyses, see Working with Analyses (p. 190).

**Visuals**

A *visual*, also known as a data visualization, is a graphical representation of a data set using a type of diagram, chart, graph, or table. All visuals begin in AutoGraph mode, which automatically selects a visualization based on the fields you select. You can also take control and choose your own visuals. Amazon QuickSight supports a variety of visuals including combo charts, heat and tree maps, pivot tables, and more. Or you can enhance your visualizations by applying filters, changing colors, or by arranging several in the workspace, just to name a few options.

To learn more about Amazon QuickSight visuals, see Working with Amazon QuickSight Visuals (p. 267).

**Insights**

If you aren't certain what to look for in a data set, you can use a suggested insight to quickly create a visual. Suggested insights, officially called ML Insights, propose potentially useful visuals based on an evaluation of your data. You can either choose one from the list, or you can create your own.

**Sheets**

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.

**Stories**

A *story* is a set of one or more *scenes* (captured visuals) that you can play like a slideshow. You can use these to step through different iterations of an analysis. A scene is a representation of an analysis at a given point in time, or with specific settings. It shows the visuals that are on the analysis at that time, but the data in those visuals continues to update. It is not a static snapshot. You *capture* a scene for use in a story.

To learn more about Amazon QuickSight stories, see Working with Stories (p. 261).

**Dashboards**

A *dashboard* is a read-only snapshot of an analysis that you can share with other Amazon QuickSight users for reporting purposes. When you create and publish a dashboard, you specify which users have access to it. They can view and filter the dashboard visuals without changing the underlying data.

To learn more about Amazon QuickSight dashboards, see Working with Dashboards (p. 447).

**Typical Amazon QuickSight Workflow**

The first time you create an analysis, the typical workflow looks like this:

1. Add or upload a data source, and use it to create a new data set.
2. (Optional) Prepare the data – get it ready for reports by standardizing field names, or adding calculations, for example.
3. Visualize (create) a new analysis from the data set.
4. Choose some fields to create the first visual in the analysis. You can use AutoGraph to dynamically create a visual based on the number and type of fields you choose. Alternatively, you can choose the visual type you want to use.
5. (Optional) Make changes to the visual if you want to (for example, by adding a filter or changing the visual type).
6. (Optional) Add more visuals to the analysis. You can resize and arrange them in the workspace.
7. (Optional) Capture the analysis into a story to create a narrative about some aspect of the data analysis.
8. (Optional) Publish the analysis as a dashboard to share insights with other users.

After you connect to your data and create a data set, you can create an analysis of it and share it in a dashboard, as shown in the following illustration:

Next Steps

If you are new to Amazon QuickSight, see Signing Up for Amazon QuickSight (p. 589) to learn more about subscribing.

If you are an administrator, see Administration (p. 585).
What's New in Amazon QuickSight

Find out what's new in Amazon QuickSight:

- Get our updates in a monthly email. Topics include all the new features and product enhancements, how-to videos, customer stories, tips, events, and more. [Sign up for our newsletter.](#)
- Attend the Amazon QuickSight monthly customer webinar live with the Amazon QuickSight product team. Topics include demos and tutorials on all of the new features that we launch. [Register for the webinar.](#)

### December 2019

**New functions for level-aware aggregations in Amazon QuickSight** – Now you can use `rank`, `denseRank`, and `percentileRank` for level-aware aggregations. For more information, see Using Level-Aware Aggregations.

**New mathematical functions in Amazon QuickSight** – Amazon QuickSight now supports functions for base 10 logarithms (log₁₀), natural logarithm (ln), absolute value (abs), square root (sqrt), and base of natural log e raised to the power of (exp). For more information, see Functions and Operators.

**Private VPC support for Presto in Amazon QuickSight** – Now Presto can use a VPC connection. For more information, see Supported Data Sources for VPCs.

**Amazon QuickSight now enables you to choose an Amazon Athena workgroup** – 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 Creating a Dataset Using Amazon Athena.

### November 2019

**Integrate Amazon SageMaker ML models into your Amazon QuickSight analyses and dashboards** – In this public preview, Amazon QuickSight launches the ability to integrate machine learning (ML) models created and trained in Amazon 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 Amazon QuickSight Integration with SageMaker.

**New formatting options for visuals in Amazon QuickSight** – 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 Formatting a Visual.

**New Amazon QuickSight API operations** – Amazon QuickSight launches new API operations to programmatically manage your data, dashboards, and IAM-linked fine-grained access control capabilities. 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 schema 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 Amazon QuickSight API Reference. For the feature video see the QuickSight APIs.

**Amazon QuickSight now supports seconds in SPICE** – 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 `addDateTime`, `dateDiff`, `extract`, and `truncDate`. For more information, see Date Functions.

**Amazon QuickSight now has themes** – 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.

**Amazon QuickSight now supports conditional formatting for tables, pivot tables, and key performance indicators (KPIs).** – 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.

**View history for SPICE ingestion on your Amazon QuickSight datasets** – 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.

**Enhance interactivity on your dashboards using Amazon QuickSight Actions** – You can use Amazon QuickSight actions to build simple point-and-click filtering between visuals and across datasets. Use the one-click setup to create a filter action across your dashboard. Also, the setup for custom URLs now appears in the Action menu at left, rather than in the on-visual menu. For more information, see Custom Actions in Amazon QuickSight. For the feature video see QuickSight Actions.

**Amazon QuickSight supports dynamic sheet titles** – You can now use parameters in sheet titles to make the context of the dashboard more clear to the reader. For more information, see Formatting a Visual.

**Amazon QuickSight Mobile iOS update and a new Android app** – 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; 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 more information, see Amazon QuickSight Mobile. For the feature video, see QuickSight Mobile App.

**Use Amazon QuickSight to join data from multiple data sources** –

Now you can use Amazon QuickSight to create datasets that join multiple data sources using a drag-and-drop UI. You can directly join tables from multiple database types and multiple file types in any combination. Joining in Amazon QuickSight can help you avoid the need to duplicate your data to a central data store before reporting on it. For more information, see Joining Tables. For the feature video, see Cross-source data joins.

**October 2019**

**Relative filtering on anchor and future dates**

Amazon QuickSight now supports additional relative date filter options. You can filter for periods ahead of the current date period. You can set a constant period or dynamically change it using controls. And, you can filter relative to a custom “anchor” date. For more information, see Date Filters.

**Amazon QuickSight supports visual-level formatting**
Now any formatting you apply from the field wells is applied only to the selected visual. For more information, see Formatting a Visual.

Amazon QuickSight supports a new AWS Region

Amazon QuickSight is now available in Asia Pacific (Seoul) (ap-northeast-2). For more information, see AWS Regions, Websites, IP Address Ranges, and Endpoints.

Amazon QuickSight supports printing

Now you can print a dashboard or an analysis. For more information, see Printing a Dashboard or Analysis.

New publishing options for dashboards

Control your user experience with more publishing options for your dashboards. These options include the ability to toggle the filter pane, tooltips, drill up or down, and more. For more information, see Publish a Dashboard.

Shared data sources

Amazon QuickSight now supports sharing data sources with users and groups. You can create data sources from any supported data source and share with users and groups, like you can do with datasets, analyses, and dashboards. Data source co-owners can now edit the underlying SQL for custom SQL datasets. Data source sharing is supported on all types of data sources except for S3 analytics and file-based datasets. For more information, see Shared Data Sources.

New aggregations for fields

You can now aggregate your visuals by statistical calculations such as Nth percentile, median, variance, and standard deviation. For more information, see Field Aggregations.

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.

Transpose table columns and rows

You can now transpose rows and columns on table charts. Transposing rows and columns on table visuals allows you to swap orientation of rows and columns to represent data in different views. For more information, see Tables.

September 2019

Use level-aware aggregations to control your calculations

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.

Put 100 million rows into a SPICE dataset

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.
<table>
<thead>
<tr>
<th><strong>Use string functions in SPICE</strong></th>
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<tbody>
<tr>
<td>Now you can use string functions for calculated fields in your analyses based on SPICE datasets. For more information, see <a href="#">Functions by Category</a>.</td>
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<tr>
<th><strong>Use the power operator (^) in SPICE</strong></th>
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<tr>
<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 <a href="#">Arithmetic and Comparison Operators</a>.</td>
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<th><strong>Sort your anomalies</strong></th>
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<tr>
<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 <a href="#">Using ML-Powered Anomaly Detection</a>.</td>
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<tr>
<th><strong>Amazon QuickSight Enterprise edition adds anomaly alerts</strong></th>
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<tr>
<td>Now 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 <a href="#">Using Data Dashboards</a>.</td>
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<th><strong>Amazon QuickSight new feature to mark favorites</strong></th>
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<tr>
<td>Amazon QuickSight has added the ability to bookmark your favorite dashboards and analyses so you can come back to them quickly. For more information, see <a href="#">Using the Amazon QuickSight Start Page</a>.</td>
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<tr>
<th><strong>Filter out the last ( N ) time periods</strong></th>
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<tr>
<td>Amazon QuickSight adds the ability to exclude a specific number and type of time periods from a time range (after) filter. This is especially helpful for ML-powered anomaly detection. For more information, see <a href="#">Adding a Date Filter</a>.</td>
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<th><strong>New visual type: Word clouds</strong></th>
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<td>Amazon QuickSight now 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 <a href="#">Word Clouds</a>.</td>
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<th><strong>August 2019</strong></th>
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<tr>
<td><strong>Amazon QuickSight supports new AWS Regions</strong></td>
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<tr>
<td>Amazon QuickSight is available in Europe (London) and Europe (Frankfurt). Also, you can now connect to Microsoft Active Directory in any AWS Region supported by Amazon QuickSight, except Asia Pacific (Singapore) and Asia Pacific (Sydney). For more information, see <a href="#">AWS Regions and IP Address Ranges</a>.</td>
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<th><strong>Amazon QuickSight adds custom colors for charts</strong></th>
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<tbody>
<tr>
<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 8 most recently used custom colors for easy selection across multiple charts. For more information, see <a href="#">Changing Visual Colors</a>.</td>
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<th><strong>Detect anomalies with less data</strong></th>
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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.

July 2019

**Embedding for Microsoft Active Directory**

In Amazon QuickSight Enterprise edition, you can now embed dashboards for users authenticated through Active Directory. For more information, see Embedding Dashboards.

June 2019

**Granular access control for using AWS services from Amazon QuickSight**

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.

**New functions**

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. For more information, see Aggregations in Calculated Fields and Table Calculations.

**New visual types**

You can now use Amazon QuickSight to chart your data on a customizable gauge chart or donut chart. For more information, see Working with Visual Types.

**Create dashboards with multiple sheets**

Amazon QuickSight now supports multiple sheets inside of analyses and dashboards. This allows you to build a comprehensive experience that is self-contained inside of a single dashboard. 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.

**Conditional string functions on SPICE**

We added support for `ifelse` in analyses that use SPICE. For more information, see `ifelse`.

**Choose period granularity for date differences**

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`.

**Hide columns in table visualizations**

In Amazon QuickSight, you can hide or show columns in visualizations that use the `table` visual type. For more information, see Customizing a Visual.

May 2019
## Angled data labels

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](#).

## Duplicate your visuals

In Amazon QuickSight, you can now duplicate visuals in the same sheet, or onto a different sheet. For more information, see [Duplicating a Visual](#).

### April 2019

## New languages added

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](#).

## Percentile aggregation

Amazon QuickSight supports aggregating by percentile. The `percentile` function helps you understand the distribution of your data. For more information, see [percentile](#).

## Custom number of data points

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 [Customizing the Number of Data Points to Display](#).

### March 2019

## ML-powered Anomaly Detection

Amazon QuickSight uses proven Amazon technology to continuously run anomaly detection powered by machine learning 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 anomaly detection powered by machine learning (ML), there's no need for manual analysis, custom development, or ML domain expertise. For more information, see [ML-Powered Anomaly Detection](#).

## ML-powered Forecasting

With forecasting and what-if scenarios powered by machine learning, 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 [ML-Powered Forecasts and What-Ifs](#).

## Auto-narratives

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 suggestions such as what the day-over-day changes look like, what was the highest sales date, what the growth rate is at, and 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 Auto-narrative Insights.

**Custom window functions**

Using custom window functions, you can calculate any aggregation for a defined window at the point your choose. You can define the window offsets you need. For more information, see Table Calculations.

**RLS support for email reports**

You can now create email reports with data tailored to each of your users and groups, for datasets that use row-level security. Amazon QuickSight generates a custom email snapshot for each user or group based on the data permissions that are defined in the dashboard. Row-level security (RLS) for email reports works for both scheduled and ad hoc (one-time) emails. For more information, see Sending Reports.

**High cardinality filters**

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 Parameter Controls.

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**February 2019**

**New table calculations**

You can now create calculated fields with percentileOver, runningAvg, runningCount, runningMax, and runningMin. For more information, see Calculated Field Function and Operator Reference.

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**January 2019**

**Conditional aggregations**

You can now create calculated fields to perform sumIf, countIf, minIf, maxIf, avgIf, and distinct_countIf. For more information, see Calculated Fields.

**Join editor enhancements**

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 Tables (p. 132).

**Pivot table enhancements**

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 Pivot Tables.

**Join editor enhancements, cross schema data sources, and self joins**
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 Tables.

### 2018

**New API for embedding Amazon QuickSight dashboards**

You can embed dashboards and manage users or groups by using the Amazon QuickSight SDKs. For more information, see Embedding and Other SDKs.

November 2018

**New API operations for user and group management**

Manage users or groups by using the Amazon QuickSight SDKs or by using the AWS CLI. For more information, see List of Actions by Function.

November 2018

**RLS group support and cascading controls**

You can use groups with row-level security (RLS), and you can add cascading controls for parameters. For more information, see Row Level Security.

November 2018

**Top and bottom filters**

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.

November 2018

**Support for parseJSON data type in source tables**

Use JSON native data types with parseJson. For more information, see parseJson.

October 2018

**Date functions and URL parameters**

Use date functions to find out what quarter a date is in:

- addDateTime (p. 467)
- extract (p. 474)
- truncDate (p. 498)

You can also add parameters to URLs. For more information, see Using Parameters in a URL (p. 253).

September 2018

**SPICE sorting**

You can sort strings in SPICE datasets. For more information on these features, see Sorting Visual Data in Amazon QuickSight (p. 307)
### Scheduled email reports

You can schedule emailed reports, and add data labels to your visuals.

For more information on these features, see the following:

- [Sending Reports by Email (p. 453)](https://aws.amazon.com)
- [Subscribing to Reports (p. 457)](https://aws.amazon.com)
- [Customizing Data Labels on Visuals (p. 281)](https://aws.amazon.com)

### Table calculations and time data granularity

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:

- [Table Calculations (p. 465)](https://aws.amazon.com)
- [Changing Date Field Granularity (p. 301)](https://aws.amazon.com)

### Customize labels, format counts, replace datasets, and new smaller visuals

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:

- [Replacing Data Sets (p. 196)](https://aws.amazon.com)
- [Customizing Visual Labels (p. 281)](https://aws.amazon.com)
- [Customizing a Field Format (p. 201)](https://aws.amazon.com)
- [Working with Amazon QuickSight Visuals (p. 267)](https://aws.amazon.com)
New reader role and usage-based pricing, plus ability to upgrade subscriptions, 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. Also, Amazon QuickSight is available in Asia Pacific (Tokyo).

For more information on these features, see the following:

- Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 610)
- Self-Provisioning an Amazon QuickSight Read-Only User (p. 652)
- Inviting Users to Access Amazon QuickSight (p. 661)
- Sharing Dashboards (p. 450)
- AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587)

May 2018

New reader role and usage-based pricing, upgrade subscriptions, private connections with VPC, and more

Amazon QuickSight 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.

For more information on these features, see the following:

- Using a Amazon VPC with Amazon QuickSight (p. 680)
- Refreshing a Data Set on a Schedule (p. 108)
- Parameters in Amazon QuickSight (p. 242)
- Using Data Dashboards in Amazon QuickSight (p. 15) (newly updated for read-only users)
- Custom Actions in Amazon QuickSight (p. 344)
- Data Source Limits (p. 70)

May 2018
Using Data Dashboards in Amazon QuickSight

Topics
- Viewing Dashboard Data (p. 15)
- Filtering Dashboard Data (p. 15)
- Sorting Dashboard Data (p. 15)
- Exporting Data from a Dashboard (p. 16)
- Using the Visuals on Your Dashboard (p. 16)
- Anomaly Alerts (p. 16)
- Subscribing to Your Dashboard (p. 17)

Viewing Dashboard Data

In Amazon QuickSight, you can view data dashboards in email or interact with them on a webpage or your mobile device. If you are an Amazon QuickSight reader, you don't need a monthly subscription. To learn how to get the most out of reading your dashboards, use the following section.

Each dashboard is like a newspaper, with one or more sheets that are filled with data visualizations. You can focus on any graph or chart. You can filter, and sort, and update chart colors. Using dashboards that have controls embedded at the top, you get easier access and control over what you see in some or all of the visuals.

Any changes that you make to a dashboard are only temporary. They don't change the data, and they don't affect other users. If you want to save your settings and you have authoring access, use Save as to create your own private copy of the dashboard. If you want to share your changes with other users, you can work with the dashboard owner to update the dashboard on the server. This way, everyone can see the same version of data in the same way.

Filtering Dashboard Data

You can filter data in a visual in three ways:

- If your dashboard has filtering controls at the top of the screen, you can use them to filter all the visuals at once.
- You can use the filter icon at the top of each visual to filter visuals one at a time.
- You can create your own filters by using the filter pane on the left side of the page.

Sorting Dashboard Data

You can sort data in a visual in three ways:

- You can hover over the label for the field you want to sort by, and choose the sort icon.
- You can choose the filter icon at the top right of the visual you want to sort.
- You can click or tap on the field and choose Sort from the context menu.
Exporting Data from a Dashboard

To export data from an analysis or dashboard to a comma-separated value (CSV) file, use the v-shaped menu at the top right of a visual. Data exports only for the visual you choose.

Using the Visuals on Your Dashboard

When you choose a data point on a visual, 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 actions vary slightly based on what type of visual 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 in that visual, 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 URL actions, you can activate them by choosing a data point on a visual. For example, you might be able to email someone directly from the visual, or open another URL and send it data points (values) from this one.

- Change chart colors or specific field colors
  
  You can change all the chart colors to a specific color. Alternatively, you can choose a specific field value to change its color, if that field is part of the color well (usually in the legend).

Anomaly Alerts

On a dashboard that has an insight configured for anomaly detection, you can subscribe to 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 5, according to
your personal alert configuration. You receive contribution analysis when its updated, provided that 
contribution analysis is configured to run with anomaly detection.

Use the following procedure to set up anomaly alerts.

1. First, open a dashboard that is shared with you.
2. You can configure alerts from one of two screens. Choose one of the following, the proceed to the 
next step:
   - In the dashboard, locate the anomaly widget you are interested in. Select it so that it has a 
     highlighted box around it.
   - If you are in the dashboard, and already have the Explore Anomalies page open. You can 
     configure the alert without returning to the dashboard view.
3. At top right, choose Configure alert.
4. The Alert configuration screen appears.
   - For Severity, choose the lowest level of significance 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 subscribing 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.

**Subscribing to Your Dashboard**

You can subscribe to a dashboard in report form, and receive it in an email. 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.
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.
Welcome to the Amazon QuickSight Quick Start Guide, designed for business analysts. Using Amazon QuickSight, you can import or connect to your data, analyze your data, and share your data visualizations in a dashboard. You can let Amazon QuickSight choose the format of your visual by leaving the AutoGraph on, or you can choose from a wide variety of charts, graphs, tables to create a customized visual data analysis. You can then group these together to form stories and dashboards. Then you can share them with your team.

How Does Amazon QuickSight Work?

You begin by choosing a dataset. You can groom your dataset by adding new data elements, creating calculations, or filtering out data. When you're satisfied that the dataset works for you, you can start analyzing it through graphics.

First, you can create a visual representation of your data. If you don't know what kind of chart you should use, Amazon QuickSight can help you by choosing a visual type for you. To see this in action, choose some fields. As you choose more fields, Amazon QuickSight's AutoGraph changes the type of visual it displays. It adapts to what you choose.

You can continue to add more visuals to the same analysis, based on different views of the same underlying data. To fit more visuals on a page, you can resize and rearrange them. Scroll down to find more space on the page.

By creating a series of visuals, you create a story. This visual narrative tells you what is happening in the subject you're investigating. You can save multiple stories, using filters to show how the data changes over time. Any of these visual data analyses can be shared with other people, who can then further analyze the data.

You can use Amazon QuickSight to publish data dashboards. These are read-only snapshots that you can share for reporting. If you choose, you can also allow other people to create a new analysis and dashboard based on the one you shared with them.

The first Amazon QuickSight user on your AWS account is free, and receives 1 GB SPICE capacity. To learn more about free trials and pricing for multiple users, see Amazon QuickSight. For more information about the Standard and Enterprise editions, see Different Editions of Amazon QuickSight

Ready to Get Started?

Depending on your experience with Amazon QuickSight or tools like it, you can begin by looking at one of the following sections:

- Guided Tour (demos)
Amazon QuickSight Demos, Walkthroughs, and Articles

In the following section, you can find demos, walkthroughs, and articles that cover aspects of working with Amazon QuickSight.

If you want to see additional or different material added here, let us know. To do this, choose Feedback at the bottom of the screen.

Demo Videos

Following, you can find a list of videos that demonstrate the use of Amazon QuickSight, most shorter than 15 minutes long:

- Data Visualization with Amazon QuickSight (AWS re:Invent 2017 - DEM74), December 2017
- Sharing Your Analysis and Insights Using Amazon QuickSight, May 2017
- Customizing Your Visuals in Amazon QuickSight, May 2017
- Using SQL to Import Data into Amazon QuickSight, May 2017
- Accessing Amazon Redshift Data from Amazon QuickSight, May 2017
- Demos from the Amazon QuickSight official website, various dates

Walkthroughs, Deep Dives, and Articles

Following, you can find a list of walkthrough and deep-dive videos demonstrating use of Amazon QuickSight, most longer than 30 minutes:

- Deep Dive on Amazon QuickSight—January 2017 AWS Online Tech Talks, January 2017
- Building Visualizations and Dashboards with Amazon QuickSight (AWS re:Invent 2017 - ABD206), December 2017
- Serverless Analytics—Amazon Redshift Spectrum, AWS Glue, and Amazon QuickSight, October 2017
- Visualizing Amazon S3 Storage Management with Amazon QuickSight—2017 AWS Online Tech Talks, August 2017
- Deploying Business Analytics at Enterprise Scale with Amazon QuickSight (AWS re:Invent 2017 - ABD311), December 2017
- Analyzing AWS Billing Data Using Amazon QuickSight, May 2017
- Tackle Your Dark Data Challenge with AWS Glue (and Visualize It in Amazon QuickSight)—2017 AWS Online Tech Talks, September 2017
- Serverless Big Data Analytics—Amazon Athena & Amazon QuickSight—2017 AWS Online Tech Talks, May 2017
- Data Visualization with Amazon QuickSight (AWS re:Invent 2017 - DEM74), December 2017

Following is a list of blog posts and quick start articles, most of which discuss how to accomplish a specific complex task using Amazon QuickSight:

- List of all the official Amazon QuickSight blog posts
• Build a social media dashboard using machine learning and BI services, January 2018
• Visualize AWS CloudTrail Logs Using AWS Glue and Amazon QuickSight, November 2017
• Query and Visualize AWS Cost and Usage Data Using Amazon Athena and Amazon QuickSight, September 2017
• Quick Start: Build a Data Lake Foundation on the AWS Cloud with AWS Services, September 2017
• Analyzing Salesforce Data with Amazon QuickSight, August 2017
• Harmonize, Query, and Visualize Data from Various Providers using AWS Glue, Amazon Athena, and Amazon QuickSight, August 2017
• Analysis of Top-N DynamoDB Objects Using Amazon Athena and Amazon QuickSight, June 2017
• Visualize Amazon S3 Analytics Data with Amazon QuickSight, June 2017
• Build a Visualization and Monitoring Dashboard for IoT Data with Amazon Kinesis Data Analytics and Amazon QuickSight, May 2017
• Visualize Big Data with Amazon QuickSight, Presto, and Apache Spark on Amazon EMR, May 2017
• Analyzing VPC Flow Logs with Amazon Kinesis Data Firehose, Amazon Athena, and Amazon QuickSight, March 2017
• Harmonize, Search, and Analyze Loosely Coupled Datasets on AWS, February 2017
• Converging Data Silos to Amazon Redshift Using AWS DMS (and Visualize in Amazon QuickSight), January 2017

**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 Amazon QuickSight (p. 21)
- Signing In to Amazon QuickSight (p. 24)
- Quick Start: Create an Analysis with a Single Visual Using Sample Data (p. 25)
- Tutorial: Create A Multivisual Analysis and a Dashboard Using Sample Data (p. 28)
- Create an Analysis Using Your Own Local Text File Data (p. 50)
- Create an Analysis Using Your Own Amazon S3 Data (p. 51)
- Create an Analysis Using Your Own Database Data (p. 52)

**Setting Up Amazon QuickSight**

The following section explains how to get setup to use Amazon QuickSight. If you can already sign in to Amazon QuickSight, you should skip this section, and proceed to Signing In to Amazon QuickSight (p. 24).

To get signed up for Amazon QuickSight, choose one of the following.

**Topics**

- Setup a Free Standalone User Account in Amazon QuickSight (p. 22)
• Sign Up for AWS and a Free Amazon QuickSight Account as an Educator or Student (p. 23)
• Set up Amazon QuickSight for an existing AWS user (p. 23)

Setup a Free Standalone User Account in Amazon QuickSight

This section covers the fastest way to setup a free Amazon QuickSight account.

If you have only one user (author or admin), you can use Amazon QuickSight for free. If your team wants to try out Amazon QuickSight, you can sign up for a 60 day free trial for up to 4 additional users (author or admin). After the trial is over, you can reduce the number of users to 1 only, and then the Amazon QuickSight account remains free.

If you want to conduct a trial with a larger number than five users, you can still sign up this way. However, you are billed for users over five during the first sixty days, and users over 1 thereafter.

Note
You can only create users in the reader role in Enterprise edition. They aren't as part of the free trial.

If one of the following applies, visit the corresponding site for more information:

• Do you already have an AWS account? See Set up Amazon QuickSight for an existing AWS user (p. 23).
• Are you a student or educator, new to AWS? See Sign Up for AWS and a Free Amazon QuickSight Account as an Educator or Student (p. 23).

The following automated sign up guides you through the steps to open your account. To begin, choose Sign Up at the top right of the Amazon QuickSight website.

The process works like this:

• First, you create a free AWS account. This step takes about ten minutes. It asks for your name, email, address, and phone number. You need to have a phone and a credit card to complete the process.
• Next, you create a free Amazon QuickSight account. In this step, you can choose either Standard or Enterprise edition. You also set up an Amazon QuickSight account name.
• After that, you open Amazon QuickSight and get some sample data to explore.
If you signed up for Amazon QuickSight using this method, you are ready to explore what you can do with Amazon QuickSight. See Getting Started with Data Analysis in Amazon QuickSight (p. 21)

**Sign Up for AWS and a Free Amazon QuickSight Account as an Educator or Student**

If you are an educator or a student, you can sign up using AWS Educate instead. You can use an AWS Educate Starter Account, if your institution doesn’t have an AWS Account.

**Set up Amazon QuickSight for an existing AWS user**

This section covers how to setup a free Amazon QuickSight account, when you already have an existing AWS account. Amazon QuickSight offers a 60 day free trial for 4 users. If you maintain 1 user only, the Amazon QuickSight account remains free.

If one of the following applies, visit the corresponding site for more information:

- If you don’t already have an AWS account, see Setup a Free Standalone User Account in Amazon QuickSight (p. 22).
- If you’re a student or educator, new to AWS, see Sign Up for AWS and a Free Amazon QuickSight Account as an Educator or Student (p. 23) instead.

The following process helps an individual user to start up a free Amazon QuickSight Standard account. If you want to use Enterprise edition, or if you are an administrator trying to configure Amazon QuickSight for your company, see Subscribe to Amazon QuickSight (p. 589) instead.

Before you begin, you must be able connect to an existing AWS account. If your company already has an AWS account, contact your AWS account administrator for assistance.

**To subscribe to Amazon QuickSight**

1. Sign in to your AWS account and open Amazon QuickSight from the AWS Management Console. It is located under Analytics, and you can find it by searching for "QuickSight".
2. Your AWS account number is displayed for verification purposes. Choose **Sign up for QuickSight**.
3. Choose **Standard**. To confirm, choose **Continue**. A screen titled **Create your QuickSight account** appears.
4. Make choices for the following items:
   - Type in a unique name for your Amazon QuickSight subscription account. Your account name can only contain characters (A–Z and a–z), digits (0–9), and hyphens (-).
   - Type in a your email address to receive Amazon QuickSight service and usage notifications.
   - (Optional) Choose the AWS region you want to utilize for your default SPICE (p. 2) capacity. This is where your account’s free SPICE capacity is allocated after signing up. Note that you aren’t able to change the default capacity region later, but you can always purchase additional SPICE capacity in different regions as needed. See AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587) for information on regions.
   - (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. 621).
5. Review the choices you made, then choose **Finish**.

After you successfully complete signup, you are ready to explore what you can do with Amazon QuickSight.
Request Access to Amazon QuickSight

If your organization is already using Amazon QuickSight, you should talk to an Amazon QuickSight administrator or an AWS administrator to find out how to get access.

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 Amazon QuickSight account name. This is the name that was created for this Amazon QuickSight subscription. You should take note of it in case you need it later.
2. If you are prompted for your email address, type it in.
3. If the username is blank, type the user name you want to use to sign in. 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.
   - User names that contain a semicolon (;) aren't supported.
4. Type the associated password in **Password**. If you aren't sure, ask the administrator. If you create a new password, there is a **Confirm password** field. Type your password again.
   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.

Signing In to Amazon QuickSight Using an Identity Provider

If your organization uses an identity provider, you must first sign in through the identity provider before you use Amazon QuickSight.

An identity provider supports single sign-on (SSO) access. This means you don't need to provide sign-in information to Amazon QuickSight. When you access Amazon QuickSight, you shouldn't see a sign-in screen.

If you do see a sign-in screen in this case, no credentials will work. Before you can use Amazon QuickSight, you must sign in through your identity provider.
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 from http://quicksightsampledata.s3.amazonaws.com/MarketingData_QuickSightSample.csv.

To upload the sample data, use the following steps:

a. Choose New data set from the New analysis screen. (Or, choose Manage data to locate the New data set screen.)

b. Choose Upload a file.

c. Choose the sample file, MarketingData_QuickSightSample.csv, from your drive.

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 Your data sets 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 year, 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.

Topics

- Tutorial: Create a Prepared Data Set (p. 28)
- Tutorial: Create an Analysis (p. 33)
- Tutorial: Modify Visuals (p. 37)
- Tutorial: Create a Dashboard (p. 49)

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 from http://quicksightsampleddata.s3.amazonaws.com/MarketingData_QuickSightSample.csv.
1. On the Amazon QuickSight start page, choose **Manage data**.

2. On the **Your data sets** page, choose **New data set**.

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/Preview data**.

   Amazon QuickSight opens the data preparation page.

4. Name the data set.

   Highlight **Group 1** in the data set name box, and type **Marketing Sample**.

5. Change the field selection to remove some fields we won't be working with.

   In the **Fields** pane, unselect the **Twitter followers cumulative** and **Mailing list cumulative** fields.
6. Rename a field.

In the data preview pane, scroll to the **Website Pageviews** field and choose the edit icon.

Highlight the field name, type **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, expand the **Fields** pane, and then choose **New Field**.
b. In the **New calculated field** pane, highlight the value in **Calculated field name**, and then type **populated_event**.

c. Choose the **ifelse** function from the **Function list** and then choose **Add**. This adds the function to the calculated field formula.

d. Scroll down in the **Field list**, choose the **Events** field, and then choose **Add**. This adds the field to the calculated field formula.
e. In **Formula**, type the additional functions and parameters required, highlighted following:

   `<ifelse(strlen((Events))=0, 'Unknown', (Events))>
   
   f. Choose **Create**.

   The new calculated field is created, and appears in the **Calculated fields** section 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. 33)**.

**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 **Your data sets** 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. 37).

Tutorial: Modify Visuals

Use the following procedures to modify the visuals created using the procedures in Tutorial: Create an Analysis (p. 33).

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.
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. Expand the Field wells pane by choosing the expand icon.
3. 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 in the tool bar.

3. On the Applied filters pane, choose the new filter icon, and then choose the Date field to filter on.
4. Choose the new filter to expand it.

5. Choose the **After** comparison type.

6. Enter a start date value of 1/1/2014.

   Choose **Start Date**, choose the month expander, and then choose **January**.
Choose the year expander and then choose 2014.
Choose the calendar and then choose 1.
7. Choose **Apply**.

The filter is applied to the currently selected visual, which is the scatter plot visual. This is indicated with a filter icon next to the visual title.
8. Apply the filter to the line chart visual as well.

Choose the selector next to the filter name, and then choose All visuals for this data set.

Next Steps

Create a dashboard from the analysis by using the procedure in Tutorial: Create a Dashboard (p. 49).

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. 33).

1. In the analysis, choose Share and then Create dashboard on the application bar.

2. Choose Create new dashboard as, type the name Marketing Dashboard, and then choose Create dashboard.
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 Data Set and an Analysis (p. 50)
- Step 2: Create a Visual (p. 50)

Step 1: Create a File Data Set and an Analysis

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

1. Check Data Source Limits (p. 70) to make sure your target file doesn't exceed data source limits.
2. On the Amazon QuickSight start page, choose Manage data.
3. On the Your Data Sets 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. 351). For more information about modifying the visual, see Working with Amazon QuickSight Visuals (p. 267).
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 Data Set and an Analysis (p. 51)
- Step 2: Create a Visual (p. 52)

**Step 1: Create an Amazon S3 Data Set 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. 91).
2. Check Data Source Limits (p. 70) 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 Manage data.
5. On the Your Data Sets page, choose New data set.
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. 351). For more information about modifying the visual, see **Working with Amazon QuickSight Visuals** (p. 267).
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 Limits (p. 70) 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 for Database Credentials (p. 620).
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. 676).
4. On the Amazon QuickSight start page, choose Manage data.
5. On the Your Data Sets page, choose New data set.
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 Limits (p. 70) to make sure your target table or query doesn't exceed data source limits.
Create an Analysis Using Your Own Database Data

2. Confirm that the database credentials you plan to use have appropriate permissions as described in Required Permissions for Database Credentials (p. 620).

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. 676).

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

5. On the Your Data Sets page, choose New data set.

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. 351). For more information about modifying the visual, see *Working with Amazon QuickSight Visuals* (p. 267).
Navigating the QuickSight App

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. 57)
- Using the Amazon QuickSight Start Page (p. 60)
- Choosing a Language in Amazon QuickSight (p. 63)
- Using the Amazon QuickSight Mobile App (p. 66)

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.
If you have autodiscovered data sources, your screen looks like the following screenshot. Optionally, you can dismiss this data source information by choosing the X icon near the top right.

To view videos about Amazon QuickSight, choose the Tutorial videos tab. 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. 2) 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.
- **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 the All dashboards tab. Choose any dashboard to open it.

To see available analyses, choose the All analyses tab. This is the default tab when Amazon QuickSight opens. Choose any analysis to open it.
To see your list of favorite dashboards and analyses, choose the **Favorites** tab. 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 **Your Data Sets**. Choose one to start analyzing it.

To see current data sets, or to create a new data set, choose **Manage data**, near the top right. This takes you to **Your Data Sets**, which displays the data sets 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 data set to analyze.
To create a new data set from Your Data Sets, choose New data set. From here, you can upload a file, or you can create a new data set 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, choose the search box at the top 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 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:

- English (en-US)
- German (de-DE)
- Spanish (es-ES)
- French (fr-FR)
- Italian (it-IT)
- Portuguese (pt-BR)
- Japanese (ja-JP)
Choosing a Language in Amazon QuickSight

• Korean (ko-KR)
• Simplified Chinese (zh-CN)
• Traditional Chinese (zh-TW)

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 user profile icon 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
Working with Data in Amazon QuickSight

You can base your Amazon QuickSight analyses on a variety of data sources. These data sources include AWS data stores, Salesforce, files in common formats, and popular database engines. You connect to these data sources and create data sets, which identify the specific data from that data source that you want to work with. Data sets also store any data preparation you have done on that data, so that you can reuse that prepared data in multiple analyses. For more information on preparing data, see Preparing Data (p. 121).

You can view your available data sets on the Your Data Sets page, which you reach by choosing Manage data on the Amazon QuickSight start page. You can view available data sources and create a new data set on the Create a Data Set page, which you reach by choosing New data set on the Your Data Sets page.

Topics
- Working with Data Sources in Amazon QuickSight (p. 67)
- Working with Data Sets (p. 84)

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 data sets from the data store without having to re-enter information. Connection information isn't saved for text or Microsoft Excel files.

Topics
- Supported Data Sources (p. 67)
- Data Source Limits (p. 70)
- Creating a Data Source (p. 75)
- Editing a Data Source (p. 82)
- Deleting a Data Source (p. 84)

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.

Relational Data Sources

You can use any of the following relational data stores as data sources for Amazon QuickSight:

- Amazon Athena
- Amazon Aurora
- Amazon Redshift
- Amazon Redshift Spectrum
- Amazon S3
• Amazon S3 Analytics
• Apache Spark 2.0 or later
• MariaDB 10.0 or later
• Microsoft SQL Server 2012 or later
• MySQL 5.1 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.

You can retrieve data from tables and materialized views in PostgreSQL instances, and from tables in all other database instances.

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
• On your local network
• In a data center or some other internet-accessible environment

**File Data Sources**
You can use files in Amazon S3 or on your local network as data sources for Amazon QuickSight. Amazon QuickSight supports files in the following formats:

• **CSV/TSV** – Delimited text files
• **ELF/CLF** – Extended and common log format files
• **JSON** – Flat or semistructured data files
• **XLSX** – Microsoft Excel files

Files in Amazon S3 that have been compressed with zip, or gzip ([www.gzip.org](http://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, unzip them before importing them.

**JSON Data Sources**
Amazon QuickSight natively supports JSON flat files and JSON semi structure 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. 488).

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 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 Sources

Following, you can find the SaaS data sources currently supported by Amazon QuickSight. The ones that aren't labeled "direct connection" use Open Authorization (OAuth) to connect instead. For sources using OAuth, the connector takes you to the SaaS site to authorize the connection before you can create the data source.

**Note**
For this approach to work, Amazon QuickSight must be able to access the SaaS data source over the network.

- Adobe Analytics
- GitHub
- JIRA (direct connection)
- Salesforce

You can use reports or objects in the following editions of Salesforce as data sources for Amazon QuickSight. Joined reports aren't supported as Amazon QuickSight data sources.

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

Data Source Limits

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

Topics
• SPICE Limits (p. 70)
• Query Limits (p. 70)
• Supported Data Types (p. 71)
• Unsupported Data Values (p. 73)
• Handling Date Time Zones (p. 74)
• Supported Date Formats (p. 74)

SPICE Limits

When you create a new data set in Amazon QuickSight, SPICE (p. 2) limits the number of rows you can add to a data set. You can ingest data into SPICE from a query or from a file. Each file can have up to 1,000 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.

Limits for SPICE are as follows:

• 25 million (25,000,000) rows per data set in Standard edition
• 100 million (100,000,000) rows per data set in Enterprise edition
• 2047 Unicode characters for each field
• 127 Unicode characters for each column name
• 1,000 columns for each file
• 1,000 files for each manifest

In rare cases, if the rows that you are ingesting into SPICE are large in size, you might encounter the limit for the number of GB per data set. Currently, the size limit per data set is 25 GB for Standard edition, and 200 GB for Enterprise edition. 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 (p. 603).

Query Limits

If you aren't importing data into SPICE, different limits apply for space and time. For operations such as connecting, sampling data for a data set, and generating visuals, timeouts can occur. In some cases, these are timeout limits 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 also Implementing Workload Management in Amazon Redshift in the Amazon Redshift Database Developer Guide.
Each result set from a direct query can have up to 1,000 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.

Limits for queries are as follows:

- 127 Unicode characters for each column name.
- 1,000 columns for each data set.
- 2-minute limit for generating a visual, or an optional data set sample.
- Data source timeout limits apply (varies for each database engine).

## Supported Data Types

Amazon QuickSight currently supports the following primitive data types:

- **Date** – Dates must be in one of the supported data formats (p. 74).
- **Decimal** – The decimal data type supports 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 SPICE. For example, 13.00049 is truncated to 13.0004.

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 as described preceding. For more information, see Handling Decimal Values in Calculated Fields (p. 153).

- **Integer**
- **String**

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 data rows that can’t be converted.

The following table lists the source data types that are supported. Boolean data types are converted to integers in 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><strong>Amazon Athena, Presto</strong></td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td>• boolean</td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td>• varchar</td>
<td>• timestamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• double</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• integer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• real</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• smallint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tinyint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amazon Aurora, MariaDB, and MySQL</strong></td>
<td>• bigint</td>
<td>• char</td>
<td>• date</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• decimal</td>
<td>• enum</td>
<td>• datetime</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• double</td>
<td>• set</td>
<td>• timestamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• int</td>
<td>• text</td>
<td>• year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• integer</td>
<td>• varchar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Database Engine or Source</td>
<td>Numeric Data Types</td>
<td>String Data Types</td>
<td>Datetime Data Types</td>
<td>Boolean Data Types</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td></td>
<td>mediumint</td>
<td>char</td>
<td>date</td>
<td>boolean</td>
</tr>
<tr>
<td></td>
<td>numeric</td>
<td>character</td>
<td>timestamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>smallint</td>
<td>text</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>tinyint</td>
<td>varchar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PostgreSQL</td>
<td>bigint</td>
<td>date</td>
<td></td>
<td>boolean</td>
</tr>
<tr>
<td></td>
<td>decimal</td>
<td>timestamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>double</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>integer</td>
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<td>numeric</td>
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<td></td>
<td>precision</td>
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<td></td>
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<td></td>
<td>real</td>
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<td></td>
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<tr>
<td></td>
<td>smallint</td>
<td></td>
<td></td>
<td></td>
</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>
<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>real</td>
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<td></td>
<td>smallint</td>
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<td></td>
<td>tinyint</td>
<td></td>
<td></td>
<td></td>
</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>text</td>
<td>time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>double</td>
<td>string</td>
<td>timestamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>doubleprecision</td>
<td>text</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>float</td>
<td>varchar</td>
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<tr>
<td></td>
<td>float4</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>float8</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>int</td>
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<td>integer</td>
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<td>number</td>
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<td>numeric</td>
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<td>real</td>
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<td></td>
<td>smallint</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>tinyint</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Data Source Limits

<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>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>
<tr>
<td></td>
<td>• decimal</td>
<td>• nvarchar</td>
<td>• datetime2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• int</td>
<td>• text</td>
<td>• datet imeoffset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• money</td>
<td>• datetime</td>
<td>• smalldatetime</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• numeric</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• real</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• smallint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• smallmoney</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• tinyint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• char</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• nchar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• nvarchar</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• text</td>
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<td></td>
<td>• datetime</td>
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<tr>
<td></td>
<td>• datetime2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• datet imeoffset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• smalldatetime</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Unsupported Data Values

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>
</tbody>
</table>
Handling Date Time Zones

Amazon QuickSight uses UTC time for querying, filtering, and displaying date data.

When date data doesn't specify a time zone, Amazon QuickSight assumes UTC values. When date data does specify a time zone, Amazon 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`.

Supported Date Formats

Data in date fields must be in one of the following supported formats, depending on the data source type.

For file uploads, Amazon S3 sources, Athena, and Salesforce, Amazon QuickSight supports the use of date and time formats described in the Joda API documentation. The time formats include both 24-hour and 12-hour clocks. For a complete list of Joda date formats, see [Class DateTimeFormat](https://www.joda.org/joda-time/) on the Joda website.

For relational database sources, including Amazon Redshift, Amazon RDS, PostgreSQL, MySQL, Aurora, MariaDB, and Microsoft SQL Server, Amazon QuickSight supports the following date and time formats (24-hour only).

Amazon QuickSight supports dates in the range from Jan 1, 1400 00:00:00 UTC to Feb 26, 2364 23:59:59 UTC for SPICE data sets.

1. `dd/MM/yyyy HH:mm:ss`, for example 31/12/2016 15:30:00.
2. `dd/MM/yyyy`, for example 31/12/2016.
3. `dd/MMM/yyyy HH:mm:ss`, for example 31/DEC/2016 15:30:00.
4. `dd/MMM/yyyy`, for example 31/DEC/2016.
5. `dd-MMM-yyyy HH:mm:ss`, for example 31-DEC-2016 15:30:00.
6. `dd-MMM-yyyy`, for example 31-DEC-2016.
7. `dd-MMM-yyyy HH:mm:ss`, for example 31-12-2016 15:30:00.
8. `dd-MMM-yyyy`, for example 31-12-2016.
9. `MM/dd/yyyy HH:mm:ss`, for example 12/31/2016 15:30:00.
10. `MM/dd/yyyy`, for example 12/31/2016.
11. `MM-dd-yyyy HH:mm:ss`, for example 12-31-2016 15:30:00.
12. `MM-dd-yyyy`, for example 12-31-2016.
13. `MMM/dd/yyyy HH:mm:ss`, for example DEC/31/2016 15:30:00.
14. `MMM/dd/yyyy`, for example DEC/31/2016.
15. `MMM-dd-yyyy HH:mm:ss`, for example DEC-31-2016 15:30:00.
16. `MMM-dd-yyyy`, for example DEC-31-2016.
17. `yyyy/MM/dd HH:mm:ss`, for example 2016/12/31 15:30:00.
18. `yyyy/MM/dd`, for example 2016/12/31.
19. `yyyy/ MMM/dd HH:mm:ss`, for example 2016/DEC/31 15:30:00.
20. `yyyy/ MMM/dd`, for example 2016/DEC/31.
21. `yyyy-MMM-dd HH:mm:ss`, for example 2016-12-31 15:30:00.
22 yyyy-MM-dd, for example 2016-12-31.
23 yyyy-MM-dd HH:mm:ss, for example 2016-DEC-31 15:30:00.
24 yyyyMMdd'T'HHmmss, for example 20161231T153000.
26 yyyy-MM-dd'T'HH:mm:ss, for example 2016-12-31T15:30:00.

Note
When you create a calculated column formula using a date format that contains apostrophes, make sure to escape them. Examples are `formatDate({myDateField}, "yyyyMMdd'T'HHmmss")` or `formatDate({myDateField}, 'yyyyMMdd'\'T\'HHmmss')`.

Creating a Data Source

An associated data source is automatically created when you create an Amazon Athena, Amazon S3, Salesforce, or database data set. No data source is created when you create a data set by uploading a file.

- For information about creating an Amazon S3 data set, see Creating a Data Set Using Amazon S3 Files (p. 88).
- For information about creating an Amazon Athena data set, see Creating a Data Set Using Amazon Athena Data (p. 95).
- For information about creating a Salesforce data set, see Creating a Data Set from Salesforce (p. 98).
- For information about creating a data set from a database, see Creating Data Sets from New Database Data Sources (p. 99).

When you create a Presto or Apache Spark data set, you must configure Presto or Apache Spark for Amazon QuickSight, as described following.

Topics
- Creating a Data Source and Data Set from SaaS Sources (p. 75)
- Creating a Data Source Using Presto (p. 81)
- Creating a Data Source Using Apache Spark (p. 81)

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 data set 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.

1. On the Amazon QuickSight start page, choose Manage data.
2. On the Your Data Sets page, choose New data set.
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. A screen similar to one of the following appears.
If the SaaS data source doesn't use OAuth, the following screen appears.

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.

**Note**
Amazon QuickSight documentation is now available on GitHub. If you'd like to make changes to this user guide, you can use GitHub to edit it directly.
(Optional) If your SaaS account is part of an organizational account, you might be asked to request organization access as part of authorizing Amazon QuickSight. If you want to do this, follow the prompts on your SaaS screen, then choose to authorize Amazon QuickSight.
7. After authorization is complete, choose a table or object to connect to. Then choose Select.
8. On the following screen, choose one of these options:

- To save the data source and data set, choose **Edit/Preview data**. Then choose **Save** from the top menu bar.

- To create a data set and an analysis using the data as-is, choose **Visualize**. This option automatically saves the data source and the data set.

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 Data Sets** (p. 121).

- **Note**
  If you don't have enough **SPICE** (p. 2) capacity, choose **Edit/Preview data**. In the data preparation screen, you can remove fields from the data set to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see **Preparing Data Sets** (p. 121).
Note
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 a 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.

Creating a Data Source Using Presto

You can connect to a variety of databases using Amazon QuickSight as a Presto client; for information about Presto, see the AWS Introduction to Presto. Presto processes the analytic queries on backend databases. Then it returns results to the Amazon QuickSight client.

The results of analytic queries run through the Presto query engine can be turned into Amazon QuickSight data sets. You can either directly query your data through Presto, or you can import the results of your query into SPICE (p. 2).

Before you use Amazon QuickSight as a Presto client to run queries, you must configure Presto for Amazon QuickSight.

Amazon QuickSight requires your Presto server to be secured and authenticated using Lightweight Directory Access Protocol (LDAP), which is available to Presto version 0.167 or later. If Presto is configured to allow unauthenticated access, Amazon QuickSight refuses the connection to the server. To use Amazon QuickSight as a Presto client, you must configure LDAP authentication to work with Presto.

Presto's documentation contains information on how to set this up. To start, you configure it to enable front-end LDAP authentication over HTTPS. For general information on Presto, see the Presto documentation. For information specifically on Presto and LDAP, see Presto LDAP documentation.

To make sure that you have configured your server for Amazon QuickSight access, follow the instructions in Network and Database Configuration Requirements (p. 676).

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. 2).
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. 676).

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 in 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 data set using the updated data source, proceed with the instructions at Creating a Data Set from a Database (p. 100). 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.

   ![Image of Athena data source edit options]

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 data set using the updated data source, proceed with the instructions at Creating a Data Set Using Amazon Athena Data (p. 95). 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 data sets unusable. Deleting an Amazon S3, Salesforce, or SPICE-based database data source doesn't affect your ability to use any associated data sets. This is because the data is stored in SPICE (p. 2). However, you can no longer refresh those data sets.

Use the following procedure 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 Data Sets

A data set 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 data set also stores any data preparation you have performed on that data, such as renaming a field or changing its data type. Storing this preparation means that you don't have to reprepare the data each time you want to create an analysis based on it.

Topics

- Importing Data into SPICE (p. 84)
- Creating Data Sets (p. 85)
- Editing a Data Set (p. 106)
- Duplicating a Data Set (p. 107)
- Refreshing Data (p. 107)
- View SPICE Ingestion History (p. 109)
- Changing a Data Set (p. 112)
- Sharing Data Sets (p. 113)
- Restricting Access to a Data Set by Using Row-Level Security (p. 114)
- Deleting a Data Set (p. 119)

Importing Data into SPICE

SPICE is the in-memory optimized calculation engine for Amazon QuickSight, designed specifically for fast, ad hoc data visualization. SPICE stores your data in a system architected for high availability, where it's saved until you choose to delete it. You can improve the performance of database data sets by importing the data into SPICE instead of using a direct query to the database. All data sets that aren't based on database data sources must use SPICE.
Each Amazon QuickSight account receives 10 GB of SPICE capacity per paid user, which is allocated when the user signs into Amazon QuickSight for the first time. Each Amazon QuickSight account also receives one free user with 1 GB of SPICE capacity. SPICE capacity is pooled across users for the Amazon QuickSight account. For example, suppose that you have four users, three paid and one free. Suppose also that you have 31 GB of SPICE capacity available. Any of the users in the account can use that capacity. All of your default SPICE capacity is allocated to your home AWS Region. Other AWS Regions have no SPICE capacity unless you choose to purchase some.

To free SPICE capacity, delete any unused data sets that you have imported into SPICE. For more information about deleting a data set, see Deleting a Data Set (p. 119).

You can purchase additional SPICE capacity if you want to, and you can also release purchased SPICE capacity that you aren't using. For information about purchasing or releasing SPICE capacity, and about monitoring SPICE usage, see Managing SPICE Capacity (p. 603).

Creating Data Sets

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

Topics

- Creating Data Sets Using New Data Sources (p. 85)
- Creating a Data Set Using an Existing Data Source (p. 103)

Creating Data Sets Using New Data Sources

To create a data set from a new data source, you must 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, you must 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, you must provide credentials to connect with.
- For Amazon Redshift, Amazon RDS, Amazon EC2, or other database data sources, you must provide information about the server and database that host the data. You also must provide valid credentials for that database instance.

Topics

- Creating a Data Set Using a Local Text File (p. 85)
- Creating a Data Set Using a Microsoft Excel File (p. 86)
- Creating a Data Set Using Amazon S3 Files (p. 88)
- Creating a Data Set Using Amazon Athena Data (p. 95)
- Creating a Data Set from Salesforce (p. 98)
- Creating Data Sets from New Database Data Sources (p. 99)

Creating a Data Set Using a Local Text File

To create a data set 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. 2) as part of creating a data set.

Use the following procedure to create a data set based on a local text file.
1. Check Data Source Limits (p. 70) to make sure that your target file doesn't exceed data source limits.

   Supported file types include .csv, .tsv, .json, .clf, or .elf files.
2. On the Amazon QuickSight start page, choose Manage data.
3. On the Your Data Sets 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 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 data set, 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 data set name as part of preparing the data. If you choose the latter, a data set with the same name as the source file is created. To learn more about data preparation, see Preparing Data (p. 121).

Creating a Data Set Using a Microsoft Excel File

To create a data set using a Microsoft Excel file data source, upload an .xlsx file from a local or networked drive. The data is imported into SPICE (p. 2).

For more information about creating new Amazon S3 data sets using Amazon S3 data sources, see Creating a Data Set Using an Existing Amazon S3 Data Source (p. 103) or Creating a Data Set Using Amazon S3 Files (p. 88).

Use the following procedure to create a data set based on an Excel file.

1. Check Data Source Limits (p. 70) to make sure that your target file doesn't exceed data source limits.
2. On the Amazon QuickSight start page, choose Manage data.
3. On the Your Data Sets 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, 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.

   ![Choose your sheet](image-url)
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.

8. A preview of the data appears on the next screen. You can't make changes directly to the data preview. If the data headings and content don't look correct, you can 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 data set 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 data set 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. 121).
Creating a Data Set Using Amazon S3 Files

To create a data set 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 data set using Amazon S3, the file data is automatically imported into SPICE (p. 2).

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 Using other AWS Services: Scoping Down Access (p. 622).

Use the following procedure to create an Amazon S3 data set.

1. Check Data Source Limits (p. 70) to make sure that your target file set doesn't exceed data source limits.
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. 91).
3. You can save the manifest file to a local directory, or upload it into Amazon S3.
4. On the Amazon QuickSight start page, choose Manage data.
5. On the Your Data Sets page, choose New data set.
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 data set name as part of preparing the data. Otherwise, the data set name matches the name of the manifest file.

To learn more about data preparation, see Preparing Data (p. 121).

Data Sets 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. 91).
For more details about combining files using a manifest, see Creating a Data Set Using Amazon S3 Files (p. 88).

- **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.

**Data Sets 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 data set.

**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.

**Topics**

- Setting Up Amazon S3 to Allow Access from a Different Amazon QuickSight Account (p. 89)
- Setting Up Amazon QuickSight to Access Amazon S3 Files in Another AWS Account (p. 90)

**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. 90). 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.

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 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. 89).

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.

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 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 QuickSight account**. It shows all the buckets your Amazon QuickSight account has access to.

6. If you want to add all the buckets you have permission to use, choose **Choose accessible buckets from other AWS accounts**. Otherwise, enter the name of the Amazon S3 bucket that you want to add. It 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 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 data set based on Amazon S3, and upload your manifest file. For more information Amazon S3 data sets, see [Creating a Data Set Using Amazon S3 Files](p. 88).

**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](p. 88) 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 flag 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` you need to specify `format`, but not `delimiter`, `textqualifier`, and `containsHeader`. 
Any files you specify must be in Amazon S3 buckets that you have granted Amazon QuickSight access to. For information about granting Amazon QuickSight access to AWS resources, see Using other AWS Services: Scoping Down Access (p. 622).

Manifest File Format for Amazon QuickSight

Amazon QuickSight manifest files use the following JSON format.

```json
{
    "fileLocations": [
        {
            "URIs": [
                "uri1",
                "uri2",
                "uri3"
            ]
        },
        {
            "URIPrefixes": [
                "prefix1",
                "prefix2",
                "prefix3"
            ]
        }
    ],
    "globalUploadSettings": {
        "format": "CSV",
        "delimiter": ",",
        "textqualifier": ",",
        "containsHeader": "true"
    }
}
```

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

https://<bucket name>.s3-<region name>.amazonaws.com/<file name> | https://data_bucket.s3-us-east-1.amazonaws.com/data.csv | This URI type identifies the AWS Region for the Amazon S3 bucket.

**• 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.

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

URI prefixes in the following formats are supported.

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

https://s3-<region name>.amazonaws.com/<bucket name>/<folder name1>/<folder name2>/etc.) | https://s3-us-east-1.amazonaws.com/data_bucket/folder1/ | This URIPrefix type identifies the AWS Region for the Amazon S3 bucket.

https://<bucket name>.s3-<region name>.amazonaws.com | https://data_bucket.s3-us-east-1.amazonaws.com | This URIPrefix type identifies the AWS Region for the Amazon S3 bucket.
• **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 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://data_bucket.s3.amazonaws.com/data.csv",
        "https://data_bucket.s3.amazonaws.com/data2.csv"
      ]
    },
    "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/data_bucket/data.tsv"
      ]
    },
    {
      "URIPrefixes": [
        "https://s3-us-east-1.amazonaws.com/data_bucket/
      ]
    }
  ],
  "globalUploadSettings": {
    "textqualifier": "\\"
  }
}
```
The following example identifies two buckets that contain .clf files for import. One is in the same AWS Region as the Amazon QuickSight account, and one in a different AWS Region. The delimiter, textqualifier, and containsHeader fields are skipped because they are not applicable to log files.

```json
{
    "fileLocations": [
        {
            "URIPrefixes": [
                "https://data_bucket.s3-us-east-1.amazonaws.com",
                "s3://other_data_bucket/"
            ]
        },
        "globalUploadSettings": {
            "format": "CLF"
        }
    ]
}
```

The following example uses the Amazon Redshift format to identify a .csv file for import.

```json
{
    "entries": [
        {
            "mandatory": true
        }
    ]
}
```

The following example uses the Amazon Redshift format to identify two JSON files for import.

```json
{
    "fileLocations": [
        {
            "URIs": [
                "https://data_bucket.s3.amazonaws.com/data.json",
                "https://data_bucket.s3.amazonaws.com/data2.json"
            ]
        },
        "globalUploadSettings": {
            "format": "JSON"
        }
    ]
}
```

**Creating a Data Set Using Amazon Athena Data**

You can connect to Amazon Athena data sources and use Athena data to create Amazon QuickSight data sets.

Before you try to read files from Amazon S3 buckets, make sure that you grant Amazon QuickSight access to them. For more information, see Using other AWS Services: Scoping Down Access (p. 622).
To create an Athena data set

1. Check Data Source Limits (p. 70) to make sure that your target table or query doesn't exceed data source limits.
2. On the Amazon QuickSight start page, choose Manage data.
3. On the Your Data Sets page, choose New data set.
4. In the FROM NEW DATA SOURCES section of the Create a Data Set page, choose the Athena icon.
5. For Data source name, enter a name for the data source.
6. For Athena workgroup, choose the Athena workgroup to use. The workgroup to use defaults to Primary.

   If you want to track Athena costs that are related to Amazon QuickSight, you can use a workgroup to help you identify which queries came from Amazon QuickSight.

7. Choose Validate connection to validate the connection. If validation fails, make sure that Amazon QuickSight has permission to access Athena resources. Then, try validating again. For more information on setting Amazon QuickSight permissions to AWS resources, see Using other AWS Services: Scoping Down Access (p. 622).
8. Choose Create data source.
   
   Note
   Amazon QuickSight automatically secures connections to Athena instances by using Secure Sockets Layer (SSL). You don't need to do anything to enable this.

9. For Database: contain sets of tables., choose Select, and then choose your Athena database.
Note
If you want to create a custom SQL query, choose **Edit/Preview data** to edit a query. If you do this without selecting a table, an error appears in the data preview area. You can safely ignore this. The error is saying that there is no data to display until your query is created.

10. Choose one of the following options:

- To prepare the data before creating an analysis, choose **Edit/Preview data** to begin data preparation. Choose to prepare data at this point if you are planning on writing a SQL query, rather than selecting data from a single table. For more information about data preparation, see Preparing Data Sets (p. 121).

- Otherwise, choose a table, and then choose **Select** to confirm.

11. If you didn't choose to prepare the data in the previous step, you see the following screen.
Creating Data Sets

To load your data into SPICE (p. 2), choose **Import to SPICE**. The green indicator shows whether or not you have space available.

Or you can choose to query your data without using SPICE. To do this, choose **Directly query your data**.

12. After choosing how to query your data, choose one of the following options:

- To prepare the data before creating an analysis, choose **Edit/Preview data** to begin data preparation for the selected table. For more information about data preparation, see Preparing Data Sets (p. 121).
- To create a data set and analyze the data using the table as-is, choose **Visualize**.

Creating a Data Set from Salesforce

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

1. Check **Data Source Limits (p. 70)** to make sure that your target report or object doesn't exceed data source limits.
2. On the Amazon QuickSight start page, choose **Manage data**.
3. On the **Your Data Sets** page, choose **New data set**.
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 Data Sets (p. 121).
   - Otherwise, choose a report or object and then choose **Select**.

9. Choose one of the following options:

   - To create a data set and an analysis using the data as-is, choose **Visualize**.

   **Note**
   
   If you don't have enough **SPICE** (p. 2) capacity, choose **Edit/Preview data**. In data preparation, you can remove fields from the data set to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see Preparing Data Sets (p. 121).

   - 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 Data Sets (p. 121).

### Creating Data Sets 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, and PostgreSQL instances in your organization, Amazon EC2, or similar environments.

When creating a new database data set, 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 data set uses a direct query or instead stores data in **SPICE** (p. 2).

When you create a data set 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 Data Set from a Database (p. 100)
Creating a Data Set from a Database

The following procedures walk you through connecting to database data sources and creating data sets. Use Creating a Data Set from an Autodiscovered Amazon Redshift Cluster or Amazon RDS Instance (p. 100) to create data sets from AWS data sources that your Amazon QuickSight account autodiscovered, or use Creating a Data Set Using a Database That’s Not Autodiscovered (p. 101) to create data sets from any other database data sources.

Creating a Data Set from an Autodiscovered Amazon Redshift Cluster or Amazon RDS Instance

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

1. Check Data Source Limits (p. 70) to make sure that 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 for Database Credentials (p. 620).
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. 676).
4. On the Amazon QuickSight start page, choose Manage data.
5. On the Your Data Sets page, choose New data set.
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.
Creating Data Sets

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 Data Sets (p. 121).
   - Create a data set and analysis using the table data as-is and to import the data set 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 data set 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 Data Sets (p. 121).

- To create a data set 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 Data Set 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, and PostgreSQL instances that are on-premises, in Amazon EC2, or in some other accessible environment.

1. Check **Data Source Limits** (p. 70) to make sure that your target table or query doesn’t exceed data source limits.
2. Confirm that the database credentials that you plan to use have appropriate permissions as described in **Required Permissions for Database Credentials** (p. 620).
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. 676).
4. On the Amazon QuickSight start page, choose **Manage data**.
5. On the **Your Data Sets** page, choose **New data set**.
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, 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, 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, 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 Amazon QuickSight SSL and CA Certificates (p. 678).
- 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 Amazon QuickSight SSL and CA Certificates (p. 678).

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. 81), or Creating a Data Source Using Apache Spark (p. 81).

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 Data Sets (p. 121).

- Create a data set and an analysis using the table data as-is and import the data set 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 data set 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 Data Sets (p. 121).

- Create a data set 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**.

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**Creating a Data Set 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 data sets without re-specifying connection information.

**Creating a Data Set Using an Existing Amazon S3 Data Source**

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

1. On the Amazon QuickSight start page, choose **Manage data**.
2. On the **Your Data Sets** page, choose **New data set**.
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 data set, choose **Edit/Preview data**. To create an analysis using the data as-is, choose **Visualize**.

**Creating a Data Set Using an Existing Amazon Athena Data Source**

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

**To create a data set using an existing Amazon Athena data source**

1. On the Amazon QuickSight start page, choose **Manage data**.
2. On the **Your Data Sets** page, choose **New data set**.
3. In the **FROM EXISTING DATA SOURCES** section of the **Create a Data Set** page, choose the Athena 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 **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**.

6. If you didn’t choose to prepare the data in the previous step, the following screen appears.

To load your data into SPICE (p. 2), choose **Import to SPICE**. The green indicator shows whether or not you have space available.

Or you can choose to query your data without using SPICE. To do this, choose **Directly query your data**.

7. After choosing how to query your data, choose one of the following options:

• To prepare the data before creating an analysis, choose **Edit/Preview data** to begin data preparation for the selected table. For more information about data preparation, see **Preparing Data Sets** (p. 121).

• To create a data set and analyze the data using the table as-is, choose **Visualize**.

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

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

1. On the Amazon QuickSight start page, choose **Manage data**.
2. On the Your Data Sets page, choose **New data set**.
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 data set and an analysis using the data as-is, choose **Visualize**.

  **Note**
  If you don’t have enough SPICE (p. 2) capacity, choose **Edit/Preview data**. In data preparation, you can remove fields from the data set to decrease its size or apply a filter that reduces the number of rows returned. For more information about data preparation, see Preparing Data Sets (p. 121).

- 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 Data Sets (p. 121).

**Creating a Data Set Using an Existing Database Data Source**

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

1. On the Amazon QuickSight start page, choose **Manage data**.
2. On the **Your Data Sets** page, choose **New data set**.
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 Data Sets** (p. 121).

• Create a data set and an analysis using the table data as-is and import the data set data into **SPICE** (p. 2) 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 data set 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 Data Sets** (p. 121).

• Create a data set 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 Data Set

You can edit an existing data set to perform data preparation. For more information about Amazon QuickSight data preparation functionality, see **Preparing Data** (p. 121).

You can open a data set for editing from the **Your Data Sets** page, or from the analysis page. Editing a data set from either location modifies the data set for all analyses that use it.

### Editing a Data Set from the Your Data Sets Page

To edit a data set from the **Your Data Sets** page, choose the data set, and then choose **Edit Data Set**. The data set opens in the data preparation page.

If you want to create a copy of the data set, choose **Duplicate data set**, and enter a name for the copy.
Editing a Data Set from the Analysis Page

Use the following procedure to edit a data set from the analysis page.

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 Data sets in this analysis, choose the data set you want to edit, and then choose Edit. The data set opens in the data preparation page.

Duplicating a Data Set

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

If you want to create a copy of the data set, open the Your Data Sets page and choose the data set 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 data set and you have permission to the data source.

Refreshing Data

You can refresh your SPICE (p. 2) data sets 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 taking any of the following approaches:

- You can use the options on the Your Data Sets page.
- You can refresh a data set during data preparation.
- You can schedule refreshes of the data.

In the following sections, you can find an explanation of each approach.

Topics

- Refreshing a Data Set from the Your Data Sets Page (p. 107)
- Refreshing a Data Set During Data Preparation (p. 108)
- Refreshing a Data Set on a Schedule (p. 108)

For data that is not stored in SPICE, you can do the following:

- To refresh file-based data, you must delete and recreate the data set.
- To refresh data from a database, reopen your data set or the visualization you created.

Refreshing a Data Set from the Your Data Sets Page

Use the following procedure to refresh a SPICE (p. 2) data set based on an Amazon S3 or database data source on the Your Data Sets page.

To refresh SPICE data from the Your Data Sets page

1. On the Your Data Sets page, choose the data set, and then choose Refresh Now.
2. Leave the refresh type as Full refresh.
3. If you are refreshing an Amazon S3 data set, 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 data set, choose OK, then OK again.
   If you are refreshing a database data set, choose OK.

### Refreshing a Data Set During Data Preparation

Use the following procedure to refresh a SPICE (p. 2) data set based on an Amazon S3 or database data source during data preparation.

**To refresh SPICE data during data preparation**

1. On the Your Data Sets page, choose the data set, and then choose Edit Data Set.
2. On the pane, choose Refresh now.
3. Leave the refresh type as Full refresh.
4. If you are refreshing an Amazon S3 data set, 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 data set, choose OK, then OK again.
   If you are refreshing a database data set, choose OK.

### Refreshing a Data Set on a Schedule

Use the following procedure to schedule refreshing the data. If your data set is based on a direct query and not stored in SPICE (p. 2), you can refresh your data by opening the data set. You can also refresh your data by refreshing the page in an analysis or dashboard.

**To refresh SPICE (p. 2) data on a schedule**

1. On the Your Data Sets page, choose the data set, 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:
View SPICE Ingestion History

View SPICE Ingestion History

You can view the ingestion history for SPICE data sets 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 dropped and rows ingested
- The job type for the refresh: scheduled, full refresh, and so on.

Use the following procedure to view a data set's SPICE ingestion history.

1. From the start screen, choose Manage Data.
2. Choose the data set that you want to examine. From the data set's overview screen, choose View history, located just under the Last refreshed status.
   
   The View refresh history screen appears.
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.

Topics

- SPICE Ingestion Error Codes (p. 110)

**SPICE Ingestion Error Codes**

For jobs that failed, an error code is included. The following list of errors codes and descriptions can help you understand and troubleshoot issues with ingestion.

- **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 data set was deleted or became unavailable during ingestion.
- **DATA_SET_SIZE_LIMIT_EXCEEDED** – This data set exceeds the maximum allowable SPICE data set size. Use filters to reduce the data set size and try again.
- **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 limit 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 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, navigate to the Security and Permissions page under the Manage 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 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 – Row size limit exceeded the maximum

S3_FILE_INACCESSIBLE – Couldn't connect to an S3 bucket. Make sure 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 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 limit for this data source. Contact your data source administrator for assistance.

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

SPICE_TABLE_NOT_FOUND – An Amazon QuickSight data source or data set was deleted or became unavailable during ingestion. Check your data set in Amazon QuickSight and try again. For more information, see My Rows Were Skipped During Data Preparation (p. 575).
Changing a Data Set

In two situations, changes to a data set might cause concern. One is if you deliberately edit the data set. 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 data sets, 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 data set, 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 data set 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 data set 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 data set a visual is based on, you might need to recreate it from your documentation. You can edit the visual and select a new data set 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 data set to use for your visuals. For more information on access files stored in S3, see Creating a Data Set Using Amazon S3 Files (p. 88).

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 Data Sets

You can give other Amazon QuickSight users and groups access to a data set 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 data set.

Sharing a Data Set

Use the following procedure to share a data set.

1. On the Your Data Sets page, choose the data set. Then choose Share (if this data set hasn’t been shared with anyone). Or choose Shared with <X> users (if the data set has been shared with others).
2. Choose Invite Users.
3. Enter the user or group that you want to share this data set 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 data set with.
4. For Permission, choose the role for each user or group, to give them permissions on the data set.
   - Choose User to allow the user to create analyses from the data set. Choose Owner to allow the user to do that and also refresh, edit, delete, and reshare the data set.
5. Choose Share.

Users receive emails with a link to the data set. Groups don’t receive invitation emails.

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

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

1. On the Your Data Sets page, choose the data set. Then choose Share (if this data set hasn’t been shared with anyone). Or choose Shared with <X> users (if the data set has been shared with others).
   - A list of all users with access to the data set 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 Data Set

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

1. On the Your Data Sets page, choose the data set. Then choose Share (if this data set hasn’t been shared with anyone). Or choose Shared with <X> users (if the data set has been shared with others).
A list of all users with access to the data set is displayed.

2. In the **Actions** column for the user, choose **Revoke access**.

## Restricting Access to a Data Set by Using Row-Level Security

In the Enterprise edition of Amazon QuickSight, you can restrict access to a data set by configuring row-level security on it. You can do this before or after you have shared the data set. 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 data set rules, see Creating Data Set Rules for Row-Level Security (p. 115).

To apply the data set rules, you add the rules as a permissions data set to your data set. Then you choose to explicitly allow or deny access based on the data set rules. Allowing access is the default. Keep in mind these points when you allow and deny access:

- The permissions data set can't contain duplicate values. Duplicates are ignored when evaluating how to apply the rules.
- If you use the rules to **grant access**, each user or group specified can see only the rows that *match* the field values in the data set rules.
- If you add a rule for a user or group and leave all the 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.
- If you use the rules to **deny access**, each user or group specified can see only the rows that *don't match* the field values in the data set rules.
- If you add a rule for a user or group and leave all the other columns with no value (NULL), you deny the user or group access to all the data.
- If you don't add a rule for a user or group, they are denied nothing—in other words, they can see all the data.

Amazon QuickSight treats spaces as literal values. If you have a space in a field that you are restricting, the data set 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 data set 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 delimit ed with quotes. If you use a direct query, you can easily change the query in the original data source.

Or you can upload data set 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 data set rules that are file-based, apply any changes by overwriting the existing rules in the data set's permissions settings.

Data sets that are restricted are marked with the word **RESTRICTED** in the **Your Data Sets** 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.
Creating Data Set Rules for Row-Level Security

Use the following procedure to create a permissions files or query to use as data set rules.

1. Create a file or a query that contains the data set rules (permissions).

   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. 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>ADGroupName</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-tp@example.com">sales-tp@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.

   UserName,Region,Segment
   AlejandroRosalez,EMEA,"Enterprise,SMB,Startup"
   MarthaRivera,US,Enterprise
Following is a SQL example.

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

/* for groups*/
select ADGroup as ADGroupName, Region, Segment
from tps-permissions;
```

2. Create a data set for the data set 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 permissions by using a file or query that contains data set rules.

1. Confirm that you have added your rules as a new data set. If you added them, but don't see them under the list of data sets, refresh the screen.
2. On the Your Data Sets page, choose the data set, and then choose Permissions.
3. From the list of data sets, choose your permissions data set.
If your permissions data set doesn't appear on this screen, return to your data sets, and refresh the page.

4. Choose the permissions policy. There are two choices:
   - To use the data set rules to allow access to the data, choose **Grant access to data set**.
   - To use the data set rules to prevent access to the data, choose **Deny access to data set**.

Each data set has only one active permissions data set. If you try to add a second permissions data set, it overwrites the existing one.

**Important**
Some restrictions apply to NULL and empty string values when working with row-level security.
If your data set has NULL values or empty strings (""") in the restricted fields, these rows are ignored when the restrictions are applied. Inside the permissions data set, NULL values and empty strings are treated the same. For more information, see the following table.

<table>
<thead>
<tr>
<th>Rules for UserName, GroupName, Region, Segment</th>
<th>Result If You Grant Access</th>
<th>Result If You Deny 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>
<td>Doesn't see EMEA Enterprise, SMB, or 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>
<td>Sees no rows</td>
</tr>
<tr>
<td>User or group has no entry</td>
<td>Sees no rows</td>
<td>Sees all rows</td>
</tr>
</tbody>
</table>

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

There are two ways to create a superuser. If you use your permissions data set to grant access, list all possible values for each field for that user. Or if you use your permissions data set to deny access, leave the values blank for all restricted fields for that user. In either case, a user configured this way can see all values.

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 data set rules from the data set.

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

To overwrite permissions, choose a new permissions data set and apply it. You can reuse the same data set 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. In this case, permissions refresh when the direct query cache is automatically refreshed.

If you delete a file-based permissions data set before you remove it from the target data set, restricted users can't access the data set. While the data set is in this state, it remains marked as RESTRICTED. However, when you view Permissions for that data set, you can see that it has no selected data set rules. To fix this, you can specify new data set rules. Creating a data set with the same name is not enough to fix this. You must choose the new permissions data set in the Permissions screen. This restriction doesn't apply to direct SQL queries.

**Deleting a Data Set**

**Important**
Currently, deleting a data set 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 data set with an identical data set.

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

Currently, when you delete a data set 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 data set.
Deleting a Data Set

This is because data sets include metadata that is integral to the analyses and dashboards that depend on that data set. This metadata is uniquely generated for each data set. 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 data set has different metadata. Each data set's metadata is unique, even for multiple data sets that share the same name and the same fields.

Use the following procedure to delete a data set.

1. Before you begin, make sure that the data set isn't being used by any analysis or dashboard that someone wants to keep using.
   - On the Your Data Sets page, choose the data set that you no longer need. Then choose Delete Data Set.

2. If you receive a warning if this data set is in use, track down all dependent analyses and dashboards and point them at a different data set. If this isn't feasible, try one or more of these best practices instead of deleting it:
   - Rename the data set, so that the data set is clearly deprecated.
   - Filter the data, so that the data set has no rows.
   - Remove everyone else's access to the data set.

   It is a good practice to use whatever means you can to inform owners of dependent objects that this data set 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 data set is deleted, choose the data set and choose Delete Data Set. Confirm your choice, or choose Cancel.

   **Important**
   Currently, deleting a data set 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 data set with an identical data set.
Preparing Data

Data sets 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 data set.

You can prepare a data set when you create it, or by editing it later. For more information about creating a new data set and preparing it, see Creating Data Sets (p. 85). For more information about opening an existing data set for data preparation, see Editing a Data Set (p. 106).

Use the following topics to learn more about data preparation.

Topics
- Preparing Data Sets (p. 121)
- Choosing File Upload Settings (p. 131)
- Joining Tables (p. 132)
- Using a SQL Query (p. 140)
- Selecting Fields (p. 144)
- Changing a Field Name (p. 148)
- Changing a Field Data Type (p. 149)
- Mapping and Joining Fields (p. 150)
- Using Unsupported or Custom Dates (p. 151)
- Working with Calculated Fields (p. 152)
- Adding a Filter (p. 158)
- Adding Geospatial Data (p. 175)
- Integrating Amazon SageMaker Models with Amazon QuickSight (p. 183)

Preparing Data Sets

You can prepare data in any data set to make it more suitable for analysis, for example changing a field name or adding a calculated field. For database data sets, 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 data sets.

Topics
- Preparing a Data Set Based on File Data (p. 122)
- Preparing a Data Set Based on Salesforce Data (p. 125)
- Preparing a Data Set Based on Database Data (p. 128)
Preparing a Data Set Based on File Data

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

1. Open a file data set for data preparation by choosing one of the following options:
   - Create a new local file data set, and then choose Edit/Preview data. For more information about creating a new data set from a local text file, see Creating a Data Set Using a Local Text File (p. 85). For more information about creating a new data set from a Microsoft Excel file, see Creating a Data Set Using a Microsoft Excel File (p. 86).
   - Create a new Amazon S3 data set, and then choose Edit/Preview data. For more information about creating a new Amazon S3 data set using a new Amazon S3 data source, see Creating a Data Set Using Amazon S3 Files (p. 88). For more information about creating a new Amazon S3 data set using an existing Amazon S3 data source, see Creating a Data Set Using an Existing Amazon S3 Data Source (p. 103).
   - Open an existing Amazon S3, text file, or Microsoft Excel data set for editing, from either the analysis page or the Your Data Sets page. For more information about opening an existing data set for data preparation, see Editing a Data Set (p. 106).

2. (Optional) On the data preparation page, enter a new name into the data set 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. 131).

   **Important**
   If you want to change upload settings, make this change before you make any other changes to the data set. 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. 144)
   - Changing a Field Name (p. 148)
   - Changing a Field Data Type (p. 149)
   - Adding a Calculated Field During Data Preparation (p. 153)
   - Adding a Filter (p. 158)

5. Check the SPICE (p. 2) indicator to see if you have enough capacity to import the data set. File data sets 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 data set smaller by using one of the following options:

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

**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 data set screen.

## Preparing a Data Set Based on a Microsoft Excel File

Use the following procedure to prepare a Microsoft Excel data set.

1. Open a text file data set for preparation by choosing one of the following options:
   - Create a new Microsoft Excel data set, and then choose **Edit/Preview data**. For more information about creating a new Excel data set, see Creating a Data Set Using a Microsoft Excel File (p. 86).
   - Open an existing Excel data set for editing. You can do this from the analysis page or the **Your Data Sets** page. For more information about opening an existing data set for data preparation, see Editing a Data Set (p. 106).

2. (Optional) On the data preparation page, enter a name into the data set name box in the application bar. If you don't rename the data set, 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. 131).

   **Important**
   If it's necessary to change upload settings, make this change before you make any other changes to the data set. 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–data set menu beneath the login name at the top right.

6. Prepare the data by doing one or more of the following:
   - Selecting Fields (p. 144)
   - Changing a Field Name (p. 148)
   - Changing a Field Data Type (p. 149)
   - Adding a Calculated Field During Data Preparation (p. 153)
   - Adding a Filter (p. 158)

7. Check the SPICE (p. 2) indicator to see if you have enough space to import the data set. Amazon QuickSight must import Excel data sets 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 data set smaller using one of the following methods:
   - Apply a filter to limit the number of rows.
   - Select fields to remove from the data set.
   - Define a smaller range of data to import.
Preparing a Data Set Based on Salesforce Data

Use the following procedure to prepare a Salesforce data set.

1. Open a Salesforce data set for preparation by choosing one of the following options:
   - Create a new Salesforce data set and choose Edit/Preview data. For more information about creating a new Salesforce data set using a new Salesforce data source, see Creating a Data Set from Salesforce (p. 98). For more information about creating a new Salesforce data set using an existing Salesforce data source, see Create a Data Set Using an Existing Salesforce Data Source (p. 104).
   - Open an existing Salesforce data set for editing from either the analysis page or the Your Data Sets page. For more information about opening an existing data set for data preparation, see Editing a Data Set (p. 106).

2. (Optional) On the data preparation page, enter a name into the data set name box in the application bar if you want to change the data set 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. 144)
   - Changing a Field Name (p. 148)
   - Changing a Field Data Type (p. 149)
   - Adding a Calculated Field During Data Preparation (p. 153)
   - Adding a Filter (p. 158)

6. Check the SPICE (p. 2) indicator to see if you have enough space to import the data set. Importing data into SPICE is required for Salesforce data sets. Importing occurs when you choose either Save & visualize or Save.

   If you don't have enough SPICE capacity, you can remove fields from the data set or apply a filter to decrease its size. For more information about adding and removing fields from a data set, see Selecting Fields (p. 144).

   **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 data set 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 data set screen.
Preparing a Data Set Based on Database Data

Use the following procedure to prepare a data set based on a query to a database. The data for this data set 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. 2), or to query the data directly.

1. Open a database data set for preparation by choosing one of the following options:
   - Create a new database data set and choose Edit/Preview data. For more information about creating a new data set using a new database data source, see Creating Data Sets from New Database Data Sources (p. 99). For more information about creating a new data set using an existing database data source, see Creating a Data Set Using an Existing Database Data Source (p. 105).
   - Open an existing database data set for editing from either the analysis page or the Your Data Sets page. For more information about opening an existing data set for data preparation, see Editing a Data Set (p. 106).

2. (Optional) On the data preparation page, enter a name into the data set 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 SPICE (p. 2) if you choose to use joined tables. For more information about joining tables using the Amazon QuickSight interface, see Joining Tables (p. 132).

• To use a custom SQL query to provide data in a new data set, choose Switch to Custom SQL tool on the Tables pane. For more information, see Using a SQL Query (p. 140).

To change the SQL query in an existing data set, 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. 144)
• Changing a Field Name (p. 148)
• Changing a Field Data Type (p. 149)
• Adding a Calculated Field During Data Preparation (p. 153)
• Adding a Filter (p. 158)

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.
Choosing File Upload Settings

If you are using a file data source, you should confirm the upload settings that Amazon QuickSight uses to import the file into SPICE (p. 2), 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 data set. 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 data set.

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 Tables

You can use the join interface in Amazon QuickSight to join tables 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 to a centralized data store.

The following limitations apply to joins:

- For joins of multiple data sources, the result set is a SPICE data set.
- For joins of multiple data sources, there's no size restriction on the data that you use to create the data set. You should 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.
• You can’t use a custom SQL query in a join between multiple data sources. To use custom SQL to join tables from different data sources, create the join before importing to Amazon QuickSight.

**Important**
If you choose a table and make changes to the fields, these changes are discarded when you add tables by using the join interface. Examples of changes are changing a field name or adding a calculated field.

For some examples of joining tables across data sources, see the [Joining across data sources on Amazon QuickSight](https://aws.amazon.com/blogs/big-data/) post on the AWS Big Data Blog.

## Creating a Join

Use the following procedure to join tables to use in a data set. Before you begin, import or connect to your data.

1. On the data preparation page, choose **Add data** near the top of the page.

   ![Add data](image)

   (Optional) If you’re using only one data source and you are connected to a SQL-based data source, you can write a custom query by choosing **Switch to custom SQL mode**. Choosing this opens the following screen, where you can paste or enter a query.

   However, switching between modes erases your work in the other view. If you switch to custom SQL mode, choose **Switch to diagram mode** to switch back. The option to switch between SQL mode and diagram mode are available only when you are creating a new data set. If you want to switch modes for an existing data set, create a new one instead.
The following steps use the diagram mode.

After you choose **Add data**, the following screen appears.

By using the graphic editor, 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, databases, or JSON objects in an Amazon S3 bucket.

2. Choose **Switch data source** to use an existing data source, or choose **Upload a file** to add a new file.

Then choose the item that you want to add. You can search for it by entering text in the search box. Doing this searches the schema that you selected for the partial table name.
When you add new data, you don't use a data set that you created previously. Instead, you are adding a new instance of the data to the data set that you are currently editing. When you choose **Upload a file**, you navigate to the file you want to add. If you choose **Switch data source**, you choose a data source you already have access to, but you don't have to enter credentials for it.

3. Choose your data from the list. Then choose **Select**. To exit without adding this data, choose **Cancel**.

After you add data, each item appears as a table icon in the workspace. You can drag and drop these icons to rearrange the tables. You can interact with each table by hovering the cursor over it until some interaction icons appear. To see information about the table, choose the information icon ( ![Info icon](i.png) ). To remove the data from your data set, choose the delete icon ( ![Delete icon](delete.png) ).

You can add a table multiple times, to create self-joins. To help you distinguish between two instances of the same table, a counter displays after the name. An example is **Product**, **Product (2)**, and **Product (3)**. Field names in the **Fields** or **Filters** sections include a label so you can see which instance of the table a particular field is from.

4. After you add tables, create a join by choosing the double red dots ( ![Double red dots](red-dots.png) ). Double red dots indicate joins that aren't yet configured. When you choose double red dots, the **Join Configuration** pane opens. On the join interface, you can specify the join type and the fields to use to join the tables.

![Join Configuration](join.png)

5. Choose the columns to join the tables on.

At the bottom of the screen, you can see options to set a field in one table equal to a field in another table.
Creating a Join

a. In the **Join clauses** section, choose the join column for each table.

b. (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 tables.

6. In the **Join configuration** pane, choose the kind of join to apply under **Join type**. You can choose each join type to learn more about it. For more information on joins, see **Join Types** (p. 138).
7. Choose **Apply** to confirm your choices. To cancel without making changes, choose the X at top right of the **Join configuration** panel.

The join icon updates to indicate that the join type and columns have been selected.

8. (Optional) Choose one or more options at the far left to help you configure your data set:

   - For **Data source**, you can choose **SPICE** to store your data set in **SPICE** (p. 2), or choose **Query** to pull live data. If your data set contains more than two tables, your data set is stored in SPICE.
   - If you choose **SPICE**, the data is ingested into SPICE, and visuals that use the data set run queries in SPICE, instead of against the database.
   - If you choose **Query**, the data isn't ingested into SPICE, and visuals that use the data set run queries against the database, instead of in SPICE.
   - In the **Fields** section, you can choose fields you want to include or exclude.
   - In the **Filters** section, you can add or edit filters.
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>

```sql
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 (\(\text{JOIN}\)) 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>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>5</td>
<td>B+</td>
<td>6</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 (\(\text{LEFT OUTER JOIN}\)) or right (\(\text{RIGHT OUTER JOIN}\)) 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 (\(\text{LEFT OUTER JOIN}\)) 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>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>
</tbody>
</table>
If you instead use a right outer join (\(\text{RIGHT OUTER JOIN}\)), call the tables in the same order so \textit{safety-rating} is on the left and \textit{widgets} is on the right. In this case, only matching \textit{safety-rating} rows are returned, and all \textit{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>5</td>
<td>B</td>
<td></td>
<td></td>
<td>WidgetE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>WidgetE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>WidgetF</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td>WidgetG</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 (\(\text{FULL OUTER JOIN}\)) 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 \textit{safety-rating} and \textit{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></td>
<td></td>
<td>WidgetE</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>5</td>
<td>WidgetE</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>WidgetF</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td>WidgetG</td>
</tr>
</tbody>
</table>

**Using a SQL Query**

When creating a new data set based on a direct query to a database, you can choose an existing SQL query or create a new SQL query. You can use either an existing or new query to refine the data retrieved from a database, or to combine data from multiple tables. Using a SQL query, you can specify SQL statements in addition to any join criteria to refine the data set. If you want to join tables only by specifying the join type and the fields to use to join the tables, you can use the join interface instead. For more information about using the join interface, see Joining Tables (p. 132).

You can specify a SQL query only for data sets based on SQL database data sources.
Important
If you chose a table and made any changes to the fields, these changes are discarded when you
switch from the table selector to the Custom SQL tool. For example, you might change a field
name or add a calculated field.

Creating a Custom SQL Query

Use the following procedure to create a custom SQL query for a data set.

1. Create a new data set that points to a database source. For more information about creating a data
   set from a database, see Creating Data Sets from New Database Data Sources (p. 99).

2. 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.
     
     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.
After you choose Use SQL, the Tables pane is renamed to Custom SQL. You can choose this new pane to switch back to using tables.

**Note**
You can explore the fields in your tables by using the Tables pane. After you select a table, its structure displays in the viewer. This view can be useful if you are unfamiliar with the field names, and want to write SQL. In some cases, Amazon QuickSight can't change a table data source into a query. In this case, the screen doesn't display the option to switch to a custom SQL query. To use a query instead, create a new data set that is based on the query you want to use. If your newly created data set doesn't appear on Your Data Sets screen, refresh your page. Likewise, if you choose your new data set and its dialog box has no options except Create analysis, close this dialog box and reopen it.

3. Enter information for a new SQL query:
   - In the Custom SQL pane, choose Use SQL.
   - For Custom SQL name, enter a query name.
   - For Custom SQL, enter a SQL query. The query must conform to the SQL syntax of the target database engine in terms of capitalization, command termination, and other requirements.

   **Note**
   The Custom SQL box has no query editing functionality. It's easier to create the query that you want in your SQL editor of choice and then paste it in.
• Choose Finish. The query is processed and a sample of the query results displays in the data preview pane.

After you have selected or created a SQL query, the SPICE (p. 2) indicator updates to reflect the size of the data set returned by the query.

Switching Back to Using a Table

To stop using a SQL query and use regular table data instead, choose Switch to table selector in the Custom SQL pane, and then choose a table. You can only do this with new data sets. Once you have saved the data set to use a SQL query, you can edit the query, but you can’t switch to using a table.

Modifying Existing Queries

To update an existing data set based on a SQL query, open the Fields pane, and choose Edit SQL to open the SQL pane and edit the query.
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 data set 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.
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.
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 Limits (p. 70).
- **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 SPICE (p. 2). 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 non-date 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.

| 10020  |
| 36803  |
| 14267a |
| 98457  |
| 78216b |

All records containing alphabetic characters in that field are skipped, as shown following.
If you have a database data set 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 a SQL Query (p. 140). For more information about how different source data types are interpreted by Amazon QuickSight, see Supported Data Types (p. 71).

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. 200).

In SPICE (p. 2), 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. 492) 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 data sets 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 data sets are going to be used together, you can take a couple of extra steps to make your work easier later on.
Mapping Fields

Amazon QuickSight can automatically map fields between data sets in the same analysis. The following tips can help make it easier for Amazon QuickSight to automatically map fields between data sets, for example if you are creating a filter action across data sets:

• 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, Viewing, and Editing Custom Actions in Amazon QuickSight (p. 346).

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 data sets. You create the joined data set by directly accessing the source data.

For more information on joining data across data sources, see Joining Tables (p. 132).

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 data set, 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. 74).

Use this procedure to help Amazon QuickSight understand dates in different formats.

1. For a data set 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, MMDyyyy, 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. 473).

   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 data set.

4. When you are satisfied with the results, choose Update. Otherwise, choose Close.

Working with Calculated Fields

Create calculated fields to use operators or functions to analyze or transform field data. For details about supported functions and operators, see Calculated Field Function and Operator Reference for Amazon QuickSight (p. 459).

You can use multiple functions and operators in a calculated field. For example, you might use the `formatDate` function to extract the year from a date field, and then the `ifelse` function to segment records based on the year.
You can create a calculated field based on one or more data set fields or existing calculated fields. For example, you can use the `ifelse` function to create a `quarter` field extrapolated from a month value.

```
ifelse(month <= 3, 1, month > 3 AND month <= 6, 2, month > 6 AND month <= 9, 3, 4)
```

You can then use that calculated `quarter` field and a sales amount field to identify high-spending customers for the first quarter.

```
ifelse(quarter = 1 AND sales_amount >= 10000, 'review account', 'n/a')
```

You can add calculated fields to a data set during data preparation or from the analysis page. When you add a calculated field to a data set during data preparation, it's available to all analyses that use that data set. When you add a calculated field to a data set in an analysis, it's available only in that analysis. For information about adding calculated fields during data preparation, see Adding a Calculated Field During Data Preparation (p. 153). For information about adding calculated fields in an analysis, see Adding a Calculated Field to an Analysis (p. 224).

### 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 data set is imported into SPICE (p. 2) or displayed in an analysis.

As an example, take decimal field FieldA 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:

- FieldA > 0 = true. The calculated field value displayed in the analysis or imported into SPICE is true.
- ceil(FieldA) = 1. The calculated field value displayed in the analysis or imported into SPICE is 1.
- FieldA + 0.00009 = 0.00015. The calculated field value displayed in the analysis or imported into SPICE is 0.0001.
- FieldA * 1.5 = 0.00009. The calculated field value displayed in the analysis or imported into SPICE is 0.0.

### Adding a Calculated Field During Data Preparation

Create calculated fields to use functions and operators to analyze or transform field data. For details about supported functions and operators, see Calculated Field Function and Operator Reference for Amazon QuickSight (p. 459). For more information about using calculated fields, see Working with Calculated Fields (p. 152).

You can add calculated fields to a data set during data preparation or from the analysis page. When you add a calculated field to a data set during data preparation, it's available to all analyses that use that data set. When you add a calculated field to a data set in an analysis, it's available only in that analysis.

Use this topic to learn about adding calculated fields during data preparation. For information about adding calculated fields in an analysis, see Adding a Calculated Field to an Analysis (p. 224).
Adding a Calculated Field

Use the following procedure to add a calculated field.

1. Do one of the following:
   
   • Create a calculated field without having the formula populated by a field.
     
     On the data preparation page, expand the Fields pane, and then choose New Field.
   
   • Create a calculated field and have the formula populated with a specified field.
     
     On the data preparation page, expand the Fields pane. Hover over the field that you want to use as the basis for the calculated field, choose the ellipsis at its right, and then choose Add calculation based on <field name>.
   
2. In the Calculated field pane, highlight the value in Calculated field name, and then enter a name for the calculated field.
3. Add a function to the calculated field formula by doing one of the following:

- If you created the calculated field by choosing **New Field**, choose a function from **Function list** and then choose **Add**.

- If you created the calculated field by choosing a specific field to use, place your cursor in front of the field name in **Formula**. Then type the name of the function that you want to use and an open parenthesis, then place your cursor after the field name and enter a close parenthesis.
4. In **Formula**, enter any parameters needed by the function (help for the function displays below **Formula**). As needed, choose fields from **Field list** and then choose **Add** to add them to the formula. You can also choose additional functions from the **Function list** to complete the formula.

If you use a field name with a space or a nonalphanumeric character other than an underscore, enclose that name in curly braces when referencing it. An example is `{customer id}`. Curly braces are optional if the field name has no space or a nonalphanumeric character.

5. Choose **Create**.

The new calculated field is created, and appears in the **Calculated fields** section at the top of the **Fields** pane.

**Editing a Calculated Field**

To edit a calculated field, locate the field that you want to edit in the **Calculated fields** section of the **Fields** pane. Then hover over it, choose the ellipsis that appears to the right of it, and then choose **Edit <field name>**.
Deleting a Calculated Field

To delete a calculated field, locate the field that you want to delete in the Calculated fields section of the Fields pane. Then hover over it, choose the ellipsis that appears to the right of it, and then choose Delete <field name>.

As with regular fields, if you delete a calculated field that is used in a visual, that visual breaks. You then need fix it the next time you open the relevant analysis.
Adding a Filter

You can use filters to refine the data in a data set. 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 data set 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. 159)
- Adding a Filter (p. 160)
- Editing a Filter (p. 172)
- Deleting a Filter (p. 174)
Viewing Filters

To see the filters for a data set, 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. 160)
- Adding a Numeric Filter (p. 164)
- Adding a Date Filter (p. 166)

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.
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 data set.

Comparisons are applied inclusive to the date specified. For example, if you apply the filter `<date> Before 1/1/16`, the records returned include all rows with date values through 1/1/16 23:59:59.
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.

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. 166).
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 data set.

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.

   ![Image of context menu for fields]

   Then choose the correct geospatial data type.

   ![Image of geospatial data type choices]

   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**.

![Create hierarchy screen](image)

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.
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 data set.

Use the following procedure to edit or disband a geospatial hierarchy.

1. Open the data set. 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 data set. 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 data set.
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. 180)
- Issues with Latitude and Longitude (p. 181)

## 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. 180)
- Issues with Ambiguous Locations (p. 180)
- Issues with Invalid Geospatial Data (p. 181)
- Issues with the Default Country in Geocoding (p. 181)

## 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></td>
</tr>
<tr>
<td>US East (N. Virginia) Region</td>
<td></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. 181)
- Using Coordinates in Degrees, Minutes, and Seconds (DMS) Format (p. 182)

**Valid Ranges for Latitude and Longitude Coordinates**

Amazon QuickSight supports latitude and longitude coordinates within specific ranges.
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).

If your data doesn't include the symbols for degree, minute and second, the formula looks like the following.

```/*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.

```/*Latitude*/
  ifelse(
    LatDir = "N",
    (LatDeg + (LatMin / 60) + (LatSec / 3600)),
    (LatDeg + (LatMin / 60) + (LatSec / 3600)) * -1
  )
/*Longitude*/
  ifelse(
    LongDir = "E",
    (LongDeg + (LongMin / 60) + (LongSec / 3600)),
    (LongDeg + (LongMin / 60) + (LongSec / 3600)) * -1
  )
```
The following sample converts \textit{53°21'N 06°15'W} to numeric format. However, without the seconds, this location doesn't map as accurately.

```c
/*Latitude*/
ifelse(
    right(Latitude, 1) = "N",
    (parseInt(split(Latitude, '°', 1)) +
    parseDecimal(substring(Latitude, (locate(Latitude, '°',3)+1), 2 )) / 60),
    (parseInt(split(Latitude, '°', 1)) +
    parseDecimal(substring(Latitude, (locate(Latitude, '°',3)+1), 2 )) / 60) * -1
)
/*Longitude*/
ifelse(
    right(Longitude, 1) = "E",
    (parseInt(split(Longitude, '°', 1)) +
    parseDecimal(substring(Longitude, (locate(Longitude, '°',3)+1), 2 )) / 60),
    (parseInt(split(Longitude, '°', 1)) +
    parseDecimal(substring(Longitude, (locate(Longitude, '°',3)+1), 2 )) / 60) * -1
)
```

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 Amazon SageMaker Models with Amazon QuickSight

\textbf{Note}

You don't need any technical experience in machine learning to author analyses and dashboards that use the ML-powered features in Amazon QuickSight.

You can augment your Amazon QuickSight Enterprise edition data with Amazon SageMaker machine learning (ML) models. This feature preview is currently available in the following AWS Regions only: US East (Ohio), US East (N. Virginia), and Europe (Ireland). You can run inference 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. 67).

Using Amazon QuickSight with Amazon 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.

Some examples of when Amazon QuickSight integrates well with Amazon SageMaker include predicting the likelihood of customer churn or employee attrition, scoring sales leads, and assessing credit risks. Amazon QuickSight doesn't limit the types of models that you can use. However, the Amazon SageMaker data must be in a tabular format. Nontabular data, such as what you'd use for image classification, isn't suitable for application of this feature.
How Amazon SageMaker Integration Works

In general, the process works like this:

1. An Amazon QuickSight administrator adds permissions for Amazon QuickSight to access Amazon SageMaker. To do this, open Security & Permissions settings from the Manage QuickSight page. Go to QuickSight access to AWS services, and add Amazon SageMaker.

When you add these permissions, QuickSight is added to an AWS Identity and Access Management (IAM) role that provides access to list all the Amazon SageMaker models in your AWS account. It also provides permissions to run Amazon SageMaker jobs that have names that are prefixed with quicksight-auto-generated--.

In addition, when creating the model, an Amazon SageMaker administrator adds other permissions. These permissions are so that the IAM role for the Amazon SageMaker model has access to the Amazon S3 bucket that Amazon QuickSight uses. To add these permissions, do the following:

- Add the Amazon Resource Name (ARN) of the IAM role in the ExecutionRoleArn parameter, when creating the model. For more information, see CreateModel in the Amazon SageMaker Developer Guide.

- Add the following policy to the IAM role for executing the model. The policy grants the the role permission to use the s3:GetObject and s3:PutObject operations for the bucket that QuickSight uses to transfer data to and from Amazon SageMaker. QuickSight writes data to this bucket under a prefix that is specific to your AWS account (indicated by the aws:PrincipalAccount placeholder). No other AWS account has access to your data within this bucket.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "s3:GetObject"
      ],
      "Resource": "arn:aws:s3:::quicksight-ml.${aws:RequestedRegion}/
#{aws:PrincipalAccount}/input/*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "s3:PutObject"
      ],
      "Resource": "arn:aws:s3:::quicksight-ml.${aws:RequestedRegion}/
#{aws:PrincipalAccount}/output/*"
    }
  ]
}
```

2. Only during this feature preview, we recommended that you connect to a Amazon SageMaker model that has an inference pipeline, because it automatically performs data preprocessing. For more information, see Deploy an Inference Pipeline in the Amazon 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 Amazon 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 are 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 you want to make predictions on. If you're uploading a file, you can add the Amazon SageMaker model on the upload settings screen. Otherwise, you 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 Amazon SageMaker. These fields can be used just as you use other fields, within the guidelines described in Usage Guidelines (p. 186).

When you run Amazon SageMaker integration, Amazon QuickSight passes a request to Amazon 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 Amazon 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 Amazon SageMaker batch transform to update the output fields with new data.

You can use the Amazon QuickSight SPICE ingestion APIs to control the data refresh process. For more information about using the APIs, 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 Amazon 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 Amazon 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 Amazon 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 ARN for the appropriate IAM role. The IAM role for the Amazon SageMaker model needs to have access to the S3 bucket that Amazon QuickSight uses.
- The model must support .csv files for both input and output. The data must be 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.
- The amount of time that it takes to complete the inference 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. 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, integration with Amazon SageMaker supports only batch transforms, not real-time data. You can't use an Amazon SageMaker endpoint.

Defining the Schema File

Before you use an Amazon SageMaker model with Amazon QuickSight data, create the JSON schema file that contains the metadata that Amazon QuickSight needs to process the model. The 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.

\[ \text{inputContent}Type \]

The content type that this Amazon 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.

\[ \text{outputContent}Type \]

The content type of the output that is produced by the Amazon SageMaker model that you want to use. The only supported value for this is "text/csv".

\[ \text{input} \]

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:

- \[ \text{name} \] – 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. If you set nullable to false, QuickSight drops rows that don't contain this value before calling Amazon SageMaker. Doing this helps avoid causing Amazon SageMaker to fail on missing required data.

**output**

A list of output columns that the Amazon 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 Amazon 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 Amazon SageMaker. For more information on supported types, see TransformResources in the Amazon SageMaker Developer Guide.

**defaultInstanceType**

(Optional) The instance type that is presented as the default option in the Amazon SageMaker wizard in QuickSight. Include this instance type in instanceTypes.

**instanceCount**

(Optional) The instance count defines how many of the selected instances for Amazon 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 Amazon 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"
    }
  ]
}
```
The structure of the schema file is related to the kind of model that is used in examples provided by Amazon SageMaker. For example, see this related model in the amazon-sagemaker-examples GitHub repository. Amazon SageMaker documentation usually provides a similarly structured example notebook for each of its new features.

## Adding an Amazon SageMaker Model to Your QuickSight Dataset

Using the following procedure, you can add a pretrained Amazon 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 Amazon 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 Amazon SageMaker

1. Create a new dataset from the start page by choosing **Manage Data**, and then choose **New data set**.
   
   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 Amazon 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 Amazon 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 Amazon SageMaker batch transform job to update the output fields with new data.
Working with Analyses

You use an analysis to create and interact with visuals and stories. You can think of an analysis as a container for a set of related visuals and stories, for example ones that all apply to a given business goal or key performance indicator. You can use multiple data sets in an analysis, although any given visual can only use one of those data sets.

After you create an analysis and an initial visual, you can expand the analysis. You can do this by adding data sets and visuals, and also by creating stories to add narrative to the analysis data.

Amazon QuickSight supports up to 20 data sets in a single analysis, and up to 20 visuals in a single analysis.

Topics
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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 Your Data Sets 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 Data Sets](#).  

3. **Create a visual.** For more information about creating visuals, see [Creating an Amazon QuickSight Visual](#).

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.

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### 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 the Autosave indicator next to the analysis name and then choose **Autosave ON** or **Autosave OFF**.

![Autosave ON and OFF indicator]

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 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 **Remove title**. Or, to remove the title, you can select the title and then choose the x-shaped delete icon.

   To create a dynamic sheet title, you can add existing parameters to the sheet title. From the title that you want to work with, choose the plus sign at right. Then choose each parameter that you want to include. The parameter must have an associated control to set the value. In the published dashboard, you can update the sheet title by using the parameter control to change the parameter value.

3. Choose **Add** in the application bar and then choose **Add description**.

4. Enter a description in the **Description** box and press **Enter**. To remove a description, choose **Add** in the application bar and then choose **Remove description**. Alternatively, to remove the description, you can select the description and then choose the x-shaped delete icon.

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**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. 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 the current sheet, choose the name of the sheet and start typing.
- To delete the current sheet, choose the delete icon beside the name of the sheet.
- 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 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.
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 from an Amazon QuickSight Visual to a CSV File (p. 271).

Adding a Data Set to an Analysis

Topics

- Add or Edit a Data Set (p. 196)
- Replacing Data Sets (p. 196)
- Remove a Data Set from an Analysis (p. 199)

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.

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.

2. Choose Add data set to add a data set. Or, choose the pencil-shaped edit icon to edit a data set. For more information about editing a data set, see Editing a Data Set (p. 106).

3. A list of your data sets appears. Choose a data set and then choose Select. To cancel, choose Cancel.

Replacing Data Sets

In an analysis, you can add, edit, replace, or remove data sets. Use this section to learn how to replace your data set.

When you replace a data set, the new data set should have similar columns, if you expect the visual to work the way you designed it. Replacing the data set 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 data set, your analysis design should be somewhat stable—not in the middle of an editing phase.

Use the following procedure to replace a data set.

1. Inside your analysis, choose the pencil icon near the data set from the top left of the screen.
2. Choose the Replace this data set with another icon in the screen that opens.
3. From the list of available data sets that appears, choose one, and then choose **Select**.

4. **Note**
   
   Replacing a data set clears the undo and redo history for this analysis.

   Review your choice, and confirm it by choosing **Replace**.

   The data set is replaced with the new one. The field list and visuals are updated with the new data set.

   At this point, you can choose to add a new data set, edit the new data set, 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 columns.

If this happens, you can choose **Replace anyway**, which breaks some or all of your visuals, or choose **Back** to cancel. By choosing **Back**, you get the opportunity to note the mismatches and investigate.

The following screenshot shows a mismatch. The `Region` field in the data set is a geographic type, when the analysis expects it to be a text field. The new data set is also missing the `Monthly Compensation` field, because the field containing this data has a different name in the data set.

In this case, you can choose **Back** and edit the data set to change `Region` to a string. You can then rename the `Compensation` field to `Monthly Compensation`. 

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Alternatively, if you choose Replace anyway, a confirmation notice appears. It warns you that some things in the analysis—visuals, filters, parameters, calculated fields, or some combination of these—don’t work with the new data set. Choose Confirm to proceed, or choose Back to cancel.
If you change your mind after replacing the data set, you can still recover. Let's say you replace the data set despite the mismatches, and then find that it is 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 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. 200)
- Changing a Field Data Type (p. 201)
- Customizing a Field Format (p. 201)

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 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 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 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 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 Date Field (p. 204)
• Format a Number Field (p. 208)
• Format a Currency Field (p. 213)
• Format a Percent Field (p. 220)
• Return a Field's Format to Default Settings (p. 224)

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.

Format a Date Field Using List Options

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.

Use the following procedure to change a date field's format by choosing a list option.

1. Choose one of the following options:
   • In the Field list pane, choose the selector icon to the right of the date field you want to format.
   • On any visual that contains an on-visual editor associated with the date field you want to format, choose that on-visual editor.
   • Expand the Field wells pane, and then choose the field well associated with the date field you want to change.
2. Choose Format, and then choose the format 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.

Format a Date Field Manually

Manually formatting a field enables you to choose from a more extensive list of date and time formats to use. It also enables you to specify custom formats for the date and time values.

Use the following procedure 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 date field you want to format.
   - On any visual that contains an on-visual editor associated with the date field you want to format, choose that on-visual editor.
   - Expand the Field wells pane, and then choose the field well associated with the date field 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:ssZZ, 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 [Class DateTimeFormat](https://joda-time.java.net/apidocs/org/joda/time/DateTimeFormat.html) in the Joda project 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.

**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.

**Format a Number Field Using List Options**

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.

Use the following procedure to change a number field's format by choosing a list option.

1. Choose one of the following options:
   - In the **Field list** pane, choose the selector icon to the right of the number field you want to format.
   - On any visual that contains an on-visual editor associated with the number field you want to format, choose that on-visual editor.
• Expand the **Field wells** pane, and then choose the field well associated with the number field you want to change.

2. Choose **Format**, and then choose the format 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.

**Format a Number Field Manually**

Manually formatting the field allows you to choose which separators to use, the number of decimal places to show, which units to use, and how to display negative numbers.

Use the following procedure 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 you want to format.
   - On any visual that contains an on-visual editor associated with the number field you want to format, choose that on-visual editor.
   - Expand the **Field wells** pane, and then choose the field well associated with the number field 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.
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.

### Format a Currency Field Using List Options

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.

Use the following procedure to select a currency field's symbol by choosing a list option.

1. Choose one of the following options:
   - In the **Field list** pane, choose the selector icon to the right of the currency field you want to format.
   - On any visual that contains an on-visual editor associated with the currency field you want to format, choose that on-visual editor.
   - Expand the **Field wells** pane, and then choose the field well associated with the currency field you want to change.
Field Format

2. Choose **Symbol**, and then choose the symbol you want. The following symbols are offered for currency fields:
   - Display in dollars ($).
   - Display in pounds (£).
   - Display in euros (€).
   - Display in yen (¥).

**Format a Currency Field Manually**

Manually formatting a field enables you to choose the following:

- Which symbol to use
- Which separators to use
- Which units to use
- The number of decimal places to show
- How to display negative numbers

Use the following procedure 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 currency field you want to format.
   - On any visual that contains an on-visual editor associated with the currency field you want to format, choose that on-visual editor.
   - Expand the **Field wells** pane, and then choose the field well associated with the currency field 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.
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.

Format a Percent Field Using List Options

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.

Use the following procedure to change a percent field's number of decimal places by choosing a list option.

1. Choose one of the following options:
   - In the Field list pane, choose the selector icon to the right of the percent field you want to format.
   - On any visual that contains an on-visual editor associated with the percent field you want to format, choose that on-visual editor.
• Expand the Field wells pane, and then choose the field well associated with the percent field you want to change.

2. Choose Decimals, and then choose the number of decimal places 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.

Format a Percent Field Manually

Manually formatting the field allows you to choose which separators to use, the number of decimal places to show, and how to display negative numbers.

Use the following procedure 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 percent field you want to format.
   • On any visual that contains an on-visual editor associated with the percent field you want to format, choose that on-visual editor.
   • Expand the Field wells pane, and then choose the field well associated with the percent field 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.
Return a Field's Format to Default Settings

Use the following procedure to return a field's format to the default settings.

1. Choose one of the following options:
   - In the Field list pane, choose the selector icon to the right of the field you want to reset.
   - On any visual that contains an on-visual editor associated with the field you want to reset, choose that on-visual editor.
   - Expand the Field wells pane, and then choose the field well associated with the field you want to change.
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

You create calculated fields to use functions and operators to analyze or transform field data. You can add calculated fields to a data set or to an analysis. You can create a calculated field and add a formula (expression) with aggregate functions only in an analysis.
When you add a calculated field to a data set during data preparation, it's available to all analyses that use that data set. Data sets support only single-row operations. When you add a calculated field to 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 the 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 data set 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.

To see which functions are available in SPICE (p. 2), see Functions by Category (p. 462).

**Note**

The date functions extract and truncDate don't support SS (second) in SPICE.

For information on calculated fields in data sets, see Working with Calculated Fields (p. 152).

**Topics**

- Using Aggregate Functions in Calculated Fields (p. 225)
- Adding a Calculated Field (p. 235)
- Parameters in a Calculated Field in an Analysis (p. 236)
- Editing a Calculated Field (p. 237)
- Deleting a Calculated Field (p. 238)

**Using Aggregate Functions in Calculated Fields**

You can use the following aggregate functions on calculated fields during analysis and visualization:

- **Average** (avg (p. 227)) – Averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
- **Count** (count (p. 227)) – Calculates the number of values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **Distinct Count** (distinct_count (p. 227)) – Calculates the number of distinct values in a dimension or measure, grouped by the chosen dimension or dimensions.
- **Maximum** (max (p. 228)) – Returns the maximum value of the specified measure, grouped by the chosen dimension or dimensions.
- **Minimum** (min (p. 228)) – Returns the minimum value of the specified measure, grouped by the chosen dimension or dimensions.
- **Median** (median (p. 228)) – Returns the median value of the specified measure, grouped by the chosen dimension or dimensions.
- **Sum** (sum (p. 229)) – Adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
Using Aggregate Functions in Calculated Fields

- Sample Standard Deviation (stdev (p. 229)) – calculates the standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
- Population Standard Deviation (stdevp (p. 230)) – 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.
- Sample Variance (var (p. 230)) – calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a sample.
- Population Variance (varp (p. 230)) – calculates the variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions, based on a biased population.
- For each aggregation, there is also a conditional aggregation. It performs the same type of aggregation, based on a condition. Conditional aggregations include avgIf (p. 231), countIf (p. 231), distinct_countIf (p. 232), maxIf (p. 232), minIf (p. 232), medianIf (p. 233), sumIf (p. 233), stdevIf (p. 234), stdevpIf (p. 234), varIf (p. 234), and varpIf (p. 235).

When a calculated field formula contains an aggregation, it becomes a custom aggregation. To make sure your data is accurately displayed, Amazon QuickSight applies the following rules:

- Custom aggregations can't contain nested aggregate functions. For example, this formula won't work: sum(avg(x)/avg(y)). However, nesting nonaggregated functions inside or outside aggregate functions do 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 won'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. 459).

Topics

- avg (p. 227)
- count (p. 227)
- distinct_count (p. 227)
- max (p. 228)
- min (p. 228)
- median (p. 228)
- percentile (p. 229)
- sum (p. 229)
- stdev (p. 229)
- stdevp (p. 230)
- var (p. 230)
- varp (p. 230)
- avgIf (p. 231)
- countIf (p. 231)
- distinct_countIf (p. 232)
- maxIf (p. 232)
• minIf (p. 232)
• medianIf (p. 233)
• sumIf (p. 233)
• stdevIf (p. 234)
• stdevpIf (p. 234)
• varIf (p. 234)
• varpIf (p. 235)

**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**

```
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.

**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**

```
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_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

\[
\text{distinct\_count(dimension or measure)}
\]

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.

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

\[
\text{max(measure)}
\]

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.

min

The min function returns the minimum value of the specified measure or date, grouped by the chosen dimension or dimensions. For example, min(return rate) returns the minimum rate of returns grouped by the (optional) chosen dimension.

Syntax

\[
\text{min(measure)}
\]

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.

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.

**percentile**

The percentile aggregation computes the nth percentile of the specified measure, grouped by the chosen dimension or dimensions. This function helps you understand the distribution of your data.

Syntax

`percentile(measure, percentile)`

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.

*percentile*

The percentile value can be any double literal between 0 and 100. A percentile value of 50 computes the median value of the measure.

**sum**

The sum function adds the set of numbers in the specified measure, grouped by the chosen dimension or dimensions. For example, `sum(profit amount)` returns the total profit amount grouped by the (optional) chosen dimension.

Syntax

`sum(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.

**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

\texttt{stdev(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.

\textbf{stdevp}

The \texttt{stdevp} function calculates the population standard deviation of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

Syntax

\texttt{stdevp(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.

\textbf{var}

The \texttt{var} function calculates the sample variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

Syntax

\texttt{var(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.

\textbf{varp}

The \texttt{varp} function calculates the population variance of the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.

Syntax

\texttt{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.

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, provided the condition evaluates to true.

Syntax

```
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.

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. For example,

```
countIf(ProdRev, CalendarDay >= ${BasePeriodStartDate} AND CalendarDay <= ${BasePeriodEndDate} AND SourcingType <> 'Indirect')
```

returns the total number of product types grouped by the (optional) chosen dimension, including any duplicates. The `countIf(sales)` function returns the total number of sales completed grouped by the (optional) chosen dimension, for example salesperson, provided the condition evaluates to true.

Syntax

```
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.
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, provided the condition evaluates to true.

Syntax

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.

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, provided 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.

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} AND SourcingType <> 'Indirect') returns the minimum rate of returns grouped by the (optional) chosen dimension, provided the condition evaluates to true.
Using Aggregate Functions in Calculated Fields

Syntax

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.

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, provided the condition evaluates to true.

Syntax

medianIf(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.

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, provided 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.

**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.

**Syntax**

```
stdevIf(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.

**stdevpIf**

Based on a conditional statement, the `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**

```
stdevpIf(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.

**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.

condition

One or more conditions in a single statement.

varpIf

Based on a conditional statement, the 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

\[
\text{varpIf}(\text{measure}, \text{conditions})
\]

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.

Adding a Calculated Field

Use the following procedure to add a calculated field.

1. Choose Add on the application bar, and then choose Add calculated field.
2. For **Calculated field name**, in **Enter a field name**, type a name for the calculated field. This name is the field label displayed in the analysis, so it should match the existing style of field names.

3. Choose a function from **Function list**, and choose the fields that you want to use from the **Field list**. Each field is entered into the formula where your cursor is. You can add user-defined parameters from **Parameter list** in the same way.

4. In **Formula**, type any formula parameters needed by the function. Choose any additional fields or parameters to complete your formula.

   If you use a field that has a space or a nonalphanumeric character other than an underscore in the name, enclose the field name in curly braces when referencing it. An example is `ship_charges amount`. Curly braces are optional if the field name has no space and no nonalphanumeric character.

5. Choose **Create**.

   If there are no errors in the formula or name, the new calculated field is created. It appears in the **Fields list** pane.

### Parameters in a Calculated Field in an Analysis

You can reference parameters in calculated fields that are in an analysis. When you create a calculation, you can choose existing parameters from the list of parameters under **Parameter list**. Or you can type the parameter name, preceded with a $ and enclosed in curly braces { }, for example `#${parameterName}`.
Editing a Calculated Field

Use the following procedure to edit a calculated field.

1. In the Field list pane, hover over the calculated field you want to change.
2. Choose the selector icon to the right of the field name, and then choose Edit calculated field.

3. If the field is a custom aggregation, you can edit it in the field well.

   Hover over the field in the field well and choose the selector icon to the right of the field name. Choose Aggregate: custom, and then choose Custom.
Then choose Edit formula.

Deleting a Calculated Field

Use the following procedure to delete a calculated field.

1. In the Field list pane, hover over the calculated field you want to delete.
2. Choose the selector icon to the right of the field name, and then choose Remove calculated field.
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. 2)).

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 preaggreggate 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. 239).

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. 520)
• `minOver` (p. 515)
• `maxOver` (p. 513)
• `avgOver` (p. 508)
• `countOver` (p. 510)
• `varOver` (p. 524)
• `varpOver` (p. 525)
• `stdevOver` (p. 522)
• `stdevpOver` (p. 523)
• `rank` (p. 527)
• `denseRank` (p. 528)
• `percentileRank` (p. 530)

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. You can download the B2B sales sample data set, which is used in the blog post examples.
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 parameters to work, whether or not they have a related control, they need to be connected to something in your analysis. You can reference them 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. 242)
- Connecting to Parameters in Amazon QuickSight (p. 247)

Setting Up Parameters in Amazon QuickSight

Topics

- Creating or Editing Parameters in Amazon QuickSight (p. 242)
- Using a Control with a Parameter in Amazon QuickSight (p. 244)
- Creating Parameter Defaults in Amazon QuickSight (p. 246)

Creating or Editing 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.

   ![Create new parameter screen](image)

   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 a user from selecting a different value. If you want to also secure the data, you can add row-level locking. For more information, see Restricting Access to a Data Set by Using Row-Level Security (p. 114).

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. 244).

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 data sets on a dashboard, without having to create the filters themselves.

Use the following procedure to create or edit a control for an existing parameter. You need to have an existing parameter to create or edit a control for it.

1. Choose an existing parameter’s context menu, the v icon near the parameter name, and choose Add control.
2. Enter a name to give the new control a label. This label displays 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).
   - Drop-down (single-select or multiselect)

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A single select drop-down lets a user select one value from a list. A multiselect drop-down lets a user select multiple values. Both type of lists work with numbers and text (strings).

Multiselect lists used by a control can work with the following:
- Custom actions
- Dashboard or analysis URLs
- Custom filters (these must either equal or not equal the values provided; no other comparisons are supported)
- 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.

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, you can recreate your parameter with the appropriate settings and try again.

4. (Optional) If you choose a drop-down 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 data set. 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.

  ![Specific values screenshot](image)

  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 data set that contains your field, then choose the field from the list. It can't be a calculated field.
The values display alphabetically in the control, unless there are more than 10,000 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 10,000 values, you can scroll through the values with pagination.

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) To show only the data values, and remove the option to select all items in the control, enable the option to **Hide [ALL] option from the control if the parameter has a default configured.** If you don't configure a static default on the parameter, this option won'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 data set. 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. If you set up a dynamic default, the parameter's control automatically uses that user's preselected default. In the absence of a dynamic default, the parameter's control uses the static default.

Use the following procedure to create or edit a static (unchanging) default value for a parameter.

1. Choose the context menu (v) by the parameter you want to edit, or create a new parameter by following the steps in **Creating or Editing Parameters in Amazon QuickSight (p. 242).**

2. To set a static default, enter a value for **Static default value.** Otherwise, leave this blank. The value you set for a static default can't be changed by the dashboard user.

To create or edit an optional dynamic default value for a parameter, use the following procedure. The data set for dynamic defaults can use a database query or an uploaded file. You can't use dynamic defaults with multivalued parameters—those that use a multiselect drop-down control.

1. Create a database table or SQL query similar to the following. To maintain this table or query more easily, the names of other fields (columns) should closely match those in the data set that you are analyzing. It doesn't matter what order the fields are in. It also doesn't matter if there are fields in this data set that aren't in the current analysis.
User ID must be unique in the data set.

<table>
<thead>
<tr>
<th>User ID</th>
<th>Region</th>
<th>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>WestRegionSalesExecs</td>
<td>West</td>
<td>Enterprise</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>

After you finish this procedure, you can use these fields to choose the default settings for each user, based on a filter you create. To learn more about using filters with parameters, see Using Filters with Parameters in Amazon QuickSight (p. 249).

We recommend that you put all dynamic default definitions in a single table.

2. Create a data set based on this data, and add it to your analysis.
3. Open the Parameters pane, choose a parameter’s context (v) menu, and choose Edit parameter.
4. Choose Set a dynamic default.
5. Choose the data set that you put your user ID and dynamic default values in. Then choose the User ID column for the User name column. Next, choose the relevant value field for the Default value column, for example Region or Segment.

For example, in the following screenshot, the user chooses the data set they created for this (DynamicDefaultsForSales), then chooses the user name column (user ID). Then the user chooses the column that contains the default values (Region) to use for each user in DynamicDefaultsForSales.

6. Choose Apply to save your changes. Each user’s dynamic default value is used in the parameter controls, the first time the user opens the page. You can have more columns in your data set to choose dynamic defaults for additional columns.

Amazon QuickSight uses the static default value for users who don't exist in the data set, don't have a default assigned to them, or don't have unique defaults. Each user must have only a single set of defaults. If you don't want to use dynamic defaults, you can choose to set a static default.

If there is no static default either, then the user can still choose values from the controls. Also, having a dynamic default set doesn't stop users from choosing a different value from the control.

**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. 249)
- Using Calculated Fields with Parameters in Amazon QuickSight (p. 251)
- Using Custom Actions with Parameters in Amazon QuickSight (p. 252)
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’s 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 data set 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, and then return a metric accordingly, as shown in the following 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, Viewing, and Editing Custom Actions in Amazon QuickSight (p. 346). If you just want to use a parameter in a link without creating a URL action, see Using Parameters in a URL (p. 253).
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.


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-abcdefef1234. 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 Custom Actions in Amazon QuickSight (p. 344).

### 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>Data</td>
<td>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>Minimum-maximum gradient</td>
<td>The default gradient to use when a gradient is used as a scale, for example in heat maps.</td>
</tr>
<tr>
<td>Data</td>
<td>Empty fill</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>
<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>
</tbody>
</table>
### Group | Setting | What the Setting Changes
--- | --- | ---
Layout | Gutter | This setting shows or hides the space between visuals in the grid.

Other | Success | This color is used for success messages, for example the check mark for a successful download.

Other | Warning | This color is used for warning and informational messages.

Other | Danger | This color is used for error messages.

Other | Dimension | This color is 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.

Other | Measure | This color is used 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.

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**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. 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 (...).

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**SPICE Data in an Analysis**

When you use **SPICE** (p. 2) 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 My Rows Were Skipped During Data Preparation (p. 575).

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. 260)
- Viewing the Users an Analysis Is Shared With (p. 261)
- Revoking Access to an Analysis (p. 261)
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.
2. You can only share analyses with users or groups who are in your Amazon QuickSight account.

   To add a user or group to share with, in the Type a user name or email box, type the first user or group 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.

   To edit sharing for this analysis, choose Manage analysis access.

3. On this screen you can edit permissions, and add more users or groups. 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.

The users you have shared the analysis with receive 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 trashcan 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 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.

**Working with Stories**

You can use a story to preserve multiple iterations of an analysis and then play them sequentially to provide a narrative about the analysis data. For example, you might want to see several versions of the analysis, all with the same charts but with different filters applied.
A captured iteration of an analysis is called a scene. A scene preserves the visuals that are in the analysis at the time you create it, including such things as filtering and sort order. The data in the visuals is not captured as part of the scene. When you play the story, visuals will reflect the current data in the data set.

Every analysis comes with a default story called Storyboard 1. When working in an analysis, you can add scenes to Storyboard 1 by choosing Capture on the application bar. You can rename Storyboard 1 by using the procedure in Rename a Story or Scene (p. 263).

You can create additional stories as needed. If you have added other stories to the analysis, choosing Capture adds a scene to whichever story is currently selected.

**View a Story**

You can view the currently selected story for an analysis by choosing Story on the tool bar. To see or select other stories, choose the expand icon next to the currently selected story.

**Create a Story**

Use the following procedure to create a new story.

1. On the analysis page, choose Story on the tool bar.
2. Choose the add icon (+) at the top of the Story pane.

3. Type a story name and then choose OK. The new story is set as the current selected story.

Choose Visualize on the tool bar to return to viewing visuals again. Whenever you want to capture the current state of the analysis as a scene in the story, choose Capture on the application bar.

**Rename a Story or Scene**

You can rename stories, and also scenes within stories. Use the following procedure to rename a story or a scene.

1. On the analysis page, choose Story on the tool bar.
2. Select and drag to highlight the story or scene name you want to change.
3. Type a new name and then press **Enter**.

**Play a Story**

Use the following procedure to play a story.

1. On the analysis page, choose **Story** on the tool bar.
2. Choose the play icon on the scene you want to start playing from. The story plays, opening on the scene you selected.
3. Choose **PREVIOUS** or **NEXT** to step through the scenes in the story.

4. To stop playing the story, choose **STOP STORY**.
Delete a Story

You can delete the currently selected story by choosing the expand icon next to the story and then choosing **Delete**.
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 data sets 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 20 data sets in a single analysis, and up to 20 visuals in a single analysis.

Use the following sections to learn how to create and modify visuals.

Topics

• Creating an Amazon QuickSight Visual (p. 267)
• Duplicating an Amazon QuickSight Visual (p. 269)
• Renaming an Amazon QuickSight Visual (p. 270)
• Deleting an Amazon QuickSight Visual (p. 270)
• Exporting Data from an Amazon QuickSight Visual to a CSV File (p. 271)
• Changing Visual Layout in Amazon QuickSight (p. 272)
• Viewing Visual Data in Amazon QuickSight (p. 275)
• Formatting a Visual in Amazon QuickSight (p. 279)
• Changing the Fields Used by a Visual in Amazon QuickSight (p. 288)
• Changing Visual Colors in Amazon QuickSight (p. 303)
• Sorting Visual Data in Amazon QuickSight (p. 307)
• Filtering Visual Data in Amazon QuickSight (p. 310)
• Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 339)
• Custom Actions in Amazon QuickSight (p. 344)
• Working with Visual Types in Amazon QuickSight (p. 347)

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. 351).

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 data set 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* section. For more information about changing a field's measure or dimension setting, see *Setting a Field as a Dimension or Measure*.

### 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*.

### 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 data set that you want to use from the data set list at the top of the **Fields list** pane. For more information, see *Adding a Data Set to an Analysis*.
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.

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**.
Exporting Data from an Amazon QuickSight Visual to a CSV File

Use the following procedure to export data from a visual to a file with the comma-separated value (CSV) format.

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.

The export contains only the fields and the filtered data that are currently displayed in the visual.

1. Choose or create an analysis or dashboard that contains one or more visuals.
2. Choose the visual that you want to export.
3. Choose the on-visual menu, at the upper right of the visual. Then choose **Export to CSV**.

4. 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 the file. If you choose to save, you can choose a file name and location.

You can provide a name for the downloaded file. By default, the CSV file name is the name of your visual. 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`.

5. To export data from additional visuals in the same analysis or dashboard, repeat this process for each visual.

**Tip**
If you have difficulty getting the download to start, try a different browser.
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. Visuals created after May 2018 are smaller in size, fitting two on each row. You can resize the visuals and drag them to rearrange them.

If you change a visual to make it considerably smaller, the on-visual 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 move 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 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. 275)
- Scrolling Through Visual Data (p. 276)
- Focusing on Visual Elements (p. 277)
- Excluding Visual Elements (p. 278)

**Viewing Visual Details**

When viewing a visual, you can hover your cursor over any graphical element to get details on that element. For example, a bar on a bar chart:

![Bar Chart Example](image)

Or a bubble on a scatter plot:
Scrolling Through Visual Data

For bar charts, line charts, and pivot tables, creating a visual on a large data set can result in more visual elements than can be fit into the page length or width. In these cases, scroll bars are provided so that you can page through the data. Drag the scroll bar slider to view different areas of the chart.

On bar charts and line charts, you can also adjust the length of the slider to reflect a greater or lesser proportion of the chart. To do this, choose one of the gray handles on either end of the slider and drag it to adjust the slider size.
Focusing on 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.

Focusing on the element creates a filter that removes all other elements except for the one you selected:
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 other elements again, either choose **Undo** on the application bar, or disable or delete the filter.

For more information about filters, see Filtering Visual Data in Amazon QuickSight (p. 310).
To see the excluded element again, either choose **Undo** on the application bar, or disable or delete the filter.

For more information about filters, see Filtering Visual Data in Amazon QuickSight (p. 310).

**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. 279)
- Customizing the Visual Legend (p. 280)
- Customizing Visual Labels (p. 281)
- Customizing Data Labels on Visuals (p. 281)
- Displaying Totals and Subtotals (p. 282)
- Adding Conditional Formatting to Visuals (p. 283)
- Customizing Style and Font Size (p. 285)
- Changing the Visual Scale with the Axis Range (p. 285)
- Formatting Options Available for Visual Types (p. 286)

**Customizing a Visual Title**

Use the following procedure to hide or display the title for a visual. The visual title displays by default.

1. On the analysis page, choose the visual that you want to format. You can change the title by putting your cursor in the title and editing it directly. To revert to the default name, delete your entry.
2. Select 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 the following settings:
   - Enable or disable the **Show title** check box.
   - Choose the font size you want to use for visual titles and subtitles.
4. Close the **Format Visual** pane by choosing the **X** icon in the upper-right corner of the pane.
Customizing the Visual Legend

The visual legend helps you identify what a visual element represents by mapping its value to a color. For example, on a line chart, line color might represent store location.

To hide or display the legend, you can use the visual menu. You can also use the Format Visual pane, which provides more options. The visual legend displays to the right of the visual by default.

When you move your cursor over the legend, a handle appears that you can use to adjust the width of the legend pane by dragging it wider or narrower.

Use the following procedure to hide or display the visual title. The visual title displays by default.

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 choose Display legend or Hide legend.
3. Choose Format visual to see formatting options.
4. On the Format Visual pane, expand the Legend section.
5. Enable or disable Show legend and Show legend title.
6. To customize the title of the legend, enter a new title for Legend. To revert to the default name, delete your entry.
7. For POSITION, choose Right, Bottom, or Top to determine where on the visual the legend displays.
8. Close the **Format Visual** pane by choosing the X icon in the upper-right corner of the pane.

## 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 label**. This option takes its name from the name of the axis, for example **Show X-Axis label**.

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, line, and scatter charts, you can label:
    - All
    - By group or color
  - For lines, the following additional label options are available:
    - Line ends
    - Minimum or maximum value only
    - Minimum and maximum values
- 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.
Use the following procedure to display or hide totals and subtotals for a visual.

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. If you are using a table, show totals by enabling Show totals. By default, totals are displayed at the bottom of the table. To display totals at the top, choose Top.
4. If you are using a pivot table, choose one or more of the following:
   - 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.
   - 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.

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:
- 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, you can format the primary value based on conditions that are applied to any dimension in the dataset.

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 Size

You can choose from several options for styling, including fitting the table to your current view, hiding column field names, and choosing 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.

Use the following procedure to customize the styling for a visual.

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. 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 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.

7. Choose you preferred font size for each of the following chart types:

- For KPIs, select the font sizes for the primary and secondary values.
- For pivot tables and tables, select the font sizes for table headers, cells, totals, and subtotals.
- For other visuals, you can select font sizes depending on which chart type you are using.

### Changing the Visual Scale with the Axis Range

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 axis 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 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 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 range to have the range start and end at values that you specify.
     If you choose Custom range, 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. To customize the number of values to show on the axis, enter in an integer between 1 and 50.
7. For combo charts, choose Single Y Axis to synchronize the Y-axes for both bars and lines into a single axis.
8. Close the Format Visual pane by choosing the X icon in the upper-right corner of the pane.

Formatting Options Available for Visual Types

Use the following list to see which visuals support what type of formatting.

- 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 the “other” category
- 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 the “other” category
• 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 the Group/Color field
  • Show or hide the “other” category

• 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

• Geospatial charts (maps) support the following formatting:
  • Customize, display, or hide title and legend

• Heat maps support the following formatting:
  • Customize, display, or hide title, legend, and labels
  • Choose how many rows and columns to display
  • Show or hide the “other” category

• 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

• 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 the “other” category, except when the x-axis is a date

• 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
  • Choose how many slices to display from the Group/Color field
  • Show or hide the “other” category

• 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
  • Choose additional styling options: fit table to view, hide column field names, hide duplicate label when using single metric
  • Conditional formatting

• Scatter plots support the following formatting:
  • Customize, display, or hide title, legend, field labels, and data labels
  • Specify axis range (on x-axis and y-axis)

• Tables support the following formatting:
Changing the Fields Used by a Visual

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. 347) 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. 200).

Use the following topics to learn more about adding, removing, and modifying fields on a visual.

Topics
- Using Visual Field Controls (p. 288)
- Adding or Removing a Field (p. 293)
- Changing the Field Associated with a Visual Element (p. 295)
- Changing Field Aggregation (p. 298)
- Changing Date Field Granularity (p. 301)

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 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.
When you drag a dimension to the X axis or color drop target on a new line chart, you see a label color-coded blue. That blue color coding indicates that the drop target expects a dimension. The drag label indicates that the target is available to add a field.

You can also drag a measure or dimension to a drop target on a line chart where the element is already associated with a field. In this case, the drag label indicates that you are replacing the field currently associated with the drop target.
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.
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. Expand the Field wells pane by choosing the expand icon.

2. Drag the field that you want to add from the Fields list pane to the appropriate field well.
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.

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. Expand the Field wells pane by choosing the expand icon.

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 nth 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. Expand the Field wells pane by choosing the expand icon.

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

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. Expand the Field wells pane by choosing the expand icon.

2. Choose the field well containing the date field, and then choose Aggregate. Choose the date granularity that you want to use.
Changing Visual Colors in Amazon QuickSight

You can change the color of one, some, or all elements on visuals that use a scatter plot, pie chart, donut chart, or gauge chart. You can also change the color of any of the bar chart or line chart visual types. 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 color for the SMB bar to blue.
Then you change the chart color to green. The SMB bar remains blue.
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 a color hex code.

   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 a color hex code.
Repeat this step until you have set the color on all elements that you want to modify.

**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. To change the chart color back to the default color for that visual type, choose any element on the visual, choose **Chart Color**, and then choose **Reset to Default**. 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.

### Sorting Visual Data in Amazon QuickSight

Most visual types offer the ability to change data sort order. Whether sorting is supported and what visual element you can sort by depends on the visual type.

For SPICE data sets, the following limitations apply to sorting text (strings). When you exceed the limits, the visual displays a notification at the upper right.

- Up to two million (2,000,000) unique values
- Up to 16 columns

Use the following table to identify the field wells or on-visual editors that support sorting 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 Value</td>
</tr>
<tr>
<td>Bar charts (all Vertical)</td>
<td>X axis and Value</td>
</tr>
<tr>
<td>Combo charts (all)</td>
<td>X axis, Bars, and Lines</td>
</tr>
<tr>
<td>Geospatial charts</td>
<td>Sorting not supported</td>
</tr>
<tr>
<td>Heat map</td>
<td>Columns and Values</td>
</tr>
<tr>
<td>KPIs</td>
<td>Sorting not supported</td>
</tr>
<tr>
<td>Line charts (all)</td>
<td>X axis and Value for numeric measures only</td>
</tr>
<tr>
<td>Pie chart</td>
<td>Value and Group/Color</td>
</tr>
</tbody>
</table>
Sorting a Visual

For most visual types, you can use either a field well or an on-visual editor to choose the sort order. Pivot tables behave differently; you specify the sort order by using the column sort icon on the visual. For more information about sorting pivot tables, see Sorting Pivot Tables (p. 379).

Use the procedures below to sort any non-pivot table visual type by using either a field well or an on-visual editor.

**Quick Sorting on a Visual Axis**

To quickly sort dimensions and measures on bar, stacked, combo charts, choose the sort icon that appears near the field name on either axis. This shortcut to sorting is available for any data type in direct queries. In SPICE, it is available only for datetime, numeric, and decimal data types.
Or, 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 each axis is set to display labels. Or, you might need to make the visual large enough to display labels.

Sorting by Using an On-Visual Editor

1. On the visual, choose an on-visual editor that supports sorting.
2. On the on-visual editor menu, choose Sort, and then choose the ascending or descending sort order icon.
### Sorting by Using a Field Well

1. Expand the **Field wells** by choosing the field well bar above the visual.

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 Visual Data in Amazon QuickSight

You can use filters to refine the data displayed in a visual. Filters are applied to the data before any aggregate functions that you specify.

A filter is associated with a single data set in an analysis. It can be scoped to one, several, or all visuals in the analysis that use that data set. By default, a filter applies only to the visual that was selected when the filter was created. You can change the scope of a filter after you create it.

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, suppose that there is one filter of `state = WA` and another filter of `sales >= 500`. In this case, the data set 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.

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. 277)**. For more information about excluding a visual element, see **Excluding Visual Elements (p. 278)**.

**Topics**

- Viewing Filters (p. 311)
- Adding a Filter (p. 313)
- Editing a Filter (p. 333)
Viewing Filters

To see the filters for a visual, choose Filter on the tool bar. 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.

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.
These scope icons match those displayed 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.

![Applied filters view](image)

You can close the **Edit filter** view by choosing the selector on the right. Doing this resets the **Filter** view.

![Edit filter view](image)

**Adding a Filter**

You can create a filter on any field from the data set associated with the currently selected visual. If you want to create a filter for a different data set, choose a visual that uses that data set. When you create
a filter, it applies by default to just the currently selected visual. You can apply the filter to additional visual that use that data set after you create it.

After you apply a filter to a visual, a filter icon appears on the top right of the visual, next to the \( \nabla \) shaped on-visual menu. 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. 314)
- Adding a Numeric Filter (p. 324)
- Adding a Date Filter (p. 328)
- Adding a Compound Filter with And/Or Operators (p. 332)

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 10,000 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 10,000 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 Parameterize a Filter (p. 336).

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 5 sales people based on revenue. You can use an integer parameter as the n value to dynamically control the number of results to show.

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. 316)
- Using a Custom Filter List to Specify Multiple Values with Additional Options (p. 317)
- Using a Custom Filter to Specify a Single Value or Parameter (p. 320)
- Using a Top and Bottom Text Filter (p. 323)
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. 317) and Using a Custom Filter to Specify a Single Value or Parameter (p. 320).

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 the field values that you want to filter on.

To narrow the values displayed, 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 10,000 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 10,000 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. Choose whether to include or exclude records that contain the field values you selected.
8. Choose how to handle null values in the filtered field. You can choose to include or exclude the values you listed. Alternatively, you can choose to show nulls only.
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. Alternatively, 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:

9. Choose Apply.
Adding a Filter

- **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. Alternatively, 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. 242). The values display alphabetically in the control, unless there are more than 10,000 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 10,000 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. 314).

For data sets 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. 242). The values display alphabetically in the control, unless there are more than 10,000 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 10,000 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 data set.
• **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** 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.
Adding a Filter

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. 242).

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. Alternatively, 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 trashcan icon near the field name.

6. When you are finished, choose **Apply**.

### 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 data set.
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.

**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 data set 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 selector to the right of the filter name.
3. On the filter menu, choose All visuals, Some visuals or Only this visual.

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 **Delete filter**.
   - To delete all filters from a filter group, choose **Delete all**.
   - To delete one filter from a filter group, scroll to the filter that you want to delete. Then choose the delete icon near the appropriate field name. Doing this removes a single filter condition.

**Parameterize a Filter**

To use an existing parameter in a filter on your analysis, you select **Use parameters**, and choose the parameter or parameters that you want to use. If you are filtering a text field (string), you need to choose a filter for **Custom filter**.

Before you can add a parameter to a filter, the parameter must exist already. If you want to filter on date parameters, create one each for start and end dates. If you want to filter on relative dates, create an integer parameter first. If you need to create a parameter, use the **Parameters** pane at left. For more information, see **Parameters in Amazon QuickSight** (p. 242).

Use the following procedure to use a parameter with a new or existing filter.

1. Choose the visual that you want to work with, and then choose the **Filter** pane on the left side of the screen.
2. Choose the filter that you want work with, so that you see the options that belong to that filter.
3. Choose one of the following:

- For a text field (string), choose **Custom filter**. The **Use parameters** option appears after you choose **Custom filter**.

- For a time range, choose **Time range** and **Use parameters**. If you want to filter for data between two dates, use the lists to choose your start and end date parameters. Alternatively, you can choose to filter for a date that is before, after, or equal to a single date parameter.

- For relative dates, choose **Relative dates** and **Use parameters**. Then use the list to choose your integer parameter.
4. Choose **Apply** to save your changes.
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 data set.

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. Expand the **Field wells** pane.
3. If your data set 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.

![Diagram of hierarchy]

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.
Custom Actions in Amazon QuickSight

In Amazon QuickSight, you can add to the basic functionality for visuals by creating your own custom actions. The fields used in the custom action must be in the visual for the action to work.

Currently, you can create the following custom actions:

- **Filter actions** – Add the ability to filter one or more visuals when you choose a data point or a menu item. For example, you might choose a country in one visual, and that action filters data according to its settings. Then you can view that country's top customers, revenue, or other key metrics in the filtered visuals. Filter actions work across multiple data sets by using automatically generated field mappings. You can use the "quick create" option to make a preconfigured filter that works for all visuals on the same sheet.

- **URL actions** – You can use URL schemes to perform an action, based on a URL, from within your dashboard. In some cases, you might want to create a link to another URL from your visual, or you
might want to create an email directly from a visual. Users viewing the dashboard can use a URL action to send data points to other URLs (dashboards, analyses, and websites) by selecting a data point (left-click), or selecting the action from the data point context (right-click) menu.

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.

Custom actions have the following attributes and options:

- **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.

  You can also parameterize the action name to include dynamic values. To select a field or a parameter from the current visual, choose the + near the URL text box to display a list of available variables. Parameter names are enclosed in angle brackets << >> and prefixed with a $ and , for example << $parameterName>>. Field names are enclosed in angle brackets, but not prefixed with a $.

- **Activation** – Available options are Select or Menu option. To use an action, you can either select the data point (left-click) or navigate to the menu option in the context menu (right-click). You can find URL actions listed in the middle of the context menu, just above Color options.

- **Action type** – The type of action that you want. To create an action that filters data, choose Filter action. To create an action that uses a URL, choose URL action. This attribute changes the options that display:
  - For filter actions:
    - **Filter scope** – Choose to filter on all fields or to filter only on the selected fields. To filter on all fields, choose All fields. To select the fields you want to filter on, choose Selected fields.
    - **Target visuals** – Choose to target all visuals or to target only the selected visuals. To apply the filter to all visuals, choose All visuals. To select the visuals you want to apply the filter to, choose Select visuals.
  - For URL actions:
    - **URL** – The URL you want to open when the custom action is activated. URL actions can be deep links into another application, but only if each can be accessed by a valid URL in the URL scheme https, http, or mailto.

      You can also parameterize the URL to include dynamic values. The parameters on both the sending and the receiving end must match in name and data type. To select a field or a parameter from the current visual, choose the + near the URL text box to display a list of available variables. Parameter names are enclosed in angle brackets << >> and prefixed with a $ and , for example << $parameterName>>. Field names are enclosed in angle brackets, but not prefixed with a $.

      If you later remove a parameterized field or any other targeted field from the source visual, the action that uses it breaks.

    - **Open in** – Where to open the URL. You can choose New browser tab, Same browser tab, or New browser window.

  - **View field mapping** – Use this option to view the automatically generated field mapping. Using this opens a screen that shows the mapping between the initial data set and all the other data sets in the visual. You can choose which mappings to view by selecting the target data set from the list. If you are not using multiple data sets, or if no fields can be automatically mapped, a message displays.

**Topics**
- One-Click Filtering for Visuals in Amazon QuickSight (p. 346)
- Creating, Viewing, and Editing Custom Actions in Amazon QuickSight (p. 346)
- Understanding Field Mapping for Custom Actions in Amazon QuickSight (p. 346)
One-Click Filtering for Visuals in Amazon QuickSight

Use the following procedure to create a one-click filter in an analysis.

1. In your analysis, choose Actions at left.
2. Under Quick create, choose Filter same-sheet visuals. This immediately adds one-click filtering. When you click a data point (for example, a bar in a bar chart), you instantly filter using all mapped fields on all the other visuals on that sheet. If you have multiple data sets, 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.
3. (Optional) To interact with the filter, choose the down icon (v) and choose one of the following from the list:
   - Edit – Opens the action so you can edit the settings. Use this to edit the Action name or other settings.
   - Delete – Delete the action.
   - View field mapping – See how the fields are joined between data sets. Use this to verify that all target fields are mapped, so that filtering works automatically.

Creating, Viewing, and Editing Custom Actions in Amazon QuickSight

Use the following procedure to create, view, or edit a custom action in an analysis.

1. In your analysis, choose Actions at left.
2. Choose one of the following:
   - To create a new action:
     Either choose the plus (+) icon near the Actions heading, or choose Define a custom action. This begins a dialog where you create a custom action with the settings you want. If you are creating a new custom action, give it a descriptive name. For a definition of each attribute and option, see the beginning of this section.
   - To view or edit an action:
     To view existing custom actions inside an analysis, choose the Actions icon at left. Actions are sorted by how they are activated. If there is an action that works by selecting a data point, it is listed under On select. Other options, which are activated from the context menu, are listed under Menu option.
3. After you are finished with the action, choose one of the following:
   - Save – Save your selections, and create the custom action.
   - Close – Close this dialog and discard your changes.
   - Delete – Delete this action. If you delete a pre-existing action, you can undo it if needed.

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 data sets. 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 data set 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 data set.

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 resave your custom action.
- Edit the data set 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 data sets, they aren't automatically mapped or remapped. This causes the filtering to work incorrectly. For example, suppose that you add a new data set, 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 data set for automated field mapping, see Mapping Fields (p. 151).

**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. 348)
- Display Limits in Visuals (p. 348)
- Using AutoGraph (p. 351)
- Using Bar Charts (p. 351)
- Using Combo Charts (p. 356)
- Using Donut Charts (p. 359)
- Using Gauge Charts (p. 362)
- Using Geospatial Charts (Maps) (p. 364)
- Using Heat Maps (p. 365)
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. 268).

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 data set 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 Visual Data in Amazon QuickSight (p. 310).

Amazon QuickSight supports up to 20 data sets in a single analysis, and up to 20 visuals in a single analysis.

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.
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 – Number of data points displayed</td>
</tr>
<tr>
<td>Bar chart, vertical</td>
<td>X-axis – Number of data points displayed</td>
</tr>
<tr>
<td>Combo chart</td>
<td>X-axis – Number of data points displayed</td>
</tr>
<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

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 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 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.

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. 348).

The icons for bar charts are as follows:

**Other Bar Charts**

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.

The icon for stacked bar charts are as follows:

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 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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td></td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</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. 277) Excluding Visual Elements (p. 278)</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. 307)</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. 298)</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. 339)</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.
To create a multi-measure bar chart, use two or more measures in the Value field well. Leave the Group/Color field well empty.

To create a clustered bar chart, choose another dimension for the Group/Color field well.

5. (Optional) Add drill-down layers by dragging one or more additional fields to the X or Y axis or Group/Color field wells. For more information about adding drill-downs, see Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 339).

Using Combo Charts

Amazon QuickSight supports the following types of combo charts:

- Clustered bar combo chart
- Stacked bar combo chart

These are also known as line and column charts.

Use the combo chart visual types to create a single visualization that shows two different types of data. These two types are individually best suited to a line chart and a bar chart. The difference between these two types can work well for comparing two sets of data, for example trends and categorical data.

On the clustered bar combo chart, bars display for each child dimension, grouped by the parent dimension. On the stacked bar combo chart, one bar displays per parent dimension. Inside each bar, colors show the relative values of each item in the child dimension. 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.

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. 348).

A clustered bar chart shows values for a dimension grouped by a parent dimension. A stacked bar combo chart shows values for a dimension stacked by parent dimension. Combo charts use a scale based on the maximum value for the selected measure.

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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td>You can set the range for the axis.</td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</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. 277)</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.
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.

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. 339).
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. 348).

The icon for a donut chart is as follows.

**Donut Chart Features**

To understand the features supported by donut charts, use the following 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. 339).

**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 data set, 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>You can customize the value displayed, the comparison method, the axis style, the arc style, and the thickness of the gauge.</td>
<td>Customizing the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Formatting gauge</td>
<td>Yes</td>
<td>The foreground color the filled area; it represents the Value. The background color the unfilled area; it represents the Target value if one is selected.</td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</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></td>
<td></td>
</tr>
<tr>
<td>Focusing on or excluding</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</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 data set 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. 175).

**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. 180).
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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</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 Visual Colors in Amazon QuickSight (p. 303)</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. 339)</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. 348).

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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</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. 339).

### Using KPIs

Use a 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></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Removing the title</td>
<td>Yes</td>
<td>You can choose not to display a title.</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</td>
<td>Yes</td>
<td>You can choose comparison (default) or actual.</td>
<td></td>
</tr>
<tr>
<td>displayed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Creating a KPI

Use the following procedure to create a KPI.

1. Create a new analysis for your data set.
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.

For example, discount amount by year by region looks like the following in a line chart.

![Line Chart Example](image)

It looks like the following in an area line chart.
Each line on the chart represents a measure value across a period of time. When you have a chart with multiple lines, hover over any line to see a pop-up legend that shows the values for each line for that point in time.

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.

Line charts show up to 2500 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 how data that falls outside the display limit for this visual type, see Display Limits in Visuals (p. 348).

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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</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 the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>You can focus on or exclude any line on the chart, except in the following cases:</td>
<td>Focusing on Visual Elements (p. 277)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• You create a multi-dimension line chart and use a date field as the dimension for the line color.</td>
<td>Excluding Visual Elements (p. 278)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• You create a measure or multi-measure line chart and use a date field as the dimension for the X axis. In these cases, you can only focus on a line, not exclude it.</td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes, with exceptions</td>
<td>You can sort data for numeric measures in the X axis and Value field wells. Other data is automatically sorted in ascending order.</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 307)</td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>You must apply aggregation to the field that you choose for the value, and can't apply aggregation to the fields you choose for the X axis and color.</td>
<td>Changing Field Aggregation (p. 298)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>Yes</td>
<td>You can add drill-down levels to the X axis and Color field wells.</td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 339)</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. 339).

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. 348).

The icon for a pie chart is as follows.

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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</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. 339).

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.

---

### 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
- Change row sort order
- 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. 288).

For information on formatting pivot tables, see Formatting a Visual in Amazon QuickSight (p. 279).

The icon for a pivot table is as follows.

![Pivot Table Icon]

**Topics**

- Pivot Table Features (p. 374)
- Creating a Pivot Table (p. 376)
- Orienting Pivot Table Values (p. 376)
- Expanding and Collapsing Pivot Table Clusters (p. 378)
- Sorting Pivot Tables (p. 379)
- Using Table Calculations in Pivot Tables (p. 380)
- Pivot Table Limitations (p. 400)
- Pivot Table Best Practices (p. 400)

**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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</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. 277) Excluding Visual Elements (p. 278)</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td>You can sort by the field that you choose for the columns.</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 307)         Sorting Pivot Tables (p. 379)</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. If you choose to create a multi-measure pivot table, you can apply different types of aggregation to the different measures. For example, you can show the sum of the sales amount and the maximum discount amount.</td>
<td>Changing Field Aggregation (p. 298)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td></td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 339)</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>
</tbody>
</table>
Using Pivot Tables

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported?</th>
<th>Comments</th>
<th>For More Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exporting or copying data</td>
<td>Yes</td>
<td>You can export all of the data to a CSV file.</td>
<td>Exporting Data from an Amazon QuickSight Visual to a CSV File (p. 271)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>You can select and copy the content of the cells.</td>
<td></td>
</tr>
<tr>
<td>Conditional formatting</td>
<td>Yes</td>
<td>You can add conditional formatting for values, subtotals and totals.</td>
<td>Adding Conditional Formatting to Visuals (p. 283)</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.
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 a pivot table, you can change the sort order on any column to sort all rows in the table according to the values in that column. You can only sort by one column at a time. Sorting on a metric based on a table calculation is supported only if the table calculation used is one of the following:

- Percent of Total (p. 386)
- Percentile (p. 388)
- Rank (p. 387)

On the visual, or in the field wells, choose the name of the column that you want to sort by. From the context menu, choose AZ for ascending or ZA for descending sort order.

The context menu in the screenshot also offers options to collapse all or expand all for this field, to remove it, or to replace it with another field.
You can sort by a value by choosing the value to get the context menu, which offers sort ascending and descending options. Doing this also works on subtotals.

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 Removing Pivot Table Calculations (p. 381)
- Functions for Pivot Table Calculations (p. 383)
- Ways to Apply Pivot Table Calculations (p. 389)

**Adding and Removing 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. 381)
- Changing How a Calculation Is Applied (p. 381)
- Removing a Calculation (p. 382)

**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.

**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**.

---

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Functions for Pivot Table Calculations

You can use the following functions in pivot table calculations.

Topics
- Running Total (p. 383)
- Difference (p. 384)
- Percentage Difference (p. 385)
- Percent of Total (p. 386)
- Rank (p. 387)
- Percentile (p. 388)

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 $Cell_{1} = (Cell_{1} - null) / null$, $Cell_{2} = (Cell_{2} - Cell_{1}) / Cell_{1}$, $Cell_{3} = (Cell_{3} / Cell_{2}) / Cell_{2}$, and so on. Because $(Cell_{1} - null) / null = null$, the $Cell_{1}$ 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 $Cell1=Cell1/(\text{sum of all cells})$, $Cell2=Cell2/(\text{sum of all cells})$, 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.

```
percentile rank(x) = 100 * 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. 390)
- Table Down (p. 390)
- Table Across Down (p. 391)
- Table Down Across (p. 393)
- Group Across (p. 394)
- Group Down (p. 396)
- Group Across Down (p. 397)
- Group Down Across (p. 398)
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.

![Pivot Table Example](image)

Applying the **Running total** function using **Table across** gives you the following results, with row totals in the last column.

![Pivot Table Example](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 Across Down

Using **Table across down** applies the calculation across the rows of the pivot table, and then takes the results and reapply 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 re-applies 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.

![Pivot Table Example](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.

![Updated Pivot Table Example](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).

![Sum of Billed Amount by Customer Region, Date, and Consumption Channel](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).
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 reapplies the calculation across the rows of the pivot table. Again, it reapplies 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.

### 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 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. 348).

The icon for a scatter plot is as follows.

#### Scatter Plot Features

To understand the features supported by scatter plots, 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>Scatter plots display a legend if you have the Group/Color field well populated.</td>
<td>Customizing the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Yes</td>
<td>You can set the range for both the X and Y axes.</td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>Yes</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes, with exceptions</td>
<td>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.</td>
<td>Focusing on Visual Elements (p. 277) Excluding Visual Elements (p. 278)</td>
</tr>
<tr>
<td>Sorting</td>
<td>No</td>
<td></td>
<td>Sorting Visual Data in Amazon QuickSight (p. 307)</td>
</tr>
<tr>
<td>Performing field aggregation</td>
<td>Yes</td>
<td>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</td>
<td>Changing Field Aggregation (p. 298)</td>
</tr>
</tbody>
</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.
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. 339).

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. Plus, you can add calculated columns.

The icon for a table is as follows.

Table Features

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.

To understand the features supported by tables, 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>Customizing the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Feature</td>
<td>Supported?</td>
<td>For More Information</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td>Sorting Visual Data in Amazon QuickSight (p. 307)</td>
</tr>
<tr>
<td>Calculated fields and aggregations</td>
<td>Yes</td>
<td>Changing Field Aggregation (p. 298)</td>
</tr>
<tr>
<td>Adding drill-downs</td>
<td>No</td>
<td>Adding Drill-Downs to Visual Data in Amazon QuickSight (p. 339)</td>
</tr>
<tr>
<td>Showing or hiding totals</td>
<td>Yes</td>
<td>Using Totals on a Table (p. 403)</td>
</tr>
<tr>
<td>Showing or hiding columns</td>
<td>Yes</td>
<td>Showing or Hiding Columns on a Table (p. 403)</td>
</tr>
<tr>
<td>Conditional formatting</td>
<td>Yes</td>
<td>Adding Conditional Formatting to Visuals (p. 283)</td>
</tr>
</tbody>
</table>

**Showing or Hiding Columns on a Table**

You can show or hide columns on a table. To hide a column, choose the field you want to hide, then choose **Hide column**. To display any hidden column, choose any column, then choose **Show all hidden columns**.

Tabular reports can display up to 200 columns.

**Transpose Columns to Rows**

You can transpose columns to rows and you can transpose rows to columns. To transpose columns and rows, choose the transpose icon near the top right of the visual. It has two arrows at a 90 degree angle:

Tabular reports can display up to 200 columns.

**Using Totals on a Table**

You can show or hide totals on a table. To access the option to **Show Totals** or **Hide Totals**, use the on-visual menu at the top right of the visual.
You can show totals at the top or the bottom of the visual. Use the on-visual menu to access the option for **Format visual**. If you enable **Show Totals**, you will see the options for **Top** and **Bottom** locations.
Creating a Table Visual

Use the following procedure to create a table visual.

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 table icon.
4. From the Fields list pane, choose the fields that you want to use. If you want to add a calculated field, choose Add on the application bar, and then choose Add calculated field.

   To create a non-aggregated view of the data, add fields only to the Value field well. 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.

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. 348).

The icon for a tree map is as follows.

### Tree Map Features

To understand the features supported by tree 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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</td>
</tr>
<tr>
<td>Changing the visual colors</td>
<td>No</td>
<td></td>
<td>Changing Visual Colors in Amazon QuickSight (p. 303)</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. 277) Excluding Visual Elements (p. 278)</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. 307)</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. 298)</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. 339)</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. 339).

Using Word Clouds

As an engaging way to display how often a word is used in relation to other words in a data set, 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 data set 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. 348).

The icon for a word cloud is as follows.

![Word Cloud Icon](https://example.com/word-cloud-icon.png)

**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 the Visual Legend (p. 280)</td>
</tr>
<tr>
<td>Changing the title display</td>
<td>Yes</td>
<td></td>
<td>Customizing a Visual Title (p. 279)</td>
</tr>
<tr>
<td>Changing the axis range</td>
<td>Not applicable</td>
<td></td>
<td>Changing the Visual Scale with the Axis Range (p. 285)</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 Visual Colors in Amazon QuickSight (p. 303)</td>
</tr>
<tr>
<td>Focusing on or excluding elements</td>
<td>Yes</td>
<td></td>
<td>Focusing on Visual Elements (p. 277)</td>
</tr>
<tr>
<td>Sorting</td>
<td>Yes</td>
<td></td>
<td>Sorting Visual Data in Amazon QuickSight (p. 307)</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. 298)</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. 339)</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 lowercase, and set the amount</td>
<td>Formatting a Visual in Amazon QuickSight (p. 279)</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. 339).
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 insights, Amazon QuickSight introduces 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. You can identify the top contributors 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.

**Topics**
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.
- Data point – a discrete unit—or simply put, a row—in a data set. 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.

Topics

- What's the Difference Between Anomaly Detection and Forecasting? (p. 411)
- What RCF Is and What It Does (p. 412)
- How RCF Is Applied to Detect Anomalies (p. 412)
- How RCF Is Applied to Generate Forecasts (p. 413)
- References for Machine Learning and RCF (p. 413)

What's the Difference Between Anomaly Detection and Forecasting?

Anomaly detection answers questions like "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. 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 whitepaper 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 (RRCF): A No Math Explanation provides a lucid explanation without the mathematical equations.
- Random Cut Forest Based Anomaly Detection On Streams, a scholarly whitepaper 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).

Data Set 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 data set 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 data set 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 data set to get started, you can download this sample data set: ML Insights Sample Dataset VI. After you have a data set ready, create a new analysis from the data set.

**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. 415)
- Adding Custom Insights to Your Analysis (p. 418)
Adding Suggested Insights

Use the following procedure to add suggested insights to your analysis.

Before you begin, make sure that your data set meets the criteria outlined in Data Set Requirements for Using ML Insights with Amazon QuickSight (p. 413).

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. 418).

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** – to browse anomalies in this time frame.
- **Edit forecast** – to choose forecast length, prediction interval, and seasonality.
- **Focus on** or **Exclude** – to zoom in or zoom out on your dimensional data.
- **Show details** – to view more information about a recent anomaly.
- 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. 419).

If your insight is for anomalies, you can also change the settings for the anomaly detection. To do this, choose **Configure anomaly**. For more information, see *Using ML-Powered Anomaly Detection* (p. 440).

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**.

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### 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. 419).

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 computations to them.

**Topics**

- Autonarratives That You Can Add as Insights (p. 420)
- Using Autonarratives (p. 421)
- Autonarrative Computations (p. 423)

## Autonarratives That You Can Add as Insights

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 [Autonarrative Computations](#) (p. 423)

- **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, the top three anomalies 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.

## Using Autonarratives

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 **Autonarratives That You Can Add as Insights** (p. 420).

   Choose one, and then 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 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 v-shaped on-visual menu, then choosing **Customize narrative**. The following screen appears.

   ![Configure narrative](image)

   Standard text formatting tools are located at the top of the screen. You can insert expressions and conditional statements like **IF** and **FOR** statements. You can add text and computations in the work area on the right.

   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 left to add a new computation, and then choose one from the list. For the purposes of 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 4, 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, so long as 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 left. 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**

7. Add the computation. Leave your cursor after the word **last**. On the left, 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** and add the expression **GrowthRate.compoundedGrowthRate.formattedValue**. Choose the expression from the list, rather than typing it in. However, you can edit the contents of the expression after you add it.
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. On the top, 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 on the left. 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 Apply. 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.

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 (p. 424)
- Bottom Movers Computation (p. 425)
- Bottom Ranked Computation (p. 427)
- ML-Powered Forecasting (p. 428)
- Growth Rate Computation (p. 429)
- Maximum Computation (p. 430)
- Metric Comparison Computation (p. 431)
- Minimum Computation (p. 432)
- Period over Period Computation (p. 433)
- Period to Date Computation (p. 434)
- Top Movers Computation (p. 436)
- Top Ranked Computation (p. 437)
- Total Aggregation Computation (p. 438)
- Unique Values Computation (p. 439)

### ML-Powered Anomaly Detection

The ML-powered anomaly detection computation searches your data for anomalies. For example, you can detect the top three anomalies for total sales on January 3, 2019.

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.

For more information about configuring anomaly detection, see Detecting Anomalies with Amazon QuickSight (p. 440).

**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 left, 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).
- **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.
  • `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 of the anomaly: `HIGH` or `LOW`. `HIGH` means "higher than expected", and `LOW` means "lower than expected."
• `actualValue` – The metric's actual value at the point of the anomaly.
  • `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.
  • `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 data set. 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 left, 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 data set. 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 left, 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.

![Default Configuration for 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. 444).

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 left, 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 left, 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.
• **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 left, 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 left, 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 left, 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 left, 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.
- **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.
- **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.
- **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 left, 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.
- 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.
- 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.
- 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 data set. 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 left, 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 left, 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 left, 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 left, 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.
Detecting Anomalies with Amazon QuickSight

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, there's no need for manual analysis, custom development, or ML domain expertise.

**Important**
Anomaly detection is a compute-intense task. Before you start using it, you can get an idea of costs by analyzing the amount of data 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**
- Using ML-Powered Anomaly Detection (p. 440)
- Exploring Anomalies (p. 442)
- Viewing Top Contributors (p. 443)

Using ML-Powered Anomaly Detection

Use the following procedure to start detecting anomalies in your analysis.

If you already have anomaly detection in your analysis, skip ahead to the following section to learn how to explore the anomalies detected by Amazon QuickSight.

1. Begin with an existing analysis. Choose one of the following:
   - On the left, choose **Insights**. Then choose **Add anomaly to sheet**.
     This creates a widget entitled **Anomaly detection**. Follow the screen prompts to add fields.
   - On the top menu, choose **Add**, then **Add insight**. From the list, choose **Anomaly detection** and Select.
     This creates a widget entitled **Insight**. Follow the screen prompts to add fields.

   **Note**
   In the field wells, **Categories** represent the dimensional values that Amazon QuickSight splits the metric by. For example, let's say you are analyzing anomalies on 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 for the split metric. You can add up to five category fields to an anomaly detection job. Table calculations don't work with anomaly detection.

2. Choose the widget that you added to your analysis. Then choose the **Get started** button on the widget.
   A scrollable screen appears with configuration settings for anomaly detection.

3. On the scrollable screen, configure one or more of the following:
   - **Name** – provide a descriptive name for your anomaly detection.
• **Fields for analysis** – view the contents of the field wells. To edit these, choose **Cancel** to exit this screen, and then add your new fields.

• **Analyze all combinations of these categories** – by default, if you have selected three categories, Amazon QuickSight runs anomaly detection on the following combinations hierarchically: A, AB, ABC. If you choose this option, Amazon QuickSight analyzes all combinations: A, AB, ABC, BC, AC. If your data isn't hierarchical, make sure to enable this option.

• **Number of anomalies to show** – set how many anomalies you want to display on the narrative widget. You can still explore all the anomalies, no matter how few you choose to show in the analysis.

• **Sorting method** – choose the method you want to apply to sorting anomalies. 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 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.

Schedule – set the time interval at which anomaly detection recalculates. The schedule runs only for published dashboards. In the analysis, you can run it manually in the analysis as needed.

• **Occurrence** – set how often you want the recalculation to run: every hour, every day, every week, or every month.

• **Start schedule on** – set the date and time to start running this schedule.

• **Timezone** – set the time zone that the schedule runs in.

• **Contribution analysis** – (optional) analyze the top contributors when an anomaly is detected. For example, Amazon QuickSight can show you the top customers that contributed to a spike in sales in the USA for home improvement products. If you have additional dimensions in your data—dimensions you aren't already using in the anomaly detection—you can add them here for contribution analysis.

• **Dimensions** – view a list of dimensions to choose contributors from. You can choose up to four dimensions.

4. Choose **OK** to confirm your choices. Choose **Cancel** to exit without saving. Choose **Delete computation** to remove it.

To reopen the configuration screen, choose the v-shaped on-visual menu, then choose **Configure anomaly**.

5. Run the anomaly and see your anomaly narrative by choosing **Run now**.

The amount of time it takes to complete anomaly detection 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. However, you shouldn't change the anomaly detection configuration or narrative, or explore the anomalies during run time.

6. (Optional) Remove the anomaly detection by choosing the v-shaped on-visual menu, then choosing **Configure anomaly**. Then choose **Delete computation** at the bottom of the screen. To confirm deletion, choose **Delete**. Otherwise, choose **Cancel**.
Exploring Anomalies

After your anomaly detection is finished running, you can interactively explore the anomalies in your analysis.

Before you begin, look at your anomaly widget. It displays one of the following:

- A completed run displays the narrative in the widget, with only the v-shaped on-visual menu icon at top right.
- An alert icon with an exclamation point ( ! ) displays next to the on-visual menu icon. Refresh the page to clear this. Alternatively, you can choose the icon and then choose Update to dismiss it.
- The Run now button displays. Refresh the page to clear this.

**Important**

You can't explore the anomalies while anomaly detection is running. However, you can do other work in your analysis, or even close the analysis, while it runs.

When you are ready to begin, open the anomaly exploration screen, choose the v-shaped on-visual menu, then choose Explore anomalies. Amazon QuickSight displays anomalies that were detected during the most recent run of anomaly detection.

The main section of the screen is composed of 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). The alerts can be setup for the level of severity (medium, high, and so on). You can get the top 5 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.
- **Status** – under the Anomalies heading, the status section displays information on the last run. It 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.
- **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 displays to show you 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.
- **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 anomaly exploration:
  - **Anomaly threshold** – sets how sensitive your detector is to detected anomalies. You should expect to see more anomalies with the setting set to Low, and fewer anomalies when the setting is set to High. This sensitivity is determined based on standard deviations of the anomaly score generated by the RCF algorithm.
  - **Anomaly direction** – sets display to show anomalies that are either higher or lower than expected.
  - **Sorting method** – choose the method you want to apply to sorting anomalies. These are listed in preferred order on the screen. Here 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 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 category settings appear at right, based on the fields in the category field well. Using these settings, you can limit the data that displays in the screen.

The left side of the screen displays contributors. It has 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.

The following screenshot shows the anomaly exploration screen with all sections expanded.

![Anomaly Exploration Screen](image)

**Tip**
If the left side of the screen doesn't display the **Contributors** section, go back to the analysis and choose **Explore anomalies** again.

**Viewing Top Contributors**

Contribution analysis locates the contributing factors to an anomaly. The report displays only the significant contributors—not all of them. For example, Amazon QuickSight can show you the top customers that contributed to a spike in sale in the USA for health products. If you have dimensions in your data that you aren't using in the anomaly detection, you can add up to four of them for contribution analysis.
Use the following procedure to add contribution analysis for up to four category dimensions.

Before you begin, you need to open an analysis that has an existing anomaly detection. If your analysis isn’t using anomaly detection, see the previous section, Detecting Anomalies with Amazon QuickSight (p. 440).

1. Open the anomaly configuration screen by choosing the v-shaped on-visual menu, then choosing Configure anomaly.
2. Scroll to the bottom of the screen. Under Contribution analysis, choose up to four dimensions to run an analysis on.
3. To confirm your choices, choose OK. Otherwise, choose Cancel.

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.
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 a few 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.
- To export the forecasting data to a CSV file, choose the v-shaped on-visual menu, then choose **Export to CSV**.

**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 Embedding Amazon QuickSight Dashboards (p. 547).

Use the following sections to learn how to publish, share, and view dashboards.

Topics
- Publishing a Dashboard (p. 447)
- Copying a Dashboard (p. 449)
- Deleting a Dashboard (p. 450)
- Sharing Dashboards (p. 450)
- Sending Reports by Email (p. 453)
- Subscribing to Reports (p. 457)
- Printing a Dashboard or Analysis (p. 458)

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. 450).

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

To create a new analysis or dashboard from an existing dashboard, choose **Save As** from the top menu. Doing so creates a new analysis. To create a new dashboard, share the new analysis as a dashboard. You must have co-owner access to the dashboard, or have **Save as** privileges on it.

After you save the original dashboard as a new analysis, you can collaborate on it by sharing the new analysis with other users. 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 a new one.

1. Open the dashboard you want to duplicate.
2. Choose **Save As**, and then type a name for the new analysis. When you save an existing dashboard using the **Save As** option, it creates an analysis based on the dashboard.
3. (Optional) Make changes to the new analysis.
At this point, you can share the analysis with other users so you can collaborate on changes. All users who have access can make changes to the new analysis.

4. (Optional) To create a new dashboard with your changes to the new analysis, choose Share, and then Publish Dashboard.

5. (Optional) To save the new dashboard without sharing it, close the Share dashboard with users screen. Alternatively, you can enter users to share with. You can always share later by choosing Share from the application bar.

For more information, see the following:

- Sharing Dashboards (p. 450)
- Sharing Analyses (p. 259)

### 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 All dashboards tab of the Amazon QuickSight start page, choose the details icon (vertical dots ⋮) 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 Embedding Amazon QuickSight Dashboards (p. 547).
Topics

- Viewing the Users Sharing the Dashboard (p. 451)
- Sharing an Existing Dashboard (p. 451)
- Revoking Access to a Dashboard (p. 453)

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 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.

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. 457).

**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.

Emailing Reports from a Dashboard

You can set up or alter emailed reports by choosing Share and Email report from your dashboard screen. The settings include the following:

- Schedule for sending the report (once only, daily, weekly, or monthly)
- Report title
- Email subject line
- Email body text
- Option to view optimized for mobile
- Recipients

You can automatically send the report to selected recipients or to all users who have access to the dashboard. Readers can also choose to subscribe from the dashboard.

Before you save your report settings, you can choose View dataset list to see which data sets are used in the report. You can also choose to send a sample of the report by choosing Send test report.

Use the following procedure to email reports from a dashboard in Enterprise edition. The same procedure applies to both creating new and editing existing reports.

1. Make sure that you are using Amazon QuickSight Enterprise edition and that you have shared the dashboard with the users or group members you want to schedule email reports for.

   To enable, edit, or delete emailed reports, you must be a co-owner of the dashboard.

2. Open the dashboard that you want to send out. Then choose Email report from the Share icon on the application bar at the top of the screen.

3. Choose Schedule to set the schedule for the report, and then choose the frequency for the report:
   - 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 on the same day of the month at the same time.
For **Send first report on**, choose the date and time that you want the first report to be sent. If you choose to repeat the report, the schedule recurs at the same time and day based on the interval you select. For example, suppose that you choose to send your first report August 1 at 9 a.m., and you choose that the report repeat once a month. In this case, the second report is sent September 1 at 9 a.m. If you choose once a week, the day of the week August 1 falls on is the day the report repeats, at the same time the first one sends.

For **Time Zone**, choose the time zone that applies to this schedule.

If you are editing 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 screen).

4. Customize the email title, subject line, and body text.

   For **Report title**, enter a title for the report. By default, this is the same as the dashboard title.

   Optionally, you can enter a customized subject line in **E-mail subject line**, and the text for your email in **E-mail body text**.

5. For **Optimize report for**, choose one of the following options:
   - **Viewing on a desktop** – send your report as it appears in your dashboard.
   - **Viewing on a mobile device** – stack visuals into a single column.
6. Choose recipients for your report:

- Enable the option for **Send email report to all users with access to dashboard** to send your report to people that you shared the dashboard with. When you add new users to the dashboard, they automatically start receiving the email reports also.
- Choose recipients from the provided list to specify and maintain a list of people you want to email reports to. You can use the search box to locate people by email or group name.

People who have access to the dashboard can choose to subscribe or unsubscribe themselves from the emailed version of the dashboard. For more information on subscribing, see **Subscribing to Reports** (p. 457).
7. (Optional) To view a list of the data sets used by this report, choose View dataset list at the bottom of the screen.

8. If you are creating a new report, choose Save report to confirm your choices. A "Report scheduled" message briefly appears at upper right.

If you are editing a report, choose one of the following options:

- To save changes and close the screen, choose Update report.
- To save changes and immediately send out a report, choose Update & send a report now. If you choose to send the report now, it's sent out immediately, even when your schedule's start date is in the future.

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. 225).

Topics

• Operators (p. 459)
• Functions by Category (p. 462)
• Function Index (p. 466)
• Table Calculation Functions Index (p. 499)

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 (/)
• 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.

• log (p. 481)(expression) – returns the base 10 logarithm of a given expression.
• ln (p. 481)(expression) – returns the natural logarithm of a given expression.
• abs (p. 468)(expression) – returns the absolute value of a given expression.
• \texttt{sqrt} (p. 494)\texttt{(expression)} – returns the square root of a given expression.
• \texttt{exp} (p. 473)\texttt{(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.

\[
\begin{align*}
5 + (7 \times 3) \\
\end{align*}
\]

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.

\[
\begin{align*}
(5 + 7) \times 3 \\
\end{align*}
\]

**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 \texttt{Region} field is \texttt{South} are included in the results. If the \texttt{Region} is \texttt{south}, these rows are excluded.

\[
\begin{align*}
\text{Region} = 'South' \\
\end{align*}
\]

In the following example, the comparison evaluates to FALSE.

\[
\begin{align*}
\text{Region} = 'south' \\
\end{align*}
\]

The following example shows a comparison that converts \texttt{Region} to all uppercase (\texttt{SOUTH}), and compares it to \texttt{SOUTH}. This returns rows where the region is \texttt{south}, \texttt{South}, or \texttt{SOUTH}.

\[
\begin{align*}
\text{toUpperCase(Region)} = 'SOUTH' \\
\end{align*}
\]

**Example: (<>)**

The not equal symbol <> means \textit{less than or greater than}.

So, if we say \texttt{x<1}, then we are saying if \textit{x is less than 1} OR if \textit{x is greater than 1}. Both \texttt{<} and \texttt{>} are evaluated together. In other words, if \textit{x is any value except 1}. Or, \textit{x is not equal to 1}.
Note

Use $\neq$, not $\neq$.

The following example compares Status Code to a numeric value. This returns rows where the Status Code is not equal to 1.

$\text{statusCode} \neq 1$

The following example compares multiple status code values. In this case, active records have $\text{activeFlag} = 1$. 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

\[
( \text{activeFlag} = 1 \text{ AND } (\text{statusCode} \neq 1 \text{ AND } \text{statusCode} \neq 2) ) \text{ OR } \quad ( \text{activeFlag} = 0 \text{ AND } (\text{statusCode} = 99 \text{ OR } \text{statusCode} = -1) )
\]

Example: (^)

The power symbol $^\text{power}$ 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 $(2 \times 2 \times 2 \times 2)$. This returns a value of 16.

$2^4$

The following example computes the square root of the revenue field.

$\text{revenue}^{0.5}$

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 $\text{promoCode}$ a specified list of values. This example returns rows where the $\text{promoCode}$ is in the list $\{1, 2, 3\}$.

$\text{promoCode} \quad = \quad 1$
OR promoCode = 2
OR promoCode = 3

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).

NOT(promoCode = 1
OR promoCode = 2
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.

promoCode <> 1
AND promoCode <> 2
AND promoCode <> 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.

OrderDate >= "1/1/2016" AND OrderDate <= "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. 462)
- Conditional Functions (p. 463)
- Date Functions (p. 463)
- Numeric Functions (p. 464)
- Mathematical Functions (p. 464)
- String Functions (p. 464)
- Table Calculations (p. 465)

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.

- avg (p. 227) averages the set of numbers in the specified measure, grouped by the chosen dimension or dimensions.
Conditional Functions

The conditional functions for calculated fields in Amazon QuickSight include the following:

- **coalesce (p. 469)** returns the value of the first argument that is not null.
- **ifelse (p. 476)** 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. 478)** evaluates an expression to see if it is not null.
- **isNull (p. 478)** evaluates an expression to see if it is null. If the expression is null, `isNull` returns true, and otherwise it returns false.
- **nullIf (p. 482)** 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. 467)** adds or subtracts a unit of time to the date or time provided.
- **dateDiff (p. 472)** returns the difference in days between two date fields.
- **epochDate (p. 473)** converts an epoch date into a standard date.
- **extract (p. 474)** returns a specified portion of a date value.
- **formatDate (p. 475)** formats a date using a pattern you specify.
Numeric Functions

The numeric functions for calculated fields in Amazon QuickSight include the following:

- `now` (p. 482) returns the current date and time, using either settings for a database, or UTC for file and Salesforce.
- `truncDate` (p. 498) returns a date value that represents a specified portion of a date.

Mathematical Functions

The mathematical functions for calculated fields in Amazon QuickSight include the following:

- `log` (p. 481)\((\text{expression})\) – returns the base 10 logarithm of a given expression.
- `ln` (p. 481)\((\text{expression})\) – returns the natural logarithm of a given expression.
- `abs` (p. 468)\((\text{expression})\) – returns the absolute value of a given expression.
- `sqrt` (p. 494)\((\text{expression})\) – returns the square root of a given expression.
- `exp` (p. 473)\((\text{expression})\) – 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. 470) concatenates two or more strings.
- `left` (p. 479) returns the specified number of leftmost characters from a string.
- `locate` (p. 480) locates a substring within another string, and returns the number of characters before the substring.
- `ltrim` (p. 481) removes preceding white space from a string.
- `parseDate` (p. 483) parses a string to determine if it contains a date value, and returns the date if found.
- `parseInt` (p. 488) parses a string to determine if it contains an integer value.
- `parseJson` (p. 488) parses values from a native JSON or from a JSON object in a text field.
- `replace` (p. 490) replaces part of a string with a new string.
- `right` (p. 491) returns the specified number of rightmost characters from a string.
- `rtrim` (p. 492) removes following white space from a string.
- `split` (p. 493) 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. 494) returns the number of characters in a string.
- `substring` (p. 495) returns the specified number of characters in a string, starting at the specified location.
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 comma-separated value (CSV) format. A table calculation function performs operations on the data to reveal relationships between fields.

The table calculations available in Amazon QuickSight for both SPICE (p. 2) and direct query data include the following:

Lookup-based functions:
- `difference` calculates the difference between a measure based on one set of partitions and sorts, and a measure based on another.
- `lag` calculates the lag (previous) value for a measure.
- `lead` calculates the lead (following) value for a measure.
- `percentDifference` calculates the percentage difference between the current value and a comparison value.

Over functions:
- `avgOver` calculates the average of a measure over one or more dimensions.
- `countOver` calculates the count of a field over one or more dimensions.
- `maxOver` calculates the maximum of a measure over one or more dimensions.
- `minOver` the minimum of a measure over one or more dimensions.
- `percentileOver` calculates the \( n \)th percentile of a measure partitioned by a list of dimensions.
- `percentOfTotal` calculates the percentage a measure contributes to the total.
- `sumOver` calculates the sum of a measure over one or more dimensions.
- `stdevOver` calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.
- `stdevpOver` calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.
- `varOver` calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.
- `varpOver` calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a biased population.

Ranking functions:
- `rank` calculates the rank of a measure or a dimension.
- `denseRank` calculates the rank of a measure or a dimension, ignoring duplicates.
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. 462).

Topics

- addDateTime (p. 467)
- abs (p. 468)
- ceil (p. 469)
- coalesce (p. 469)
- concat (p. 470)
- decimalToInt (p. 471)
- dateDiff (p. 472)
- epochDate (p. 473)
- exp (p. 473)
- extract (p. 474)
- floor (p. 474)
- formatDate (p. 475)
- ifelse (p. 476)
- intToDecimal (p. 477)
- isnotNull (p. 478)
- isNull (p. 478)
- left (p. 479)
- locate (p. 480)
addDateTime

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>May</td>
<td>13</td>
<td>13:24</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Jan</td>
<td>31</td>
<td>23:06</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>Dec</td>
<td>28</td>
<td>06:45</td>
<td></td>
</tr>
</tbody>
</table>

Using the following calculations, `addDateTime` modifies the values as shown following.

```
addDateTime(-2, 'YYYY', purchaseDate)
```

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>May</td>
<td>13</td>
<td>13:24</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Jan</td>
<td>31</td>
<td>23:06</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>Dec</td>
<td>28</td>
<td>06:45</td>
<td></td>
</tr>
</tbody>
</table>

```
addDateTime(4, 'DD', purchaseDate)
```

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>May</td>
<td>17</td>
<td>13:24</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Feb</td>
<td>4</td>
<td>23:06</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Jan</td>
<td>1</td>
<td>06:45</td>
<td></td>
</tr>
</tbody>
</table>

```
addDateTime(20, 'MI', purchaseDate)
```

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>May</td>
<td>13</td>
<td>13:44</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Jan</td>
<td>31</td>
<td>23:26</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>Dec</td>
<td>28</td>
<td>07:05</td>
<td></td>
</tr>
</tbody>
</table>

**abs**

`abs` returns the absolute value of a given expression.

**Syntax**

```
abs(expression)
```

**Arguments**

*expression*

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.

<table>
<thead>
<tr>
<th>Field Value</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.

<table>
<thead>
<tr>
<th>Field Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
</tr>
<tr>
<td>893</td>
</tr>
<tr>
<td>58</td>
</tr>
</tbody>
</table>

**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.

```sql
coalesce(billingAddress, streetAddress, 'No address listed')
```

**concat**

`concat` concatenates two or more strings.

**Syntax**

```sql
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.

```sql
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.
The following example concatenates two string literals.

```
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**

```
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.

```
decimalToInt(salesAmount)
```

The following are the given field values.

```
20.13
892.03
57.54
```

For these field values, the following values are returned.

```
20
892
58
```
**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
```
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 SPICE (p. 2) data sets.

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**

\[
\text{extract}(\text{period, date})
\]

**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.

\[
\text{extract('DD', orderDate)}
\]

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>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>13</td>
</tr>
</tbody>
</table>

**floor**

floor decrements a decimal value to the next lowest integer. For example, \(\text{floor}(29.08)\) returns 29.
Syntax

```plaintext
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.

```plaintext
floor(salesAmount)
```

The following are the given field values.

```plaintext
20.13
892.03
57.54
```

For these field values, the following values are returned.

```plaintext
20
892
57
```

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

```plaintext
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. 74).
If you don’t specify a format, this string defaults to yyyy-MM-ddTkk:mm:ss:SSS.

**Return Type**

String

**Example**

The following example formats a UTC date.

```sql
formatDate(orderDate, 'dd MMM yyyy')
```

The following are the given field values.

<table>
<thead>
<tr>
<th>order date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-12-14T00:00:00.000Z</td>
</tr>
<tr>
<td>2013-12-29T00:00:00.000Z</td>
</tr>
<tr>
<td>2012-11-15T00:00:00.000Z</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

```
13 Dec 2012
28 Dec 2013
14 Nov 2012
```

**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**

```
ifelse(if, then [, if, then ...], else)
```

**Arguments**

`ifelse` takes one or more `if, then` expression pairings, plus one expression for the `else` argument.

**if**

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)`.

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.

```
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.
ifelse(month = 5 OR (month < 3 AND year = 2000), 'yes', 'no')

then

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

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

ifelse returns a value of the same data type as the input arguments.

Example

The following example assigns a group to a sales record based on the sales total.

ifelse(salesTotal > 0 AND salesTotal < 500, 'Group 1', salesTotal >= 500 AND salesTotal < 1000, 'Group 2', 'Group 3')

intToDecimal

intToDecimal converts an integer value to the decimal data type.

Syntax

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.

intToDecimal(price)

The following are the given field values.

20
For these field values, the following values are returned.

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
</tr>
<tr>
<td>892.0</td>
</tr>
<tr>
<td>58.0</td>
</tr>
</tbody>
</table>

You can apply formatting inside an analysis, for example to format price as currency.

### isNotNull

`isNotNull` evaluates an expression to see if it is not null. If the expression is not null, `isNotNull` returns true, and otherwise it returns false.

#### Syntax

```
isNotNull(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.

```
isNotNull(salesAmount)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.13</td>
</tr>
<tr>
<td>(null)</td>
</tr>
<tr>
<td>57.54</td>
</tr>
</tbody>
</table>

For these field values, the following values are returned.

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>true</td>
</tr>
<tr>
<td>false</td>
</tr>
<tr>
<td>true</td>
</tr>
</tbody>
</table>

### 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
ture
false
```

**left**

`left` returns the leftmost characters from a string, including spaces. You specify the number of characters to be returned.

Syntax

```sql
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')
```

480
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**

```
ln(expression)
```

**Arguments**

`expression`

The expression must be numeric. It can be a field name, a literal value, or another function.

**ltrim**

`ltrim` removes preceding white 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

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-ddTkk:mm:ss:SSSZ (for example, 2015-10-15T19:11:51:003Z).

Syntax

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

nullIf(expression1, expression2)

Arguments

nullIf takes two expressions as arguments.
**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.

```sql
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 `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. See also [Supported Date Formats](p. 74).

**Syntax**

```sql
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. 74).</td>
</tr>
</tbody>
</table>
| Direct query of Amazon Aurora, MariaDB, and MySQL databases | • MM/dd/yyyy  
• dd/MM/yyyy  
• yyyy/MM/dd  
• MMM/dd/yyyy  
• dd/MM/yyyyy  
• yyyy/MMM/dd  
• MMM/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-yyyyy 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 |
| Direct query of Snowflake | • dd/MM/yyyy  
• dd/MM/yyyy HH:mm:ss  
• dd-MM-yyyy  
• dd-MM-yyyy HH:mm:ss  
• MM/dd/yyyy  
• MM/dd/yyyy HH:mm:ss  
• MM-dd-yyyy  
• MMM-dd-yyyy HH:mm:ss  
• yyyy/MM/dd  
• yyyy/MM/dd HH:mm:ss  
• yyyy-MM-dd  
• yyyy-MM-dd HH:mm:ss  
• yyyy/MM/dd HH:mm:ss |
<table>
<thead>
<tr>
<th>Date Source Type</th>
<th>Supported Date Formats</th>
</tr>
</thead>
</table>
| Direct query of Microsoft SQL Server databases | • dd-MM-yyyy  
• MM/dd/yyyy  
• dd/MM/yyyy  
• yyyy/MM/dd  
• MMM/dd/yyyy  
• dd/MM/MM/yyyy  
• yyyy/MM/MM/dd  
• yyyy/MM/dd HH:mm:ss  
• MMM/dd/yyyy HH:mm:ss  
• dd/MM/MM/yyyy HH:mm:ss  
• yyyy/MM/MM/dd HH:mm:ss  
• MM-dd-yyyy  
• yyyy-MM-dd  
• MMM-dd-yyyy  
• yyyy-MM-dd  
• MM-dd-yyyy HH:mm:ss  
• dd-MM-yyyy HH:mm:ss  
• yyyy-MM-yyyy HH:mm:ss  
• MMM-dd-yyyy HH:mm:ss  
• dd-MM-yyyy HH:mm:ss  
• yyyy-MM-yyyy HH:mm:ss |
### Date Source Type
- Direct query of Amazon Redshift or PostgreSQL databases
- Also, SPICE (p. 2) database data sets (any DBMS)

### 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.

```sql
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**

```markdown
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.

```markdown
parseInt(feeType)
```

The following are the given field values.

```
feeType
--------
2
2.1
2a
3
3b
(null)
5
```

For these field values, the following rows are returned.

```
2
2
3
(null)
5
```

**parseJson**

Use `parseJson` to extract values from a JSON object.

In SPICE (p. 2), 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>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**

```plaintext
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.

```plaintext
parseJson({jsonField}, ".items.qty")
```

The following shows the JSON.

```json
{
    "customer": "John Doe",
    "items": [
        {
            "quantity": 5
        },
        {
            "quantity": 10
        }
    ]
}
```
"items": {
"product": "Beer",
"qty": 6
},
"list1": [
"val1",
"val2"
],
"list2": {
"list2key1": "list1value1"
}
}

For this example, the following value is returned.

6

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.

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

replace(expression, substring, replacement)

Arguments

description

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.
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 white space from a string.
Syntax

\[\text{rtrim(expression)}\]

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.

\[\text{rtrim('Seattle Store #14   ')}\]

For these field values, the following values are returned.

Seattle Store #14

\(\text{split}\)

\(\text{split}\) 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 \(\text{split}\) to a calculated field during data preparation, not to an analysis. This function is not supported in direct queries to Microsoft SQL Server.

Syntax

\[\text{split(expression, delimiter , position)}\]

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;1402 35th Ave;1818 Elm Ct;11 Janes Lane', or a call to another function that outputs a string.

\(delimiter\)

The character that delimits where the string is broken into substrings. For example, \(\text{split('one|two|three', ',|' , 2)}\) becomes the following.

one
twothree
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.

```sql
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.

```
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,0,5).

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.

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.

```
substring('Fantasy and Science Fiction',13,7)
```

The following value is returned.
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.

```
SEATTLE STORE #14
```

trim

`trim` removes both preceding and following white space from a string.
Syntax

\[ \text{trim}(\text{expression}) \]

Arguments

\[ \text{expression} \]

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.

\[ \text{trim(' Seattel Store #14 ')} \]

For these field values, the following values are returned.

Seattle Store #14

\[ \text{truncDate} \]

\[ \text{truncDate('period', date)} \]

Arguments

\[ \text{period} \]

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.

```plaintext
truncDate('MM', orderDate)
```

The following are the given field values.

<table>
<thead>
<tr>
<th>orderDate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-12-14T00:00:00.000Z</td>
</tr>
<tr>
<td>2013-12-29T00:00:00.000Z</td>
</tr>
<tr>
<td>2012-11-15T00:00:00.000Z</td>
</tr>
</tbody>
</table>

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 comma-separated value (CSV) format. 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. 462).

### Lookup-based functions:

- difference (p. 500)
- lag (p. 502)
- lead (p. 504)
- percentDifference (p. 506)

### Over functions:
• avgOver (p. 508)
• countOver (p. 510)
• maxOver (p. 513)
• minOver (p. 515)
• percentileOver (p. 517)
• percentOfTotal (p. 518)
• sumOver (p. 520)
• stdevOver (p. 522)
• stdevpOver (p. 523)
• varOver (p. 524)
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Ranking functions:
• rank (p. 527)
• denseRank (p. 528)
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Running functions:
• runningAvg (p. 531)
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• runningMax (p. 533)
• runningMin (p. 534)
• runningSum (p. 535)

Custom window functions:
• windowAvg (p. 537)
• windowCount (p. 539)
• windowMax (p. 540)
• windowMin (p. 542)
• windowSum (p. 544)

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 (p. 2) and direct query data sets.

Syntax
The brackets are required. To see which arguments are optional, see the following descriptions.

```sql
difference
```
difference

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 with MySQL compatibility, 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 sum( {Billed Amount} ), sorted by Customer Region ascending, compared to the next row, and partitioned by Service Line.

difference(  
    sum( {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}]. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

difference(  
    sum( {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

`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 (p. 2) 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 with MySQL compatibility, 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 \( \text{sum}(\text{sales}) \), partitioned by the state of origin, in the ascending sort order on \( \text{cancellation\_code} \).

\[
\text{lag}(
\quad \text{sum}(\text{Sales}),
\quad \left[ \text{cancellation\_code \ ASC},
\quad \text{1},
\quad \text{origin\_state\_nm}\right]
\)
\]

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 \( \text{Customer Segment} \). This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

\[
\text{lag}(
\quad \text{sum}({\text{Billed Amount}}),
\quad \left[ \{\text{Customer Segment}\ \ASC},
\quad \text{1}\right]
\)
\]

The following screenshot shows the results of the example.
lead calculates the lead (following) value for a measure based on specified partitions and sorts.

lead is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

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 with MySQL compatibility, 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 \( \sum(\text{sales}) \), partitioned by the state of origin, in the ascending sort order on \( \text{cancellation_code} \).

```sql
lead
(
  \( \sum(\text{sales}) \),
  [\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`. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```sql
lead(
  \( \sum(\{\text{Billed Amount}\}) \),
  [\{\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.

percentDifference is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
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.

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 with MySQL compatibility, 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.

```plaintext
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]). This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```plaintext
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.

avgOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
avgOver
{
    measure
    , [partition_field, ...]
    , calculation level
}
```

The following example shows the average Billed Amount over Customer Region. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
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 \( \text{sum}(\{\text{Sales Amt}\}) \). Use an aggregation if the calculation level is set to \text{NULL} or \text{POST_AGG_FILTER}. Don't use an aggregation if the calculation level is set to \text{PRE_FILTER} or \text{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:

• \text{PRE_FILTER} – prefilter calculations are computed before the dataset filters.
• \text{PRE_AGG} – preaggregate calculations are computed before applying aggregations and top and bottom \( N \) filters to the visuals.
• \text{POST_AGG_FILTER} – (default) table calculations are computed when the visuals display.

This value defaults to \text{POST_AGG_FILTER} when blank. For more information, see Using Level-Aware Aggregations (p. 240).
Example
The following example gets the average \( \text{sum}(\text{Sales}) \) partitioned over \text{City} and \text{State}.

```plaintext
avgOver
(
  \text{sum}(\text{Sales}),
  \text{[City, State]}
)
```

countOver

countOver calculates the count of a dimension or measure partitioned by a list of dimensions.
countOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax
The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
countOver
(
  \text{measure or dimension field}
  ,[ \text{partition_field, ...} ]
  ,\text{calculation level}
)
```

Arguments

\textit{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 \text{NULL} or \text{POST_AGG_FILTER}. Don't use an aggregation if the calculation level is set to \text{PRE_FILTER} or \text{PRE_AGG}.

\textit{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).

\textit{calculation level}

(Optional) Specifies the calculation level to use:

- \text{PRE_FILTER} – prefilter calculations are computed before the dataset filters.
- \text{PRE_AGG} – preaggregate calculations are computed before applying aggregations and top and bottom \( N \) filters to the visuals.
- \text{POST_AGG_FILTER} – (default) table calculations are computed when the visuals display.

This value defaults to \text{POST_AGG_FILTER} when blank. For more information, see Using Level-Aware Aggregations (p. 240).

Example
The following example gets the count of Sales partitioned over \text{City} and \text{State}.

```plaintext
countOver
```
The following example gets the count of `{County}` partitioned over `City` and `State`.

```plaintext
countOver
{
    {County},
    [City, State]
}
```

The following example shows the count of `Billed Amount` over `Customer Region`. This example uses the `revenue sample dataset`, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```plaintext
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. maxOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
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. 240).

**Example**

The following example calculates the maximum $\text{sum}(\text{Sales})$, partitioned by **City** and **State**.

```
maxOver
{
  sum(Sales),
  [City, State]
}
```

The following example shows the maximum **Billed Amount** over **Customer Region**. This example uses the **revenue sample dataset**, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
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.

minOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

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. 240).

**Example**

The following example calculates the min \( \text{sum}(\text{Sales}) \), partitioned by \( \text{City} \) and \( \text{State} \).

```
minOver
(   
    sum(Sales),
    [City, State]
)
```

The following example shows the minimum Billed Amount over Customer Region. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
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

`percentileOver` calculates the \( n \)th percentile of a measure partitioned by a list of dimensions. `percentileOver` is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
percentileOver
(  
    measure
    ,percentile-n
    ,[ partition_field, ...]
)
```

**Arguments**

- **measure**
  
  The aggregated measure that you want to do the calculation for, for example `sum({Sales Amt})`.

- **percentile-n**
  
  The percentile that you want to calculate for this measure. This decimal value can be 0–100.

- **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 median (the 50th percentile) of Sales partitioned by City and State.

```plaintext
percentileOver
{
  Sales,
  50,
  [City, State]
}
```

The following example calculates the 98th percentile of sum({Billed Amount}) partitioned by Customer Region. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```plaintext
percentileOver
{
  sum({Billed Amount}),
  98,
  [{Customer Region}]
}
```

The following screenshot shows the how these two examples looks on a chart.

![Chart showing Sum of Billed Amount, PercOver50, and PercOver98 by Customer Region](chart.png)

**percentOfTotal**

`percentOfTotal` calculates the percentage a measure contributes to the total, based on the dimensions specified.

`percentOfTotal` is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
percentOfTotal
```
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`.

```sql
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]). This example uses the `revenue sample dataset`, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```sql
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.
sumOver

sumOver calculates the sum of a measure partitioned by a list of dimensions.

sumOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
sumOver(
   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. 240).

Example

The following example calculates the sum of `sum(Sales)`, partitioned by City and State.

```sql
sumOver
(
  sum(Sales),
  [City, State]
)
```

The following example sums `Billed Amount` over `Customer Region`. This example uses the revenue sample dataset, located in an Amazon S3 bucket. 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.
**stdevOver**

`stdevOver` calculates the standard deviation of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.

`stdevOver` is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**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. 240).

**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. This example uses the revenue sample dataset, located in an Amazon S3 bucket. 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.

**stdevpOver** is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```sql
stdevpOver
{
  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. 240).

Example

The following example calculates the standard deviation of `sum(Sales)`, partitioned by City and State, based on a biased population.

```java
stdevpOver
  (  
    sum(Sales),  
    [City, State]  
  )
```

The following example calculates the standard deviation of Billed Amount over Customer Region, based on a biased population. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```java
stdevpOver
  (  
    sum({Billed Amount}),  
    [{Customer Region}]  
  )
```

**varOver**

*varOver* calculates the variance of the specified measure, partitioned by the chosen attribute or attributes, based on a sample.

*varOver* is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**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. 240).

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. This example uses the revenue sample dataset, located in an Amazon S3 bucket. 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.
varpOver is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

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. 240).

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. This example uses the revenue sample data set, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
varpOver
  (sum({Billed Amount}),
    [{Customer Region}]
  )
```
**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.

*rank* is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
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. 240).

**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.

```
rank
(
    [max(Sales) DESC],
```

```
The following example ranks $\text{max(Sales)}$, based on an ascending sort order, by State. Any states with the same $\text{max(Sales)}$ 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.

```
rank
  (  
    [\text{max(Sales)} \text{ ASC}],  
    [State]
  )
```

The following example ranks Customer Region by total Billed Amount. This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
rank(  
  [\text{sum\{Billed Amount\}} \text{ DESC}]
)
```

The following screenshot shows the results of the example, along with the total Billed Amount so you can see how each region ranks.

**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.

denseRank is supported for use with analyses based on SPICE (p. 2) and direct query data sets.
**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
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. 240).

**Example**

The following example densely ranks `max(Sales)`, based on a descending sort order, by State and City. Any cities with the same `max(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.

```plaintext
denseRank
{
  [max(Sales) DESC],
  [State, City]
}
```

The following example densely ranks `max(Sales)`, based on a descending sort order, by State. Any states with the same `max(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.

```plaintext
denseRank
{
}
```
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).

percentileRank is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```plaintext
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. 240).

**Example**

The following example does a percentile ranking of $\text{max}(\text{Sales})$ in descending order, by State.

```plaintext
percentileRank
{
    [max(Sales) DESC],
    [State]
}
```
The following example does a percentile ranking of Customer Region by total Billed Amount. This example uses the revenue sample data file, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
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.

runningAvg is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

**Syntax**

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningAvg
{
    measure
    ,[ sortorder_field ASC_or_DESC, ... ]
}```
runningCount

runningCount calculates a running count for a measure or dimension, based on the specified dimensions and sort orders.

runningCount is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```python
runningCount
```
runningMax

runningMax calculates a running maximum for a measure based on the specified dimensions and sort orders.

runningMax is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.
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).

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 maximum of sum(Sales), sorted by Sales, partitioned by City and State.

```
runningMax
( sum(Sales),
  [Sales ASC],
  [City, State]
)
```

The following example calculates a running maximum of Billed Amount, sorted by month ([truncDate("MM",Date) ASC]). This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
runningMax
( sum({Billed Amount}),
  [truncDate("MM",Date) ASC]
)
```

runningMin

runningMin calculates a running minimum for a measure based on the specified dimensions and sort orders.

runningMin is supported for use with analyses based on SPICE (p. 2) and direct query data sets.
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 `sum(Sales)`, sorted by `Sales`, partitioned by `City` and `State`.

```
runningMin
(
    sum(Sales),
    [Sales ASC],
    [City, State]
)
```

The following example calculates a running minimum of `Billed Amount`, sorted by month (`[truncDate("MM","Date") ASC]`). This example uses the revenue sample dataset, located in an Amazon S3 bucket. 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.
runningSum is supported for use with analyses based on SPICE (p. 2) and direct query data sets.

Syntax

The brackets are required. To see which arguments are optional, see the following descriptions.

```
runningSum
(
    measure
    ,[ sortorder_field ASC_or_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 \(\text{sum}(\text{Sales})\), sorted by \(\text{Sales}\), partitioned by \(\text{City}\) and \(\text{State}\).

```
runningSum
(
    \text{sum}(\text{Sales}),
    [\text{Sales ASC}],
    [\text{City, State}]
)
```

The following example calculates a running sum of \(\text{Billed Amount}\), sorted by month ([\text{truncDate("MM",Date) ASC}]). This example uses the revenue sample dataset, located in an Amazon S3 bucket. The fields in the table calculation are in the field wells of the visual.

```
runningSum
(
    \text{sum}({\text{Billed Amount}}),
    [\text{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.
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.

windowAvg is supported for use with analyses based on SPICE (p. 2) and direct query data sets. 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 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 average of \( \text{sum(Revenue)} \), partitioned by \( \text{SaleDate} \). The calculation includes three rows above and two rows below of the current row.

```sql
windowAvg
  (  
    sum(Revenue),  
    [SaleDate ASC],  
    3,  
    2  
  )
```

The following screenshot shows the results of this moving average example. The \( \text{sum(Revenue)} \) 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.

windowCount is supported for use with analyses based on SPICE (p. 2) and direct query data sets. 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 \( \text{sum(Revenue)} \), partitioned by \( \text{SaleDate} \). The calculation includes three rows above and two row below of the current row.

```plaintext
windowCount
(     sum(Revenue),
     [SaleDate ASC],
     3,
     2
)
```

**windowMax**

\( \text{windowMax} \) 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 \( \text{windowMax} \) to help you identify the maximum of the metric over a period time.

\( \text{windowMax} \) is supported for use with analyses based on \( \text{SPICE (p. 2)} \) and direct query data sets. 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.

```plaintext
windowMax
```
Arguments

measure

The aggregated metric that you want to get the average for, for example \( \text{sum}(\{\text{Revenue}\}) \).

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 \( \text{sum}(\text{Revenue}) \), partitioned by SaleDate. The calculation includes 12 rows above and 0 row below of the current row.

\[
\text{windowMax} \\
\left( \text{sum}(\text{Revenue}), \\
\text{[SaleDate ASC]}, \\
12, \\
0 \\
\right)
\]

The following screenshot shows the results of this trailing twelve month example. The \( \text{sum}(\text{Revenue}) \) 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.

`windowMin` is supported for use with analyses based on SPICE (p. 2) and direct query data sets. 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 $\text{sum(Revenue)}$, partitioned by $\text{SaleDate}$. The calculation includes 12 rows above and 0 row below of the current row.

```
windowMin
(
    sum(Revenue),
    [SaleDate ASC],
    12,
    0
)
```

The following screenshot shows the results of this trailing twelve month example. The $\text{sum(Revenue)}$ field is added to the chart to show the difference between the revenue and the trailing twelve month minimum revenue.
windowSum

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.

windowSum is supported for use with analyses based on SPICE (p. 2) and direct query data sets. 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}).

**windowAvg** is supported for use with analyses based on SPICE (p. 2) and direct query data sets. 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 `sum(Revenue)`, sorted by **SaleDate**. The calculation includes two rows above and one row ahead of the current row.

```sql
windowSum
(
   sum(Revenue),
   [SaleDate ASC],
   2,
   1
)
```

The following example show a trailing 12-month sum.

```sql
windowSum(sum(Revenue),[SaleDate ASC],12,0)
```

The following screenshot shows the results of this trailing 12-month sum example. The `sum(Revenue)` field is added to the chart to show the difference between the revenue and the trailing 12-month sum of revenue.
Embedding and Other SDKs

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#.

Available API Operations for Amazon QuickSight

The Amazon QuickSight API operations provide the following:

- User and group management
- Dashboard embedding

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, so that it's easier for you to get started.

For more information about downloading the AWS SDKs, see AWS SDKs and Tools.

Topics

- Embedding Amazon QuickSight Dashboards (p. 547)
- Using Amazon QuickSight with the AWS SDKs (p. 560)

Embedding Amazon QuickSight Dashboards

With Enterprise edition, you can use embedded dashboards to help you focus on your core product experience by offloading scalable, responsive analytics code to Amazon QuickSight. There are no servers to manage, no upfront costs, no annual commitments, and no charges for unused embedded dashboards. You can embed dashboards into apps or websites, and scale your insights with your growing user base. For dashboard viewers, you pay only for usage with a pay-per-session pricing model.
Every user receives a secure, personalized dashboard while requiring no user-facing authentication specific to Amazon QuickSight. Viewers of embedded dashboards can be Amazon QuickSight users (readers, authors, or admins) authenticated in your AWS account as one of the following:

- Active Directory (AD) users or group members
- Invited non-federated users
- IAM users and IAM role-based sessions authenticated through Federated Single Sign-On using SAML, OpenID Connect, or IAM Federation

Dashboard embedding is available in all supported AWS Regions. Before you can embed content, you need a subscription to Amazon QuickSight Enterprise edition in the AWS account where you plan to use to embed dashboards. If your app also resides in AWS, the app doesn’t need to reside on the same AWS account as the Amazon QuickSight subscription. However, the app needs the ability to assume the IAM role that you use for the API calls.

In general, embedding a dashboard in your webpage or app involves the following steps, explained in greater detail later:

1. Create your dashboards in Amazon QuickSight and add domains to your allowlist. Publish the dashboards that you want to embed into your app. Share each dashboard with the users or groups that you choose. Then add the domain of the web app where you want to embed the dashboard to the list of domains that are approved for embedding. An Amazon QuickSight admin can view or edit the list of approved domains.

2. In your AWS account, set up permissions for viewers of the embedded dashboard. Verify that your users can be authenticated through IAM, AWS Managed Microsoft AD, SAML, or WebIdentity. Create or choose an IAM role that grants permissions to become a reader in Amazon QuickSight and to retrieve the specific embedded dashboard. These permissions can be configured by an AWS administrator.

3. On your application server, authenticate the user and get the embedded dashboard URL by using one of the AWS SDKs.

4. On your application page, embed the dashboard. To simplify this process you can use the Amazon QuickSight Embedding SDK, available on NPMJS and GitHub. This customized JavaScript SDK is designed to enable you to efficiently integrate Amazon QuickSight dashboards into your application pages, set defaults, connect controls, and handle errors.

In the following sections, you can details about how to implement embedded dashboards.

Topics

- Creating Embedded Dashboards with Amazon QuickSight (p. 548)
- How Embedded Amazon QuickSight Dashboards Work (p. 557)
- Pricing and Licensing for Embedded Dashboards with Amazon QuickSight (p. 558)
- Security and User Provisioning for Embedded Dashboards in Amazon QuickSight (p. 558)
- Limitations for Embedded Dashboards in Amazon QuickSight (p. 559)
- Scenarios for Embedding Dashboards with Amazon QuickSight (p. 559)

Creating Embedded Dashboards with Amazon QuickSight

In the following sections, you can find detailed information on how to set up embedded dashboards. Users can be authenticated either by AWS Managed Microsoft AD or by Federated Single Sign-On (SAML, OpenID Connect, or IAM Federation). To generate a URL to access an embedded dashboard, you use an IAM role to get a temporary set of credentials on behalf of the user.

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In addition to reviewing the steps described in the following sections, you might be interested in the examples available at the following links:

- **Amazon QuickSight Embedding SDK Sample** – This example explains how to use a JavaScript SDK created by the Amazon QuickSight team to simplify dashboard embedding. This is also available on NPM.
- **Amazon QuickSight Embedding Sample with Infrastructure** – This example sets up a serverless environment to host embedded dashboards on a website. It uses AWS services such as AWS CloudFormation, Amazon API Gateway, Amazon Cognito, and AWS Lambda. We use Amazon Cognito for authenticating users into the app. You can also use your own identity provider and change the Lambda code accordingly). Amazon API Gateway is used to expose an API that can be invoked by the web app. The API gateway triggers a function in AWS Lambda, which eventually calls the `GetDashboardEmbedUrl` API with the parameters that you pass to the API gateway, along with the Amazon Cognito user credentials. An authenticated Amazon Cognito role, bound to the Cognito Identity Pool, is used to call the embedding API to get the embedding URL.

**Topics**
- Step 1: Share Dashboards and Add Domains to the Allowlist (p. 549)
- Step 2: Set Up Permissions for Dashboard Viewers (p. 550)
- Step 3: Authenticate the User and Get the URL (p. 551)
- Step 4: Embed the Dashboard URL (p. 553)
- Code Samples for Getting the Dashboard URL from the App Server (p. 553)

**Step 1: Share Dashboards and Add Domains to the Allowlist**

In the following section, you can find out how to publish and share your dashboards and add your domain for embedding dashboards with Amazon QuickSight. Adding a domain to the allowlist requires administrative access to Amazon QuickSight.

When you are ready to publish an analysis, choose **Share** from the top menu, then choose **Publish dashboard**. When you publish a dashboard, you can choose to enable or disable the following options:

- **Advanced filtering** – Enables dashboard users to do the following:
  - Focus on or exclude data points.
  - Use the filter panel.
  - Know which visuals are filtered.
  - See what filters are applied in each visual.

- **Allow CSV download of data** – Enables dashboard users to download data in comma-separated value (CSV) format.

By leaving these these options disabled, you can provide a simplified dashboard experience.

Next, share the dashboard with a group. Then add users to the group after they are added to Amazon QuickSight. Each user who views the dashboard embedded in your application must be a member of the Amazon QuickSight subscription that contains the dashboard. You can provision users in advance, either manually or by using API operations. Or you can provision them just-in-time as they access your application.

Finally, an Amazon QuickSight administrator must explicitly enable domains where you plan to embed your Amazon QuickSight. You do this by using the **Manage QuickSight** option, which is available only to Amazon QuickSight administrators. There is an option to add subdomains as part of a domain. For more information, see Adding Domains for Embedded Dashboard Users (p. 615). All domains in use (such as
dev, staging, and production) must be explicitly allowed, and they must use HTTPS. You can add up to 100 domains to the allowlist.

**Step 2: Set Up Permissions for Dashboard Viewers**

In the following section, you can find out how to set up permissions for embedded viewers by using IAM. 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. Add `quicksight:RegisterUser` permissions to ensure that the reader can access Amazon 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 dashboards by using `quicksight:GetDashboardEmbedUrl`.

The following sample policy provides these permissions.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Action": "quicksight:RegisterUser",
         "Resource": "*",
         "Effect": "Allow"
      },
      {
         "Action": "quicksight:GetDashboardEmbedUrl",
         "Effect": "Allow"
      }
   ]
}
```

If you are using `QUICKSIGHT` as your `identityType`, and providing the user’s 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": [
      {
         "Action": "quicksight:GetAuthCode",
         "Effect": "Allow"
      }
   ]
}
```

Your application’s IAM identity must have a trust policy associated with it to allow access to the role 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 Amazon 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",
```
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 3: Authenticate the User and Get the URL**

In the following section, you can find out how to authenticate the user and get the embeddable dashboard URL on your application server. Although we explain this process using AWS CLI commands as examples, you or your developer needs to wrap these API operations in code that runs on the application server. You can find some examples following.

When a user accesses your app, the app should assume the IAM role (created in step 2) on the user's behalf. Then it should add the user to Amazon QuickSight, if that user doesn't already exist. Next, it should pass an identifier as the unique role session ID.

Doing this ensures that each viewer of the dashboard is uniquely provisioned in Amazon QuickSight. It also enforces per-user settings, such as the row-level security and dynamic defaults for parameters.

To assume the role, choose one of the following AWS Security Token Service (AWS STS) API operations:

- **AssumeRole** – Use this when you are using an IAM identity to assume the role.
- **AssumeRoleWithWebIdentity** – Use this when you are using a web identity provider to authenticate your user.
- **AssumeRoleWithSaml** – Use this when you are using SAML to authenticate your users.

The following example shows the CLI command to set the IAM role.

```bash
/* Assume the role with permissions enabled for actions: quickSight:RegisterUser and quicksight:GetDashboardEmbedURL */
/* You can use assume-role, assume-role-with-web-identity, or assume-role-with-saml */
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 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`.

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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 Amazon QuickSight from multiple locations.

The role session ID also becomes the user name in Amazon QuickSight. You can use this pattern to provision your users in Amazon QuickSight ahead of time, or to provision them the first time they access the dashboard. With Amazon QuickSight's pay-per-session mode, you can provision thousands of users. You get charged only when they access Amazon QuickSight.

The following example shows the CLI command that you can use to provision a user. For more information about `RegisterUser`, `DescribeUser`, and other Amazon QuickSight API operations, see the Amazon QuickSight API Reference.

```bash
/* If the user does not exist in QuickSight, register the user */
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 \
  --session-name "john.doe@example.com" \
  --email john.doe@example.com \
  --region us-east-1
```

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 Amazon QuickSight. For Microsoft AD users, you can use `DescribeUser` to get the user ARN.

The first time a user accesses Amazon 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.

```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 Amazon 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.

```bash
aws quicksight get-dashboard-embed-url \
  --aws-account-id 111122223333 \
  --namespace=default \
  --dashboard-arn arn:aws:quicksight:us-east-1:111122223333:user/default/embedding_quicksight_dashboard_role/embeddingsession
```
The following example shows how to get the URL for an embedded dashboard using a server-side call for users authenticated through SSO.

```bash
aws quicksight get-dashboard-embed-url
   --aws-account-id 111122223333
   --dashboard-id 1a1ac2b2-3fc3-4b44-5e5d-c6db6778df89
   --identity-type IAM
```

For more information on using this operation, see `GetDashboardEmbedUrl`. You can use this and other API operations in your own code.

**Step 4: 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 to get the URL that you can embed in your dashboard. This URL is valid for 5 minutes, and the resulting session is valid for 10 hours. The API provides the URL with an `auth_code` that enables a single-signon session.

The following shows an example response from `get-dashboard-embed-url`.

```json
{
   "Status": "200",
   "EmbedUrl": "https://spaceneedle-alpha.amazon.com/embed/620bef1f0822743f9329fb3751187d2d...",
   "RequestId": "7bee030e-f191-45c4-97fe-d9fafe03713"
}
```

Embed this dashboard in your webpage by using the Amazon QuickSight Embedding SDK or by adding this URL into an iframe. If you set a fixed height and width number (in pixels), Amazon QuickSight uses those and doesn't change your visual as your window resizes. If you set a relative percent height and width, Amazon QuickSight provides a responsive layout that is modified as your window size changes. Using the Amazon QuickSight Embedding SDK also enables you to control parameters within the dashboard and receive callbacks in terms of page load completion and errors.

**Code Samples for Getting the Dashboard URL from the App Server**

The following sections provide examples of code that you can run on your app server to get the URL for the embedded dashboard.

**Topics**

- JavaScript (Node.js) Example for Getting the Dashboard URL from the App Server (p. 554)
- Java Example for Getting the Dashboard URL from the App Server (p. 554)
- Python3 Example for Getting the Dashboard URL from the App Server (p. 555)
- .NET/C# Example for Getting the Dashboard URL from the App Server (p. 556)
• HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server (p. 556)

JavaScript (Node.js) Example for Getting the Dashboard URL from the App Server

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. For more information, see HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server (p. 556).

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
}, 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://spaceneedle-alpha.amazon.com/embed/620bef10822743fab329fb3751187d2d...
  RequestId: '7bee030e-f191-45c4-97fe-d9fafa0e03713' }
```

Java Example for Getting the Dashboard URL from the App Server

The following example shows the Java 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. For more information, see HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server (p. 556).

Example

```java
final String dashboardId = "1c1fe111-e2d2-3b30-44ef-a0e111111cde";
final String awsAccountId = "111122223333";
final GetDashboardEmbedUrlResult dashboardEmbedUrlResult =
    client.getDashboardEmbedUrl(new GetDashboardEmbedUrlRequest()
```

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The following example shows a sample response.

**Example**

```java
//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.
https://spaceneedle-alpha.amazon.com/embed/d11facd655b645878350470a1895d9fc_
System.out.println(dashboardEmbedUrlResult.getEmbedUrl());
```

The following example shows the Java code that you can use to create the client.

**Example**

```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();
}
```

**Python3 Example for Getting the Dashboard URL from the App Server**

The following example shows the Python3 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. For more information, see HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server (p. 556).

**Example**

```python
import botocore.session
session = botocore.session.get_session()
client = session.create_client("quicksight", region_name='us-east-1')
client.get_dashboard_embed_url(AwsAccountId="111122223333", DashboardId="1c1fe111-e2d2-3b30-44ef-a0e11111cdde", IdentityType="IAM", SessionLifetimeInMinutes=100, ResetDisabled=True, UndoRedoDisabled=True)
```
.NET/C# Example for Getting the Dashboard URL from the App Server

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. For more information, see HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server (p. 556).

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
        }).Result.EmbedUrl
    );
} catch (Exception ex) {
    Console.WriteLine(ex.Message);
}
```

HTML Example for Embedding a Dashboard with Amazon QuickSight Using the URL from the App Server

The following example shows HTML that you can use to display an embedded dashboard. This example uses JavaScript. You can use the Amazon QuickSight Embedding SDK (JavaScript) to integrate Amazon QuickSight dashboards in your application pages, set defaults, connect controls, and handle errors. The SDK is also available on GitHub. However, you can achieve the same result with any of the AWS SDK supported languages. For more information, see Tools for Amazon Web Services.

Before you can use this example, you need to get the URL from the app server, as shown in previous sections. There are examples of this in various languages in the following sections.

```html
<!DOCTYPE html>
<html>
<head>
    <title>Basic Embed</title>
    <script src="https://unpkg.com/amazon-quicksight-embedding-sdk@1.0.3/dist/quicksight-embedding-js-sdk.min.js" />
    <script type="text/JavaScript">
        var dashboard
        function onDashboardLoad(payload) {
            console.log("Do something when the dashboard is fully loaded.");
        }
        function onError(payload) {
            console.log("Do something when the dashboard fails loading");
        }
```
function embedDashboard() {
    var containerDiv = document.getElementById("dashboardContainer");
    var options = {
        container: containerDiv,
        parameters: {
            country: "United States"
        },
        scrolling: "no",
        height: "700px",
        width: "1000px"
    };
    dashboard = QuickSightEmbedding.embedDashboard(options);
    dashboard.on("error", onError);
    dashboard.on("load", onDashboardLoad);
}

function onCountryChange(obj) {
    dashboard.setParameters({country: obj.value});
}
</script>
</head>
<body onload="embedDashboard()">
<span>
    <label for="country">Country</label>
    <select id="country" name="country" onchange="onCountryChange(this)"
        onchange="onCountryChange(this)"
        value="United States">United States</option>
        value="Mexico">Mexico</option>
        value="Canada">Canada</option>
    </select>
</span>
<div id="dashboardContainer"></div>
</body>
</html>

How Embedded Amazon QuickSight Dashboards Work

Embedded dashboards provide the same level of interactivity as Amazon QuickSight. They support the following interactions available in Amazon QuickSight dashboards:

- Drill-down, both implicit (time hierarchies) and explicit (defined by the user)
- Custom actions (link to a new tab)
- On-screen filters
- Download to CSV
- Sorting on visuals
- Email report opt-in
- Reset dashboard to defaults option
- Undo and redo actions on the dashboard

All features available to a reader on the web dashboard experience are available to an embedded user. Authors of dashboards can determine whether to enable features such as advanced filtering (left filter panel, filter restatement icon and focus/exclude options) and download to CSV option.
Embedded dashboards support features that provide a customized view of data with features, such as row-level security and dynamic default values for filters. You can customize dashboards using the regular Amazon QuickSight dashboard customization options. From the JavaScript SDK, Amazon QuickSight also supports the following abilities:

- Create an iframe of the preferred size to contain the Amazon QuickSight dashboard
- Dynamically authenticate the user
- Enable or disable email report subscription options
- Enable or disable undo/redo options on embedding chrome

To enable you to customize the dashboard with your app's theme, Amazon QuickSight hides the top navigation bar. When you publish a dashboard, you can also choose to hide the advanced filtering options and the on-sheet filter controls. That way, you can use controls that are embedded in your app instead. You can also pass in fragments by using the dashboard URL to further customize the view of the data.

Pricing and Licensing for Embedded Dashboards with Amazon QuickSight

Following, you can find pricing and licensing information for using embedded dashboards with Amazon QuickSight Enterprise edition.

Pricing for Embedded Dashboards with Amazon QuickSight

Embedded dashboards are billed in a way that is similar to billing for readers. Each viewer gets a 30-minute session charged at $0.30, with a max charge of $5 per user per month. Session authentication in Amazon QuickSight expires after 10 hours. Currently, if the hosting app needs sessions longer than 10 hours, users see a time-out page.

Licensing for Embedded Dashboards with Amazon QuickSight

All embedded iframes feature a "Powered by Amazon QuickSight" label, along with required legal notices. Loading animations feature an Amazon QuickSight logo.

Each individual user who accesses an embedded dashboard is licensed separately, and must be a user of Amazon QuickSight. As with dashboards within Amazon QuickSight, embedded dashboards need to be shared with a group that the user is a member of. Or embedded dashboards can be shared explicitly with each user.

Routing more than one user through a single Amazon QuickSight user is not yet supported. Doing this triggers throttling at the user level, so that the same user identity can't access Amazon QuickSight from multiple browsers. If you need to use multiple embedded dashboards on the same page, contact the Amazon QuickSight team to discuss your use case.

Security and User Provisioning for Embedded Dashboards in Amazon QuickSight

You can control access to dashboards through user groups, which can be programmatically managed using the group API operations. You can also use features such as row-level security to control granular access to data.

Embedded dashboards provide secure access and seamless integration with websites or apps by using transparent authentication by using IAM roles, SAML, or OpenID Connect. Each individual viewer of an
embedded dashboard requires a valid Amazon QuickSight session token. You can provision viewers of embedded dashboards as users of Amazon QuickSight by one of the following methods:

- On the fly, by using Amazon QuickSight's just-in-time user provisioning capabilities
- In advance, by using available user management API operations

To enable a seamless authentication experience for users on the embedded page, you can validate the user by providing them an AWS role. Or you can authenticate them using SAML/Open ID connect when displaying the iframe on the webpage or app. The JavaScript SDK validates the users with their AWS credentials and, on successful completion, provides access to the embedded Amazon QuickSight dashboard.

To ensure that the dashboards are embedded only in authorized apps, an Amazon QuickSight admin must add each domain that you want to use in the Amazon QuickSight settings. For more information, see Adding Domains for Embedded Dashboard Users (p. 615).

You can use AWS CloudTrail auditing logs to get information about the number of dashboards embedded, access rates, and domains where they are embedded.

**Limitations for Embedded Dashboards in Amazon QuickSight**

Following, you can find information regarding limitations and other things you should be aware of when using embedded dashboards:

- We encourage users of Active Directory to use reader roles to provide data analysis capabilities.
- Users who are signed in to the AWS Management Console can encounter an error when opening an embedded dashboard in Amazon QuickSight with a different user account.
- Currently, users of the hosting app have access to the console with limited permissions.
- You can't access the full Amazon QuickSight app from the embedded dashboard. Instead, access Amazon QuickSight separately using the authentication method that you normally use to access the dashboard.
- If the underlying dashboard is deleted, users see an Amazon QuickSight error page.

**Scenarios for Embedding Dashboards with Amazon QuickSight**

Following are some business scenarios and how Amazon QuickSight applies to them.

**Scenario 1**

You can embed dashboards in an app. You can use Amazon QuickSight to build interactive dashboards that are seamlessly embedded in your SaaS app. Your users log in to the app and securely view customized and easy-to-use dashboards. You don't have to provision servers, manage infrastructure, or develop your own code to create charts.

**Scenario 2**

You can embed dashboards in a website where users log in. Using Amazon QuickSight, you can share interactive data dashboards with all your authenticated intranet users, without needing to purchase software for every user or server infrastructure. Amazon QuickSight runs in the cloud, scales to
thousands of users, and offers pay-per-session pricing to bring large-scale solutions within reach. The code required to implement embedded dashboards is minimal, and fast to implement.

**Scenario 3**

You currently can’t embed dashboards in a website where users are anonymous. If a single user accesses the same dashboard from multiple locations, their usage is automatically throttled. This means that the first user sees the dashboard, and then the request times out for subsequent users. This results in an inconsistent user experience until each connection times out. Embedding dashboards in an anonymous website is not currently supported.

**Scenario 4**

You can’t currently embed dashboards with no connectivity as a static report. Using embedded dashboards for display only is not supported. However, if you have this requirement, you could potentially use a screenshot of your visual in your display. But users can’t interact with it, and you have to refresh it using a different mechanism.

### Using Amazon QuickSight with the AWS SDKs

Using Amazon QuickSight, you can manage some aspects of your deployment by using the AWS SDKs. You can use one of 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](https://aws.amazon.com/documentation/). For more information, see [Amazon QuickSight API Reference](https://docs.aws.amazon.com/amazonsqs/)

**Topics**

- Permissions for Using Amazon QuickSight from the AWS SDKs (p. 560)
- Amazon QuickSight and the AWS CLI (p. 561)
- Amazon QuickSight Java SDK (p. 561)
- Amazon QuickSight JavaScript (Node.js) SDK (p. 563)
- Amazon QuickSight Python3 SDK (p. 563)
- Amazon QuickSight .NET/C# SDK (p. 564)
- Terminology (p. 565)

### Permissions for Using Amazon QuickSight from the AWS SDKs

Before you can call the Amazon QuickSight 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 the call and the client tells you what the missing permission is. You can use asterisk (*) in the Resource field of your permission policy in lieu of explicit resources, but it is highly 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. 648)
- Actions, Resources, and Condition Keys

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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.

```
{
  "Effect": "Allow",
  "Action": "quicksight:CreateGroupMembership",
  "Condition": {
    "StringNotEquals": {
      "quicksight:UserName": "user1"
    }
  }
}
```

Amazon QuickSight and the 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.

   ```bash
   aws configure
   ```
3. Look at the Amazon QuickSight SDK help by issuing the following command:

   ```bash
   aws quicksight help
   ```
4. To get detailed instructions on how to use an API, enter its name followed by help, like so:

   ```bash
   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.

   ```bash
   aws quicksight list-users --aws-account-id aws-account-id --namespace default --region us-east-1
   ```

Amazon QuickSight 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:
AWSQuickSightJavaClient-1.11.11.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 your 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](#)
- `commons-logging-1.2.jar` — See [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](#)
- `joda-time-2.1.jar` — See [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")).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.

Amazon QuickSight 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.

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',
    });

console.log(quicksight.config.apiConfig.operations);

quicksight.listUsers({
    'AwsAccountId': 'relevant_AWS_account_ID',
    'Namespace': 'default',
}, function(err, data) {
    console.log('---');
    console.log('Errors: ');
    console.log(err);
    console.log('---');
    console.log('Response: ');
    console.log(data);
});
```

Amazon QuickSight 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)
```

Amazon QuickSight .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
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)
            );

            var listGroupsRequest = new ListGroupsRequest
            {
                AwsAccountId = AccountID,  
                Namespace = Namespace
            };

            client.ListGroupsAsync(listGroupsRequest).Result.GroupList.ForEach(  
                group => Console.WriteLine(group.Arn)
            );
        }
    }
}
```

**Terminology**

*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 Assume Role functionality when making calls to Amazon QuickSight. AWS approve 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 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.

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:

<table>
<thead>
<tr>
<th>ARN Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>arn:aws:quicksight:us-east-1:111122233333:group/default/MyGroup1</td>
</tr>
<tr>
<td>arn:aws:quicksight:us-east-1:111122233333:user/default/User1</td>
</tr>
<tr>
<td>arn:aws:quicksight:us-west-2:111122233333:dashboard/1a1ac2b2-3fc3-4b44-5e5d-c6db6778df89</td>
</tr>
</tbody>
</table>

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.
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. 567)
- I Can't Connect to My Data Source (p. 567)
- My visual can't find missing columns (p. 574)
- My visual can't find the query table (p. 574)
- My Rows Were Skipped During Data Preparation (p. 575)
- I Can't Add a Visual to My Analysis (p. 575)
- I Get a Feedback Bar Across My Printed Docs (p. 575)
- How Do I Delete My Amazon QuickSight Account? (p. 576)
- My Map Charts Don't Show Locations (p. 576)
- Amazon QuickSight Isn't Working in My Browser (p. 576)
- Troubleshooting Issues When Using Athena with Amazon QuickSight (p. 576)
- My Pivot Table Stops Working (p. 584)
- My Email Sign-in Stopped Working (p. 584)

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 from data set ingestion, see SPICE Ingestion Error Codes (p. 110).
- 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 top right, and then choose Support Center.

I Can't Connect to My Data Source

Use this section to help you troubleshoot connections to data sources. Before you continue, verify that the 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. 568)
- I Can't Connect to Amazon Athena (p. 568)
- I Can't Connect Although My Data Source Connection Options Look Right (SSL) (p. 569)
I Need to Validate the Connection to My Data Source, or Change Data Source Settings

If you need to update your data source, or you got a connection error and need to check your settings, follow these steps and validate your connection to the data source.

1. From the QuickSight home screen, choose Manage data.
2. Choose New data set.
3. Scroll to FROM EXISTING DATA SOURCES.
4. Choose the data source you want to test or change.
5. If the option is offered, choose Edit/Preview data.
6. Choose Validate connection.
7. Make any changes you want to make, then choose Update data source.

I Can't Connect to Amazon Athena

You get an insufficient permissions error when your run a query and the permissions aren't configured. To verify that you can connect Amazon QuickSight to Amazon Athena, check these settings:

- AWS resource permissions inside of Amazon QuickSight
- IAM (IAM) policies
- Amazon S3 location
- Query results location
- AWS KMS key policy (for encrypted data sets only)

Use the following procedure to make sure that you authorized Amazon QuickSight to use Athena. Permissions to AWS resources apply to all Amazon QuickSight users.

To authorize Amazon QuickSight to access Athena

1. In the AWS Region list at top right, choose the US East (N. Virginia) Region. You use this AWS Region temporarily while you edit your account permissions.
2. Choose your profile name (top right). Choose Manage QuickSight, and then choose Security & permissions.
3. Choose Add or remove.
4. Locate Athena in the list. Clear the check box next to it, and then enable it. Then choose Connect both.
5. Select the buckets you want to access from Amazon QuickSight.
   The settings for S3 buckets that you access here is the same one that you access by choosing Amazon S3 from the list of AWS Services. Be careful you don't inadvertently disable a bucket that someone else uses.
6. Choose Select to save your S3 buckets.
7. Choose Update to save your new settings for Amazon QuickSight access to AWS services. Or, choose Cancel to exit without making any changes.
8. If you changed your AWS Region during the first step of this process, change it back to the AWS Region that you want to use.

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.

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 the policy has the correct permissions. Choose a policy you want to verify, 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.

The IAM user needs access to read and write to the results location in S3. Athena stores query results in `aws-athena-query-results-<ACCOUNTID>-<REGION>`. Let Athena create the bucket using the name it requires, and then add it to the list of buckets that QuickSight can access. Also, if the data set is encrypted, the IAM user needs to be a key user in the specified KMS key's policy.

**Important**
Do not put the endpoint in the S3 URL.
This format is correct: `s3://bucket/path`
This format generates an "Access Denied" error: `s3://us-east-1.amazonaws.com/bucket/path`

To set permissions to your Athena query results location

2. Choose Settings and get the value in Query result location. If Encrypt query results is enabled (selected), check whether it uses SSE-KMS or CSE-KMS, and note the key.
3. Make sure that your IAM user has access to the correct bucket by opening the S3 console at https://console.aws.amazon.com/s3/. Alternatively, if you are managing access with an access control list (ACL), check the ACLs.
4. If your data set is encrypted (Encrypt query results is enabled), 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 in IAM.

To grant access to the S3 bucket used by Athena

1. Open the Amazon S3 console at 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.

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 he can connect a different database in another AWS Region. He checks other versions of the same database and he can connect easily.

2. The administrator reviews the issue and decides to verify that the certificates are working correctly. She 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:

```none
... 
... 
... 
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
```
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.

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.

<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ssl_accept_renegotiates</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_accepts</td>
<td>1</td>
</tr>
<tr>
<td>Ssl_callback_cache_hits</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_cipher</td>
<td></td>
</tr>
<tr>
<td>Ssl_cipher_list</td>
<td></td>
</tr>
<tr>
<td>Ssl_client_connects</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_connect_renegotiates</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_cipher_verify_depth</td>
<td>18446744073709551615</td>
</tr>
<tr>
<td>Ssl_cipher_verify_mode</td>
<td>5</td>
</tr>
<tr>
<td>Ssl_default_timeout</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_finished_accepts</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_finished_connects</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_hits</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_misses</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_mode</td>
<td>SERVER</td>
</tr>
<tr>
<td>Ssl_session_cache_overflows</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_size</td>
<td>128</td>
</tr>
<tr>
<td>Ssl_session_cache_timeout</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_sessions_reused</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_used_session_cache_entries</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_verify_depth</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_verify_mode</td>
<td>0</td>
</tr>
</tbody>
</table>

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.
If SSL is disabled, you see results like the following.

<table>
<thead>
<tr>
<th>Variable_name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ssl_accept_renegotiates</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_accepts</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_callback_cache_hits</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_cipher</td>
<td></td>
</tr>
<tr>
<td>Ssl_cipher_list</td>
<td></td>
</tr>
<tr>
<td>Ssl_client_connects</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_connect_renegotiates</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_ctx_verify_depth</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_ctx_verify_mode</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_default_timeout</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_finished_accepts</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_finished_connects</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_hits</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_misses</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_mode</td>
<td>NONE</td>
</tr>
<tr>
<td>Ssl_session_cache_overflows</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_size</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_session_cache_timeouts</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_sessions_reused</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_used_session_cache_entries</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_verify_depth</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_verify_mode</td>
<td>0</td>
</tr>
<tr>
<td>Ssl_version</td>
<td></td>
</tr>
</tbody>
</table>

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, you must configure authentication and create a valid manifest file inside the bucket you are trying to access. You also need to 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 top 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 (top 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. Select the buckets you want to access from Amazon QuickSight. Then choose Select.
6. Choose Update.
7. If you changed your AWS Region during the first step of this process, change it back to the AWS Region you want to use.

We strongly recommend that you make sure that your manifest file is valid. If Amazon QuickSight can't parse your file, it gives you an error similar to "We can't parse the manifest file as a valid JSON" or "We can't connect to the S3 bucket."

To verify your manifest file

1. Open your manifest file. You can do this directly from the Amazon S3 console at https://console.aws.amazon.com/s3/. Navigate to your manifest file and choose Open.
2. Make sure that the URI or URLs provided inside the manifest file indicate the file or files that you want connect to.
3. Make sure that your manifest file is formed correctly, if you use a link to the manifest file rather than uploading the file. The link shouldn't have any additional phrases after the word .json. You can get the correct link to an S3 file by viewing its Link value in the details on the S3 console.
4. Make sure that the content of the manifest file is valid by using a JSON validator, like the one at https://jsonlint.com.
5. Verify permissions on your bucket or file. In the https://console.aws.amazon.com/s3/, navigate to your Amazon S3 bucket, choose the Permissions tab, and add the appropriate permissions. Make sure that the permissions are at the right level, either on the bucket or on the file or files.
6. If you are using the s3:// protocol, rather than https://, make sure that you reference your bucket directly. For example, use s3://mybucket/myfile.csv instead of s3://s3-us-west-2.amazonaws.com/mybucket/myfile.csv. Doubly specifying Amazon S3, by using s3:// and also s3-us-west-2.amazonaws.com, causes an error.

For more information on manifest files and connecting to Amazon S3, see Supported Formats for Amazon S3 Manifest Files (p. 91).

In addition, verify that your Amazon S3 data set was created according to the steps in Creating a Data Set Using Amazon S3 Files (p. 88).

If you use Athena to connect to Amazon S3, see I Can't Connect to Amazon Athena (p. 568).

I Can't Connect to RDS

For details on troubleshooting connections to Amazon RDS, see Creating Data Sets from New Database Data Sources (p. 99).
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 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 effected visuals.
  • Choose Save & visualize.

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 “x_table” to “y_table”, you can update the FROM clause in the SQL statement to refer to the new table instead.

• Choose Save & visualize.

• Click each visual and re-add the fields as needed.

• If the dataset is not based on custom SQL:
  • Create a new dataset using the new table, “y_table” for example.
  • Open your analysis.
My Rows Were Skipped During Data Preparation

When you prepare data, Amazon QuickSight previews a portion of your data for you to work with. If it can't interpret a row for any reason, it skips this row. Then it displays a message to say how many rows are skipped.

Here is a list of things to check:

- Inconsistency between the field data type and the field data, for example text data in a field with a numeric data type.
- Having a file that contains a header but having the `Contains header` upload setting deselected.
- Having the data source data violate one or more Data Source Limits (p. 70).
- Field data that is incompatible with or excluded by the function used in a calculated field. For example, if you have a calculated field that uses `parseDate` (p. 483), rows with data that doesn't evaluate to a valid date are skipped.

I Can't Add a Visual to My Analysis

If you are editing an analysis for a selected data source, and the connection to the data source terminates 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. 180). For help with preparing data for geospatial charts, see Adding Geospatial Data (p. 175).

Amazon QuickSight Isn't Working in My Browser

If you can't view Amazon QuickSight correctly in your Chrome browser, follow these steps to fix the problem:

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

This section covers troubleshooting various issues you might encounter when using Athena with Amazon QuickSight. This list came from support calls frequently made by Amazon QuickSight customers.

Topics

- Insufficient Permissions When Using Athena with Amazon QuickSight (p. 576)
- Table Not Found When Using Athena with Amazon QuickSight (p. 577)
- Column Not Found When Using Athena with Amazon QuickSight (p. 578)
- Staging Bucket No Longer Exists When Using Athena with Amazon QuickSight (p. 578)
- Query Timeout When Using Athena with Amazon QuickSight (p. 578)
- Invalid Data When Using Athena with Amazon QuickSight (p. 578)
- Table Incompatible When Using AWS Glue with Athena in Amazon QuickSight (p. 579)
- Workgroup or Output Errors When Using Amazon Athena with Amazon QuickSight (p. 583)

Insufficient Permissions When Using Athena with Amazon QuickSight

If you receive an "insufficient permissions" error, try these steps to resolve your problem:
1. Make sure that Amazon QuickSight can access the S3 buckets used by Athena.
   a. To do this, choose your profile name (top right). Choose Manage QuickSight, and then choose Security & permissions.
   b. Choose Add or remove.
   c. Locate Athena in the list. Clear the check box next to it, and then enable it. Then choose Connect both.
   d. Select the buckets you want to access from Amazon QuickSight.
      
      The settings for S3 buckets that you access here is the same one that you access by choosing Amazon S3 from the list of AWS Services. Be careful 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-<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.

### 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 Athena console, check for your table under the corresponding schema. You can recreate the table in Athena and then create a new data set 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 locate 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
```
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 data set..., then Edit analysis data sets.

In the Data sets in this analysis screen, choose Edit near your data set to refresh the data set. 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 Athena console 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.

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 data set using Athena, Amazon QuickSight creates an S3 bucket. By default, this bucket has a name similar to "aws-athena-query-results->region<->account-id<". 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. Alternatively, 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.

1. Use the CLI to learn which AWS Glue tables have no `TableType` attributes.

   ```shell
   aws glue get-tables --database-name <your_database_name>
   
   For example, you can run the following command in the CLI.
   
   ```shell
   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": ",",
           "compressionType": "none",
           "skip.header.line.count": "1",
           "sizeKey": "75",
           "averageRecordSize": "7",
           "classification": "csv"
         }
       }
     ]
   }
   ```
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": {
    "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",
  "averageRecordSize": "7",
  "objectCount": "1",
  "sizeKey": "75",
  "delimiter": ",",
  "compressionType": "none",
  "skip.header.line.count": "1"}
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": ",",
      "compressionType": "none",
      "recordCount": "9",
      "CrawlerSchemaDeserializerVersion": "1.0",
      "typeOfData": "file",
      "skip.header.line.count": "1"
    }
  }
}'
```
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. 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. 400).

**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. 585)
• AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587)
• Supported Browsers (p. 588)
• Signing Up for Amazon QuickSight (p. 589)
• Managing Amazon QuickSight Usage (p. 594)

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. 2) 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.

Each AWS Region contains two or more distinct locations called Availability Zones (AZs). Each Availability Zone is a distinct location within a Region that is insulated from failures in other Availability Zones. An Availability Zone provides inexpensive, low-latency network connectivity to other Availability Zones in the same Region. For more information about AWS Regions and AZs, see Global Infrastructure.

AWS uses IP address ranges to safe-list Amazon QuickSight access to data sources in Enterprise and Standard edition. Enterprise Edition also supports private VPC access, which doesn't need safe-listing.

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 (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
- Europe (Frankfurt) (eu-central-1)
  - Website for user access - https://eu-central-1.quicksight.amazonaws.com
  - IP address range – 35.158.127.192/27
When you sign up for Amazon QuickSight, you choose a home AWS Region. This is the AWS Region where you want Amazon QuickSight to allocate the initial SPICE capacity associated with any user accounts you create. Typically, this is the AWS Region closest to your physical location. It's also usually the same AWS Region where you have the majority of your other AWS resources (like Amazon RDS instances). For more information about how SPICE capacity is allocated, see Managing SPICE Capacity (p. 603).

When you sign in to Amazon QuickSight using the default URL of aws.amazon.com/quicksight, the US East (N. Virginia) (us-east-1) Region is selected by default. You might also sign in using a URL that specifies a supported AWS Region, for example us-west-2.quicksight.aws.amazon.com. In this case, the AWS Region specified in the URL is selected. You can change to other supported AWS Regions by using the Region selector on the right side of the application bar.

You can autodiscover your Amazon RDS instances and Amazon Redshift clusters that run in any of the AWS Regions that Amazon QuickSight supports. If you enable autodiscovery, the autodiscovered resources displayed reflect whatever AWS Region you currently have selected. You can still use AWS resources in other AWS Regions by manually creating connections to them. For more information about enabling autodiscovery of AWS data stores, see Authorizing Connections from Amazon QuickSight to AWS Data Stores (p. 625).

It is important to remember that each AWS Region is independent. Any Amazon QuickSight resources you create, like data sets and analyses, exist only in the AWS Region in which you create them. You can't move these resources to other AWS Regions.

## 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>
</tbody>
</table>
Signing Up for Amazon QuickSight

If you are new to AWS, see Setting Up Amazon QuickSight (p. 21) to create an Amazon QuickSight account.

If you have an existing AWS account, see Subscribe to Amazon QuickSight (p. 589) to create an Amazon QuickSight account.

If your organization has an existing Amazon QuickSight account and you want to request access to it, follow the procedure in Request Access to an Existing Amazon QuickSight Account (p. 590).

Note
To avoid confusion with AWS users and AWS administrators, we refer to all Amazon QuickSight users as Amazon QuickSight users. Users of Amazon QuickSight can be Readers (viewers), Authors (analysts), or Admins (administrators).

For information on supported browsers, see Supported Browsers (p. 588).

Topics
- Subscribe to Amazon QuickSight (p. 589)
- Request Access to an Existing Amazon QuickSight Account (p. 590)

Subscribe to Amazon QuickSight

Use this topic to subscribe to Amazon QuickSight using an existing AWS account. If you don't have an AWS account, see Setting Up Amazon QuickSight (p. 21) for streamlined sign-up.

You can have only one Amazon QuickSight account for each AWS account. The Amazon QuickSight account contains all the users who use Amazon QuickSight. Users can sign in directly, through an AWS Identity and Access Management (IAM) user or role, or through Single Sign-On. For details on using IAM, see Identity and Access Management in Amazon QuickSight (p. 640). For details on using Single Sign-On, see Single Sign-On Access to Amazon QuickSight Using SAML 2.0 (p. 656).

Before you begin, you must be able to connect to an existing AWS account. If your company already has an AWS account, contact your AWS account administrator for assistance.

To subscribe to Amazon QuickSight

1. Sign in to your AWS account and open Amazon 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**. A screen titled **Create your QuickSight account** appears.

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

   If you choose Enterprise, you first choose the method that you want to connect with. Choose one of the following.

   • **Use Role Based Federation (SSO)**
   • **Use Active Directory**

5. For both Standard and Enterprise editions, make choices for the following items:

   • Enter a unique account name for Amazon 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 Amazon 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 default SPICE (p. 2) capacity. This is where your account’s free SPICE capacity is allocated after signing up. You can’t change the default capacity AWS Region later, but you can always purchase additional SPICE capacity in different AWS Regions as needed. For information on AWS Regions, see **AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587)**.
   • (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. 621)**.

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

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

For Enterprise edition, there are a few more steps to complete: configuring users and groups to access Amazon QuickSight.

After you sign up for Amazon QuickSight, users can start to sign in, connect to data, and create analyses.

To set up data sources for your users, see **Working with Data Sources in Amazon QuickSight (p. 67)**.

To enable self-provisioning for Amazon QuickSight by setting an IAM policy on a role with permissions for **CreateUser** or **CreateAdmin**, see **Identity and Access Management in Amazon QuickSight (p. 640)**.

To start creating analyses, see **Getting Started with Data Analysis in Amazon QuickSight (p. 21)**.

For more information about managing users, see **Managing User Access Inside Amazon QuickSight (p. 660)**.

**Request Access to an Existing Amazon QuickSight Account**

If your organization has already signed up for Amazon QuickSight, you can ask your Amazon QuickSight administrator to add you as a user.
For Standard edition accounts, your Amazon QuickSight administrator can give you access through your IAM credentials, through Single Sign-On (SSO), or through your email address. For more information for Standard edition users, see Getting Access as a New Amazon QuickSight Standard Edition User (p. 591).

For more information for Enterprise edition users, see Getting Access as a New Amazon QuickSight Enterprise Edition User (p. 592).

After you sign in for the first time, you can connect to data and creating analyses. For more information about creating your first analysis, see Getting Started with Data Analysis in Amazon QuickSight (p. 21).

Topics
- Getting Access as a New Amazon QuickSight Standard Edition User (p. 591)
- Getting Access as a New Amazon QuickSight Enterprise Edition User (p. 592)

Getting Access as a New Amazon QuickSight Standard Edition User

Your Amazon QuickSight administrator uses either your IAM credentials, your Single Sign-On (SSO) service, or your email address to create your Amazon QuickSight user account. Then Amazon QuickSight sends you an email inviting you to activate it. The invitation email you receive indicates what type of credentials you should use.

**Note**
If your company uses a Single Sign-On (SSO) service with Amazon QuickSight, your administrator must provide instructions on how to sign in. For more information on how this is set up, see Single Sign-On Access to Amazon QuickSight Using SAML 2.0 (p. 656).

Signing In as a New User Using Credentials Based on Your Email Address

Use the following procedure to sign in as a new user who has an Amazon QuickSight–only account based on an email address.

**To sign in as a new user who has an account based on an email address**

1. In your invitation email, choose the link in the body of the email to open the Amazon QuickSight sign-up page.
2. Complete your user account by typing a password.
   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 four categories:
   - Lowercase letters (a–z)
   - Uppercase letters (A–Z)
   - Numbers (0–9)
   - Nonalphanumeric characters (~@#$%^&*_-+=`|(){}[]:;'",<>,.?/)  
3. Choose Create account and sign in.
4. Choose Continue. Doing this takes you to the Amazon QuickSight start page.

**Signing In as a New User Using Your IAM Credentials**

Use the following procedure to sign in to Amazon QuickSight as a new user who has IAM credentials.

**To sign in as a new user with IAM credentials**

1. When you receive the invitation email, go to the Amazon QuickSight sign in page, https://quicksight.aws.amazon.com/.
2. For **Account name**, enter the account name in your invitation email, and then choose **Continue**.
3. Enter your IAM user name in **Email address or username**.
4. Enter your IAM password in **Password**.
5. Choose **Sign in**.

**Self-Provisioning an Amazon QuickSight User**

Use the following procedure to sign in to Amazon QuickSight as a new user who has access to Amazon QuickSight, but has not yet created a login. For this process to work, the AWS administrator must have granted permissions, using an AWS user or group policy in IAM. For more information, see **Identity and Access Management in Amazon QuickSight (p. 640)**.

**To sign in as a new user with access but no login**

1. When you are invited to do so, go to the Amazon QuickSight sign in page, [https://quicksight.aws.amazon.com/](https://quicksight.aws.amazon.com/).
2. For **Account name**, enter the Amazon QuickSight account name (not the AWS account number). Your administrator or manager might provide this name. Then choose **Continue**.
3. Enter your new Amazon QuickSight user name in **Email address or username**.
4. Enter your new Amazon QuickSight password in **Password**.
5. Choose **Sign in**.

**Self-Provisioning an Amazon QuickSight Administrator**

Use the following procedure to set or create the administrator for Amazon QuickSight. This procedure doesn’t require using an alias for your account or your directory.

**To make a user the Amazon QuickSight administrator**

1. Create the AWS user and grant permissions:
   a. Use IAM to create the user that you want to be the administrator of Amazon QuickSight. Or, identify an existing user in IAM for the administrator role. If you prefer, you can put the user inside a new group, for manageability.
   b. Grant the user (or group) sufficient permissions, as described in **IAM Policy Examples for Amazon QuickSight (p. 648)**.

   For more information on working with IAM, see **Identity and Access Management in Amazon QuickSight (p. 640)**.
2. Log in to your AWS console with the target user’s credentials.
4. Enter your email address, and choose **Continue**.

On success, the target IAM user is now an Amazon QuickSight administrator.

**Getting Access as a New Amazon QuickSight Enterprise Edition User**

Before you begin, your Amazon QuickSight administrator must add your network user account to a Microsoft Active Directory group associated with Amazon QuickSight. Then, the administrator must give you the information that you need to activate your Amazon QuickSight user account, including the Amazon QuickSight account name.
Use the following procedure to sign in to Amazon QuickSight as a new Enterprise edition user.

**To sign in as a new Enterprise edition user**

1. Choose Standard or Enterprise. To confirm, choose Continue. A screen titled Create your QuickSight account appears.
2. (Optional) If you choose Standard, skip this step and go to the next one.

   If you choose Enterprise, you can choose the method you want to use to connect. You can choose one of the following:

   - Use Role Based Federation (SSO)
   - Use Active Directory

   **Note**
   If you want to use IAM to manage your users, choose Use Role Based Federation (SSO).

   If you choose Active Directory, you can add groups and users at this point. However, you also can do this later.

3. For all editions, make choices for the following items:

   - Enter a unique account name for Amazon 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, the alias becomes the account name.
   - Enter a notification email address for the Amazon QuickSight account owner or group. This email address receives service and usage notifications
   - (Optional) Choose a capacity AWS Region for SPICE (p. 2). New Enterprise accounts must start in US East (N. Virginia). Users can change their AWS Region at any time. For information on AWS Regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587).
   - (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. 621).

4. Before you choose Finish, make sure that you chose the correct edition (Standard or Enterprise). Currently, to change editions you must either unsubscribe and create a new Amazon QuickSight account or contact the service team for migration assistance.

   Verify the choices you made, then choose Finish.

5. (Optional) If you are using Standard edition, skip this step. For Enterprise edition, to open Amazon QuickSight choose Go to Amazon QuickSight. To manage Active Directory user groups, choose Manage access to QuickSight.

   Otherwise, close the browser and notify your users how to connect.

After you sign up for Amazon QuickSight, users can log in, connect to data, and create analyses. You can send them a link to Amazon QuickSight Quick Start Guide (p. 19) to provide them with information to get started.

To enable self-provisioning for Amazon QuickSight by setting an IAM policy on a role with permissions for CreateUser or CreateAdmin, see Identity and Access Management in Amazon QuickSight (p. 640).

To set up data sources for your users, see Working with Data Sources in Amazon QuickSight (p. 67).

For more information about managing users for Amazon QuickSight administrators, see Managing User Access Inside Amazon QuickSight (p. 660).
Managing Amazon QuickSight Usage

If your Amazon QuickSight user account has administrative privileges, you can manage user account subscriptions and SPICE (p. 2) capacity.

Use the following topics to manage subscriptions and SPICE capacity.

**Topics**
- Managing Subscriptions (p. 594)
- Managing SPICE Capacity (p. 603)
- Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 610)
- Changing your Notification Email (p. 613)
- Canceling Your Amazon QuickSight Subscription and Closing the Account (p. 613)
- Adding Domains for Embedded Dashboard Users (p. 615)

Managing Subscriptions

You can purchase standard user subscriptions to get discounted pricing on Amazon QuickSight. When you create an Amazon QuickSight account, you automatically get one free user account. When you invite additional users to Amazon QuickSight, you are 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.

View Current Subscriptions

Use the following procedure 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. The types of user accounts shown are as follows:

- Free users: This is the free user you receive as a standard part of your Amazon QuickSight account.
- Purchased annual subscriptions: These are users covered by purchased subscriptions rather than billed month-to-month.
- Monthly billed users: These are users that are billed month-to-month.

In the following example, the account has 21 users total:

- 1 free user.
- 7 users with annual subscriptions. Only currently active subscriptions are shown here.
- 13 month-to-month users.

Hover over any section of the meter to get details on that user segment.
4. Use the information in the subscriptions table to see what current and future subscriptions you have.

<table>
<thead>
<tr>
<th>Start Date</th>
<th>Time Remaining</th>
<th>Auto-Renewal</th>
<th># of Subscriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 2016</td>
<td>339 days</td>
<td>On</td>
<td>4</td>
</tr>
<tr>
<td>Sep 2016</td>
<td>309 days</td>
<td>On</td>
<td>3</td>
</tr>
<tr>
<td>Nov 2016</td>
<td>---</td>
<td>Off</td>
<td>5</td>
</tr>
<tr>
<td>Nov 2016</td>
<td>---</td>
<td>On</td>
<td>3</td>
</tr>
<tr>
<td>Nov 2016</td>
<td>---</td>
<td>Off</td>
<td>1 (Free trial)</td>
</tr>
</tbody>
</table>

**Purchase Subscriptions**

Use the following procedure 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**.

---

**Edit Subscriptions**

Use the following procedure 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.
Delete Subscriptions

Use the following procedure to delete subscriptions. You can only delete subscriptions that haven't started yet.

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 Amazon QuickSight's Super-fast, Parallel, In-memory Calculation Engine and it's engineered to rapidly perform advanced calculations and serve data. After you import your data into SPICE, its storage and processing capacity speed up your analytical queries. By using SPICE rather than running direct queries on your data, you save time. You save time because you don't need to retrieve the data every time that you change an analysis or update a visual.

You can use the admin page to see how much SPICE capacity you have overall, and how much of that you are using. SPICE capacity is allocated by AWS Region, so the information displayed is for the currently selected AWS Region.

SPICE stores your data until you choose to delete it. You can improve performance by importing the data into SPICE instead of using a direct query to the database. All nondatabase data sets must use SPICE. In Enterprise edition, data in SPICE is encrypted at rest. For more information, see Data Encryption in Amazon QuickSight.

SPICE capacity is pooled across users for the Amazon QuickSight account. All of your default SPICE capacity is allocated to your home AWS Region. The other AWS Regions have no SPICE capacity unless you choose to purchase some.

To free up SPICE capacity, delete unused data sets from SPICE. For more information about deleting a data set, see Deleting a Data Set.

You can purchase additional SPICE capacity if you want to, up to a limit of 1 TB total capacity for each Amazon QuickSight account. If you need an exception to this limit, follow the instructions at AWS Service Limits to submit a limit increase request. You can also release purchased SPICE capacity that you aren't using. Purchasing or releasing SPICE capacity only affects the capacity for the currently selected AWS Region. For information about additional SPICE pricing, see Amazon QuickSight.

Capacity Planning for SPICE

The amount of SPICE capacity a data set 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 data set apply to SPICE capacity.

In capacity planning for SPICE, consider what data types will be defined in the data set. For example, the file you want to import may contain all strings (text). But in order 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 data set 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 data set 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 this:

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

\[
\text{Total bytes of data} = \text{Number of rows} \times \text{Total logical row size in bytes}
\]

\[
\text{GB of SPICE Capacity Needed} = \frac{\text{Total bytes of data}}{1,073,741,824}
\]

For example, let's say you have a table with 5,000,000 rows that you want to import into SPICE. It has 30 numeric fields, 20 date fields, and 10 string fields of 100 bytes each. Your formula looks like this:

\[
\text{Total logical row size in bytes} = \\
\quad 1480 \text{ bytes} = \\
\quad (30 \times 8) \\
\quad + (20 \times 8) \\
\quad + (10 \times (8 + 100)) \\
\]

\[
\text{Total bytes of data} = \\
\quad 5,000,000 \text{ rows} \times 1480 \text{ bytes} = \\
\quad 7,400,000,000 \text{ bytes}
\]

\[
\text{GB of SPICE Capacity Needed} = \frac{7,400,000,000}{1,073,741,824} = 7 \text{ GB}
\]

**View SPICE Capacity and Usage**

Use the following procedure to review your SPICE capacity and usage.

1. Choose your user name on the application bar, and then choose **Manage QuickSight**.
Note
If you are low on SPICE capacity, you can also choose the Buy SPICE alert that appears on the Your Data Sets and Create a Data Set pages.

2. Choose SPICE Capacity.

3. Use the Total SPICE Capacity meter to see your SPICE capacity, broken out by type. Capacity types are as follows:

- Free tier: This is the 1 GB of capacity associated with the free user that you get with every Amazon QuickSight account.
• Free bundled: This is the total default capacity associated with your paid users. You get 10 GB of default SPICE capacity per paid user.

• Purchased: This is the additional SPICE capacity you have purchased.

Hover over any section of the meter to see details on that capacity type.

4. Use the SPICE Usage meter to see your SPICE usage, broken out by type. Usage types are as follows:

• Used capacity: This is used portion of the default SPICE capacity you get per user.

• Unused capacity: This is unused portion of the default SPICE capacity you get per user.

• Releasable unused capacity: This is purchased capacity that isn't in use, and so can be released to reduce costs.

Hover over any section of the meter to see details on that usage type.
Purchase SPICE Capacity

Use the following procedure to purchase additional SPICE capacity.

1. Choose your user name on the application bar and then choose Manage QuickSight.

   Note
   If you are low on SPICE capacity, you can also choose the Buy SPICE alert that appears on the Your Data Sets and Create a Data Set pages.

2. Choose SPICE Capacity.
3. Choose **Purchase more capacity**.

4. For **How much SPICE capacity do you need?**, type the number of gigabytes (GBs) you want to purchase.

5. Choose **Purchase SPICE capacity**.
Release SPICE Capacity

Use the following procedure to release unused purchased SPICE (p. 2) capacity.

1. Before you begin, delete data sets that are using the SPICE capacity you want to release. To learn more about deleting data sets, see Deleting a Data Set (p. 119).
2. Choose your user name on the application bar and then choose Manage QuickSight.

3. Choose SPICE Capacity.

5. For **How much SPICE capacity do you need to release?**, choose **Release all** if you want to release all unused purchased capacity, or choose **Release <amount> GB** and type the number of gigabytes (GBs) that you want to release.

6. Choose **Release SPICE capacity**.

---

**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:

- Active directory integration
- Encryption for data at REST
• Pay-per-session pricing for users in the reader role
• Row-level security
• Hourly refresh of datasets
• Private connections to data in a VPC with a private subnet

To see a full comparison of Standard edition with Enterprise edition, see Amazon QuickSight Editions.

When you upgrade your account, your admins and authors are billed at the Amazon QuickSight Enterprise edition rates. For up-to-date information on rates, see Pricing. To enjoy pay-per-session pricing, you can add additional users as readers. Before you reprovision existing users as readers, 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, data sets, 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 pro-rated for the month of the upgrade. Upgrades to users are also pro-rated. 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. It isn't possible to 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.

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 https://aws.amazon.com/quicksight/.

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 pro-rated for the month of upgrade. Upgrades to Amazon QuickSight users are also pro-rated.

4. When you upgrade to Enterprise edition, your admin and author users retain their roles. You can downgrade users to readers. First make sure to transfer any assets they own that you want to keep. Then, delete them and add them back to your subscription as readers. If you are using Active Directory, delete the authors, move them to the new reader group, then recreate them as readers in Amazon QuickSight.

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.

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.

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 strongly 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. To 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 Dashboard Users

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 allowlist, 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.

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
- https://www.アマゾンドメイン.jp
- https://www.亚马逊域名.cn:1234
- https://111.222.33.44:1234
- https://111.222.33.44

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://111.222.33.44:1234
- https://111.222.33.44:55
For more information about embedded dashboards, see Embedding Amazon QuickSight Dashboards (p. 547).
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

Amazon QuickSight conforms to the AWS shared responsibility model, which includes regulations and guidelines for data protection. AWS is responsible for protecting the global infrastructure that runs all the AWS services. AWS maintains control over data hosted on this infrastructure, including the security configuration controls for handling customer content and personal data. AWS customers and APN partners, acting either as data controllers or data processors, are responsible for any personal data that they put in the AWS Cloud.

**General Recommendations for Working with AWS Services**

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). By doing so, you give each user 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 Secure Sockets Layer (SSL) to communicate with AWS resources.
• 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.

We strongly recommend that you never put sensitive identifying information, such as your AWS 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. When you provide a URL to an external server, don't include credentials information in the URL to validate your request to that server. Also, use HTTPS any time you use a URL, to enforce encrypted connections.

Content delivered to Amazon S3 buckets might contain customer content. For more information about removing sensitive data, see How Do I Empty an S3 Bucket? or How Do I Delete an S3 Bucket?.

For more information about data protection, see the AWS Shared Responsibility Model and GDPR blog post on the AWS Security Blog.

Topics
• Data Encryption in Amazon QuickSight (p. 618)
• Inter-network Traffic Privacy in Amazon QuickSight (p. 619)
• Accessing Data Sources (p. 620)

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. 618)
• Encryption in Transit (p. 619)
• Key Management (p. 619)

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. 610).

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. 676).

**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 (ECDH).

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Curve Diffie-Hellman Ephemeral (ECDHE). Most modern systems such as Java 7 and later support these modes.

**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 autodiscovery, manage permissions, and authorize secure connections to all supported data sources. For details on specific data sources, see Creating a Data Source (p. 75).

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 Amazon QuickSight SSL and CA Certificates (p. 678).

**Topics**
- Required Permissions for Database Credentials (p. 620)
- Allowing Autodiscovery of AWS Resources (p. 621)
- Using other AWS Services: Scoping Down Access (p. 622)
- Authorizing Connections from Amazon QuickSight to AWS Data Stores (p. 625)
- Exploring Your AWS Data in Amazon QuickSight (p. 638)

**Required Permissions for Database Credentials**

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

To connect to a database, you must provide a user name and password. The user account identified by these credentials 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 on, depending on the type of database you are connecting to. These requirements apply for all database instances you connect to, regardless of their environment—that is, whether they are on-premises, in Amazon RDS, in Amazon EC2, or elsewhere.

<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>Instance Type</td>
<td>Tables</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------</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>PostgreSQL</td>
<td>• pg_stats</td>
</tr>
<tr>
<td></td>
<td>• pg_class</td>
</tr>
<tr>
<td></td>
<td>• pg_namespace</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. 679).

**Allowing Autodiscovery of AWS Resources**

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

**Configuring AWS Resources**

Use the following sections to help you configure your AWS resources to work with Amazon QuickSight.

**Configuring Your AWS Data Sources for Amazon QuickSight Access**

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. 625). 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. 628). 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. 625) or Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 628). 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 Non-Default VPC (p. 677).
- 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.

Confirming the Availability of AWS Identity and Access Management (IAM) Roles

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 you to 250 IAM roles, be sure that you have at least one free role for Amazon QuickSight to use if you want Amazon QuickSight to autodiscover your AWS resources.

Using other AWS Services: Scoping Down Access

**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. You can scope down access to those 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.

Before you begin, you need the correct permissions. Your system administrator can give you the correct permissions by creating a policy that allows you to use the following IAM actions, and then associating that policy with your user or group in IAM.

- **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**

1. Choose your user name on the application bar, and then choose Manage QuickSight.
3. Under QuickSight access to AWS services, choose Add or remove.

   A screen appears where you can enable all available AWS services.

   If you see a permissions error, and you’re an authorized Amazon QuickSight administrator, contact your system administrator for assistance.

4. 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. Choose the
check boxes for the services you want to allow. Clear check boxes for services you don't want to allow.

In some cases, you might see a message like this one: 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::111122223333: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 deletes the IAM policy listed in the error message, and reload the Security & permissions screen before you try again.

5. 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, if you don't configure specific permissions for the AWS services that an Amazon QuickSight user can access, Amazon QuickSight uses a default set of permissions, based on your 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**

1. Open the settings screen for Security & permissions, if it isn't already open.
2. Choose your user name on the application bar, 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 Detailed Resource Access to AWS Services

**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, so that 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. 640).
To assign an IAM policy to a user or group

1. Open the settings screen for Security & permissions, if it isn't already open.
2. Choose your user name on the application bar, and then choose Manage QuickSight.
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. The next screen divides the policy assignment process into steps. However, 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.
      - For Assign to all users and groups, enable 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.

- To edit any of your choices, choose that step to edit it.
- To save this policy assignment as a draft, choose **Save as draft**. You can enable the draft at a later time.
- To immediately enable this policy, choose **Save and enable**. This option overwrites any existing policy assignment with the same name.

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**Authorizing Connections from Amazon QuickSight to AWS Data Stores**

**Applies to:** Enterprise Edition and Standard Edition

**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.

**Topics**

- Authorizing Connections from Amazon QuickSight to Amazon RDS DB Instances (p. 625)
- Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 628)
- Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances (p. 635)

**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. 626) or Manually Enabling Access to an Amazon RDS Instance That Is Not in a VPC (p. 627).

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 Data Sets from New Database Data Sources (p. 99).
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 Using a Amazon VPC with Amazon QuickSight (p. 680).

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 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. 587).

   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 maintainence 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. 587).

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. 629) or [Manually Enabling Access to an Amazon Redshift Cluster That Is Not in a VPC](p. 633).

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 Data Sets from New Database Data Sources](p. 99).
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/.
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. 587).

**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. 587).
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 and 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](https://docs.aws.amazon.com/redshift/latest/dg/using-amazon-redshift-spectrum-querying.html).

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 Data Sets from New Database Data Sources (p. 99).

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/](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. 587).

**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.
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. 638)

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/.
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 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 SSO using SAML. You can use AWS IAM to further enhance your security, or for custom options such as embedding dashboards.

Amazon QuickSight Standard edition allows you to manage users entirely within Amazon QuickSight. If you prefer, you can integrate with your existing users, groups, and roles in AWS IAM.

You can use the following tools for identity and access to Amazon QuickSight.

- Using IAM (p. 640) (Standard and Enterprise editions)
- AWS Active Directory (p. 655) (Enterprise edition only)
- Multi-Factor Authentication (MFA) (p. 660) (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. 640)
- Using Amazon QuickSight with IAM (p. 644)
- IAM Policy Examples for Amazon QuickSight (p. 648)
- Provisioning Users for Amazon QuickSight (p. 651)
- Troubleshooting Amazon QuickSight Identity and Access (p. 652)

### 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 username 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 the 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.

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. 644).

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. 648).

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 The IAM Console and Sign-in Page 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 or your IAM user name. You can access AWS programmatically using your root user or IAM user 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.

- **AWS service access** – A service role is an IAM role that a service assumes to perform actions in your account on your behalf. When you set up some AWS service environments, you must define a role for the service to assume. This service role must include all the permissions that are required for the service to access the AWS resources that it needs. Service roles vary from service to service, but many allow you to choose your permissions as long as you meet the documented requirements for that service. Service roles provide access only within your account and cannot be used to grant access to services in other accounts. You can create, modify, and delete a service role from within IAM. For example, you can create a role that allows Amazon Redshift to access an Amazon S3 bucket on your behalf and then load data from that bucket into an Amazon Redshift cluster. For more information, see Creating a Role to Delegate Permissions to an AWS Service in the IAM User Guide.

- **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, 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. AWS evaluates these policies when an entity (root user, IAM user, or IAM role) makes a request. 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.

An IAM administrator can use policies to specify who has access to AWS resources, and what actions they can perform on those resources. 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, role, or group. These policies control what actions that identity 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 such as an Amazon S3 bucket. Service administrators can use these policies to define what actions a specified principal (account member, user, or role) can perform on that resource and under what conditions. Resource-based policies are inline policies. There are no managed resource-based policies.

Access Control Lists (ACLs)

Access control policies (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they are the only policy type that does 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

**Applies to:** Enterprise Edition and Standard Edition

**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. 645)
- Amazon QuickSight Policies (Resource-Based) (p. 647)
- Access Control Lists (ACLs) (p. 647)
- Authorization Based on Amazon QuickSight Tags (p. 647)
- Amazon QuickSight IAM Roles (p. 647)
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. 613).

**Actions**

The Action element of an IAM identity-based policy describes the specific action or actions that will be allowed or denied by the policy. Policy actions usually have the same name as the associated AWS API operation. The action is used 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. 648).
To see the most up-to-date list of Amazon QuickSight actions, see Actions Defined by Amazon QuickSight in the IAM User Guide.

Resources

The Resource element specifies the object or objects to which the action applies. Statements must include either a Resource or a NotResource element. You specify a resource using an ARN or using the wildcard (*) to indicate that the statement applies to all resources.

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

The Condition element (or Condition block) lets you specify conditions in which a statement is in effect. The Condition element is optional. You can build 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.

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. 648).

Amazon QuickSight Policies (Resource-Based)

Amazon QuickSight does not support resource-based policies. However, you can use the Amazon QuickSight console to configure access to other AWS resources in your AWS account.

Access Control Lists (ACLs)

Access control lists (ACLs) are lists of grantees that you can attach to resources. They grant accounts permissions to access the resource to which they are attached. You can attach ACLs to an Amazon S3 bucket resource. For more information about attaching ACLs to buckets, see ADD XREF TO YOUR DOCS HERE.

With Amazon S3 access control lists (ACLs), you can manage access to bucket resources. Each bucket has an ACL attached to it as a subresource. It defines which AWS accounts, IAM users or groups of users, or IAM roles are granted access and the type of access. When a request is received for a resource, AWS checks the corresponding ACL to verify that the requester has the necessary access permissions.

When you create a bucket resource, Amazon S3 creates a default ACL that grants the resource owner full control over the bucket. In the following example bucket ACL, John Doe is listed as the owner of the bucket and is granted full control over that bucket. An ACL can have up to 100 grantees.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<Owner>
  <ID>c1daexampleaf850ea79cf0430f33d72579fd1611c97f7ded193374c0b1636</ID>
  <DisplayName>john-doe</DisplayName>
</Owner>
<AccessControlList>
<Grant>
  <Grantee xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:type="Canonical User">
    <ID>c1daexampleaf850ea79cf0430f33d72579fd1611c97f7ded193374c0b1636</ID>
    <DisplayName>john-doe</DisplayName>
  </Grantee>
  <Permission>FULL_CONTROL</Permission>
</Grant>
</AccessControlList>
</AccessControlPolicy>
```

The ID field in the ACL is the AWS account canonical user ID. To learn how to view this ID in an account that you own, see Finding an AWS Account Canonical User ID.

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 Embedding
Amazon QuickSight Dashboards (p. 547).

For more information on how Amazon QuickSight uses IAM roles, see Using Amazon QuickSight with
IAM (p. 644) and IAM Policy Examples for Amazon QuickSight (p. 648).

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. 648)
• IAM Identity-Based Policies for Amazon QuickSight: Creating Users (p. 648)
• IAM Identity-Based Policies for Amazon QuickSight: All Access for Standard Edition (p. 649)
• IAM Identity-Based Policies for Amazon QuickSight: All Access for Enterprise Edition (p. 649)
• IAM Identity-Based Policies for Amazon QuickSight: Active Directory Groups (p. 650)
• IAM Identity-Based Policies for Amazon QuickSight: Accessing AWS Resources (p. 650)
• IAM Identity-Based Policies for Amazon QuickSight: Scoping Policies in Enterprise Edition (p. 651)

IAM Identity-Based Policies for Amazon QuickSight: Dashboards

The following example shows an IAM policy that enables dashboard sharing and embedding for specific
dashboards.

```
{
   "Version": "2012-10-17",
   "Statement": [
       {
           "Action": "quicksight:RegisterUser",
           "Resource": "*",
           "Effect": "Allow"
       },
       {
           "Action": "quicksight:GetDashboardEmbedUrl",
           "Resource": "arn:aws:quicksight:us-west-2:111122223333:dashboard/1a1ac2b2-3fc3-4b44-5e5d-c6dbb776d789",
           "Effect": "Allow"
       }
   ]
}
```

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.

```
{
   "Version": "2012-10-17",
   "Statement": [
```
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:DescribeIdentityPoolDirectory",
                "ds:CreateIdentityPoolDirectory",
                "iam:ListAccountAliases",
                "quicksight:CreateUser",
                "quicksight:Subscribe"
            ],
            "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": "PolicyForAccessingAWSResourcesFromQuickSight",
  "Statement": [
    {
      "Sid": "Attach this policy while you are setting up access to AWS resources",
      "Effect": "Allow",
      "Principal": "*",
      "Action": [
        "iam:AttachRolePolicy",
```
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.

```json
{
   "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. 2) 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...
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.
2. 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 QuickSight menu. They can't change account settings, manage user accounts, purchase additional Amazon QuickSight user subscriptions or SPICE (p. 2) 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 pro-rated 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>
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<tr>
<th>Intended audience:</th>
<th>System administrators</th>
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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. 653)
- I Am Not Authorized to Perform iam:PassRole (p. 653)
- I Want to View My Access Keys (p. 653)
- I’m an Administrator and Want to Allow Others to Access Amazon QuickSight (p. 654)
- I Want to Allow People Outside of My AWS Account to Access My Amazon QuickSight Resources (p. 654)

**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, `wJalrXUtFRoPwMDENG/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. 644).
- 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.

### 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.

Topics
  • Using Active Directory with Amazon QuickSight (p. 655)
  • Single Sign-On Access to Amazon QuickSight Using SAML 2.0 (p. 656)

Using Active Directory with Amazon QuickSight

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, you use AWS Directory Service for Microsoft Active Directory, also known as AWS Managed Microsoft AD. This is a Microsoft Active Directory host in the AWS cloud, which offers most of the same functionality of Microsoft Active Directory. Currently, you can connect to Active Directory in any region supported by Amazon QuickSight, except Asia Pacific (Singapore) and Asia Pacific (Sydney). When you create a directory, you use it with a virtual private cloud (VPC).

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 Microsoft Active Directory—in another AWS region or on-premises—without caching any information in the cloud.

There is a video available on the Knowledge Center that walks through creating and managing a directory: Use an AWS Managed Microsoft AD with Amazon QuickSight?

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.

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, purchase additional Amazon QuickSight user subscriptions or SPICE (p. 2) capacity, or cancel subscriptions to Amazon QuickSight. 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 select Microsoft Active Directory as your identity provider, you get the opportunity to associate your AD groups with Amazon QuickSight. You can also add or change your AD groups later on.

**Single Sign-On Access to Amazon QuickSight Using SAML 2.0**

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

Amazon QuickSight supports identity federation through Security Assertion Markup Language 2.0 (SAML 2.0) in both Standard and Enterprise editions. You can use an identity provider that supports SAML 2.0 to provide a simple on-boarding flow for your Amazon QuickSight users. Such identity providers include Microsoft Active Directory Federation Services, Ping One Federation Server, and Okta.

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.

**Example Authentication Workflow**

**Applies to:** Enterprise Edition

**Intended audience:** System administrators

In the following diagram, you can see a typical authentication flow between Amazon QuickSight and a third-party identity provider. In this example, the administrator has set up a sign-in page to access Amazon QuickSight, called applications.exampleco.com. The web page uses a federation service that complies with SAML 2.0 to trigger a sign-on request. The administrator has also set up a user to allow access to Amazon QuickSight.
In this authentication flow, the following happens:

1. The user browses to https://applications.exampleco.com. The sign-on page requests authentication for the user.
2. The federation service requests authentication from the organization’s identity store.
3. The identity store authenticates the user and returns the authentication response to the federation service.
4. When authentication is successful, the federation service posts the SAML assertion to the user’s browser.
5. The user’s browser posts the SAML assertion to the AWS Sign-In SAML endpoint (https://signin.aws.amazon.com/saml). AWS Sign-In receives the SAML request, processes the request, authenticates the user, and forwards the authentication token to the Amazon QuickSight service.
6. Using the authentication token from AWS, Amazon QuickSight authorizes the user and presents applications to the browser.

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.

**Setting Up SAML**

**Applies to:** Enterprise 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. 658)
- Step 1: Create a SAML Provider in AWS (p. 658)
- Step 2: Configure Permissions in AWS for Your Federated Users (p. 658)
- Step 3: Configure the SAML IdP (p. 660)
- Step 4: Create Assertions for the SAML Authentication Response (p. 660)
- Step 5: Configure the Relay State of Your Federation (p. 660)

**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 (See Step 5: Configure the Relay State of Your Federation (p. 660)).
  - 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 Amazon QuickSight (p. 589).

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 about integrating with your IdP or using SSO in AWS, see Integrating Third-Party SAML Solution Providers with AWS in the IAM User Guide.

**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 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, review 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 `-`).

```json
{
  "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.

```json
{
  "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.

Once 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, you can configure the relay state of your federation to point to the Amazon 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:

https://quicksight.aws.amazon.com

Using Multi-Factor Authentication (MFA) with Amazon QuickSight

**Applies to:** Enterprise Edition and Standard Edition

**Intended audience:** System administrators

You can use multi-factor authentication (MFA) with Amazon QuickSight by using your AWS Directory Service for Microsoft Active Directory, also known as AWS Microsoft Active Directory or AWS Managed Microsoft Active Directory.

For more information on how to set this up, see How to Enable Multi-Factor Authentication for AWS Services by Using AWS Microsoft Active Directory and On-Premises Credentials.

For more information on multi-factor authentication, see Multi-Factor Authentication in the AWS Directory Service Administration 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.
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. 24).

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.

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. If your company uses single sign-on (SSO), the user’s email domain must match yours.

   **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. 2) 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 (p. 2) 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. 648).

• 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 24 hours. 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**.
3. For **Search for a user**, enter a search term to search for a specific user account. Any user name or email address that starts with the search term is shown. Search is case-insensitive and wildcards aren't supported. To clear the search results and view all user accounts, delete the search term.
4. Review the user name, email, assigned role, and status. The status field shows either **ACTIVE** or **INACTIVE** to indicate whether or not the user has responded to the invitation email and activated an account.
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. 668).

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**.

---

![Delete user dialog box](image-url)
If you chose to delete user resources, choose **Delete**. You can't undo this action.

Creating a Group in Amazon QuickSight

**Intended audience:** Amazon QuickSight administrators

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.
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. 660).

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. 648). 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 migrating 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. 667). For more information about adding a user to a 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. 651).

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 your user name on the application bar and then choose Manage QuickSight.

2. Choose Manage Users. On this screen, you can see which users were active this month. You can also see deleted users.
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. 667).

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. 670).

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 a 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 (p. 2) 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. 664).
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. 671).

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. 671)

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 calls from the Amazon QuickSight console and 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. 671)
- Tracking Non-API Events by Using CloudTrail Logs (p. 672)
- Example: Amazon QuickSight Log File Entries (p. 674)

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

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
  - **External** – External
  - **S3** – S3
  - **ImportS3ManifestFile** – S3 Manifest File
- **Presto** – Presto
- **RDS** – RDS
- **Redshift** – Redshift (manual)
- **UpdateDataSource** – Update Data Source
- **DeleteDataSource** – Delete Data Source

**Data Set**

- **CreateDataSet** – Create Data Set
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",
  "eventSource": "quicksight.amazonaws.com",
  "eventName": "BatchCreateUser",
  "awsRegion": "us-west-2",
  "requestParameters": null,
  "responseElements": null,
  "eventID": "e7d2382e-70a0-3fb7-9d41-a7a913422240",
  "readOnly": false,
  "eventType": "AwsServiceEvent",
  "recipientAccountId": "123456789012",
  "serviceEventDetails": {
    "eventRequestDetails": {
      "users": {
        "test-user-11": {
          "role": "USER"
        },
        "test-user-22": {
          "role": "ADMIN"
        }
      }
    },
    "eventResponseDetails": {
      "validUsers": [],
      "InvalidUsers": [
        "test-user-11",
        "test-user-22"
      ]
    }
  }
}
```
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.
- **Architecting for HIPAA Security and Compliance Whitepaper** – This whitepaper describes how companies can use AWS to create HIPAA-compliant applications.

This is a HIPAA Eligible Service. For more information about AWS, U.S. Health Insurance Portability and Accountability Act of 1996 (HIPAA), and using AWS services to process, store, and transmit protected health information (PHI), see HIPAA Overview.

- **AWS Compliance Resources** – This collection of workbooks and guides might apply to your industry and location.
- **AWS Config** – This AWS service assesses how well your resource configurations comply with internal practices, industry guidelines, and regulations.
- **AWS Security Hub** – This AWS service provides a comprehensive view of your security state within AWS that helps you check your compliance with security industry standards and best practices.

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.
Infrastructure Security in Amazon QuickSight

Intended audience: Amazon QuickSight administrators

Amazon QuickSight is delivered as a web application, hosted on dedicated EC2 hosts, separate from AWS VPCs. Instead of deploying Amazon QuickSight on your own hosts, you access the Amazon QuickSight service through regional public endpoints. Amazon QuickSight accesses data sources over a secured internet connection from regional endpoints. To access data sources that are located inside a corporate network, you configure the network to allow access from one of Amazon QuickSight's public IP address blocks. We recommend you consider using a Virtual Private Cloud (VPC). 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. 587)
- Using a Amazon VPC with Amazon QuickSight (p. 680)

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 whitepaper.

If you use AWS published API calls to access Amazon 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 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 Amazon QuickSight does support resource-based access policies, which can include restrictions based on the source IP address. You can also use Amazon 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 Amazon QuickSight resource from only the specific VPC within the AWS network. For more information on using Amazon QuickSight in a VPC, see Using a Amazon VPC with Amazon QuickSight (p. 680).

Topics

- Network and Database Configuration Requirements (p. 676)
- Using a Amazon VPC with Amazon QuickSight (p. 680)

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. 677) as well as the Database Configuration Requirements for Self-Administered Instances (p. 679).
Network Configuration Requirements

Intended audience: System administrators

To be usable from Amazon QuickSight, a database server must be accessible from the internet. It must also allow inbound traffic from Amazon QuickSight servers.

If the database is on AWS and in the same AWS Region as your Amazon QuickSight account, you can auto-discover the instance to make connecting to it easier. To do this, you must grant Amazon QuickSight permissions to access it. For more information, see Using other AWS Services: Scoping Down Access (p. 622).

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 and is publicly accessible (that is, you didn’t choose to make private). In such cases, your database is already appropriately configured to be accessible from the internet. However, you still need to enable access from Amazon 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. 625)
- Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 628)
- Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances (p. 635)

Network Configuration for an AWS Instance in a Non-Default VPC

If you are configuring an AWS instance in a non-default 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 Amazon QuickSight servers. These ACLs must do the following:
  - Allow inbound traffic from the appropriate Amazon 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 Amazon QuickSight IP address range and all ports.

For more information about Amazon QuickSight IP address ranges, see IP Address Ranges for Amazon QuickSight (p. 679) following.

For more information about configuring VPC ACLs, see Network ACLs.

- Security group rules that allow traffic between the cluster or instance and Amazon QuickSight servers. For further details on how to create appropriate security group rules, see Authorizing Connections from Amazon QuickSight to AWS Data Stores (p. 625).

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 Amazon QuickSight. For more information, see Using a Amazon VPC with Amazon QuickSight (p. 680).
For more information on Amazon Virtual Private Cloud, 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 Amazon 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. 625)
- Authorizing Connections from Amazon QuickSight to Amazon Redshift Clusters (p. 628)
- Authorizing Connections from Amazon QuickSight to Amazon EC2 Instances (p. 635)

Network Configuration for a Non-AWS Database Instance

If you want 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). Amazon QuickSight doesn't accept certificates that are self-signed or issued from a non-public CA. For more information, see Amazon QuickSight SSL and CA Certificates (p. 678).

If your database is on a non-AWS server, you must change that server's firewall configuration to accept traffic from the appropriate Amazon QuickSight IP address range. For more information about Amazon QuickSight IP address ranges, see IP Address Ranges for Amazon QuickSight (p. 679). Refer to your operating system documentation for any other steps you need to take to enable internet connectivity.

Amazon 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
- 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
Network and Database Configuration Requirements

- 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
- Global Chambersign Root - 2008
- GlobalSign
- GlobalSign Root CA
- Go Daddy Root Certificate Authority - G2
- GTE CyberTrust Global Root
- KEYNECTIS ROOT CA
- 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
- XRamp Global Certification Authority

IP Address Ranges for Amazon QuickSight

For more information on the IP address ranges for Amazon QuickSight in supported regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587).

Database Configuration Requirements for Self-Administered Instances

**Intended audience:** System administrators and Amazon QuickSight administrators

For a database to be accessible to Amazon 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 must control client authentication by using the `pg_hba.conf` file in the database cluster's data directory, although this file might be named and located differently on your system. For more information, see Client Authentication in the PostgreSQL documentation.

### Using a Amazon VPC with Amazon QuickSight

**Intended audience:** System administrators and Amazon QuickSight administrators

Amazon QuickSight is fully integrated with the Amazon Virtual Private Cloud (Amazon VPC) service. Use this section to find how to configure Amazon QuickSight to access data in your VPC.

A VPC works both for data in AWS data sources and for data in on-premises servers without public connectivity. For AWS sources, VPC access for 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.

In Amazon QuickSight Enterprise edition, you can create connections to your VPCs from your AWS account's Amazon QuickSight subscription. Each connection creates an elastic network interface in your VPC for Amazon QuickSight to send traffic to instances in your VPC. When creating a data set, Amazon QuickSight accesses a VPC connection using only private IP addresses to connect to an instance that is not reachable from the public internet. You can access VPCs that are located in the same AWS Region where you are using Amazon QuickSight to create analyses.

**Create a Private Connection to Amazon VPC Using Amazon QuickSight**

Use the following procedure to create a connection to a VPC. Before you begin, you should understand your deployment of Amazon VPC in the AWS Region you are using: its subnets, and security groups, in relation to the destinations (databases) you want to reach from Amazon QuickSight.

1. In Amazon QuickSight, choose your profile icon at the top right of the screen, then choose Manage QuickSight. From the menu at left, choose Manage VPC connections.

   The Account Settings page appears. Any existing private connections to VPCs display on this page.
2. Choose **Add VPC connection** to add a new VPC connection.

On this page, you can also delete a VPC connection by using the delete icon. You can change a VPC connection on this page by creating a new VPC connection and deleting the old one.

3. For **VPC connection name**, type a unique descriptive name. This name doesn't need to be an actual VPC ID or name.

4. Type the subnet ID for **Subnet ID**, and type the group ID for **Security group ID**. Make sure that the subnet and the security group are in the same VPC. Also, make sure you are accessing a VPC that is in the same AWS Region where you are creating Amazon QuickSight analyses. You can't use Amazon QuickSight in one AWS Region to connect to a subnet and security group that are in a different AWS Region. More detailed requirements are provided in the following steps, and in How Amazon QuickSight Connects to Your VPC (p. 685).

If you need to locate information about the subnet and security group, do the following:

a. On the Amazon VPC console, find the **VPC ID** that you want to use.
b. On the Amazon VPC subnet console page, see which subnets are in that VPC by locating the VPC ID. Choose a subnet, and copy its **Subnet ID** value. The subnet you choose is the one where you plan to create an elastic network interface. It must be possible to route from this subnet to any destinations you want to reach. For more information, see VPCs and Subnets.
c. On the Adding VPC connection screen, enter the Subnet ID value that you copied in the previous step for Subnet ID.

d. On the Amazon VPC security group console page, see which security groups are in that VPC by locating the VPC ID. Choose a group, and copy its Group ID value.

Create a new security group for use only with the elastic network interface created by Amazon QuickSight. The group must allow inbound traffic on relevant ports from the security groups of the destinations you want to reach. Avoid opening traffic on all ports. For example, you might add something similar to the following examples:

<table>
<thead>
<tr>
<th>Service</th>
<th>Protocol</th>
<th>Port Range</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDS: MySQL/Aurora</td>
<td>TCP</td>
<td>3306</td>
<td>sg-RDS11111111</td>
</tr>
<tr>
<td>RedShift: All TCP</td>
<td>TCP</td>
<td>0 - 65535</td>
<td>sg-RedSh2222222</td>
</tr>
</tbody>
</table>

The group must also allow outbound traffic to the database on the port that the database is listening on.

Additionally, you must update your database's security group to allow inbound traffic from your new security group.

For more information, see Security Group Rules for Amazon QuickSight's Elastic Network Interface (p. 686).

**Note**
The database server's security group must allow inbound traffic from the security group you choose.
e. On the Adding VPC connection screen, enter the Group ID value that you copied in the previous step for Security group ID.

5. **Important**
   
   You can't change the settings for a VPC connection.

   Review your choices, then choose Create.
Note
Creating a VPC connection requires permission for the quicksight:CreateVPCConnection and ec2:CreateNetworkInterface actions.

For best practices when using Amazon VPC, see the following:

- AWS Single VPC Design on the AWS website
- Recommended Network ACL Rules for Your VPC in the Amazon VPC User Guide
- VPC Scenarios and Examples in the Amazon VPC User Guide

What Is Amazon VPC?

Amazon Virtual Private Cloud (Amazon VPC) enables you to define a virtual network in your own logically isolated area within the AWS cloud, known as a virtual private cloud (VPC). You can launch your AWS resources, such as instances, into your VPC. Your VPC closely resembles a traditional network that you might operate in your own data center, with the benefits of using AWS's scalable infrastructure. You can configure your VPC; you can select its IP address range, create subnets, and configure route tables, network gateways, and security settings. You can connect instances in your VPC to the internet. You can connect your VPC to your own corporate data center, making the AWS cloud an extension of your data center. To protect the resources in each subnet, you can use multiple layers of security, including security groups and network access control lists. For more information, see the Amazon VPC User Guide.

How Amazon QuickSight Connects to Your VPC

Intended audience: Amazon QuickSight administrators

When you create a VPC connection from Amazon QuickSight to your VPC, Amazon QuickSight creates an elastic network interface in the subnet that you choose. It must be possible to route from this subnet to any destinations you want to reach.
Network traffic from Amazon QuickSight then originates from this network interface when Amazon QuickSight connects to a database or other instance within your VPC using a VPC connection. Because this network interface exists inside your VPC, traffic originating from it can reach destinations within your VPC using their private IP addresses.

Controlling the Resources That Amazon QuickSight Can Reach in Your VPC

**Intended audience:** System administrators

Network traffic sent from Amazon QuickSight to an instance within your VPC through a VPC connection is subject to all of the standard security controls, just as other traffic in your VPC is. Route tables, network ACLs, and security groups all apply to network traffic from Amazon QuickSight in the same way they apply to traffic between other instances in your VPC.

**Configuring Security Group Rules for Use with Amazon QuickSight**

For Amazon QuickSight to successfully connect to an instance in your VPC, you must configure your security group rules to allow traffic between the Amazon QuickSight network interface and your instance.

**Security Group Rules for the Instance in Your VPC**

The security group attached to your data source's instance must allow inbound traffic from Amazon QuickSight on the port that Amazon QuickSight is connecting to.

You can do this by adding a rule to your security group that allows traffic from the security group ID that is associated with the Amazon QuickSight (recommended). Alternatively, you can use a rule that allows traffic from the private IP address assigned to Amazon QuickSight.

For more information, see [Security Groups for Your VPC and VPCs and Subnets](#).

**Security Group Rules for Amazon QuickSight's Elastic Network Interface**

When using a VPC Connection, traffic comes from the elastic network interface that we create in your VPC. Each elastic network interface gets its own private IP address that's chosen from the subnet you configure. The private IP address is unique for each AWS account, unlike the public IP range.

The security group attached to the Amazon QuickSight elastic network interface should have outbound rules allowing traffic to all of the data source instances in your VPC that you want Amazon QuickSight to connect to. If you want to restrict Amazon QuickSight to connect only to certain instances, you specify the security group ID (recommended) or private IP address of the instances you want to allow. You set this up, along with the appropriate port numbers for your instances, in your outbound security group rule.

**Important**

Do not configure your data source's security group 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 [Controlling VPC Egress Traffic](#).

The security group attached to the Amazon QuickSight elastic network interface behaves differently than most security groups. Security groups are usually stateful, meaning that when an outbound connection is established the return traffic from the destination host is automatically allowed. However, the security group attached to the Amazon QuickSight network interface isn't stateful. This means that your return traffic from the destination host isn't automatically allowed. In this case, adding an egress rule to the network interface security group doesn't work. Therefore, you must add inbound rules to your security group to explicitly authorize it.
Because the destination port number of any inbound return packets is set to a randomly allocated port number, the inbound rule in your security group must allow traffic on all ports (0–65535). If you don’t want to restrict which instances Amazon QuickSight can connect to, then you can configure this security group with an inbound rule to allow traffic on 0.0.0.0/0 on all ports. If you want to restrict Amazon QuickSight to connect only to certain instances, you can specify the security group ID (recommended). Alternatively, you can specify the private IP address of the instances you want to allow in your inbound security group rule. In this case, your inbound security group rule still needs to allow traffic on all ports.

**Supported Data Sources Using a VPC Connection**

The following data source types can use a VPC connection:

- Amazon Redshift
- Amazon RDS
- Amazon Aurora
- PostgreSQL
- MySQL
- MariaDB
- Microsoft SQL Server
- Presto
- Snowflake

**Other Requirements for Data Sources Using a VPC Connection**

The DNS name of the database or instance you are connecting to through a VPC connection must be resolvable from outside of your VPC. Also, the connection must return the private IP address of your instance. Databases hosted by Amazon Redshift, Amazon RDS, and Aurora automatically meet this requirement.

The instance you are connecting to must either reside within your VPC or be reachable by using an AWS Direct Connect gateway, NAT gateway or VPN gateway. Amazon QuickSight can't send traffic through a VPC connection to instances that are only reachable by a VPC peering connection.

Amazon QuickSight can't connect to a network load balancer by using a VPC connection.

**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’s 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.
For the latest AWS terminology, see the AWS Glossary in the AWS General Reference.
# Document History

The following table describes the important changes to the *Amazon QuickSight User Guide*. If you want to be notified about updates, you can subscribe to the RSS feed using the icon in the menu bar. If you are also interested in updates for all AWS products, see *What’s New with AWS*.

**Note**

In a Kindle publication, you can find the last change date above the table of contents. However, on the Kindle website, the original publication date is unchanged.

The following table describes important changes in each release of the *Amazon QuickSight User Guide* after March 4, 2019. For notification about updates to this documentation, you can subscribe to an RSS feed.

<table>
<thead>
<tr>
<th>update-history-change</th>
<th>update-history-description</th>
<th>update-history-date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private VPC support for Presto in Amazon QuickSight (p. 690)</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. 690)</td>
<td>Amazon QuickSight now supports functions for base 10 logarithms ($\log_{10}$), natural logarithm ($\ln$), absolute value ($\text{abs}$), square root ($\sqrt{x}$), and base of natural log $e$ raised to the power of ($\exp$). For more information, see Functions and Operators.</td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>New LAA functions in Amazon QuickSight (p. 690)</td>
<td>Now you can use $\text{rank}$, $\text{denseRank}$, and $\text{percentileRank}$ for level-aware aggregations. For more information, see Using Level-Aware Aggregations.</td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now enables you to choose an Amazon Athena workgroup (p. 690)</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 Creating a Dataset Using Amazon Athena.</td>
<td>December 10, 2019</td>
</tr>
<tr>
<td>Integrate Amazon SageMaker ML models into your Amazon QuickSight analyses and dashboards (p. 690)</td>
<td>In this public preview, Amazon QuickSight launches the ability to integrate machine learning (ML) models created and trained in Amazon SageMaker. This new feature makes it easier to augment your business.</td>
<td>November 26, 2019</td>
</tr>
</tbody>
</table>
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 Amazon QuickSight Integration with SageMaker.

New formatting options for visuals in Amazon QuickSight (p. 690)

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 Formatting a Visual.

New Amazon QuickSight API operations (p. 690)

Amazon QuickSight launches new API operations to programmatically manage your data, dashboards, and IAM-linked fine-grained access control capabilities. 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 Amazon QuickSight API Reference.
<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon QuickSight supports the now function in SPICE</td>
<td>For more information, see <a href="#">now</a>.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now supports seconds in SPICE</td>
<td>Seconds are now supported in SPICE data sets. Datetime fields are no longer truncated to minutes. Now you can use the <code>SS</code> option for the <code>period</code> parameter in date functions including <code>addDateTime</code>, <code>dateDiff</code>, <code>extract</code>, and <code>truncDate</code>. For more information, see <a href="#">Date Functions</a>.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now has themes</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 <a href="#">Using Themes in Amazon QuickSight</a>.</td>
<td>November 22, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now supports conditional formatting</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 <a href="#">Adding Conditional Formatting to Visuals</a>.</td>
<td>November 18, 2019</td>
</tr>
<tr>
<td>View history for SPICE ingestion on your Amazon QuickSight</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 <a href="#">View SPICE Ingestion History</a>.</td>
<td>November 7, 2019</td>
</tr>
<tr>
<td>Add your own functionality to visuals with Amazon QuickSight actions</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 <a href="#">Custom Actions in Amazon QuickSight</a>.</td>
<td>November 7, 2019</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Amazon QuickSight now supports dynamic sheet titles (p. 690)</td>
<td>You can now use parameters in sheet titles to make the context of a dashboard more clear to the reader. For more information, see <a href="#">Formatting a Visual</a>.</td>
<td>November 6, 2019</td>
</tr>
<tr>
<td>Use Amazon QuickSight to join data from multiple data sources (p. 690)</td>
<td>Amazon QuickSight now supports creating datasets that join multiple data sources. For more information, see <a href="#">Joining Tables</a>.</td>
<td>November 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight Mobile iOS update and a new Android app (p. 690)</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; 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 more information, see <a href="#">Amazon QuickSight Mobile</a>.</td>
<td>November 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports printing (p. 690)</td>
<td>Now you can print a dashboard or an analysis. For more information, see <a href="#">Printing</a>.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports a new AWS Region (p. 690)</td>
<td>Amazon QuickSight is now available in Asia Pacific (Seoul) (ap-northeast-2). For more information, see <a href="#">AWS Regions, Websites, IP Address Ranges, and Endpoints</a>.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight now supports visual-level formatting (p. 690)</td>
<td>Now, any formatting you apply from the field wells is applied only to the selected visual. For more information, see <a href="#">Formatting a Visual</a>.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Transpose tables (p. 690)</td>
<td>In table visuals, you can now transpose columns and rows. For more information, see <a href="#">Tables</a>.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td>Shared data sources (p. 690)</td>
<td>Share data sources with other users and groups. For more information, see <a href="#">Shared Data Sources</a>.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
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<tr>
<td><strong>SPICE enhancements (p. 690)</strong></td>
<td>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.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td><strong>New publishing options for dashboards (p. 690)</strong></td>
<td>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.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td><strong>New median function (p. 690)</strong></td>
<td>Amazon QuickSight supports median as a new aggregation. For more information, see median.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td><strong>New filter functionality (p. 690)</strong></td>
<td>Amazon QuickSight now supports additional relative date filter options. For more information, see Date Filters.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td><strong>New aggregations for fields (p. 690)</strong></td>
<td>You can now use Nth percentile, median, standard deviation, and variance in field wells, filters, and ML Insights. For more information, see Field Aggregations.</td>
<td>October 10, 2019</td>
</tr>
<tr>
<td><strong>Filter for context (p. 690)</strong></td>
<td>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.</td>
<td>October 10, 2019</td>
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<tr>
<td>Feature</td>
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<tr>
<td>Use the power operator (^) in SPICE (p. 690)</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. 690)</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. 690)</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>
</tr>
<tr>
<td>Sort your anomalies (p. 690)</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. 690)</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. 690)</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>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
<td>Date</td>
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<tr>
<td>New visual type: Word clouds (p. 690)</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 <a href="#">Word Clouds</a>.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Filter out the last N time periods (p. 690)</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 <a href="#">Adding a Date Filter</a>.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight new feature to mark favorites (p. 690)</td>
<td>Mark your favorite dashboards and analyses so you can come back to them quickly. For more information, see <a href="#">Using the Amazon QuickSight Start Page</a>.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight Enterprise edition adds anomaly alerts (p. 690)</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 <a href="#">Using Data Dashboards</a>.</td>
<td>September 5, 2019</td>
</tr>
<tr>
<td>Detect anomalies with less data (p. 690)</td>
<td>In Amazon QuickSight Enterprise edition, we lowered the required minimum data points to 15 for training anomaly detection. For more information, see <a href="#">Data Set Requirements for Using ML Insights with Amazon QuickSight</a>.</td>
<td>August 1, 2019</td>
</tr>
<tr>
<td>Amazon QuickSight supports new regions (p. 690)</td>
<td>Amazon QuickSight is available in Europe (London) and Europe (Frankfurt). Also, you can now connect to Active Directory in any region supported by Amazon QuickSight, except Asia Pacific (Singapore) and Asia Pacific (Sydney). For more information, see <a href="#">AWS Regions and IP Address Ranges</a>.</td>
<td>August 1, 2019</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
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<tr>
<td>Amazon QuickSight adds custom colors for charts. (p. 690)</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 8 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. 690)</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. 690)</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. 690)</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. 690)</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>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
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<tr>
<td>New Visual Types (p. 690)</td>
<td>You can now use Amazon QuickSight to chart your data on a customizable gauge and donut charts. For more information, see <a href="#">Visual Types</a>.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Hide/Show columns in table visualizations (p. 690)</td>
<td>In Amazon QuickSight, you can hide or show columns in visualizations that use the <code>table</code> visual type. For more information, see <a href="#">Customizing a Visual</a>.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Conditional String Functions on SPICE (p. 690)</td>
<td>We added support for <code>ifelse</code> in analyses that use SPICE. For more information, see <code>ifelse</code>.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Choose period granularity for date differences (p. 690)</td>
<td>We added an optional parameter to <code>dateDiff</code> so you can show differences between dates in the period you choose (years, months, and so on). For more information, see <code>dateDiff</code>.</td>
<td>June 11, 2019</td>
</tr>
<tr>
<td>Duplicate visuals (p. 690)</td>
<td>In Amazon QuickSight, you can now duplicate visuals. For more information, see <a href="#">Duplicating a Visual</a>.</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>Angled data labels (p. 690)</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 <a href="#">Customizing Data Labels</a>.</td>
<td>May 21, 2019</td>
</tr>
<tr>
<td>New languages added (p. 690)</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 <a href="#">Choosing a Language in Amazon QuickSight</a>.</td>
<td>April 8, 2019</td>
</tr>
<tr>
<td>New aggregation function (p. 690)</td>
<td>Amazon QuickSight supports aggregating by percentile. This function helps you understand the distribution of your data. For more information, see <code>percentile</code>.</td>
<td>April 8, 2019</td>
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<tr>
<td>Feature</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 &quot;other&quot; category. This feature is available for bar charts, combo charts, line charts, pie charts, heat maps, and tree maps. For more information, see Customizing 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 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 suggestions such as what the day-over-day changes look like, what was the highest sales date, what the growth rate is at and 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.

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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</thead>
<tbody>
<tr>
<td>New features</td>
<td>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 <code>sum</code>, <code>average</code>, <code>minimum</code>, <code>maximum</code>, and <code>count</code> functions. Doing this enables a moving window aggregation as you progress through your data points. For more information, see Table Calculation Functions Index (p. 499). 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. 453). Amazon QuickSight now supports unbounded cardinality. That means you can have more than 10,000 values in...</td>
<td>March 4, 2019</td>
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<tr>
<td>Change</td>
<td>Description</td>
<td>Date Changed</td>
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</tr>
<tr>
<td>New features</td>
<td>There are new table calculations available:</td>
<td>February 7, 2019</td>
</tr>
<tr>
<td></td>
<td>• percentileOver (p. 517)</td>
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<tr>
<td></td>
<td>• runningAvg (p. 531)</td>
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<td></td>
<td>• runningCount (p. 532)</td>
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<tr>
<td></td>
<td>• runningMax (p. 533)</td>
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<tr>
<td></td>
<td>• runningMin (p. 534)</td>
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<tr>
<td>New features</td>
<td>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:</td>
<td>January 22, 2019</td>
</tr>
<tr>
<td></td>
<td>• Sending Reports by Email (p. 453)</td>
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<tr>
<td></td>
<td>• Using a Control with a Parameter in Amazon QuickSight (p. 244)</td>
<td></td>
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<tr>
<td></td>
<td>• Adding a Date Filter (p. 328)</td>
<td></td>
</tr>
<tr>
<td>New features</td>
<td>We added conditional aggregations, including sumIf, countIf, minIf, maxIf, avgIf, and distinct_countIf.</td>
<td>January 10, 2019</td>
</tr>
<tr>
<td></td>
<td>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.</td>
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<td></td>
<td>For more information, see the following:</td>
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<tr>
<td></td>
<td>• Using Aggregate Functions in Calculated Fields (p. 225)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Using Pivot Tables (p. 373)</td>
<td></td>
</tr>
<tr>
<td>New feature</td>
<td>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.</td>
<td>January 3, 2019</td>
</tr>
<tr>
<td></td>
<td>For more information, see Joining Tables (p. 132).</td>
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</tr>
<tr>
<td>New SDK</td>
<td>You can embed dashboards and manage users or groups by using the Amazon QuickSight SDKs. For more information, see Embedding and Other SDKs (p. 547).</td>
<td>November 27, 2018</td>
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<tr>
<td>Change</td>
<td>Description</td>
<td>Date Changed</td>
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</tr>
<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:</td>
<td>November 20, 2018</td>
</tr>
<tr>
<td></td>
<td>• Restricting Access to a Data Set by Using Row-Level Security (p. 114)</td>
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<tr>
<td></td>
<td>• Using a Control with a Parameter in Amazon QuickSight (p. 244)</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. 530).</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. 314).</td>
<td>November 1, 2018</td>
</tr>
<tr>
<td></td>
<td>Use a 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. 242).</td>
<td></td>
</tr>
<tr>
<td>New feature</td>
<td>Use JSON native data types with parseJson. For more information see, parseJson (p. 488).</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. 467)</td>
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<tr>
<td></td>
<td>• extract (p. 474)</td>
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<tr>
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<td>• truncDate (p. 498)</td>
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<tr>
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<td>Add parameters to URLs. For more information see, Using Parameters in a URL (p. 253).</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. 307)</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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<tr>
<td></td>
<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. 453)</td>
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<tr>
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<td>• Subscribing to Reports (p. 457)</td>
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<tr>
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<td>• Customizing Data Labels on Visuals (p. 281)</td>
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<tr>
<td>Change</td>
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</tr>
<tr>
<td>New features</td>
<td>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.&lt;br&gt;&lt;br&gt;For more information on these features, see the following sections:&lt;br&gt;&lt;br&gt;• Table Calculations (p. 465)&lt;br&gt;• Changing Date Field Granularity (p. 301)</td>
<td>August 8, 2018</td>
</tr>
<tr>
<td>New features</td>
<td>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.&lt;br&gt;&lt;br&gt;For more information on these features, see the following sections:&lt;br&gt;&lt;br&gt;• Replacing Data Sets (p. 196)&lt;br&gt;• Customizing Visual Labels (p. 281)&lt;br&gt;• Customizing a Field Format (p. 201)&lt;br&gt;• Working with Amazon QuickSight Visuals (p. 267)</td>
<td>June 21, 2018</td>
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<td>Change</td>
<td>Description</td>
<td>Date Changed</td>
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<tr>
<td>New features and a new AWS Region</td>
<td>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 supports 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:</td>
<td>May 30, 2018</td>
</tr>
<tr>
<td></td>
<td>• Upgrading Your Amazon QuickSight Subscription from Standard Edition to Enterprise Edition (p. 610) • Self-Provisioning an Amazon QuickSight Read-Only User (p. 652) • Inviting Users to Access Amazon QuickSight (p. 661) • Sharing Dashboards (p. 450) • Using a Amazon VPC with Amazon QuickSight (p. 680) • Refreshing a Data Set on a Schedule (p. 108) • Parameters in Amazon QuickSight (p. 242) • Using Data Dashboards in Amazon QuickSight (p. 15) (newly updated for read-only users) • Custom Actions in Amazon QuickSight (p. 344) • Data Source Limits (p. 70) • AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587)</td>
<td></td>
</tr>
<tr>
<td>New feature</td>
<td>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:</td>
<td>May 25, 2018</td>
</tr>
<tr>
<td></td>
<td>• Quick Sorting on a Visual Axis (p. 308) • Duplicating a Data Set (p. 107) • Using Totals on a Table (p. 403) • Creating a Custom SQL Query (p. 141)</td>
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<tr>
<td>Change</td>
<td>Description</td>
<td>Date Changed</td>
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<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 Sources (p. 69).&lt;br&gt;&lt;br&gt;You can import JSON files to Amazon QuickSight. For more information, see JSON Data Sources (p. 68). You can also parse JSON fields in a CSV file. For more information, see parseJson (p. 488).</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 Data Sets Using S3 Files in Another AWS Account (p. 89).</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. 175). For more information on creating a geospatial visual, see Using Geospatial Charts (Maps) (p. 364). For more information on using tabular reports, see Using Tables as Visuals (p. 402).</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 Limits (p. 70). Calculated fields are supported in SPICE datasets. For more information, see Adding a Calculated Field to an Analysis (p. 224). 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. 347).</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 Restricting Access to a Data Set by Using Row-Level Security (p. 114).</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. 356).</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. 225). For more information on using unsupported dates by creating a custom date format, see Using Unsupported or Custom Dates (p. 151). For more information on duplicating dashboards, see Copying a Dashboard (p. 449).</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. 332).</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>
</tbody>
</table>
## Previous Updates

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date Changed</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Features</td>
<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 Navigating the QuickSight App (p. 57).</td>
<td>August 31, 2017</td>
</tr>
<tr>
<td>New regions</td>
<td>Amazon QuickSight is now available in Asia Pacific (Singapore) and Asia Pacific (Sydney).</td>
<td>August 8, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight supports Snowflake cloud data warehouse.</td>
<td>July 31, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight added a new aggregation: Count Distinct. To learn more, see Changing Field Aggregation (p. 298).</td>
<td>July 19, 2017</td>
</tr>
<tr>
<td>New feature</td>
<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. 638).</td>
<td>July 5, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight supports Amazon Redshift Spectrum. To learn more, see Enabling Access to Amazon Redshift Spectrum (p. 634).</td>
<td>May 25, 2017</td>
</tr>
<tr>
<td>New feature</td>
<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. 648).</td>
<td>May 25, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight supports direct connections to Teradata 14.0 and later.</td>
<td>May 25, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight added relative date filters for datasets and visuals. To learn more, see Adding a Date Filter (p. 166).</td>
<td>May 25, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight supports connecting to Apache Spark and Presto. To learn more, see Creating a Data Source Using Apache Spark (p. 81) and Creating a Data Source Using Presto (p. 81).</td>
<td>May 3, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight supports operational logging with AWS CloudTrail. To learn more, see Logging Operations with AWS CloudTrail (p. 671).</td>
<td>April 28, 2017</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Date Changed</td>
</tr>
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</tr>
<tr>
<td>New feature</td>
<td>Amazon QuickSight is available in US East (Ohio). To learn more about regions, see AWS Regions, Websites, IP Address Ranges, and Endpoints (p. 587).</td>
<td>April 11, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>• You can use the AD Connector with Amazon QuickSight. To learn more about managing Enterprise users, see Managing User Access Inside Amazon QuickSight (p. 660).</td>
<td>April 6, 2017</td>
</tr>
<tr>
<td></td>
<td>• You can add Key Performance Indicators (KPIs) to your visualizations. To learn more, see Using KPIs (p. 367).</td>
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<td></td>
<td>• And 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. 131).</td>
<td></td>
</tr>
<tr>
<td>New feature</td>
<td>You can now export to a comma-separated value (CSV) format file using Amazon QuickSight. To learn more, see Exporting Data from an Amazon QuickSight Visual to a CSV File (p. 271).</td>
<td>March 21, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>You can now schedule data refreshes for SPICE datasets. To learn more, see Refreshing Data (p. 107).</td>
<td>February 14, 2017</td>
</tr>
<tr>
<td>New feature</td>
<td>You can now connect to Amazon Athena databases and use them as data sources in Amazon QuickSight. To learn more, see Creating a Data Set Using Amazon Athena Data (p. 95).</td>
<td>December 22, 2016</td>
</tr>
<tr>
<td>New edition</td>
<td>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. 585).</td>
<td>December 15, 2016</td>
</tr>
<tr>
<td>New guide</td>
<td>This is the first release of Amazon QuickSight User Guide.</td>
<td>November 15, 2016</td>
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Switzerland: swisstopo
Europe-wide: European Environment Agency (EEA) urban morphological zones 2006

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