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What Is AWS CloudTrail?

AWS CloudTrail is an AWS service that helps you enable operational and risk auditing, governance, and compliance of your AWS account. Actions taken by a user, role, or an AWS service are recorded as events in CloudTrail. Events include actions taken in the AWS Management Console, AWS Command Line Interface, and AWS SDKs and APIs.

CloudTrail is enabled on your AWS account when you create it. When activity occurs in your AWS account, that activity is recorded in a CloudTrail event. You can view the past 90 days of recorded API activity (management events) in an AWS Region in the CloudTrail console by going to the Event history. For an ongoing record of activity and events in your AWS account, create an event data store (p. 169) or create a trail (p. 85). For more information about CloudTrail pricing, see AWS CloudTrail Pricing.

Visibility into your AWS account activity is a key aspect of security and operational best practices. You can use CloudTrail to view, search, download, archive, analyze, and respond to account activity across your AWS infrastructure. You can identify who or what took which action, what resources were acted upon, when the event occurred, and other details to help you analyze and respond to activity in your AWS account. Optionally, you can enable AWS CloudTrail Insights on a trail to help you identify and respond to unusual activity.

You can integrate CloudTrail into applications using the API, automate trail creation for your organization, check the status of event data stores and trails you create, and control how users view CloudTrail events.

Topics

- How CloudTrail works (p. 1)
- CloudTrail workflow (p. 4)
- CloudTrail concepts (p. 8)
- CloudTrail supported Regions (p. 19)
- CloudTrail log file examples (p. 21)
- CloudTrail supported services and integrations (p. 27)
- Quotas in AWS CloudTrail (p. 42)

How CloudTrail works

CloudTrail is enabled on your AWS account when you create it. When activity occurs in your AWS account, that activity is recorded in a CloudTrail event. You can view the past 90 days of recorded API activity (management events) in an AWS Region in the CloudTrail console by going to the Event history.

For an ongoing record of events in your AWS account, create an event data store or a trail. Trails can log events for CloudTrail management, data, and Insights events. Event data stores can log CloudTrail management and data events, AWS Config configuration items, AWS Audit Manager evidence, and non-AWS events from integrations.

To get started with CloudTrail, see Getting started with AWS CloudTrail tutorial (p. 47).

For CloudTrail pricing, see AWS CloudTrail Pricing. For Amazon S3 and Amazon SNS pricing, see Amazon S3 Pricing and Amazon SNS Pricing.
Event history

You can easily view management events in the CloudTrail console by going to Event history. The Event history provides a viewable, searchable, downloadable, and immutable record of the past 90 days of recorded API activity (management events) in an AWS Region. You can search events in Event history by filtering for events on a single attribute. For more information, see Viewing events with CloudTrail Event history.

CloudTrail Lake and event data stores

You can create a CloudTrail Lake event data store to archive, analyze, and respond to changes in your AWS resources. Events are aggregated into event data stores, which are immutable collections of events based on criteria that you select by applying advanced event selectors (p. 270). You can keep event data in an event data store for up to seven years, or 2557 days.

You can create an event data store to collect CloudTrail management and data events, AWS Config configuration items, AWS Audit Manager evidence, or non-AWS events. You can create event data stores using the console, the AWS CLI, or the CloudTrail API. For more information about creating event data stores using the console, see Create an event data store (p. 169). For more information about creating event data stores using the AWS CLI, see Managing CloudTrail Lake by using the AWS CLI (p. 224).

CloudTrail Lake lets you log events from applications outside of AWS, including from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers by creating integrations. You can create integrations with more than 12 partners to log events that occur outside AWS to your event data stores. To create an integration, you first configure a channel over which events are delivered. You can use CloudTrail Lake to store, access, analyze, troubleshoot and take action on this data without maintaining multiple log aggregators and reporting tools.

Event data stores can log events from the current AWS Region, or from all AWS Regions in your AWS account. Event data stores that you are using to log Integration events from outside AWS must be for a single Region only; they cannot be multi-Region event data stores.

To change an event data store after you create it, you can run the update-event-data-store command, or use the CloudTrail Lake console.

If you have created an organization in AWS Organizations, you can create an organization event data store that logs all events for all AWS accounts in that organization. Organization event data stores can apply to all AWS Regions, or the current Region. Organization event data stores must be created in the management account or delegated administrator account, and when specified as applying to an organization, are automatically applied to all member accounts in the organization. Member accounts cannot see the organization event data store, nor can they modify or delete it. By default, member accounts do not have access to the log files for an organization event data store, nor can they run queries on organization event data stores. Organization event data stores cannot be used to collect events from outside of AWS.

For more information about how to get started with CloudTrail Lake, see Working with AWS CloudTrail Lake (p. 166) in this guide.
CloudTrail trails

You can also create a CloudTrail trail to archive, analyze, and respond to changes in your AWS resources. Trails can log CloudTrail management events, data events, and Insights events.

A trail is a configuration that enables delivery of events to an Amazon S3 bucket that you specify. You can also deliver and analyze events in a trail with Amazon CloudWatch Logs and Amazon EventBridge. You can create trails with the CloudTrail console, the AWS CLI, or the CloudTrail API.

You can create two types of trails for an AWS account:

A trail that applies to all Regions

When you create a trail that applies to all Regions, CloudTrail records events in each Region and delivers the CloudTrail event log files to an S3 bucket that you specify. If a Region is added after you create a trail that applies to all Regions, that new Region is automatically included, and events in that Region are logged. Creating a multi-Region trail is a recommended best practice since you capture activity in all Regions in your account. All trails you create using the CloudTrail console are multi-Region. You can update a single-Region trail to log all Regions by using the AWS CLI. For more information, see Creating a trail in the console (basic event selectors) (p. 85) and Converting a trail that applies to one Region to apply to all Regions (p. 109).

A trail that applies to one Region

When you create a trail that applies to one Region, CloudTrail records the events in that Region only. It then delivers the CloudTrail event log files to an Amazon S3 bucket that you specify. You can only create a single-Region trail by using the AWS CLI. If you create additional single trails, you can have those trails deliver CloudTrail event log files to the same Amazon S3 bucket or to separate buckets. This is the default option when you create a trail using the AWS CLI or the CloudTrail API. For more information, see Creating, updating, and managing trails with the AWS Command Line Interface (p. 104).

Note

For both types of trails, you can specify an Amazon S3 bucket from any Region.

Beginning on April 12, 2019, trails are viewable only in the AWS Regions where they log events. If you create a trail that logs events in all AWS Regions, it will appear in the console in all AWS Regions. If you create a trail that only logs events in a single AWS Region, you can view and manage it only in that AWS Region.

If you have created an organization in AWS Organizations, you can create an organization trail that logs all events for all AWS accounts in that organization. Organization trails can apply to all AWS Regions, or the current Region. Organization trails must be created in the management account or delegated administrator account, and when specified as applying to an organization, are automatically applied to all member accounts in the organization. Member accounts can see the organization trail, but cannot modify or delete it. By default, member accounts do not have access to the log files for an organization trail in the Amazon S3 bucket.

You can change the configuration of a trail after you create it, including whether it logs events in one Region or all Regions. To change a single-Region trail to an all-Region trail, or vice-versa, you must run the AWS CLI update-trail (p. 108) command. You can also change whether it logs data or CloudTrail Insights events. Changing whether a trail logs events in one Region or in all Regions affects which events are logged. For more information, see Managing trails with the AWS CLI (p. 111) (AWS CLI), and Working with CloudTrail log files (p. 246).

By default, CloudTrail event log files from trails are encrypted using Amazon S3 server-side encryption (SSE). You can also choose to encrypt your log files with an AWS Key Management Service (AWS KMS)
CloudTrail publishes log files multiple times an hour, about every 5 minutes. These log files contain API calls from services in the account that support CloudTrail. For more information, see CloudTrail supported services and integrations (p. 27).

Note
CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the AWS CloudTrail Service Level Agreement for more information. CloudTrail captures actions made directly by the user or on behalf of the user by an AWS service. For example, an AWS CloudFormation CreateStack call can result in additional API calls to Amazon EC2, Amazon RDS, Amazon EBS, or other services as required by the AWS CloudFormation template. This behavior is normal and expected. You can identify if the action was taken by an AWS service with the invokedby field in the CloudTrail event.

CloudTrail channels

CloudTrail supports two types of channels:

Channels for CloudTrail Lake integrations with event sources outside of AWS

CloudTrail Lake uses channels to bring non-AWS events into CloudTrail Lake from external partners that work with CloudTrail, or from your own sources. When you create a channel, you choose one or more event data stores to store events that arrive from the channel source. You can change the destination event data stores for a channel as needed, as long as the destination event data stores are set to log activity events. When you create a channel for events from an external partner, you provide a channel ARN to the partner or source application. The resource policy attached to the channel allows the source to transmit events through the channel. For more information, see Create an integration with an event source outside of AWS (p. 190) and CreateChannel in the AWS CloudTrail API Reference.

Service-linked channels

AWS services can create a service-linked channel to receive CloudTrail events on your behalf. The AWS service creating the service-linked channel configures advanced event selectors for the channel and specifies whether the channel applies to all Regions, or a single Region.

Using the AWS CLI, you can view information about any CloudTrail service-linked channels created by AWS services. For more information, see Viewing service-linked channels for CloudTrail by using the AWS CLI (p. 163).

CloudTrail workflow

This section provides information about CloudTrail features and the tasks you can perform for these features.

CloudTrail is enabled by default when you open your AWS account and you automatically have access to view the last 90 days of management events for your AWS account using Event history.

For an ongoing record of events in your AWS account past 90 days, create an event data store or a trail. Trails can log events for CloudTrail management, data, and Insights events. Event data stores can collect CloudTrail management and data events, AWS Config configuration items, AWS Audit Manager evidence, and non-AWS events from integrations.
Event history

View event history for your AWS account

You can view and search the last 90 days of events recorded by CloudTrail in the CloudTrail console or by using the AWS CLI. For more information, see Viewing events with CloudTrail Event history (p. 57).

Download events

You can download a CSV or JSON file containing up to the past 90 days of CloudTrail events for your AWS account. For more information, see Downloading events (p. 61).

CloudTrail Lake

Enable CloudTrail Lake

CloudTrail Lake lets you run fine-grained SQL-based queries on events from both AWS sources, and sources outside of AWS. Events are aggregated into event data stores, which are immutable collections of events based on criteria that you select by applying advanced event selectors (p. 270). You can keep the event data in an event data store for up to seven years. CloudTrail Lake is part of an auditing solution that helps you perform security investigations and troubleshooting. For more information, see Working with AWS CloudTrail Lake (p. 166).

Create an event data store

When you create an event data store in CloudTrail Lake, you choose the type of events to include in your event data store. For more information, see Create an event data store (p. 169).

View Lake dashboards

You can use CloudTrail Lake dashboards to visualize the events in an event data store. You can select from several different dashboard types. For more information, see View Lake dashboards (p. 201).

Log management and data events

Configure your event data stores to log read-only, write-only, or all management and data events. By default, event data stores log log management events. For more information, see Create an event data store for CloudTrail events (p. 169), Logging management events (p. 249), and Logging data events (p. 256).

Copy trail events to CloudTrail Lake

You can copy existing trail events to a CloudTrail Lake event data store to create a point-in-time snapshot of events logged to the trail. For more information, see Copy trail events to an event data store (p. 183).

Stop or start event ingestion on an event data store

You can stop and start event ingestion on event data stores that collect CloudTrail management and data events, or AWS Config configuration items. For more information about how to stop event ingestion in the CloudTrail console, see Stop an event data store from ingesting events (p. 183). For more information about how to stop event ingestion by using the AWS CLI, see Stop ingestion on an event data store (p. 233).

Create an integration with an event source outside of AWS

You can use CloudTrail Lake integrations to log and store user activity data from outside of AWS; from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers. For information about creating an integration in the CloudTrail console, see Create an integration with an event source outside of AWS.
AWS (p. 190). For information about creating an integration by using the AWS CLI, see Create an integration to log events from outside AWS (p. 226).

View Lake sample queries in the CloudTrail console

The CloudTrail console provides a number of sample queries that can help you get started writing your own queries. For more information, see Viewing sample queries in the CloudTrail console (p. 206).

Create or edit a query

Queries in CloudTrail are authored in SQL. You can build a query on the CloudTrail Lake Editor tab by writing the query in SQL from scratch, or by opening a saved or sample query and editing it. For more information, see Create or edit a query (p. 203) and CloudTrail Lake SQL constraints (p. 237).

Save CloudTrail Lake query results to an Amazon S3 bucket

When you run a query, you can save the query results to an S3 bucket. For more information, see Run a query and save query results (p. 210).

Download saved query results

You can download a CSV file containing your saved CloudTrail Lake query results. For more information, see Download your CloudTrail Lake saved query results (p. 213).

Validate saved query results

You can use CloudTrail query results integrity validation to determine whether the query results were modified, deleted, or unchanged after CloudTrail delivered the query results to the S3 bucket. For more information, see Validate saved query results (p. 214).

Manage user permissions

Use AWS Identity and Access Management (IAM) to manage which users have permissions to create, configure, or delete event data stores and channels; start and stop event ingestion; and copy trail events to an event data store. For more information, see Granting permissions for CloudTrail administration (p. 373).

Register a delegated administrator to manage your organization's CloudTrail resources

You can register a delegated administrator to manage your organization's CloudTrail event data stores. For more information, see Organization delegated administrator (p. 353).

Work with partner solutions

Analyze your CloudTrail output with a partner solution that integrates with CloudTrail. Partner solutions offer a broad set of capabilities, such as change tracking, troubleshooting, and security analysis. For more information, see the AWS CloudTrail partner page.

Trails

Create a trail

A trail enables CloudTrail to deliver log files to your Amazon S3 bucket. By default, when you create a trail in the console, the trail applies to all Regions. The trail logs events from all Regions in the AWS partition and delivers the log files to the S3 bucket that you specify. For more information, see Creating a trail for your AWS account (p. 84).

Log management and data events

Configure your trails to log read-only, write-only, or all management and data events. By default, trails log management events. For more information, see Logging management events (p. 249) and Logging data events (p. 256).
Log Insights events

Configure your trails to log Insights events to help you identify and respond to unusual activity associated with management API calls. For more information, see Logging Insights events for trails (p. 285).

View Insights events

After you enable CloudTrail Insights on a trail, you can view up to 90 days of Insights events by using the CloudTrail console or the AWS CLI. For more information, see Viewing CloudTrail Insights events (p. 69).

Download Insights events

After you enable CloudTrail Insights on a trail, you can download a CSV or JSON file containing up to the past 90 days of Insights events for your trail. For more information, see Downloading Insights events (p. 76).

Copy trail events to CloudTrail Lake

You can copy existing trail events to a CloudTrail Lake event data store to create a point-in-time snapshot of events logged to the trail. For more information, see Copying trail events to CloudTrail Lake (p. 149).

Create and subscribe to an Amazon SNS topic

Subscribe to a topic to receive notifications about log file delivery to your bucket. Amazon SNS can notify you in multiple ways, including programmatically with Amazon Simple Queue Service. For information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

Note
If you want to receive SNS notifications about log file deliveries from all Regions, specify only one SNS topic for your trail. If you want to programmatically process all events, see Using the CloudTrail Processing Library (p. 344).

View your log files

Use Amazon S3 to retrieve log files. For information, see Getting and viewing your CloudTrail log files (p. 154).

Monitor events with CloudWatch Logs

You can configure your trail to send events to CloudWatch Logs. You can then use CloudWatch Logs to monitor your account for specific API calls and events. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

Note
If you configure a trail that applies to all Regions to send events to a CloudWatch Logs log group, CloudTrail sends events from all Regions to a single log group.

Enable log encryption

Log file encryption provides an extra layer of security for your log files. For more information, see Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403).

Enable log file integrity

Log file integrity validation helps you verify that log files have remained unchanged since CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).

Share log files with other AWS accounts

You can share log files between accounts. For more information, see Sharing CloudTrail log files between AWS accounts (p. 315).
Aggregate logs from multiple accounts

You can aggregate log files from multiple accounts to a single bucket. For more information, see Receiving CloudTrail log files from multiple accounts (p. 307).

Manage user permissions

Use AWS Identity and Access Management (IAM) to manage which users have permissions to create, configure, or delete trails; start and stop logging; and access buckets that have log files. For more information, see Granting permissions for CloudTrail administration (p. 373).

Register a delegated administrator to manage your organization's CloudTrail resources

You can register a delegated administrator to manage your organization's CloudTrail trails. For more information, see Organization delegated administrator (p. 353).

Work with partner solutions

Analyze your CloudTrail output with a partner solution that integrates with CloudTrail. Partner solutions offer a broad set of capabilities, such as change tracking, troubleshooting, and security analysis. For more information, see the AWS CloudTrail partner page.

CloudTrail concepts

This section summarizes basic concepts related to CloudTrail.

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- What are CloudTrail events? (p. 9)
  - What are management events? (p. 9)
  - What are data events? (p. 9)
  - What are Insights events? (p. 12)
- What is CloudTrail event history? (p. 13)
- What are trails? (p. 13)
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- How do you manage CloudTrail? (p. 14)
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- How do you log management and data events? (p. 15)
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- How does CloudTrail behave regionally and globally? (p. 16)
  - What are the advantages of applying a trail to all Regions? (p. 16)
  - What happens when you apply a trail to all Regions? (p. 17)
  - Multiple trails per Region (p. 17)
What are CloudTrail events?

An event in CloudTrail is the record of an activity in an AWS account. This activity can be an action taken by an IAM identity, or service that is monitorable by CloudTrail. CloudTrail events provide a history of both API and non-API account activity made through the AWS Management Console, AWS SDKs, command line tools, and other AWS services. There are three types of events that can be logged in CloudTrail: management events, data events, and CloudTrail Insights events. By default, trails log management events, but not data or Insights events.

All event types use a CloudTrail JSON log format.

Note
CloudTrail does not log all AWS services and all events. For more information about which APIs are logged for a specific service, see documentation for that service in CloudTrail supported services and integrations (p. 27).

What are management events?

Management events provide information about management operations that are performed on resources in your AWS account. These are also known as control plane operations. Example management events include:

- Configuring security (for example, AWS Identity and Access Management AttachRolePolicy API operations).
- Registering devices (for example, Amazon EC2 CreateDefaultVpc API operations).
- Configuring rules for routing data (for example, Amazon EC2 CreateSubnet API operations).
- Setting up logging (for example, AWS CloudTrail CreateTrail API operations).

Management events can also include non-API events that occur in your account. For example, when a user signs in to your account, CloudTrail logs the ConsoleLogin event. For more information, see Non-API events captured by CloudTrail (p. 450). For a list of management events that CloudTrail logs for AWS services, see CloudTrail supported services and integrations (p. 27).

What are data events?

Data events provide information about the resource operations performed on or in a resource. These are also known as data plane operations. Data events are often high-volume activities.

The following table shows the data event types available for trails and event data stores. The Data event type (console) column shows the appropriate selection in the console. The resources.Type column shows the resources.Type value that you would specify to include data events of that type in your trail or event data store.

For trails, you can use basic or advanced event selectors to log data events for Amazon S3 buckets and bucket objects, Lambda functions, and DynamoDB tables (shown in the first three rows of the table). You can use only advanced event selectors to log the data event types shown in the remaining rows.

For event data stores, you can use only advanced event selectors to include data events.
## What are CloudTrail events?

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Description</th>
<th>Data event type (console)</th>
<th>resources.Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon DynamoDB</td>
<td>Amazon DynamoDB object-level API activity on tables (for example, PutItem, DeleteItem, and UpdateItem API operations). For more information about DynamoDB events, see DynamoDB data plane events in CloudTrail.</td>
<td>DynamoDB</td>
<td>AWS::DynamoDB::Table</td>
</tr>
<tr>
<td>AWS Lambda</td>
<td>AWS Lambda function execution activity (the Invoke API).</td>
<td>Lambda</td>
<td>AWS::Lambda::Function</td>
</tr>
<tr>
<td>Amazon S3</td>
<td><strong>Amazon S3 object-level API activity</strong> (for example, GetObject, DeleteObject, and PutObject API operations) on buckets and objects in buckets.</td>
<td>S3</td>
<td>AWS::S3::Object</td>
</tr>
<tr>
<td>AWS CloudTrail</td>
<td>CloudTrail PutAuditEvents activity on a CloudTrail Lake channel (<a href="#">p. 190</a>) that is used to log events from outside AWS.</td>
<td>CloudTrail</td>
<td>AWS::CloudTrail::Channel</td>
</tr>
<tr>
<td>Amazon CodeWhisperer</td>
<td>Amazon CodeWhisperer API activity on a profile.</td>
<td>CodeWhisperer</td>
<td>AWS::CodeWhisperer::Profile</td>
</tr>
<tr>
<td>Amazon Cognito</td>
<td>Amazon Cognito API activity on Amazon Cognito identity pools.</td>
<td>Cognito Identity Pools</td>
<td>AWS::Cognito::IdentityPool</td>
</tr>
<tr>
<td>Amazon DynamoDB</td>
<td><strong>Amazon DynamoDB</strong> API activity on streams.</td>
<td>DynamoDB Streams</td>
<td>AWS::DynamoDB::Stream</td>
</tr>
<tr>
<td>Amazon Elastic Block Store</td>
<td><strong>Amazon Elastic Block Store (EBS)</strong> direct APIs, such as PutSnapshotBlock, GetSnapshotBlock, and ListChangedBlocks on Amazon EBS snapshots.</td>
<td>Amazon EBS direct APIs</td>
<td>AWS::EC2::Snapshot</td>
</tr>
<tr>
<td>Amazon EMR</td>
<td>Amazon EMR API activity on a write-ahead log workspace.</td>
<td>EMR write-ahead log workspace</td>
<td>AWS::EMRWAL::Workspace</td>
</tr>
</tbody>
</table>
## What are CloudTrail events?

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Description</th>
<th>Data event type (console)</th>
<th>resources.Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon FinSpace</td>
<td>Amazon FinSpace API activity on environments.</td>
<td>FinSpace</td>
<td>AWS::FinSpace::Environment</td>
</tr>
<tr>
<td>AWS Glue</td>
<td>AWS Glue API activity on tables that were created by Lake Formation.</td>
<td>Lake Formation</td>
<td>AWS::Glue::Table</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWS Glue data events for tables are currently supported only in the following regions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US East (N. Virginia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US East (Ohio)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US West (Oregon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Europe (Ireland)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Asia Pacific (Tokyo) Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazon GuardDuty</td>
<td>Amazon GuardDuty API activity for a <a href="https://aws.amazon.com/documentation/guardduty/how-to/data-event-detector/">detector</a></td>
<td>GuardDuty detector</td>
<td>AWS::GuardDuty::Detector</td>
</tr>
<tr>
<td>AWS HealthImaging</td>
<td>AWS HealthImaging API activity on data stores.</td>
<td>Medical Imaging data store</td>
<td>AWS::MedicalImaging::Datastore</td>
</tr>
<tr>
<td>Amazon Kendra Intelligent Ranking</td>
<td>Amazon Kendra Intelligent Ranking API activity on <a href="https://docs.aws.amazon.com/kendra/latest/dg/rescore-execution-plan.html">rescore execution plans</a></td>
<td>Kendra Ranking</td>
<td>AWS::KendraRanking::ExecutionPlan</td>
</tr>
<tr>
<td>Amazon Managed Blockchain</td>
<td>Amazon Managed Blockchain API activity on a network.</td>
<td>Managed Blockchain network</td>
<td>AWS::ManagedBlockchain::Network</td>
</tr>
<tr>
<td>Amazon Managed Blockchain</td>
<td>Amazon Managed Blockchain JSON-RPC calls on Ethereum nodes, such as <a href="https://docs.aws.amazon.com/managedblockchain/latest/api-reference/API_eth_getBalance.html">eth_getBalance</a> or <a href="https://docs.aws.amazon.com/managedblockchain/latest/api-reference/API_eth_getBlockByNumber.html">eth_getBlockByNumber</a>.</td>
<td>Managed Blockchain</td>
<td>AWS::ManagedBlockchain::Node</td>
</tr>
</tbody>
</table>
Data events are not logged by default when you create a trail or event data store. To record CloudTrail data events, you must explicitly add the supported resources or resource types for which you want to collect activity. For more information, see Creating a trail (p. 85) and Create an event data store for CloudTrail events (p. 169).

Additional charges apply for logging data events. For CloudTrail pricing, see AWS CloudTrail Pricing.

**What are Insights events?**

CloudTrail Insights events capture unusual API call rate or error rate activity in your AWS account by analyzing CloudTrail management activity. If you have Insights events enabled, and CloudTrail detects unusual activity, Insights events are logged to a different folder or prefix in the destination S3 bucket for your trail. You can also see the type of insight and the incident time period when you view Insights events on the CloudTrail console. Insights events provide relevant information, such as the associated API, error code, incident time, and statistics, that help you understand and act on unusual activity. Unlike other types of events captured in a CloudTrail trail, Insights events are logged only when CloudTrail detects changes in your account's API usage or error rate logging that differ significantly from the account's typical usage patterns. Examples of activity that might generate Insights events include:

- Your account typically logs no more than 20 Amazon S3 deleteBucket API calls per minute, but your account starts to log an average of 100 deleteBucket API calls per minute. An Insights event is logged at the start of the unusual activity, and another Insights event is logged to mark the end of the unusual activity.
• Your account typically logs 20 calls per minute to the Amazon EC2
  AuthorizeSecurityGroupIngress API, but your account starts to log zero calls to
  AuthorizeSecurityGroupIngress. An Insights event is logged at the start of the unusual activity,
  and ten minutes later, when the unusual activity ends, another Insights event is logged to mark the
  end of the unusual activity.

• Your account typically logs less than one AccessDeniedException error in a seven-day period on
  the AWS Identity and Access Management API, DeleteInstanceProfile. Your account starts to log
  an average of 12 AccessDeniedException errors per minute on the DeleteInstanceProfile
  API call. An Insights event is logged at the start of the unusual error rate activity, and another Insights
  event is logged to mark the end of the unusual activity.

These examples are provided for illustration purposes only. Your results may vary depending on your use
 case.

Insights events are disabled by default when you create a trail. To log CloudTrail Insights events,
 you must explicitly enable Insights event collection on a new or existing trail, and the trail must log
 CloudTrail management events. For more information, see Creating a trail (p. 85) and Logging Insights
events for trails (p. 285).

Additional charges apply for logging CloudTrail Insights events. For CloudTrail pricing, see AWS
 CloudTrail Pricing.

What is CloudTrail event history?

CloudTrail event history provides a viewable, searchable, downloadable, and immutable record of the
 past 90 days of CloudTrail management events in an AWS Region. You can use this history to gain
 visibility into actions taken in your AWS account in the AWS Management Console, AWS SDKs, command
 line tools, and other AWS services. You can customize your view of event history in the CloudTrail
 console by selecting which columns are displayed. For more information, see Viewing events with
 CloudTrail Event history (p. 57).

What are trails?

A trail is a configuration that enables delivery of CloudTrail events to an Amazon S3 bucket, CloudWatch
 Logs, and Amazon EventBridge. You can use a trail to filter the CloudTrail events you want delivered,
 encrypt your CloudTrail event log files with an AWS KMS key, and set up Amazon SNS notifications for
 log file delivery. For more information about how to create and manage a trail, see Creating a trail for
 your AWS account (p. 84).

What are organization trails?

An organization trail is a configuration that enables delivery of CloudTrail events in the management
 account, delegated administrator account, and all member accounts in an AWS Organizations
 organization to the same Amazon S3 bucket, CloudWatch Logs, and Amazon EventBridge. Creating an
 organization trail helps you define a uniform event logging strategy for your organization.

When you create an organization trail, a trail with the name that you give it will be created in every
 AWS account that belongs to your organization. Users with CloudTrail permissions in member accounts
 will be able to see this trail (including the trail ARN) when they log into the AWS CloudTrail console
 from their AWS accounts, or when they run AWS CLI commands such as describe-trails (although
 member accounts must use the ARN for the organization trail, and not the name, when using the AWS
 CLI). However, users in member accounts will not have sufficient permissions to delete the organization
 trail, turn logging on or off, change what types of events are logged, or otherwise alter the organization
 trail in any way. For more information about AWS Organizations, see Organizations Terminology and
How do you manage CloudTrail?

CloudTrail console

You can use and manage the service with the AWS CloudTrail console. The console provides a user interface for performing many CloudTrail tasks such as:

- Viewing recent events and event history for your AWS account.
- Downloading a filtered or complete file of the last 90 days of events.
- Creating and editing CloudTrail trails.
- Creating and editing CloudTrail Lake event data stores.
- Running queries on event data stores.
- Configuring CloudTrail trails, including:
  - Selecting an Amazon S3 bucket for trails.
  - Setting a prefix.
  - Configuring delivery to CloudWatch Logs.
  - Using AWS KMS keys for encryption of trail data.
  - Enabling Amazon SNS notifications for log file delivery on trails.
  - Adding and managing tags for your trails.
- Configuring CloudTrail Lake event data stores, including:
  - Integrating event data stores with CloudTrail partners or with your own applications, to log events from sources outside of AWS.
  - Using AWS KMS keys for encryption of event data store data.
  - Adding and managing tags for your event data stores.

Beginning on April 12, 2019, trails will be viewable only in the AWS Regions where they log events. If you create a trail that logs events in all AWS Regions, it will appear in the console in all AWS Regions. If you create a trail that only logs events in a single AWS Region, you can view and manage it only in that AWS Region.

For more information about the AWS Management Console, see AWS Management Console.

CloudTrail CLI

The AWS Command Line Interface is a unified tool that you can use to interact with CloudTrail from the command line. For more information, see the AWS Command Line Interface User Guide. For a complete list of CloudTrail CLI commands, see Available Commands.

CloudTrail APIs

In addition to the console and the CLI, you can also use the CloudTrail RESTful APIs to program CloudTrail directly. For more information, see the AWS CloudTrail API Reference.

AWS SDKs

As an alternative to using the CloudTrail API, you can use one of the AWS SDKs. Each SDK consists of libraries and sample code for various programming languages and platforms. The SDKs provide a

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How do you control access to CloudTrail?

AWS Identity and Access Management is a web service that enables Amazon Web Services (AWS) customers to securely control access to AWS resources. Using IAM, you can centrally manage permissions that control which CloudTrail resources users can access. For more information about controlling user permissions, see Controlling user permissions for CloudTrail (p. 158).

How do you log management and data events?

By default, trails log management events for your AWS account and don't include data events. You can choose to create or update trails to log data events. Only events that match your trail settings are delivered to your Amazon S3 bucket, and optionally to an Amazon CloudWatch Logs log group. If the event doesn't match the settings for a trail, the trail doesn't log the event. For more information, see Working with CloudTrail log files (p. 246).

How do you log CloudTrail Insights events?

AWS CloudTrail Insights helps AWS users identify and respond to unusual volumes of API calls or errors logged on API calls by continuously analyzing CloudTrail management events. An Insights event is a record of unusual levels of write management API activity, or unusual levels of errors returned on management API activity. The details page of an Insights event shows the event as a graph of unusual activity, and shows the start and end times of the unusual activity, along with the baseline that is used to determine whether the activity is unusual. By default, trails don't log CloudTrail Insights events. In the console, you can choose to log Insights events when you create or update a trail. When you use the CloudTrail API, you can log Insights events by editing the settings of an existing trail with the PutInsightSelectors API. Additional charges apply for logging CloudTrail Insights events. For more information, see Logging Insights events for trails (p. 285) and AWS CloudTrail Pricing.

How do you run complex queries on events logged by CloudTrail?

CloudTrail Lake lets you run fine-grained SQL-based queries on your events, and log events from sources outside AWS, including from your own applications, and from partners who are integrated with CloudTrail. You do not need to have a trail configured in your account to use CloudTrail Lake. Event data stores are immutable collections of events based on criteria that you select by applying advanced event selectors (p. 270). You can keep the event data in an event data store for up to seven years. You can save Lake queries for future use, and view results of queries for up to seven days. You can also save query results to an Amazon Simple Storage Service bucket. CloudTrail Lake can also store events from an organization in AWS Organizations in an event data store, or events from multiple Regions and...
How do you perform monitoring with CloudTrail?

CloudWatch Logs, EventBridge, and CloudTrail

Amazon CloudWatch is a web service that collects and tracks metrics to monitor your Amazon Web Services (AWS) resources and the applications that you run on AWS. Amazon CloudWatch Logs is a feature of CloudWatch that you can use specifically to monitor log data. Integration with CloudWatch Logs enables CloudTrail to send events containing API activity in your AWS account to a CloudWatch Logs log group. CloudTrail events that are sent to CloudWatch Logs can trigger alarms according to the metric filters you define. You can optionally configure CloudWatch alarms to send notifications or make changes to the resources that you are monitoring based on log stream events that your metric filters extract. Using CloudWatch Logs, you can also track CloudTrail events alongside events from the operating system, applications, or other AWS services that are sent to CloudWatch Logs. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

Amazon EventBridge is an AWS service that delivers a near real-time stream of system events that describe changes in AWS resources. In EventBridge, you can create rules that respond to events recorded by CloudTrail. For more information, see Create a rule in Amazon EventBridge.

You can deliver events that you are subscribed to on your trail to EventBridge. When you create a rule with the EventBridge console, choose either the AWS API Call via CloudTrail detail-type to deliver CloudTrail data and management events, or the AWS Insight via CloudTrail detail-type to deliver Insights events.

To record events with a detail-type value of AWS API Call via CloudTrail, you must have an active trail that is logging management or data events. For more information about how to create a trail, see Creating a trail (p. 85).

To record events with a detail-type value of AWS Insight via CloudTrail, you must have an active trail that is logging Insights events. For information about logging Insights events, see Logging Insights events for trails (p. 285).

How does CloudTrail behave regionally and globally?

A trail can be applied to all Regions or a single Region. As a best practice, create a trail that applies to all Regions in the AWS partition in which you are working. This is the default setting when you create a trail in the CloudTrail console.

**Note**

Turning on a trail means that you create a trail and start delivery of CloudTrail event log files to an Amazon S3 bucket. In the CloudTrail console, logging is turned on automatically when you create a trail.

What are the advantages of applying a trail to all Regions?

A trail that applies to all AWS Regions has the following advantages:

- The configuration settings for the trail apply consistently across all AWS Regions.
- You receive CloudTrail events from all AWS Regions in a single Amazon S3 bucket and, optionally, in a CloudWatch Logs log group.
- You manage trail configuration for all AWS Regions from one location.
How does CloudTrail behave regionally and globally?

- You immediately receive events from a new AWS Region. When a new AWS Region is launched, CloudTrail automatically creates a copy of all of your Region trails for you in the new Region with the same settings as your original trail.
- You don’t need to create trails in AWS Regions that you don’t use often in order to monitor for unusual activity. Any activity in any AWS Region is logged in a trail that applies to all AWS Regions.

What happens when you apply a trail to all Regions?

When you apply a trail to all AWS Regions, CloudTrail uses the trail that you create in a particular Region to create trails with identical configurations in all other Regions in your account.

This has the following effects:

- CloudTrail delivers log files for account activity from all AWS Regions to the single Amazon S3 bucket that you specify, and, optionally, to a CloudWatch Logs log group.
- If you configured an Amazon SNS topic for the trail, SNS notifications about log file deliveries in all AWS Regions are sent to that single SNS topic.
- If you enabled it, log file integrity validation is enabled for the trail in all AWS Regions. For information, see [Validating CloudTrail log file integrity](p. 324).

Regardless of whether a trail is multi-Region or single-Region, events sent to Amazon EventBridge are received in each Region's event bus, rather than in one single event bus.

Multiple trails per Region

If you have different but related user groups, such as developers, security personnel, and IT auditors, you can create multiple trails per Region. This allows each group to receive its own copy of the log files.

CloudTrail supports five trails per Region. A trail that applies to all AWS Regions counts as one trail in every Region.

The following example is a Region with five trails:

- You create two trails in the US West (N. California) Region that apply to this Region only.
- You create two more trails in US West (N. California) Region that apply to all AWS Regions.
- You create a trail in the Asia Pacific (Sydney) Region that applies to all AWS Regions. This trail also exists as a trail in the US West (N. California) Region.

Trails appear in the AWS Region where they exist. Trails that log events in all AWS Regions appear in every Region. You can view a list of trails in an AWS Region in the Trails page of the CloudTrail console. For more information, see [Updating a trail](p. 96). For CloudTrail pricing, see [AWS CloudTrail Pricing](p. 101).

AWS Security Token Service and CloudTrail

AWS Security Token Service (AWS STS) is a service that has a global endpoint and also supports Region-specific endpoints. An endpoint is a URL that is the entry point for web service requests. For example, https://cloudtrail.us-west-2.amazonaws.com is the US West (Oregon) regional entry point for the AWS CloudTrail service. Regional endpoints help reduce latency in your applications.

When you use an AWS STS Region-specific endpoint, the trail in that Region delivers only the AWS STS events that occur in that Region. For example, if you are using the endpoint sts.us-west-2.amazonaws.com, the trail in us-west-2 delivers only the AWS STS events that originate from us-west-2. For more information about AWS STS regional endpoints, see [Activating and Deactivating AWS STS in an AWS Region](p. 96) in the IAM User Guide.
For a complete list of AWS regional endpoints, see AWS Regions and Endpoints in the AWS General Reference. For details about events from the global AWS STS endpoint, see Global service events (p. 18).

Global service events

Important
As of November 22, 2021, AWS CloudTrail changed how trails capture global service events. Now, events created by Amazon CloudFront, AWS Identity and Access Management, and AWS STS are recorded in the Region in which they were created, the US East (N. Virginia) Region, us-east-1. This makes how CloudTrail treats these services consistent with that of other AWS global services. To continue receiving global service events outside of US East (N. Virginia), be sure to convert single-Region trails using global service events outside of US East (N. Virginia) into multi-Region trails. For more information about capturing global service events, see Enabling and disabling global service event logging (p. 109) later in this section.

In contrast, the Event history in the CloudTrail console and the aws cloudtrail lookup-events command will show these events in the Region where they occurred. For example, if a ConsoleLogin event occurred in us-west-1, the Event history in the CloudTrail console and the aws cloudtrail lookup-events command will show this event in us-west-1.

For most services, events are recorded in the Region where the action occurred. For global services such as AWS Identity and Access Management (IAM), AWS STS, and Amazon CloudFront, events are delivered to any trail that includes global services.

For most global services, events are logged as occurring in US East (N. Virginia) Region, but some global service events are logged as occurring in other Regions, such as US East (Ohio) Region or US West (Oregon) Region.

To avoid receiving duplicate global service events, remember the following:

- Global service events are delivered by default to trails that are created using the CloudTrail console. Events are delivered to the bucket for the trail.
- If you have multiple single Region trails, consider configuring your trails so that global service events are delivered in only one of the trails. For more information, see Enabling and disabling global service event logging (p. 109).
- If you change the configuration of a trail from logging all Regions to logging a single Region, global service event logging is turned off automatically for that trail. Similarly, if you change the configuration of a trail from logging a single Region to logging all Regions, global service event logging is turned on automatically for that trail.

For more information about changing global service event logging for a trail, see Enabling and disabling global service event logging (p. 109).

Example:

1. You create a trail in the CloudTrail console. By default, this trail logs global service events.
2. You have multiple single Region trails.
3. You do not need to include global services for the single Region trails. Global service events are delivered for the first trail. For more information, see Creating, updating, and managing trails with the AWS Command Line Interface (p. 104).

Note
When you create or update a trail with the AWS CLI, AWS SDKs, or CloudTrail API, you can specify whether to include or exclude global service events for trails. You cannot configure global service event logging from the CloudTrail console.
How does CloudTrail relate to other AWS monitoring services?

CloudTrail adds another dimension to the monitoring capabilities already offered by AWS. It does not change or replace logging features you might already be using, such as those for Amazon S3 or Amazon CloudFront subscriptions. Amazon CloudWatch focuses on performance monitoring and system health. CloudTrail focuses on API activity. Although CloudTrail does not report on system performance or health, you can use CloudTrail with CloudWatch alarms to notify you about activity that you might be interested in.

Partner solutions

AWS partners with third-party specialists in logging and analysis to provide solutions that use CloudTrail output. For more information, visit the CloudTrail detail page at AWS CloudTrail.

CloudTrail supported Regions

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region</th>
<th>Endpoint</th>
<th>Protocol</th>
<th>AWS Account ID</th>
<th>Support Date</th>
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<tbody>
<tr>
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</table>
### CloudTrail supported Regions

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region</th>
<th>Endpoint</th>
<th>Protocol</th>
<th>AWS Account ID</th>
<th>Support Date</th>
</tr>
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<td>11/16/2022</td>
</tr>
</tbody>
</table>
CloudTrail log file examples

CloudTrail monitors events for your account. If you create a trail, it delivers those events as log files to your Amazon S3 bucket. If you create an event data store in CloudTrail Lake, events are logged to your event data store. Event data stores do not use S3 buckets.

Topics
- CloudTrail log file name format (p. 21)
- Log file examples (p. 22)

CloudTrail log file name format

CloudTrail uses the following file name format for the log file objects that it delivers to your Amazon S3 bucket:

AccountID_CloudTrail_RegionName_YYYYMMDDTHHmmZ_UniqueString.FileNameFormat

- The YYYY, MM, DD, HH, and mm are the digits of the year, month, day, hour, and minute when the log file was delivered. Hours are in 24-hour format. The Z indicates that the time is in UTC.

Note
A log file delivered at a specific time can contain records written at any point before that time.
The 16-character UniqueString component of the log file name is there to prevent overwriting of files. It has no meaning, and log processing software should ignore it.

FileNameFormat is the encoding of the file. Currently, this is json.gz, which is a JSON text file in compressed gzip format.

Example CloudTrail Log File Name

```
111122223333_CloudTrail_us-east-2_20150801T0210Z_Mu0KsOhtH1ar15ZZ.json.gz
```

Log file examples

A log file contains one or more records. The following examples are snippets of logs that show the records for an action that started the creation of a log file.

Contents

- Amazon EC2 log examples (p. 22)
- IAM log examples (p. 24)
- Error code and message log example (p. 26)
- CloudTrail Insights event log example (p. 26)

Amazon EC2 log examples

Amazon Elastic Compute Cloud (Amazon EC2) provides resizeable computing capacity in the AWS Cloud. You can launch virtual servers, configure security and networking, and manage storage. Amazon EC2 can also scale up or down quickly to handle changes in requirements or spikes in popularity, thereby reducing your need to forecast server traffic. For more information, see the Amazon EC2 User Guide for Linux Instances.

The following example shows that an IAM user named Alice used the AWS CLI to call the Amazon EC2 StartInstances action using the ec2-start-instances command for instance i-ebeaf9e2.

```
{"Records": [{
  "eventVersion": "1.0",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "EX_PRINCIPAL_ID",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accessKeyId": "EXAMPLE_KEY_ID",
    "accountId": "123456789012",
    "userName": "Alice"
  },
  "eventTime": "2014-03-06T21:22:54Z",
  "eventSource": "ec2.amazonaws.com",
  "eventName": "StartInstances",
  "awsRegion": "us-east-2",
  "sourceIPAddress": "205.251.233.176",
  "userAgent": "ec2-api-tools 1.6.12.2",
  "requestParameters": {"instancesSet": [{"instanceId": "i-ebeaf9e2"]},
  "responseElements": {"instancesSet": [{"instanceId": "i-ebeaf9e2",
    "currentState": {"code": 0,
    "name": "pending"}
  },
  "previousState": {
```
The following example shows that an IAM user named Alice used the AWS CLI to call the Amazon EC2 StopInstances action by using the `ec2-stop-instances`.

```
{"Records": [{
    "eventId": "1.0",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
    },
    "eventTime": "2014-03-06T21:01:59Z",
    "eventSource": "ec2.amazonaws.com",
    "eventName": "StopInstances",
    "awsRegion": "us-east-2",
    "sourceIPAddress": "205.251.233.176",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
    }
}],
"responseElements": {
    "instancesSet": {
        "items": [{
            "instanceId": "i-ebeaf9e2",
            "currentState": {
                "code": 64,
                "name": "stopping"
            },
            "previousState": {
                "code": 16,
                "name": "running"
            }
        }]
    }
}}
```

The following example shows that the Amazon EC2 console backend called the CreateKeyPair action in response to requests initiated by the IAM user Alice. Note that the `responseElements` contain a hash of the key pair and that AWS removed the key material.

```
{"Records": [{
    "eventId": "1.0",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice",
        "sessionContext": {
            "attributes": {
                "mfaAuthenticated": "false",
                "creationDate": "2014-03-06T15:06Z"
            }
        }
    },
    "eventTime": "2014-03-06T17:10:34Z",
    "eventSource": "ec2.amazonaws.com",
    "eventName": "CreateKeyPair",
}]
```
IAM log examples

AWS Identity and Access Management (IAM) is a web service that helps you securely control access to AWS resources. With IAM, you can centrally manage permissions that control which AWS resources users can access. You use IAM to control who is authenticated (signed in) and authorized (has permissions) to use resources. For more information, see the IAM User Guide.

The following example shows that the IAM user Alice used the AWS CLI to call the CreateUser action to create a new user named Bob.

```
{"Records": [{
    "eventVersion": "1.0",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice"
    },
    "eventTime": "2014-03-24T21:11:59Z",
    "eventSource": "iam.amazonaws.com",
    "eventName": "CreateUser",
    "awsRegion": "us-east-2",
    "sourceIPAddress": "127.0.0.1",
    "userAgent": "aws-cli/1.3.2 Python/2.7.5 Windows/7",
    "requestParameters": {"userName": "Bob"},
    "responseElements": {"user": {
        "createDate": "Mar 24, 2014 9:11:59 PM",
        "userName": "Bob",
        "arn": "arn:aws:iam::123456789012:user/Bob",
        "path": "/",
        "userId": "EXAMPLEUSERID"
    }}
}]
```

The following example shows that the IAM user Alice used the AWS Management Console to call the AddUserToGroup action to add Bob to the administrator group.

```
{"Records": [{
    "eventVersion": "1.0",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:user/Alice",
        "accountId": "123456789012",
        "accessKeyId": "EXAMPLE_KEY_ID",
        "userName": "Alice",
        "sessionContext": {"attributes": {
            "version": "1.0",
            "eventName": "CreateUser",
            "awsRegion": "us-east-2",
            "sourceIPAddress": "72.21.198.64",
            "userAgent": "EC2ConsoleBackend, aws-sdk-java/Linux/x.xx.fleetxen Java_HotSpot(TM)_64-Bit_Server_VM/xx",
            "requestParameters": {"keyName": "mykeypair"},
            "responseElements": {
                "keyName": "mykeypair",
                "keyMaterial": "\u003csensitiveDataRemoved\u003e"
            }
        }
    }
}]
```
The following example shows that the IAM user Alice used the AWS CLI to call the CreateRole action to create a new IAM role.

```json
{
  "Records": [{
    "eventVersion": "1.0",
    "userIdentity": {
      "type": "IAMUser",
      "principalId": "EX_PRINCIPAL_ID",
      "arn": "arn:aws:iam::123456789012:user/Alice",
      "accountId": "123456789012",
      "accessKeyId": "EXAMPLE_KEY_ID",
      "userName": "Alice"
    },
    "eventTime": "2014-03-25T20:17:37Z",
    "eventSource": "iam.amazonaws.com",
    "eventName": "CreateRole",
    "awsRegion": "us-east-2",
    "sourceIPAddress": "127.0.0.1",
    "userAgent": "aws-cli/1.3.2 Python/2.7.5 Windows/7",
    "requestParameters": {
      "assumeRolePolicyDocument": "{\n      "Version": "2012-10-17",\n      "Statement": [\n        {\n          "Sid": "",
          "Effect": "Allow",
          "Principal": {\n            "AWS": "arn:aws:iam::803981987763:root"\n          },
          "Action": "sts:AssumeRole"
        }\n      ]\n    }
  }
}
```
Error code and message log example

The following example shows that the IAM user Alice used the AWS CLI to call the UpdateTrail action to update a trail named myTrail2, but the trail name was not found. The log shows this error in the errorCode and errorMessage elements.

```json
{"Records": [{
  "eventVersion": "1.04",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "EX_PRINCIPAL_ID",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accountId": "123456789012",
    "accessKeyId": "EXAMPLE_KEY_ID",
    "userName": "Alice"
  },
  "eventTime": "2016-07-14T19:15:45Z",
  "eventSource": "cloudtrail.amazonaws.com",
  "eventName": "UpdateTrail",
  "awsRegion": "us-east-2",
  "sourceIPAddress": "205.251.233.182",
  "userAgent": "aws-cli/1.10.32 Python/2.7.9 Windows/7 botocore/1.4.22",
  "errorCode": "TrailNotFoundException",
  "errorMessage": "Unknown trail: myTrail2 for the user: 123456789012",
  "requestParameters": {"name": "myTrail2"},
  "responseElements": null,
  "requestID": "5d40662a-49f7-11e6-97e4-d9cb6ff7d6a3",
  "eventID": "b7d4398e-b2f0-4faa-9c76-e2d516a8d67f",
  "eventType": "AwsApiCall",
  "recipientAccountId": "123456789012"
}]
}
```

CloudTrail Insights event log example

The following example shows a CloudTrail Insights event log. An Insights event is actually a pair of events that mark the start and end of a period of unusual write management API activity or error response activity. The state field shows whether the event was logged at the start or end of the period of unusual activity. The event name, UpdateInstanceInformation, is the same name as the AWS Systems Manager API for which CloudTrail analyzed management events to determine that unusual activity occurred. Although the start and end events have unique eventID values, they also have a sharedEventID value that is used by the pair. The Insights event shows the baseline, or the normal pattern of activity, the insight, or average unusual activity that triggered the start Insights event, and in the end event, the insight value for the average unusual activity over the duration of the Insights event. For more information about CloudTrail Insights, see [Logging Insights events for trails](p. 285).

```json
[{
  "Records": [
    {
      "eventVersion": "1.07",
      "eventTime": "2019-11-14T00:51:00Z",
      "awsRegion": "us-east-1",
      "eventID": "EXAMPLE8-9621-4d00-b913-beca2EXAMPLE",
      "eventType": "AwsCloudTrailInsight",
      "recipientAccountId": "123456789012",
      "sharedEventID": "EXAMPLE2-1729-42f1-b735-5d8c0EXAMPLE",
      "insightDetails": {
        "state": "Start",
        "eventSource": "ssm.amazonaws.com",
        "eventName": "UpdateInstanceInformation",
        "insightType": "ApiCallRateInsight",
        "insightContext": {
```
CloudTrail supported services and integrations

CloudTrail supports logging events for many AWS services. You can find the specifics for each supported service in that service's guide. Links to those service-specific topics are provided below. In addition, some AWS services can be used to analyze and act upon data collected in CloudTrail logs. You can browse an overview of those service integrations here.

**Note**
To see the list of supported Regions for each service, see Service endpoints and quotas in the Amazon Web Services General Reference.

**Topics**
- AWS service integrations with CloudTrail logs (p. 28)
- CloudTrail integration with Amazon EventBridge (p. 29)
- CloudTrail integration with AWS Organizations (p. 29)
- AWS service topics for CloudTrail (p. 29)
- CloudTrail unsupported services (p. 42)
AWS service integrations with CloudTrail logs

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 topics.

<table>
<thead>
<tr>
<th>AWS Service</th>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Athena</td>
<td>Querying AWS CloudTrail Logs</td>
<td>Using Athena with CloudTrail logs is a powerful way to enhance your analysis of AWS service activity. For example, you can use queries to identify trends and further isolate activity by attribute, such as source IP address or user. You can automatically create tables for querying logs directly from the CloudTrail console, and use those tables to run queries in Athena. For more information, see <a href="https://docs.aws.amazon.com/athena/latest/ug/creating-tables-cloudtrail.html">Creating a Table for CloudTrail Logs in the CloudTrail Console</a> in the Amazon Athena User Guide. Note Running queries in Amazon Athena incurs additional costs. For more information, see <a href="https">Amazon Athena Pricing</a>.</td>
</tr>
<tr>
<td>Amazon CloudWatch Logs</td>
<td>Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294)</td>
<td>You can configure CloudTrail with CloudWatch Logs to monitor your trail logs and be notified when specific activity occurs. For example, you can define CloudWatch Logs metric filters that will trigger CloudWatch alarms and send notifications to you when those alarms are triggered. Note Standard pricing for Amazon CloudWatch and Amazon</td>
</tr>
</tbody>
</table>
CloudTrail integration with Amazon EventBridge

Amazon EventBridge is an AWS service that delivers a near real-time stream of system events that describe changes in AWS resources. In EventBridge, you can create rules that respond to events recorded by CloudTrail. For more information, see Create a rule in Amazon EventBridge.

You can deliver events that you are subscribed to on your trail to EventBridge. When you create a rule with the EventBridge console, choose either the AWS API Call via CloudTrail detail-type to deliver CloudTrail data and management events, or the AWS Insight via CloudTrail detail-type to deliver Insights events.

To record events with a detail-type value of AWS API Call via CloudTrail, you must have an active trail that is logging management or data events. For more information about how to create a trail, see Creating a trail (p. 85).

To record events with a detail-type value of AWS Insight via CloudTrail, you must have an active trail that is logging Insights events. For information about logging Insights events, see Logging Insights events for trails (p. 285).

Note
Events from API actions that start with the keywords List, Get, or Describe are not processed by EventBridge, with the exception of events from the following STS actions: GetFederationToken and GetSessionToken.

CloudTrail integration with AWS Organizations

The management account for an AWS Organizations organization can configure a delegated administrator to manage the organization's CloudTrail resources. You can create a trail in the management account or delegated administrator account for an organization that collects all event data for all AWS accounts in an organization in AWS Organizations. This is called an organization trail. Creating an organization trail helps you define a uniform event logging strategy for your organization. An organization trail is applied automatically to each AWS account in your organization. Users in member accounts can see these trails but cannot modify them, and by default cannot see the log files created for the organization trail. For more information, see Creating a trail for an organization (p. 135).

AWS service topics for CloudTrail

You can learn more about how the events for individual AWS services are recorded in CloudTrail logs, including example events for that service in log files. For more information about how specific AWS services integrate with CloudTrail, see the topic about integration in the individual guide for that service.

Services that are still in preview, or not yet released for general availability (GA), or which don't have public APIs, are not considered supported. CloudTrail does not currently log Amazon VPC endpoint policy-specific events.

Note
To see the list of supported Regions for each service, see Service endpoints and quotas in the Amazon Web Services General Reference. For information about which services log data events, see Data events (p. 257).
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|                                                      | The Amazon VPC API is a subset of the Amazon EC2 API.                               |               |</p>
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<td>Logging AWS CodeBuild API Calls with AWS CloudTrail</td>
<td>12/01/2016</td>
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<td>AWS CodeCommit</td>
<td>Logging AWS CodeCommit API Calls with AWS CloudTrail</td>
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<td>AWS CodeDeploy</td>
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<td>AWS CodePipeline</td>
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<td>AWS CodeStar</td>
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<td>AWS CodeStar Notifications</td>
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<td>AWS Control Tower</td>
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<td>AWS DataSync</td>
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<td>AWS Service</td>
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<td>AWS Device Farm</td>
<td>Logging AWS Device Farm API Calls By Using AWS CloudTrail</td>
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<td>AWS Elastic Disaster Recovery</td>
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<td>AWS IAM Identity Center (successor to AWS Single Sign-</td>
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<td>AWS IoT Greengrass V2</td>
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<td>AWS Key Management Service (AWS KMS)</td>
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<td>AWS Lake Formation</td>
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<td>AWS Lambda</td>
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<td>Using Lambda with AWS CloudTrail</td>
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<td>AWS Marketplace Metering Service</td>
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<td>AWS Network Firewall</td>
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<td>AWS OpsWorks for Chef Automate</td>
<td>Logging AWS OpsWorks for Chef Automate API Calls with AWS CloudTrail</td>
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<td>AWS OpsWorks for Puppet Enterprise</td>
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<td>AWS OpsWorks Stacks</td>
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<td>Logging AWS Organizations API calls with AWS CloudTrail</td>
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<td>Logging AWS Outposts API calls with AWS CloudTrail</td>
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<td>AWS Private Certificate Authority</td>
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<td>AWS Resilience Hub</td>
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<td>AWS Resource Access Manager (AWS RAM)</td>
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<td>AWS Resource Groups</td>
<td>Logging AWS Resource Groups API Calls with AWS CloudTrail</td>
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<td>AWS RoboMaker</td>
<td>Logging AWS RoboMaker API Calls with AWS CloudTrail</td>
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<td>AWS Secrets Manager</td>
<td>Monitor the Use of Your AWS Secrets Manager Secrets</td>
<td>04/05/2018</td>
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<tr>
<td>AWS Security Token Service (AWS STS)</td>
<td>Logging IAM Events with AWS CloudTrail</td>
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<td></td>
<td>The IAM topic includes information for AWS STS.</td>
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<td>AWS Service</td>
<td>CloudTrail Topics</td>
<td>Support began</td>
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<td>AWS Serverless Application Repository</td>
<td>Logging AWS Serverless Application Repository API Calls with AWS CloudTrail</td>
<td>02/20/2018</td>
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<tr>
<td>AWS Service Catalog</td>
<td>Logging Service Catalog API Calls with AWS CloudTrail</td>
<td>07/06/2016</td>
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<tr>
<td>AWS Shield</td>
<td>Logging Shield Advanced API Calls with AWS CloudTrail</td>
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<tr>
<td>AWS Snowball</td>
<td>Logging AWS Snowball API Calls with AWS CloudTrail</td>
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<td>AWS Snowball Edge</td>
<td>Logging AWS Snowball Edge API Calls with AWS CloudTrail</td>
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<td>AWS Step Functions</td>
<td>Logging AWS Step Functions API Calls with AWS CloudTrail</td>
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<td>Storage Gateway</td>
<td>Logging Storage Gateway API Calls by Using AWS CloudTrail</td>
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<td>AWS Support</td>
<td>Logging AWS Support API Calls with AWS CloudTrail</td>
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<td>AWS Systems Manager</td>
<td>Logging AWS Systems Manager API Calls with AWS CloudTrail</td>
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<td>AWS Systems Manager Incident Manager</td>
<td>Logging AWS Systems Manager Incident Manager API calls using AWS CloudTrail</td>
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<td>AWS Telco Network Builder (AWS TNB)</td>
<td>Logging AWS Telco Network Builder API calls using AWS CloudTrail</td>
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<td>AWS Transfer for SFTP</td>
<td>Logging AWS Transfer for SFTP API Calls with AWS CloudTrail</td>
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<tr>
<td>AWS Transit Gateway</td>
<td>Logging API Calls for Your Transit Gateway Using AWS CloudTrail</td>
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<td>AWS Trusted Advisor</td>
<td>Logging AWS Trusted Advisor console actions with AWS CloudTrail</td>
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<tr>
<td>AWS WAF</td>
<td>Logging AWS WAF API Calls with AWS CloudTrail</td>
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<tr>
<td>AWS Well-Architected Tool</td>
<td>Logging AWS Well-Architected Tool API Calls with AWS CloudTrail</td>
<td>12/15/2020</td>
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<tr>
<td>AWS X-Ray</td>
<td>Logging AWS X-Ray API Calls With CloudTrail</td>
<td>04/25/2018</td>
</tr>
</tbody>
</table>
CloudTrail unsupported services

The following AWS services and events are not supported:

- AWS Import/Export
- Amazon VPC endpoint policy-specific events

For a list of supported AWS services, see [AWS service topics for CloudTrail](p. 29).

### Quotas in AWS CloudTrail

The following table describes quotas (formerly referred to as limits) within CloudTrail. CloudTrail has no adjustable quotas. For information about other quotas in AWS, see [AWS service quotas](#).

<table>
<thead>
<tr>
<th>Resource</th>
<th>Default quota</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails per Region</td>
<td>5</td>
<td>This quota cannot be increased.</td>
</tr>
<tr>
<td>Get, describe, and list APIs</td>
<td>10 transactions per second (TPS)</td>
<td>The maximum number of operation requests you can make per second without being throttled. The CancelQuery, LookupEvents, PutAuditEvents, and StartQuery APIs are not included in this category. This quota cannot be increased.</td>
</tr>
<tr>
<td>CancelQuery, StartQuery APIs</td>
<td>3 transactions per second (TPS)</td>
<td>The maximum number of operation requests you can make per second without being throttled.</td>
</tr>
<tr>
<td>LookupEvents API</td>
<td>2 transactions per second (TPS)</td>
<td>The maximum number of operation requests you can make per second without being throttled.</td>
</tr>
</tbody>
</table>
## Quotas in AWS CloudTrail

<table>
<thead>
<tr>
<th>Resource</th>
<th>Default quota</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PutAuditEvents API</td>
<td>100 transactions per second (TPS)</td>
<td>The maximum number of operation requests you can make per second without being throttled. This quota cannot be increased.</td>
</tr>
<tr>
<td>All other APIs</td>
<td>1 transaction per second (TPS)</td>
<td>The maximum number of operation requests you can make per second without being throttled. This quota cannot be increased.</td>
</tr>
<tr>
<td>Event data stores</td>
<td>10</td>
<td>The maximum number of event data stores that you can have in any one AWS Region. This includes single-Region event data stores for the Region as well as any multi-Region event data stores across all AWS Regions. This includes event data stores in any lifecycle stage. This quota cannot be increased.</td>
</tr>
<tr>
<td>Channels</td>
<td>25</td>
<td>This quota applies to channels used for CloudTrail Lake integrations with event sources outside of AWS, and does not apply to service-linked channels. This quota cannot be increased.</td>
</tr>
<tr>
<td>Concurrent queries</td>
<td>10</td>
<td>The maximum number of queued or running queries that you can run simultaneously in CloudTrail Lake. This quota cannot be increased.</td>
</tr>
<tr>
<td>Events per PutAuditEvents request</td>
<td>100</td>
<td>You can add up to 100 activity events (or up to 1 MB) per PutAuditEvents request. This quota cannot be increased.</td>
</tr>
<tr>
<td>Event selectors</td>
<td>5 per trail</td>
<td>This quota cannot be increased.</td>
</tr>
<tr>
<td>Resource</td>
<td>Default quota</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Advanced event selectors</td>
<td>500 conditions across all advanced event selectors</td>
<td>If a trail or event data store uses advanced event selectors, a maximum of 500 total values for all conditions in all advanced event selectors is allowed. Unless a trail or event data store logs data events on all resources, such as all S3 buckets or all Lambda functions, you are limited to 250 data resources. Data resources can be distributed across event selectors, but the overall total cannot exceed 250. This quota cannot be increased.</td>
</tr>
<tr>
<td>Resource</td>
<td>Default quota</td>
<td>Comments</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Data resources in event selectors | 250 across all event selectors in a trail         | If you choose to limit data events by using event selectors or advanced event selectors, the total number of data resources cannot exceed 250 across all event selectors in a trail. The limit of number of resources on an individual event selector is configurable up to 250. This upper limit is allowed only if the total number of data resources does not exceed 250 across all event selectors. Examples:  
  • A trail with 5 event selectors, each configured with 50 data resources, is allowed. \((5*50=250)\)  
  • A trail with 5 event selectors, 3 of which are configured with 50 data resources, 1 of which is configured with 99 data resources, and 1 of which is configured with 1 data resource, is also allowed. \(((3*50)+1+99=250)\)  
  • A trail configured with 5 event selectors, all of which are configured with 100 data resources, is not allowed. \((5*100=500)\)  

  Event selectors apply only to trails. For event data stores, you must use advanced event selectors.  

  This quota cannot be increased.  

  The quota does not apply if you choose to log data events on all resources, such as all S3 buckets or all Lambda functions. |
### Quotas in AWS CloudTrail

<table>
<thead>
<tr>
<th>Resource</th>
<th>Default quota</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event size</td>
<td>All event versions: events over 256 KB cannot be sent to CloudWatch Logs</td>
<td>Amazon CloudWatch Logs and Amazon EventBridge each allow a maximum event size of 256 KB. CloudTrail does not send events over 256 KB to CloudWatch Logs or EventBridge. Starting with event version 1.05, events have a maximum size of 256 KB. This is to help prevent exploitation by malicious actors, and allow events to be consumed by other AWS services, such as CloudWatch Logs and EventBridge.</td>
</tr>
<tr>
<td></td>
<td>Event version 1.05 and newer: total event size limit of 256 KB</td>
<td></td>
</tr>
<tr>
<td>CloudTrail file size sent to Amazon S3</td>
<td>50 MB ZIP file, after compression</td>
<td>For both management and data events, CloudTrail sends events to S3 in maximum 50 MB (compressed) ZIP files. If enabled on the trail, log delivery notifications are sent by Amazon SNS after CloudTrail sends ZIP files to S3.</td>
</tr>
</tbody>
</table>
Getting started with AWS CloudTrail tutorial

If you're new to AWS CloudTrail, this tutorial helps you learn how to use its features. In this tutorial, you review your recent AWS account activity in the CloudTrail console and examine an event. You then create a trail, which is an ongoing record of management event activity that is stored in an Amazon S3 bucket. Unlike Event history, this ongoing record is not limited to 90 days, logs events in all AWS Regions, and can help you meet your security and auditing needs over time.

Topics
- Prerequisites (p. 47)
- Step 1: Review AWS account activity in event history (p. 48)
- Step 2: Create your first trail (p. 50)
- Step 3: View your log files (p. 53)
- Step 4: Plan for next steps (p. 55)

Prerequisites

Before you begin, you must complete the following prerequisites and setup.

Topics
- Sign up for an AWS account (p. 47)
- Create an administrative user (p. 48)
- Grant permissions to use the CloudTrail console (p. 48)

Sign up for an AWS account

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

To sign up for an AWS account

2. Follow the online instructions.

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

When you sign up for an AWS account, an AWS account root user is created. The root user has access to all AWS services and resources in the account. As a security best practice, assign administrative access to an administrative user, and use only the root user to perform tasks that require root user access.

AWS sends you a confirmation email after the sign-up process is complete. At any time, you can view your current account activity and manage your account by going to https://aws.amazon.com/ and choosing My Account.
Create an administrative user

After you sign up for an AWS account, create an administrative user so that you don't use the root user for everyday tasks.

Secure your AWS account root user

1. Sign in to the AWS Management Console as the account owner by choosing Root user and entering your AWS account email address. On the next page, enter your password.
   For help signing in by using root user, see Signing in as the root user in the AWS Sign-In User Guide.
2. Turn on multi-factor authentication (MFA) for your root user.
   For instructions, see Enable a virtual MFA device for your AWS account root user (console) in the IAM User Guide.

Create an administrative user

• For your daily administrative tasks, grant administrative access to an administrative user in AWS IAM Identity Center (successor to AWS Single Sign-On).
  For instructions, see Getting started in the AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide.

Sign in as the administrative user

• To sign in with your IAM Identity Center user, use the sign-in URL that was sent to your email address when you created the IAM Identity Center user.
  For help signing in using an IAM Identity Center user, see Signing in to the AWS access portal in the AWS Sign-In User Guide.

Grant permissions to use the CloudTrail console

Grant permissions to use the CloudTrail console. For more information, see Granting permissions for CloudTrail administration (p. 373).

Step 1: Review AWS account activity in event history

CloudTrail is enabled on your AWS account when you create the account. When activity occurs in any AWS service that supports CloudTrail, that activity is recorded in a CloudTrail event along with other AWS service events in Event history. In other words, you can view, search, and download recent events in your AWS account before creating a trail, though creating a trail is important for long-term records and auditing of your AWS account activity. Unlike a trail, Event history only shows events that have occurred over the last 90 days.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. In the navigation pane, choose Dashboard. Review the information in your dashboard about the most recent events that have occurred in your AWS account. A recent event should be a ConsoleLogin event, showing that you just signed in to the AWS Management Console.
3. To see more information about an event in your dashboard, expand it.

4. In the navigation pane, choose Event history. You see a filtered list of events, with the most recent events showing first. The default filter for events is Read only, set to false. You can clear that filter by choosing X at the right of the filter.

5. Many more events are shown without the default filter. You can filter events in many ways. For example, to view all console login events, you could choose the Event name filter, and specify ConsoleLogin. The choice of filters is up to you.

6. You can save event history by downloading it as a file in CSV or JSON format. Downloading your event history can take a few minutes.

For more information, see Viewing events with CloudTrail Event history (p. 57).
Step 2: Create your first trail

While the events provided in Event history in the CloudTrail console are useful for reviewing recent activity, they are limited to recent activity, and they do not include all possible events that can be recorded by CloudTrail. Additionally, your view of events in the console is limited to the AWS Region where you are signed in. To create an ongoing record of activity in your AWS account that captures information for all AWS Regions, create a trail. By default, when you create a trail in the CloudTrail console, the trail logs events in all Regions. Logging events in all Regions in your account is a recommended best practice.

For your first trail, we recommend creating a trail that logs all management events (p. 9) in all AWS Regions, and does not log any data events (p. 9). Examples of management events include security events such as IAM CreateUser and AttachRolePolicy events, resource events such as RunInstances and CreateBucket, and many more. You will create an Amazon S3 bucket where you will store the log files for the trail as part of creating the trail in the CloudTrail console.

Note
This tutorial assumes you are creating your first trail. Depending on the number of trails you have in your AWS account, and how those trails are configured, the following procedure might or might not incur expenses. CloudTrail stores log files in an Amazon S3 bucket, which incurs costs. For more information about pricing, see AWS CloudTrail Pricing and Amazon S3 Pricing.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/. For more information, see AWS CloudTrail Pricing and Amazon S3 Pricing.

2. In the Region selector, choose the AWS Region where you want your trail to be created. This is the home Region for the trail.

   Note
   The home Region is the only AWS Region where you can view and update the trail after it is created, even if the trail logs events in all AWS Regions.

3. On the CloudTrail service home page, the Trails page, or the Trails section of the Dashboard page, choose Create trail.

4. In Trail name, give your trail a name, such as My-Management-Events-Trail. As a best practice, use a name that quickly identifies the purpose of the trail. In this case, you're creating a trail that logs management events.

5. Leave default settings for AWS Organizations organization trails. This option won't be available to change unless you have accounts configured in Organizations.

6. For Storage location, choose Create new S3 bucket to create a bucket. When you create a bucket, CloudTrail creates and applies the required bucket policies. Give your bucket a name, such as my-bucket-for-storing-cloudtrail-logs.

   To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.

   Note
   The name of your Amazon S3 bucket must be globally unique. For more information, see Bucket naming rules in the Amazon Simple Storage Service User Guide.
7. Clear the check box to disable **Log file SSE-KMS encryption**. By default, your log files are encrypted with SSE-S3 encryption. For more information about this setting, see [Protecting Data Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3)](#).

8. Leave default settings in **Additional settings**.

9. For now, do not send logs to Amazon CloudWatch Logs.

10. In **Tags**, add one or more custom tags (key-value pairs) to your trail. Tags can help you identify your CloudTrail trails and other resources, such as the Amazon S3 buckets that contain CloudTrail log files. For example, you could attach a tag with the name **Compliance** and the value **Auditing**.

    **Note**
    Though you can add tags to trails when you create them in the CloudTrail console, and you can create an Amazon S3 bucket to store your log files in the CloudTrail console, you cannot add tags to the Amazon S3 bucket from the CloudTrail console. For more information about viewing and changing the properties of an Amazon S3 bucket, including adding tags to a bucket, see the [Amazon S3 User Guide](#).
When you are finished creating tags, choose Next.

11. On the Choose log events page, select event types to log. For this trail, keep the default, Management events. In the Management events area, choose to log both Read and Write events, if they are not already selected. Leave the check boxes for Exclude AWS KMS events and Exclude Amazon RDS Data API events empty, to log all events.
12. Leave default settings for **Data events** and Insights events. This trail will not log any data or CloudTrail Insights events. Choose **Next**.

13. On the **Review and create** page, review the settings you've chosen for your trail. Choose **Edit** for a section to go back and make changes. When you are ready to create your trail, choose **Create trail**.

14. The **Trails** page shows your new trail in the table. Note that the trail is set to **Multi-region trail** by default, and that logging is turned on for the trail by default.

### Step 3: View your log files

Within an average of about 5 minutes of creating your first trail, CloudTrail delivers the first set of log files to the Amazon S3 bucket for your trail. You can look at these files and learn about the information they contain.

**Note**

CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the [AWS CloudTrail Service Level Agreement](https://aws.amazon.com/service-terms/) for more information.

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. In the navigation pane, choose **Trails**. On the **Trails** page, find the name of the trail you just created (in the example, My-Management-Events-Trail).

3. In the row for the trail, choose the value for the S3 bucket (in the example, aws-cloudtrail-logs-08132020-mytrail).

4. The Amazon S3 console opens and shows that bucket, at the top level for log files. Because you created a trail that logs events in all AWS Regions, the display opens at the level that shows you each Region folder. The hierarchy of the Amazon S3 bucket navigation at this level is bucket-name/AWSLogs/account-id/CloudTrail. Choose the folder for the AWS Region where you want to review log files. For example, if you want to review the log files for the US East (Ohio) Region, choose **us-east-2**.

5. Navigate the bucket folder structure to the year, the month, and the day where you want to review logs of activity in that Region. In that day, there are a number of files. The name of the files begin with your AWS account ID, and end with the extension .gz. For example, if your account ID is 123456789012, you would see files with names similar to this: 123456789012_CloudTrail_us-east-2_20190610T1255abcdeEXAMPLE.json.gz.

To view these files, you can download them, unzip them, and then view them in a plain-text editor or a JSON file viewer. Some browsers also support viewing .gz and JSON files directly. We recommend using a JSON viewer, as it makes it easier to parse the information in CloudTrail log files.

As you're browsing through the file content, you might start to wonder about what you're seeing. CloudTrail logs events for every AWS service that experienced activity in that AWS Region at the time that event occurred. In other words, events for different AWS services are mixed together, based solely on time. To learn more about what a specific AWS service logs with CloudTrail, including examples of log file entries for API calls for that service, see the [list of supported services for CloudTrail](p. 29), and read the CloudTrail integration topic for that service. You can also learn more about the content and structure of CloudTrail log files by reviewing the [CloudTrail log event reference](p. 420).

You might also notice what you're not seeing in log files in US East (Ohio). Specifically, you won't see any console sign-in events, even though you know you logged into the console. That's because console sign-in and IAM events are [global service events](p. 18), which are usually logged in a specific AWS Region. In this case, they are logged in US East (N. Virginia), and found in the folder **us-east-1**. Open that folder, and open the year, the month, and day you're interested in. Browse the log files, and you find **ConsoleLogin** events that look similar to the following:

```json
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "AKIAIOSFODNN7EXAMPLE",
        "arn": "arn:aws:iam::123456789012:user/Mary_Major",
        "accountId": "123456789012",
        "userName": "Mary_Major"
    }
}
```
This log file entry tells you more than just the identity of the IAM user who logged in (Mary_Major), the date and time she logged in, and that the login was successful. You can also learn the IP address she logged in from, the operating system and browser software of the computer she used, and that she was not using multi-factor authentication.

### Step 4: Plan for next steps

Now that you have a trail, you have access to an ongoing record of events and activities in your AWS account. This ongoing record helps you meet accounting and auditing needs for your AWS account. However, there is a lot more you can do with CloudTrail and CloudTrail data.

- **Add additional security for your trail data.** CloudTrail automatically applies a certain level of security when you create a trail. However, there are additional steps you can take to help keep your data secure.

  - By default, the Amazon S3 bucket you created as part of creating a trail has a policy applied that allows CloudTrail to write log files to that bucket. The bucket is not publicly accessible, but it might be accessible to other users in your AWS account if they have permissions to read and write to buckets in your AWS account. Review the policy for your bucket and if necessary, make changes to restrict access. For more information, see the Amazon S3 security documentation and the example walkthrough for securing a bucket.

  - 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. To use SSE-KMS with CloudTrail, you create and manage a KMS key, also known as an AWS KMS key. For more information, see Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403).

  - For additional security planning, review the security best practices for CloudTrail (p. 399).

- **Create a trail to log data events.** If you are interested in logging when objects are added, retrieved, and deleted in one or more Amazon S3 buckets, when items are added, changed, or deleted in DynamoDB tables, or when one or more AWS Lambda functions are invoked, these are data events. The management event trail you created earlier in this tutorial doesn't log these types of events. You can create a separate trail specifically to log data events for some or all of supported resources. For more information, see Data events (p. 257).
Note
Additional charges apply for logging data events. For more information, see AWS CloudTrail Pricing.

- **Log CloudTrail Insights events on your trail.** CloudTrail Insights helps you identify and respond to unusual or anomalous activity associated with write API calls by continuously analyzing CloudTrail management events. CloudTrail Insights uses mathematical models to determine the normal levels of API and service event activity for an account. It identifies behavior that is outside normal patterns, generates Insights events, and delivers those events to a /CloudTrail-Insight folder in the chosen destination S3 bucket for your trail. For more information about CloudTrail Insights, see Logging Insights events for trails (p. 285).

  Note
  Additional charges apply for logging Insights events. For more information, see AWS CloudTrail Pricing.

- **Set up CloudWatch Logs alarms to alert you when certain events occur.** CloudWatch Logs lets you monitor and receive alerts for specific events captured by CloudTrail. For example, you can monitor key security and network-related management events, such as security group changes (p. 301), failed AWS Management Console sign-in events (p. 302), or changes to IAM policies (p. 303). For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

- **Use analysis tools to identify trends in your CloudTrail logs.** While the filters in Event history can help you find specific events or event types in your recent activity, it does not provide the ability to search through activity over longer time periods. For deeper and more sophisticated analysis, you can use Amazon Athena. For more information, see Querying AWS CloudTrail Logs in the Amazon Athena User Guide.
Working with CloudTrail

CloudTrail is enabled by default for your AWS account. You can use Event history in the CloudTrail console to view, search, download, archive, analyze, and respond to account activity across your AWS infrastructure. This includes activity made through the AWS Management Console, AWS Command Line Interface, and AWS SDKs and APIs.

For an ongoing record of events in your AWS account, 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.

If you have created an organization in AWS Organizations, you can create a trail that will log all events for all AWS accounts in that organization. Creating an organization trail helps you define a uniform event logging strategy for your organization.

Topics

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- Viewing CloudTrail Insights events (p. 69)
- Creating a trail for your AWS account (p. 84)
- Creating a trail for an organization (p. 135)
- Copying trail events to CloudTrail Lake (p. 149)
- Getting and viewing your CloudTrail log files (p. 154)
- Configuring Amazon SNS notifications for CloudTrail (p. 157)
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Viewing events with CloudTrail Event history

You can troubleshoot operational and security incidents in the CloudTrail console by viewing Event history. The Event history provides a viewable, searchable, downloadable, and immutable record of the past 90 days of recorded API activity (management events) in an AWS Region.

You can look up events related to the creation, modification, or deletion of resources (such as IAM users or Amazon EC2 instances) in your AWS account on a by-Region basis. You can view events and download them with the AWS CloudTrail console. You can customize the view of event history in the console by selecting which columns to display or hide. You can programmatically look up events by using the AWS SDKs or AWS Command Line Interface. You can also compare the details of events in Event history side-by-side.

CloudTrail logging varies between AWS services. While most AWS services support CloudTrail logging of all events, some services only support logging a subset of APIs and events, and a few services are...
unsupported. For example, some AWS services log a ThrottlingException when API requests are throttled, while other AWS services do not. You can learn more about the specifics of how CloudTrail logs events for a specific service by consulting the documentation for that service. For more information, see CloudTrail supported services and integrations (p. 27).

**Note**
Over time, AWS services might add additional events. CloudTrail records these events in Event history, but a full 90-day record of activity that includes added events won’t be available until 90 days after it adds the events.

This section describes how to look up events by using the CloudTrail console and the AWS CLI. It also describes how to download a file of events. For information on using the LookupEvents API to retrieve information from CloudTrail events, see the AWS CloudTrail API Reference.

For information on creating a trail so that you have a record of events that extends past 90 days, see Creating a trail (p. 85) and Getting and viewing your CloudTrail log files (p. 154).

Topics
- Viewing CloudTrail events in the CloudTrail console (p. 58)
- Viewing CloudTrail events with the AWS CLI (p. 62)

Viewing CloudTrail events in the CloudTrail console

You can use the CloudTrail console to view the last 90 days of recorded API activity (management events) in an AWS Region. You can also download a file with that information, or a subset of information based on the filter and time range you choose. You can customize your view of Event history by selecting which columns are displayed in the console. You can also look up and filter events by the resource types available for a particular service. You can select up to five events in Event history and compare their details side-by-side.

Event history does not show data events. To view data events, create a trail (p. 84).

After 90 days, events are no longer shown in Event history. You cannot manually delete events from Event history. When you create a trail (p. 85), you can view events that are logged to your trail for as long as you store them in the S3 bucket that is configured in your trail settings.

CloudTrail logging varies between AWS services. While most AWS services support CloudTrail logging of all events, some services only support logging a subset of APIs and events, and a few services are unsupported. You can learn more about the specifics of how CloudTrail logs events for a specific service by consulting the documentation for that service. For more information, see CloudTrail supported services and integrations (p. 27).

**Note**
For an ongoing record of activity and events, create a trail (p. 85). Creating a trail also enables you to take advantage of the following integrations:

- A trail lets you log CloudTrail Insights events, which can help you identify and respond to unusual activity associated with write management API calls. For more information, see Logging Insights events for trails (p. 285).
- Analyze your AWS service activity with queries in Amazon Athena. For more information, see Creating a Table for CloudTrail Logs in the CloudTrail Console in the Amazon Athena User Guide, or choose the option to create a table directly from Event history in the CloudTrail console.
- Monitor your trail logs and be notified when specific activity occurs with Amazon CloudWatch Logs. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).
A trail lets you exclude AWS Key Management Service (AWS KMS) or Amazon Relational Database Service Data API events. AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. Events cannot be excluded from Event history; you can only exclude events if you create or update a trail to log management events.

To view CloudTrail events

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/home/.
2. In the navigation pane, choose Event history.
   - A filtered list of events appears in the content pane with the latest event first. Scroll down to see more events.
3. To compare events, select up to five events by filling their check boxes in the left margin of the Event history table. View details for selected events side-by-side in the Compare event details table.

The default view of events in Event history has a filter applied so that it does not display read-only events. To remove this filter, or to apply other filters, change the filter settings. For more information, see Filtering CloudTrail events (p. 60).

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- Displaying CloudTrail events (p. 59)
- Filtering CloudTrail events (p. 60)
- Viewing details for an event (p. 61)
- Downloading events (p. 61)
- Viewing resources referenced with AWS Config (p. 62)

Displaying CloudTrail events

You can customize the display of Event history by selecting which columns to display in the CloudTrail console. By default, the following columns are displayed:

- Event name
- Event time
- User name
- Event source
- Resource type
- Resource name

Note
You cannot change the order of the columns, or manually delete events from Event history.

To customize the columns displayed in Event history

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/home/.
2. In the navigation pane, choose Event history.
3. Choose the gear icon.
4. In Select visible columns, select the columns you want to display. Turn off columns you do not want to display. When you have finished, choose Confirm.

Filtering CloudTrail events

The default display of events in Event history uses an attribute filter to exclude read-only events from the list of displayed events. This attribute filter is named Read-only, and it is set to false. You can remove this filter to display both read and write events. To view only Read events, you can change the filter value to true. You can also filter events by other attributes. You can additionally filter by time range.

Note
You can only apply one attribute filter and a time range filter. You cannot apply multiple attribute filters.

AWS access key
The AWS access key ID that was used to sign the request. If the request was made with temporary security credentials, this is the access key ID of the temporary credentials.

Event ID
The CloudTrail ID of the event. Each event has a unique ID.

Event name
The name of the event. For example, you can filter on IAM events, such as CreatePolicy, or Amazon EC2 events, such as RunInstances.

Event source
The AWS service to which the request was made, such as iam.amazonaws.com or s3.amazonaws.com. You can scroll through a list of event sources after you choose the Event source filter.

Read only
The read type of the event. Events are categorized as read events or write events. If set to false, read events are not included in the list of displayed events. By default, this attribute filter is applied and the value is set to false.

Resource name
The name or ID of the resource referenced by the event. For example, the resource name might be "auto-scaling-test-group" for an Auto Scaling group or "i-12345678910" for an EC2 instance.

Resource type
The type of resource referenced by the event. For example, a resource type can be Instance for EC2 or DBInstance for RDS. Resource types vary for each AWS service.

Time range
The time range in which you want to filter events. You can filter events for the last 90 days.

User name
The identity referenced by the event. For example, this can be a user, a role name, or a service role.

If there are no events logged for the attribute or time that you choose, the results list is empty. You can apply only one attribute filter in addition to the time range. If you choose a different attribute filter, your specified time range is preserved.

The following steps describe how to filter by attribute.
To filter by attribute

1. To filter the results by an attribute, choose an attribute from the Lookup attributes drop-down list, and then type or choose a value for the attribute in the text box.
2. To remove an attribute filter, choose the X at the right of the attribute filter box.

The following steps describe how to filter by a start and end date and time.

To filter by a start and end date and time

1. To narrow the time range for the events that you want to see, choose a time range in the time range bar. Preset values are 30 minutes, 1 hour, 3 hours, or 12 hours. To specify a custom time range, choose Custom.
2. To remove a time range filter, choose Clear in the time range bar.

Viewing details for an event

1. Choose an event in the results list to show its details.
2. Resources referenced in the event are shown in the Resources referenced table on the event details page.
3. Some referenced resources have links. Choose the link to open the console for that resource.
4. Scroll to Event record on the details page to see the JSON event record, also called the event payload.
5. Choose Event history in the page breadcrumb to close the event details page and return to Event history.

Downloading events

You can download recorded event history as a file in CSV or JSON format. Use filters and time ranges to reduce the size of the file you download.

Note
CloudTrail event history files are data files that contain information (such as resource names) that can be configured by individual users. Some data can potentially be interpreted as commands in programs used to read and analyze this data (CSV injection). For example, when CloudTrail events are exported to CSV and imported to a spreadsheet program, that program might warn you about security concerns. You should choose to disable this content to keep your system secure. Always disable links or macros from downloaded event history files.

1. Add a filter and time range for events in Event history that you want to download. For example, you can specify the event name, StartInstances, and specify a time range for the last three days of activity.
2. Choose Download events, and then choose Download as CSV or Download as JSON. The download starts immediately.

Note
Your download might take some time to complete. For faster results, before you start the download process, use a more specific filter or a shorter time range to narrow the results. You can cancel a download. If you cancel a download, a partial download including only some event data might be on your local computer. To download the full event history, restart the download.

3. After your download is complete, open the file to view the events that you specified.
4. To cancel your download, choose Cancel, and then confirm by choosing Cancel download. If you need to restart a download, wait until the earlier download is finished canceling.
Viewing resources referenced with AWS Config

AWS Config records configuration details, relationships, and changes to your AWS resources.

On the Resources Referenced pane, choose the ↯ in the Config timeline column to view the resource in the AWS Config console.

If the icon is gray, AWS Config isn’t turned on, or it’s not recording the resource type. Choose the icon to go to the AWS Config console to turn on the service or start recording that resource type. For more information, see Set Up AWS Config Using the Console in the AWS Config Developer Guide.

If Link not available appears in the column, the resource can’t be viewed for one of the following reasons:

- AWS Config doesn’t support the resource type. For more information, see Supported Resources, Configuration Items, and Relationships in the AWS Config Developer Guide.
- AWS Config recently added support for the resource type, but it’s not yet available from the CloudTrail console. You can look up the resource in the AWS Config console to see the timeline for the resource.
- The resource is owned by another AWS account.
- The resource is owned by another AWS service, such as a managed IAM policy.
- The resource was created and then deleted immediately.
- The resource was recently created or updated.

Example

1. You configure AWS Config to record IAM resources.
2. You create an IAM user, Bob-user. The Event history page shows the CreateUser event and Bob-user as an IAM resource. You can choose the AWS Config icon to view this IAM resource in the AWS Config timeline.
3. You update the user name to Bob-admin.
4. The Event history page shows the UpdateUser event and Bob-admin as the updated IAM resource.
5. You can choose the icon to view the Bob-admin IAM resource in the timeline. However, you can’t choose the icon for Bob-user, because the resource name changed. AWS Config is now recording the updated resource.

To grant users read-only permission to view resources in the AWS Config console, see Granting permission to view AWS Config information on the CloudTrail console (p. 377).

For more information about AWS Config, see the AWS Config Developer Guide.

Viewing CloudTrail events with the AWS CLI

You can look up CloudTrail management events for the last 90 days for the current AWS Region using the aws cloudtrail lookup-events command. The aws cloudtrail lookup-events command shows events in the AWS Region where they occurred.

Lookup supports the following attributes for management events:

- AWS access key
- Event ID
- Event name
- Event source
• Read only
• Resource name
• Resource type
• User name

All attributes are optional.

The `lookup-events` command includes the following options:

• `--max-items <integer>` – The total number of items to return in the command's output. If the total number of items available is more than the value specified, a NextToken is provided in the command's output. To resume pagination, provide the NextToken value in the starting-token argument of a subsequent command. Do not use the NextToken response element directly outside of the AWS CLI.

• `--start-time <timestamp>` – Specifies that only events that occur after or at the specified time are returned. If the specified start time is after the specified end time, an error is returned.

• `--lookup-attributes <integer>` – Contains a list of lookup attributes. Currently the list can contain only one item.

• `--generate-cli-skeleton <string>` – Prints a JSON skeleton to standard output without sending an API request. If provided with no value or the value input, prints a sample input JSON that can be used as an argument for `--cli-input-json`. Similarly, if provided yaml-input it will print a sample input YAML that can be used with `--cli-input-yml`. If provided with the value output, it validates the command inputs and returns a sample output JSON for that command. The generated JSON skeleton is not stable between versions of the AWS CLI and there are no backwards compatibility guarantees in the JSON skeleton generated.

• `--cli-input-json <string>` – Reads arguments from the JSON string provided. The JSON string follows the format provided by the `--generate-cli-skeleton` parameter. If other arguments are provided on the command line, those values will override the JSON-provided values. It is not possible to pass arbitrary binary values using a JSON-provided value as the string will be taken literally. This may not be specified along with the `--cli-input-yaml` parameter.

For general information about using the AWS Command Line Interface, see the AWS Command Line Interface User Guide.

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Prerequisites

• To run AWS CLI commands, you must install the AWS CLI. For information, see Installing the AWS Command Line Interface.
• Make sure your AWS CLI version is greater than 1.6.6. To verify the CLI version, run `aws --version` on the command line.

• To set the account, AWS Region, and default output format for an AWS CLI session, use the `aws configure` command. For more information, see Configuring the AWS Command Line Interface.

Note
The CloudTrail AWS CLI commands are case-sensitive.

Getting command line help

To see the command line help for `lookup-events`, type the following command:

```bash
aws cloudtrail lookup-events help
```

Looking up events

Important
The rate of lookup requests is limited to two per second, per account, per Region. If this limit is exceeded, a throttling error occurs.

To see the ten latest events, type the following command:

```bash
aws cloudtrail lookup-events --max-items 10
```

A returned event looks similar to the following fictitious example, which has been formatted for readability:

```json
{
  "NextToken": "kbOt5llZe+mEcCeby2TgaMgmDvF1kYGFeH64J5jjjBZfsvurSrqq66b5YGssKutDYIy1I141rP4IDbeQdi0bkp9YAlju3oXd12juy5CIZWB=",
  "Events": [
    {
      "EventId": "0ebbaee4-6e67-431d-8225-ba0d81df5972",
      "Username": "root",
      "EventTime": 1424476529.0,
      "CloudTrailEvent": "{
        "eventVersion": "1.02",
        "userIdentity": {
          "type": "Root",
          "principalId": "111122223333",
          "arn": "arn:aws:iam::111122223333:root",
          "accountId": "111122223333"},
        "eventTime": "2015-02-20T23:55:29Z",
        "eventSource": "signin.amazonaws.com",
        "eventName": "ConsoleLogin",
        "awsRegion": "us-east-2",
        "sourceIPAddress": "203.0.113.4",
        "userAgent": "Mozilla/5.0",
        "requestParameters": null,
        "responseElements": {"ConsoleLogin": "Success"},
        "additionalEventData": {
          "MobileVersion": "No",
          "LoginTo": "https://console.aws.amazon.com/console/home",
          "MFAUsed": "No",
          "eventID": "0ebbaee4-6e67-431d-8225-ba0d81df5972",
          "eventType": "AwsApiCall",
          "recipientAccountId": "111122223333"},
        "EventName": "ConsoleLogin",
        "Resources": []
      }
    }
  ]
}
```
For an explanation of the lookup-related fields in the output, see the section Lookup output fields (p. 68) later in this document. For an explanation of the fields in the CloudTrail event, see CloudTrail record contents (p. 422).

Specifying the number of events to return

To specify the number of events to return, type the following command:

```bash
aws cloudtrail lookup-events --max-items <integer>
```

Possible values are 1 through 50. The following example returns one event.

```bash
aws cloudtrail lookup-events --max-items 1
```

Looking up events by time range

Events from the past 90 days are available for lookup. To specify a time range, type the following command:

```bash
aws cloudtrail lookup-events --start-time <timestamp> --end-time <timestamp>
```

--start-time <timestamp> specifies that only events that occur after or at the specified time are returned. If the specified start time is after the specified end time, an error is returned.

--end-time <timestamp> specifies that only events that occur before or at the specified time are returned. If the specified end time is before the specified start time, an error is returned.

The default start time is the earliest date that data is available within the last 90 days. The default end time is the time of the event that occurred closest to the current time.

Valid <timestamp> formats

The --start-time and --end-time attributes take UNIX time values or valid equivalents.

The following are examples of valid formats. Date, month, and year values can be separated by hyphens or forward slashes. Double quotes must be used if spaces are present.

```plaintext
1422317782
1422317782.0
01-27-2015
01-27-2015, 01:16PM
"01-27-2015, 01:16 PM"
"01/27/2015, 13:16"
2015-01-27
"2015-01-27, 01:16 PM"
```

Looking up events by attribute

To filter by an attribute, type the following command:

```bash
aws cloudtrail lookup-events --lookup-attributes AttributeKey=<attribute>,AttributeValue=<string>
```
You can specify only one attribute key/value pair for each **lookup-events** command. The following are values for AttributeKey. Value names are case sensitive.

- AccessKeyId
- EventId
- EventName
- EventSource
- ReadOnly
- ResourceName
- ResourceType
- Username

**Attribute lookup examples**

The following example command returns events in Region US East (N. Virginia) Region, us-east-1 which allows you to view console login events. Replace `ConsoleLogin` with the appropriate value for your configuration.

```shell
aws cloudtrail --region us-east-1 lookup-events --lookup-attributes AttributeKey=EventName,AttributeValue=ConsoleLogin
```

The following example command returns events in which the value of AccessKeyId is AKIAIOSFODNN7EXAMPLE.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=AccessKeyId,AttributeValue=AKIAIOSFODNN7EXAMPLE
```

The following example command returns the event for the specified CloudTrail EventId.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=EventId,AttributeValue=b5cc8c40-12ba-4d08-a8d9-2bceb9a3e002
```

The following example command returns events in which the value of EventName is RunInstances.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=EventName,AttributeValue=RunInstances
```

The following example command returns events in which the value of EventSource is iam.amazonaws.com.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=EventSource,AttributeValue=iam.amazonaws.com
```

The following example command returns write events. It excludes read events such as GetBucketLocation and DescribeStream.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=ReadOnly,AttributeValue=false
```

The following example command returns events in which the value of ResourceName is CloudTrail_CloudWatchLogs_Role.

```shell
aws cloudtrail lookup-events --lookup-attributes AttributeKey=ResourceName,AttributeValue=CloudTrail_CloudWatchLogs_Role
```
The following example command returns events in which the value of ResourceType is AWS::S3::Bucket.

```bash
aws cloudtrail lookup-events --lookup-attributes AttributeKey=ResourceType,AttributeValue=AWS::S3::Bucket
```

The following example command returns events in which the value of Username is root.

```bash
aws cloudtrail lookup-events --lookup-attributes AttributeKey=Username,AttributeValue=root
```

**Specifying the next page of results**

To get the next page of results from a `lookup-events` command, type the following command:

```bash
aws cloudtrail lookup-events <same parameters as previous command> --next-token=<token>
```

where the value for `<token>` is taken from the first field of the output of the previous command.

When you use `--next-token` in a command, you must use the same parameters as in the previous command. For example, suppose you run the following command:

```bash
aws cloudtrail lookup-events --lookup-attributes AttributeKey=Username,AttributeValue=root
```

To get the next page of results, your next command would look like this:

```bash
aws cloudtrail lookup-events --lookup-attributes AttributeKey=Username,AttributeValue=root --next-token=kbOt5LlZe+*mErCebpy2TgaMgmDvFlkYGFCFHC64J5j1bZFsuvrSqq66b5YGssKutDYIyI14ltP4IdBeQdIObkb9YAlju3oXd12juy5CIIZW8=
```

**Getting JSON input from a file**

The AWS CLI for some AWS services has two parameters, `--generate-cli-skeleton` and `--cli-input-json`, that you can use to generate a JSON template which you can modify and use as input to the `--cli-input-json` parameter. This section describes how to use these parameters with `aws cloudtrail lookup-events`. For more general information, see [Generate CLI Skeleton and CLI Input JSON Parameters](#).

**To look up CloudTrail events by getting JSON input from a file**

1. Create an input template for use with `lookup-events` by redirecting the `--generate-cli-skeleton` output to a file, as in the following example.

```bash
aws cloudtrail lookup-events --generate-cli-skeleton > LookupEvents.txt
```

The template file generated (in this case, LookupEvents.txt) looks like this:

```json
{
    "LookupAttributes": [
        {
            "AttributeKey": "",
            "AttributeValue": ""
        }
    ],
    "StartTime": null,
    "Token": "kbOt5LlZe+*mErCebpy2TgaMgmDvFlkYGFCFHC64J5j1bZFsuvrSqq66b5YGssKutDYIyI14ltP4IdBeQdIObkb9YAlju3oXd12juy5CIIZW8=
```

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2. Use a text editor to modify the JSON as needed. The JSON input must contain only values that are specified.

   **Important**
   All empty or null values must be removed from the template before you can use it.

   The following example specifies a time range and maximum number of results to return.

   ```json
   {
     "StartTime": "2015-01-01",
     "EndTime": "2015-01-27",
     "MaxResults": 2
   }
   ```

3. To use the edited file as input, use the syntax `--cli-input-json file://<filename>`, as in the following example:

   ```
   aws cloudtrail lookup-events --cli-input-json file://LookupEvents.txt
   ```

   **Note**
   You can use other arguments on the same command line as `--cli-input-json`.

### Lookup output fields

**Events**

A list of lookup events based on the lookup attribute and time range that were specified. The events list is sorted by time, with the latest event listed first. Each entry contains information about the lookup request and includes a string representation of the CloudTrail event that was retrieved.

The following entries describe the fields in each lookup event.

- **CloudTrailEvent**
  A JSON string that contains an object representation of the event returned. For information about each of the elements returned, see [Record Body Contents](#).

- **EventId**
  A string that contains the GUID of the event returned.

- **EventName**
  A string that contains the name of the event returned.

- **EventSource**
  The AWS service that the request was made to.

- **EventTime**
  The date and time, in UNIX time format, of the event.

- **Resources**
  A list of resources referenced by the event that was returned. Each resource entry specifies a resource type and a resource name.
Viewing CloudTrail Insights events

After you enable CloudTrail Insights on a trail, you can view up to 90 days of Insights events by using the CloudTrail console or the AWS CLI. This section describes how to view, look up, and download a file of Insights events. For information about using the LookupEvents API to retrieve information from CloudTrail events, see the AWS CloudTrail API Reference. For more information about CloudTrail Insights, see Logging Insights events for trails (p. 285) in this guide.

For information about how to create a trail, see Creating a trail (p. 85) and Getting and viewing your CloudTrail log files (p. 154).

Note
To log Insights events on API call volume, the trail must log write management events. To log Insights events on API error rate, the trail must log read or write management events.

Topics
• Viewing CloudTrail Insights events in the CloudTrail console (p. 69)
• Viewing CloudTrail Insights events with the AWS CLI (p. 76)

Viewing CloudTrail Insights events in the CloudTrail console

After you enable CloudTrail Insights events on a trail, when CloudTrail detects unusual API or error rate activity, CloudTrail generates Insights events and displays them on the Dashboard and Insights pages in the AWS Management Console. You can view the Insights events in the console and troubleshoot the unusual activity. The most recent 90 days of Insights events are shown in the console. You can also download Insights events by using the AWS CloudTrail console. You can programmatically look up events by using the AWS SDKs or AWS Command Line Interface. For more information about CloudTrail Insights events, see Logging Insights events for trails (p. 285) in this guide.

Note
To log Insights events on API call volume, the trail must log write management events. To log Insights events on API error rate, the trail must log read or write management events.

After Insights events are logged, the events are shown on the Insights page for 90 days. You cannot manually delete events from the Insights page. Because you must create a trail (p. 85) before you can
enable CloudTrail Insights, you can view Insights events that are logged to your trail for as long as you store them in the S3 bucket that is configured in your trail settings.

Monitor your trail logs and be notified when specific Insights events activity occurs with Amazon CloudWatch Logs. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

To view Insights events

CloudTrail Insights events must be enabled on your trail to see Insights events in the console. Allow up to 36 hours for CloudTrail to deliver the first Insights events, if unusual activity is detected.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/home/.
2. In the navigation pane, choose Dashboard to see the five most recent Insights events, or Insights to see all Insights events logged in your account in the last 90 days.

   On the Insights page, you can filter Insights events by criteria including event API source, event name, and event ID, and limit the events displayed to those occurring within a specific time range. For more information about filtering Insights events, see Filtering Insights events (p. 70).

Contents

- Filtering Insights events (p. 70)
- Viewing Insights events details (p. 61)
- Zoom, pan, and download graph (p. 74)
- Change graph time span settings (p. 74)
- Downloading Insights events (p. 76)

Filtering Insights events

The default display of events in Insights shows events in reverse chronological order. The newest Insights events, sorted by event start time, are at the top. The following list describes the available attributes. You can filter on the first three attributes: Event name, Event source, and Event ID.

Event name

The name of the event, typically the AWS API on which unusual levels of activity were recorded.
Insight type

The type of CloudTrail Insights event, which is either API call rate or API error rate. The API call rate insight type analyzes write-only management API calls that are aggregated per minute against a baseline API call volume. The API error rate insight type analyzes management API calls that result in error codes. The error is shown if the API call is unsuccessful.

Event source

The AWS service to which the request was made, such as iam.amazonaws.com or s3.amazonaws.com. You can scroll through a list of event sources after you choose the Event source filter.

Event ID

The ID of the Insights event. Event IDs are not shown in the Insights page table, but they are an attribute on which you can filter Insights events. The event IDs of management events that are analyzed to generate Insights events are different from the event IDs of Insights events.

Event start time

The start time of the Insights event, measured as the first minute in which unusual activity was recorded. This attribute is shown in the Insights table, but you cannot filter on event start time in the console.

Baseline average

The normal pattern of API call rate or error rate activity. The baseline average is calculated over the seven days preceding the start of an Insights event. Though the value of the baseline duration—the period that CloudTrail analyzes for normal activity on APIs—is approximately seven days, CloudTrail rounds the baseline duration to a whole integer day, so the exact baseline duration can vary.

Insight average

The average number of calls to an API, or the average number of a specific error that was returned on calls to an API, that triggered the Insights event. The CloudTrail Insights average for the start event is the rate of occurrences that triggered the Insights event. Typically, this is the first minute of unusual activity. The Insights average for the end event is the rate of occurrences over the duration of the unusual activity, between the start Insights event and the end Insights event.

Rate change

The difference between the value of Baseline average and Insight average, measured as a percentage. For example, if the baseline average of an AccessDenied error occurring is 1.0, and the Insight average is 3.0, the rate change is 300%. A rate change for an Insight average that exceeds a baseline average shows an up-arrow next to the value. If the Insights event was logged because the activity is below the baseline average, Rate change shows a down-arrow next to the percentage.

The following steps describe how to filter by attribute.

To filter by attribute

1. To filter the results by an attribute, choose a lookup attribute from the drop-down menu, and then type or choose a value in the Enter a lookup value box.
2. To remove an attribute filter, choose the X on the right of the attribute filter box.

The following steps describe how to filter by a start and end date and time.
**To filter by a start and end date and time**

1. To narrow the time range for the events that you want to see, choose a time range on the time span bar at the top of the table. Preset time ranges include 30 minutes, 1 hour, 3 hours, or 12 hours. To specify a custom time range, choose **Custom**.

2. Choose one of the following tabs.
   - **Absolute** - Lets you choose a specific time. Go on to the next step.
   - **Relative to selected event** - Selected by default. Lets you choose a time period relative to the start time of an Insights event. Go on to step 4.

3. To set an **Absolute** time range, do the following.
   a. On the **Absolute** tab, choose the day that you want the time range to start. Enter a start time on the selected day. To enter a date manually, type the date in the format `yyyy/mm/dd`. The start and end times use a 24-hour clock, and values must be in the format `hh:mm:ss`. For example, to indicate a 6:30 p.m. start time, enter `18:30:00`.
   b. Choose an end date for the range on the calendar, or specify an end date and time below the calendar. Choose **Apply**.

4. To set a **Relative to selected event** time range, do the following.
   a. Choose a preset time period relative to the start time of Insights events. Preset values are available in minutes, hours, days, or weeks. The maximum relative time period is 12 weeks.
   b. If needed, customize the preset value in the boxes below the presets. Choose **Clear** to reset your changes if needed. When you have set the relative time that you want, choose **Apply**.

5. In **To**, choose the day and specify the time that you want to be the end of the time range. Choose **Apply**.

6. To remove a time range filter, choose the calendar icon on the right of the **Time range** box, and then choose **Remove**.

**Viewing Insights events details**

1. Choose an Insights event in the results list to show its details. The details page for an Insights event shows a graph of the unusual activity timeline.
2. Hover over the highlighted bands to show the start time and duration of each Insights event in the graph.

The following information is shown in the Additional information area of the graph:

- **Insight type.** This can be API call rate or API error rate.
- **Trigger.** This is a link to the Cloudtrail events tab, which lists the management events that were analyzed to determine that unusual activity occurred.
- **API calls per minute**
  - **Baseline average** - The typical rate of occurrences per minute on the API on which the Insights event was logged, as measured within approximately the preceding seven days, in a specific Region in your account.
  - **Insights average** - The rate of occurrences per minute on this API that triggered the Insights event. The CloudTrail Insights average for the start event is the rate of calls or errors per minute on the API that triggered the Insights event. Typically, this is the first minute of unusual activity. The Insights average for the end event is the rate of API calls or errors per minute over the duration of the unusual activity, between the start Insights event and the end Insights event.
- **Event source.** The AWS service endpoint on which the unusual number of API calls or errors were logged. In the preceding image, the source is ec2.amazonaws.com, which is the service endpoint for Amazon EC2.
- **Event IDs.**
  - **Start event ID** - The ID of the Insights event that was logged at the start of unusual activity.
  - **End event ID** - The ID of the Insights event that was logged at the end of unusual activity.
  - **Shared event ID** - In Insights events, the Shared event ID is a GUID that is generated by CloudTrail Insights to uniquely identify a start and end pair of Insights events. Shared event ID is common between the start and the end Insights event, and helps to create a correlation between both events to uniquely identify unusual activity.
3. Choose the **Attributions** tab to view information about the user identities, user agents, and API call rate Insights events, error codes correlated with unusual and baseline activity. A maximum of five user identities, five user agents, and five error codes are shown in tables on the **Attributions** tab, sorted by an average of the count of activity, in descending order from highest to lowest. For more information about the **Attributions** tab, see [Attributions tab](#) and [CloudTrail Insights insightDetails element](#) in this guide.

4. On the **CloudTrail events** tab, view related events that CloudTrail analyzed to determine that unusual activity occurred. By default, a filter is already applied for the Insights event name, which is also the name of the related API. The **CloudTrail events** tab shows CloudTrail management events related to the subject API that occurred between the start time (minus one minute) and end time (plus one minute) of the Insights event.

   As you select other Insights events in the graph, the events shown in the **CloudTrail events** table change. These events help you perform deeper analysis to determine the probable cause of an Insights event and reasons for unusual API activity.

   To show all CloudTrail events that were logged during the Insights event duration, and not only those for the related API, turn off the filter.

5. Choose the **Insights event record** tab to view the Insights start and end events in JSON format.

6. Choosing the linked Event source returns you to the Insights page, filtered by that event source.

### Zoom, pan, and download graph

You can zoom, pan, and reset the axes of the graph on the Insights event details page by using a toolbar in the upper right corner.

From left to right, the command buttons on the graph toolbar do the following:

- **Download plot as a PNG** - Download the graph image shown on the details page, and save it in PNG format.
- **Zoom** - Drag to select an area on the graph that you want to enlarge and see in greater detail.
- **Pan** - Shift the graph to see adjacent dates or times.
- **Reset axes** - Change graph axes back to the original, clearing zoom and pan settings.

### Change graph time span settings

You can change the time span—the selected duration of the events shown on the x axis—that is shown in the graph by choosing a setting in the graph's upper right corner.

The default time span that is shown in the graph depends on the duration of the selected Insights event.

<table>
<thead>
<tr>
<th>Duration of Insights event</th>
<th>Default time span</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 4 hours</td>
<td>3h (three hours)</td>
</tr>
</tbody>
</table>
You can choose presets of five minutes, 30 minutes, one hour, three hours, 12 hours, or Custom. The following image shows Relative to selected event time periods you can choose in Custom settings. Relative time periods are approximate time periods surrounding the start and end of the selected Insights event that is displayed on an Insights event details page.

To customize a selected preset, specify a number and time unit in the boxes below the presets.

To specify an exact date and time range, choose the Absolute tab. If you set an absolute date and time range, start and end times are required. For information about how to set the time, see the section called “Filtering Insights events” (p. 70) in this topic.
Downloading Insights events

You can download recorded Insights event history as a file in CSV or JSON format. Use filters and time ranges to reduce the size of the file you download.

Note
CloudTrail event history files are data files that contain information (such as resource names) that can be configured by individual users. Some data can potentially be interpreted as commands in programs used to read and analyze this data (CSV injection). For example, when CloudTrail events are exported to CSV and imported to a spreadsheet program, that program might warn you about security concerns. As a security best practice, disable links or macros from downloaded event history files.

1. Specify the filter and time range for events you want to download. For example, you can specify the event name, StartInstances, and specify a time range for the last three days of activity.
2. Choose Download events, and then choose Download CSV or Download JSON. You are prompted to choose a location to save the file.

   Note
   Your download might take some time to finish. For faster results, before you start the download process, use a more specific filter or a shorter time range to narrow the results.

3. After your download is complete, open the file to view the events that you specified.
4. To cancel your download, choose Cancel download. If you cancel a download before it is finished, a CSV or JSON file on your local computer might contain only part of your events.

Viewing CloudTrail Insights events with the AWS CLI

You can look up CloudTrail Insights events for the last 90 days by running the aws cloudtrail lookup-events command. The lookup-events command has the following options:

- --end-time
• --event-category
• --max-results
• --start-time
• --lookup-attributes
• --next-token
• --generate-cli-skeleton
• --cli-input-json

For general information about using the AWS Command Line Interface, see the AWS Command Line Interface User Guide.

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• Prerequisites (p. 77)
• Getting command line help (p. 77)
• Looking up Insights events (p. 77)
• Specifying the number of Insights events to return (p. 80)
• Looking up Insights events by time range (p. 81)
  • Valid <timestamp> formats (p. 81)
• Looking up Insights events by attribute (p. 81)
  • Attribute lookup examples (p. 81)
• Specifying the next page of results (p. 82)
• Getting JSON input from a file (p. 82)
• Lookup output fields (p. 83)

Prerequisites

• To run AWS CLI commands, you must install the AWS CLI. For more information, see Installing the AWS Command Line Interface.

• Make sure your AWS CLI version is greater than 1.6.6. To verify the CLI version, run aws --version on the command line.

• To set the account, Region, and default output format for an AWS CLI session, use the aws configure command. For more information, see Configuring the AWS Command Line Interface.

• To log Insights events on API call volume, the trail must log write management events. To log Insights events on API error rate, the trail must log read or write management events.

  Note
  The CloudTrail AWS CLI commands are case-sensitive.

Getting command line help

To see the command line help for lookup-events, type the following command.

aws cloudtrail lookup-events help

Looking up Insights events

To see the ten latest Insights events, type the following command.
aws cloudtrail lookup-events --event-category insight

A returned event looks similar to the following example,

```json
{
    "NextToken": "kbOt5bLZe+
+mErCebpy2TgaMg6fV1kYFchH64j5j1bZFjusvrsQgg66b5YGssKutDYIyI141rP41DbeQdi0bkp9YAlju30Xdl2juEXAMPLE=",
    "Events": [

        {
            "eventVersion": "1.07",
            "eventTime": "2019-10-15T21:13:00Z",
            "awsRegion": "us-east-1",
            "eventID": "EXAMPLE-9b6f-45f8-bc6b-9b41c052ebc7",
            "eventType": "AwsCloudTrailInsight",
            "recipientAccountID": "123456789012",
            "sharedEventID": "EXAMPLE8-02b2-4e93-9a9b-08ed47ea5fd3",
            "insightDetails": {
                "state": "Start",
                "eventSource": "autoscaling.amazonaws.com",
                "eventName": "CompleteLifecycleAction",
                "insightType": "ApiCallRateInsight",
                "insightContext": {
                    "statistics": {
                        "baseline": {
                            "average": 0.0000882145
                        },
                        "insight": {
                            "average": 0.6
                        },
                        "insightDuration": 5,
                        "baselineDuration": 11336
                    },
                    "attributions": [
                        {
                            "attribute": "userIdentityArn",
                            "insight": [
                                {
                                    "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
                                    "average": 0.2
                                },
                                {
                                    "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole2",
                                    "average": 0.2
                                },
                                {
                                    "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole3",
                                    "average": 0.2
                                }
                            ],
                            "baseline": [
                                {
                                    "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
                                    "average": 0.0000882145
                                }
                            ]
                        },
                        {
                            "attribute": "userAgent",
                            "insight": [
                                {
                                    "value": "codedeploy.amazonaws.com",
                                    "average": 0.6
                                }
                            ]
                        }
                    ]
                }
            }
        }
    ]
}```
"baseline": [
  {
    "value": "codedeploy.amazonaws.com",
    "average": 0.0000882145
  }
],
"attribute": "errorCode",
"insight": [
  {
    "value": "null",
    "average": 0.6
  }
],
"baseline": [
  {
    "value": "null",
    "average": 0.0000882145
  }
]
},
"eventCategory": "Insight"
]
},
"eventVersion": "1.07",
"eventTime": "2019-10-15T21:14:00Z",
"awsRegion": "us-east-1",
"eventID": "EXAMPLEc-9eac-4af6-8e07-26a5ae8786a5",
"eventType": "AwsCloudTrailInsight",
"recipientAccountId": "123456789012",
"sharedEventID": "EXAMPLE8-02b2-4e93-9aab-08ed47ea5fd3",
"insightDetails": {
  "state": "End",
  "eventSource": "autoscaling.amazonaws.com",
  "eventName": "CompleteLifecycleAction",
  "insightType": "ApiCallRateInsight",
  "insightContext": {
    "statistics": {
      "baseline": {
        "average": 0.0000882145
      },
      "insight": {
        "average": 0.6
      },
      "insightDuration": 5,
      "baselineDuration": 11336
    },
    "attributions": [
      {
        "attribute": "userIdentityArn",
        "insight": [
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
            "average": 0.2
          },
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole2",
            "average": 0.2
          },
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole3",
            "average": 0.2
          }
        ]
      }
    ]
  }
}
For an explanation of the lookup-related fields in the output, see `Lookup output fields (p. 83)` in this topic. For an explanation of fields in the Insights event, see `CloudTrail record contents (p. 422)`.

### Specifying the number of Insights events to return

To specify the number of events to return, type the following command.

```bash
aws cloudtrail lookup-events --event-category insight --max-results <integer>
```

The default value for `<integer>`, if it is not specified, is 10. Possible values are 1 through 50. The following example returns one result.

```bash
aws cloudtrail lookup-events --event-category insight --max-results 1
```
Looking up Insights events by time range

Insights events from the past 90 days are available for lookup. To specify a time range, type the following command.

```
aws cloudtrail lookup-events --event-category insight --start-time <timestamp> --end-time <timestamp>
```

--start-time <timestamp> specifies that only Insights events that occur after or at the specified time are returned. If the specified start time is after the specified end time, an error is returned.

--end-time <timestamp> specifies that only Insights events that occur before or at the specified time are returned. If the specified end time is before the specified start time, an error is returned.

The default start time is the earliest date that data is available within the last 90 days. The default end time is the time of the event that occurred closest to the current time.

Valid <timestamp> formats

The --start-time and --end-time attributes take UNIX time values or valid equivalents.

The following are examples of valid formats. Date, month, and year values can be separated by hyphens or forward slashes. Double quotes must be used if spaces are present.

```
1422317782
1422317782.0
01-27-2015
01-27-2015,01:16PM
"01-27-2015, 01:16 PM"
"01/27/2015, 13:16"
2015-01-27
"2015-01-27, 01:16 PM"
```

Looking up Insights events by attribute

To filter by an attribute, type the following command.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes AttributeKey=<attribute>,AttributeValue=<string>
```

You can specify only one attribute key-value pair for each lookup-events command. The following are valid Insights event values for AttributeKey. Value names are case sensitive.

- EventId
- EventName
- EventSource

Attribute lookup examples

The following example command returns Insights events in which the value of EventName is PutRule.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes AttributeKey=EventName, AttributeValue=PutRule
```
The following example command returns Insights events in which the value of EventId is b5cc8c40-12ba-4d08-a8d9-2bceb9a3e002.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes
  AttributeKey=EventId, AttributeValue=b5cc8c40-12ba-4d08-a8d9-2bceb9a3e002
```

The following example command returns Insights events in which the value of EventSource is iam.amazonaws.com.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes
  AttributeKey=EventSource, AttributeValue=iam.amazonaws.com
```

### Specifying the next page of results

To get the next page of results from a `lookup-events` command, type the following command.

```
aws cloudtrail lookup-events --event-category insight --next-token=...<token>...
```

In this command, the value for `<token>` is taken from the first field of the output of the previous command.

When you use `--next-token` in a command, you must use the same parameters as in the previous command. For example, suppose you run the following command.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes
  AttributeKey=EventName, AttributeValue=PutRule
```

To get the next page of results, your next command would look like the following.

```
aws cloudtrail lookup-events --event-category insight --lookup-attributes
  AttributeKey=EventName, AttributeValue=PutRule --next-token=EXAMPLEZe+mErCebpy2TgaMgmDvF1kYGfcH6AJS5jBfJsuvr5qqG6b5YGssKu6DYy1F41rP4I0beQdiO0bkp9YA1ju3oXd12juEXAMPLE=
```

### Getting JSON input from a file

The AWS CLI for some AWS services has two parameters, `--generate-cli-skeleton` and `--cli-input-json`, that you can use to generate a JSON template, which you can modify and use as input to the `--cli-input-json` parameter. This section describes how to use these parameters with `aws cloudtrail lookup-events`. For more information, see Generate CLI Skeleton and CLI Input JSON Parameters.

To look up Insights events by getting JSON input from a file

1. Create an input template for use with `lookup-events` by redirecting the `--generate-cli-skeleton` output to a file, as in the following example.

```
aws cloudtrail lookup-events --event-category insight --generate-cli-skeleton > LookupEvents.txt
```

The template file generated (in this case, LookupEvents.txt) looks like the following.

```
{
```
2. Use a text editor to modify the JSON as needed. The JSON input must contain only values that are specified.

   **Important**
   All empty or null values must be removed from the template before you can use it.

   The following example specifies a time range and maximum number of results to return.

   ```
   {
     "StartTime": "2015-01-01",
     "EndTime": "2015-01-27",
     "MaxResults": 2
   }
   ```

3. To use the edited file as input, use the syntax `--cli-input-json file://<filename>`, as in the following example.

   ```bash
   aws cloudtrail lookup-events --event-category insight --cli-input-json file://LookupEvents.txt
   ```

   **Note**
   You can use other arguments on the same command line as `--cli-input-json`.

**Lookup output fields**

**Events**

   A list of lookup events based on the lookup attribute and time range that were specified. The events list is sorted by time, with the latest event listed first. Each entry contains information about the lookup request and includes a string representation of the CloudTrail event that was retrieved.

   The following entries describe the fields in each lookup event.

   **CloudTrailEvent**

   A JSON string that contains an object representation of the event returned. For information about each of the elements returned, see [Record Body Contents](#).

   **EventId**

   A string that contains the GUID of the event returned.

   **EventName**

   A string that contains the name of the event returned.

   **EventSource**

   The AWS service that the request was made to.
Creating a trail for your AWS account

When you create a trail, you enable ongoing delivery of events as log files to an Amazon S3 bucket that you specify. Creating a trail has many benefits, including:

- A record of events that extends past 90 days.
- The option to automatically monitor and alarm on specified events by sending log events to Amazon CloudWatch Logs.
- The option to query logs and analyze AWS service activity with Amazon Athena.

Beginning on April 12, 2019, you can view trails only in the AWS Regions where they log events. If you create a trail that logs events in all AWS Regions, it appears in the console in all Regions. If you create a trail that only logs events in a single Region, you can view and manage it only in that Region. Creating a multi-Region trail is the default option if you create a trail by using the AWS CloudTrail console, and is a recommended best practice. To create a single-Region trail, you must use the AWS CLI.

If you use AWS Organizations, you can create a trail that will log events for all AWS accounts in the organization. A trail with the same name will be created in each member account, and events from each trail will be delivered to the Amazon S3 bucket that you specify.

**Note**

Only the management account or delegated administrator account for an organization can create a trail for the organization. Creating a trail for an organization automatically enables integration between CloudTrail and Organizations. For more information, see Creating a trail for an organization (p. 135).

**Topics**

- [Creating and updating a trail with the console (p. 85)]
Creating and updating a trail with the console

You can use the CloudTrail console to create, update, or delete your trails. Trails created using the console are multi-Region. To create a trail that logs events in only one AWS Region, use the AWS CLI (p. 107).

You can create up to five trails for each Region. After you create a trail, CloudTrail automatically starts logging API calls and related events in your account to the Amazon S3 bucket that you specify. To stop logging, you can turn off logging for the trail or delete it.

Using the CloudTrail console to create or update a trail provides the following advantages.

- If this is your first time creating a trail, using the CloudTrail console lets you view the available feature and options.
- If you are configuring a trail to log data events, using the CloudTrail console lets you view the available data types. For more information about logging data events, see Logging data events (p. 256).

For information specific to creating a trail for an organization in AWS Organizations, see Creating a trail for an organization (p. 135).

Topics
- Creating a trail (p. 85)
- Updating a trail (p. 96)
- Deleting a trail (p. 104)
- Turning off logging for a trail (p. 104)

Creating a trail

Follow the procedure to create a trail that applies to all Regions. A trail that applies to all Regions delivers log files from all Regions to an S3 bucket. After you create the trail, AWS CloudTrail automatically starts logging the events that you specified.

Note
After you create a trail, you can configure other AWS services to further analyze and act upon the event data collected in CloudTrail logs. For more information, see CloudTrail supported services and integrations (p. 27).

Topics
- Creating a trail in the console (basic event selectors) (p. 85)
- Creating a trail in the console (advanced event selectors) (p. 90)
- Next steps (p. 96)

Creating a trail in the console (basic event selectors)

In the console, you create a trail that logs events in all AWS Regions that you have enabled. This is a recommended best practice. To log events in a single Region (not recommended), use the AWS CLI (p. 107).

Use the following procedure if you have not yet enabled advanced event selectors. If you have advanced event selectors enabled, see Creating a trail in the console (advanced event selectors) (p. 90) to configure data event logging on your trail.
To create a CloudTrail trail with the AWS Management Console

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. On the CloudTrail service home page, the Trails page, or the Trails section of the Dashboard page, choose Create trail.
3. On the Create Trail page, for Trail name, type a name for your trail. For more information, see CloudTrail naming requirements (p. 161).
4. If this is an AWS Organizations organization trail, you can enable the trail for all accounts in your organization. To see this option, you must sign in to the console with a user or role in the management or delegated administrator account. To successfully create an organization trail, be sure that the user or role has sufficient permissions (p. 138). For more information, see Creating a trail for an organization (p. 135).
5. For Storage location, choose Create new S3 bucket to create a bucket. When you create a bucket, CloudTrail creates and applies the required bucket policies.

   **Note**
   If you chose Use existing S3 bucket, specify a bucket in Trail log bucket name, or choose Browse to choose a bucket. The bucket policy must grant CloudTrail permission to write to it. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail (p. 380).

   To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.

6. For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

   If you enable SSE-KMS encryption, choose a New or Existing AWS KMS key. In AWS KMS Alias, specify an alias, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

   **Note**
   You can also type the ARN of a key from another account. The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

7. In Additional settings, configure the following.

   a. For Log file validation, choose Enabled to have log digests delivered to your S3 bucket. You can use the digest files to verify that your log files did not change after CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).

   b. For SNS notification delivery, choose Enabled to be notified each time a log is delivered to your bucket. CloudTrail stores multiple events in a log file. SNS notifications are sent for every log file, not for every event. For more information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

   If you enable SNS notifications, for Create a new SNS topic, choose New to create a topic, or choose Existing to use an existing topic. If you are creating a trail that applies to all Regions, SNS notifications for log file deliveries from all Regions are sent to the single SNS topic that you create.
Creating and updating a trail with the console

If you choose **New**, CloudTrail specifies a name for the new topic for you, or you can type a name. If you choose **Existing**, choose an SNS topic from the drop-down list. You can also enter the ARN of a topic from another Region or from an account with appropriate permissions. For more information, see [Amazon SNS topic policy for CloudTrail](p. 387).

If you create a topic, you must subscribe to the topic to be notified of log file delivery. You can subscribe from the Amazon SNS console. Due to the frequency of notifications, we recommend that you configure the subscription to use an Amazon SQS queue to handle notifications programmatically. For more information, see the [Amazon Simple Notification Service Getting Started Guide](p. 392).

8. Optionally, configure CloudTrail to send log files to CloudWatch Logs by choosing **Enabled** in CloudWatch Logs. For more information, see Sending events to CloudWatch Logs (p. 295).

   a. If you enable integration with CloudWatch Logs, choose **New** to create a new log group, or **Existing** to use an existing one. If you choose **New**, CloudTrail specifies a name for the new log group for you, or you can type a name.

   b. If you choose **Existing**, choose a log group from the drop-down list.

   c. Choose **New** to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose **Existing** to choose an existing IAM role from the drop-down list. The policy statement for the new or existing role is displayed when you expand **Policy document**. For more information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).

   **Note**
   When you configure a trail, you can choose an S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.

9. For **Tags**, add one or more custom tags (key-value pairs) to your trail. Tags can help you identify both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then use resource groups for your CloudTrail resources. For more information, see AWS Resource Groups and Why use tags for trails? (p. 15).

10. On the Choose log events page, choose the event types that you want to log. For Management events, do the following.

   a. For **API activity**, choose if you want your trail to log **Read** events, **Write** events, or both. For more information, see Management events (p. 249).

   b. Choose **Exclude AWS KMS events** to filter AWS Key Management Service (AWS KMS) events out of your trail. The default setting is to include all AWS KMS events.

   The option to log or exclude AWS KMS events is available only if you log management events on your trail. If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. These actions are now logged as **Read** events. Low-volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which typically account for less than 0.5% of AWS KMS event volume) are logged as **Write** events.

To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still log relevant events such as Disable, Delete and ScheduleKey, choose to log **Write** management events, and clear the check box for **Exclude AWS KMS events**.

   c. Choose **Exclude Amazon RDS Data API events** to filter Amazon Relational Database Service Data API events out of your trail. The default setting is to include all Amazon RDS Data API events. For more information about Amazon RDS Data API events, see Logging Data API calls with AWS CloudTrail in the Amazon RDS User Guide for Aurora.
11. For **Data events**, you can specify logging data events for Amazon S3 buckets, AWS Lambda functions, Amazon DynamoDB tables, and many other resource types. By default, trails don't log data events. Additional charges apply for logging data events. For more information, see [Data events](p. 257). For CloudTrail pricing, see [AWS CloudTrail Pricing](p. 257). More data event types are available if you use advanced event selectors, for more information, see [Creating a trail in the console (advanced event selectors)](p. 90).

For Amazon S3 buckets:

a. For **Data event source**, choose **S3**.

b. You can choose to log **All current and future S3 buckets**, or you can specify individual buckets or functions. By default, data events are logged for all current and future S3 buckets.

   **Note**
   Keeping the default **All current and future S3 buckets** option enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.
   If you are creating a trail for a single Region (done by using the AWS CLI), choosing **All current and future S3 buckets** enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

   c. If you leave the default, **All current and future S3 buckets**, choose to log **Read** events, **Write** events, or both.

   d. To select individual buckets, empty the **Read** and **Write** check boxes for **All current and future S3 buckets**. In **Individual bucket selection**, browse for a bucket on which to log data events. Find specific buckets by typing a bucket prefix for the bucket you want. You can select multiple buckets in this window. Choose **Add bucket** to log data events for more buckets. Choose to log **Read** events, such as **GetObject**, **Write** events, such as **PutObject**, or both.

      This setting takes precedence over individual settings you configure for individual buckets. For example, if you specify logging **Read** events for all S3 buckets, and then choose to add a specific bucket for data event logging, **Read** is already selected for the bucket you added. You cannot clear the selection. You can only configure the option for **Write**.

      To remove a bucket from logging, choose **X**.

12. To add another data type on which to log data events, choose **Add data event type**.

13. For Lambda functions:

a. For **Data event source**, choose **Lambda**.

b. In **Lambda function**, choose **All regions** to log all Lambda functions, or **Input function as ARN** to log data events on a specific function.

To log data events for all Lambda functions in your AWS account, select **Log all current and future functions**. This setting takes precedence over individual settings you configure for individual functions. All functions are logged, even if all functions are not displayed.

   **Note**
   If you are creating a trail for all Regions, this selection enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions.
Logging data events for all functions also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

c. If you choose **Input function as ARN**, enter the ARN of a Lambda function.

   **Note**
   If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still select the option to log all functions, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the `put-event-selectors` command to configure data event logging for specific Lambda functions. For more information, see [Managing trails with the AWS CLI](p. 111).

14. For DynamoDB tables:

   a. For **Data event source**, choose **DynamoDB**.

   b. In **DynamoDB table selection**, choose **Browse** to select a table, or paste in the ARN of a DynamoDB table to which you have access. A DynamoDB table ARN uses the following format:

   ```
   arn:partition:dynamodb:region:account_ID:table/table_name
   ```

   To add another table, choose **Add row**, and browse for a table or paste in the ARN of a table to which you have access.

15. Choose **Insights events** if you want your trail to log CloudTrail Insights events.

   In **Event type**, select **Insights events**. In **Insights events**, choose **API call rate**, **API error rate**, or both. You must be logging **Read** or **Write** management events to log Insights events for **API call rate**. You must be logging **Read** or **Write** management events to log Insights events for **API error rate**.

   CloudTrail Insights analyzes management events for unusual activity, and logs events when anomalies are detected. By default, trails don't log Insights events. For more information about Insights events, see [Logging Insights events for trails](p. 285). Additional charges apply for logging Insights events. For CloudTrail pricing, see [AWS CloudTrail Pricing](p. 111).

   Insights events are delivered to a different folder named `/CloudTrail-Insight` of the same S3 bucket that is specified in the **Storage location** area of the trail details page. CloudTrail creates the new prefix for you. For example, if your current destination S3 bucket is named `S3bucketName/AWSLogs/CloudTrail/`, the S3 bucket name with a new prefix is named `S3bucketName/AWSLogs/CloudTrail-Insight/`.

16. When you are finished choosing event types to log, choose **Next**.

17. On the **Review and create** page, review your choices. Choose **Edit** in a section to change the trail settings shown in that section. When you are ready to create the trail, choose **Create trail**.

18. The new trail appears on the **Trails** page. The **Trails** page shows the trails in your account from all Regions. In about 5 minutes, CloudTrail publishes log files that show the AWS API calls made in your account. You can see the log files in the S3 bucket that you specified. It can take up to 36 hours for CloudTrail to deliver the first Insights event, if you have enabled Insights event logging, and unusual activity is detected.

   **Note**
   CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the [AWS CloudTrail Service Level Agreement](p. 111) for more information.
Creating a trail in the console (advanced event selectors)

In the console, you create a trail that logs events in all AWS Regions. This is a recommended best practice. To log events in a single Region (not recommended), use the AWS CLI (p. 107).

Use the following procedure if you have enabled advanced event selectors. If you prefer to use basic data event selectors, see Creating a trail in the console (basic event selectors) (p. 85) to configure data event logging on your trail.

To create a CloudTrail trail with the AWS Management Console

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. On the CloudTrail service home page, the Trails page, or the Trails section of the Dashboard page, choose Create trail.
3. On the Create Trail page, for Trail name, type a name for your trail. For more information, see CloudTrail naming requirements (p. 161).
4. If this is an AWS Organizations organization trail, you can enable the trail for all accounts in your organization. To see this option, you must sign in to the console with a user or role in the management or delegated administrator account. To successfully create an organization trail, be sure that the user or role has sufficient permissions (p. 138). For more information, see Creating a trail for an organization (p. 135).
5. For Storage location, choose Create new S3 bucket to create a bucket. When you create a bucket, CloudTrail creates and applies the required bucket policies.

   Note
   If you chose Use existing S3 bucket, specify a bucket in Trail log bucket name, or choose Browse to choose a bucket. The bucket policy must grant CloudTrail permission to write to it. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail (p. 380).

   To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.

6. For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

   If you enable SSE-KMS encryption, choose a New or Existing AWS KMS key. In AWS KMS Alias, specify an alias, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

   Note
   You can also type the ARN of a key from another account. For more information, see Updating a resource to use your KMS key (p. 414). The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

7. In Additional settings, configure the following.

   a. For Log file validation, choose Enabled to have log digests delivered to your S3 bucket. You can use the digest files to verify that your log files did not change after CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).
Creating and updating a trail with the console

b. For **SNS notification delivery**, choose **Enabled** to be notified each time a log is delivered to your bucket. CloudTrail stores multiple events in a log file. SNS notifications are sent for every log file, not for every event. For more information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

If you enable SNS notifications, for **Create a new SNS topic**, choose **New** to create a topic, or choose **Existing** to use an existing topic. If you are creating a trail that applies to all Regions, SNS notifications for log file deliveries from all Regions are sent to the single SNS topic that you create.

If you choose **New**, CloudTrail specifies a name for the new topic for you, or you can type a name. If you choose **Existing**, choose an SNS topic from the drop-down list. You can also enter the ARN of a topic from another Region or from an account with appropriate permissions. For more information, see Amazon SNS topic policy for CloudTrail (p. 387).

If you create a topic, you must subscribe to the topic to be notified of log file delivery. You can subscribe from the Amazon SNS console. Due to the frequency of notifications, we recommend that you configure the subscription to use an Amazon SQS queue to handle notifications programmatically. For more information, see the Amazon Simple Notification Service Getting Started Guide.

8. Optionally, configure CloudTrail to send log files to CloudWatch Logs by choosing **Enabled** in **CloudWatch Logs**. For more information, see Sending events to CloudWatch Logs (p. 295).

a. If you enable integration with CloudWatch Logs, choose **New** to create a new log group, or **Existing** to use an existing one. If you choose **New**, CloudTrail specifies a name for the new log group for you, or you can type a name.

b. If you choose **Existing**, choose a log group from the drop-down list.

c. Choose **New** to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose **Existing** to choose an existing IAM role from the drop-down list. The policy statement for the new or existing role is displayed when you expand **Policy document**. For more information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).

   **Note**

   When you configure a trail, you can choose an S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.

9. For **Tags**, add one or more custom tags (key-value pairs) to your trail. Tags can help you identify both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then use resource groups for your CloudTrail resources. For more information, see AWS Resource Groups and Why use tags for trails? (p. 15).

10. On the **Choose log events** page, choose the event types that you want to log. For **Management events**, do the following.

   a. For **API activity**, choose if you want your trail to log **Read** events, **Write** events, or both. For more information, see Management events (p. 249).

   b. Choose **Exclude AWS KMS events** to filter AWS Key Management Service (AWS KMS) events out of your trail. The default setting is to include all AWS KMS events.

      The option to log or exclude AWS KMS events is available only if you log management events on your trail. If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

      AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. These actions are now logged as **Read** events. Low-volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which typically account for less than 0.5% of AWS KMS event volume) are logged as **Write** events.
To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still log relevant events such as Disable, Delete and ScheduleKey, choose to log Write management events, and clear the check box for Exclude AWS KMS events.

c. Choose **Exclude Amazon RDS Data API events** to filter Amazon Relational Database Service Data API events out of your trail. The default setting is to include all Amazon RDS Data API events. For more information about Amazon RDS Data API events, see [Logging Data API calls with AWS CloudTrail in the Amazon RDS User Guide for Aurora](https://docs.aws.amazon.com/AmazonRDS/latest/AuroraUserGuide/rds-data-api.html).

11. To log data events, choose **Data events**.

12. For **Data event type**, choose the resource type on which you want to log data events.

   **Note**
   To log data events for AWS Glue tables created by Lake Formation, choose Lake Formation.

13. Choose a log selector template. CloudTrail includes predefined templates that log all data events for the resource type. To build a custom log selector template, choose **Custom**.

   **Note**
   Choosing a predefined template for S3 buckets enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.
   
   If the trail applies only to one Region, choosing a predefined template that logs all S3 buckets enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.
   
   If you are creating a trail for all Regions, choosing a predefined template for Lambda functions enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions.
   
   Logging data events for all functions also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

14. (Optional) In **Selector name**, enter a name to identify your selector. The selector name is a descriptive name for an advanced event selector, such as "Log data events for only two S3 buckets". The selector name is listed as Name in the advanced event selector and is viewable if you expand the **JSON view**.

15. In **Advanced event selectors**, build an expression for the specific resources on which you want to log data events. You can skip this step if you are using a predefined log template.

   a. Choose from the following fields. For fields that accept an array (more than one value), CloudTrail adds an OR between values.

      - **readOnly** - readOnly can be set to **Equals** a value of true or false. Read-only data events are events that do not change the state of a resource, such as Get* or Describe* events. Write events add, change, or delete resources, attributes, or artifacts, such as Put*, Delete*, or Write* events. To log both read and write events, don't add a readOnly selector.

      - **eventName** - eventName can use any operator. You can use it to include or exclude any data event logged to CloudTrail, such as PutBucket, PutItem, or GetSnapshotBlock. You can have multiple values for this field, separated by commas.

      - **resources.ARN** - You can use any operator with **resources.ARN**, but if you use **Equals** or **NotEquals**, the value must exactly match the ARN of a valid resource of the type you've specified in the template as the value of **resources.type**.
The following table shows the valid ARN format for each resources.Type.

<table>
<thead>
<tr>
<th>resources.Type</th>
<th>resources.ARN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::DynamoDB::Table</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name</td>
</tr>
<tr>
<td>AWS::Lambda::Function</td>
<td>arn:partition:lambda:region:account_ID:function:function_name</td>
</tr>
<tr>
<td>AWS::S3::Object¹</td>
<td>arn:partition:s3:::bucket_name/arn:partition:s3:::bucket_name/object_or_file_name</td>
</tr>
<tr>
<td>AWS::CloudTrail::Channel</td>
<td>arn:partition:cloudtrail:region:account_ID:channel/channel_UUID</td>
</tr>
<tr>
<td>AWS::CodeWhisperer::Profile</td>
<td>arn:partition:codewhisperer:region:account_ID:profile/profile_ID</td>
</tr>
<tr>
<td>AWS::DynamoDB::Stream</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name/stream/date_time</td>
</tr>
<tr>
<td>AWS::EC2::Snapshot</td>
<td>arn:partition:ec2:region::snapshot/snapshot_ID</td>
</tr>
<tr>
<td>AWS::EMR::Workspace</td>
<td>arn:partition:emr:workspace/region::workspace</td>
</tr>
<tr>
<td>AWS::FinSpace::Environment</td>
<td>arn:partition:finspace:region:account_ID:environment/environment_ID</td>
</tr>
<tr>
<td>AWS::Glue::Table</td>
<td>arn:partition:glue:region:account_ID:table/database_name/table_name</td>
</tr>
<tr>
<td>AWS::GuardDuty::Detector</td>
<td>arn:partition:guardduty:region:account_ID:detector/detector_ID</td>
</tr>
</tbody>
</table>

¹ AWS::S3::Object is used for AWS S3 objects that are not a bucket.
<table>
<thead>
<tr>
<th>resources&gt;Type</th>
<th>resources.ARN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::ManagedBlockchain::Network</td>
<td>arn:partition:managedblockchain::networks/network_name</td>
</tr>
<tr>
<td>AWS::ManagedBlockchain::Node</td>
<td>arn:partition:managedblockchain:region:account_ID:nodes/node_ID</td>
</tr>
<tr>
<td>AWS::MedicalImaging::Datastore</td>
<td>arn:partition:medical-imaging:region:account_ID:datastore/data_store_ID</td>
</tr>
<tr>
<td>AWS::SageMaker::FeatureGroup</td>
<td>arn:partition:sagemaker:region:account_ID:feature-group/feature_group_name</td>
</tr>
<tr>
<td>AWS::SageMaker::ExperimentTrialComponent</td>
<td>arn:partition:sagemaker:region:account_ID:experiment-trial-component/experiment_trial_component_name</td>
</tr>
<tr>
<td>AWS::S3::AccessPoint²</td>
<td>arn:partition:s3:region:account_ID:accesspoint/access_point_name</td>
</tr>
<tr>
<td>AWS::S3ObjectLambda::AccessPoint</td>
<td>arn:partition:s3-object-lambda:region:account_ID:accesspoint/access_point_name</td>
</tr>
<tr>
<td>AWS::S3Outposts::Object</td>
<td>arn:partition:s3-outposts:region:account_ID:object_path</td>
</tr>
<tr>
<td>AWS::SSMMessages::ControlChannel</td>
<td>arn:partition:ssmmessages:region:account_ID:control-channel/control_channel_ID</td>
</tr>
<tr>
<td>AWS::VerifiedPermissions::PolicyStore</td>
<td>arn:partition:verifiedpermissions:region:account_ID:policy-store/policy_store_ID</td>
</tr>
</tbody>
</table>

¹ To log all data events for all objects in a specific S3 bucket, use the.StartsWith operator, and include only the bucket ARN as the matching value. The trailing slash is intentional; do not exclude it.

² To log events on all objects in an S3 access point, we recommend that you use only the access point ARN, don't include the object path, and use the StartsWith or NotStartsWith operators.

For more information about the ARN formats of data event resources, see Actions, resources, and condition keys in the AWS Identity and Access Management User Guide.

b. For each field, choose **Conditions** to add as many conditions as you need, up to a maximum of 500 specified values for all conditions. For example, to exclude data events for two S3 buckets from data events that are logged on your trail, you can set the field to resources.ARN, set the
operator for \texttt{NotStartsWith}, and then either paste in an S3 bucket ARN, or browse for the S3 buckets for which you do not want to log events.

To add the second S3 bucket, choose \texttt{+ Conditions}, and then repeat the preceding instruction, pasting in the ARN for or browsing for a different bucket.

\textbf{Note}
You can have a maximum of 500 values for all selectors on a trail. This includes arrays of multiple values for a selector such as \texttt{eventName}. If you have single values for all selectors, you can have a maximum of 500 conditions added to a selector. If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still log all functions with a predefined selector template, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the \texttt{put-event-selectors} command to configure data event logging for specific Lambda functions. For more information, see \textit{Managing trails with the AWS CLI} (p. 111).

c. Choose \texttt{+ Field} to add additional fields as required. To avoid errors, do not set conflicting or duplicate values for fields. For example, do not specify an ARN in one selector to be equal to a value, then specify that the ARN not equal the same value in another selector.

d. Save changes to your custom selector template by choosing \texttt{Next}. Do not choose another log selector template, or leave this page, or your custom selectors will be lost.

16. To add another data type on which to log data events, choose \texttt{Add data event type}. Repeat steps 12 through this step to configure advanced event selectors for the data event type.

17. Choose \texttt{Insights events} if you want your trail to log CloudTrail Insights events.

In \texttt{Event type}, select \texttt{Insights events}. You must be logging \texttt{Write} management events to log Insights events for \texttt{API call rate}. You must be logging \texttt{Read} or \texttt{Write} management events to log Insights events for \texttt{API error rate}.

CloudTrail Insights analyzes management events for unusual activity, and logs events when anomalies are detected. By default, trails don't log Insights events. For more information about Insights events, see \textit{Logging Insights events for trails} (p. 285). Additional charges apply for logging Insights events. For CloudTrail pricing, see \textit{AWS CloudTrail Pricing}.

Insights events are delivered to a different folder named /CloudTrail-Insight of the same S3 bucket that is specified in the \texttt{Storage location} area of the trail details page. CloudTrail creates the new prefix for you. For example, if your current destination S3 bucket is named S3bucketName/AWSLogs/CloudTrail/, the S3 bucket name with a new prefix is named S3bucketName/AWSLogs/CloudTrail-Insight/.

18. When you are finished choosing event types to log, choose \texttt{Next}.

19. On the \texttt{Review and create} page, review your choices. Choose \texttt{Edit} in a section to change the trail settings shown in that section. When you are ready to create the trail, choose \texttt{Create trail}.

20. The new trail appears on the \texttt{Trails} page. The \texttt{Trails} page shows the trails in your account from all Regions. In about 5 minutes, CloudTrail publishes log files that show the AWS API calls made in your account. You can see the log files in the S3 bucket that you specified. It can take up to 36 hours for CloudTrail to deliver the first Insights event, if you have enabled Insights event logging, and unusual activity is detected.

\textbf{Note}
CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the \textit{AWS CloudTrail Service Level Agreement} for more information.
Next steps

After you create your trail, you can return to the trail to make changes:

• If you haven't already, you can configure CloudTrail to send log files to CloudWatch Logs. For more information, see Sending events to CloudWatch Logs (p. 295).
• Create a table and use it to run a query in Amazon Athena to analyze your AWS service activity. For more information, see Creating a Table for CloudTrail Logs in the CloudTrail Console in the Amazon Athena User Guide.
• Add custom tags (key-value pairs) to the trail.
• To create another trail, open the Trails page, and choose Add new trail.

Updating a trail

This section describes how to change trail settings.

To update a single-Region trail to log events in all AWS Regions, or update an multi-Region trail to log events in only a single Region, you must use the AWS CLI. For more information about how to update a single-Region trail to log events in all Regions, see Converting a trail that applies to one Region to apply to all Regions (p. 109). For more information about how to update an multi-Region trail to log events in a single Region, see Converting a multi-Region trail to a single-Region trail (p. 109).

If you’ve enabled CloudTrail management events in Amazon Security Lake, you are required to maintain at least one organizational trail that is multi-Region and logs both read and write management events. You cannot update a qualifying trail in such a way that it fails to meet the Security Lake requirement. For example, by changing the trail to single-Region, or by turning off the logging of read or write management events.

To update a trail with the AWS Management Console

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. In the navigation pane, choose Trails, and then choose a trail name.
3. In General details, choose Edit to change the following settings. You cannot change the name of a trail.

   • Apply trail to my organization - Change whether this trail is an AWS Organizations organization trail.
   • Trail log location - Change the name of the S3 bucket or prefix in which you are storing logs for this trail.
   • Log file SSE-KMS encryption - Choose to enable or disable encrypting log files with SSE-KMS instead of SSE-S3.
   • Log file validation - Choose to enable or disable validation of the integrity of log files.
   • SNS notification delivery - Choose to enable or disable Amazon Simple Notification Service (Amazon SNS) notifications that log files have been delivered to the bucket specified for the trail.

   a. To change the trail to an AWS Organizations organization trail, you can choose to enable the trail for all accounts in your organization. For more information, see Creating a trail for an organization (p. 135).
   b. To change the specified bucket in Storage location, choose Create new S3 bucket to create a bucket. When you create a bucket, CloudTrail creates and applies the required bucket policies.

   Note
   If you chose Use existing S3 bucket, specify a bucket in Trail log bucket name, or choose Browse to choose a bucket. The bucket policy must grant CloudTrail permission
to write to it. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail (p. 380).

To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.

c. For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

If you enable SSE-KMS encryption, choose a New or Existing AWS KMS key. In AWS KMS Alias, specify an alias, in the format $\text{alias/MyAliasName}$. For more information, see Updating a resource to use your KMS key (p. 414). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

Note
You can also type the ARN of a key from another account. For more information, see Updating a resource to use your KMS key (p. 414). The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

d. For Log file validation, choose Enabled to have log digests delivered to your S3 bucket. You can use the digest files to verify that your log files did not change after CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).

e. For SNS notification delivery, choose Enabled to be notified each time a log is delivered to your bucket. CloudTrail stores multiple events in a log file. SNS notifications are sent for every log file, not for every event. For more information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

If you enable SNS notifications, for Create a new SNS topic, choose New to create a topic, or choose Existing to use an existing topic. If you are creating a trail that applies to all Regions, SNS notifications for log file deliveries from all Regions are sent to the single SNS topic that you create.

If you choose New, CloudTrail specifies a name for the new topic for you, or you can type a name. If you choose Existing, choose an SNS topic from the drop-down list. You can also enter the ARN of a topic from another Region or from an account with appropriate permissions. For more information, see Amazon SNS topic policy for CloudTrail (p. 387).

If you create a topic, you must subscribe to the topic to be notified of log file delivery. You can subscribe from the Amazon SNS console. Due to the frequency of notifications, we recommend that you configure the subscription to use an Amazon SQS queue to handle notifications programatically. For more information, see the Amazon Simple Notification Service Getting Started Guide.

4. In CloudWatch Logs, choose Edit to change settings for sending CloudTrail log files to CloudWatch Logs. Choose Enabled in CloudWatch Logs to enable sending log files. For more information, see Sending events to CloudWatch Logs (p. 295).

a. If you enable integration with CloudWatch Logs, choose New to create a new log group, or Existing to use an existing one. If you choose New, CloudTrail specifies a name for the new log group for you, or you can type a name.

b. If you choose Existing, choose a log group from the drop-down list.

c. Choose New to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose Existing to choose an existing IAM role from the drop-down list. The policy statement
for the new or existing role is displayed when you expand Policy document. For more information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).

**Note**

- When you configure a trail, you can choose an S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.
- The delegated administrator account cannot currently configure a CloudWatch Logs log group using the console, because the console operation is not supported. The delegated administrator account must use the AWS CLI or CloudTrail APIs to create an organization trail with a CloudWatch Logs log group.

5. In **Tags**, choose **Edit** to change, add, or delete tags on the trail. Add one or more custom tags (key-value pairs) to your trail. Tags can help you identify both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then use resource groups for your CloudTrail resources. For more information, see AWS Resource Groups and Why use tags for trails? (p. 15).

6. In **Management events**, choose **Edit** to change management event logging settings.
   a. For **API activity**, choose if you want your trail to log Read events, Write events, or both. For more information, see Management events (p. 249).
   b. Choose **Exclude AWS KMS events** to filter AWS Key Management Service (AWS KMS) events out of your trail. The default setting is to include all AWS KMS events.

   The option to log or exclude AWS KMS events is available only if you log management events on your trail. If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

   AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. These actions are now logged as Read events. Low-volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which typically account for less than 0.5% of AWS KMS event volume) are logged as Write events.

   To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still log relevant events such as Disable, Delete and ScheduleKey, choose to log Write management events, and clear the check box for Exclude AWS KMS events.
   c. Choose **Exclude Amazon RDS Data API events** to filter Amazon Relational Database Service Data API events out of your trail. The default setting is to include all Amazon RDS Data API events. For more information about Amazon RDS Data API events, see Logging Data API calls with AWS CloudTrail in the Amazon RDS User Guide for Aurora.

7. **Important**

   Steps 7-9 are for configuring data events on your trail if you are using basic event selectors. If you are using advanced event selectors, see Updating data event settings with advanced event selectors (p. 100), then return to this procedure for Step 10 and forward.

   In **Data events**, choose **Edit** to change data event logging settings. With basic event selectors, you can specify logging data events for Amazon S3 buckets, AWS Lambda functions, DynamoDB tables, or a combination of those resources. Additional data event types are supported with advanced event selectors (p. 100). By default, trails don't log data events. Additional charges apply for logging data events. For more information, see Data events (p. 257). For CloudTrail pricing, see AWS CloudTrail Pricing.

   For Amazon S3 buckets:
   a. For **Data event source**, choose **S3**.
b. You can choose to log All current and future S3 buckets, or you can specify individual buckets or functions. By default, data events are logged for all current and future S3 buckets.

Note
Keeping the default All current and future S3 buckets option enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.

If the trail applies only to one Region, choosing All current and future S3 buckets enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

If you leave the default, All current and future S3 buckets, choose to log Read events, Write events, or both.

c. To select individual buckets, empty the Read and Write check boxes for All current and future S3 buckets. In Individual bucket selection, browse for a bucket on which to log data events.

To find specific buckets, type a bucket prefix for the bucket you want. You can select multiple buckets in this window. Choose Add bucket to log data events for more buckets. Choose to log Read events, such as GetObject, Write events, such as PutObject, or both.

This setting takes precedence over individual settings you configure for individual buckets. For example, if you specify logging Read events for all S3 buckets, and then choose to add a specific bucket for data event logging, Read is already selected for the bucket you added. You cannot clear the selection. You can only configure the option for Write.

To remove a bucket from logging, choose X.

8. To add another data type on which to log data events, choose Add data event type.

9. For Lambda functions:

   a. For Data event source, choose Lambda.

   b. In Lambda function, choose All regions to log all Lambda functions, or Input function as ARN to log data events on a specific function.

To log data events for all Lambda functions in your AWS account, select Log all current and future functions. This setting takes precedence over individual settings you configure for individual functions. All functions are logged, even if all functions are not displayed.

Note
If you are creating a trail for all Regions, this selection enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions.

Logging data events for all functions also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

If you choose Input function as ARN, enter the ARN of a Lambda function.

Note
If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still select the option to log all functions, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the
10. To add another data type on which to log data events, choose **Add data event type**.

11. For DynamoDB tables:
   a. For **Data event source**, choose **DynamoDB**.
   b. In **DynamoDB table selection**, choose **Browse** to select a table, or paste in the ARN of a DynamoDB table to which you have access. A DynamoDB table ARN is in the following format:

   \[
   \text{arn:partition:dynamodb:region:account_ID:table/table_name}
   \]

   To add another table, choose **Add row**, and browse for a table or paste in the ARN of a table to which you have access.

12. In **Insights events** choose **Edit** if you want your trail to log CloudTrail Insights events.

   In **Event type**, select **Insights events**.

   In **Insights events**, choose **API call rate**, **API error rate**, or both. You must be logging **Write** management events to log Insights events for **API call rate**. You must be logging **Read** or **Write** management events to log Insights events for **API error rate**.

   CloudTrail Insights analyzes management events for unusual activity, and logs events when anomalies are detected. By default, trails don't log Insights events. For more information about Insights events, see [Logging Insights events for trails](p. 285). Additional charges apply for logging Insights events. For CloudTrail pricing, see [AWS CloudTrail Pricing](p. 393).

   Insights events are delivered to a different folder named `/CloudTrail-Insight` of the same S3 bucket that is specified in the **Storage location** area of the trail details page. CloudTrail creates the new prefix for you. For example, if your current destination S3 bucket is named `S3bucketName/AWSLogs/CloudTrail/`, the S3 bucket name with a new prefix is named `S3bucketName/AWSLogs/CloudTrail-Insight/`.

13. When you are finished changing settings on your trail, choose **Update trail**.

### Updating data event settings with advanced event selectors

1. On the trail's details page, in **Data events**, choose **Edit**.

2. If you are not already logging data events, choose **Data events**.

3. For **Data event type**, choose the resource type on which you want to log data events.

   **Note**

   To log data events for AWS Glue tables created by Lake Formation, choose **Lake Formation**.

4. Choose a log selector template. CloudTrail includes predefined templates that log all data events for the resource type. To build a custom log selector template, choose **Custom**.

   **Note**

   Choosing a predefined template for S3 buckets enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.

   If the trail applies only to one Region, choosing a predefined template that logs all S3 buckets enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.
If you are creating a trail for all Regions, choosing a predefined template for Lambda functions enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions. Logging data events for all functions also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

5. (Optional) In **Selector name**, enter a name to identify your selector. The selector name is a descriptive name for an advanced event selector, such as "Log data events for only two S3 buckets". The selector name is listed as Name in the advanced event selector and is viewable if you expand the **JSON view**.

6. In **Advanced event selectors**, build an expression for the specific resources on which you want to collect data events. You can skip this step if you are using a predefined log template.
   a. Choose from the following fields. For fields that accept an array (more than one value), CloudTrail adds an OR between values.

   - **readOnly** - `readOnly` can be set to **Equals** a value of `true` or false. To log both read and write events, don't add a `readOnly` selector.
   - **eventName** - `eventName` can use any operator. You can use it to include or exclude any data event logged to CloudTrail, such as `PutBucket` or `GetSnapshotBlock`. You can have multiple values for this field, separated by commas.
   - **resources.ARN** - You can use any operator with `resources.ARN`, but if you use **Equals** or **NotEquals**, the value must exactly match the ARN of a valid resource of the type you've specified in the template as the value of `resources.type`.

The following table shows the valid ARN format for each `resources.Type`.

<table>
<thead>
<tr>
<th><code>resources.Type</code></th>
<th><code>resources.ARN</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::DynamoDB::Table</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name</td>
</tr>
<tr>
<td>AWS::Lambda::Function</td>
<td>arn:partition:lambda:region:account_ID:function/Function_name</td>
</tr>
<tr>
<td>AWS::S3::Object¹</td>
<td>arn:partition:s3::bucket_name/</td>
</tr>
<tr>
<td>AWS::CloudTrail::Channel</td>
<td>arn:partition:cloudtrail:region:account_ID:channel/channel_UUID</td>
</tr>
<tr>
<td>AWS::CodeWhisperer::Profile</td>
<td>arn:partition:codewhisperer:region:account_ID:profile/profile_ID</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>resources.Type</th>
<th>resources.ARN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::DynamoDB::Stream</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name/stream/date_time</td>
</tr>
<tr>
<td>AWS::EC2::Snapshot</td>
<td>arn:partition:ec2:region:snapshot/snapshot_ID</td>
</tr>
<tr>
<td>AWS::EMRWAL::Workspace</td>
<td>arn:partition:emrwal:region:workspace/workspace_name</td>
</tr>
<tr>
<td>AWS::FinSpace::Environment</td>
<td>arn:partition:finspace:region:account_ID:environment/environment_ID</td>
</tr>
<tr>
<td>AWS::Glue::Table</td>
<td>arn:partition:glue:region:account_ID:table/database_name/table_name</td>
</tr>
<tr>
<td>AWS::GuardDuty::Detector</td>
<td>arn:partition:guardduty:region:account_ID:detector/detector_ID</td>
</tr>
<tr>
<td>AWS::Kendra Ranking::ExecutionPlan</td>
<td>arn:.partition:kendra-ranking:region:account_ID:rescore-execution-plan/rescore_execution_plan_ID</td>
</tr>
<tr>
<td>AWS::ManagedBlockchain::Network</td>
<td>arn:partition:managedblockchain::networks/network_name</td>
</tr>
<tr>
<td>AWS::ManagedBlockchain::Node</td>
<td>arn:partition:managedblockchain:region:account_ID:nodes/node_ID</td>
</tr>
<tr>
<td>AWS::Medical Imaging::Datastore</td>
<td>arn:partition:medical-imaging:region:account_ID:datastore/data_store_ID</td>
</tr>
<tr>
<td>AWS::SageMaker::FeatureGroup</td>
<td>arn:partition:sagemaker:region:account_ID:feature-group/feature_group_name</td>
</tr>
<tr>
<td>AWS::SageMaker::ExperimentTrialComponent</td>
<td>arn:partition:sagemaker:region:account_ID:experiment-trial-component/experiment_trial_component_name</td>
</tr>
<tr>
<td>AWS::S3::AccessPoint²</td>
<td>arn:partition:s3:region:account_ID:accesspoint/access_point_name</td>
</tr>
<tr>
<td>AWS::S3 Object Lambda::AccessPoint</td>
<td>arn:partition:s3-object-lambda:region:account_ID:accesspoint/access_point_name</td>
</tr>
</tbody>
</table>
Creating and updating a trail with the console

<table>
<thead>
<tr>
<th>resources.Type</th>
<th>resources.ARN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::S3Outposts::Object</td>
<td>arn:partition:s3-outposts:region:account_ID:object_path</td>
</tr>
<tr>
<td>AWS::SSMMessages::ControlChannel</td>
<td>arn:partition:ssmmessages:region:account_ID:control-channel/control_channel_ID</td>
</tr>
<tr>
<td>AWS::VerifiedPermissions::PolicyStore</td>
<td>arn:partition:verifiedpermissions:region:account_ID:policy-store/policy_store_ID</td>
</tr>
</tbody>
</table>

1. To log all data events for all objects in a specific S3 bucket, use the StartsWith operator, and include only the bucket ARN as the matching value. The trailing slash is intentional; do not exclude it.

2. To log events on all objects in an S3 access point, we recommend that you use only the access point ARN, don’t include the object path, and use the StartsWith or NotStartsWith operators.

For more information about the ARN formats of data event resources, see Actions, resources, and condition keys in the AWS Identity and Access Management User Guide.

b. For each field, choose + Conditions to add as many conditions as you need, up to a maximum of 500 specified values for all conditions. For example, to exclude data events for two S3 buckets from data events that are logged on your trail, you can set the field to resources.ARN, set the operator for NotStartsWith, and then either paste in an S3 bucket ARN, or browse for the S3 buckets for which you do not want to log events.

To add the second S3 bucket, choose + Conditions, and then repeat the preceding instruction, pasting in the ARN for or browsing for a different bucket.

Note
You can have a maximum of 500 values for all selectors on a trail. This includes arrays of multiple values for a selector such as eventName. If you have single values for all selectors, you can have a maximum of 500 conditions added to a selector. If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still log all functions with a predefined selector template, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the put-event-selectors command to configure data event logging for specific Lambda functions. For more information, see Managing trails with the AWS CLI (p. 111).

c. Choose + Field to add additional fields as required. To avoid errors, do not set conflicting or duplicate values for fields. For example, do not specify an ARN in one selector to be equal to a value, then specify that the ARN not equal the same value in another selector.

d. Save changes to your custom selector template by choosing Next. Do not choose another log selector template, or leave this page, or your custom selectors will be lost.

7. To add another data type on which to log data events, choose Add data event type. Repeat steps 3 through this step to configure advanced event selectors for the data event type.

8. After you choose Next, in Step 2: Choose log events, review the log selector template options you’ve chosen. Choose Edit to go back and make changes.
9. To configure Insights events and other settings for your trail, go back to the preceding procedure in this topic, [Updating a trail](#).  

## Deleting a trail

You can delete trails with the CloudTrail console. If an organization's management account or delegated administrator account deletes an organization trail, the trail is removed from all member accounts of the organization.

If you've enabled CloudTrail management events in Amazon Security Lake, you are required to maintain at least one organizational trail that is multi-Region and logs both read and write management events. You cannot delete a trail if it is the only trail you have that meets this requirement, unless you turn off CloudTrail management events in Security Lake.

**To delete a trail with the CloudTrail console**

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. Open the Trails page of the CloudTrail console.
3. Choose the trail name.
4. At the top of the trail details page, choose Delete.
5. When you are prompted to confirm, choose Delete to delete the trail permanently. The trail is removed from the list of trails. Log files that were already delivered to the Amazon S3 bucket are not deleted.

   **Note**  
   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?](#).

## Turning off logging for a trail

When you create a trail, logging is turned on automatically. You can turn off logging for a trail. Existing logs are still stored in the trail's Amazon S3 bucket.

**To turn off logging for a trail with the CloudTrail console**

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. In the navigation pane, choose Trails, and then choose the name of the trail.
3. At the top of the trail details page, choose Stop logging to turn off logging for the trail.
4. When you are prompted to confirm, choose Stop logging. CloudTrail stops logging activity for that trail.
5. To resume logging for that trail, choose Start logging on the trail configuration page.

## Creating, updating, and managing trails with the AWS Command Line Interface

You can use the AWS CLI to create, update, and manage your trails. When using the AWS CLI, remember that your commands run in the AWS Region configured for your profile. If you want to run the
commands in a different Region, either change the default Region for your profile, or use the --region parameter with the command.

**Note**
You need the AWS command line tools to run the AWS Command Line Interface (AWS CLI) commands in this topic. Make sure you have a recent version of the AWS CLI installed. For more information, see the AWS Command Line Interface User Guide. For help with CloudTrail commands at the AWS CLI command line, type `aws cloudtrail help`.

### Commonly used commands for trail creation, management, and status

Some of the more commonly used commands for creating and updating trails in CloudTrail include:

- **create-trail (p. 106)** to create a trail.
- **update-trail (p. 108)** to change the configuration of an existing trail.
- **add-tags (p. 111)** to add one or more tags (key-value pairs) to an existing trail.
- **remove-tags (p. 112)** to remove one or more tags from a trail.
- **list-tags (p. 111)** to return a list of tags associated with a trail.
- **put-event-selectors (p. 115)** to add or modify event selectors for a trail.
- **put-insight-selectors** to add or modify Insights event selectors for an existing trail, and enable or disable Insights events.
- **start-logging (p. 106)** to begin logging events with your trail.
- **stop-logging (p. 134)** to pause logging events with your trail.
- **delete-trail (p. 135)** to delete a trail. This command does not delete the Amazon S3 bucket that contains the log files for that trail, if any.
- **describe-trails (p. 112)** to return information about trails in an AWS Region.
- **get-trail (p. 112)** to return settings information for a trail.
- **get-trail-status (p. 112)** to return information about the current status of a trail.
- **get-event-selectors (p. 115)** to return information about event selectors configured for a trail.
- **get-insight-selectors** to return information about Insights event selectors configured for a trail.

### Supported commands for creating and updating trails: create-trail and update-trail

The create-trail and update-trail commands offer a variety of functionality for creating and managing trails, including:

- Creating a trail that receives logs across Regions, or update a trail with the --is-multi-region-trail option. In most circumstances, you should create trails that log events in all AWS Regions.
- Creating a trail that receives logs for all AWS accounts in an organization with the --is-organization-trail option.
- Converting a multi-Region trail to single-Region trail with the --no-is-multi-region-trail option.
- Enabling or disabling log file encryption with the --kms-key-id option. The option specifies an AWS KMS key that you already created and to which you have attached a policy that allows CloudTrail to encrypt your logs. For more information, see Enabling and disabling CloudTrail log file encryption with the AWS CLI (p. 416).
- Enabling or disabling log file validation with the --enable-log-file-validation and --no-enable-log-file-validation options. For more information, see Validating CloudTrail log file integrity (p. 324).
• Specifying a CloudWatch Logs log group and role so that CloudTrail can deliver events to a CloudWatch Logs log group. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

Deprecated commands: create-subscription and update-subscription

Important
The create-subscription and update-subscription commands were used to create and update trails, but are deprecated. Do not use these commands. They do not provide full functionality for creating and managing trails.
If you configured automation that uses one or both of these commands, we recommend that you update your code or scripts to use supported commands such as create-trail.

Using create-trail

You can run the create-trail command to create trails that are specifically configured to meet your business needs. When using the AWS CLI, remember that your commands run in the AWS Region configured for your profile. If you want to run the commands in a different Region, either change the default Region for your profile, or use the --region parameter with the command.

Creating a trail that applies to all Regions

To create a trail that applies to all Regions, use the --is-multi-region-trail option. By default, the create-trail command creates a trail that logs events only in the AWS Region where the trail was created. To ensure that you log global service events and capture all management event activity in your AWS account, you should create trails that log events in all AWS Regions.

Note
When you create a trail, if you specify an Amazon S3 bucket that was not created with CloudTrail, you need to attach the appropriate policy. See Amazon S3 bucket policy for CloudTrail (p. 380).

The following example creates a trail with the name my-trail and a tag with a key named Group with a value of Marketing that delivers logs from all Regions to an existing bucket named my-bucket.

/aws cloudtrail create-trail --name my-trail --s3-bucket-name my-bucket --is-multi-region-trail --tags-list [key=Group,value=Marketing]

To confirm that your trail exists in all Regions, the IsMultiRegionTrail element in the output shows true.

```
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": false,
  "IsMultiRegionTrail": true,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

Note
Use the start-logging command to start logging for your trail.

Start logging for the trail

After the create-trail command completes, run the start-logging command to start logging for that trail.
Note
When you create a trail with the CloudTrail console, logging is turned on automatically.

The following example starts logging for a trail.

```bash
aws cloudtrail start-logging --name my-trail
```

This command doesn't return an output, but you can use the `get-trail-status` command to verify that logging has started.

```bash
aws cloudtrail get-trail-status --name my-trail
```

To confirm that the trail is logging, the `IsLogging` element in the output shows true.

```json
{
    "IncludeGlobalServiceEvents": true,
    "Name": "my-trail",
    "LogFileValidationEnabled": false,
    "IsMultiRegionTrail": false,
    "IsOrganizationTrail": false,
    "S3BucketName": "my-bucket"
}
```

Creating a single-Region trail

The following command creates a single-Region trail. The specified Amazon S3 bucket must already exist and have the appropriate CloudTrail permissions applied. For more information, see [Amazon S3 bucket policy for CloudTrail](p. 380).

```bash
aws cloudtrail create-trail --name my-trail --s3-bucket-name my-bucket
```

For more information, see [CloudTrail naming requirements](p. 161).

The following is example output.

```json
{
    "IncludeGlobalServiceEvents": true,
    "Name": "my-trail",
    "LogFileValidationEnabled": false,
    "IsMultiRegionTrail": false,
    "IsOrganizationTrail": false,
    "S3BucketName": "my-bucket"
}
```

Creating a trail that applies to all Regions and that has log file validation enabled

To enable log file validation when using `create-trail`, use the `--enable-log-file-validation` option.

For information about log file validation, see [Validating CloudTrail log file integrity](p. 324).
The following example creates a trail that delivers logs from all Regions to the specified bucket. The command uses the `--enable-log-file-validation` option.

```
aws cloudtrail create-trail --name my-trail --s3-bucket-name my-bucket --is-multi-region-trail --enable-log-file-validation
```

To confirm that log file validation is enabled, the `LogFileValidationEnabled` element in the output shows true.

```
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": true,
  "IsMultiRegionTrail": true,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

**Using update-trail**

**Important**
As of November 22, 2021, AWS CloudTrail changed how trails capture global service events. Now, events created by Amazon CloudFront, AWS Identity and Access Management, and AWS STS are recorded in the Region in which they were created, the US East (N. Virginia) Region, us-east-1. This makes how CloudTrail treats these services consistent with that of other AWS global services. To continue receiving global service events outside of US East (N. Virginia), be sure to convert **single-Region trails** using global service events outside of US East (N. Virginia) into **multi-Region trails**. For more information about capturing global service events, see [Enabling and disabling global service event logging](p. 109) later in this section.

In contrast, the Event history in the CloudTrail console and the `aws cloudtrail lookup-events` command will show these events in the Region where they occurred. For example, if a ConsoleLogin event occurred in us-west-1, the Event history in the CloudTrail console and the `aws cloudtrail lookup-events` command will show this event in us-west-1.

You can use the `update-trail` command to change the configuration settings for a trail. You can also use the `add-tags` and `remove-tags` commands to add and remove tags for a trail. You can only update trails from the AWS Region where the trail was created (its Home Region). When using the AWS CLI, remember that your commands run in the AWS Region configured for your profile. If you want to run the commands in a different Region, either change the default Region for your profile, or use the `--region` parameter with the command.

If you've enabled CloudTrail management events in Amazon Security Lake, you are required to maintain at least one organizational trail that is multi-Region and logs both read and write management events. You cannot update a qualifying trail in such a way that it fails to meet the Security Lake requirement. For example, by changing the trail to single-Region, or by turning off the logging of read or write management events.

**Note**
If you use the AWS CLI or one of the AWS SDKs to modify a trail, be sure that the trail's bucket policy is up-to-date. In order for your bucket to automatically receive events from a new AWS Region, the policy must contain the full service name, cloutrust.amazonaws.com. For more information, see [Amazon S3 bucket policy for CloudTrail](p. 380).

**Topics**
- Converting a trail that applies to one Region to apply to all Regions (p. 109)
- Converting a multi-Region trail to a single-Region trail (p. 109)
• **Enabling and disabling global service event logging (p. 109)**
• **Enabling log file validation (p. 110)**
• **Disabling log file validation (p. 110)**

### Converting a trail that applies to one Region to apply to all Regions

To change an existing trail so that it applies to all Regions, use the **--is-multi-region-trail** option.

```
aws cloudtrail update-trail --name my-trail --is-multi-region-trail
```

To confirm that the trail now applies to all Regions, the `IsMultiRegionTrail` element in the output shows `true`.

```json
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": false,
  "IsMultiRegionTrail": true,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

### Converting a multi-Region trail to a single-Region trail

To change an existing multi-Region trail so that it applies only to the Region in which it was created, use the **--no-is-multi-region-trail** option.

```
aws cloudtrail update-trail --name my-trail --no-is-multi-region-trail
```

To confirm that the trail now applies to a single Region, the `IsMultiRegionTrail` element in the output shows `false`.

```json
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": false,
  "IsMultiRegionTrail": false,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

### Enabling and disabling global service event logging

To change a trail so that it does not log global service events, use the **--no-include-global-service-events** option.

```
aws cloudtrail update-trail --name my-trail --no-include-global-service-events
```

To confirm that the trail no longer logs global service events, the `IncludeGlobalServiceEvents` element in the output shows `false`.

```json
{
}
```
To change a trail so that it logs global service events, use the `--include-global-service-events` option.

Single-Region trails will no longer receive global service events beginning November 22, 2021, unless the trail already appears in US East (N. Virginia) Region, us-east-1. To continue capturing global service events, update the trail configuration to a multi-Region trail. For example, this command updates a single-Region trail in US East (Ohio), us-east-2, into a multi-Region trail. Replace `myExistingSingleRegionTrailWithGSE` with the appropriate trail name for your configuration.

```bash
aws cloudtrail --region us-east-2 update-trail --name myExistingSingleRegionTrailWithGSE --is-multi-region-trail
```

Because global service events are only available in US East (N. Virginia) beginning November 22, 2021, you can also create a single-Region trail to subscribe to global service events in the US East (N. Virginia) Region, us-east-1. The following command creates a single-Region trail in us-east-1 to receive CloudFront, IAM, and AWS STS events:

```bash
aws cloudtrail --region us-east-1 create-trail --include-global-service-events --name myTrail --s3-bucket-name DOC-EXAMPLE-BUCKET
```

### Enabling log file validation

To enable log file validation for a trail, use the `--enable-log-file-validation` option. Digest files are delivered to the Amazon S3 bucket for that trail.

```bash
aws cloudtrail update-trail --name my-trail --enable-log-file-validation
```

To confirm that log file validation is enabled, the `LogFileValidationEnabled` element in the output shows `true`.

```json
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": true,
  "IsMultiRegionTrail": false,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

### Disabling log file validation

To disable log file validation for a trail, use the `--no-enable-log-file-validation` option.

```bash
aws cloudtrail update-trail --name my-trail-name --no-enable-log-file-validation
```
To confirm that log file validation is disabled, the LogFileValidationEnabled element in the output shows false.

```json
{
  "IncludeGlobalServiceEvents": true,
  "Name": "my-trail",
  "LogFileValidationEnabled": false,
  "IsMultiRegionTrail": false,
  "IsOrganizationTrail": false,
  "S3BucketName": "my-bucket"
}
```

To validate log files with the AWS CLI, see Validating CloudTrail log file integrity with the AWS CLI (p. 326).

Managing trails with the AWS CLI

The AWS CLI includes several other commands that help you manage your trails. These commands add tags to trails, get trail status, start and stop logging for trails, and delete a trail. You must run these commands from the same AWS Region where the trail was created (its Home Region). When using the AWS CLI, remember that your commands run in the AWS Region configured for your profile. If you want to run the commands in a different Region, either change the default Region for your profile, or use the --region parameter with the command.

Topics
- Add one or more tags to a trail (p. 111)
- List tags for one or more trails (p. 111)
- Remove one or more tags from a trail (p. 112)
- Retrieving trail settings and the status of a trail (p. 112)
- Configuring CloudTrail Insights event selectors (p. 114)
- Configuring event selectors (p. 115)
- Configuring advanced event selectors (p. 119)
- Stopping and starting logging for a trail (p. 134)
- Deleting a trail (p. 135)

Add one or more tags to a trail

To add one or more tags to an existing trail, run the add-tags command.

The following example adds a tag with the name Owner and the value of Mary to a trail with the ARN of arn:aws:cloudtrail:us-east-2:123456789012:trail/my-trail in the US East (Ohio) Region.

```bash
```

If successful, this command returns nothing.

List tags for one or more trails

To view the tags associated with one or more existing trails, use the list-tags command.

The following example lists the tags for Trail1 and Trail2.

If successful, this command returns output similar to the following.

```json
{
  "ResourceTagList": [
    {
      "TagsList": [
        {
          "Value": "Alice",
          "Key": "Name"
        },
        {
          "Value": "Ohio",
          "Key": "Location"
        }
      ]
    },
    {
      "TagsList": [
        {
          "Value": "Bob",
          "Key": "Name"
        }
      ]
    }
  ]
}
```

Remove one or more tags from a trail

To remove one or more tags from an existing trail, run the `remove-tags` command.

The following example removes tags with the names `Location` and `Name` from a trail with the ARN of `arn:aws:cloudtrail:us-east-2:123456789012:trail/Trail1` in the US East (Ohio) Region.

aws cloudtrail remove-tags --resource-id arn:aws:cloudtrail:us-east-2:123456789012:trail/Trail1 --tags-list Key=Name Key=Location --region us-east-2

If successful, this command returns nothing.

Retrieving trail settings and the status of a trail

Run the `describe-trails` command to retrieve information about trails in an AWS Region. The following example returns information about trails configured in the US East (Ohio) Region.

aws cloudtrail describe-trails --region us-east-2

If the command succeeds, you see output similar to the following.

```json
{
  "trailList": [
    {
      "Name": "my-trail",
      "S3BucketName": "my-bucket",
      "S3KeyPrefix": "my-prefix",
      "IncludeGlobalServiceEvents": true,
    }
  ]
}
Run the `get-trail` command to retrieve settings information about a specific trail. The following example returns settings information for a trail named `my-trail`.

```shell
aws cloudtrail get-trail --name my-trail
```

If successful, this command returns output similar to the following.

```json
{
    "Trail": {
        "Name": "my-trail",
        "S3BucketName": "my-bucket",
        "S3KeyPrefix": "my-prefix",
        "IncludeGlobalServiceEvents": true,
        "IsMultiRegionTrail": true,
        "HomeRegion": "us-east-2",
        "LogFileValidationEnabled": false,
        "HasCustomEventSelectors": false,
        "SnsTopicName": "my-topic",
        "IsOrganizationTrail": false,
    }
}
```

Run the `get-trail-status` command to retrieve the status of a trail. You must either run this command from the AWS Region where it was created (the Home Region), or you must specify that Region by adding the `--region` parameter.
Note
If the trail is an organization trail and you are a member account in the organization in AWS Organizations, you must provide the full ARN of that trail, and not just the name.

/aws cloudtrail get-trail-status --name my-trail

If the command succeeds, you see output similar to the following.

```
{
    "LatestDeliveryTime": 1441139757.497,
    "LatestDeliveryAttemptTime": "2015-09-01T20:35:57Z",
    "LatestNotificationAttemptSucceeded": "2015-09-01T20:35:57Z",
    "LatestDeliveryAttemptSucceeded": "2015-09-01T20:35:57Z",
    "IsLogging": true,
    "TimeLoggingStarted": "2015-09-01T00:54:02Z",
    "StartLoggingTime": 1441068842.76,
    "LatestDigestDeliveryTime": 1441140723.629,
    "LatestNotificationAttemptTime": "2015-09-01T20:35:57Z",
    "TimeLoggingStopped": ""
}
```

In addition to the fields shown in the preceding JSON code, the status contains the following fields if there are Amazon SNS or Amazon S3 errors:

- **LatestNotificationError**. Contains the error emitted by Amazon SNS if a subscription to a topic fails.
- **LatestDeliveryError**. Contains the error emitted by Amazon S3 if CloudTrail cannot deliver a log file to a bucket.

### Configuring CloudTrail Insights event selectors

Enable Insights events on a trail by running the `put-insight-selectors`, and specifying `ApiCallRateInsight`, `ApiErrorRateInsight`, or both as the value of the `InsightType` attribute.

To view the Insights selector settings for a trail, run the `get-insight-selectors` command. You must either run this command from the AWS Region where the trail was created (the Home Region), or you must specify that Region by adding the `--region` parameter to the command.

**Note**
To log Insights events for `ApiCallRateInsight`, the trail must log write management events. To log Insights events for `ApiErrorRateInsight`, the trail must log read or write management events.

### Example trail that logs Insights events

The following example uses `put-insight-selectors` to create an Insights event selector for a trail named `TrailName3`. This enables Insights event collection for the `TrailName3` trail. The Insights event selector logs both `ApiErrorRateInsight` and `ApiCallRateInsight` Insights event types.

/aws cloudtrail put-insight-selectors --trail-name TrailName3 --insight-selectors
'{"InsightType": "ApiCallRateInsight"},
{"InsightType": "ApiErrorRateInsight"}'}

The example returns the Insights event selector that is configured for the trail.

```
{
    "InsightSelectors": [
        {}
    ]
```
Example: Turn off collection of Insights events

The following example uses put-insight-selectors to remove the Insights event selector for a trail named TrailName3. Clearing the JSON string of Insights selectors disables Insights event collection for the TrailName3 trail.

```
aws cloudtrail put-insight-selectors --trail-name TrailName3 --insight-selectors '[]'
```

The example returns the now-empty Insights event selector that is configured for the trail.

```
{
   "InsightSelectors": [],
   "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName3"
}
```

Configuring event selectors

To view the event selector settings for a trail, run the get-event-selectors command. You must either run this command from the AWS Region where it was created (the Home Region), or you must specify that Region by using the --region parameter.

```
aws cloudtrail get-event-selectors --trail-name TrailName
```

**Note**

If the trail is an organization trail and you are a member account in the organization in AWS Organizations, you must provide the full ARN of that trail, and not just the name.

The following example returns the default settings for an event selector for a trail.

```
{
   "EventSelectors": [
      {
         "ExcludeManagementEventSources": [],
         "IncludeManagementEvents": true,
         "DataResources": [],
         "ReadWriteType": "All"
      }
   ],
   "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

To create an event selector, run the put-event-selectors command. If you want to log Insights events on the trail, be sure the event selector enables logging of the Insights types you want configured your trail. For more information about logging Insights events, see Logging Insights events for trails (p. 285).

When an event occurs in your account, CloudTrail evaluates the configuration for your trails. If the event matches any event selector for a trail, the trail processes and logs the event. You can configure up to
5 event selectors for a trail and up to 250 data resources for a trail. For more information, see Logging data events (p. 256).

Topics

- Example trail with specific event selectors (p. 116)
- Example trail that logs all management and data events (p. 116)
- Example trail that does not log AWS Key Management Service events (p. 117)
- Example trail that logs relevant low-volume AWS Key Management Service events (p. 118)
- Example trail that does not log Amazon RDS data API events (p. 118)

Example trail with specific event selectors

The following example creates an event selector for a trail named `TrailName` to include read-only and write-only management events, data events for two Amazon S3 bucket/prefix combinations, and data events for a single AWS Lambda function named `hello-world-python-function`.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "All","IncludeManagementEvents": true,"DataResources": ["Type":"AWS::S3::Object", "Values": ["arn:aws:s3:::mybucket/prefix","arn:aws:s3:::mybucket2/prefix2"],"Type": "AWS::Lambda::Function","Values": ["arn:aws:lambda:us-west-2:999999999999:function:hello-world-python-function"]}],["ReadWriteType": "All"]]
```

The example returns the event selector configured for the trail.

```json
{
  "EventSelectors": [
    {
      "ExcludeManagementEventSources": [],
      "IncludeManagementEvents": true,
      "DataResources": [
        {
          "Values": [
            "arn:aws:s3:::mybucket/prefix",
            "arn:aws:s3:::mybucket2/prefix2"
          ],
          "Type": "AWS::S3::Object"
        },
        {
          "Values": [
          ],
          "Type": "AWS::Lambda::Function"
        },
        {
          "ReadWriteType": "All"
        }
      ],
      "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
    }
  ]
}
```

Example trail that logs all management and data events

The following example creates an event selector for a trail named `TrailName2` that includes all events, including read-only and write-only management events, and all data events for all Amazon S3 buckets, AWS Lambda functions, and Amazon DynamoDB tables in the AWS account. Because this example uses basic event selectors, it cannot configure logging for S3 events on AWS Outposts, Amazon Managed Blockchain JSON-RPC calls on Ethereum nodes, or other advanced event selector resource types. You
must use advanced event selectors to log data events for those resources. For more information, see Configuring advanced event selectors (p. 119).

Note
If the trail applies only to one Region, only events in that Region are logged, even though the event selector parameters specify all Amazon S3 buckets and Lambda functions. Event selectors apply only to the Regions where the trail is created.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName2 --event-selectors
'[{"ReadWriteType": "All","IncludeManagementEvents": true,"DataResources": [{"Type":"AWS::S3::Object", "Values": ["arn:aws:s3:::"],"Type": "AWS::Lambda::Function","Values": ["arn:aws:lambda"],"Type": "AWS::DynamoDB::Table","Values": ["arn:aws:dynamodb"]}]}]
```

The example returns the event selectors configured for the trail.

```
{
  "EventSelectors": [
    {
      "ExcludeManagementEventSources": [],
      "IncludeManagementEvents": true,
      "DataResources": [
        {
          "Values": ["arn:aws:s3:::"],
          "Type": "AWS::S3::Object"
        },
        {
          "Values": ["arn:aws:lambda"],
          "Type": "AWS::Lambda::Function"
        },
        {
          "Values": ["arn:aws:dynamodb"],
          "Type": "AWS::DynamoDB::Table"
        }
      ],
      "ReadWriteType": "All"
    },
    "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName2"
  ]
}
```

Example trail that does not log AWS Key Management Service events

The following example creates an event selector for a trail named `TrailName` to include read-only and write-only management events, but to exclude AWS Key Management Service (AWS KMS) events. Because AWS KMS events are treated as management events, and there can be a high volume of them, they can have a substantial impact on your CloudTrail bill if you have more than one trail that captures management events. The user in this example has chosen to exclude AWS KMS events from every trail except for one. To exclude an event source, add `ExcludeManagementEventSources` to your event selectors, and specify an event source in the string value.

If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

To start logging AWS KMS events to a trail again, pass an empty array as the value of `ExcludeManagementEventSources`.

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aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "All","ExcludeManagementEventSources": ["kms.amazonaws.com"],"IncludeManagementEvents": true]]'

The example returns the event selector that is configured for the trail.

```
{
  "EventSelectors": [
  {
    "ExcludeManagementEventSources": [ "kms.amazonaws.com" ],
    "IncludeManagementEvents": true,
    "DataResources": [],
    "ReadWriteType": "All"
  },
  "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

To start logging AWS KMS events to a trail again, pass an empty array as the value of ExcludeManagementEventSources, as shown in the following command.

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "All","ExcludeManagementEventSources": [],"IncludeManagementEvents": true]]'
```

Example trail that logs relevant low-volume AWS Key Management Service events

The following example creates an event selector for a trail named TrailName to include write-only management events and AWS KMS events. Because AWS KMS events are treated as management events, and there can be a high volume of them, they can have a substantial impact on your CloudTrail bill if you have more than one trail that captures management events. The user in this example has chosen to include AWS KMS Write events, which will include Disable, Delete and ScheduleKey, but no longer include high-volume actions such as Encrypt, Decrypt, and GenerateDataKey (these are now treated as Read events).

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "WriteOnly","ExcludeManagementEventSources": [],"IncludeManagementEvents": true]]'
```

The example returns the event selector that is configured for the trail. This logs write-only management events, including AWS KMS events.

```
{
  "EventSelectors": [
  {
    "ExcludeManagementEventSources": [],
    "IncludeManagementEvents": true,
    "DataResources": [],
    "ReadWriteType": "WriteOnly"
  },
  "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

Example trail that does not log Amazon RDS data API events

The following example creates an event selector for a trail named TrailName to include read-only and write-only management events, but to exclude Amazon RDS Data API events. Because Amazon RDS Data API events are treated as management events, and there can be a high volume of them,
they can have a substantial impact on your CloudTrail bill if you have more than one trail that captures management events. The user in this example has chosen to exclude Amazon RDS Data API events from every trail except for one. To exclude an event source, add `ExcludeManagementEventSources` to your event selectors, and specify the Amazon RDS Data API event source in the string value: `rdsdata.amazonaws.com`.

If you choose not to log management events, Amazon RDS Data API events are not logged, and you cannot change event logging settings.

To start logging Amazon RDS Data API events to a trail again, pass an empty array as the value of `ExcludeManagementEventSources`:

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[
{"ReadWriteType": "All","ExcludeManagementEventSources": ["rdsdata.amazonaws.com"],"IncludeManagementEvents": true}]
```

The example returns the event selector that is configured for the trail.

```json
{
    "EventSelectors": [
        {
            "ExcludeManagementEventSources": ["rdsdata.amazonaws.com"],
            "IncludeManagementEvents": true,
            "DataResources": [],
            "ReadWriteType": "All"
        }
    ],
    "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

To start logging Amazon RDS Data API events to a trail again, pass an empty array as the value of `ExcludeManagementEventSources`, as shown in the following command.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[
{"ReadWriteType": "All","ExcludeManagementEventSources": [],"IncludeManagementEvents": true}]
```

### Configuring advanced event selectors

To use advanced event selectors to include or exclude data events instead of basic event selectors, use advanced event selectors on a trail's details page. Advanced event selectors let you log data events on more resource types than basic event selectors. Basic selectors log S3 object activity, AWS Lambda function execution activity, and DynamoDB tables.

In **Advanced event selectors**, build an expression to collect data events on specific S3 buckets, AWS Lambda functions, `PutAuditEvents` calls on CloudTrail Lake channels, DynamoDB tables, Amazon S3 on Outposts, Amazon Managed Blockchain JSON-RPC calls on Ethereum nodes, S3 Object Lambda access points, Amazon EBS direct APIs on EBS snapshots, S3 access points, DynamoDB streams, AWS Glue tables created by Lake Formation, Amazon FinSpace environments, Amazon SageMaker metrics experiment trial components, Amazon SageMaker feature stores, Amazon Kendra rescore execution plans, Amazon Cognito identity pools, Amazon GuardDuty detectors, Amazon EMR write-ahead log workspaces, Amazon CodeWhisperer profiles, Amazon Verified Permissions policy stores, AWS Systems Manager control channels, Amazon Managed Blockchain networks, and AWS HealthImaging data stores.

For more information advanced event selectors, see [Configuring advanced event selectors](#).

To view the advanced event selector settings for a trail, run the following `get-event-selectors` command. You must either run this command from the AWS Region where the trail was created (the Home Region), or you must specify that Region by adding the `--region` parameter.
aws cloudtrail get-event-selectors --trail-name TrailName

**Note**
If the trail is an organization trail, and you are signed in with a member account in the organization in AWS Organizations, you must provide the full ARN of the trail, and not just the name.

The following example returns the default settings for advanced event selectors for a trail. By default, no advanced event selectors are configured for a trail.

```
{
  "AdvancedEventSelectors": [],
  "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

To create an advanced event selector, run the `put-event-selectors` command. When a data event occurs in your account, CloudTrail evaluates the configuration for your trails. If the event matches any advanced event selector for a trail, the trail processes and logs the event. You can configure up to 500 conditions on a trail, including all values specified for all advanced event selectors on your trail. For more information, see [Logging data events](p. 256).

**Topics**
- [Example trail with specific advanced event selectors](p. 120)
- [Example trail that uses custom advanced event selectors to log all management and data events](p. 122)
- [Example trail that uses custom advanced event selectors to log Amazon S3 on AWS Outposts data events](p. 131)
- [Example trail that uses advanced event selectors to exclude AWS Key Management Service events](p. 132)
- [Example trail that uses advanced event selectors to exclude Amazon RDS data API events](p. 133)

**Example trail with specific advanced event selectors**

The following example creates custom advanced event selectors for a trail named `TrailName` to include read and write management events (by omitting the `readOnly` selector), PutObject and DeleteObject data events for all Amazon S3 bucket/prefix combinations except for a bucket named `sample_bucket_name` and data events for an AWS Lambda function named `MyLambdaFunction`. Because these are custom advanced event selectors, each set of selectors has a descriptive name. Note that a trailing slash is part of the ARN value for S3 buckets.

```
aws cloudtrail put-event-selectors --trail-name TrailName --advanced-event-selectors 
'[
  {
    "Name": "Log readOnly and writeOnly management events",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Management"] }
    ]
  },
  {
    "Name": "Log PutObject and DeleteObject events for all but one bucket",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::S3::Object"] },
      { "Field": "eventName", "Equals": ["PutObject","DeleteObject"] },
      { "Field": "resources.ARN", "NotEquals": ["arn:aws:s3:::sample_bucket_name/"] }
    ]
  }
]
```
The example returns the advanced event selectors that are configured for the trail.

```json
{
    "AdvancedEventSelectors": [
        {
            "Name": "Log readOnly and writeOnly management events",
            "FieldSelectors": [
                {
                    "Field": "eventCategory",
                    "Equals": [ "Management" ],
                    "StartsWith": [],
                    "EndsWith": [],
                    "NotEquals": [],
                    "NotStartsWith": [],
                    "NotEndsWith": []
                }
            ],
            "Name": "Log PutObject and DeleteObject events for all but one bucket",
            "FieldSelectors": [
                {
                    "Field": "eventCategory",
                    "Equals": [ "Data" ],
                    "StartsWith": [],
                    "EndsWith": [],
                    "NotEquals": [],
                    "NotStartsWith": [],
                    "NotEndsWith": []
                },
                {
                    "Field": "resources.type",
                    "Equals": [ "AWS::S3::Object" ],
                    "StartsWith": [],
                    "EndsWith": [],
                    "NotEquals": [],
                    "NotStartsWith": [],
                    "NotEndsWith": []
                },
                {
                    "Field": "resources.ARN",
                    "Equals": [],
                    "StartsWith": [],
                    "EndsWith": [],
                    "NotEquals": [ "arn:aws:s3:::sample_bucket_name/" ],
                    "NotStartsWith": [],
                    "NotEndsWith": []
                }
            ]
        }
    ]
}
```
Example trail that uses custom advanced event selectors to log all management and data events

The following example creates advanced event selectors for a trail named TrailName2 that includes all events, including read-only and write-only management events, and all data events for all S3 buckets, AWS Lambda functions, PutAuditEvents calls on CloudTrail Lake channels, DynamoDB tables, Amazon S3 on Outposts, Amazon Managed Blockchain JSON-RPC calls on Ethereum nodes, S3 Object Lambda access points, Amazon EBS direct APIs on EBS snapshots, S3 access points, DynamoDB streams, AWS Glue tables created by Lake Formation, Amazon FinSpace environments, Amazon SageMaker metrics experiment trial components, Amazon SageMaker feature stores, Amazon Kendra rescore execution plans, Amazon Cognito identity pools, Amazon GuardDuty detectors, Amazon EMR write-ahead log workspaces, Amazon CodeWhisperer profiles, Amazon Verified Permissions policy stores, AWS Systems Manager control channels, Amazon Managed Blockchain networks, and AWS HealthImaging data stores.

**Note**
If the trail applies only to one Region, only events in that Region are logged, even though the event selector parameters specify all Amazon S3 buckets and Lambda functions. In a single-Region trail, event selectors apply only to the Region where the trail is created.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName2 \
--advanced-event-selectors ' {
  {
    "Field": "eventCategory",
    "Equals": [ "Data" ],
    "StartsWith": [],
    "EndsWith": [],
    "NotEquals": [],
    "NotStartsWith": [],
    "NotEndsWith": []
  },
  {
    "Field": "resources.type",
    "Equals": [ "AWS::Lambda::Function" ],
    "StartsWith": [],
    "EndsWith": [],
    "NotEquals": [],
    "NotStartsWith": [],
    "NotEndsWith": []
  },
  {
    "Field": "eventName",
    "Equals": [ "Invoke" ],
    "StartsWith": [],
    "EndsWith": [],
    "NotEquals": [],
    "NotStartsWith": [],
    "NotEndsWith": []
  },
  {
    "Field": "resources.ARN",
    "Equals": [ "arn:aws:lambda:us-east-2:111122223333:function/MyLambdaFunction" ],
    "StartsWith": [],
    "EndsWith": [],
    "NotEquals": [],
    "NotStartsWith": [],
    "NotEndsWith": []
  }
}
}
```

Raw text:

```json
{
  "Version": "1.0",
  "Statement":
  ["Arn": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName2"
}
```
"Name": "Log readOnly and writeOnly management events",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Management"] }
],

"Name": "Log all events for all Amazon S3 buckets",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3::Object"] }
]
],

"Name": "Log all events for Lambda functions",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::Lambda::Function"] }
]
],

"Name": "Log all events for DynamoDB tables",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::DynamoDB::Table"] }
]
],

"Name": "Log all CloudTrail PutAuditEvents activity on a CloudTrail Lake channel",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::CloudTrail::Channel"] }
]
],

"Name": "Log all events for Amazon S3 on Outposts",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3Outposts::Object"] }
]
],

"Name": "Log all JSON-RPC calls for Ethereum nodes in Amazon Managed Blockchain",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::ManagedBlockchain::Node"] }
]
],

"Name": "Log all events for Amazon S3 Object Lambda access points",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3ObjectLambda::AccessPoint"] }
]
],

"Name": "Log all Amazon EBS direct API calls on snapshots",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::EC2::Snapshot"] }
]
],

"Name": "Log all events for Amazon S3 access points",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3::AccessPoint"] }
]
],
  },
  {
    "Name": "Log all events for DynamoDB streams",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] }
    ],
  },
  {
    "Name": "Log all events for AWS Glue tables created by Lake Formation",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::Glue::Table"] }
    ],
  },
  {
    "Name": "Log all events for FinSpace environments",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::FinSpace::Environment"] }
    ],
  },
  {
    "Name": "Log all events for SageMaker metrics experiment trial components",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::SageMaker::ExperimentTrialComponent"] }
    ],
  },
  {
    "Name": "Log all events for SageMaker feature stores",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::SageMaker::FeatureGroup"] }
    ],
  },
  {
    "Name": "Log all events for Amazon Kendra Intelligent Ranking rescore execution plans",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::KendraRanking::ExecutionPlan"] }
    ],
  },
  {
    "Name": "Log all events for Amazon Cognito identity pools",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::Cognito::IdentityPool"] }
    ],
  },
  {
    "Name": "Log all events for an Amazon GuardDuty detector",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::GuardDuty::Detector"] }
    ],
  },
  {
    "Name": "Log all events for Amazon EMR write-ahead log workspaces",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::EMRWAL::Workspace"] }
    ]
  }
]
"Name": "Log all events for Amazon CodeWhisperer profiles",
"FieldSelectors": [
    { "Field": "eventCategory", "Equals": ["Data"] },
    { "Field": "resources.type", "Equals": ["AWS::CodeWhisperer::Profile"] }
],

"Name": "Log all events for Amazon Verified Permissions policy stores",
"FieldSelectors": [
    { "Field": "eventCategory", "Equals": ["Data"] },
    { "Field": "resources.type", "Equals": ["AWS::VerifiedPermissions::PolicyStore"] }
],

"Name": "Log all events for AWS Systems Manager control channels",
"FieldSelectors": [
    { "Field": "eventCategory", "Equals": ["Data"] },
    { "Field": "resources.type", "Equals": ["AWS::SSMMessages::ControlChannel"] }
],

"Name": "Log all events for Amazon Managed Blockchain networks",
"FieldSelectors": [
    { "Field": "eventCategory", "Equals": ["Data"] },
    { "Field": "resources.type", "Equals": ["AWS::ManagedBlockchain::Network"] }
],

"Name": "Log all events for AWS HealthImaging data stores",
"FieldSelectors": [
    { "Field": "eventCategory", "Equals": ["Data"] },
    { "Field": "resources.type", "Equals": ["AWS::MedicalImaging::Datastore"] }
]
]

The example returns the advanced event selectors configured for the trail.

[
    { "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName2",
      "AdvancedEventSelectors": [
        { "Name": "Log readOnly and writeOnly management events",
          "FieldSelectors": [
            { "Field": "eventCategory", "Equals": ["Management"] }
          ]
        },
        { "Name": "Log all events for all Amazon S3 buckets",
          "FieldSelectors": [
            { "Field": "eventCategory", "Equals": ["Data"] }
          ],
          { "Field": "resources.type", "Equals": ["AWS::S3::Object"] }
        }
      ]
]
{
  "Name": "Log all events for Lambda functions",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::Lambda::Function"
      ]
    }
  ]
},
{
  "Name": "Log all events for DynamoDB tables",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::DynamoDB::Table"
      ]
    }
  ]
},
{
  "Name": "Log all CloudTrail PutAuditEvents activity on a CloudTrail Lake channel",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::CloudTrail::Channel"
      ]
    }
  ]
},
{
  "Name": "Log all events for Amazon S3 on Outposts",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::S3::Bucket"
      ]
    }
  ]
}
]
"Field": "resources.type",
"Equals": [
    "AWS::S3Outposts::Object"
  ]
},
{
  "Name": "Log all JSON-RPC calls for Ethereum nodes in Amazon Managed Blockchain",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::ManagedBlockchain::Node"
      ]
    }
  ]
},
{
  "Name": "Log all events for Amazon S3 Object Lambda access points",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::S3ObjectLambda::AccessPoint"
      ]
    }
  ]
},
{
  "Name": "Log all Amazon EBS direct API calls on snapshots",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    },
    {
      "Field": "resources.type",
      "Equals": [
        "AWS::EC2::Snapshot"
      ]
    }
  ]
},
{
  "Name": "Log all events for Amazon S3 access points",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": [
        "Data"
      ]
    }
  ]
}

}
{
  "Name": "Log all events for DynamoDB streams",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": ["Data"]
    },
    {
      "Field": "resources.type",
      "Equals": ["AWS::DynamoDB::Stream"]
    }
  ]
},
{
  "Name": "Log all events for AWS Glue tables created by Lake Formation",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": ["Data"]
    },
    {
      "Field": "resources.type",
      "Equals": ["AWS::Glue::Table"]
    }
  ]
},
{
  "Name": "Log all events for FinSpace environments",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": ["Data"]
    },
    {
      "Field": "resources.type",
      "Equals": ["AWS::FinSpace::Environment"]
    }
  ]
},
{
  "Name": "Log all events for SageMaker metrics experiment trial components",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": ["Data"]
    },
    {
      "Field": "resources.type",
      "Equals": ["AWS::SageMaker::MetricCollection"]
    }
  ]
}
"Equals": ["Data"],
},
{
"Field": "resources.type",
"Equals": ["AWS::SageMaker::ExperimentTrialComponent"
}
],
{
"Name": "Log all events for SageMaker feature stores",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": ["Data"
]
},
{
"Field": "resources.type",
"Equals": ["AWS::SageMaker::FeatureGroup"
]
}
],
{
"Name": "Log all events for Amazon Kendra Intelligent Ranking rescore execution plans",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": ["Data"
]
},
{
"Field": "resources.type",
"Equals": ["AWS::KendraRanking::ExecutionPlan"
]
}
],
{
"Name": "Log all events for Amazon Cognito identity pools",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": ["Data"
]
},
{
"Field": "resources.type",
"Equals": ["AWS::Cognito::IdentityPool"
]
}
],
{
"Name": "Log all events for an Amazon GuardDuty detector",

"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": [
"Data"
]
},
{
"Field": "resources.type",
"Equals": [
"AWS::GuardDuty::Detector"
]
}
],
{"Name": "Log all events for Amazon EMR write-ahead log workspaces",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": [
"Data"
]
},
{
"Field": "resources.type",
"Equals": [
"AWS::EMRWAL::Workspace"
]
}
],
{"Name": "Log all events for Amazon CodeWhisperer profiles",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": [
"Data"
]
},
{
"Field": "resources.type",
"Equals": [
"AWS::CodeWhisperer::Profile"
]
}
],
{"Name": "Log all events for Amazon Verified Permissions policy stores",
"FieldSelectors": [
{
"Field": "eventCategory",
"Equals": [
"Data"
]
},
{
"Field": "resources.type",
"Equals": [
"AWS::VerifiedPermissions::PolicyStore"
]
}
]}
]
Example trail that uses custom advanced event selectors to log Amazon S3 on AWS Outposts data events

The following example shows how to configure your trail to include all data events for all Amazon S3 on AWS Outposts objects in your outpost. In this release, the supported value for S3 on AWS Outposts events for the resources.type field is AWS::S3Outposts::Object.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --region region \
--advanced-event-selectors \
'[
```
Creating, updating, and managing trails with the AWS Command Line Interface

```json
{
    "Name": "OutpostsEventSelector",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::S3Outposts::Object"] }
    ]
}
```

The command returns the following example output.

```json
{
    "AdvancedEventSelectors": [
      {
        "Name": "OutpostsEventSelector",
        "FieldSelectors": [
          { "Field": "eventCategory", "Equals": ["Data"] }
        ]
      },
      {
        "Field": "resources.type",
        "Equals": ["AWS::S3Outposts::Object"]
      }
    ],
    "TrailARN": "arn:aws:cloudtrail:region:123456789012:trail/TrailName"
}
```

**Example trail that uses advanced event selectors to exclude AWS Key Management Service events**

The following example creates an advanced event selector for a trail named `TrailName` to include read-only and write-only management events (by omitting the `readOnly` selector), but to exclude AWS Key Management Service (AWS KMS) events. Because AWS KMS events are treated as management events, and there can be a high volume of them, they can have a substantial impact on your CloudTrail bill if you have more than one trail that captures management events. In this release, you can exclude events from kms.amazonaws.com.

If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

To start logging AWS KMS events to a trail again, remove the `eventSource` selector, and run the command again.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --advanced-event-selectors '
[ {
    "Name": "Log all management events except KMS events",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Management"] },
      { "Field": "eventSource", "NotEquals": ["kms.amazonaws.com"] }
    ]
} ]'
```
The example returns the advanced event selectors that are configured for the trail.

```json
{
  "AdvancedEventSelectors": [
    {
      "Name": "Log all management events except KMS events",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": [ "Management" ],
          "StartsWith": [],
          "EndsWith": [],
          "NotEquals": [],
          "NotStartsWith": [],
          "NotEndsWith": []
        },
        {
          "Field": "eventSource",
          "Equals": [],
          "StartsWith": [],
          "EndsWith": [],
          "NotEquals": [ "kms.amazonaws.com" ],
          "NotStartsWith": [],
          "NotEndsWith": []
        }
      ]
    }
  ],
  "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}
```

To start logging excluded events to a trail again, remove the eventSource selector, as shown in the following command.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName \  
  --advanced-event-selectors '  
    [  
      "Name": "Log all management events",
      "FieldSelectors": [  
        { "Field": "eventCategory", "Equals": ["Management"] }  
      ]
    ]',
```

**Example trail that uses advanced event selectors to exclude Amazon RDS data API events**

The following example creates an advanced event selector for a trail named `TrailName` to include read-only and write-only management events (by omitting the `readOnly` selector), but to exclude Amazon RDS Data API events. Because Amazon RDS Data API events are treated as management events, and there can be a high volume of them, they can have a substantial impact on your CloudTrail bill if you have more than one trail that captures management events. To exclude Amazon RDS Data API events, specify the Amazon RDS Data API event source in the string value for the `eventSource` field: `rdsdata.amazonaws.com`.

If you choose not to log management events, Amazon RDS Data API events are not logged, and you cannot change Amazon RDS Data API event logging settings.

To start logging Amazon RDS Data API events to a trail again, remove the `eventSource` selector, and run the command again.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName \  
  --advanced-event-selectors '  
    [  
      { "Field": "eventCategory", "Equals": ["Management"] },  
      { "Field": "eventSource", "Equals": [], "StartsWith": [], "EndsWith": [],  
        "NotEquals": [ "rdsdata.amazonaws.com" ],  
        "NotStartsWith": [],  
        "NotEndsWith": [] }  
    ]',
```
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---advanced-event-selectors ' {
    "Name": "Log all management events except Amazon RDS data events",
    "FieldSelectors": [
        { "Field": "eventCategory", "Equals": ["Management"] },
        { "Field": "eventSource", "NotEquals": ["rdsdata.amazonaws.com"] }
    ]
}

The example returns the advanced event selectors that are configured for the trail.

--advanced-event-selectors ' {
    "AdvancedEventSelectors": [
        {
            "Name": "Log all management events except Amazon RDS data events",
            "FieldSelectors": [
                { "Field": "eventCategory", "Equals": ["Management"] },
                { "Field": "eventSource", "NotEquals": ["rdsdata.amazonaws.com"] },
                { "Field": "eventSource", "Equals": [],
                  "StartsWith": [],
                  "EndsWith": [],
                  "NotEquals": ["rdsdata.amazonaws.com"],
                  "NotStartsWith": [],
                  "NotEndsWith": []
                },
                { "Field": "eventSource", "Equals": [],
                  "StartsWith": [],
                  "EndsWith": [],
                  "NotEquals": ["rdsdata.amazonaws.com"],
                  "NotStartsWith": [],
                  "NotEndsWith": []
                }
            ]
        }
    ],
    "TrailARN": "arn:aws:cloudtrail:us-east-2:123456789012:trail/TrailName"
}

To start logging excluded events to a trail again, remove the eventSource selector, as shown in the following command.

```
aws cloudtrail put-event-selectors --trail-name TrailName \ --advanced-event-selectors ' {
    "Name": "Log all management events",
    "FieldSelectors": [
        { "Field": "eventCategory", "Equals": ["Management"] }
    ]
}
```

Stopping and starting logging for a trail

The following commands start and stop CloudTrail logging.

```
aws cloudtrail start-logging --name awscloudtrail-example
```
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aws cloudtrail stop-logging --name awscloudtrail-example

Note
Before deleting a bucket, run the stop-logging command to stop delivering events to the bucket. If you don’t stop logging, CloudTrail attempts to deliver log files to a bucket with the same name for a limited period of time.
If you stop logging or delete a trail, CloudTrail Insights is disabled on that trail.

Deleting a trail

If you’ve enabled CloudTrail management events in Amazon Security Lake, you are required to maintain at least one organizational trail that is multi-Region and logs both read and write management events. You cannot delete a trail if it is the only trail you have that meets this requirement, unless you turn off CloudTrail management events in Security Lake.

You can delete a trail with the following command. You can delete a trail only in the Region it was created (the Home Region).

aws cloudtrail delete-trail --name awscloudtrail-example

When you delete a trail, you do not delete the Amazon S3 bucket or the Amazon SNS topic associated with it. Use the AWS Management Console, AWS CLI, or service API to delete these resources separately.

Creating a trail for an organization

If you have created an organization in AWS Organizations, you can create a trail that logs all events for all AWS accounts in that organization. This is sometimes called an organization trail.

The management account for the organization can assign a delegated administrator to manage the organization’s trails. For more information on adding a delegated administrator, see Add a CloudTrail delegated administrator (p. 354).

You can choose to edit an existing trail in the management account or delegated administrator account, and apply it to an organization, making it an organization trail. Organization trails log events for the management account and all member accounts in the organization. For more information about AWS Organizations, see Organizations Terminology and Concepts.

Note
You must sign in with the management account or a delegated administrator account associated with an organization to create an organization trail. You must also have sufficient permissions for the user or role in the management or delegated administrator account to create the trail. If you don’t have sufficient permissions, you won’t have the option to apply the trail to an organization.

When you create an organization trail, a trail with the name that you give it is created in every AWS account that belongs to your organization. Users with CloudTrail permissions in member accounts can see this trail when they log into the AWS CloudTrail console from their AWS accounts, or when they run AWS CLI commands such as describe-trail. However, users in member accounts do not have sufficient permissions to delete the organization trail, turn logging on or off, change what types of events are logged, or otherwise change the organization trail in any way.

By default, when you create an organization trail in the CloudTrail console, the trail is a multi-Region trail; that is, it logs events from all Regions in each account in the organization, but only in the AWS
**partition** in which the trail is created. To log events across all Regions in all AWS partitions in your organization, create a multi-Region organization trail in each partition.

When you create an organization trail in the console, or when you enable CloudTrail as a trusted service in Organizations, this creates a service-linked role to perform logging tasks in your organization's member accounts. This role is named **AWSServiceRoleForCloudTrail**, and is required for CloudTrail to log events for an organization. If an AWS account is added to an organization, the organization trail and service-linked role are added to that AWS account, and logging starts for that account automatically in the organization trail. If an AWS account is removed from an organization, the organization trail and service-linked role are deleted from the AWS account that is no longer part of the organization. However, log files for the removed account that were created before the account's removal remain in the Amazon S3 bucket where log files are stored for the trail.

If the management account for an AWS Organizations organization creates an organization trail, but then is subsequently removed as the organization's management account, any organization trail created using their account becomes a non-organization trail.

In the following example, the organization's management account 111111111111 creates a trail named **MyOrganizationTrail** for the organization **o-exampleorgid**. The trail logs activity for all accounts in the organization in the same Amazon S3 bucket. All accounts in the organization can see **MyOrganizationTrail** in their list of trails, but member accounts cannot remove or modify the organization trail. Only the management account or delegated administrator account can change or delete the trail for the organization. Only the management account can remove a member account from an organization. Similarly, by default, only the management account has access to the Amazon S3 bucket **my-organization-bucket** for the trail, and the logs contained within it. The high-level bucket structure for log files contains a folder named with the organization ID, and subfolders named with the account IDs for each account in the organization. Events for each member account are logged in the folder that corresponds to the member account ID. If member account 444444444444 is removed from the organization, **MyOrganizationTrail** and the service-linked role no longer appear in AWS account 444444444444, and no further events are logged for that account by the organization trail. However, the 444444444444 folder remains in the Amazon S3 bucket, with all logs created before the removal of the account from the organization.
In this example, the ARN of the trail created in the management account is `aws:cloudtrail:us-east-2:111111111111:trail/MyOrganizationTrail`. This ARN is the ARN for the trail in all member accounts as well.

Organization trails are similar to regular trails in many ways. You can create multiple trails for your organization, and choose whether to create an organization trail in all Regions or a single Region, and what kinds of events you want logged in your organization trail, just as in any other trail. However, there are some differences. For example, when you create a trail in the console and choose whether to log data events for Amazon S3 buckets or AWS Lambda functions, the only resources listed in the CloudTrail console are those for the management account or delegated administrator account, but you can add the ARNs for resources in member accounts. Data events for specified member account resources are logged without having to manually configure cross-account access to those resources. For more information about logging management events, Insights events, and data events, see Working with CloudTrail log files (p. 246).

Note
In the console, you create a trail that logs all Regions. This is a recommended best practice; logging activity in all Regions helps you keep your AWS environment more secure. To create a single-Region trail, use the AWS CLI (p. 107).

You can also configure other AWS services to further analyze and act upon the event data collected in CloudTrail logs for an organization trail the same way you would for any other trail. For example, you can analyze the data in an organization trail using Amazon Athena. For more information, see AWS service integrations with CloudTrail logs (p. 28).

Topics
- Event history and organization trails (p. 137)
- Best practices for moving from member account trails to organization trails (p. 137)
- Prepare for creating a trail for your organization (p. 138)
- Creating a trail for your organization in the console (p. 140)
- Creating a trail for an organization with the AWS Command Line Interface (p. 145)

Event history and organization trails

When you view events in Event history for an organization in AWS Organizations, you can view the events only for the AWS account with which you are signed in. For example, if you are signed in with the organization management account, Event history shows the last 90 days of management events for the management account. Organization member account events are not shown in Event history for the management account. To view member account events in Event history, sign in with the member account.

Best practices for moving from member account trails to organization trails

If you already have CloudTrail trails configured for individual member accounts, but want to move to an organization trail to log events in all accounts, you do not want to lose events by deleting individual member account trails before you create an organization trail. But when you have two trails, you incur higher costs because of the additional copy of events delivered to the organization trail.

To help manage costs, but avoid losing events before log delivery starts on the organization trail, consider keeping both your individual member account trails and your organization trail for up to one day. This ensures that the organization trail logs all events, but you incur duplicate event costs only for one day. After the first day, you can stop logging on (or delete) any individual member account trails.
Prepare for creating a trail for your organization

Before you create a trail for your organization, be sure that your organization management account or delegated administrator account is set up correctly for trail creation.

- Your organization must have all features enabled before you can create a trail for it. For more information, see [Enabling All Features in Your Organization](#).

- The management account or delegated administrator account must have the `AWSServiceRoleForOrganizations` role. This role is created automatically by Organizations when you create your organization, and is required for CloudTrail to log events for an organization. For more information, see [Organizations and service-linked roles](#).

- The user or role that creates the organization trail in the management or delegated administrator account must have sufficient permissions to create an organization trail. You must at least apply either the `AWSCloudTrail_FullAccess` policy, or an equivalent policy, to that role or user. You must also have sufficient permissions in IAM and Organizations to create the service-linked role and enable trusted access. The following example policy shows the minimum required permissions.

  **Note**
  You shouldn't share the `AWSCloudTrail_FullAccess` policy broadly across your AWS account. Instead, you should restrict it to AWS account administrators due to the highly sensitive nature of the information collected by CloudTrail. Users with this role have the ability to turn off or reconfigure the most sensitive and important auditing functions in their AWS accounts. For this reason, you must closely control and monitor access to this policy.

  ```json
  {
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "iam:GetRole",
        "organizations:EnableAWSServiceAccess",
        "organizations:ListAccounts",
        "iam:CreateServiceLinkedRole",
        "organizations:DisableAWSServiceAccess",
        "organizations:DescribeOrganization",
        "organizations:ListAWSServiceAccessForOrganization"
      ],
      "Resource": "*"
    }
  ]
  }
  ``

- To use the AWS CLI or the CloudTrail APIs to create an organization trail, you must enable trusted access for CloudTrail in Organizations, and you must manually create an Amazon S3 bucket with a policy that allows logging for an organization trail. For more information, see [Creating a trail for an organization with the AWS Command Line Interface (p. 145)](#).

- To use an existing IAM role to add monitoring of an organization trail to Amazon CloudWatch Logs, you must manually modify the IAM role to allow delivery of CloudWatch Logs for member accounts to the CloudWatch Logs group for the management or delegated administrator account, as shown in the following example.

  **Note**
  You must use an IAM role and CloudWatch Logs log group that exists in your own account. You cannot use an IAM role or CloudWatch Logs log group owned by a different account.

  ```json
  {
  "Version": "2012-10-17",
  "Statement": [
  ```

  ```json
  ```

  ```json
  ```
You can learn more about CloudTrail and Amazon CloudWatch Logs in Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294). In addition, consider the limits on CloudWatch Logs and the pricing considerations for the service before deciding to enable the experience for an organization trail. For more information, see CloudWatch Logs Limits and Amazon CloudWatch Pricing.

- To log data events in your organization trail for specific resources in member accounts, have ready a list of Amazon Resource Names (ARNs) for each of those resources. Member account resources are not displayed in the CloudTrail console when you create a trail; you can browse for resources in the management account on which data event collection is supported, such as S3 buckets. Similarly, if you want to add specific member resources when creating or updating an organization trail at the command line, you need the ARNs for those resources.

  **Note**
  Additional charges apply for logging data events. For CloudTrail pricing, see AWS CloudTrail Pricing.

You should also consider reviewing how many trails already exist in the management account, delegated administrator account, and in the member accounts before creating an organization trail. CloudTrail limits the number of trails that can be created in each Region. You cannot exceed this limit in the Region where you create the organization trail in the management account or delegated administrator account. However, the trail will be created in the member accounts even if member accounts have reached the limit of trails in a Region. While the first trail of management events in any Region is free, charges apply to additional trails. To reduce the potential cost of an organization trail, consider deleting any unneeded trails in the management and member accounts. For more information about CloudTrail pricing, see AWS CloudTrail Pricing.

**Security best practices in organization trails**

As a security best practice, we recommend adding the `aws:SourceArn` condition key to resource policies (such as those for S3 buckets, KMS keys, or SNS topics) that you use with an organization trail. The value of `aws:SourceArn` is the organization trail ARN (or ARNs, if you are using the same resource for more than one trail, such as the same S3 bucket to store logs for more than one trail). This ensures
that the resource, such as an S3 bucket, accepts only data that is associated with the specific trail. The trail ARN must use the account ID of the management account. The following policy snippet shows an example where more than one trail is using the resource.

```
"Condition": {
  "StringEquals": {
    "aws:SourceArn": ["Trail_ARN_1",..., "Trail_ARN_n"]
  }
}
```

For information about how to add condition keys to resource policies, see the following:

- Amazon S3 bucket policy for CloudTrail (p. 380)
- Configure AWS KMS key policies for CloudTrail (p. 404)
- Amazon SNS topic policy for CloudTrail (p. 387)

## Creating a trail for your organization in the console

To create an organization trail from the CloudTrail console, you must sign in to the console as a user or role in the management or delegated administrator account that has sufficient permissions (p. 138). If you don't sign in with the management or delegated administrator account, you won't see the option to apply a trail to an organization when you create or edit a trail from the CloudTrail console.

You can configure an organization trail in multiple ways. For example, you can configure the following details for your organization trail:

- By default, when you create a trail in the console, the trail logs all AWS Regions. As a best practice, we strongly recommend logging events in all Regions in your AWS account. To create a trail for a single Region, use the AWS CLI (p. 107). For more information, see How CloudTrail works (p. 1).
- Specify whether to apply the trail to your organization. By default, trails aren't applied to organizations. You must choose this option to create an organization trail.
- Specify which Amazon S3 bucket that receives log files for the organization trail. You can choose an existing Amazon S3 bucket, or create one specifically for the organization trail.
- For management and data events, specify if you want to log Read events, Write events, or both. CloudTrail Insights (p. 285) events are logged only on management events. You can specify logging data events for resources in the management account by choosing them from the lists in the console, and in member accounts if you specify the ARNs of each resource for which you want to enable data event logging. For more information, see Data events (p. 257).

### To create an organization trail with the AWS Management Console

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
   
   You must be signed in using an IAM identity in the management or delegated administrator account with sufficient permissions (p. 138) to create an organization trail.
2. Choose Trails, and then choose Create trail.
3. On the Create Trail page, for Trail name, type a name for your trail. For more information, see CloudTrail naming requirements (p. 161).
4. Select Enable for all accounts in my organization. You only see this option if you sign in to the console with a user or role in the management or delegated administrator account. To successfully create an organization trail, be sure that the user or role has sufficient permissions (p. 138).
5. For Storage location, choose Create new S3 bucket to create a bucket. When you create a bucket, CloudTrail creates and applies the required bucket policies.
Creating a trail for your organization in the console

Note
If you chose Use existing S3 bucket, specify a bucket in Trail log bucket name, or choose Browse to choose a bucket. You can choose a bucket belonging to any account, however, the bucket policy must grant CloudTrail permission to write to it. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail (p. 380).

To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.

6. For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

If you enable SSE-KMS encryption, choose a New or Existing AWS KMS key. In AWS KMS Alias, specify an alias, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414).

Note
You can also type the ARN of a key from another account. For more information, see Updating a resource to use your KMS key (p. 414). The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

7. In Additional settings, configure the following.
   a. For Log file validation, choose Enabled to have log digests delivered to your S3 bucket. You can use the digest files to verify that your log files did not change after CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).
   b. For SNS notification delivery, choose Enabled to be notified each time a log is delivered to your bucket. CloudTrail stores multiple events in a log file. SNS notifications are sent for every log file, not for every event. For more information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

If you enable SNS notifications, for Create a new SNS topic, choose New to create a topic, or choose Existing to use an existing topic. If you are creating a trail that applies to all Regions, SNS notifications for log file deliveries from all Regions are sent to the single SNS topic that you create.

If you choose New, CloudTrail specifies a name for the new topic for you, or you can type a name. If you choose Existing, choose an SNS topic from the drop-down list. You can also enter the ARN of a topic from another Region or from an account with appropriate permissions. For more information, see Amazon SNS topic policy for CloudTrail (p. 387).

If you create a topic, you must subscribe to the topic to be notified of log file delivery. You can subscribe from the Amazon SNS console. Due to the frequency of notifications, we recommend that you configure the subscription to use an Amazon SQS queue to handle notifications programmatically. For more information, see the Amazon Simple Notification Service Getting Started Guide.

8. Optionally, configure CloudTrail to send log files to CloudWatch Logs by choosing Enabled in CloudWatch Logs. For more information, see Sending events to CloudWatch Logs (p. 295).
   a. If you enable integration with CloudWatch Logs, choose New to create a new log group, or Existing to use an existing one. If you choose New, CloudTrail specifies a name for the new log group for you, or you can type a name.
   b. If you choose Existing, choose a log group from the drop-down list.
c. Choose New to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose Existing to choose an existing IAM role from the drop-down list. The policy statement for the new or existing role is displayed when you expand Policy document. For more information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).

**Note**

- When you configure a trail, you can choose an S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.
- The delegated administrator account cannot currently configure a CloudWatch Logs log group using the console, because the console operation is not supported. The delegated administrator account must use the AWS CLI or CloudTrail APIs to create an organization trail with a CloudWatch Logs log group.

9. For Tags, add one or more custom tags (key-value pairs) to your trail. Tags can help you identify both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then use resource groups for your CloudTrail resources. For more information, see AWS Resource Groups and Why use tags for trails? (p. 15).

10. On the Choose log events page, choose the event types that you want to log. For Management events, do the following.

a. For API activity, choose if you want your trail to log Read events, Write events, or both. For more information, see Management events (p. 249).

b. Choose Exclude AWS KMS events to filter AWS Key Management Service (AWS KMS) events out of your trail. The default setting is to include all AWS KMS events.

The option to log or exclude AWS KMS events is available only if you log management events on your trail. If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. These actions are now logged as Read events. Low-volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which typically account for less than 0.5% of AWS KMS event volume) are logged as Write events.

To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still log relevant events such as Disable, Delete and ScheduleKey, choose to log Write management events, and clear the check box for Exclude AWS KMS events.

c. Choose Exclude Amazon RDS Data API events to filter Amazon Relational Database Service Data API events out of your trail. The default setting is to include all Amazon RDS Data API events. For more information about Amazon RDS Data API events, see Logging Data API calls with AWS CloudTrail in the Amazon RDS User Guide for Aurora.

11. For Data events, you can specify logging data events for Amazon S3 buckets, AWS Lambda functions, Amazon DynamoDB tables, or multiple other resource types. By default, trails don’t log data events. Additional charges apply for logging data events. For more information, see Data events (p. 257). For CloudTrail pricing, see AWS CloudTrail Pricing.

**Note**

More data event types are available if you use advanced event selectors. If you have opted in to use advanced event selectors, follow steps in Creating a trail in the console [advanced event selectors] (p. 90) to configure data event logging on your trail.

For Amazon S3 buckets:

a. For Data event source, choose S3.
b. You can choose to log **All current and future S3 buckets**, or you can specify individual buckets or functions. By default, data events are logged for all current and future S3 buckets.

**Note**

Keeping the default **All current and future S3 buckets** option enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.

If the trail applies only to one Region, selecting the **Select all S3 buckets in your account** option enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

c. If you leave the default, **All current and future S3 buckets**, choose to log **Read** events, **Write** events, or both.

d. To select individual buckets, empty the **Read** and **Write** check boxes for **All current and future S3 buckets**. In **Individual bucket selection**, browse for a bucket on which to log data events. To find specific buckets, type a bucket prefix for the bucket you want. You can select multiple buckets in this window. Choose **Add bucket** to log data events for more buckets. Choose to log **Read** events, such as GetObject, **Write** events, such as PutObject, or both.

This setting takes precedence over individual settings you configure for individual buckets. For example, if you specify logging **Read** events for all S3 buckets, and then choose to add a specific bucket for data event logging, **Read** is already selected for the bucket you added. You cannot clear the selection. You can only configure the option for **Write**.

To remove a bucket from logging, choose X.

12. To add another data type on which to log data events, choose **Add data event type**.

13. For Lambda functions:

   a. For **Data event source**, choose **Lambda**.

   b. In **Lambda function**, choose **All regions** to log all Lambda functions, or **Input function as ARN** to log data events on a specific function.

To log data events for all Lambda functions in your AWS account, select **Log all current and future functions**. This setting takes precedence over individual settings you configure for individual functions. All functions are logged, even if all functions are not displayed.

**Note**

If you are creating a trail for all Regions, this selection enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions.

Logging data events for all functions also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

   c. If you choose **Input function as ARN**, enter the ARN of a Lambda function.

   **Note**

   If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still select the option to log all functions, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the
**Creating a trail for your organization in the console**

14. For DynamoDB tables:
   
a. For **Data event source**, choose **DynamoDB**.
   
b. In **DynamoDB table selection**, choose **Browse** to select a table, or paste in the ARN of a DynamoDB table to which you have access. A DynamoDB table ARN is in the following format:

   ```plaintext
   arn:partition:dynamodb:region:account_ID:table/table_name
   ```

   To add another table, choose **Add row**, and browse for a table or paste in the ARN of a table to which you have access.

15. Choose **Insights events** if you want your trail to log CloudTrail Insights events.

   In **Event type**, select **Insights events**. In **Insights events**, choose **API call rate**, **API error rate**, or both. You must be logging **Write** management events to log Insights events for **API call rate**. You must be logging **Read** or **Write** management events to log Insights events for **API error rate**.

   CloudTrail Insights analyzes management events for unusual activity, and logs events when anomalies are detected. By default, trails don't log Insights events. For more information about Insights events, see [Logging Insights events for trails](#). Additional charges apply for logging Insights events. For CloudTrail pricing, see [AWS CloudTrail Pricing](#).

   Insights events are delivered to a different folder named `/CloudTrail-Insight`of the same S3 bucket that is specified in the **Storage location** area of the trail details page. CloudTrail creates the new prefix for you. For example, if your current destination S3 bucket is named `S3bucketName/AWSLogs/CloudTrail/`, the S3 bucket name with a new prefix is named `S3bucketName/AWSLogs/CloudTrail-Insight/`.

16. When you are finished choosing event types to log, choose **Next**.

17. On the **Review and create** page, review your choices. Choose **Edit** in a section to change the trail settings shown in that section. When you are ready to create the trail, choose **Create trail**.

18. The new trail appears on the **Trails** page. An organization trail might take up to 24 hours to be created in all Regions in all member accounts. The **Trails** page shows the trails in your account from all Regions. In about 5 minutes, CloudTrail publishes log files that show the AWS API calls made in your organization. You can see the log files in the Amazon S3 bucket that you specified.

**Note**

You can’t rename a trail after it has been created. Instead, you can delete the trail and create a new one.

**Next steps**

After you create your trail, you can return to the trail to make changes:

- Change the configuration of your trail by editing it. For more information, see [Updating a trail](#).
- If needed, configure the Amazon S3 bucket to allow specific users in member accounts to read the log files for the organization. For more information, see [Sharing CloudTrail log files between AWS accounts](#).
- Configure CloudTrail to send log files to CloudWatch Logs. For more information, see [Sending events to CloudWatch Logs](#) and the [CloudWatch Logs item](#) in [Prepare for creating a trail for your organization](#).
• Create a table and use it to run a query in Amazon Athena to analyze your AWS service activity. For more information, see Creating a Table for CloudTrail Logs in the CloudTrail Console in the Amazon Athena User Guide.
• Add custom tags (key-value pairs) to the trail.
• To create another organization trail, return to the Trails page and choose Create trail.

Note
When you configure a trail, you can choose an Amazon S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.

Creating a trail for an organization with the AWS Command Line Interface

You can create an organization trail by using the AWS CLI. The AWS CLI is regularly updated with additional functionality and commands. To help ensure success, be sure that you have installed or updated to a recent AWS CLI version before you begin.

Note
The examples in this section are specific to creating and updating organization trails. For examples of using the AWS CLI to manage trails, see Managing trails with the AWS CLI (p. 111) and Configuring CloudWatch Logs monitoring with the AWS CLI (p. 297). When creating or updating an organization trail with the AWS CLI, you must use an AWS CLI profile in the management account or delegated administrator account with sufficient permissions. You must configure the Amazon S3 bucket used for an organization trail with sufficient permissions.

Create or update an Amazon S3 bucket to use to store the log files for an organization trail

You must specify an Amazon S3 bucket to receive the log files for an organization trail. This bucket must have a policy that allows CloudTrail to put the log files for the organization into the bucket.

The following is an example policy for an Amazon S3 bucket named myOrganizationBucket. This bucket is in an AWS account with the ID 111111111111, which is the management account for an organization with the ID o-exampleorgid that allows logging for an organization trail. It also allows logging for the 111111111111 account in the event that the trail is changed from an organization trail to a trail for that account only. Replace myOrganizationBucket, 111111111111, region, and trailName with the appropriate values for your configuration.

The example policy includes an aws:SourceArn condition key for the Amazon S3 bucket policy. The IAM global condition key aws:SourceArn helps ensure that CloudTrail writes to the S3 bucket only for a specific trail or trails. In an organization trail, the value of aws:SourceArn must be a trail ARN that is owned by the management account, and uses the management account ID.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSCloudTrailAclCheck20150319",
      "Effect": "Allow",
      "Principal": {
        "Service": [
          "cloudtrail.amazonaws.com"
        ]
      }
    }
  ]
}
```
Creating a trail for an organization with the AWS Command Line Interface

```
"Action": "s3:GetBucketAcl",
"Resource": "arn:aws:s3:::myOrganizationBucket",
"Condition": {
  "StringEquals": {
    "aws:SourceArn": "arn:aws:cloudtrail:region:1111111111:trail/trailName"
  }
},
{
  "Sid": "AWSCloudTrailWrite20150319",
  "Effect": "Allow",
  "Principal": {
    "Service": ["cloudtrail.amazonaws.com"]
  },
  "Action": "s3:PutObject",
  "Resource": "arn:aws:s3:::myOrganizationBucket/AWSLogs/1111111111/*",
  "Condition": {
    "StringEquals": {
      "s3:x-amz-acl": "bucket-owner-full-control",
      "aws:SourceArn": "arn:aws:cloudtrail:region:1111111111:trail/trailName"
    }
  }
},
{
  "Sid": "AWSCloudTrailOrganizationWrite20150319",
  "Effect": "Allow",
  "Principal": {
    "Service": ["cloudtrail.amazonaws.com"]
  },
  "Action": "s3:PutObject",
  "Resource": "arn:aws:s3:::myOrganizationBucket/AWSLogs/o-exampleorgid/*",
  "Condition": {
    "StringEquals": {
      "s3:x-amz-acl": "bucket-owner-full-control",
      "aws:SourceArn": "arn:aws:cloudtrail:region:1111111111:trail/trailName"
    }
  }
}
```

This example policy does not allow any users from member accounts to access the log files created for the organization. By default, organization log files are accessible only to the management account. For information about how to allow read access to the Amazon S3 bucket for IAM users in member accounts, see [Sharing CloudTrail log files between AWS accounts](p. 315).

### Enabling CloudTrail as a trusted service in AWS Organizations

Before you can create an organization trail, you must first enable all features in Organizations. For more information, see [Enabling All Features in Your Organization](p. 146), or run the following command using a profile with sufficient permissions in the management account:

```
aws organizations enable-all-features
```

After you enable all features, you must configure Organizations to trust CloudTrail as a trusted service.
To create the trusted service relationship between AWS Organizations and CloudTrail, open a terminal or command line and use a profile in the management account. Run the `aws organizations enable-aws-service-access` command, as demonstrated in the following example.

```bash
aws organizations enable-aws-service-access --service-principal cloudtrail.amazonaws.com
```

### Using `create-trail`

#### Creating an organization trail that applies to all Regions

To create an organization trail that applies to all Regions, add the `--is-organization-trail` and `--is-multi-region-trail` options.

**Note**
When you create or update an organization trail with the AWS CLI, you must use an AWS CLI profile in the management account or delegated administrator account with sufficient permissions.

The following example creates an organization trail that delivers logs from all Regions to an existing bucket named `my-bucket`:

```bash
aws cloudtrail create-trail --name my-trail --s3-bucket-name my-bucket --is-organization-trail --is-multi-region-trail
```

To confirm that your trail exists in all Regions, the `IsOrganizationTrail` and `IsMultiRegionTrail` parameters in the output are both set to `true`:

```json
{
    "IncludeGlobalServiceEvents": true,
    "Name": "my-trail",
    "LogFileValidationEnabled": false,
    "IsMultiRegionTrail": true,
    "IsOrganizationTrail": true,
    "S3BucketName": "my-bucket"
}
```

**Note**
Run the `start-logging` command to start logging for your trail. For more information, see [Stopping and starting logging for a trail](p. 134).

#### Creating an organization trail as a single-Region trail

The following command creates an organization trail that only logs events in a single AWS Region, also known as a single-Region trail. The AWS Region where events are logged is the Region specified in the configuration profile for the AWS CLI.

```bash
aws cloudtrail create-trail --name my-trail --s3-bucket-name my-bucket --is-organization-trail
```

For more information, see [CloudTrail naming requirements](p. 161).

Sample output:

```json
{
    "IncludeGlobalServiceEvents": true,
    "Name": "my-trail",
    "LogFileValidationEnabled": false,
```
By default, the create-trail command creates a single-Region trail that does not enable log file validation.

**Note**
Run the start-logging command to start logging for your trail.

### Running update-trail to update an organization trail

You can run the update-trail command to change the configuration settings for an organization trail, or to apply an existing trail for a single AWS account to an entire organization. Remember that you can run the update-trail command only from the Region in which the trail was created.

**Note**
If you use the AWS CLI or one of the AWS SDKs to update a trail, be sure that the trail’s bucket policy is up-to-date. For more information, see Creating a trail for an organization with the AWS Command Line Interface (p. 145).

When you create or update an organization trail with the AWS CLI, you must use an AWS CLI profile in the management account or delegated administrator account with sufficient permissions.

### Applying an existing trail to an organization

To change an existing trail so that it also applies to an organization instead of a single AWS account, add the --is-organization-trail option, as shown in the following example.

```bash
aws cloudtrail update-trail --name my-trail --is-organization-trail
```

To confirm that the trail now applies to the organization, the IsOrganizationTrail parameter in the output has a value of true.

```json
{
   "IncludeGlobalServiceEvents": true,
   "Name": "my-trail",
   "LogFileValidationEnabled": false,
   "IsMultiRegionTrail": true,
   "IsOrganizationTrail": true,
   "S3BucketName": "my-bucket"
}
```

In the preceding example, the trail was configured to apply to all Regions ("IsMultiRegionTrail": true). A trail that applied only to a single Region would show "IsMultiRegionTrail": false in the output.

### Converting an organization trail that applies to one Region to apply to all Regions

To change an existing organization trail so that it applies to all Regions, add the --is-multi-region-trail option as shown in the following example.

```bash
aws cloudtrail update-trail --name my-trail --is-multi-region-trail
```

To confirm that the trail now applies to all Regions, the IsMultiRegionTrail parameter in the output has a value of true.
Copying trail events to CloudTrail Lake

You can copy existing trail events to a CloudTrail Lake event data store to create a point-in-time snapshot of events logged to the trail. Copying trail events does not interfere with the trail’s ability to log events and does not modify the trail in any way.

You can copy trail events to an existing event data store configured for CloudTrail events, or you can create a new CloudTrail event data store and choose the Copy trail events option as part of event data store creation. For more information about copying trail events to an existing event data store, see Copy trail events to CloudTrail Lake using the CloudTrail console (p. 153). For more information about creating a new event data store, see Create an event data store for CloudTrail events (p. 169).

Copying trail events to a CloudTrail Lake event data store, allows you to run queries on the copied events. CloudTrail Lake queries offer a deeper and more customizable view of events than simple key and value lookups in Event history, or running LookupEvents. For more information on CloudTrail Lake, see Working with AWS CloudTrail Lake (p. 166).

If you are copying trail events to an organization event data store, you must use the management account for the organization. You cannot copy trail events using the delegated administrator account for an organization.

Scenarios

The following table describes some common scenarios for copying trail events and how you accomplish each scenario using the console.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>How do I accomplish this in the console?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and query historical trail events in CloudTrail Lake without ingesting new events</td>
<td>Create a new event data store and choose the Copy trail events option as part of event data store creation. When creating the event data store, deselect Ingest events (step 13 of the procedure) to ensure the event data store contains only the historical events for your trail and no future events.</td>
</tr>
<tr>
<td>Replace your existing trail with a CloudTrail Lake event data store</td>
<td>Create an event data store with the same event selectors as your trail to ensure that the event data store has the same coverage as your trail. To avoid duplicating events between the source trail and destination event data store, choose a date range for the copied events that is earlier than the creation of the event data store. After your event data store is created, you can turn off logging for the trail to avoid additional charges. For more information about pricing, see AWS CloudTrail Pricing.</td>
</tr>
</tbody>
</table>
Considerations for copying trail events

Consider the following factors when copying trail events.

• When copying trail events, CloudTrail uses the S3 GetObject API operation to retrieve the trail events in the source S3 bucket. There are some S3 archived storage classes, such as S3 Glacier Flexible Retrieval, S3 Glacier Deep Archive, S3 Outposts, and S3 Intelligent-Tiering Deep Archive tiers that are not accessible by using GetObject. To copy trail events stored in these archived storage classes, you must first restore a copy using the S3 RestoreObject operation. For information about restoring archived objects, see Restoring Archived Objects in the Amazon S3 User Guide.

• When you copy trail events to an event data store, CloudTrail copies all trail events regardless of the configuration of the destination event data store's event types, advanced event selectors, or AWS Region.

• Before copying trail events, check the retention period of the event data store. CloudTrail only copies trail events that are within the event data store's retention period. For example, if an event data store's retention period is 90 days, then CloudTrail will not copy any trail events older than 90 days.

• Before copying trail events, disable any access control lists (ACLs) attached to the source S3 bucket, and update the S3 bucket policy for the destination event data store. For more information about updating the S3 bucket policy, see Amazon S3 bucket policy for copying trail events (p. 152). For more information about disabling ACLs, see Controlling ownership of objects and disabling ACLs for your bucket.

• CloudTrail only copies trail events from Gzip compressed log files that are in the source S3 bucket. CloudTrail does not copy trail events from uncompressed log files, or log files that were compressed using a format other than Gzip.

• To avoid duplicating events between the source trail and destination event data store, choose a time range for the copied events that is earlier than the creation of the event data store.

• By default, CloudTrail only copies CloudTrail events contained in the S3 bucket's CloudTrail prefix and the prefixes inside the CloudTrail prefix, and does not check prefixes for other AWS services. If you want to copy CloudTrail events contained in another prefix, you must choose the prefix when you copy trail events.

• To copy trail events to an organization event data store, you must use the management account for the organization. You cannot use the delegated administrator account to copy trail events to an organization event data store.

• If you are copying trail events to an event data store for investigation and do not want to ingest any future events, you can stop ingestion on the event data store when you create it. When creating the event data store, deselect the Ingest events option (step 13 of the procedure (p. 170)) to ensure the event data store contains only the historical events for your trail and no future events.

Required permissions for copying trail events

Before copying trail events, ensure you have all the required permissions for your IAM role and the event data store's S3 bucket. You only need to update the IAM role permissions if you choose an existing IAM role to copy trail events. If you choose to create a new IAM role, CloudTrail provides all necessary permissions for the role.
If the source S3 bucket uses a KMS key for data encryption, ensure that the KMS key policy allows CloudTrail to decrypt data in the bucket. If the source S3 bucket uses multiple KMS keys, you must update each key’s policy to allow CloudTrail to decrypt the data in the bucket.

**Topics**

- [IAM permissions for copying trail events](#)
- [Amazon S3 bucket policy for copying trail events](#)
- [KMS key policy for decrypting data in the source S3 bucket](#)

**IAM permissions for copying trail events**

When copying trail events, you have the option to create a new IAM role, or use an existing IAM role. When you choose a new IAM role, CloudTrail creates an IAM role with the required permissions and no further action is required on your part.

If you choose an existing role, ensure the IAM role's policies allow CloudTrail to copy trail events to the destination event data store. This section provides examples of the required IAM role permission and trust policies.

The following example provides the permissions policy, which allows CloudTrail to copy trail events to the event data store's S3 bucket. Replace `myBucketName`, `myAccountID`, `region`, `prefix`, and `eventDataStoreArn` with the appropriate values for your configuration. The `myAccountID` is the AWS account ID used for CloudTrail Lake, which may not be the same as the AWS account ID for the S3 bucket.

Replace `key-region`, `keyAccountID`, and `keyID` with the values for the KMS key used to encrypt the source S3 bucket. You can omit the `AWSCloudTrailImportKeyAccess` statement if the source S3 bucket does not use a KMS key for encryption.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSCloudTrailImportBucketAccess",
      "Effect": "Allow",
      "Action": ["s3:ListBucket", "s3:GetBucketAcl"],
      "Resource": ["arn:aws:s3:::myBucketName"],
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": "myAccountID",
          "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
        }
      }
    },
    {
      "Sid": "AWSCloudTrailImportObjectAccess",
      "Effect": "Allow",
      "Action": ["s3:GetObject"],
      "Resource": ["arn:aws:s3:::myBucketName/prefix", "arn:aws:s3:::myBucketName/prefix/*"],
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": "myAccountID",
          "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
        }
      }
    }
  ]
}
```
Required permissions for copying trail events

The following example provides the IAM trust policy, which allows CloudTrail to assume an IAM role to copy trail events to the event data store's S3 bucket. Replace `myAccountID`, `region`, and `eventDataStoreArn` with the appropriate values for your configuration. The `myAccountID` is the AWS account ID used for CloudTrail Lake, which may not be the same as the AWS account ID for the S3 bucket.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "cloudtrail.amazonaws.com"
            },
            "Action": "sts:AssumeRole",
            "Condition": {
                "StringEquals": {
                    "aws:SourceAccount": "myAccountID",
                    "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
                }
            }
        }
    ]
}
```

Amazon S3 bucket policy for copying trail events

By default, Amazon S3 buckets and objects are private. Only the resource owner (the AWS account that created the bucket) can access the bucket and objects it contains. The resource owner can grant access permissions to other resources and users by writing an access policy.

Before you copy trail events, you must update the S3 bucket policy for the destination event data store to allow CloudTrail to copy trail events to the bucket.

You can add the following statement to the event data store's S3 bucket policy to grant these permissions. Replace `roleArn` and `myBucketName` with the appropriate values for your configuration.

```json
{
    "Sid": "AWSCloudTrailImportBucketAccess",
    "Effect": "Allow",
    "Action": [
        "s3:ListBucket",
        "s3:GetBucketAcl",
        "s3:GetObject"
    ]
}
```
Copy trail events to CloudTrail Lake using the CloudTrail console

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. Choose Trails in the left navigation pane of the CloudTrail console.
3. On the Trails page, choose the trail, and then choose Copy events to Lake. If the source S3 bucket for the trail uses a KMS key for data encryption, ensure that the KMS key policy allows CloudTrail to decrypt the data.
decrypt data in the bucket. If the source S3 bucket uses multiple KMS keys, you must update each key’s policy to allow CloudTrail to decrypt data in the bucket. For more information about updating the KMS key policy, see KMS key policy for decrypting data in the source S3 bucket (p. 153).

4. (Optional) By default, CloudTrail only copies CloudTrail events contained in the S3 bucket’s CloudTrail prefix and the prefixes inside the CloudTrail prefix, and does not check prefixes for other AWS services. If you want to copy CloudTrail events contained in another prefix, choose Enter S3 URI, and then choose Browse S3 to browse to the prefix.

5. (Optional) For Event source, choose the time range for copying the events. If you choose a time range, CloudTrail checks the prefix and log file name to verify the name contains a date between the chosen start and end date before attempting to copy trail events. You can choose a Relative range or an Absolute range. To avoid duplicating events between the source trail and destination event data store, choose a time range that is earlier than the creation of the event data store.

   - If you choose Relative range, you can choose to copy events logged in the last 6 months, 1 year, 2 years, 7 years, or a custom range. CloudTrail copies the events logged within the chosen time period.
   - If you choose Absolute range, you can choose a specific start and end date. CloudTrail copies the events that occurred between the chosen start and end dates.

6. For Delivery location, choose the destination event data store from the drop-down list. The S3 bucket policy for the event data store must grant CloudTrail access to copy trail events into the bucket. For more information about updating the S3 bucket policy, see Amazon S3 bucket policy for copying trail events (p. 152).

7. For Permissions, choose from the following IAM role options. If you choose an existing IAM role, verify that the IAM role policy provides the necessary permissions. For more information about updating the IAM role permissions, see IAM permissions for copying trail events (p. 151).

   - Choose Create a new role (recommended) to create a new IAM role. For Enter IAM role name, enter a name for the role. CloudTrail automatically creates the necessary permissions for this new role.
   - Choose Use a custom IAM role to use a custom IAM role that is not listed. For Enter IAM role ARN, enter the IAM ARN.
   - Choose Use an existing role to choose an existing IAM role from the drop-down list.

8. Choose Copy events.

9. You are prompted to confirm the copy. When you are ready to confirm, choose Copy trail events to Lake, and then choose Copy events.

10. On the Copy details page, you can see the copy status and review any failures. When a trail event copy completes, its Copy status is set to either Completed if there were no errors, or Failed if errors occurred.

   
   Note
   Details shown on the event copy details page are not in real-time. The actual values for details such as Prefixes copied may be higher than what is shown on the page. CloudTrail updates the details incrementally over the course of the event copy.

11. If the Copy status is Failed, fix any errors shown in Copy failures, and then choose Retry copy. When you retry a copy, CloudTrail resumes the copy at the location where the failure occurred.

For more information about viewing the details of a trail event copy, see Event copy details (p. 189).

Getting and viewing your CloudTrail log files

After you create a trail and configure it to capture the log files you want, you need to be able to find the log files and interpret the information they contain.
CloudTrail delivers your log files to an Amazon S3 bucket that you specify when you create the trail. CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the AWS CloudTrail Service Level Agreement for more information. Insights events are typically delivered to your bucket within 30 minutes of unusual activity. After you enable Insights events for the first time, allow up to 36 hours to see the first Insights events, if unusual activity is detected.

Topics
- Finding your CloudTrail log files (p. 155)
- Downloading your CloudTrail log files (p. 156)

Finding your CloudTrail log files

CloudTrail publishes log files to your S3 bucket in a gzip archive. In the S3 bucket, the log file has a formatted name that includes the following elements:

- The bucket name that you specified when you created trail (found on the Trails page of the CloudTrail console)
- The (optional) prefix you specified when you created your trail
- The string "AWSLogs"
- The account number
- The string "CloudTrail"
- A Region identifier such as us-west-1
- The year the log file was published in YYYY format
- The month the log file was published in MM format
- The day the log file was published in DD format
- An alphanumeric string that disambiguates the file from others that cover the same time period

The following example shows a complete log file object name:

```
bucket_name/prefix_name/AWSLogs/Account ID/CloudTrail/region/YYYY/MM/DD/file_name.json.gz
```

Note

For organization trails, the log file object name includes the organization unit ID in the path, as follows:

```
bucket_name/prefix_name/AWSLogs/O-ID/Account ID/CloudTrail/Region/YYYY/MM/DD/file_name.json.gz
```

To retrieve a log file, you can use the Amazon S3 console, the Amazon S3 command line interface (CLI), or the API.

To find your log files with the Amazon S3 console

1. Open the Amazon S3 console.
2. Choose the bucket you specified.
3. Navigate through the object hierarchy until you find the log file you want.

All log files have a .gz extension.
You will navigate through an object hierarchy that is similar to the following example, but with a different bucket name, account ID, Region, and date.

<table>
<thead>
<tr>
<th>All Buckets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bucket_Name</td>
</tr>
<tr>
<td>AWSLogs</td>
</tr>
<tr>
<td>123456789012</td>
</tr>
<tr>
<td>CloudTrail</td>
</tr>
<tr>
<td>us-west-1</td>
</tr>
<tr>
<td>2014</td>
</tr>
<tr>
<td>06</td>
</tr>
</tbody>
</table>

A log file for the preceding object hierarchy will look like the following:

123456789012_CloudTrail_us-west-1_20140620T1255ZHdkvFTXOA3Vnhbc.json.gz

**Note**
Although uncommon, you may receive log files that contain one or more duplicate events. Duplicate events will have the same *eventID*. For more information about the *eventID* field, see [CloudTrail record contents](p. 422).

## Downloading your CloudTrail log files

Log files are in JSON format. If you have a JSON viewer add-on installed, you can view the files directly in your browser. Double-click the log file name in the bucket to open a new browser window or tab. The JSON displays in a readable format.

For example, if you use Mozilla Firefox, you can also download the [JSONView](http://jsonview.com) add-on. With JSONView, you can double-click the compressed .gz file in your bucket to open the log file in JSON format.

CloudTrail log files are Amazon S3 objects. You can use the Amazon S3 console, the AWS Command Line Interface (CLI), or the Amazon S3 API to retrieve log files.

For more information, see [Working with Amazon S3 Objects](http://docs.aws.amazon.com/amazons3/latest/userguide/working-with-amazon-s3-objects.html) in the Amazon Simple Storage Service User Guide.

The following procedure describes how to download a log file with the AWS Management Console.

### To download and read a log file

1. Open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).
2. Choose the bucket and choose the log file that you want to download.
3. Choose **Download** or **Download as** and follow the prompts to save the file. This saves the file in compressed format.
   
   **Note**
   Some browsers, such as Chrome, automatically extract the log file for you. If your browser does this for you, skip to step 5.
4. Use a product such as [7-Zip](http://www.7-zip.org) to extract the log file.
5. Open the log file in a text editor such as Notepad++.

For more information about the event fields that can appear in a log file entry, see [CloudTrail log event reference](p. 420).
AWS partners with third-party specialists in logging and analysis to provide solutions that use CloudTrail output. For more information, see [AWS Partner Network - AWS CloudTrail Partners](#).

**Note**

You can also use the Event history feature to look up events for create, update, and delete API activity during the last 90 days. For more information, see [Viewing events with CloudTrail Event history](#).

## Configuring Amazon SNS notifications for CloudTrail

You can be notified when CloudTrail publishes new log files to your Amazon S3 bucket. You manage notifications using Amazon Simple Notification Service (Amazon SNS).

Notifications are optional. If you want notifications, you configure CloudTrail to send update information to an Amazon SNS topic whenever a new log file has been sent. To receive these notifications, you can use Amazon SNS to subscribe to the topic. As a subscriber you can get updates sent to a Amazon Simple Queue Service (Amazon SQS) queue, which enables you to handle these notifications programmatically.

### Topics

- [Configuring CloudTrail to send notifications](#) (p. 157)

## Configuring CloudTrail to send notifications

You can configure a trail to use an Amazon SNS topic. You can use the CloudTrail console or the `aws cloudtrail create-trail` CLI command to create the topic. CloudTrail creates the Amazon SNS topic for you and attaches an appropriate policy, so that CloudTrail has permission to publish to that topic.

When you create an SNS topic name, the name must meet the following requirements:

- Between 1 and 256 characters long
- Contain uppercase and lowercase ASCII letters, numbers, underscores, or hyphens

When you configure notifications for a trail that applies to all Regions, notifications from all Regions are sent to the Amazon SNS topic that you specify. If you have one or more Region-specific trails, you must create a separate topic for each Region and subscribe to each individually.

To receive notifications, subscribe to the Amazon SNS topic or topics that CloudTrail uses. You do this with the Amazon SNS console or Amazon SNS CLI commands. For more information, see [Subscribe to a topic](#) in the [Amazon Simple Notification Service Developer Guide](#).

**Note**

CloudTrail sends a notification when log files are written to the Amazon S3 bucket. An active account can generate a large number of notifications. If you subscribe with email or SMS, you can receive a large volume of messages. We recommend that you subscribe using Amazon Simple Queue Service (Amazon SQS), which lets you handle notifications programmatically. For more information, see [Subscribing a Queue to an Amazon SNS Topic](#) in the [Amazon Simple Queue Service Developer Guide](#).

The Amazon SNS notification consists of a JSON object that includes a Message field. The Message field lists the full path to the log file, as shown in the following example:

```json
{

}
```
Controlling user permissions for CloudTrail

AWS CloudTrail integrates with AWS Identity and Access Management (IAM) to help you to control access to CloudTrail and other AWS resources that CloudTrail requires. Examples of these resources include Amazon S3 buckets and Amazon Simple Notification Service (Amazon SNS) topics. You can use IAM to control which AWS users can create, configure, or delete CloudTrail trails, event data stores, or channels, start and stop logging, and access the buckets that contain log information. To learn more, see Identity and Access Management for AWS CloudTrail (p. 357).

The following topics help you understand permissions, policies, and CloudTrail security:

- Granting permissions for CloudTrail administration (p. 373)
- Amazon S3 bucket naming rules
- Amazon S3 bucket policy for CloudTrail (p. 380)
- Amazon S3 bucket policy for CloudTrail Lake query results (p. 385)
- An example of a bucket policy for an organization trail in Creating a trail for an organization with the AWS Command Line Interface (p. 145).
- Amazon SNS topic policy for CloudTrail (p. 387)
- Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403)
- Required permissions for copying trail events (p. 150)
Tips for managing trails

- Beginning on April 12, 2019, trails are viewable only in the AWS Regions where they log events. If you create a trail that logs events in all AWS Regions, it will appear in the console in all AWS Regions. If you create a trail that only logs events in a single AWS Region, you can view and manage it only in that AWS Region.
- To edit a trail in the list, choose the trail name.
- Configure at least one trail that applies to all Regions so that you receive log files from all Regions in your account.
- To log events from a specific Region and deliver log files to an S3 bucket in the same Region, you can update the trail to apply to a single Region. This is useful if you want to keep your log files separate. For example, you may want users to manage their own logs in specific Regions, or you may want to separate CloudWatch Logs alarms by Region.
- To log events from multiple AWS accounts in one trail, consider creating an organization in AWS Organizations and then creating an organization trail.
- Creating multiple trails will incur additional costs. For more information about prices, see AWS CloudTrail Pricing.

Topics
- Managing CloudTrail costs (p. 159)
- CloudTrail naming requirements (p. 161)
- Amazon S3 bucket naming requirements (p. 161)
- AWS KMS alias naming requirements (p. 162)

Managing CloudTrail costs

As a best practice, we recommend using AWS services and tools that can help you manage CloudTrail costs. You can also configure and manage CloudTrail trails and event data stores in ways that capture the data you need while remaining cost-effective. For more information about CloudTrail pricing, see AWS CloudTrail Pricing.

Tools to help manage costs

AWS Budgets, a feature of AWS Billing and Cost Management, lets you set custom budgets that alert you when your costs or usage exceed (or are forecasted to exceed) your budgeted amount.

As you create multiple trails or event data stores, creating a budget for CloudTrail by using AWS Budgets is a recommended best practice, and can help you track your CloudTrail spending. Cost-based budgets help promote awareness of how much you might be billed for your CloudTrail use. Budget alerts notify you when your bill reaches a threshold that you define. When you receive a budget alert, you can make changes before the end of the billing cycle to manage your costs.
After you create a budget, you can use AWS Cost Explorer to see how your CloudTrail costs are influencing your overall AWS bill. In AWS Cost Explorer, after adding CloudTrail to the Service filter, you can compare your historical CloudTrail spending to that of your current month-to-date (MTD) spending, by both Region and account. This feature helps you monitor and detect unexpected costs in your monthly CloudTrail spending. Additional features in Cost Explorer let you compare CloudTrail spending to monthly spending at the specific resource level, providing information about what might be driving cost increases or decreases in your bill.

Note
Though you can apply tags to CloudTrail trails, AWS Billing cannot currently use tags applied to trails for cost allocation. Cost Explorer can show costs for CloudTrail Lake event data stores and for the CloudTrail service as a whole.

To get started with AWS Budgets, open AWS Billing and Cost Management, and then choose Budgets in the left navigation bar. We recommend configuring budget alerts as you create a budget to track CloudTrail spending. For more information about how to use AWS Budgets, see Managing Your Costs with Budgets and Best Practices for AWS Budgets.

Creating user-defined cost allocation tags for CloudTrail Lake event data stores

You can create user-defined cost allocation tags to track the query and ingestion costs for your CloudTrail Lake event data stores. A user-defined cost allocation tag is a key-value pair that you can associate with an event data store. After you activate cost allocation tags, AWS uses the tags to organize your resource costs on your cost allocation report.

- To create tags in the console, see step 7 of the To create an event data store for CloudTrail events (p. 170) procedure.
- To create tags using the CloudTrail API, see CreateEventDataStore and AddTags in the AWS CloudTrail API Reference. You can also define
- To create tags using the AWS CLI, see create-event-data-store and add-tags in the AWS CLI Command Reference.

For more information about activating tags, see Activating user-defined cost allocation tags.

Trail configuration

CloudTrail offers flexibility in how you configure trails in your account. Some decisions that you make during the setup process require that you understand the impacts to your CloudTrail bill. The following are examples of how trail configurations can influence your CloudTrail bill.

Multiple trail creation

The first delivery of each management event for an account is free. If you create more trails that deliver the same management events to other destinations, those subsequent deliveries incur CloudTrail costs. You can do this to allow different user groups (such as developers, security personnel, and IT auditors) to receive their own copies of log files. For data events, all deliveries incur CloudTrail costs, including the first.

As you create more trails, it is especially important to be familiar with your logs, and understand the types and volumes of events that are generated by resources in your account. This helps you anticipate the volume of events that are associated with an account, and plan for trail costs. For example, using AWS KMS-managed server-side encryption (SSE-KMS) on your S3 buckets can result in a large number of AWS KMS management events in CloudTrail. Larger volumes of events across multiple trails can also influence costs.

To help limit the number of events that are logged to your trail, you can filter out AWS KMS or Amazon RDS Data API events by choosing Exclude AWS KMS events or Exclude Amazon RDS Data
API events on the Create trail or Update trail pages. The option to filter out events is only available if your trail is logging management events. For more information, see Creating a trail (p. 85) or Updating a trail (p. 96) in this guide.

AWS Organizations

When you set up an Organizations trail with CloudTrail, CloudTrail replicates the trail to each member account within your organization. The new trail is created in addition to any existing trails in member accounts. Be sure that the configuration of your organization trail matches how you want trails configured for all accounts within an organization, because the organization trail configuration propagates to all accounts.

Because Organizations creates a trail in each member account, an individual member account that creates an additional trail to collect the same management events as the Organizations trail is collecting a second copy of events. The account is charged for the second copy. Similarly, if an account has a multi-Region trail, and creates a second trail in a single Region to collect the same management events as the multi-Region trail, the trail in the single Region is delivering a second copy of events. The second copy incurs charges.

See also

- AWS CloudTrail Pricing
- Managing Your Costs with Budgets
- Getting Started with Cost Explorer
- Prepare for creating a trail for your organization (p. 138)

CloudTrail naming requirements

CloudTrail resource names must meet the following requirements:

- Contain only ASCII letters (a-z, A-Z), numbers (0-9), periods (.), underscores (_), or dashes (-).
- Start with a letter or number, and end with a letter or number.
- Be between 3 and 128 characters.
- Have no adjacent periods, underscores or dashes. Names like my-_namespace and my-
  -namespace are invalid.
- Not be in IP address format (for example, 192.168.5.4).

Amazon S3 bucket naming requirements

The Amazon S3 bucket that you use to store CloudTrail log files must have a name that conforms with naming requirements for non-US Standard Regions. Amazon S3 defines a bucket name as a series of one or more labels, separated by periods, that adhere to the following rules:

For complete information about Amazon S3 bucket naming requirements, see Bucket naming rules in the Amazon Simple Storage Service User Guide

The following are some of the bucket naming rules:

- The bucket name can be between 3 and 63 characters long, and can contain only lower-case
  characters, numbers, periods, and dashes.
- Each label in the bucket name must start with a lowercase letter or number.
- The bucket name cannot contain underscores, end with a dash, have consecutive periods, or use dashes
  adjacent to periods.
• The bucket name cannot be formatted as an IP address (198.51.100.24).

Warning
Because S3 allows your bucket to be used as a URL that can be accessed publicly, the bucket name that you choose must be globally unique. If some other account has already created a bucket with the name that you chose, you must use another name. For more information, see Bucket restrictions and limitations in the Amazon Simple Storage Service User Guide.

AWS KMS alias naming requirements

When you create an AWS KMS key, you can choose an alias to identify it. For example, you might choose the alias "KMS-CloudTrail-us-west-2" to encrypt the logs for a specific trail.

The alias must meet the following requirements:

• Between 1 and 256 characters, inclusive
• Contain alphanumeric characters (A-Z, a-z, 0-9), hyphens (-), forward slashes (/), and underscores (_)
• Cannot begin with aws

For more information, see Creating Keys in the AWS Key Management Service Developer Guide.

Using AWS CloudTrail with interface VPC endpoints

If you use Amazon Virtual Private Cloud (Amazon VPC) to host your AWS resources, you can establish a private connection between your VPC and AWS CloudTrail. You can use this connection to enable CloudTrail to communicate with your resources on your VPC without going through the public internet.

Amazon VPC is an AWS service that you can use to launch AWS resources in a virtual network that you define. With a VPC, you have control over your network settings, such as the IP address range, subnets, route tables, and network gateways. With VPC endpoints, the routing between the VPC and AWS services is handled by the AWS network, and you can use IAM policies to control access to service resources.

To connect your VPC to CloudTrail, you define an interface VPC endpoint for CloudTrail. An interface endpoint is an elastic network interface with a private IP address that serves as an entry point for traffic destined to a supported AWS service. The endpoint provides reliable, scalable connectivity to CloudTrail without requiring an internet gateway, network address translation (NAT) instance, or VPN connection. For more information, see What is Amazon VPC in the Amazon VPC User Guide.

Interface VPC endpoints are powered by AWS PrivateLink, an AWS technology that enables private communication between AWS services using an elastic network interface with private IP addresses. For more information, see AWS PrivateLink.

The following steps are for users of Amazon VPC. For more information, see Getting Started in the Amazon VPC User Guide.

Availability

CloudTrail currently supports VPC endpoints in the following AWS Regions:

• US East (Ohio)
• US East (N. Virginia)
Create a VPC endpoint for CloudTrail

To start using CloudTrail with your VPC, create an interface VPC endpoint for CloudTrail. For more information, see Creating an Interface Endpoint in the Amazon VPC User Guide.

You don't need to change the settings for CloudTrail. CloudTrail calls other AWS services using either public endpoints or private interface VPC endpoints, whichever are in use.

Viewing service-linked channels for CloudTrail by using the AWS CLI

AWS services can create a service-linked channel to receive CloudTrail events on your behalf. The AWS service creating the service-linked channel configures advanced event selectors for the channel and specifies whether the channel applies to all Regions, or the current Region.

Using the AWS CLI, you can view information about any CloudTrail service-linked channels created by AWS services.

Topics
Get a CloudTrail service-linked channel

The following example AWS CLI command returns information about a specific CloudTrail service-linked channel, including the name of the destination AWS service, any advanced selectors configured for the channel, and whether the channel applies to all Regions or a single Region.

You must specify an ARN or the ID suffix of an ARN for --channel.

```
aws cloudtrail get-channel --channel EXAMPLE-ee54-4813-92d5-999aeEXAMPLE
```

The following is an example response. In this example, AWS_service_name represents the name of the AWS service that created the channel.

```
{
  "Name": "aws-service-channel/AWS_service_name/slc",
  "Source": "CloudTrail",
  "SourceConfig": {
    "ApplyToAllRegions": false,
    "AdvancedEventSelectors": [
      {
        "Name": "Management Events Only",
        "FieldSelectors": [
          {
            "Field": "eventCategory",
            "Equals": [
              "Management"
          ]
        ]
      }
    ],
    "Destinations": [
      {
        "Type": "AWS_SERVICE",
        "Location": "AWS_service_name"
      }
    ]
  }
}
```

List all CloudTrail service-linked channels

The following example AWS CLI command returns information about all CloudTrail service-linked channels that were created on your behalf. Optional parameters include --max-results, to specify a maximum number of results that you want the command to return on a single page. If there are more results than your specified --max-results value, run the command again adding the returned NextToken value to get the next page of results.

```
aws cloudtrail list-channels
```
The following is an example response. In this example, AWS_service_name represents the name of the AWS service that created the channel.

```
{
  "Channels": [
    "Name": "aws-service-channel/AWS_service_name/slc"
  ]
}
```

**AWS service events on service-linked channels**

The AWS service managing the service-linked channel can initiate actions on the service-linked channel (for example, creating or updating a service-linked channel). CloudTrail logs these actions as **AWS service events**, and delivers these events to the **Event history**, and any active trails and event data stores configured for management events. For these events, the `eventType` field is `AwsServiceEvent`.

The following is an example log file entry of an AWS service event for creation of a service-linked channel.

```
{
  "eventVersion": "1.08",
  "userIdentity": {
    "accountId": "111122223333",
    "invokedBy": "AWS Internal"
  },
  "eventTime": "2022-08-18T17:11:22Z",
  "eventSource": "cloudtrail.amazonaws.com",
  "eventName": "CreateServiceLinkedChannel",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "AWS Internal",
  "userAgent": "AWS Internal",
  "requestParameters": null,
  "responseElements": null,
  "requestID": "564f004c-EXAMPLE",
  "eventID": "234f004b-EXAMPLE",
  "readOnly": false,
  "resources": [
    {
      "accountId": "184434908391",
      "type": "AWS::CloudTrail::Channel",
      "ARN": "arn:aws:cloudtrail:us-east-1:111122223333:channel/7944f0ec-EXAMPLE"
    }
  ],
  "eventType": "AwsServiceEvent",
  "managementEvent": true,
  "recipientAccountId": "111122223333",
  "eventCategory": "Management"
}
```
Working with AWS CloudTrail Lake

AWS CloudTrail Lake lets you run SQL-based queries on your events. CloudTrail Lake converts existing events in row-based JSON format to Apache ORC format. ORC is a columnar storage format that is optimized for fast retrieval of data. Events are aggregated into event data stores, which are immutable collections of events based on criteria that you select by applying advanced event selectors (p. 270). You can keep the event data in an event data store for up to seven years, or 2557 days. By default, event data is retained for the maximum period, 2557 days. The selectors that you apply to an event data store control which events persist and are available for you to query. CloudTrail Lake is an auditing solution that can complement your compliance stack, and assist you with near real-time troubleshooting.

You can use CloudTrail Lake integrations to log and store user activity data from outside of AWS; from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers. After you create event data stores in CloudTrail Lake and create a channel to log activity events, you call the PutAuditEvents API to ingest your application activity into CloudTrail. You can then use CloudTrail Lake to search, query, and analyze the data that is logged from your applications.

Integrations can also log events to your event data stores from over a dozen CloudTrail partners. In a partner integration, you create destination event data stores, a channel, and a resource policy. After you create the integration, you provide the channel ARN to the partner. There are two types of integrations: direct and solution. With direct integrations, the partner calls the PutAuditEvents API to deliver events to the event data store for your AWS account. With solution integrations, the application runs in your AWS account and the application calls the PutAuditEvents API to deliver events to the event data store for your AWS account.

When you create an event data store, you choose the type of events to include in your event data store. You can create an event data store to include CloudTrail events, AWS Config configuration items, AWS Audit Manager evidence, or events from outside of AWS. Each event data store can only contain a specific event category (for example, AWS Config configuration items), because the event schema is unique to the event category. You can run SQL queries across multiple event data stores using the supported SQL JOIN keywords. For information about running queries across multiple event data stores, see Advanced, multi-table query support (p. 239).

CloudTrail Lake queries offer a deeper and more customizable view of events than simple key and value lookups in Event history, or running LookupEvents. An Event history search is limited to a single AWS account, only returns events from a single AWS Region, and cannot query multiple attributes. In contrast, CloudTrail Lake users can run complex Standard Query Language (SQL) queries across multiple event fields. CloudTrail Lake supports all valid Presto SELECT statements and functions. For more information about the supported SQL functions and operators, see Functions and Operators on the Presto 0.280 documentation website.

You can save CloudTrail Lake queries for future use, and view results of queries for up to seven days. When you run queries, you can save the query results to an Amazon S3 bucket. CloudTrail Lake can also store events from an organization in AWS Organizations in an event data store, including events from multiple Regions and accounts.

You can use CloudTrail Lake dashboards to visualize the data in your event data stores. Each dashboard consists of multiple widgets and each widget represents a SQL query. For more information about Lake dashboards, see View Lake dashboards (p. 201).

CloudTrail doesn't support authorization based on tags for trails. However, you can control access to actions on event data stores by using authorization based on tags. For more information and examples, see Examples: Denying access to create or delete event data stores based on tags (p. 371) in this guide.
By default, all events in an event data store are encrypted by CloudTrail. When you configure an event data store, you can choose to use your own AWS Key Management Service key. Using your own KMS key incurs AWS KMS costs for encryption and decryption. After you associate an event data store with a KMS key, the KMS key cannot be removed or changed.

CloudTrail Lake event data stores incur charges when they ingest events and when you run queries. For event data stores containing CloudTrail events (data and management events), or AWS Config configuration items, you can choose whether you want the event data store to start ingesting events when you create it, and you can also stop ingestion at any time. For more information about CloudTrail Lake pricing, see AWS CloudTrail Pricing.

CloudTrail Lake supports Amazon CloudWatch metrics, which you can use to view information about the amount of data ingested into your event data store during the last hour and over the course of its retention period. For more information about supported CloudWatch metrics, see Supported CloudWatch metrics (p. 245).

**Note**
CloudTrail typically delivers events within an average of about 5 minutes of an API call. This time is not guaranteed.

**Topics**
- CloudTrail Lake supported Regions (p. 167)
- Create an event data store (p. 169)
- Manage event data store lifecycles (p. 182)
- Copy trail events to an event data store (p. 183)
- Create an integration with an event source outside of AWS (p. 190)
- View Lake dashboards (p. 201)
- Create or edit a query (p. 203)
- Learning resources (p. 223)
- Managing CloudTrail Lake by using the AWS CLI (p. 224)
- CloudTrail Lake SQL constraints (p. 237)
- Supported CloudWatch metrics (p. 245)

## CloudTrail Lake supported Regions

Currently, CloudTrail Lake is supported in the following AWS Regions:

<table>
<thead>
<tr>
<th>Region Name</th>
<th>Region</th>
<th>Endpoint</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>US East (N. Virginia)</td>
<td>us-east-1</td>
<td>cloudtrail.us-east-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>US East (Ohio)</td>
<td>us-east-2</td>
<td>cloudtrail.us-east-2.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>US West (N. California)</td>
<td>us-west-1</td>
<td>cloudtrail.us-west-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>US West (Oregon)</td>
<td>us-west-2</td>
<td>cloudtrail.us-west-2.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Canada (Central)</td>
<td>ca-central-1</td>
<td>cloudtrail.ca-central-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Africa (Cape Town)</td>
<td>af-south-1</td>
<td>cloudtrail.af-south-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Region Name</td>
<td>Region</td>
<td>Endpoint</td>
<td>Protocol</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Asia Pacific (Hong Kong)</td>
<td>ap-east-1</td>
<td>cloudtrail.ap-east-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Mumbai)</td>
<td>ap-south-1</td>
<td>cloudtrail.ap-south-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Tokyo)</td>
<td>ap-northeast-1</td>
<td>cloudtrail.ap-northeast-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Seoul)</td>
<td>ap-northeast-2</td>
<td>cloudtrail.ap-northeast-2.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Osaka)</td>
<td>ap-northeast-3</td>
<td>cloudtrail.ap-northeast-3.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Singapore)</td>
<td>ap-southeast-1</td>
<td>cloudtrail.ap-southeast-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Sydney)</td>
<td>ap-southeast-2</td>
<td>cloudtrail.ap-southeast-2.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Asia Pacific (Jakarta)</td>
<td>ap-southeast-3</td>
<td>cloudtrail.ap-southeast-3.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (Frankfurt)</td>
<td>eu-central-1</td>
<td>cloudtrail.eu-central-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (Stockholm)</td>
<td>eu-north-1</td>
<td>cloudtrail.eu-north-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (Ireland)</td>
<td>eu-west-1</td>
<td>cloudtrail.eu-west-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (London)</td>
<td>eu-west-2</td>
<td>cloudtrail.eu-west-2.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (Paris)</td>
<td>eu-west-3</td>
<td>cloudtrail.eu-west-3.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Europe (Milan)</td>
<td>eu-south-1</td>
<td>cloudtrail.eu-south-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Middle East (UAE)</td>
<td>me-central-1</td>
<td>cloudtrail.me-central-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>Middle East (Bahrain)</td>
<td>me-south-1</td>
<td>cloudtrail.me-south-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>AWS GovCloud (US-East)</td>
<td>us-gov-east-1</td>
<td>cloudtrail.us-gov-east-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>AWS GovCloud (US-West)</td>
<td>us-gov-west-1</td>
<td>cloudtrail.us-gov-west-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
<tr>
<td>South America (São Paulo)</td>
<td>sa-east-1</td>
<td>cloudtrail.sa-east-1.amazonaws.com</td>
<td>HTTPS</td>
</tr>
</tbody>
</table>


For more information about using CloudTrail in the AWS GovCloud (US-West) Region, see [AWS GovCloud (US-West) Endpoints](#) in the [AWS GovCloud (US) User Guide](#).
Create an event data store

When you create an event data store in CloudTrail Lake, you choose the type of events to include in your event data store. You can create an event data store to include CloudTrail data or management events, AWS Config configuration items, or events outside of AWS. Each event data store type can only contain specific event categories (for example, AWS Config configuration items), because the event schema is unique to the event category. You can run SQL queries across multiple event data stores using the supported SQL JOIN keywords. For information about running queries across multiple event data stores, see Advanced, multi-table query support (p. 239).

The following table shows the supported event categories for each event data store type. The eventCategory column shows the value that you would specify in the advanced event selectors to collect events of that type.

<table>
<thead>
<tr>
<th>Event type (console)</th>
<th>eventCategory (API)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CloudTrail events</td>
<td>Management</td>
<td>This event data store type can collect CloudTrail management and data events. For more information, see Create an event data store for CloudTrail events.</td>
</tr>
<tr>
<td></td>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>Configuration items</td>
<td>ConfigurationItem</td>
<td>This event data store type can collect AWS Config configuration items. For more information, see Create an event data store for AWS Config configuration items.</td>
</tr>
<tr>
<td>Events from integration</td>
<td>ActivityAuditLog</td>
<td>This event data store type can collect non-AWS events from integrations. For more information, see Create an event data store for events outside of AWS.</td>
</tr>
</tbody>
</table>

You can also create an event data store for AWS Audit Manager evidence by using the Audit Manager console. For more information about aggregating evidence in CloudTrail Lake using Audit Manager, see Understanding how evidence finder works with CloudTrail Lake in the AWS Audit Manager User Guide.

The sections which follow describe how to create an event data store using the CloudTrail console. For information about how to create an event data store using the AWS CLI, see Managing CloudTrail Lake by using the AWS CLI (p. 224).

Topics
- Create an event data store for CloudTrail events (p. 169)
- Create an event data store for AWS Config configuration items (p. 173)
- Create an event data store for events outside of AWS (p. 180)

Create an event data store for CloudTrail events

Event data stores for CloudTrail events can log CloudTrail management and data events. You can keep the event data in an event data store for up to seven years, or 2557 days. By default, event data is retained for 2557 days, and termination protection is enabled for an event data store.

An event data store incurs charges when it ingest events and when you run queries. You can stop an event data store from ingesting events at any time and you can restart ingestion at any time. When you create an event data store, you can choose whether you want the event data store to immediately start ingesting events. For more information about CloudTrail Lake pricing, see AWS CloudTrail Pricing.
To create an event data store for CloudTrail events

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Event data stores.
3. Choose Create event data store.
4. On the Configure event data store page, in General details, enter a name for the event data store. A name is required.
5. Specify a retention period for the event data store in days. Valid values are integers between 7 to 2557 (seven years). The event data store retains event data for the specified number of days. By default, event data is retained for 2557 days.
6. (Optional) To enable encryption using AWS Key Management Service, choose Use my own AWS KMS key. Choose New to have an AWS KMS key created for you, or choose Existing to use an existing KMS key. In Enter KMS alias, specify an alias, in the format alias/MyAliasName. Using your own KMS key requires that you edit your KMS key policy to allow CloudTrail logs to be encrypted and decrypted. For more information, see Configure AWS KMS key policies for CloudTrail (p. 404). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

Using your own KMS key incurs AWS KMS costs for encryption and decryption. After you associate an event data store with a KMS key, the KMS key cannot be removed or changed.

   Note
   To enable AWS Key Management Service encryption for an organization event data store, you must use an existing KMS key for the management account.

7. (Optional) In the Tags section, you can add up to 50 tag key pairs to help you identify, sort, and control access to your event data store. For more information about how to use IAM policies to authorize access to an event data store based on tags, see Examples: Denying access to create or delete event data stores based on tags (p. 371). For more information about how you can use tags in AWS, see Tagging AWS resources in the AWS General Reference.
8. Choose Next to configure the event data store.
9. On the Choose events page, choose AWS events, and then choose CloudTrail events.
10. For CloudTrail events, choose at least one event type. By default, Management events is selected. You can add both management and data events to your event data store. For more information about management events, see Logging management events (p. 249). For more information about data events, see Logging data events (p. 256).
11. (Optional) Choose Copy trail events if you want to copy events from an existing trail to run queries on past events. To copy trail events to an organization event data store, you must use the management account for the organization. The delegated administrator account cannot copy trail events to an organization event data store. For more information about considerations for copying trail events, see Considerations for copying trail events (p. 184).
12. To have your event data store collect events from all accounts in an AWS Organizations organization, select Enable for all accounts in my organization. You must be signed in to the management account or delegated administrator account for the organization to create an event data store that collects events for an organization.
13. Expand Additional settings to choose whether you want your event data store to collect events for all AWS Regions, or only the current AWS Region, and choose whether the event data store ingests events. By default, your event data store collects events from all Regions in your account and starts ingesting events when it's created.
   a. Select Include only the current region in my event data store to include only events that are logged in the current Region. If you do not choose this option, your event data store includes events from all Regions.
b. Deselect **Ingest events** if you do not want the event data store to start ingesting events. For example, you may want to deselect **Ingest events**, if you are copying trail events and do not want the event data store to include any future events. By default, the event data store starts ingesting events when it's created.

14. If your event data store includes management events, you can choose from the following options. For more information about management events, see [Logging management events](#) (p. 249).

   a. Choose whether you want to include **Read** events, **Write** events, or both. At least one is required.

   b. Choose whether to exclude AWS Key Management Service or Amazon RDS Data API events from your event data store.

15. To include data events in your event data store, do the following.

   a. Choose a data event type. This is the AWS service and resource on which data events are logged. To log data events for AWS Glue tables created by Lake Formation, choose **Lake Formation** for the data type.

   b. In **Log selector template**, choose a template. You can choose to log all data events, **readOnly** events, **writeOnly** events, or **Custom** to build a custom log selector.

   c. (Optional) In **Selector name**, enter a name to identify your selector. The selector name is a descriptive name for an advanced event selector, such as "Log data events for only two S3 buckets". The selector name is listed as Name in the advanced event selector and is viewable if you expand the **JSON view**.

   d. In **Advanced event selectors**, build expressions by choosing values for **Field**, **Operator**, and **Value**. Advanced event selectors for an event data store work the same as advanced event selectors that you apply to a trail. For more information about how to build advanced event selectors, see [Logging data events with advanced event selectors](#) (p. 270).

The following example uses a **Custom** log selector template to choose only event names from S3 objects that start with Put, such as **PutObject**. Because the advanced event selector does not include or exclude any other event types or resource ARNs, all S3 data events, both read and write, that are logged to the US East (N. Virginia) Region, and that have event names starting with Put, are stored in the event data store.

![Custom Log Selector Template](image-url)

**Data event: S3**

- **Data event type**: Choose the source of data events to log.
  - **S3**

- **Log selector template**: **Custom**

- **Selector name - optional**
  - **my-custom-selector**

- **Collect events**: Log all events, or choose a template to log specific. Filtered events to your trail. You can edit templates later.

- **Advanced event selectors**: Log or exclude events from specific resources.
  - **Field**
    - **eventName**
  - **Operator**
    - **starts with**
  - **Value**
    - **Put**
Important
To exclude or include data events with advanced event selectors by using an S3 bucket ARN, always use the Starts with operator.

e. Optionally, expand JSON view to see your advanced event selectors as a JSON block.

16. To copy existing trail events to your event data store, do the following.

a. Choose the trail that you want to copy. By default, CloudTrail only copies CloudTrail events contained in the S3 bucket's CloudTrail prefix and the prefixes inside the CloudTrail prefix, and does not check prefixes for other AWS services. If you want to copy CloudTrail events contained in another prefix, choose Enter S3 URI, and then choose Browse S3 to browse to the prefix. If the source S3 bucket for the trail uses a KMS key for data encryption, ensure that the KMS key policy allows CloudTrail to decrypt the data. If your source S3 bucket uses multiple KMS keys, you must update each key's policy to allow CloudTrail to decrypt the data in the bucket. For more information about updating the KMS key policy, see KMS key policy for decrypting data in the source S3 bucket (p. 187).

b. (Optional) Choose a time range for copying the events. If you choose a time range, CloudTrail checks the prefix and log file name to verify the name contains a date between the chosen start and end date before attempting to copy trail events. You can choose a Relative range or an Absolute range. To avoid duplicating events between the source trail and destination event data store, choose a time range that is earlier than the creation of the event data store.

   • If you choose Relative range, you can choose to copy events logged in the last 6 months, 1 year, 2 years, 7 years, or a custom range. CloudTrail copies the events logged within the chosen time period.
   • If you choose Absolute range, you can choose a specific start and end date. CloudTrail copies the events that occurred between the chosen start and end dates.

c. For Permissions, choose from the following IAM role options. If you choose an existing IAM role, verify that the IAM role policy provides the necessary permissions. For more information about updating the IAM role permissions, see IAM permissions for copying trail events (p. 185).

   • Choose Create a new role (recommended) to create a new IAM role. For Enter IAM role name, enter a name for the role. CloudTrail automatically creates the necessary permissions for this new role.
   • Choose Use a custom IAM role to use a custom IAM role that is not listed. For Enter IAM role ARN, enter the IAM ARN.
   • Choose Use an existing role to choose an existing IAM role from the drop-down list.

17. Choose Next to review your choices.

18. On the Review and create page, review your choices. Choose Edit to make changes to a section. When you're ready to create the event data store, choose Create event data store.


   From this point forward, the event data store captures events that match its advanced event selectors (if you selected the Ingest events option). Events that occurred before you created the event data store are not in the event data store, unless you opted to copy existing trail events.

You can now run queries on your new event data store. The Sample queries tab provides example queries to get you started. For more information about creating and editing queries, see Create or edit a query (p. 203).

You can also view the CloudTrail Lake dashboard to visualize the events in your event data store. For more information about Lake dashboards, see View Lake dashboards (p. 201).
Create an event data store for AWS Config configuration items

You can create an event data store to include AWS Config configuration items, and use the event data store to investigate non-compliant changes to your production environments. With an event data store, you can relate non-compliant rules to the users and resources associated with the changes. A configuration item represents a point-in-time view of the attributes of a supported AWS resource that exists in your account. AWS Config creates a configuration item whenever it detects a change to a resource type that it is recording. AWS Config also creates configuration items when a configuration snapshot is captured.

You can use both AWS Config and CloudTrail Lake to run queries against your configuration items. You can use AWS Config to query the current configuration state of AWS resources based on configuration properties for a single AWS account and AWS Region, or across multiple accounts and Regions. In contrast, you can use CloudTrail Lake to query across diverse data sources such as CloudTrail events, configuration items, and rule evaluations. CloudTrail Lake queries cover all AWS Config configuration items including resource configuration and compliance history.

Creating an event data store for configuration items doesn't impact existing AWS Config advanced queries, or any configured AWS Config aggregators. You can continue to run advanced queries using AWS Config, and AWS Config continues to deliver history files to your S3 buckets.

Limitations

The following limitations apply to event data stores for configuration items.

- No support for custom configuration items
- No support for event filtering using advanced event selectors

Prerequisites

Before you create your event data store, set up AWS Config recording for all your accounts and Regions. You can use Quick Setup, a capability of AWS Systems Manager, to quickly create a configuration recorder powered by AWS Config.

Note

You are charged service usage fees when AWS Config starts recording configurations. For more information about pricing, see AWS Config Pricing. For information about managing the configuration recorder, see Managing the Configuration Recorder in the AWS Config Developer Guide.

Additionally, the following actions are recommended, but are not required to create an event data store.

- Set up an Amazon S3 bucket to receive a configuration snapshot on request and configuration history. For more information about snapshots, see Managing the Delivery Channel and Delivering Configuration Snapshot to an Amazon S3 Bucket in the AWS Config Developer Guide.
- Specify the rules that you want AWS Config to use to evaluate compliance information for the recorded resource types. Several of the CloudTrail Lake sample queries for AWS Config require AWS Config Rules to evaluate the compliance state of your AWS resources. For more information about AWS Config Rules, see Evaluating Resources with AWS Config Rules in the AWS Config Developer Guide.

To create an event data store for configuration items

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Event data stores.
3. Choose Create event data store.
4. On the Configure event data store page, in General details, enter a name for the event data store. A name is required.
5. Specify a retention period for the event data store in days. Valid values are integers from 7 to 2557 (seven years). The event data store retains configuration items for the specified number of days. By default, event data is retained for 2557 days.
6. (Optional) To enable encryption using AWS Key Management Service, choose Use my own AWS KMS key. Choose New to have an AWS KMS key created for you, or choose Existing to use an existing KMS key. In Enter KMS alias, specify an alias, in the format alias/MyAliasName. Using your own KMS key requires that you edit your KMS key policy to allow CloudTrail logs to be encrypted and decrypted. For more information, see Configure AWS KMS key policies for CloudTrail (p. 404). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

Using your own KMS key incurs AWS KMS costs for encryption and decryption. After you associate an event data store with a KMS key, the KMS key cannot be removed or changed.

Note
To enable AWS Key Management Service encryption for an organization event data store, you must use an existing KMS key for the management account.

7. (Optional) In the Tags section, you can add up to 50 tag key pairs to help you identify, sort, and control access to your event data store. For more information about how to use IAM policies to authorize access to an event data store based on tags, see Examples: Denying access to create or delete event data stores based on tags (p. 371). For more information about how you can use tags in AWS, see Tagging AWS resources in the AWS General Reference.
8. Choose Next.
9. On the Choose events page, choose AWS events, and then choose Configuration items.
10. CloudTrail stores the event data store resource in the Region in which you create it, but by default, the configuration items collected in the data store are from all Regions in your account that have recording enabled. Optionally, you can select Include only the current region in my event data store to include only configuration items that are captured in the current Region. If you do not choose this option, your event data store includes configuration items from all Regions that have recording enabled.
11. To have your event data store collect configuration items from all accounts in an AWS Organizations organization, select Enable for all accounts in my organization. You must be signed in to the management account or delegated administrator account for the organization to create an event data store that collects configuration items for an organization.
12. Choose Next to review your choices.
13. On the Review and create page, review your choices. Choose Edit to make changes to a section. When you're ready to create the event data store, choose Create event data store.

From this point forward, the event data store captures configuration items. Configuration items that occurred before you created the event data store are not in the event data store.

Sample queries

You can now run queries on your new event data store. The Sample queries tab on the CloudTrail console provides example queries to get you started. The following are a few of the sample queries that you can run against your configuration item event data store.
Create an event data store for AWS Config configuration items

<table>
<thead>
<tr>
<th>Description</th>
<th>Query</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find which user performed an action that resulted in a non-compliant status by joining a configuration item event data store with a CloudTrail event data store.</td>
<td><code>SELECT</code> <code>element_at(config1.eventData.configuration, 'targetResourceId')</code> as targetResourceId, <code>element_at(config1.eventData.configuration, 'complianceType')</code> as complianceType, <code>config2.eventData.resourceType</code>, <code>cloudtrail.userIdentity</code> FROM <code>config_event_data_store_ID</code> as config1 JOIN <code>config_event_data_store_ID</code> as config2 on <code>element_at(config1.eventData.configuration, 'targetResourceId')</code> = <code>config2.eventData.resourceId</code> JOIN <code>cloudtrail_event_data_store_ID</code> as cloudtrail on config2.eventData.arn = <code>element_at(cloudtrail.resources, 1).arn</code> WHERE <code>element_at(config1.eventData.configuration, 'configRuleList')</code> is not null AND <code>element_at(config1.eventData.configuration, 'complianceType')</code> = 'NON_COMPLIANT' AND <code>cloudtrail.eventTime</code> &gt; '2022-11-14 00:00:00' AND <code>config2.eventData.resourceType</code> = 'AWS::DynamoDB::Table'</td>
</tr>
<tr>
<td>Find all AWS Config rules and return the compliance state from configuration items generated within the past day.</td>
<td><code>SELECT</code> <code>eventData.configuration, eventData.accountId, eventData.awsRegion, eventData.resourceName, eventData.resourceCreationTime, </code>element_at(eventData.configuration,'complianceType')<code>AS complianceType,</code>element_at(eventData.configuration,'configRuleList')<code>AS configRuleList,</code>element_at(eventData.configuration,'resourceId')<code>AS resourceId,</code>element_at(eventData.configuration,'resourceType')<code>AS resourceType FROM</code>config_event_data_store_ID<code>WHERE</code>eventData.resourceType<code>= 'AWS::Config::ResourceCompliance' AND</code>eventTime<code>&gt; '2022-11-22 00:00:00' ORDER BY</code>eventData.resourceCreationTime` DESC</td>
</tr>
</tbody>
</table>
Create an event data store for
AWS Config configuration items

### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Query</th>
</tr>
</thead>
</table>
| Find the total count of AWS Config resources grouped by resource type, account ID, and Region. | SELECT eventData.resourceType, eventData.awsRegion, eventData.accountId, COUNT(*) AS resourceCount  
FROM `config_event_data_store_ID`  
WHERE eventData.resourceType, eventData.awsRegion, eventData.accountId |

| Find the resource creation time for all AWS Config configuration items generated on a specific date. | SELECT eventData.configuration, eventData.accountId, eventData.awsRegion, eventData.resourceId, eventData.resourceName, eventData.resourceType, eventData.availabilityZone, eventData.resourceCreationTime  
FROM `config_event_data_store_ID`  
WHERE eventData.resourceCreationTime  
ORDER BY eventData.resourceCreationTime DESC  
limit 10; |

For more information about creating and editing queries, see [Create or edit a query](#) (p. 203).

### Configuration item schema

The following table describes the required and optional schema elements that match those in configuration item records. The contents of `eventData` are provided by your configuration items; other fields are provided by CloudTrail after ingestion.

CloudTrail event record contents are described in more detail in [CloudTrail record contents](#) (p. 422).

- [Fields that are provided by CloudTrail after ingestion](#) (p. 176)
- [Fields that are provided by your events](#) (p. 177)

### Fields that are provided by CloudTrail after ingestion

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eventVersion</td>
<td>string</td>
<td>Required</td>
<td>The version of the AWS event format.</td>
</tr>
</tbody>
</table>
### Field name | Input type | Requirement | Description
--- | --- | --- | ---
**eventCategory** | string | Required | The event category. For configuration items, the valid value is `ConfigurationItem`.

**eventType** | string | Required | The event type. For configuration items, the valid value is `AwsConfigurationItem`.

**eventID** | string | Required | A unique ID for an event.

**eventTime** | string | Required | The event timestamp, in `yyyy-MM-DDTHH:mm:ss` format, in Universal Coordinated Time (UTC).

**awsRegion** | string | Required | The AWS Region to which to assign an event.

**recipientAccountId** | string | Required | Represents the AWS account ID that received this event.

**addendum** | addendum | Optional | Shows information about why an event was delayed. If information was missing from an existing event, the addendum block includes the missing information and a reason for why it was missing.

### Fields in eventData are provided by your configuration items

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eventData</td>
<td>-</td>
<td>Required</td>
<td>Fields in eventData are provided by your configuration items.</td>
</tr>
</tbody>
</table>

- **configurationItemVersion**: string | Optional | The version of the configuration item from its source. |

- **configurationItemCaptureTime**: string | Optional | The time when the configuration recording was initiated. |
<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• configurationItemStatus</td>
<td>string</td>
<td>Optional</td>
<td>The configuration item status. Valid values are OK, ResourceDiscovered, ResourceNotRecorded, ResourceDeleted, and ResourceDeletedNotRecorded.</td>
</tr>
<tr>
<td>• accountId</td>
<td>string</td>
<td>Optional</td>
<td>The 12-digit AWS account ID associated with the resource.</td>
</tr>
<tr>
<td>• resourceType</td>
<td>string</td>
<td>Optional</td>
<td>The type of AWS resource. For more information about valid resource types, see ConfigurationItem in the AWS Config API Reference.</td>
</tr>
<tr>
<td>• resourceId</td>
<td>string</td>
<td>Optional</td>
<td>The ID of the resource (for example, sg-xxxxx).</td>
</tr>
<tr>
<td>• resourceName</td>
<td>string</td>
<td>Optional</td>
<td>The custom name of the resource, if available.</td>
</tr>
<tr>
<td>• arn</td>
<td>string</td>
<td>Optional</td>
<td>Amazon Resource Name (ARN) associated with the resource.</td>
</tr>
<tr>
<td>• awsRegion</td>
<td>string</td>
<td>Optional</td>
<td>The AWS Region where the resource resides.</td>
</tr>
<tr>
<td>• availabilityZone</td>
<td>string</td>
<td>Optional</td>
<td>The Availability Zone associated with the resource.</td>
</tr>
<tr>
<td>• resourceCreationTime</td>
<td>string</td>
<td>Optional</td>
<td>The time stamp when the resource was created.</td>
</tr>
<tr>
<td>• configuration</td>
<td>JSON</td>
<td>Optional</td>
<td>The description of the resource configuration.</td>
</tr>
<tr>
<td>• supplementaryConfiguration</td>
<td>JSON</td>
<td>Optional</td>
<td>Configuration attributes that AWS Config returns for certain resource types to supplement the information returned for the configuration parameter.</td>
</tr>
</tbody>
</table>
Create an event data store for AWS Config configuration items

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• relatedEvents</td>
<td>string</td>
<td>Optional</td>
<td>A list of CloudTrail event IDs.</td>
</tr>
<tr>
<td>• relationships</td>
<td>-</td>
<td>Optional</td>
<td>A list of related AWS resources.</td>
</tr>
<tr>
<td>• • name</td>
<td>string</td>
<td>Optional</td>
<td>The type of relationship with the related resource.</td>
</tr>
<tr>
<td>• • resourceType</td>
<td>string</td>
<td>Optional</td>
<td>The resource type of the related resource.</td>
</tr>
<tr>
<td>• • resourceId</td>
<td>string</td>
<td>Optional</td>
<td>The ID of the related resource (for example, sg-xxxxxx).</td>
</tr>
<tr>
<td>• • resourceName</td>
<td>string</td>
<td>Optional</td>
<td>The custom name of the related resource, if available.</td>
</tr>
<tr>
<td>• tags</td>
<td>JSON</td>
<td>Optional</td>
<td>A mapping of key value tags associated with the resource.</td>
</tr>
</tbody>
</table>

The following example shows the hierarchy of schema elements that match those in configuration item records.

```json
{
    "eventVersion": String,
    "eventCategory": String,
    "eventType": String,
    "eventID": String,
    "eventTime": String,
    "awsRegion": String,
    "recipientAccountId": String,
    "addendum": Addendum,
    "eventData": {
        "configurationItemVersion": String,
        "configurationItemCaptureTime": String,
        "configurationItemStatus": String,
        "configurationStateId": String,
        "accountId": String,
        "resourceType": String,
        "resourceId": String,
        "resourceName": String,
        "arn": String,
        "awsRegion": String,
        "availabilityZone": String,
        "resourceCreationTime": String,
        "configuration": {
            JSON,
        },
        "supplementaryConfiguration": {
            JSON,
        },
        "relatedEvents": [
            String
        ]
    }
}
```
Create an event data store for events outside of AWS

You can create an event data store to include events outside of AWS, and then use CloudTrail Lake to search, query, and analyze the data that is logged from your applications.

You can use CloudTrail Lake integrations to log and store user activity data from outside of AWS; from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers.

When you create an event data store for an integration, you also create a channel, and attach a resource policy to the channel.

To create an event data store for events outside of AWS

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Event data stores.
3. Choose Create event data store.
4. On the Configure event data store page, in General details, enter a name for the event data store. A name is required.
5. Specify a retention period for the event data store in days. Valid values are integers between 7 to 2557 (seven years). The event data store retains event data for the specified number of days. By default, event data is retained for 2557 days.
6. (Optional) To enable encryption using AWS Key Management Service, choose Use my own AWS KMS key. Choose New to have an AWS KMS key created for you, or choose Existing to use an existing KMS key. In Enter KMS alias, specify an alias, in the format alias/MyAliasName. Using your own KMS key requires that you edit your KMS key policy to allow CloudTrail logs to be encrypted and decrypted. For more information, see Configure AWS KMS key policies for CloudTrail (p. 404). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

Using your own KMS key incurs AWS KMS costs for encryption and decryption. After you associate an event data store with a KMS key, the KMS key cannot be removed or changed.

Note
To enable AWS Key Management Service encryption for an organization event data store, you must use an existing KMS key for the management account.

7. (Optional) In the Tags section, you can add up to 50 tag key pairs to help you identify, sort, and control access to your event data store. For more information about how to use IAM policies to authorize access to an event data store based on tags, see Examples: Denying access to create or delete event data stores based on tags (p. 371). For more information about how you can use tags in AWS, see Tagging AWS resources in the AWS General Reference.
8. Choose **Next** to configure the event data store.

9. On the **Choose events** page, choose **Events from integrations**.

10. From **Events from integration**, choose the source to deliver events to the event data store.

11. Provide a name to identify the integration's channel. The name can be 3-128 characters. Only letters, numbers, periods, underscores, and dashes are allowed.

12. In **Resource policy**, configure the resource policy for the integration's channel. Resource policies are JSON policy documents that specify what actions a specified principal can perform on the resource and under what conditions. The accounts defined as principals in the resource policy can call the `PutAuditEvents` API to deliver events to your channel. The resource owner has implicit access to the resource if their IAM policy allows the `cloudtrail-data:PutAuditEvents` action.

The information required for the policy is determined by the integration type. For a direction integration, CloudTrail automatically adds the partner's AWS account IDs, and requires you to enter the unique external ID provided by the partner. For a solution integration, you must specify at least one AWS account ID as principal, and can optionally enter an external ID to prevent against confused deputy.

**Note**

If you do not create a resource policy for the channel, only the channel owner can call the `PutAuditEvents` API on the channel.

a. For a direct integration, enter the external ID provided by your partner. The integration partner provides a unique external ID, such as an account ID or a randomly generated string, to use for the integration to prevent against confused deputy. The partner is responsible for creating and providing a unique external ID.

You can choose **How to find this?** to view the partner's documentation that describes how to find the external ID.

**External ID**

Enter the unique account identifier provided by Nordcloud. How to find this? [Link]

**Note**

If the resource policy includes an external ID, all calls to the `PutAuditEvents` API must include the external ID. However, if the policy does not define an external ID, the partner can still call the `PutAuditEvents` API and specify an `externalId` parameter.

b. For a solution integration, choose **Add AWS account** to specify each AWS account ID to add as a principal in the policy.

13. Choose **Next** to review your choices.

14. On the **Review and create** page, review your choices. Choose **Edit** to make changes to a section. When you're ready to create the event data store, choose **Create event data store**.

15. The new event data store is visible in the **Event data stores** table on the **Event data stores** page.

16. Provide the channel Amazon Resource Name (ARN) to the partner application. Instructions for providing the channel ARN to the partner application are found on the partner documentation website. For more information, choose the **Learn more** link for the partner on the **Available sources** tab of the **Integrations** page to open the partner's page in AWS Marketplace.

The event data store starts ingesting partner events into CloudTrail through the integration's channel when you, the partner, or the partner applications calls the `PutAuditEvents` API on the channel.
Manage event data store lifecycles

The following are the lifecycle stages of an event data store.

- **CREATED** – A short-term state indicating that the event data store has been created.
- **ENABLED** – The event data store is active and ingesting events. You can run queries and copy trail events to the event data store.
- **STARTING_INGESTION** – A short-term state indicating that the event data store will start ingesting live events.
- **STOPPING_INGESTION** – A short-term state indicating that the event data store will stop ingesting live events.
- **STOPPED_INGESTION** – The event data store is not ingesting live events. You can still run queries on any events already in the event data store and copy trail events to the event data store.
- **PENDING_DELETION** – The event data store was in an **ENABLED** or **STOPPED_INGESTION** state and has been deleted, but is within the seven-day wait period before permanent deletion. You cannot run queries on the event data store, and no operations can be performed on the event data store except restoration.

You can only delete an event data store if termination protection is disabled. Termination protection prevents an event data store from getting accidentally deleted. By default, termination protection is enabled on an event data store.

After you delete an event data store, it remains in the **PENDING_DELETION** state for seven days before it is permanently deleted. You can restore an event data store during the seven-day wait period. While in the **PENDING_DELETION** state, an event data store is not available for queries, and no other operations can be performed on the event data store except restore operations. An event data store that is pending deletion does not ingest events and does not incur costs.

**Actions available on event data stores**

To delete or restore an event data store, copy trail events, start or stop ingesting events, or turn on or turn off an event data store's termination protection, use commands on the **Actions** menu of the event data store's details page.

The option to **Copy trail events** is only available on event data stores that contain CloudTrail management and data events. The options to **Start ingestion** and **Stop ingestion** are only available on event data stores containing either CloudTrail events (management and data events), or AWS Config configuration items.
Stop an event data store from ingesting events

By default, event data stores are configured to ingest events. You can stop an event data store from ingesting events by using the console, AWS CLI, or APIs.

The options to Start ingestion and Stop ingestion are only available on event data stores containing either CloudTrail events (management and data events), or AWS Config configuration items.

When you stop ingestion on an event data store, the event data store's state changes to STOPPED_INGESTION. You can still run queries on any events already in the event data store. You can also copy trail events to the event data store (if it contains only CloudTrail management or data events).

To stop an event data store from ingesting events
1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. In the navigation pane, under Lake, choose Event data stores.
3. Choose the event data store.
4. From Actions, choose Stop ingestion.
5. When you are prompted to confirm, choose Stop ingestion. The event data store will stop ingesting live events.
6. To resume ingestion, choose Start ingestion.

Copy trail events to an event data store

You can copy trail events to a CloudTrail Lake event data store to create a point-in-time snapshot of events logged to the trail. Copying a trail's events does not interfere with the trail's ability to log events and does not modify the trail in any way.

You can copy trail events to an existing event data store configured for CloudTrail events, or you can create a new CloudTrail event data store and choose the Copy trail events option as part of event data store creation. For more information about copying trail events to an existing event data store, see Copy trail events to an event data store (p. 187). For more information about creating a new event data store, see Create an event data store for CloudTrail events (p. 169).

If you are copying trail events to an organization event data store, you must use the management account for the organization. You cannot copy trail events using the delegated administrator account for an organization.

Scenarios

The following table describes some common scenarios for copying trail events and how you accomplish each scenario using the console.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>How do I accomplish this in the console?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and query historical trail events in CloudTrail Lake without ingesting new events</td>
<td>Create a new event data store and choose the Copy trail events option as part of event data store creation. When creating the event data store, deselect Ingest events (step 13 of the procedure) to ensure the event data store contains only the historical events for your trail and no future events.</td>
</tr>
<tr>
<td>Replace your existing trail with a CloudTrail Lake event data store</td>
<td>Create an event data store with the same event selectors as your trail to ensure that the event data store has the same coverage as your trail.</td>
</tr>
</tbody>
</table>
Considerations for copying trail events

Consider the following factors when copying trail events.

- When copying trail events, CloudTrail uses the S3 `GetObject` API operation to retrieve the trail events in the source S3 bucket. There are some S3 archived storage classes, such as S3 Glacier Flexible Retrieval, S3 Glacier Deep Archive, S3 Outposts, and S3 Intelligent-Tiering Deep Archive tiers that are not accessible by using `GetObject`. To copy trail events stored in these archived storage classes, you must first restore a copy using the S3 `RestoreObject` operation. For information about restoring archived objects, see [Restoring Archived Objects](https://docs.aws.amazon.com/AmazonS3/latest/userguide/restoring-archived-objects.html) in the Amazon S3 User Guide.

- When you copy trail events to an event data store, CloudTrail copies all trail events regardless of the configuration of the destination event data store's event types, advanced event selectors, or AWS Region.

- Before copying trail events, check the retention period of the event data store. CloudTrail only copies trail events that are within the event data store's retention period. For example, if an event data store's retention period is 90 days, then CloudTrail will not copy any trail events older than 90 days.

- Before copying trail events, disable any access control lists (ACLs) attached to the source S3 bucket, and update the S3 bucket policy for the destination event data store. For more information about updating the S3 bucket policy, see [Amazon S3 bucket policy for copying trail events](https://docs.aws.amazon.com/AmazonS3/latest/userguide/policy-copystreams.html) (p. 152). For more information about disabling ACLs, see [Controlling ownership of objects and disabling ACLs for your bucket](https://docs.aws.amazon.com/AmazonS3/latest/userguide/bucketOwnership.html) in the Amazon S3 User Guide.

- CloudTrail only copies trail events from Gzip compressed log files that are in the source S3 bucket. CloudTrail does not copy trail events from uncompressed log files or log files that were compressed using a format other than Gzip.

- To avoid duplicating events between the source trail and destination event data store, choose a time range for the copied events that is earlier than the creation of the event data store.

- By default, CloudTrail only copies CloudTrail events contained in the S3 bucket's CloudTrail prefix and the prefixes inside the CloudTrail prefix, and does not check prefixes for other AWS services. If you want to copy CloudTrail events contained in another prefix, you must choose the prefix when you copy trail events.

- To copy trail events to an organization event data store, you must use the management account for the organization. The delegated administrator account cannot copy trail events to an organization event data store.

- If you are copying trail events to an event data store for investigation and do not want to ingest any future events, you can stop ingestion on the event data store when you create it. When creating the AWS CloudTrail User Guide
Considerations for copying trail events

<table>
<thead>
<tr>
<th>Scenario</th>
<th>How do I accomplish this in the console?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenario</strong></td>
<td><strong>How do I accomplish this in the console?</strong></td>
</tr>
<tr>
<td>To avoid duplicating events between the source trail and destination event data store, choose a date range for the copied events that is earlier than the creation of the event data store.</td>
<td>After your event data store is created, you can turn off logging for the trail to avoid additional charges. For more information about pricing, see <a href="https://aws.amazon.com/cloudtrail/pricing/">AWS CloudTrail Pricing</a>.</td>
</tr>
</tbody>
</table>

Topics

- Considerations for copying trail events (p. 184)
- Required permissions for copying trail events (p. 185)
- Copy trail events to an event data store (p. 187)
- Event copy details (p. 189)
event data store, deselect the **Ingest events** option (step 13 of the procedure (p. 170)) to ensure the event data store contains only the historical events for your trail and no future events.

## Required permissions for copying trail events

Before copying trail events, ensure you have all the required permissions for your IAM role and the event data store's S3 bucket. You only need to update the IAM role permissions if you choose an existing IAM role to copy trail events. If you choose to create a new IAM role, CloudTrail provides all necessary permissions for the role.

If the source S3 bucket uses a KMS key for data encryption, ensure that the KMS key policy allows CloudTrail to decrypt data in the bucket. If the source S3 bucket uses multiple KMS keys, you must update each key's policy to allow CloudTrail to decrypt data in the bucket.

### Topics
- [IAM permissions for copying trail events (p. 185)](#)
- [Amazon S3 bucket policy for copying trail events (p. 186)](#)
- [KMS key policy for decrypting data in the source S3 bucket (p. 187)](#)

### IAM permissions for copying trail events

When copying trail events, you have the option to create a new IAM role, or use an existing IAM role. When you choose a new IAM role, CloudTrail creates an IAM role with the required permissions and no further action is required on your part.

If you choose an existing role, ensure the IAM role's policies allow CloudTrail to copy trail events to the destination event data store. This section provides examples of the required IAM role permission and trust policies.

The following example provides the permissions policy, which allows CloudTrail to copy trail events to the event data store's S3 bucket. Replace `myBucketName`, `myAccountID`, `region`, `prefix`, and `eventDataStoreArn` with the appropriate values for your configuration. The `myAccountID` is the AWS account ID used for CloudTrail Lake, which may not be the same as the AWS account ID for the S3 bucket.

Replace `key-region`, `keyAccountID`, and `keyID` with the values for the KMS key used to encrypt the source S3 bucket. You can omit the `AWSCloudTrailImportKeyAccess` statement if the source S3 bucket does not use a KMS key for encryption.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "AWSCloudTrailImportBucketAccess",
         "Effect": "Allow",
         "Action": ["s3:ListBucket", "s3:GetBucketAcl"],
         "Resource": ["arn:aws:s3:::myBucketName"],
         "Condition": {
            "StringEquals": {
               "aws:SourceAccount": "myAccountID",
               "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
            }
         }
      },
      {
         "Sid": "AWSCloudTrailImportObjectAccess",
```
The following example provides the IAM trust policy, which allows CloudTrail to assume an IAM role to copy trail events to the event data store's S3 bucket. Replace `myAccountID`, `region`, and `eventDataStoreArn` with the appropriate values for your configuration. The `myAccountID` is the AWS account ID used for CloudTrail Lake, which may not be the same as the AWS account ID for the S3 bucket.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "cloudtrail.amazonaws.com"
      },
      "Action": "sts:AssumeRole",
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": "myAccountID",
          "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
        }
      }
    }
  ]
}
```

Amazon S3 bucket policy for copying trail events

By default, Amazon S3 buckets and objects are private. Only the resource owner (the AWS account that created the bucket) can access the bucket and objects it contains. The resource owner can grant access permissions to other resources and users by writing an access policy.

Before you copy trail events, you must update the S3 bucket policy for the destination event data store to allow CloudTrail to copy trail events to the bucket.

You can add the following statement to the event data store's S3 bucket policy to grant these permissions. Replace `roleArn` and `myBucketName` with the appropriate values for your configuration.

```json
"Effect": "Allow",
"Action": ["s3:GetObject"],
"Resource": [
  "arn:aws:s3:::myBucketName/prefix",
  "arn:aws:s3:::myBucketName/prefix/*"
],
"Condition": {
  "StringEquals": {
    "aws:SourceAccount": "myAccountID",
    "aws:SourceArn": 
    "arn:aws:cloudtrail:region:myAccountID:eventdataStore/eventDataStoreArn"
  }
}

{"Sid": "AWSCloudTrailImportKeyAccess",
"Effect": "Allow",
"Action": ["kms:GenerateDataKey","kms:Decrypt"],
"Resource": [
  "arn:aws:kms:key-region:keyAccountID:key/keyID"
]}
```
Copy trail events to an event data store

Use the following procedure to copy trail events to an existing event data store.
AWS CloudTrail User Guide
Copy trail events to an event data store

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.

2. From the navigation pane, under Lake, choose Event data stores.

3. Choose Copy trail events.

4. On the Copy trail events page, for Event source, choose the trail that you want to copy. By default, CloudTrail only copies CloudTrail events contained in the S3 bucket's CloudTrail prefix and the prefixes inside the CloudTrail prefix, and does not check prefixes for other AWS services. If you want to copy CloudTrail events contained in another prefix, choose Enter S3 URI, and then choose Browse S3 to browse to the prefix. If the source S3 bucket for the trail uses a KMS key for data encryption, ensure that the KMS key policy allows CloudTrail to decrypt the data. If your source S3 bucket uses multiple KMS keys, you must update each key's policy to allow CloudTrail to decrypt the data in the bucket. For more information about updating the KMS key policy, see KMS key policy for decrypting data in the source S3 bucket (p. 187).

5. (Optional) For Event source, choose the time range for copying the events. If you choose a time range, CloudTrail checks the prefix and log file name to verify the name contains a date between the chosen start and end date before attempting to copy trail events. You can choose a Relative range or an Absolute range. To avoid duplicating events between the source trail and destination event data store, choose a time range that is earlier than the creation of the event data store.

   - If you choose Relative range, you can choose to copy events logged in the last 6 months, 1 year, 2 years, 7 years, or a custom range. CloudTrail copies the events logged within the chosen time period.
   - If you choose Absolute range, you can choose a specific start and end date. CloudTrail copies the events that occurred between the chosen start and end dates.

6. For Delivery location, choose the destination event data store from the drop-down list. The S3 bucket policy for the event data store must grant CloudTrail access to copy trail events into the bucket. For more information about updating the S3 bucket policy, see Amazon S3 bucket policy for copying trail events (p. 186).

7. For Permissions, choose from the following IAM role options. If you choose an existing IAM role, verify that the IAM role policy provides the necessary permissions. For more information about updating the IAM role permissions, see IAM permissions for copying trail events (p. 185).

   - Choose Create a new role (recommended) to create a new IAM role. For Enter IAM role name, enter a name for the role. CloudTrail automatically creates the necessary permissions for this new role.
   - Choose Use a custom IAM role to use a custom IAM role that is not listed. For Enter IAM role ARN, enter the IAM ARN.
   - Choose Use an existing role to choose an existing IAM role from the drop-down list.

8. Choose Copy events.

9. You are prompted to confirm. When you are ready to confirm, choose Copy trail events to Lake, and then choose Copy events.

10. On the Copy details page, you can see the copy status and review any failures. When a trail event copy completes, its Copy status is set to either Completed if there were no errors, or Failed if errors occurred.

    **Note**
    Details shown on the event copy details page are not in real-time. The actual values for details such as Prefixes copied may be higher than what is shown on the page. CloudTrail updates the details incrementally over the course of the event copy.

11. If the Copy status is Failed, fix any errors shown in Copy failures, and then choose Retry copy. When you retry a copy, CloudTrail resumes the copy at the location where the failure occurred.

For more information about viewing the details of a trail event copy, see Event copy details (p. 189).
Event copy details

After a trail event copy starts, you can view the event copy details, including the status of the copy, and information on any copy failures.

**Note**
Details shown on the event copy details page are not in real-time. The actual values for details such as *Prefixes copied* may be higher than what is shown on the page. CloudTrail updates the details incrementally over the course of the event copy.

**To access the event copy details page**
1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. From the left navigation pane, under *Lake*, choose *Event data stores*.
3. Choose the event data store.
4. Choose the event copy in the *Event copy status* section.

**Copy details**

From *Copy details*, you can view the following details about the trail event copy.

- **Event log S3 location** - The location of the source S3 bucket containing the trail event log files.
- **Copy ID** - The ID for the copy.
- **Prefixes copied** - Represents the number of S3 prefixes copied. During a trail event copy, CloudTrail copies the events in the trail log files that are stored in the prefixes.
- **Copy status** - The status of the copy.
  - **Initializing** - Initial status shown when the trail event copy starts.
  - **In progress** - Indicates the trail event copy is in progress.
    **Note**
    You cannot copy trail events if another trail event copy is *In progress*. To stop a trail event copy, choose *Stop copy*.
  - **Stopped** - Indicates a *Stop copy* action occurred. To retry a trail event copy, choose *Retry copy*.
  - **Failed** - The copy completed, but some trail events failed to copy. Review the error messages in *Copy failures*. To retry a trail event copy, choose *Retry copy*. When you retry a copy, CloudTrail resumes the copy at the location where the failure occurred.
  - **Completed** - The copy completed without errors. You can query the copied trail events in the event data store.
- **Created time** - Indicates when the trail event copy started.
- **Finish time** - Indicates when the trail event copy completed or stopped.

**Copy failures**

From *Copy failures*, you can review the error location, error message, and error type for each copy failure. Common reasons for failure, include if an S3 prefix contained an uncompressed file, or contained a file delivered by a service other than CloudTrail. Another possible cause of failure relates to access issues. For example, if the event data store's S3 bucket did not grant CloudTrail access to import the events, you would get an *AccessDenied* error.

For each copy failure, review the following error information.
Create an integration with an event source outside of AWS

You can use CloudTrail to log and store user activity data from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers. You can store, access, analyze, troubleshoot and take action on this data without maintaining multiple log aggregators and reporting tools.

Activity events from non-AWS sources work by using channels to bring events into CloudTrail Lake from external partners that work with CloudTrail, or from your own sources. When you create a channel, you choose one or more event data stores to store events that arrive from the channel source. You can change the destination event data stores for a channel as needed, as long as the destination event data stores are set to log eventCategory="ActivityAuditLog" events. When you create a channel for events from an external partner, you provide a channel ARN to the partner or source application. The resource policy attached to the channel allows the source to transmit events through the channel. If a channel does not have a resource policy, only the channel owner can call the PutAuditEvents API on the channel.

CloudTrail has partnered with many event source providers, such as Okta and LaunchDarkly. When you create an integration with an event source outside AWS, you can choose one of these partners as your event source, or choose My custom integration to integrate events from your own sources into CloudTrail. A maximum of one channel is allowed per source.

There are two types of integrations: direct and solution. With direct integrations, the partner calls the PutAuditEvents API to deliver events to the event data store for your AWS account. With solution integrations, the application runs in your AWS account and the application calls the PutAuditEvents API to deliver events to the event data store for your AWS account.

From the Integrations page, you can choose the Available sources tab to view the Integration type for partners.
To get started, create an integration to log events from partner or other application sources using the CloudTrail console.

Topics

- Create an integration with a CloudTrail partner (p. 191)
- Create a custom integration (p. 193)
- Additional information about integration partners (p. 195)
- CloudTrail Lake integrations event schema (p. 196)

Create an integration with a CloudTrail partner

When you create an integration with an event source outside AWS, you can choose one of these partners as your event source. When you create an integration in CloudTrail with a partner application, the partner needs the Amazon Resource Name (ARN) of the channel that you create in this workflow to send events to CloudTrail. After you create the integration, you finish configuring the integration by following the partner's instructions to provide the required channel ARN to the partner. The integration starts ingesting partner events into CloudTrail after the partner calls $\texttt{PutAuditEvents}$ on the integration's channel.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Integrations.
3. On the Add integration page, enter a name for your channel. The name can be 3-128 characters. Only letters, numbers, periods, underscores, and dashes are allowed.
4. Choose the partner application source from which you want to get events. If you're integrating with events from your own applications hosted on-premises or in the cloud, choose My custom integration.
5. From Event delivery location, choose to log the same activity events to existing event data stores, or create a new event data store.

If you choose to create a new event data store, enter a name for the event data store and specify the retention period in days. Valid values for the retention period are integers from 7 to 2557 (seven years). The event data store retains event data for the specified number of days. By default, event data is retained for 2557 days.
If you choose to log activity events to one or more existing event data stores, choose the event
data stores from the list. The event data stores can only include activity events. The event type
in the console must be **Events from integrations**. In the API, the eventCategory value must be
`ActivityAuditLog`.

6. **In Resource policy**, configure the resource policy for the integration's channel. Resource policies are
JSON policy documents that specify what actions a specified principal can perform on the resource
and under what conditions. The accounts defined as principals in the resource policy can call the
PutAuditEvents API to deliver events to your channel. The resource owner has implicit access to
the resource if their IAM policy allows the `cloudtrail-data:PutAuditEvents` action.

The information required for the policy is determined by the integration type. For a direction
integration, CloudTrail automatically adds the partner's AWS account IDs, and requires you to enter
the unique external ID provided by the partner. For a solution integration, you must specify at least
one AWS account ID as principal, and can optionally enter an external ID to prevent against confused
deputy.

**Note**

If you do not create a resource policy for the channel, only the channel owner can call the
PutAuditEvents API on the channel.

a. **For a direct integration**, enter the external ID provided by your partner. The integration partner
provides a unique external ID, such as an account ID or a randomly generated string, to use for
the integration to prevent against confused deputy. The partner is responsible for creating and
providing a unique external ID.

You can choose **How to find this?** to view the partner's documentation that describes how to
find the external ID.

**External ID**

Enter the unique account identifier provided by Nordcloud. **How to find this?**

**Note**

If the resource policy includes an external ID, all calls to the PutAuditEvents API
must include the external ID. However, if the policy does not define an external ID, the
partner can still call the PutAuditEvents API and specify an `externalId`
parameter.

b. **For a solution integration**, choose **Add AWS account** to specify an AWS account ID to add as a
principal in the policy.

7. **(Optional) In the Tags area**, you can add up to 50 tag key and value pairs to help you identify, sort,
and control access to your event data store and channel. For more information about how to use
IAM policies to authorize access to an event data store based on tags, see Examples: Denying access
to create or delete event data stores based on tags (p. 371). For more information about how you
can use tags in AWS, see Tagging AWS resources in the AWS General Reference.

8. **When you are ready to create the new integration**, choose **Add integration**. There is no review page.
CloudTrail creates the integration, but you must provide the channel Amazon Resource Name (ARN)
to the partner application. Instructions for providing the channel ARN to the partner application are
found on the partner documentation website. For more information, choose the Learn more link
for the partner on the **Available sources** tab of the **Integrations** page to open the partner's page in
AWS Marketplace.

To finish the setup for your integration, provide the channel ARN to the partner or source
application. Depending upon the integration type, either you, the partner, or the application runs the
PutAuditEvents API to deliver activity events to the event data store for your AWS account. After your
activity events are delivered, you can use CloudTrail Lake to search, query, and analyze the data that is
logged from your applications. Your event data includes fields that match CloudTrail event payload, such as eventVersion, eventSource, and userIdentity.

Create a custom integration

You can use CloudTrail to log and store user activity data from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers. Perform the first half of this procedure in the CloudTrail Lake console, then call the PutAuditEvents API to ingest events, providing your channel ARN and event payload. After you use the PutAuditEvents API to ingest your application activity into CloudTrail, you can use CloudTrail Lake to search, query, and analyze the data that is logged from your applications.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Integrations.
3. On the Add integration page, enter a name for your channel. The name can be 3-128 characters. Only letters, numbers, periods, underscores, and dashes are allowed.
4. Choose My custom integration.
5. From Event delivery location, choose to log the same activity events to existing event data stores, or create a new event data store.

If you choose to create a new event data store, enter a name for the event data store and specify the retention period in days. Valid values for the retention period are integers from 7 to 2557 (seven years). The event data store retains event data for the specified number of days. By default, event data is retained for 2557 days.

If you choose to log activity events to one or more existing event data stores, choose the event data stores from the list. The event data stores can only include activity events. The event type in the console must be Events from integrations. In the API, the eventCategory value must be ActivityAuditLog.

6. In Resource policy, configure the resource policy for the integration's channel. Resource policies are JSON policy documents that specify what actions a specified principal can perform on the resource and under what conditions. The accounts defined as principals in the resource policy can call the PutAuditEvents API to deliver events to your channel.

   Note
   If you do not create a resource policy for the channel, only the channel owner can call the PutAuditEvents API on the channel.

   a. (Optional) Enter a unique external ID to provide an extra layer of protection. The external ID is a unique string such as an account ID or a randomly generated string, to prevent against confused deputy.

      Note
      If the resource policy includes an external ID, all calls to the PutAuditEvents API must include the external ID. However, if the policy does not define an external ID, you can still call the PutAuditEvents API and specify an externalId parameter.

   b. Choose Add AWS account to specify each AWS account ID to add as a principal in the resource policy for the channel.

7. (Optional) In the Tags area, you can add up to 50 tag key and value pairs to help you identify, sort, and control access to your event data store and channel. For more information about how to use IAM policies to authorize access to an event data store based on tags, see Examples: Denying access to create or delete event data stores based on tags (p. 371). For more information about how you can use tags in AWS, see Tagging AWS resources in the AWS General Reference.
8. When you are ready to create the new integration, choose Add integration. There is no review page. CloudTrail creates the integration, but to integrate your custom events, you must specify the channel ARN in a PutAuditEvents request.

9. Call the PutAuditEvents API to ingest your activity events into CloudTrail. You can add up to 100 activity events (or up to 1 MB) per PutAuditEvents request. You'll need the channel ARN that you created in preceding steps, the payload of events that you want CloudTrail to add, and the external ID (if specified for your resource policy). Be sure that there is no sensitive or personally-identifying information in event payload before ingesting it into CloudTrail. Events that you ingest into CloudTrail must follow the CloudTrail Lake integrations event schema (p. 196).

Tip
Use AWS CloudShell to be sure you are running the most current AWS APIs.

The following examples show how to use the put-audit-events CLI command. The --audit-events and --channel-arn parameters are required. You need the ARN of the channel that you created in the preceding steps, which you can copy from the integration details page. The value of --audit-events is a JSON array of event objects. --audit-events includes a required ID from the event, the required payload of the event as the value of EventData, and an optional checksum (p. 195) to help validate the integrity of the event after ingestion into CloudTrail.

```bash
aws cloudtrail-data put-audit-events \
--region region \n--channel-arn $ChannelArn \n--audit-events \n id="event_ID",eventData="{event_payload}"
 id="event_ID",eventData="{event_payload}" , eventDataChecksum="optional_checksum"
```

The following is an example command with two event examples.

```bash
aws cloudtrail-data put-audit-events \
--region us-east-1 \n--channel-arn arn:aws:cloudtrail:us-east-1:01234567890:channel/EXAMPLE8-0558-4f7e-a06a-43969EXAMPLE \
--audit-events \n id="EXAMPLE3-0f1f-4a85-9664-d50a3EXAMPLE",eventData='{"eventVersion":0.01", \n"eventSource":"custom1.domain.com", ... \n"}\n id="EXAMPLE7-a999-4b6d-b241-b33a1EXAMPLE",eventData='{"eventVersion":0.02", \n"eventSource":"custom2.domain.com", ... \n"}',eventDataChecksum="EXAMPLE6e7dd61f3ead...93a691d8EXAMPLE"
```

The following example command adds the --cli-input-json parameter to specify a JSON file (custom-events.json) of event payload.

```bash
aws cloudtrail-data put-audit-events \
--channel-arn $channelArn \
--cli-input-json file://custom-events.json \
--region us-east-1
```

The following are the sample contents of the example JSON file, custom-events.json.

```json
{
   "auditEvents": [
      {
         "eventData": "{"version":"eventData.version","UID":"UID", \n         "userIdentity":{"type":"CustomUserIdentity","principalId":"principalId \n      ",
```

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(Optional) Calculate a checksum value

The checksum that you specify as the value of EventDataChecksum in a PutAuditEvents request helps you verify that CloudTrail receives the event that matches with the checksum; it helps verify the integrity of events. The checksum value is a base64-SHA256 algorithm that you calculate by running the following command.

```
printf %s "{"eventData": "{\"version\": "{\"eventData\" version\" }", "{\"UID\": "{\"UID\" },
\"UserIdentity\": "{\"type\": "{\"CustomUserIdentity\" }, "{\"principalId\": "{\"principalId\" },
\"details\": "{\"key\": "{\"value\" }}, "{\"eventTime": "{\"2021-10-27T12:13:14Z\" }, "{\"eventName": "{\"eventName\" },
\"userAgent\": "{\"userAgent\" }, "{\"eventSource\": "{\"eventSource\" },
\"requestParameters\": "{\"key\": "{\"value\" }}, "{\"responseElements\": "{\"key\": "{\"value\" }},
\"additionalEventData\": "{\"key\": "{\"value\" }}, "{\"sourceIPAddress\": "{\"source_IP_address\" }, "{\"recipientAccountId\": "{\"recipient_account_ID\" },
\"id": "{\"1\" }
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"
" openssl dgst -binary -sha256 | base64
```

The command returns the checksum. The following is an example.

```
EXAMPLEHjkI8iehvCUCW1IAbNYk0g0/t0YNw+7rrQE=
```

The checksum value becomes the value of EventDataChecksum in your PutAuditEvents request. If the checksum doesn't match with the one for the provided event, CloudTrail rejects the event with an InvalidChecksum error.

### Additional information about integration partners

The table in this section provides the source name for each integration partner and identifies the integration type (direct or solution).

The information in the Source name column is required when calling the CreateChannel API. You specify the source name as the value for the Source parameter.

<table>
<thead>
<tr>
<th>Partner name (console)</th>
<th>Source name (API)</th>
<th>Integration type</th>
</tr>
</thead>
<tbody>
<tr>
<td>My custom integration</td>
<td>Custom</td>
<td>solution</td>
</tr>
<tr>
<td>Cloud Storage Security</td>
<td>CloudStorageSecurityConsole</td>
<td>solution</td>
</tr>
<tr>
<td>Clumio</td>
<td>Clumio</td>
<td>direct</td>
</tr>
<tr>
<td>CrowdStrike</td>
<td>CrowdStrike</td>
<td>solution</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Partner name (console)</th>
<th>Source name (API)</th>
<th>Integration type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CyberArk</td>
<td>CyberArk</td>
<td>solution</td>
</tr>
<tr>
<td>GitHub</td>
<td>GitHub</td>
<td>solution</td>
</tr>
<tr>
<td>Kong Inc</td>
<td>KongGatewayEnterprise</td>
<td>solution</td>
</tr>
<tr>
<td>LaunchDarkly</td>
<td>LaunchDarkly</td>
<td>direct</td>
</tr>
<tr>
<td>Netskope</td>
<td>NetskopeCloudExchange</td>
<td>solution</td>
</tr>
<tr>
<td>Nordcloud, an IBM Company</td>
<td>IBMMulticloud</td>
<td>direct</td>
</tr>
<tr>
<td>MontyCloud</td>
<td>MontyCloud</td>
<td>direct</td>
</tr>
<tr>
<td>Okta</td>
<td>OktaSystemLogEvents</td>
<td>solution</td>
</tr>
<tr>
<td>One Identity</td>
<td>OneLogin</td>
<td>solution</td>
</tr>
<tr>
<td>Shoreline.io</td>
<td>Shoreline</td>
<td>solution</td>
</tr>
<tr>
<td>Snyk.io</td>
<td>Snyk</td>
<td>direct</td>
</tr>
<tr>
<td>Wiz</td>
<td>WizAuditLogs</td>
<td>solution</td>
</tr>
</tbody>
</table>

View partner documentation

You can learn more about a partner's integration with CloudTrail Lake by viewing their documentation.

To view partner documentation

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Integrations.
3. From the Integrations page, choose Available sources, then choose Learn more for the partner whose documentation you want to view.

CloudTrail Lake integrations event schema

The following table describes the required and optional schema elements that match those in CloudTrail event records. The contents of eventData are provided by your events; other fields are provided by CloudTrail after ingestion.

CloudTrail event record contents are described in more detail in CloudTrail record contents (p. 422).

- Fields that are provided by CloudTrail after ingestion (p. 196)
- Fields that are provided by your events (p. 198)

Fields that are provided by CloudTrail after ingestion

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eventVersion</td>
<td>string</td>
<td>Required</td>
<td>The event version.</td>
</tr>
<tr>
<td>Field name</td>
<td>Input type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>eventCategory</td>
<td>string</td>
<td>Required</td>
<td>The event category. For non-AWS events, the value is ActivityAuditLog.</td>
</tr>
<tr>
<td>eventType</td>
<td>string</td>
<td>Required</td>
<td>The event type. For non-AWS events, the valid value is ActivityLog.</td>
</tr>
<tr>
<td>eventID</td>
<td>string</td>
<td>Required</td>
<td>A unique ID for an event.</td>
</tr>
<tr>
<td>eventTime</td>
<td>string</td>
<td>Required</td>
<td>Event timestamp, in yyyy-MM-DDTHH:mm:ss format, in Universal Coordinated Time (UTC).</td>
</tr>
<tr>
<td>awsRegion</td>
<td>string</td>
<td>Required</td>
<td>The AWS Region where the PutAuditEvents call was made.</td>
</tr>
<tr>
<td>recipientAccountId</td>
<td></td>
<td>Required</td>
<td>Represents the account ID that received this event. CloudTrail populates this field by calculating it from event payload.</td>
</tr>
<tr>
<td>addendum</td>
<td>-</td>
<td>Optional</td>
<td>Shows information about why event processing was delayed. If information was missing from an existing event, the addendum block includes the missing information and a reason for why it was missing.</td>
</tr>
<tr>
<td>• reason</td>
<td>string</td>
<td>Optional</td>
<td>The reason that the event or some of its contents were missing.</td>
</tr>
<tr>
<td>• updatedFields</td>
<td>string</td>
<td>Optional</td>
<td>The event record fields that are updated by the addendum. This is only provided if the reason is UPDATED_DATA.</td>
</tr>
</tbody>
</table>
### CloudTrail Lake integrations event schema

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• originalUID</td>
<td>string</td>
<td>Optional</td>
<td>The original event UID from the source. This is only provided if the reason is UPDATED_DATA.</td>
</tr>
<tr>
<td>• originalEventID</td>
<td>string</td>
<td>Optional</td>
<td>The original event ID. This is only provided if the reason is UPDATED_DATA.</td>
</tr>
<tr>
<td>metadata</td>
<td>-</td>
<td>Required</td>
<td>Information about the channel that the event used.</td>
</tr>
<tr>
<td>• ingestionTime</td>
<td>string</td>
<td>Required</td>
<td>The timestamp when the event was processed, in yyyy-MM-DDTHH:mm:ss format, in Universal Coordinated Time (UTC).</td>
</tr>
<tr>
<td>• channelARN</td>
<td>string</td>
<td>Required</td>
<td>The ARN of the channel that the event used.</td>
</tr>
</tbody>
</table>

### Fields that are provided by customer events

<table>
<thead>
<tr>
<th>Field name</th>
<th>Input type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eventData</td>
<td>-</td>
<td>Required</td>
<td>The audit data sent to CloudTrail in a PutAuditEvents call.</td>
</tr>
<tr>
<td>• version</td>
<td>string</td>
<td>Required</td>
<td>The version of the event from its source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 256.</td>
</tr>
<tr>
<td>• userIdentity</td>
<td>-</td>
<td>Required</td>
<td>Information about the user who made a request.</td>
</tr>
<tr>
<td>• type</td>
<td>string</td>
<td>Required</td>
<td>The type of user identity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 128.</td>
</tr>
<tr>
<td>• principalId</td>
<td>string</td>
<td>Required</td>
<td>A unique identifier for the actor of the event.</td>
</tr>
<tr>
<td>Field name</td>
<td>Input type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>• details</td>
<td>JSON object</td>
<td>Optional</td>
<td>Additional information about the identity.</td>
</tr>
<tr>
<td>• userAgent</td>
<td>string</td>
<td>Optional</td>
<td>The agent through which the request was made.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 1024.</td>
</tr>
<tr>
<td>• eventSource</td>
<td>string</td>
<td>Required</td>
<td>This is the partner event source, or the custom application about which events are logged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 1024.</td>
</tr>
<tr>
<td>• eventName</td>
<td>string</td>
<td>Required</td>
<td>The requested action, one of the actions in the API for the source service or application.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 1024.</td>
</tr>
<tr>
<td>• eventTime</td>
<td>string</td>
<td>Required</td>
<td>Event timestamp, in yyyy-MM-DDTHH:mm:ss format, in Universal Coordinated Time (UTC).</td>
</tr>
<tr>
<td>• UID</td>
<td>string</td>
<td>Required</td>
<td>The UID value that identifies the request. The service or application that is called generates this value.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 1024.</td>
</tr>
<tr>
<td>Field name</td>
<td>Input type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>requestParameters</td>
<td>JSON object</td>
<td>Optional</td>
<td>The parameters, if any, that were sent with the request. This field has a maximum size of 100 kB, and content exceeding the limit is rejected.</td>
</tr>
<tr>
<td>responseElements</td>
<td>JSON object</td>
<td>Optional</td>
<td>The response element for actions that make changes (create, update, or delete actions). This field has a maximum size of 100 kB, and content exceeding the limit is rejected.</td>
</tr>
<tr>
<td>errorCode</td>
<td>string</td>
<td>Optional</td>
<td>A string representing an error for the event.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 256.</td>
</tr>
<tr>
<td>errorMessage</td>
<td>string</td>
<td>Optional</td>
<td>The description of the error.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Length constraints: Maximum length of 256.</td>
</tr>
<tr>
<td>sourceIPAddress</td>
<td>string</td>
<td>Optional</td>
<td>The IP address from which the request was made. Both IPv4 and IPv6 addresses are accepted.</td>
</tr>
<tr>
<td>recipientAccountID</td>
<td>string</td>
<td>Required</td>
<td>Represents the account ID that received this event. The account ID must be the same as the AWS account ID that owns the channel.</td>
</tr>
<tr>
<td>additionalEventData</td>
<td>JSON object</td>
<td>Optional</td>
<td>Additional data about the event that was not part of the request or response. This field has a maximum size of 28 kB, and content exceeding that limit is rejected.</td>
</tr>
</tbody>
</table>

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The following example shows the hierarchy of schema elements that match those in CloudTrail event records.

```
{
  "eventVersion": String,
  "eventCategory": String,
  "eventType": String,
  "eventID": String,
  "eventTime": String,
  "awsRegion": String,
  "recipientAccountId": String,
  "addendum": {
    "reason": String,
    "updatedFields": String,
    "originalUID": String,
    "originalEventID": String
  },
  "metadata": {
    "ingestionTime": String,
    "channelARN": String
  },
  "eventData": {
    "version": String,
    "userIdentity": {
      "type": String,
      "principalId": String,
      "details": {
        JSON
      }
    },
    "userAgent": String,
    "eventSource": String,
    "eventName": String,
    "eventTime": String,
    "UID": String,
    "requestParameters": {
      JSON
    },
    "responseElements": {
      JSON
    },
    "errorCode": String,
    "errorMessage": String,
    "sourceIPAddress": String,
    "recipientAccountId": String,
    "additionalEventData": {
      JSON
    }
  }
}
```

View Lake dashboards

You can use CloudTrail Lake dashboards to visualize the events in an event data store. You can select from several different dashboard types. The dashboard types available for an event data store are dependent upon the advanced event selectors configuration of the event data store. For example, if a dashboard type displays information about CloudTrail management events, you can only select the dashboard if the currently selected event data store collects CloudTrail management events.

Each dashboard type consists of multiple widgets and each widget represents a SQL query. To view the query for a widget, choose View and analyze in query editor to open up the query editor. You can't
modify the system-generated query that is used to populate the widget, but you can make edits to the query and run the query in the query editor for further analysis.

To populate and update a dashboard, choose **Run queries**. When you choose **Run queries**, CloudTrail runs system-generated queries on your behalf. Because running queries incur costs, CloudTrail asks you to acknowledge the costs associated with running queries. This is a one time confirmation. For more information about CloudTrail pricing, see **CloudTrail Pricing**.

**Topics**
- Limitations (p. 202)
- Prerequisites (p. 202)
- Choosing a dashboard (p. 202)
- Filtering a dashboard on a date or time range (p. 203)
- Viewing the query for a dashboard widget (p. 203)

**Limitations**

The following limitations apply to the current release.

- The current release doesn't support customized dashboards, widgets, or queries.
- The current release only provides dashboards for event data stores that collect CloudTrail events (data events, management events).
- The current release doesn't support editing the system-generated queries used to populate the dashboard. You can view and edit the underlying query for any widget on the **Query Editor** tab, however, any changes you make to the query are intended for supplemental analysis outside of the dashboard.

**Prerequisites**

The following prerequisites apply to Lake dashboards.

- To view and use Lake dashboards, you must create at least one CloudTrail Lake event data store. You can create event data stores using the console, AWS CLI, or SDKs. For information about creating an event data store using the console, see **Create an event data store for CloudTrail events (p. 169)**. For information about creating an event data store using the AWS CLI, see **Managing CloudTrail Lake by using the AWS CLI (p. 224)**.
- To populate the dashboard, CloudTrail runs queries on your behalf. The first time you view the **Dashboards** page, CloudTrail asks you to acknowledge the costs associated with running queries. Choose **I agree** to acknowledge the cost of running queries.

**Choosing a dashboard**

Use the following procedure to choose an event data store and dashboard type to view.

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. In the left navigation pane, under **Lake**, choose **Dashboard**.
3. Choose the event data store for which you want to visualize data.
4. Choose the dashboard type you want to view. The dashboards list is populated based upon the advanced event selectors configuration of the selected event data store.
The following are the possible dashboard types.

- **Overview** dashboard - Shows the most active users, AWS Regions, and AWS services by event count. You can also view information about read and write management event activity, most throttled events, and the top errors. This dashboard is available for event data stores that collect management events.

- **Management Events** dashboard - Shows console sign-in events, access denied events, destructive actions, and top errors by user. You can also view information about TLS versions and outdated TLS calls by user. This dashboard is available for event data stores that collect management events.

- **S3 Data Events** dashboard - Shows S3 account activity, most accessed S3 objects, top S3 users, and top S3 actions. This dashboard is available for event data stores that collect Amazon S3 data events.

5. Choose to filter the dashboard data by an **Absolute range** or **Relative range**. Choose **Absolute range** to select a specific date and time range. Choose **Relative range** to select a predefined time range or a custom range. By default, the dashboard displays event data for the past 24 hours.

6. Choose **Run queries** to run the queries for the dashboard's widgets.

### Filtering a dashboard on a date or time range

By default, the dashboard displays data for the past 24 hours. You can filter a dashboard by an **Absolute range** or **Relative range**.

Choose **Absolute range** to select a specific date and time range.

Choose **Relative range** to select a predefined time range or a custom range.

After you've chosen the time range, choose **Run queries** to refresh the dashboard.

### Viewing the query for a dashboard widget

Each widget represents a SQL query. To view the query for a widget, choose **View and analyze in query editor** to open up the query editor. Using the query editor, you can further refine the query outside the dashboard and run the query to see the results of your updated query. For more information about working with queries, see [Create or edit a query](p. 203).

**Note**

You cannot modify the system-generated query for a dashboard widget. Any changes made to the query on the **Query Editor** tab are intended solely for further analysis outside of the dashboard.

### Create or edit a query

Queries in CloudTrail are authored in SQL. You can build a query on the CloudTrail Lake Editor tab by writing the query in SQL from scratch, or by opening a saved or sample query and editing it. You cannot overwrite an included sample query with your changes, but you can save it as a new query. For more information about the SQL query language that is allowed, see [CloudTrail Lake SQL constraints](p. 237).

An unbounded query (such as `SELECT * FROM edsID`) scans all data in your event data store. To help control costs, we recommend that you constrain queries by adding starting and ending eventTime time
stamps to queries. The following is an example that searches for all events in a specified event data store where the event time is after (> January 5, 2022 at 1:51 p.m. and before (< January 19, 2022 at 1:51 p.m. Because an event data store has a minimum retention period of seven days, the minimum time span between starting and ending eventTime values is also seven days.

```
SELECT * 
FROM `eds-ID` 
WHERE 
  eventtime >= '2022-01-05 13:51:00' and eventtime <='2022-01-19 13:51:00' 
```

In this walkthrough, we open one of the sample queries, edit it to find actions taken by a specific user named Alice, and save it as a new query. You can also edit a saved query on the Saved queries tab, if you have saved queries.

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. From the navigation pane, under Lake, choose Query.
3. On the Query page, choose the Sample queries tab.
4. Open a sample query by choosing the Query name. This opens the query in the Editor tab. In this example, we'll select the query named Investigate user actions and edit the query to find the actions for a specific user named Alice.
5. In the Editor tab, edit the WHERE line to specify the user that you want to investigate and update the eventTime values as needed. The value of FROM is the ID portion of the event data store's ARN and is automatically populated by CloudTrail when you choose the event data store.

```
SELECT 
  eventID, eventName, eventSource, eventTime, userIdentity.arn AS user 
FROM `event-data-store-id` 
WHERE 
  userIdentity.arn LIKE '%Alice%' 
  AND eventTime > '2023-06-23 00:00:00' AND eventTime < '2023-06-26 00:00:00' 
```

6. You can run a query before you save it, to verify that the query works. To run a query, choose an event data store from the Event data store drop-down list, and then choose Run. View the Status column of the Command output tab for the active query to verify that a query ran successfully.
7. When you have updated the sample query, choose Save.
8. In Save query, enter a name and description for the query. Choose Save query to save your changes as the new query. To discard changes to a query, choose Cancel, or close the Save query window.
Note
Saved queries are tied to your browser; if you use a different browser or a different device to access the CloudTrail console, the saved queries are not available.

9. Open the Saved queries tab to see the new query in the table.

Query editor tools

A toolbar at the upper right of the query editor offers commands to help author and format your SQL query.

The following list describes the commands on the toolbar.

- **Undo** – Reverts the last content change made in the query editor.
- **Redo** – Repeats the last content change made in the query editor.
- **Format selected** – Arranges the query editor content according to SQL formatting and spacing conventions.
Example queries

This section describes how you can access sample queries in the CloudTrail console and includes a few example CloudTrail Lake queries to help you get started.

**Note**
You can also view queries created by the GitHub community. For more information and to view these sample queries, see CloudTrail Lake sample queries on the GitHub website. AWS CloudTrail has not evaluated the queries in GitHub.

**Topics**

- Viewing sample queries in the CloudTrail console (p. 206)
- Example: Find all principal user identities who called CreateBucket on January 22, 2023 (p. 206)
- Example: Find all APIs that a user called on January 22, 2023 (p. 207)
- Example: Find the number of API calls since January 1, 2023, grouped by eventName and eventSource (p. 208)
- Example: Find all users who signed in to the console in a set of Regions (p. 209)
- Example: Find all CloudTrail Lake queries that were run in January 2023 (p. 210)

**Viewing sample queries in the CloudTrail console**

The CloudTrail console provides a number of sample queries that can help you get started writing your own queries.

**To access the sample queries in the CloudTrail console**

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. From the navigation pane, under Lake, choose Query.
3. Choose the Sample queries tab.
4. To edit a sample query, choose the Query name. For information about running queries, see Run a query and save query results (p. 210).

**Example: Find all principal user identities who called CreateBucket on January 22, 2023**

```sql
SELECT
    userIdentity.principalid,
    eventName
FROM
    event_data_store_ID
WHERE
    userIdentity.principalid IS NOT NULL
    AND
    eventTime > '2023-01-22 00:00:00'
    AND
    eventTime < '2023-01-23 00:00:00'
```
Example queries

**eventName='CreateBucket'**

Results

```json
{
  "QueryStatus": "FINISHED",
  "QueryStatistics": {
    "ResultsCount": 1,
    "TotalResultsCount": 1,
    "BytesScanned": 25077
  },
  "QueryResultRows": [
    {
      "principalId": "principal_ID"
    },
    {
      "eventName": "CreateBucket"
    }
  ]
}
```

**Example: Find all APIs that a user called on January 22, 2023**

```sql
SELECT
  eventID,
  eventName,
  eventSource,
  eventTime
FROM
  event_data_store_ID
WHERE
  userIdentity.username = 'bob'
AND
  eventTime > '2023-01-22 00:00:00'
AND
  eventTime < '2023-01-23 00:00:00'
```

Results

```json
{
  "QueryStatus": "FINISHED",
  "QueryStatistics": {
    "ResultsCount": 2,
    "TotalResultsCount": 2,
    "BytesScanned": 13287
  },
  "QueryResultRows": [
    {
      "eventID": "EXAMPLE-c3b6-43e4-aa35-b2490EXAMPLE"
    },
    {
      "eventName": "DescribeQuery"
    },
    {
      "eventSource": "cloudtrail.amazonaws.com"
    },
    {
      "eventTime": "2023-01-22 16:53:53.000"
    }
  ]
}
```
Example queries

Example: Find the number of API calls since January 1, 2023, grouped by eventName and eventSource

```sql
SELECT
    eventSource,
    eventName,
    COUNT(*) AS apiCount
FROM
    event_data_store_ID
WHERE
    eventTime > '2023-01-01 00:00:00'
GROUP BY
    eventSource, eventName
ORDER BY
    apiCount DESC
```

Results

```json
{
    "QueryStatus": "FINISHED",
    "QueryStatistics": {
        "ResultsCount": 3,
        "TotalResultsCount": 3,
        "BytesScanned": 10442
    },
    "QueryResultRows": [
        [
            { "eventSource": "s3.amazonaws.com" },
            { "eventName": "PutObject" },
            { "apiCount": "96059" }
        ],
        [
            { "eventSource": "dynamodb.amazonaws.com" },
            { "eventName": "DescribeTable" }
        ]
    ]
}
```
Example: Find all users who signed in to the console in a set of Regions

```sql
SELECT  
eventTime,  
userIdentity.arn,  
awsRegion  
FROM  
event_data_store_ID  
WHERE  
awsRegion in ('us-east-1', 'us-west-2')  
AND  
eventName = 'ConsoleLogin'
```

Results

```json
{
"QueryStatus": "FINISHED",
"QueryStatistics": {
  "ResultsCount": 2,
  "TotalResultsCount": 2,
  "BytesScanned": 15580
},
"QueryResultRows": [
  [
    {
      "eventTime": "2022-02-08 19:54:44.000"
    },
    {
      "arn": "arn:aws:sts::123456789012:assumed-role/example-identity"
    },
    {
      "awsRegion": "us-east-1"
    }
  ],
  [
    {
      "eventTime": "2022-01-21 16:38:27.000"
    },
    {
      "arn": "arn:aws:sts::123456789012:assumed-role/example-identity"
    },
    {
      "awsRegion": "us-west-2"
    }
  ]
}
```
Example: Find all CloudTrail Lake queries that were run in January 2023

```sql
SELECT
    element_at(responseElements, 'queryId'),
    element_at(requestParameters, 'queryStatement')
FROM
    event_data_store_ID
WHERE
    eventName='StartQuery'
AND
    eventSource = 'cloudtrail.amazonaws.com'
AND
    responseElements IS NOT NULL
AND
    eventTime > '2023-01-01 00:00:00'
AND
    eventTime < '2023-02-01 00:00:00'
```

Results

```
{
    "QueryStatus": "FINISHED",
    "QueryStatistics": {
        "ResultsCount": 1,
        "TotalResultsCount": 1,
        "BytesScanned": 13002
    },
    "QueryResultRows": [
        {
            "_col0": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE"
        },
        {
            "_col1": "select * from event_data_store_ID limit 1;"
        }
    ]
}
```

Run a query and save query results

After you choose or save a query, you can run a query on an event data store.

When you run a query, you have the option to save the query results to an Amazon S3 bucket. When you run queries in CloudTrail Lake, you incur charges based on the amount of data scanned by the query. There are no additional CloudTrail Lake charges for saving query results to an S3 bucket, however, there are S3 storage charges. For more information about S3 pricing, see Amazon S3 pricing.

When you save query results, the query results may display in the CloudTrail console before they are viewable in the S3 bucket since CloudTrail delivers the query results after the query scan completes. While most queries complete within a few minutes, depending on the size of your event data store, it can take considerably longer for CloudTrail to deliver query results to your S3 bucket. CloudTrail delivers the
To run a query using CloudTrail Lake

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. From the navigation pane, under Lake, choose Query.
3. On the Saved queries or Sample queries tabs, choose a query to run by choosing the Query name.
4. On the Editor tab, for Event data store, choose an event data store from the drop-down list.
5. (Optional) On the Editor tab, choose Save results to S3 to save the query results to an S3 bucket. When you choose the default S3 bucket, CloudTrail creates and applies the required bucket policies. For more information about saving query results, see Additional information about saved query results (p. 211).

   **Note**  
   To use a different bucket, specify a bucket name, or choose Browse S3 to choose a bucket. The bucket policy must grant CloudTrail permission to deliver query results to the bucket. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail Lake query results (p. 385).

6. On the Editor tab, choose Run.

   Depending on the size of your event data store, and the number of days of data it includes, a query can take several minutes to run. The Command output tab shows the status of a query, and whether a query is finished running. When a query has finished running, open the Query results tab to see a table of results for the active query (the query currently shown in the editor).

   **Note**  
   Queries that run for longer than one hour might time out. You can still get partial results that were processed before the query timed out. CloudTrail does not deliver partial query results to an S3 bucket. To avoid a time out, you can refine your query to limit the amount of data scanned by specifying a narrower time range.

**Additional information about saved query results**

After you save query results, you can download the saved query results from the S3 bucket. For more information about finding and downloading saved query results, see Get and download saved query results (p. 212).

You can also validate saved query results to determine whether the query results were modified, deleted, or unchanged after CloudTrail delivered the query results. For more information about validating saved query results, see Validate saved query results (p. 214).

**View query results**

After your query finishes, you can view its results. The results of a query are available for seven days after the query finishes. You can view results for the active query on the Query results tab, or you can access results for all recent queries on the Results history tab on the Lake home page.

Query results can change from older runs of a query to newer ones, as later events in the query period can be logged between queries.

When you save query results, the query results may display in the CloudTrail console before they are viewable in the S3 bucket since CloudTrail delivers the query results after the query scan completes. While most queries complete within a few minutes, depending on the size of your event data store, it can take considerably longer for CloudTrail to deliver query results to your S3 bucket. CloudTrail delivers the query results to the S3 bucket in compressed gzip format.
On average, after the query scan completes you can expect a latency of 60 to 90 seconds for every GB of data delivered to the S3 bucket. For more information about finding and downloading saved query results, see Get and download saved query results (p. 212).

Note
Queries that run for longer than one hour might time out. You can still get partial results that were processed before the query timed out. CloudTrail does not deliver partial query results to an S3 bucket. To avoid a time out, you can refine your query to limit the amount of data scanned by specifying a narrower time range.

1. On the **Query results** tab for an active query, each row represents an event result that matched the query. Filter results by entering all or part of an event field value in the search bar. To copy an event, choose the event you want to copy and then choose Copy.

2. On the **Command output** tab, view metadata about the query that was run, such as the event data store ID, run time, number of results scanned, and whether or not the query was successful. If you saved the query results to an Amazon S3 bucket, the metadata also includes a link to the S3 bucket containing the saved query results.

Get and download saved query results

After you save query results, you need to be able to locate the file containing the query results. CloudTrail delivers your query results to an Amazon S3 bucket that you specify when you save the query results.

Note
When you save query results, the query results may display in the console before they are viewable in the S3 bucket since CloudTrail delivers the query results after the query scan completes. While most queries complete within a few minutes, depending on the size of your event data store, it can take considerably longer for CloudTrail to deliver query results to your S3 bucket. CloudTrail delivers the query results to the S3 bucket in compressed gzip format. On average, after the query scan completes you can expect a latency of 60 to 90 seconds for every GB of data delivered to the S3 bucket.
Find your CloudTrail Lake saved query results

CloudTrail publishes query result and sign files to your S3 bucket. The query result file contains the output of the saved query and the sign file provides the signature and hash value for the query results. You can use the sign file to validate the query results. For more information about validating query results, see Validate saved query results (p. 214).

To retrieve a query result or sign file, you can use the Amazon S3 console, the Amazon S3 command line interface (CLI), or the API.

**To find your query results and sign files with the Amazon S3 console**

1. Open the Amazon S3 console.
2. Choose the bucket you specified.
3. Navigate through the object hierarchy until you find the query result and sign files. The query result file has a .csv.gz extension and the sign file has a .json extension.

You will navigate through an object hierarchy that is similar to the following example, but with a different bucket name, account ID, date, and query ID.

<table>
<thead>
<tr>
<th>All Buckets</th>
<th>Bucket_Name</th>
<th>Account_ID;</th>
<th>CloudTrail-Lake</th>
<th>Query</th>
<th>2022</th>
<th>06</th>
<th>20</th>
<th>Query_ID</th>
</tr>
</thead>
</table>

Download your CloudTrail Lake saved query results

When you save query results, CloudTrail delivers two types of files to your Amazon S3 bucket.

- A sign file in JSON format that you can use to validate the query result files. The sign file is named result_sign.json. For more information about the sign file, see CloudTrail sign file structure (p. 216).
- One or more query result files in CSV format, which contain the results from the query. The number of query result files delivered is dependent upon the total size of the query results. The maximum file size for a query result file is 1 TB. Each query result file is named result_number.csv.gz. For example, if the total size of the query results was 2 TB, you would have two query result files, result_1.csv.gz and result_2.csv.gz.

CloudTrail query result and sign files are Amazon S3 objects. You can use the S3 console, the AWS Command Line Interface (CLI), or the S3 API to retrieve query result and sign files.

The following procedure describes how to download the query result and sign files with the Amazon S3 console.
To download your query result or sign file with the Amazon S3 console

1. Open the Amazon S3 console.
2. Choose the bucket and choose the file that you want to download.
3. Choose Download and follow any prompts to save the file.
   
   **Note**
   
   Some browsers, such as Chrome, automatically extract the query result file for you. If your browser does this for you, skip to step 5.
4. Use a product such as 7-Zip to extract the query result file.
5. Open the query result or sign file.

Validate saved query results

To determine whether the query results were modified, deleted, or unchanged after CloudTrail delivered the query results, you can use CloudTrail query results integrity validation. This feature is built using industry standard algorithms: SHA-256 for hashing and SHA-256 with RSA for digital signing. This makes it computationally infeasible to modify, delete or forge CloudTrail query result files without detection.

You can use the command line to validate the query result files.

**Why use it?**

Validated query result files are invaluable in security and forensic investigations. For example, a validated query result file enables you to assert positively that the query result file itself has not changed. The CloudTrail query result file integrity validation process also lets you know if a query result file has been deleted or changed.

**Topics**

- Validate saved query results with the AWS CLI (p. 214)
- CloudTrail sign file structure (p. 216)
- Custom implementations of CloudTrail query result file integrity validation (p. 217)

Validate saved query results with the AWS CLI

You can validate the integrity of the query result files and sign file by using the **aws cloudtrail verify-query-results** command.

**Prerequisites**

To validate query results integrity with the command line, the following conditions must be met:

- You must have online connectivity to AWS.
- You must use AWS CLI version 2.
- To validate query result files and sign file locally, the following conditions apply:
  - You must put the query result files and sign file in the specified file path. Specify the file path as the value for the **--local-export-path** parameter.
  - You must not rename the query result files and sign file.
To validate the query result files and sign file in the S3 bucket, the following conditions apply:

- You must not rename the query result files and sign file.
- You must have read access to the Amazon S3 bucket that contains the query result files and sign file.
- The specified S3 prefix must contain the query result files and sign file. Specify the S3 prefix as the value for the `--s3-prefix` parameter.

**verify-query-results**

The `verify-query-results` command verifies the hash value of each query result file by comparing the value with the `fileHashValue` in the sign file, and then validating the `hashSignature` in the sign file.

When you verify query results, you can use either the `--s3-bucket` and `--s3-prefix` command line options to validate the query result files and sign file stored in an S3 bucket, or you can use the `--local-export-path` command line option to perform a local validation of the downloaded query result files and sign file.

**Note**
The `verify-query-results` command is Region specific. You must specify the `--region` global option to validate query results for a specific AWS Region.

The following are the options for the `verify-query-results` command.

`--s3-bucket <string>`

Specifies the S3 bucket name that stores the query result files and sign file. You cannot use this parameter with `--local-export-path`.

`--s3-prefix <string>`

Specifies the S3 path of the S3 folder that contains the query result files and sign file (for example, `s3/path/`). You cannot use this parameter with `--local-export-path`. You do not need to provide this parameter if the files are located in the root directory of the S3 bucket.

`--local-export-path <string>`

Specifies the local directory that contains the query result files and sign file (for example, `/local/path/to/export/file/`). You cannot use this parameter with `--s3-bucket` or `--s3-prefix`.

**Examples**

The following example validates query results using the `--s3-bucket` and `--s3-prefix` command line options to specify the S3 bucket name and prefix containing the query result files and sign file.

```bash
aws cloudtrail verify-query-results --s3-bucket bucket_name --s3-prefix prefix --region region
```

The following example validates downloaded query results using the `--local-export-path` command line option to specify the local path for the query result files and sign file. For more information about downloading query result files, see Download your CloudTrail Lake saved query results (p. 213).

```bash
aws cloudtrail verify-query-results --local-export-path local_file_path --region region
```

**Validation results**

The following table describes the possible validation messages for query result files and sign file.
### CloudTrail sign file structure

The sign file contains the name of each query result file that was delivered to your Amazon S3 bucket when you saved the query results, the hash value for each query result file, and the digital signature of the file. The digital signature and hash values are used for validating the integrity of the query result files and of the sign file itself.

#### Sign file location

The sign file is delivered to an Amazon S3 bucket location that follows this syntax.

```
s3://s3-bucket-name/optional-prefix/AWSLogs/aws-account-ID/CloudTrail-Lake/Query/year/month/date/query-ID/result_sign.json
```

#### Sample sign file contents

The following example sign file contains information for CloudTrail Lake query results.

```
{
    "version": "1.0",
    "region": "us-east-1",
    "files": [
        {
            "fileHashValue": "de85a48b8a363033c891abd723181243620a3af3b6505f0a44db77e147e9c188",
            "fileName": "result_1.csv.gz"
        }
    ],
    "hashAlgorithm": "SHA-256",
    "signatureAlgorithm": "SHA256withRSA",
    "queryCompleteTime": "2022-05-10T22:06:30Z",
    "hashSignature": "7664652aaf1d5a17a12ba50abe6aca77c0ec76264bf7dce71ac6d1c7781117c2a412e5820bccf473b1361306d4ff648feae2885e...34628aabf1ba2c32e0cdf28ef403e8fe3772499ac61e21b70802dfddded9bea0ddfc3a021bf2a0b209f312ccee5a43f2b06aa35cac34638f7611e5d7",
    "publicKeyFingerprint": "67b9fa73676d86966b449dd677850f188"
}
```

#### Sign file field descriptions

The following are descriptions for each field in the sign file:
Validate saved query results

version
The version of the sign file.

region
The Region for the AWS account used for saving the query results.

files.fileHashValue
The hexadecimal encoded hash value of the compressed query result file content.

files.fileName
The name of the query result file.

hashAlgorithm
The hash algorithm used to hash the query result file.

signatureAlgorithm
The algorithm used to sign the file.

queryCompleteTime
Indicates when CloudTrail delivered the query results to the S3 bucket. You can use this value to find the public key.

hashSignature
The hash signature for the file.

publicKeyFingerprint
The hexadecimal encoded fingerprint of the public key used to sign the file.

Custom implementations of CloudTrail query result file integrity validation

Because CloudTrail uses industry standard, openly available cryptographic algorithms and hash functions, you can create your own tools to validate the integrity of the CloudTrail query result files. When you save query results to an Amazon S3 bucket, CloudTrail delivers a sign file to your S3 bucket. You can implement your own validation solution to validate the signature and query result files. For more information about the sign file, see CloudTrail sign file structure (p. 216).

This topic describes how the sign file is signed, and then details the steps that you will need to take to implement a solution that validates the sign file and the query result files that the sign file references.

Understanding how CloudTrail sign files are signed

CloudTrail sign files are signed with RSA digital signatures. For each sign file, CloudTrail does the following:
1. Creates a hash list containing the hash value for each query result file.
2. Gets a private key unique to the Region.
3. Passes the SHA-256 hash of the string and the private key to the RSA signing algorithm, which produces a digital signature.
4. Encodes the byte code of the signature into hexadecimal format.
5. Puts the digital signature into the sign file.

Contents of the data signing string

The data signing string consists of the hash value for each query result file separated by a space. The sign file lists the fileHashValue for each query result file.

Custom validation implementation steps

When implementing a custom validation solution, you will need to validate the sign file and the query result files that it references.

Validate the sign file

To validate a sign file, you need its signature, the public key whose private key was used to sign it, and a data signing string that you compute.

1. Get the sign file.
2. Verify that the sign file has been retrieved from its original location.
4. Get the hexadecimal-encoded fingerprint of the public key whose private key was used to sign the sign file.
5. Retrieve the public key for the time range corresponding to queryCompleteTime in the sign file. For the time range, choose a StartTime earlier than the queryCompleteTime and an EndTime later than the queryCompleteTime.
6. From among the public keys retrieved, choose the public key whose fingerprint matches the publicKeyFingerprint value in the sign file.
7. Using a hash list containing the hash value for each query result file separated by a space, recreate the data signing string used to verify the sign file signature. The sign file lists the fileHashValue for each query result file.

For example, if your sign file's files array contains the following three query result files, your hash list is "aaa bbb ccc".

```
"files": [
    {
        "fileHashValue" : "aaa",
        "fileName" : "result_1.csv.gz"
    },
    {
        "fileHashValue" : "bbb",
        "fileName" : "result_2.csv.gz"
    },
    {
```

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Validate the signature by passing in the SHA-256 hash of the string, the public key, and the signature as parameters to the RSA signature verification algorithm. If the result is true, the sign file is valid.

Validate the query result files

If the sign file is valid, validate the query result files that the sign file references. To validate the integrity of a query result file, compute its SHA-256 hash value on its compressed content and compare the results with the fileHashValue for the query result file recorded in the sign file. If the hashes match, the query result file is valid.

The following sections describe the validation process in detail.

A. Get the sign file

The first steps are to get the sign file and get the fingerprint of the public key.

1. Get the sign file from your Amazon S3 bucket for the query results that you want to validate.
2. Next, get the hashSignature value from the sign file.
3. In the sign file, get the fingerprint of the public key whose private key was used to sign the file from the publicKeyFingerprint field.

B. Retrieve the public key for validating the sign file

To get the public key to validate the sign file, you can use either the AWS CLI or the CloudTrail API. In both cases, you specify a time range (that is, a start time and end time) for the sign file that you want to validate. Use a time range corresponding to the queryCompleteTime in the sign file. One or more public keys may be returned for the time range that you specify. The returned keys may have validity time ranges that overlap.

Note
Because CloudTrail uses different private/public key pairs per Region, each sign file is signed with a private key unique to its Region. Therefore, when you validate a sign file from a particular Region, you must retrieve its public key from the same Region.

Use the AWS CLI to retrieve public keys

To retrieve a public key for a sign file by using the AWS CLI, use the cloudtrail list-public-keys command. The command has the following format:

```
aws cloudtrail list-public-keys [--start-time <start-time>] [--end-time <end-time>]
```

The start-time and end-time parameters are UTC timestamps and are optional. If not specified, the current time is used, and the currently active public key or keys are returned.

Sample Response

The response will be a list of JSON objects representing the key (or keys) returned:

Use the CloudTrail API to retrieve public keys

To retrieve a public key for a sign file by using the CloudTrail API, pass in start time and end time values to the ListPublicKeys API. The ListPublicKeys API returns the public keys whose private keys
were used to sign the file within the specified time range. For each public key, the API also returns the corresponding fingerprint.

**ListPublicKeys**

This section describes the request parameters and response elements for the `ListPublicKeys` API.

**Note**
The encoding for the binary fields for `ListPublicKeys` is subject to change.

**Request Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>StartTime</td>
<td>Optionally specifies, in UTC, the start of the time range to look up the public key for CloudTrail sign file. If <code>StartTime</code> is not specified, the current time is used, and the current public key is returned. Type: <code>DateTime</code></td>
</tr>
<tr>
<td>EndTime</td>
<td>Optionally specifies, in UTC, the end of the time range to look up public keys for CloudTrail sign files. If <code>EndTime</code> is not specified, the current time is used. Type: <code>DateTime</code></td>
</tr>
</tbody>
</table>

**Response Elements**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PublicKeyList</td>
<td>an array of <code>PublicKey</code> objects that contains:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>The DER encoded public key value in PKCS #1 format.</td>
</tr>
<tr>
<td></td>
<td>Type: <code>Blob</code></td>
</tr>
<tr>
<td>ValidityStart</td>
<td>The starting time of validity of the public key.</td>
</tr>
<tr>
<td></td>
<td>Type: <code>DateTime</code></td>
</tr>
<tr>
<td>ValidityEnd</td>
<td>The ending time of validity of the public key.</td>
</tr>
<tr>
<td></td>
<td>Type: <code>DateTime</code></td>
</tr>
<tr>
<td>Fingerprint</td>
<td>The fingerprint of the public key. The fingerprint can be used to identify the public key that you must use to validate the sign file.</td>
</tr>
<tr>
<td></td>
<td>Type: <code>String</code></td>
</tr>
</tbody>
</table>

C. **Choose the public key to use for validation**

From among the public keys retrieved by `list-public-keys` or `ListPublicKeys`, choose the public key whose fingerprint matches the fingerprint recorded in the `publicKeyFingerprint` field of the sign file. This is the public key that you will use to validate the sign file.

D. **Recreate the data signing string**

Now that you have the signature of the sign file and the associated public key, you need to calculate the data signing string. After you have calculated the data signing string, you will have the inputs needed to verify the signature.
The data signing string consists of the hash value for each query result file separated by a space. After you recreate this string, you can validate the sign file.

E. Validate the sign file

Pass the recreated data signing string, digital signature, and public key to the RSA signature verification algorithm. If the output is true, the signature of the sign file is verified and the sign file is valid.

F. Validate the query result files

After you have validated the sign file, you can validate the query result files it references. The sign file contains the SHA-256 hashes of the query result files. If one of the query result files was modified after CloudTrail delivered it, the SHA-256 hashes will change, and the signature of the sign file will not match.

Use the following procedure to validate the query result files listed in the sign file's files array.

1. Retrieve the original hash of the file from the files.fileHashValue field in the sign file.
2. Hash the compressed contents of the query result file with the hashing algorithm specified in hashAlgorithm.
3. Compare the hash value that you generated for each query result file with the files.fileHashValue in the sign file. If the hashes match, the query result files are valid.

Validating signature and query result files offline

When validating sign and query result files offline, you can generally follow the procedures described in the previous sections. However, you must take into account the following information about public keys.

Public keys

In order to validate offline, the public key that you need for validating query result files in a given time range must first be obtained online (by calling ListPublicKeys, for example) and then stored offline. This step must be repeated whenever you want to validate additional files outside the initial time range that you specified.

Sample validation snippet

The following sample snippet provides skeleton code for validating CloudTrail sign and query result files. The skeleton code is online/offline agnostic; that is, it is up to you to decide whether to implement it with or without online connectivity to AWS. The suggested implementation uses the Java Cryptography Extension (JCE) and Bouncy Castle as a security provider.

The sample snippet shows:

• How to create the data signing string used to validate the sign file signature.
• How to verify the sign file's signature.
• How to calculate the hash value for the query result file and compare it with the fileHashValue listed in the sign file to verify the authenticity of the query result file.

```java
import org.apache.commons.codec.binary.Hex;
import org.bouncycastle.asn1.pkcs.PKCSObjectIdentifiers;
import org.bouncycastle.asn1.pkcs.RSAPublicKey;
import org.bouncycastle.asn1.x509.AlgorithmIdentifier;
import org.bouncycastle.asn1.x509.SubjectPublicKeyInfo;
import org.bouncycastle.jce.provider.BouncyCastleProvider;
```
public class SignFileValidationSampleCode {

    public void validateSignFile(String s3Bucket, String s3PrefixPath) throws Exception {
        MessageDigest messageDigest = MessageDigest.getInstance("SHA-256");

        // Load the sign file from S3 (using Amazon S3 Client) or from your local copy
        JSONObject signFile = loadSignFileToMemory(s3Bucket, String.format("%s/%s", s3PrefixPath, "result_sign.json");

        // Using the Bouncy Castle provider as a JCE security provider - http://www.bouncycastle.org/
        Security.addProvider(new BouncyCastleProvider());

        List<String> hashList = new ArrayList<>();
        JSONArray jsonArray = signFile.getJSONArray("files");

        for (int i = 0; i < jsonArray.length(); i++) {
            JSONObject file = jsonArray.getJSONObject(i);
            String fileS3ObjectKey = String.format("%s/%s", s3PrefixPath, file.getString("fileName"));

            byte[] exportFileContent = loadCompressedExportFileInMemory(s3Bucket, fileS3ObjectKey);
            messageDigest.update(exportFileContent);
            byte[] exportFileHash = messageDigest.digest();
            messageDigest.reset();
            byte[] expectedHash = Hex.decodeHex(file.getString("fileHashValue");

            boolean signaturesMatch = Arrays.equals(expectedHash, exportFileHash);
            if (!signaturesMatch) {
                System.err.println(String.format("Export file: %s/%s hash doesn't match. Expected: %s Actual: %s", s3Bucket, fileS3ObjectKey, Hex.encodeHexString(expectedHash), Hex.encodeHexString(exportFileHash));
            } else {
                System.out.println(String.format("Export file: %s/%s hash match", s3Bucket, fileS3ObjectKey));
            }

            hashList.add(file.getString("fileHashValue");
        }

        String hashListString = hashList.stream().collect(Collectors.joining(" "));
    }

    /*
     * NOTE:
     * To find the right public key to verify the signature, call CloudTrail ListPublicKey API to get a list
     */
}
of public keys, then match by the publicKeyFingerprint in the sign file. Also, the public key bytes returned from ListPublicKey API are DER encoded in PKCS#1 format:

```java
PublicKeyInfo ::= SEQUENCE {
    algorithm   AlgorithmIdentifier,
    PublicKey   BIT STRING
}
```

```java
AlgorithmIdentifier ::= SEQUENCE {
    algorithm   OBJECT IDENTIFIER,
    parameters  ANY DEFINED BY algorithm OPTIONAL
}
```

```
byte[] pkcs1PublicKeyBytes = getPublicKey(signFile.getString("queryCompleteTime"),
    signFile.getString("publicKeyFingerprint"));
byte[] signatureContent = Hex.decodeHex(signFile.getString("hashSignature"));
```

```
// Transform the PKCS#1 formatted public key to x.509 format.
RSAPublicKey rsaPublicKey = RSAPublicKey.getInstance(pkcs1PublicKeyBytes);
AlgorithmIdentifier rsaEncryption = new
AlgorithmIdentifier(PKCSObjectIdentifiers.rsaEncryption, null);
SubjectPublicKeyInfo publicKeyInfo = new SubjectPublicKeyInfo(rsaEncryption, rsaPublicKey);
```

```
// Create the PublicKey object needed for the signature validation
PublicKey publicKey = KeyFactory.getInstance("RSA", "BC")
    .generatePublic(new X509EncodedKeySpec(publicKeyInfo.getEncoded()));
```

```
// Verify signature
Signature signature = Signature.getInstance("SHA256withRSA", "BC");
signature.initVerify(publicKey);
signature.update(hashListString.getBytes("UTF-8"));
if (signature.verify(signatureContent)) {
    System.out.println("Sign file signature is valid.");
} else {
    System.err.println("Sign file signature failed validation.");
}
```

```
System.out.println("Sign file validation completed.");
```

---

**Learning resources**

The following resources can help you get a better understanding of what CloudTrail Lake is and how you can use it.

- Modernize Your Audit Log Management Using CloudTrail Lake ([YouTube video](#))
- Log Activity Events from Non-AWS Sources in AWS CloudTrail Lake ([YouTube video](#))
- Get visibility into the activity logs for your workforce and customer identities ([AWS blog](#))
- Using AWS CloudTrail Lake to identify older TLS connections to AWS service endpoints ([AWS blog](#))
- How Arctic Wolf uses AWS CloudTrail Lake to Simplify Security and Operations ([AWS blog](#))
- CloudTrail Lake FAQs
- AWS CloudTrail API Reference
- AWS CloudTrail Data API Reference
- AWS CloudTrail Partner Onboarding Guide
Managing CloudTrail Lake by using the AWS CLI

The following are example AWS CLI commands for creating and managing event data stores and queries in CloudTrail Lake.

Topics
- Create an event data store for CloudTrail data events (p. 224)
- Create an event data store for AWS Config configuration items (p. 225)
- Create an integration to log events from outside AWS (p. 226)
- Get an event data store (p. 231)
- List all event data stores in an account (p. 232)
- Update an event data store (p. 232)
- Stop ingestion on an event data store (p. 233)
- Start ingestion on an event data store (p. 233)
- Delete an event data store (p. 234)
- Restore an event data store (p. 234)
- List all channels (p. 234)
- Update a channel (p. 234)
- Delete a channel to delete an integration (p. 235)
- Start a query (p. 235)
- Get metadata about a query (p. 235)
- Get query results (p. 236)
- List all queries on an event data store (p. 236)
- Cancel a running query (p. 237)

Create an event data store for CloudTrail data events

The following example AWS Command Line Interface (AWS CLI) command creates an event data store named my-event-data-store that selects all Amazon S3 data events. The event data store retention period in this example is 90 days. --name is required; other parameters are optional. Valid values for --retention-period are integers between 7 and 2557, representing days. If you do not specify --retention-period, CloudTrail uses the default retention period of 2557 days. By default, --multi-region-enabled is set, even if the parameter is not added, and the event data store includes events from all Regions. The event data store is not enabled for all accounts in an AWS Organizations organization by default. To enable an event data store to collect events for all accounts in an organization, add the --organization-enabled parameter. The parameters --termination-protection-enabled (the default) and --no-termination-protection-enabled set and remove termination protection, respectively. Optionally, you can choose to enable AWS Key Management Service encryption and specify an AWS KMS key by adding --kms-key-id to the command, and specifying a KMS key ARN as the value. The --advanced-event-selectors parameter includes or excludes data events in your event data store. For more information about --advanced-event-selectors, see AdvancedEventSelectors in the CloudTrail API Reference.

```
aws cloudtrail create-event-data-store
  --name my-event-data-store
  --retention-period 90
  --kms-key-id "arn:aws:kms:us-east-1:123456789012:alias/KMS_key_alias"
  --advanced-event-selectors "$["Name": "Select all S3 data events",
```
Create an event data store for AWS Config configuration items

The following example AWS CLI `create-event-data-store` command creates an event data store named `my-event-data-store` that selects AWS Config configuration items. The event data store retention period in this example is 90 days. The `--name` parameter is required; other parameters are optional. Valid values for `--retention-period` are integers between 7 and 2557, representing days. If you don't specify `--retention-period`, CloudTrail uses the default retention period of 2557 days. By default, `--multi-region-enabled` is set, even if the parameter is not added, and the event data store includes configuration items from all AWS Regions. The event data store is not enabled for all accounts in an AWS Organizations organization by default; to enable an event data store to collect configuration items...
for all accounts in an organization, add the --organization-enabled parameter. The parameters
--termination-protection-enabled (the default) and --no-termination-protection-enabled set and remove termination protection, respectively. Optionally, you can choose to enable
AWS Key Management Service encryption and specify an AWS KMS key by adding --kms-key-id to the
command, and specifying a KMS key ARN as the value. The --advanced-event-selectors parameter
includes configuration items in your event data store by specifying the eventCategory field equals
ConfigurationItem.

```bash
aws cloudtrail create-event-data-store
--name my-event-data-store
--retention-period 90
--kms-key-id "arn:aws:kms:us-east-1:123456789012:alias/KMS_key_alias" \ 
--advanced-event-selectors '[
  {
    "Name": "Select AWS Config configuration items",
    "FieldSelectors": [
      {
        "Field": "eventCategory",
        "Equals": ["ConfigurationItem"]
      }
    ]
  }]
]
```

The following is an example response.

```json
{
  "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLE-ee54-4813-92d5-999aeEXAMPLE",
  "Name": "my-event-data-store",
  "Status": "CREATED",
  "AdvancedEventSelectors": [
    {
      "Name": "Select AWS Config configuration items",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": ["ConfigurationItem"
        ]
      ]
    }
  ],
  "MultiRegionEnabled": true,
  "OrganizationEnabled": false,
  "RetentionPeriod": 90,
  "KmsKeyId": "arn:aws:kms:us-east-1:123456789012:alias/KMS_key_alias",
  "TerminationProtectionEnabled": true,
  "CreatedTimestamp": "2022-10-07T19:03:24.277000+00:00",
  "UpdatedTimestamp": "2022-10-07T19:03:24.468000+00:00"
}
```

Create an integration to log events from outside AWS

In the AWS CLI, you create an integration that logs events from outside AWS in four commands (three
if you already have an event data store that meets the criteria). Event data stores that you use as the
destinations for an integration must be for a single Region and single account; they cannot be multi-
region, they cannot log events for organizations in AWS Organizations, and they can only include
activity events. The event type in the console must be **Events from integrations**. In the API, the
eventCategory value must be **ActivityAuditLog**. For more information about integrations, see
Create an integration with an event source outside of AWS (p. 190).
1. Run `create-event-data-store` to create an event data store, if you do not already have one or more event data stores that you can use for the integration.

The following example AWS CLI command creates an event data store that logs events from outside AWS. For activity events, the `eventCategory` field selector value is `ActivityAuditLog`. The event data store has a retention period of 90 days set. By default, the event data store collects events from all Regions, but because this is collecting non-AWS events, set it to a single Region by adding the `--no-multi-region-enabled` option. Termination protection is enabled by default, and the event data store does not collect events for accounts in an organization.

```bash
aws cloudtrail create-event-data-store \
   --name my-event-data-store \
   --no-multi-region-enabled \
   --retention-period 90 \
   --advanced-event-selectors '[
   
   
   
   ]'
```

The following is an example response.

```json
{
   "Name": "my-event-data-store",
   "ARN": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLEf852-4e8f-8bd1-bcf6cEXAMPLE",
   "RetentionPeriod": "90",
   "MultiRegionEnabled": false,
   "OrganizationEnabled": false,
   "TerminationProtectionEnabled": true,
   "AdvancedEventSelectors": [
   
   
   ]
}
```

You'll need the event data store ID (the suffix of the ARN, or EXAMPLEf852-4e8f-8bd1-bcf6cEXAMPLE in the preceding response example) to go on to the next step and create your channel.

2. Run the `create-channel` command to create a channel that allows a partner or source application to send events to an event data store in CloudTrail.

A channel has the following components:
Source

CloudTrail uses this information to determine the partners that are sending event data to CloudTrail on your behalf. A source is required, and can be either Custom for all valid non-AWS events, or the name of a partner event source. A maximum of one channel is allowed per source.

For information about the Source values for available partners, see Additional information about integration partners (p. 195).

Ingestion status

The channel status shows when the last events were received from a channel source.

Destinations

The destinations are the CloudTrail Lake event data stores that are receiving events from the channel. You can change destination event data stores for a channel.

To stop receiving events from a source, delete the channel.

You need the ID of at least one destination event data store to run this command. The valid type of destination is EVENT_DATA_STORE. You can send ingested events to more than one event data store. The following example command creates a channel that sends events to two event data stores, represented by their IDs in the Location attribute of the --destinations parameter. The --destinations, --name, and --source parameters are required. To ingest events from a CloudTrail partner, specify the name of the partner as the value of --source. To ingest events from your own applications outside AWS, specify Custom as the value of --source.

```
aws cloudtrail create-channel \
  --region us-east-1 \
  --destinations '[["Type": "EVENT_DATA_STORE", "Location": "EXAMPLEf852-4e8f-8bd1-bcf6ceEXAMPLE"], ["Type": "EVENT_DATA_STORE", "Location": "EXAMPLEg922-5n2l-3vz1-apqw8EXAMPLE"]]' \
  --name my-partner-channel \
  --source $partnerSourceName \
```

In the response to your create-channel command, copy the ARN of the new channel. You need the ARN to run the put-resource-policy and put-audit-events commands in the next steps.

3. Run the put-resource-policy command to attach a resource policy to the channel. Resource policies are JSON policy documents that specify what actions a specified principal can perform on the resource and under what conditions. The accounts defined as principals in the channel's resource policy can call the PutAuditEvents API to deliver events.

   Note
   If you do not create a resource policy for the channel, only the channel owner can call the PutAuditEvents API on the channel.

The information required for the policy is determined by the integration type.

- For a direction integration, CloudTrail requires the policy to contain the partner's AWS account IDs, and requires you to enter the unique external ID provided by the partner. CloudTrail automatically adds the partner's AWS account IDs to the resource policy when you create an integration using the CloudTrail console. Refer to the partner's documentation to learn how to get the AWS account numbers required for the policy.
- For a solution integration, you must specify at least one AWS account ID as principal, and can optionally enter an external ID to prevent against confused deputy.
The following are requirements for the resource policy:

- The resource ARN defined in the policy must match the channel ARN the policy is attached to.
- The policy contains only one action: cloudtrail-data:PutAuditEvents
- The policy contains at least one statement. The policy can have a maximum of 20 statements.
- Each statement contains at least one principal. A statement can have a maximum of 50 principals.

For more information about resource policies, see AWS CloudTrail resource-based policy examples (p. 378).

4. Run the PutAuditEvents API to ingest your activity events into CloudTrail. You'll need the payload of events that you want CloudTrail to add. Be sure that there is no sensitive or personally-identifying information in event payload before ingesting it into CloudTrail. Note that the PutAuditEvents API uses the cloudtrail-data CLI endpoint, not the cloudtrail endpoint.

The following examples show how to use the put-audit-events CLI command. The --audit-events and --channel-arn parameters are required. The --external-id parameter is required if an external ID is defined in the resource policy. You need the ARN of the channel that you created in the preceding step. The value of --audit-events is a JSON array of event objects. --audit-events includes a required ID from the event, the required payload of the event as the value of EventData, and an optional checksum (p. 268) to help validate the integrity of the event after ingestion into CloudTrail.

aws cloudtrail-data put-audit-events \
--channel-arn $ChannelArn \\
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Create an integration to log events from outside AWS

```bash
--external-id $UniqueExternalIDFromPartner \
--audit-events \
id="event_ID",eventData='"{event_payload}"' \
id="event_ID",eventData='"{event_payload}"',eventDataChecksum="optional_checksum"
```

The following is an example command with two event examples.

```bash
aws cloudtrail-data put-audit-events \
--channel-arn arn:aws:cloudtrail:us-east-1:123456789012:channel/EXAMPLE8-0558-4f7e-a06a-43969EXAMPLE \
--external-id UniqueExternalIDFromPartner \
--audit-events \
id="EXAMPLE3-0f1f-4a85-9664-d50a3EXAMPLE",eventData='"{"eventVersion":0.01,
\n"eventSource":"custom1.domain.com","...
\}"' \
id="EXAMPLE7-a999-486d-b241-b33a1EXAMPLE",eventData='"{"eventVersion":0.02,
\n"eventSource":"custom2.domain.com","...
\}"',eventDataChecksum="EXAMPLE6e7dd61f3ead...93a691d8EXAMPLE"
```

The following example command adds the `--cli-input-json` parameter to specify a JSON file (`custom-events.json`) of event payload.

```bash
aws cloudtrail-data put-audit-events --channel-arn $channelArn --external-id $UniqueExternalIDFromPartner --cli-input-json file:///custom-events.json --region us-east-1
```

The following are the sample contents of the example JSON file, `custom-events.json`.

```json
{
   "auditEvents": [
      {
         "eventData": "{"version"":"eventData.version","UID":"UID",
         \"userIdentity\":{\"type\":"CustomUserIdentity","principalId":\"principalId \
         \", \"details\":{\"key\":\"value\"},\"eventTime":"2021-10-27T12:13:14Z",\n         \"eventName\":\"eventName\", \"userAgent\":\"userAgent\", \"eventSource\":\"eventSource\",
         \"requestParameters\":{\"key\":\"value\"}, \"responseElements\":{\"key\":\"value\",
         \"additionalEventData\":{\"key\":\"value\"}, \"sourceIPAddress":\"12.34.56.78\", \"recipientAccountId":\"152089810396\"}",
         \"id": "1"
      }
   ]
}
```

You can verify that the integration is working, and CloudTrail is ingesting events from the source correctly, by running the `get-channel` command. The output of `get-channel` shows the most recent time stamp that CloudTrail received events.

```bash
aws cloudtrail get-channel --channel arn:aws:cloudtrail:us-east-1:01234567890:channel/EXAMPLE8-0558-4f7e-a06a-43969EXAMPLE
```

(Optional) Calculate a checksum value

The checksum that you specify as the value of `EventDataChecksum` in a `PutAuditEvents` request helps you verify that CloudTrail receives the event that matches with the checksum; it helps verify the
Get an event data store

The following example AWS CLI `get-event-data-store` command returns information about the event data store specified by the required `--event-data-store` parameter, which accepts an ARN or the ID suffix of the ARN.

```bash
aws cloudtrail get-event-data-store
```

The following is an example response. Creation and last updated times are in timestamp format.

```json
{
  "EventDataStoreARN": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE",
  "Name": "my-event-data-store",
  "Status": "Enabled",
  "KmsKeyId": "kms_key_ID",
  "AdvancedEventSelectors": [
    {
      "Name": "Select All S3 Data Events",
      "FieldSelectors": [
        { "Field": "eventCategory", "Equals": ["Data"] }
      ]
    }
  ],
  "CreatedTimestamp": 1248496624,
  "UpdatedTimestamp": 1598296624,
  "MultiRegionEnabled": true,
  "RetentionPeriod": 90,
  "TerminationProtectionEnabled": true
}
```
List all event data stores in an account

The following example AWS CLI `list-event-data-stores` command returns information about all event data stores in an account, in the current Region. Optional parameters include `--max-results`, to specify a maximum number of results that you want the command to return on a single page. If there are more results than your specified `--max-results` value, run the command again adding the returned `NextToken` value to get the next page of results.

```
aws cloudtrail list-event-data-stores
```

The following is an example response.

```
{
    "EventDataStores": [
        {
            "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLE-ee54-4813-92d5-999aeEXAMPLE",
            "Name": "my-event-data-store"
        }
    ]
}
```

Update an event data store

The following example AWS CLI `update-event-data-store` command updates an event data store to change its retention period to 100 days, and enable termination protection. The required `--event-data-store` parameter value is an ARN (or the ID suffix of the ARN) and is required; other parameters are optional. In this example, the `--retention-period` parameter is added to change the retention period to 100 days. Optionally, you can choose to enable AWS Key Management Service encryption and specify an AWS KMS key by adding `--kms-key-id` to the command, and specifying a KMS key ARN as the value. `--termination-protection-enabled` is added to enable termination protection on an event data store that did not have termination protection enabled.

An event data store that logs events from outside AWS cannot be updated to log AWS events. Similarly, an event data store that logs AWS events cannot be updated to log events from outside AWS.AWS

```
aws cloudtrail update-event-data-store
--retention-period 100
--kms-key-id "arn:aws:kms:us-east-1:0123456789:alias/KMS_key_alias"
--termination-protection-enabled
```

The following is an example response.

```
{
    "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:123456789012:eventdatastore/EXAMPLE-ee54-4813-92d5-999aeEXAMPLE",
    "Name": "my-event-data-store",
    "Status": "ENABLED",
    "KmsKeyId": "kms_key_ID",
    "AdvancedEventSelectors": [
        {
            "Name": "Select all S3 data events",
            "FieldSelectors": [
```

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Stop ingestion on an event data store

The following example AWS CLI `stop-event-data-store-ingestion` command stops an event data store from ingesting events. To stop ingestion, the event data store Status must be ENABLED and the `eventCategory` must be Management, Data, or ConfigurationItem. The event data store is specified by `--event-data-store`, which accepts an event data store ARN, or the ID suffix of the ARN. After you run `stop-event-data-store-ingestion`, the state of the event data store changes to STOPPED_INGESTION.

The event data store does count towards your account maximum of ten event data stores when its state is STOPPED_INGESTION.

```
aws cloudtrail stop-event-data-store-ingestion
```

There is no response if the operation is successful.

Start ingestion on an event data store

The following example AWS CLI `start-event-data-store-ingestion` command starts event ingestion on an event data store. To start ingestion, the event data store Status must be STOPPED_INGESTION and the `eventCategory` must be Management, Data, or ConfigurationItem. The event data store is specified by `--event-data-store`, which accepts an event data store ARN, or the ID suffix of the ARN. After you run `start-event-data-store-ingestion`, the state of the event data store changes to ENABLED.

```
aws cloudtrail start-event-data-store-ingestion
```
Delete an event data store

The following example AWS CLI `delete-event-data-store` command disables the event data store specified by `--event-data-store`, which accepts an event data store ARN, or the ID suffix of the ARN. After you run `delete-event-data-store`, the final state of the event data store is PENDING_DELETION, and the event data store is automatically deleted after a wait period of seven days. `--no-termination-protection-enabled` must be set on the event data store; this operation cannot work if `--termination-protection-enabled` is set.

After you run `delete-event-data-store` on an event data store, you cannot run `list-queries`, `describe-query`, or `get-query-results` on queries that are using the disabled data store. The event data store does count towards your account maximum of ten event data stores when it is pending deletion.

```
aws cloudtrail delete-event-data-store
```

There is no response if the operation is successful.

Restore an event data store

The following example AWS CLI `restore-event-data-store` command restores an event data store that is pending deletion. The event data store is specified by `--event-data-store`, which accepts an event data store ARN or the ID suffix of the ARN. You can only restore a deleted event data store within the seven-day wait period after deletion.

```
aws cloudtrail restore-event-data-store
--event-data-store EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE
```

The response includes information about the event data store, including its ARN, advanced event selectors, and the status of restoration.

List all channels

To list all channels in your account, run the `list-channels` command. The following is an example.

```
aws cloudtrail list-channels
```

Update a channel

To update a channel's name or destination event data stores, run the `update-channel` command. The `--channel` parameter is required. You cannot update the source of a channel. The following is an example.

```
aws cloudtrail update-channel \
--channel aws:cloudtrail:us-east-1:123456789012:channel/EXAMPLE8-0558-4f7e-a06a-43968EXAMPLE \
--name "new-channel-name" \
--destinations '[{"Type": "EVENT_DATA_STORE", "Location": "EXAMPLEf852-4e8f-8bd1-bcf6cEXAMPLE"}, {"Type": "EVENT_DATA_STORE", "Location": "EXAMPLEg922-5n2l-3vz1-apqw8EXAMPLE"}]'
```
Delete a channel to delete an integration

To stop ingesting partner or other activity events outside AWS, delete the channel by running the `delete-channel` command. The ARN or channel ID (the ARN suffix) of the channel that you want to delete is required. The following is an example.

```bash
code
aws cloudtrail delete-channel
  --channel EXAMPLE8-0558-4f7e-a06a-43969EXAMPLE
```

Start a query

The following example AWS CLI `start-query` command runs a query on the event data store specified as an ID in the query statement and delivers the query results to a specified S3 bucket. The `--query-statement` parameter provides a SQL query, enclosed in single quotation marks. Optional parameters include `--delivery-s3uri`, to deliver the query results to a specified S3 bucket. For more information about the query language you can use in CloudTrail Lake, see CloudTrail Lake SQL constraints (p. 237).

```bash
code
aws cloudtrail start-query
  --query-statement 'SELECT eventID, eventTime FROM EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE LIMIT 10'
  --delivery-s3uri "s3://aws-cloudtrail-lake-query-results-123456789012-us-east-1"
```

The response is a QueryId string. To get the status of a query, run `describe-query` using the QueryId value returned by `start-query`. If the query is successful, you can run `get-query-results` to get results.

**Output**

```plaintext
{
  "QueryId": "EXAMPLE2-0add-4207-8135-2d8a4EXAMPLE"
}
```

**Note**

Queries that run for longer than one hour might time out. You can still get partial results that were processed before the query timed out. If you are delivering the query results to an S3 bucket using the optional `--delivery-s3uri` parameter, the bucket policy must grant CloudTrail permission to deliver query results to the bucket. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail Lake query results (p. 385).

Get metadata about a query

The following example AWS CLI `describe-query` command gets metadata about a query, including query run time in milliseconds, number of events scanned and matched, total number of bytes scanned, and query status. The `BytesScanned` value matches the number of bytes for which your account is billed for the query, unless the query is still running. If the query results were delivered to an S3 bucket, the response also provides the S3 URI and the delivery status.

You must specify a value for either the `--query-id` or the `--query-alias` parameter. Specifying the `--query-alias` parameter returns information about the last query run for the alias.

```bash
code
aws cloudtrail describe-query
  --query-id EXAMPLEd-17a7-47c3-a9a1-eccf7EXAMPLE
```

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The following is an example response.

```json
{
  "QueryId": "EXAMPLE2-0add-4207-8135-2d8a4EXAMPLE",
  "QueryString": "SELECT eventID, eventTime FROM EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE LIMIT 10",
  "QueryStatus": "RUNNING",
  "QueryStatistics": {
    "EventsMatched": 10,
    "EventsScanned": 1000,
    "BytesScanned": 35059,
    "ExecutionTimeInMillis": 3821,
    "CreationTime": "1598911142"
  }
}
```

**Get query results**

The following example AWS CLI `get-query-results` command gets event data results of a query. You must specify the `--query-id` returned by the `start-query` command. The `BytesScanned` value matches the number of bytes for which your account is billed for the query, unless the query is still running. Optional parameters include `--max-query-results`, to specify a maximum number of results that you want the command to return on a single page. If there are more results than your specified `--max-query-results` value, run the command again adding the returned `NextToken` value to get the next page of results.

```bash
aws cloudtrail get-query-results
--query-id EXAMPLE2-0add-4207-8135-2d8a4EXAMPLE
```

**Output**

```json
{
  "QueryStatus": "RUNNING",
  "QueryStatistics": {
    "ResultsCount": 244,
    "TotalResultsCount": 1582,
    "BytesScanned": 27044
  },
  "QueryResults": [
    {
      "key": "eventName",
      "value": "StartQuery"
    }
  ],
  "QueryId": "EXAMPLE2-0add-4207-8135-2d8a4EXAMPLE",
  "QueryString": "SELECT eventID, eventTime FROM EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE LIMIT 10",
  "NextToken": "20add42078135EXAMPLE"
}
```

**List all queries on an event data store**

The following example AWS CLI `list-queries` command returns a list of queries and query statuses on a specified event data store for the past seven days. You must specify an ARN or the ID suffix of an ARN value for `--event-data-store`. Optionally, to shorten the list of results, you can specify a time range, formatted as timestamps, by adding `--start-time` and `--end-time` parameters, and a `--query-status` value. Valid values for `QueryStatus` include QUEUED, RUNNING, FINISHED, FAILED, or CANCELLED.
list-queries also has optional pagination parameters. Use --max-results to specify a maximum number of results that you want the command to return on a single page. If there are more results than your specified --max-results value, run the command again adding the returned NextToken value to get the next page of results.

```bash
aws cloudtrail list-queries
--event-data-store EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE
--query-status CANCELLED
--start-time 1598384589
--end-time 1598384602
--max-results 10
```

**Output**

```json
{
  "Queries": [
    {
      "QueryId": "EXAMPLE2-0add-4207-8135-2d8a4EXAMPLE",
      "QueryStatus": "CANCELLED",
      "CreationTime": 1598911142
    },
    {
      "QueryId": "EXAMPLE2-4e89-9230-2127-5dr3aEXAMPLE",
      "QueryStatus": "CANCELLED",
      "CreationTime": 1598296624
    }
  ],
  "NextToken": "20add42078135EXAMPLE"
}
```

**Cancel a running query**

The following example AWS CLI cancel-query command cancels a query with a status of RUNNING. You must specify a value for --query-id. When you run cancel-query, the query status might show as CANCELLED even if the cancel-query operation is not yet finished.

**Note**

A canceled query can incur charges. Your account is still charged for the amount of data that was scanned before you canceled the query.

The following is a CLI example.

```bash
aws cloudtrail cancel-query
--query-id EXAMPLEd-17a7-47c3-a9a1-eccf7EXAMPLE
```

**Output**

```json
QueryId -> (string)
QueryStatus -> (string)
```

**CloudTrail Lake SQL constraints**

CloudTrail Lake queries are SQL strings. This section provides information about the supported functions, operators, and schemas.
Only SELECT statements are allowed. No query strings can change or mutate data.

CloudTrail Lake supports all valid Presto SQL SELECT statements, functions, and operators. For more information about the supported SQL functions and operators, see Functions and Operators on the Presto 0.280 documentation website.

The CloudTrail console provides a number of sample queries that can help you get started writing your own queries. For more information, see Viewing sample queries in the CloudTrail console (p. 206).

Topics
- Supported functions, condition and join operators (p. 238)
- Advanced, multi-table query support (p. 239)
- Supported schemas for event data stores (p. 239)

Supported functions, condition and join operators

Supported functions

CloudTrail Lake supports all Presto functions. For more information about the supported functions, see Functions and Operators on the Presto 0.280 documentation website.

CloudTrail Lake does not support the INTERVAL keyword.

Supported condition operators

The following are supported condition operators.

```
AND
OR
IN
NOT
IS (NOT) NULL
LIKE
BETWEEN
GREATEST
LEAST
IS DISTINCT FROM
IS NOT DISTINCT FROM
<
>
<=
>=
<>|!=
( (conditions ) #parenthesised conditions
```

Supported join operators

The following are the supported JOIN operators. For more information about running multi-table queries, see Advanced, multi-table query support (p. 239).

```
UNION
UNION ALL
EXCEPT
INTERSECT
LEFT JOIN
RIGHT JOIN
INNER JOIN
```
Advanced, multi-table query support

CloudTrail Lake supports advanced query language across multiple event data stores. Only queries that do not include sub-queries are supported.

- **UNION|UNION ALL|EXCEPT|INTERSECT** (p. 239)
- **LEFT|RIGHT|INNER JOIN** (p. 239)

To run your query, use the **start-query** command in the AWS CLI. The following is an example, using one of the sample queries in this section.

```bash
aws cloudtrail start-query
--query-statement "Select eventId, eventName from EXAMPLEf852-4e8f-8bd1-bcf6cEXAMPLE
UNION Select eventId, eventName from EXAMPLEg741-6y1x-9p3v-bnh6iEXAMPLE
UNION ALL Select eventId, eventName from EXAMPLEb529-4e8f9l3d-6m2z-lkp5sEXAMPLE ORDER BY eventId LIMIT 10;"
```

The response is a **QueryId** string. To get the status of a query, run **describe-query**, using the **QueryId** value returned by **start-query**. If the query is successful, you can run **get-query-results** to get results.

**UNION|UNION ALL|EXCEPT|INTERSECT**

This release adds **multi-table** queries, or queries that you can run across multiple event data stores. The following is an example query that uses **UNION** and **UNION ALL** to find events by their event ID and event name in three event data stores, EDS1, EDS2, and EDS3. The results are selected from each event data store first, then results are concatenated, ordered by event ID, and limited to ten events.

```sql
Select eventId, eventName from EDS1
UNION
Select eventId, eventName from EDS2
UNION ALL
Select eventId, eventName from EDS3
ORDER BY eventId LIMIT 10;
```

**LEFT|RIGHT|INNER JOIN**

This release adds **multi-table** queries, or queries that you can run across multiple event data stores. The following is an example query that uses **LEFT JOIN** to find all events from an event data store named eds2, mapped to edsB, that match those in a primary (left) event data store, edsA. The returned events occur on or before January 1, 2020, and only the event names are returned.

```sql
SELECT edsA.eventName, edsB.eventName, element_at(edsA.map, 'test')
FROM eds1 as edsA
LEFT JOIN eds2 as edsB
ON edsA.eventId = edsB.eventId
WHERE edsA.eventtime <= '2020-01-01'
ORDER BY edsB.eventName;
```

**Supported schemas for event data stores**

The following sections provide the supported SQL schema for each event data store type.

**Topics**
Supported schema for CloudTrail event record fields

The following is the valid SQL schema for CloudTrail event record fields. For more information about CloudTrail event record fields, see CloudTrail record contents (p. 422).

```
[  
  
  {  
    "Name": "eventversion",  
    "Type": "string"  
  },  

  {  
    "Name": "useridentity",  
    "Type":  
    "struct<type:string,principalid:string,arn:string,accountid:string,accesskeyid:string,  
    username:string,sessioncontext:struct<attributes:struct<creationdate:timestamp,  
    mfaauthenticated:string>,sessionissuer:struct<type:string,principalid:string,arn:string,  
    accountid:string,username:string>,webidfederationdata:struct<federatedprovider:string,  
    attributes:map<string,string>>,sourceidentity:string,ec2roledelivery:string,  
    ec2issuedinvpc:string>,invokedby:string,identityprovider:string>"  
  },  

  {  
    "Name": "eventtime",  
    "Type": "timestamp"  
  },  

  {  
    "Name": "eventsource",  
    "Type": "string"  
  },  

  {  
    "Name": "eventname",  
    "Type": "string"  
  },  

  {  
    "Name": "awsregion",  
    "Type": "string"  
  },  

  {  
    "Name": "sourceipaddress",  
    "Type": "string"  
  },  

  {  
    "Name": "useragent",  
    "Type": "string"  
  },  

  {  
    "Name": "errorcode",  
    "Type": "string"  
  },  

  {  
    "Name": "errormessage",  
    "Type": "string"  
  }  
]
```
Supported schemas for event data stores

```
"Name": "requestparameters",
"Type": "map<string,string>"
},
{"Name": "responseelements",
"Type": "map<string,string>"
},
{"Name": "additionaleventdata",
"Type": "map<string,string>"
},
{"Name": "requestid",
"Type": "string"
},
{"Name": "eventid",
"Type": "string"
},
{"Name": "readonly",
"Type": "boolean"
},
{"Name": "resources",
"Type": "array<struct<accountid:string,type:string,arn:string,arnprefix:string>>"
},
{"Name": "eventtype",
"Type": "string"
},
{"Name": "apiversion",
"Type": "string"
},
{"Name": "managementevent",
"Type": "boolean"
},
{"Name": "recipientaccountid",
"Type": "string"
},
{"Name": "sharedeventid",
"Type": "string"
},
{"Name": "annotation",
"Type": "string"
},
{"Name": "vpcendpointid",
"Type": "string"
},
{"Name": "serviceeventdetails",
"Type": "map<string,string>"
},
{"Name": "addendum",
"Type": "map<string,string>"
},
{"Name": "edgedevicedetails",
"Type": "map<string,string>"
```

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Supported schema for AWS Config configuration item record fields

The following is the valid SQL schema for configuration item record fields. For configuration items, the value of eventcategory is ConfigurationItem, and the value of eventtype is AwsConfigurationItem.
Supported schema for AWS Audit Manager evidence record fields

The following is the valid SQL schema for Audit Manager evidence record fields. For Audit Manager evidence record fields, the value of eventcategory is Evidence, and the value of eventtype is AwsAuditManagerEvidence. For more information about aggregating evidence in CloudTrail Lake using Audit Manager, see Evidence finder in the AWS Audit Manager User Guide.

```json
[
    {
        "Name": "eventversion",
        "Type": "string"
    },
    {
        "Name": "eventcategory",
        "Type": "string"
    },
    {
        "Name": "eventtype",
        "Type": "string"
    },
    {
        "Name": "eventid",
        "Type": "string"
    },
    {
        "Name": "eventtime",
        "Type": "timestamp"
    },
    {
        "Name": "awsregion",
        "Type": "string"
    },
    {
        "Name": "recipientaccountid",
        "Type": "string"
    },
    {
        "Name": "addendum",
        "Type": "map<string,string>"
    },
    {
        "Name": "eventdata",
        "Type": "struct<attributes:map<string,string>,awsaccountid:string,awsorganization:string,
```
Supported schema for non-AWS event fields

The following is the valid SQL schema for non-AWS events. For non-AWS events, the value of eventcategory is ActivityAuditLog, and the value of eventtype is ActivityLog.

```json
[
  {
    "Name": "eventversion",
    "Type": "string"
  },
  {
    "Name": "eventcategory",
    "Type": "string"
  },
  {
    "Name": "eventtype",
    "Type": "string"
  },
  "Name": "eventid",
  "Type": "string"
},
  {
    "Name": "eventtime",
    "Type": "timestamp"
  },
  {
    "Name": "awsregion",
    "Type": "string"
  },
  {
    "Name": "recipientaccountid",
    "Type": "string"
  },
  {
    "Name": "addendum",
    "Type": "struct<reason:string,updatedfields:string,originalUID:string,originaleventid:string>"
  },
  {
    "Name": "metadata",
    "Type": "struct<ingestiontime:string,channelarn:string>"
  },
  {
    "Name": "eventdata",
    "Type": "struct<version:string,useridentity:struct<type:string,principalid:string,details:map<string,string>>,useragent:string,eventsource:string,eventname:string,eventtime:string,uid:string,requestparameters:map<string,string>>",
```
### Supported CloudWatch metrics

CloudTrail Lake supports Amazon CloudWatch metrics. CloudWatch is a monitoring service for AWS resources. You can use CloudWatch to collect and track metrics, set alarms, and automatically react to changes in your AWS resources.

The AWS/CloudTrail namespace includes the following metrics for CloudTrail Lake.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>HourlyDataIngested</td>
<td>The amount of data ingested into the event data store during the last hour.</td>
<td>Bytes</td>
</tr>
<tr>
<td></td>
<td>This metric is updated every hour.</td>
<td></td>
</tr>
<tr>
<td>TotalDataRetained</td>
<td>The amount of data retained in the event data store during its entire retention period.</td>
<td>Bytes</td>
</tr>
<tr>
<td></td>
<td>This metric is updated nightly.</td>
<td></td>
</tr>
</tbody>
</table>

For more information about CloudWatch metrics, see the following topics.

- [Using Amazon CloudWatch metrics](#)
- [Using Amazon CloudWatch alarms](#)
Working with CloudTrail log files

You can perform more advanced tasks with your CloudTrail files.

• Create multiple trails per Region.
• Monitor CloudTrail log files by sending them to CloudWatch Logs.
• Share log files between accounts.
• Use the AWS CloudTrail Processing Library to write log processing applications in Java.
• Validate your log files to verify that they have not changed after delivery by CloudTrail.

When an event occurs in your account, CloudTrail evaluates whether the event matches the settings for your trails. Only events that match your trail settings are delivered to your Amazon S3 bucket and Amazon CloudWatch Logs log group.

You can configure multiple trails differently so that the trails process and log only the events that you specify. For example, one trail can log read-only data and management events, so that all read-only events are delivered to one S3 bucket. Another trail can log only write-only data and management events, so that all write-only events are delivered to a separate S3 bucket.

You can also configure your trails to have one trail log and deliver all management events to one S3 bucket, and configure another trail to log and deliver all data events to another S3 bucket.

You can configure your trails to log the following:

• **Data events (p. 256)**: These events provide visibility into the resource operations performed on or within a resource. These are also known as data plane operations.

• **Management events (p. 249)**: Management events provide visibility into management operations that are performed on resources in your AWS account. These are also known as control plane operations. Management events can also include non-API events that occur in your account. For example, when a user logs in to your account, CloudTrail logs the ConsoleLogin event. For more information, see [Non-API events captured by CloudTrail (p. 450)].

  **Note**
  Not all AWS services support CloudTrail events. For more information about supported services, see [CloudTrail supported services and integrations (p. 27)]. For specific details about what APIs are logged for a specific service, see that service’s documentation in [CloudTrail supported services and integrations (p. 27)].

• **Insights events (p. 285)**: Insights events capture unusual activity that is detected in your account. If you have Insights events enabled, and CloudTrail detects unusual activity, Insights events are logged to the destination S3 bucket for your trail, but in a different folder. You can also see the type of Insights event and the incident time period when you view Insights events on the CloudTrail console. Unlike other types of events captured in a CloudTrail trail, Insights events are logged only when CloudTrail detects changes in your account’s API usage that differ significantly from the account’s typical usage patterns.

  Insights events are generated only for [write] management APIs.

**Topics**

• [Create multiple trails (p. 247)]
Create multiple trails

You can use CloudTrail log files to troubleshoot operational or security issues in your AWS account. You can create trails for different users, who can create and manage their own trails. You can configure trails to deliver log files to separate S3 buckets or shared S3 buckets.

**Note**
Creating multiple trails will incur additional costs. For more information, see [AWS CloudTrail Pricing](#).

For example, you might have the following users:

- A security administrator creates a trail in the Europe (Ireland) Region and configures KMS log file encryption. The trail delivers the log files to an S3 bucket in the Europe (Ireland) Region.
- An IT auditor creates a trail in the Europe (Ireland) Region and configures log file integrity validation to ensure the log files have not changed since CloudTrail delivered them. The trail is configured to deliver log files to an S3 bucket in the Europe (Frankfurt) Region.
- A developer creates a trail in the Europe (Frankfurt) Region and configures CloudWatch alarms to receive notifications for specific API activity. The trail shares the same S3 bucket as the trail configured for log file integrity.
- Another developer creates a trail in the Europe (Frankfurt) Region and configures SNS. The log files are delivered to a separate S3 bucket in the Europe (Frankfurt) Region.

The following image illustrates this example.
Note
You can create up to five trails per AWS Region. A trail that logs activity from all Regions counts as one trail per Region.

You can use resource-level permissions to manage a user's ability to perform specific operations on CloudTrail.

For example, you might grant one user permission to view trail activity, but restrict the user from starting or stopping logging for a trail. You might grant another user full permission to create and delete trails. This gives you granular control over your trails and user access.

For more information about resource-level permissions, see Examples: Creating and applying policies for actions on specific trails (p. 369).

For more information about multiple trails, see the following resources:
- How does CloudTrail behave regionally and globally? (p. 16)
- CloudTrail FAQs
Logging management events

By default, trails log management events and don't include data or Insights events.

By default, event data stores log management events and don't include data events. Event data stores do not currently support Insights events.

Additional charges apply for data or Insights events. For more information, see AWS CloudTrail Pricing.

Contents

• Management events (p. 249)
  • Logging management events with the AWS Management Console (p. 249)
• Read and write events (p. 250)
• Logging events with the AWS Command Line Interface (p. 251)
  • Examples: Logging management events for trails (p. 251)
  • Examples: Logging management events for event data stores (p. 253)
• Logging events with the AWS SDKs (p. 256)
• Sending events to Amazon CloudWatch Logs (p. 256)

Management events

Management events provide visibility into management operations that are performed on resources in your AWS account. These are also known as control plane operations. Example management events include:

• Configuring security (for example, IAM AttachRolePolicy API operations)
• Registering devices (for example, Amazon EC2 CreateDefaultVpc API operations)
• Configuring rules for routing data (for example, Amazon EC2 CreateSubnet API operations)
• Setting up logging (for example, AWS CloudTrail CreateTrail API operations)

Management events can also include non-API events that occur in your account. For example, when a user logs in to your account, CloudTrail logs the ConsoleLogin event. For more information, see Non-API events captured by CloudTrail (p. 450). For a list of supported management events that CloudTrail logs for AWS services, see CloudTrail supported services and integrations (p. 27).

By default, trails and event data stores are configured to log management events. For a list of supported management events that CloudTrail logs for AWS services, see CloudTrail supported services and integrations (p. 27).

Note

The CloudTrail Event history feature supports only management events. Not all management events are supported in event history. You cannot exclude AWS KMS or Amazon RDS Data API events from Event history; settings that you apply to a trail or event data store do not apply to Event history. For more information, see Viewing events with CloudTrail Event history (p. 57).

Logging management events with the AWS Management Console

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. To update a trail, open the Trails page of the CloudTrail console and choose the trail name.

To update an event data store, open the Event data stores page of the CloudTrail console and choose the event data store name.

3. For Management events, choose Edit.

- Choose if you want your trail or event data store to log Read events, Write events, or both.
- Choose Exclude AWS KMS events to filter AWS Key Management Service (AWS KMS) events out of your trail or event data store. The default setting is to include all AWS KMS events.

The option to log or exclude AWS KMS events is available only if you log management events on your trail or event data store. If you choose not to log management events, AWS KMS events are not logged, and you cannot change AWS KMS event logging settings.

AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a large volume (more than 99%) of events. These actions are now logged as Read events. Low-volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which typically account for less than 0.5% of AWS KMS event volume) are logged as Write events.

To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still log relevant events such as Disable, Delete and ScheduleKey, choose to log Write management events, and clear the check box for Exclude AWS KMS events.

- Choose Exclude Amazon RDS Data API events to filter Amazon Relational Database Service Data API events out of your trail or event data store. The default setting is to include all Amazon RDS Data API events. For more information about Amazon RDS Data API events, see Logging Data API calls with AWS CloudTrail in the Amazon RDS User Guide for Aurora.

Choose Save changes when you are finished.

Read and write events

When you configure your trail or event data store to log management events, you can specify whether you want read-only events, write-only events, or both.

- Read
  
  Read-only events include API operations that read your resources, but don't make changes. For example, read-only events include the Amazon EC2 DescribeSecurityGroups and DescribeSubnets API operations. These operations return only information about your Amazon EC2 resources and don't change your configurations.

- Write
  
  Write-only events include API operations that modify (or might modify) your resources. For example, the Amazon EC2 RunInstances and TerminateInstances API operations modify your instances.

Example: Logging read and write events for separate trails

The following example shows how you can configure trails to split log activity for an account into separate S3 buckets: one bucket receives read-only events and a second bucket receives write-only events.

1. You create a trail and choose an S3 bucket named read-only-bucket to receive log files. You then update the trail to specify that you want Read management events.

2. You create a second trail and choose an S3 bucket named write-only-bucket to receive log files. You then update the trail to specify that you want Write management events.
3. The Amazon EC2 DescribeInstances and TerminateInstances API operations occur in your account.
4. The DescribeInstances API operation is a read-only event and it matches the settings for the first trail. The trail logs and delivers the event to the read-only-bucket.
5. The TerminateInstances API operation is a write-only event and it matches the settings for the second trail. The trail logs and delivers the event to the write-only-bucket.

Logging events with the AWS Command Line Interface

You can configure your trails or event data stores to log management events using the AWS CLI.

Topics
- Examples: Logging management events for trails (p. 251)
- Examples: Logging management events for event data stores (p. 253)

Examples: Logging management events for trails

To view whether your trail is logging management events, run the `get-event-selectors` command.

```
aws cloudtrail get-event-selectors --trail-name TrailName
```

The following example returns the default settings for a trail. By default, trails log all management events, log events from all event sources, and don’t log data events.

```
{
    "TrailARN": "arn:aws:clouddtrail:us-east-1:111122223333:trail/TrailName",
    "AdvancedEventSelectors": [
        {
            "Name": "Management events selector",
            "FieldSelectors": [
                {
                    "Field": "eventCategory",
                    "Equals": [
                        "Management"
                    ]
                }
            ]
        }
    ]
}
```

To configure your trail to log management events, run the `put-event-selectors` command. The following example shows how to configure your trail to include all management events for two S3 objects. You can specify from 1 to 5 event selectors for a trail. You can specify from 1 to 250 data resources for a trail.

*Note*

The maximum number of S3 data resources is 250, regardless of the number of event selectors.

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[[ "ReadWriteType": "All", "IncludeManagementEvents":true, "DataResources": [[ "Type": "AWS::S3::Object", "Values": ["arn:aws:s3:::mybucket/prefix", "arn:aws:s3:::mybucket2/prefix2"] ]] ]]
```
The following example returns the event selector configured for the trail.

```
{
    "TrailARN": "arn:aws:cloudtrail:us-east-1:111122223333:trail/TrailName",
    "EventSelectors": [
        {
            "ReadWriteType": "All",
            "IncludeManagementEvents": true,
            "DataResources": [
                {
                    "Type": "AWS::S3::Object",
                    "Values": [
                        "arn:aws:s3:::mybucket/prefix",
                        "arn:aws:s3:::mybucket2/prefix2"
                    ]
                }
            ],
            "ExcludeManagementEventSources": []
        }
    ]
}
```

To exclude AWS Key Management Service (AWS KMS) events from a trail's logs, run the `put-event-selectors` command and add the attribute `ExcludeManagementEventSources` with a value of `kms.amazonaws.com`. The following example creates an event selector for a trail named `TrailName` to include read-only and write-only management events, but exclude AWS KMS events. Because AWS KMS can generate a high volume of events, the user in this example might want to limit events to manage the cost of a trail.

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "All","ExcludeManagementEventSources": ["kms.amazonaws.com"],"IncludeManagementEvents": true]]'
```

The example returns the event selector configured for the trail.

```
{
    "TrailARN": "arn:aws:cloudtrail:us-east-1:111122223333:trail/TrailName",
    "EventSelectors": [
        {
            "ReadWriteType": "All",
            "IncludeManagementEvents": true,
            "DataResources": [],
            "ExcludeManagementEventSources": ["kms.amazonaws.com"
        }
    ]
}
```

To exclude Amazon RDS Data API events from a trail's logs, run the `put-event-selectors` command and add the attribute `ExcludeManagementEventSources` with a value of `rdsdata.amazonaws.com`. The following example creates an event selector for a trail named `TrailName` to include read-only and write-only management events, but exclude Amazon RDS Data API events. Because Amazon RDS Data API can generate a high volume of events, the user in this example might want to limit events to manage the cost of a trail.

```
{
    "TrailARN": "arn:aws:cloudtrail:us-east-1:111122223333:trail/TrailName",
    "EventSelectors": [
        {
            "ReadWriteType": "All",
            "IncludeManagementEvents": true,
            "DataResources": [],
            "ExcludeManagementEventSources": []
        }
    ]
}
```
To start logging AWS KMS or Amazon RDS Data API events to a trail again, pass an empty string as the value of `ExcludeManagementEventSources`, as shown in the following command.

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "All","ExcludeManagementEventSources": [],"IncludeManagementEvents": true}}]
```

To log relevant AWS KMS events to a trail like `Disable`, `Delete` and `ScheduleKey`, but exclude high-volume AWS KMS events like `Encrypt`, `Decrypt`, and `GenerateDataKey`, log write-only management events, and keep the default setting to log AWS KMS events, as shown in the following example.

```
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors '[["ReadWriteType": "WriteOnly","ExcludeManagementEventSources": [],"IncludeManagementEvents": true}}]
```

### Examples: Logging management events for event data stores

To view whether your event data store includes management events, run the `get-event-data-store` command.

```
```

The following is an example response. Creation and last updated times are in timestamp format.

```
{
    "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:12345678910:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE",
    "Name": "myManagementEvents",
    "Status": "ENABLED",
    "AdvancedEventSelectors": [
        {
            "Name": "Management events selector",
            "FieldSelectors": [
                {
                    "Field": "eventCategory",
                    "Equals": [
                        "Management"
                    ]
                }
            ]
        }
    ],
    "MultiRegionEnabled": true,
    "OrganizationEnabled": false,
    "RetentionPeriod": 2557,
    "TerminationProtectionEnabled": true,
    "CreatedTimestamp": "2023-01-04T15:27:418000+00:00",
    "UpdatedTimestamp": "2023-01-04T15:27:544000+00:00"
}
```
To create an event data store that includes all management events, you run the `create-event-data-store` command. You do not need to specify any advanced event selectors to include all management events.

```bash
aws cloudtrail create-event-data-store
--name my-event-data-store
--retention-period 90
```

The following is an example response.

```json
{
  "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:12345678910:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE",
  "Name": "my-event-data-store",
  "Status": "CREATED",
  "AdvancedEventSelectors": [
    {
      "Name": "Default management events",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": ["Management"]
        }
      ]
    }
  ],
  "MultiRegionEnabled": true,
  "OrganizationEnabled": false,
  "RetentionPeriod": 90,
  "TerminationProtectionEnabled": true,
  "CreatedTimestamp": "2023-02-13T16:41:57.224000+00:00",
  "UpdatedTimestamp": "2023-02-13T16:41:57.357000+00:00"
}
```

To create an event data store that excludes AWS Key Management Service (AWS KMS) events, run the `create-event-data-store` command and specify that `eventSource` does not equal `kms.amazonaws.com`. The following example creates an event data store that includes read-only and write-only management events, but excludes AWS KMS events.

```bash
aws cloudtrail create-event-data-store --name event-data-store-name --retention-period 90
--advanced-event-selectors '[
  "Name": "Management events selector",
  "FieldSelectors": [
    {
      "Field": "eventCategory",
      "Equals": ["Management"]
    },
    {
      "Field": "eventSource",
      "NotEquals": ["kms.amazonaws.com"]
    }
  ]'
```

The following is an example response.

```json
{
  "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:12345678910:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE",
  "Name": "event-data-store-name",
  "Status": "CREATED",
  "AdvancedEventSelectors": [
    {
      "Name": "Management events selector",
      "FieldSelectors": [...
```

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To create an event data store that excludes Amazon RDS Data API events, run the `create-event-data-store` command and specify that `eventSource` does not equal `rdsdata.amazonaws.com`. The following example creates an event data store that includes read-only and write-only management events, but excludes Amazon RDS Data API events.

```
aws cloudtrail create-event-data-store --name event-data-store-name --retention-period 90
--advanced-event-selectors '[
    { "Name": "Management events selector",
      "FieldSelectors": [
        { "Field": "eventCategory", "Equals": [ "Management" ] },
        { "Field": "eventSource", "NotEquals": [ "rdsdata.amazonaws.com" ] }
      ]
    }
]
```

The following is an example response.

```
{
  "EventDataStoreArn": "arn:aws:cloudtrail:us-east-1:12345678910:eventdatastore/EXAMPLE-f852-4e8f-8bd1-bcf6cEXAMPLE",
  "Name": "event-data-store-name",
  "Status": "CREATED",
  "AdvancedEventSelectors": [
    { "Name": "Management events selector",
      "FieldSelectors": [
        { "Field": "eventCategory", "Equals": [ "Management" ] }
      ]
    },
    { "Field": "eventSource", "NotEquals": [ "rdsdata.amazonaws.com" ] }
  ]
}
```
Logging events with the AWS SDKs

Use the `GetEventSelectors` operation to see whether your trail is logging management events for a trail. You can configure your trails to log management events with the `PutEventSelectors` operation. For more information, see the AWS CloudTrail API Reference.

Run the `GetEventDataStore` operation to see whether your event data store includes management events. You can configure your event data stores to include management events by running the `CreateEventDataStore` or `UpdateEventDataStore` operations and specifying advanced event selectors. For more information, see Managing CloudTrail Lake by using the AWS CLI (p. 224) and the AWS CloudTrail API Reference.

Sending events to Amazon CloudWatch Logs

CloudTrail supports sending data and management events to CloudWatch Logs. When you configure your trail to send events to your CloudWatch Logs log group, CloudTrail sends only the events that you specify in your trail. For example, if you configure your trail to log management events only, your trail delivers management events only to your CloudWatch Logs log group. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

Logging data events

By default, trails and event data stores do not log data events. Additional charges apply for data events. For more information, see AWS CloudTrail Pricing.

**Note**

The events that are logged by your trails are available in Amazon EventBridge. For example, if you choose to log data events for S3 objects but not management events, your trail processes and logs only data events for the specified S3 objects. The data events for these S3 objects are available in Amazon EventBridge. For more information, see Events from AWS services in the Amazon EventBridge User Guide.

Contents

- Data events (p. 257)
  - Examples: Logging data events for Amazon S3 objects (p. 266)
  - Logging data events for S3 objects in other AWS accounts (p. 267)
- Read-only and write-only events (p. 268)
- Logging data events with the AWS Command Line Interface (p. 269)
  - Examples: Logging data events for trails (p. 269)
    - Log events by using basic event selectors (p. 269)
    - Log events by using advanced event selectors (p. 270)
    - Log all Amazon S3 events for a bucket by using advanced event selectors (p. 271)
    - Log Amazon S3 on AWS Outposts events by using advanced event selectors (p. 272)
Data events

Data events provide visibility into the resource operations performed on or within a resource. These are also known as data plane operations. Data events are often high-volume activities.

The following table shows the data event types available for trails and event data stores. The Data event type (console) column shows the appropriate selection in the console. The resources.Type column shows the resources.Type value that you would specify to include data events of that type in your trail or event data store.

For trails, you can use basic or advanced event selectors to log data events for Amazon S3 buckets and bucket objects, Lambda functions, and DynamoDB tables (shown in the first three rows of the table). You can use only advanced event selectors to log the data event types shown in the remaining rows.

For event data stores, you can use only advanced event selectors to include data events.

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Description</th>
<th>Data event type (console)</th>
<th>resources.Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon DynamoDB</td>
<td>Amazon DynamoDB object-level API activity on tables (for example, PutItem, DeleteItem, and UpdateItem API operations). For more information about DynamoDB events, see DynamoDB data plane events in CloudTrail.</td>
<td>DynamoDB</td>
<td>AWS::DynamoDB::Table</td>
</tr>
<tr>
<td>AWS Lambda</td>
<td>AWS Lambda function execution activity (the Invoke API).</td>
<td>Lambda</td>
<td>AWS::Lambda::Function</td>
</tr>
<tr>
<td>Amazon S3</td>
<td>Amazon S3 object-level API activity (for example, GetObject, DeleteObject, and PutObject API operations) on buckets and objects in buckets.</td>
<td>S3</td>
<td>AWS::S3::Object</td>
</tr>
<tr>
<td>AWS CloudTrail</td>
<td>CloudTrail PutAuditEvents activity on a CloudTrail Lake channel (p. 190) that is used to log</td>
<td>CloudTrail</td>
<td>AWS::CloudTrail::Channel</td>
</tr>
<tr>
<td><strong>AWS service</strong></td>
<td><strong>Description</strong></td>
<td><strong>Data event type (console)</strong></td>
<td><strong>resources.Type</strong></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Amazon CodeWhisperer</td>
<td>Amazon CodeWhisperer API activity on a profile.</td>
<td>CodeWhisperer</td>
<td>AWS::CodeWhisperer::Profile</td>
</tr>
<tr>
<td>Amazon Cognito</td>
<td>Amazon Cognito API activity on Amazon Cognito identity pools.</td>
<td>Cognito Identity Pools</td>
<td>AWS::Cognito::IdentityPool</td>
</tr>
<tr>
<td>Amazon DynamoDB</td>
<td><strong>Amazon DynamoDB</strong> API activity on streams.</td>
<td>DynamoDB Streams</td>
<td>AWS::DynamoDB::Stream</td>
</tr>
<tr>
<td>Amazon Elastic Block Store</td>
<td><strong>Amazon Elastic Block Store (EBS)</strong> direct APIs, such as PutSnapshotBlock, GetSnapshotBlock, and ListChangedBlocks on Amazon EBS snapshots.</td>
<td>Amazon EBS direct APIs</td>
<td>AWS::EC2::Snapshot</td>
</tr>
<tr>
<td>Amazon EMR</td>
<td>Amazon EMR API activity on a write-ahead log workspace.</td>
<td>EMR write-ahead log workspace</td>
<td>AWS::EMRWAL::Workspace</td>
</tr>
<tr>
<td>Amazon FinSpace</td>
<td><strong>Amazon FinSpace</strong> API activity on environments.</td>
<td>FinSpace</td>
<td>AWS::FinSpace::Environment</td>
</tr>
<tr>
<td>AWS service</td>
<td>Description</td>
<td>Data event type (console)</td>
<td>resources.Type</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>AWS Glue</td>
<td>AWS Glue API activity on tables that were created by Lake Formation.</td>
<td>Lake Formation</td>
<td>AWS::Glue::Table</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWS Glue data events for tables are currently supported only in the following regions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US East (N. Virginia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US East (Ohio)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• US West (Oregon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Europe (Ireland)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Asia Pacific (Tokyo) Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amazon GuardDuty</td>
<td>Amazon GuardDuty API activity for a <a href="https://example.com">detector</a></td>
<td>GuardDuty detector</td>
<td>AWS::GuardDuty::Detector</td>
</tr>
<tr>
<td>AWS HealthImaging</td>
<td>AWS HealthImaging API activity on data stores.</td>
<td>Medical Imaging data store</td>
<td>AWS::MedicalImaging::Datastore</td>
</tr>
<tr>
<td>Amazon Kendra Intelligent Ranking</td>
<td>Amazon Kendra Intelligent Ranking API activity on <a href="https://example.com">rescore execution plans</a></td>
<td>Kendra Ranking</td>
<td>AWS::KendraRanking::ExecutionPlan</td>
</tr>
<tr>
<td>Amazon Managed Blockchain</td>
<td>Amazon Managed Blockchain API activity on a network.</td>
<td>Managed Blockchain network</td>
<td>AWS::ManagedBlockchain::Network</td>
</tr>
<tr>
<td>Amazon Managed Blockchain</td>
<td><a href="https://example.com">Amazon Managed Blockchain</a> JSON-RPC calls on Ethereum nodes, such as <code>eth_getBalance</code> or <code>eth_getBlockByNumber</code>.</td>
<td>Managed Blockchain</td>
<td>AWS::ManagedBlockchain::Node</td>
</tr>
<tr>
<td>Amazon SageMaker</td>
<td>Amazon SageMaker API activity on feature stores.</td>
<td>SageMaker feature store</td>
<td>AWS::SageMaker::FeatureGroup</td>
</tr>
</tbody>
</table>
### AWS service

<table>
<thead>
<tr>
<th>AWS service</th>
<th>Description</th>
<th>Data event type (console)</th>
<th>resources.Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon SageMaker</td>
<td>Amazon SageMaker API activity on <a href="https://aws.amazon.com/sagemaker/">experiment trial components</a>.</td>
<td>SageMaker metrics experiment trial component</td>
<td>AWS::SageMaker::ExperimentTrialComponent</td>
</tr>
<tr>
<td>Amazon S3</td>
<td>Amazon S3 API activity on access points.</td>
<td>S3 Access Point</td>
<td>AWS::S3::AccessPoint</td>
</tr>
<tr>
<td>Amazon S3</td>
<td>Amazon S3 Object Lambda access points API activity, such as calls to CompleteMultipartUpload and GetObject.</td>
<td>S3 Object Lambda</td>
<td>AWS::S3ObjectLambda::AccessPoint</td>
</tr>
<tr>
<td>Amazon S3 on Outposts</td>
<td>Amazon S3 on Outposts object-level API activity.</td>
<td>S3 Outposts</td>
<td>AWS::S3Outposts::Object</td>
</tr>
<tr>
<td>AWS Systems Manager</td>
<td>AWS Systems Manager API activity on control channels.</td>
<td>Systems Manager</td>
<td>AWS::SSMMessages::ControlChannel</td>
</tr>
<tr>
<td>Amazon Verified Permissions</td>
<td>Amazon Verified Permissions API activity on a policy store.</td>
<td>Amazon Verified Permissions</td>
<td>AWS::VerifiedPermissions::PolicyStore</td>
</tr>
</tbody>
</table>

Data events are not logged by default when you create a trail or event data store. To record CloudTrail data events, you must explicitly add the supported resources or resource types for which you want to collect activity. For more information, see [Creating a trail](p. 85) and [Create an event data store](p. 169).

On a single-Region trail or event data store, you can log data events only for resources that you can access in that Region. Though S3 buckets are global, AWS Lambda functions and DynamoDB tables are regional.

Additional charges apply for logging data events. For CloudTrail pricing, see [AWS CloudTrail Pricing](https://aws.amazon.com/cloudtrail/pricing/).

Steps for logging data events depend on whether you have advanced event selectors enabled. You can use only advanced event selectors for event data stores. For trails, you can use either basic or advanced event selectors, but not both. Use the procedure in this section that matches the kind of event selectors you have enabled.

### Logging data events with basic event selectors in the AWS Management Console

Use the following procedure to log data events using basic event selectors.

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. Open the **Trails** page of the CloudTrail console and choose the trail name.
   
   **Note**  
   While you can edit an existing trail to log data events, as a best practice, consider creating a separate trail specifically for logging data events.

3. For **Data events**, choose **Edit**.
4. For Amazon S3 buckets:
a. For **Data event source**, choose **S3**.

b. You can choose to log **All current and future S3 buckets**, or you can specify individual buckets or functions. By default, data events are logged for all current and future S3 buckets.

   **Note**
   Keeping the default **All current and future S3 buckets** option enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail. It also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.

   If you are creating a trail for a single Region (done by using the AWS CLI), selecting the **Select all S3 buckets in your account** option enables data event logging for all buckets in the same Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

   c. If you leave the default, **All current and future S3 buckets**, choose to log **Read** events, **Write** events, or both.

d. To select individual buckets, empty the **Read** and **Write** check boxes for **All current and future S3 buckets**. In **Individual bucket selection**, browse for a bucket on which to log data events. To find specific buckets, type a bucket prefix for the bucket you want. You can select multiple buckets in this window. Choose **Add bucket** to log data events for more buckets. Choose to log **Read** events, such as **GetObject**, **Write** events, such as **PutObject**, or both.

   This setting takes precedence over individual settings you configure for individual buckets. For example, if you specify logging **Read** events for all S3 buckets, and then choose to add a specific bucket for data event logging, **Read** is already selected for the bucket you added. You cannot clear the selection. You can only configure the option for **Write**.

   To remove a bucket from logging, choose **X**.

5. To add another data type on which to log data events, choose **Add data event type**.

6. For Lambda functions:

   a. For **Data event source**, choose **Lambda**.

   b. In **Lambda function**, choose **All regions** to log all Lambda functions, or **Input function as ARN** to log data events on a specific function.

   To log data events for all Lambda functions in your AWS account, select **Log all current and future functions**. This setting takes precedence over individual settings you configure for individual functions. All functions are logged, even if all functions are not displayed.

   **Note**
   If you are creating a trail for all Regions, this selection enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions. Logging data events for all functions also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

   c. If you choose **Input function as ARN**, enter the ARN of a Lambda function.

   **Note**
   If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still select the option to log all functions, even if they are not displayed. If you want to log data
To add another data type on which to log data events, choose **Add data event type**.

7. To add another data type on which to log data events, choose **Add data event type**.

8. For DynamoDB tables:
   a. For **Data event source**, choose **DynamoDB**.
   b. In **DynamoDB table selection**, choose **Browse** to select a table, or paste in the ARN of a DynamoDB table to which you have access. A DynamoDB table ARN uses the following format:

   ```text
   arn:partition:dynamodb:region:account_ID:table/table_name
   ```

   To add another table, choose **Add row**, and browse for a table or paste in the ARN of a table to which you have access.

9. Choose **Save changes**.

### Logging data events with advanced event selectors in the AWS Management Console

In the AWS Management Console, if you have advanced event selectors enabled, you can choose from predefined templates that log all data events on a selected resource (Amazon S3 buckets or access points, Lambda functions, S3 objects on AWS Outposts, Ethereum for Managed Blockchain nodes, or S3 Object Lambda access points). After you choose a log selector template, you can customize the template to include only the data events you most want to see. For more information and tips about using advanced event selectors, see [Log events by using advanced event selectors](p. 270) in this topic.

1. On the **Dashboard**, ** Trails**, or **Event data stores** pages of the CloudTrail console, choose the trail or event data store you want to update.

   **Note**
   You can only enable data events on event data stores that contain CloudTrail events. You cannot enable data events on CloudTrail event data stores for AWS Config configuration items or non-AWS events.

2. On the details page, in **Data events**, choose **Edit**.

3. If you are not already logging data events, choose the **Data events** check box.

4. For **Data event type**, choose the resource type on which you want to log data events.

5. Choose a log selector template. CloudTrail includes predefined templates that log all data events for the resource type. To build a custom log selector template, choose **Custom**.

   **Note**
   Choosing a predefined template for S3 buckets enables data event logging for all buckets currently in your AWS account and any buckets you create after you finish creating the trail or event data store. It also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a bucket that belongs to another AWS account.

   If the trail or event data store applies only to one Region, choosing a predefined template that logs all S3 buckets enables data event logging for all buckets in the same Region as your trail or event data store and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

   If you are creating a trail or event data store for all Regions, choosing a predefined template for Lambda functions enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail or event data store. If you are creating a trail or event data store for a single Region (for trails, this only can be done by using the AWS CLI), this selection enables data event logging for specific functions, you can manually add a function if you know its ARN.

   You can also finish creating the trail in the console, and then use the AWS CLI and the **put-event-selectors** command to configure data event logging for specific Lambda functions. For more information, see [Managing trails with the AWS CLI](p. 111).
logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail or event data store. It does not enable data event logging for Lambda functions created in other Regions. Logging data events for all functions also enables logging of data event activity performed by any user or role in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

6. **Optional** In **Selector name**, enter a name to identify your selector. The selector name is a descriptive name for an advanced event selector, such as "Log data events for only two S3 buckets". The selector name is listed as Name in the advanced event selector and is viewable if you expand the JSON view.

7. In **Advanced event selectors**, build an expression for the specific resources on which you want to log data events. You can skip this step if you are using a predefined log template.

   a. Choose from the following fields. For fields that accept an array (more than one value), CloudTrail adds an OR between values.

      - **readOnly** - readOnly can be set to `Equals` a value of true or false. Read-only data events are events that do not change the state of a resource, such as `Get*` or `Describe*` events. Write events add, change, or delete resources, attributes, or artifacts, such as `Put*`, `Delete*`, or `Write*` events. To log both read and write events, don't add a readOnly selector.

      - **eventName** - `eventName` can use any operator. You can use it to include or exclude any data event logged to CloudTrail, such as `PutBucket`, `GetItem`, or `GetSnapshotBlock`. You can have multiple values for this field, separated by commas.

      - **resources.ARN** - You can use any operator with `resources.ARN`, but if you use `Equals` or `NotEquals`, the value must exactly match the ARN of a valid resource of the type you've specified in the template as the value of `resources.type`.

The following table shows the valid ARN format for each `resources.Type`.

<table>
<thead>
<tr>
<th>resources.Type</th>
<th>resources.ARN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS::DynamoDB::Table</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name</td>
</tr>
<tr>
<td>AWS::Lambda::Function</td>
<td>arn:partition:lambda:region:account_ID:function:function_name</td>
</tr>
<tr>
<td>AWS::S3::Object</td>
<td>arn:partition:s3::bucket_name/arn:partition:s3::bucket_name/object_or_file_name</td>
</tr>
<tr>
<td>AWS::CloudTrail::Channel</td>
<td>arn:partition:cloudtrail:region:account_ID:channel/channel_UUID</td>
</tr>
<tr>
<td>AWS::CodeWhisperer::Profile</td>
<td>arn:partition:codewhisperer:region:account_ID:profile/profile_ID</td>
</tr>
<tr>
<td>resources.Type</td>
<td>resources.ARN</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>AWS::DynamoDB::Stream</td>
<td>arn:partition:dynamodb:region:account_ID:table/table_name/stream/date_time</td>
</tr>
<tr>
<td>AWS::EC2::Snapshot</td>
<td>arn:partition:ec2:region:snapshot/snapshot_ID</td>
</tr>
<tr>
<td>AWS::EMRWAL::Workspace</td>
<td>arn:partition:emrwal:region:workspace/workspace_name</td>
</tr>
<tr>
<td>AWS::FinSpace::Environment</td>
<td>arn:partition:finspace:region:account_ID:environment/environment_ID</td>
</tr>
<tr>
<td>AWS::Glue::Table</td>
<td>arn:partition:glue:region:account_ID:table/database_name/table_name</td>
</tr>
<tr>
<td>AWS::GuardDuty::Detector</td>
<td>arn:partition:guardduty:region:account_ID:detector/detector_ID</td>
</tr>
<tr>
<td>AWS::ManagedBlockchain::Network</td>
<td>arn:partition:managedblockchain::networks/network_name</td>
</tr>
<tr>
<td>AWS::ManagedBlockchain::Node</td>
<td>arn:partition:managedblockchain:region:account_ID:nodes/node_ID</td>
</tr>
<tr>
<td>AWS::MedicalImaging::Datastore</td>
<td>arn:partition:medical-imaging:region:account_ID:datstore/data_store_ID</td>
</tr>
<tr>
<td>AWS::SageMaker::FeatureGroup</td>
<td>arn:partition:sagemaker:region:account_ID:feature-group/feature_group_name</td>
</tr>
<tr>
<td>AWS::SageMaker::ExperimentTrialComponent</td>
<td>arn:partition:sagemaker:region:account_ID:experiment-trial-component/experiment_trial_component_name</td>
</tr>
<tr>
<td>AWS::S3::AccessPoint²</td>
<td>arn:partition:s3:region:account_ID:accesspoint/access_point_name</td>
</tr>
<tr>
<td>AWS::S3ObjectLambda::AccessPoint</td>
<td>arn:partition:s3-object-lambda:region:account_ID:accesspoint/access_point_name</td>
</tr>
<tr>
<td>resources.Type</td>
<td>resources.ARN</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>AWS::S3Outposts::Object</td>
<td>arn:partition:s3-outposts:region:account_ID:object_path</td>
</tr>
<tr>
<td>AWS::SSM::Messages::ControlChannel</td>
<td>arn:partition:ssmmessages:region:account_ID:control-channel/control_channel_ID</td>
</tr>
<tr>
<td>AWS::VerifiedPermissions::PolicyStore</td>
<td>arn:partition:verifiedpermissions:region:account_ID:policy-store/policy_store_ID</td>
</tr>
</tbody>
</table>

1. To log all data events for all objects in a specific S3 bucket, use the `StartsWith` operator, and include only the bucket ARN as the matching value. The trailing slash is intentional; do not exclude it.

2. To log events on all objects in an S3 access point, we recommend that you use only the access point ARN, don't include the object path, and use the `StartsWith` or `NotStartsWith` operators.

For more information about the ARN formats of data event resources, see [Actions, resources, and condition keys](#) in the AWS Identity and Access Management User Guide.

b. For each field, choose **Conditions** to add as many conditions as you need, up to a maximum of 500 specified values for all conditions. For example, to exclude data events for two S3 buckets from data events that are logged on your trail or event data store, you can set the field to `resources.ARN`, set the operator for `NotStartsWith`, and then either paste in an S3 bucket ARN, or browse for the S3 buckets for which you do not want to log events.

To add the second S3 bucket, choose **Conditions**, and then repeat the preceding instruction, pasting in the ARN for or browsing for a different bucket.

**Note**

You can have a maximum of 500 values for all selectors on a trail or event data store. This includes arrays of multiple values for a selector such as `eventName`. If you have single values for all selectors, you can have a maximum of 500 conditions added to a selector.

If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail or event data store. You can still log all functions with a predefined selector template, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail or event data store in the console, and then use the AWS CLI to configure data event logging for specific Lambda functions. For more information, see [Logging data events with the AWS Command Line Interface](#) (p. 269).

c. Choose **Field** to add additional fields as required. To avoid errors, do not set conflicting or duplicate values for fields. For example, do not specify an ARN in one selector to be equal to a value, then specify that the ARN not equal the same value in another selector.

d. Save changes to your custom selector template by choosing **Next**. Do not choose another log selector template, or leave this page, or your custom selectors will be lost.

8. To add another data type on which to log data events, choose **Add data event type**. Repeat steps 4 through this step to configure advanced event selectors for the data event type.

9. After you choose **Next**, in Step 2: Choose log events, review the log selector template options you've chosen. Choose **Edit** to go back and make changes.
10. After you've reviewed and verified your choices, choose **Save changes** if this is an existing trail or event data store, or **Create trail** or **Create event data store** if you are creating a new trail or event data store.

**Examples: Logging data events for Amazon S3 objects**

**Logging data events for all S3 objects in an S3 bucket**

The following example demonstrates how logging works when you configure logging of all data events for an S3 bucket named `bucket-1`. In this example, the CloudTrail user specified an empty prefix, and the option to log both **Read** and **Write** data events.

1. A user uploads an object to `bucket-1`.
2. The `PutObject` API operation is an Amazon S3 object-level API. It is recorded as a data event in CloudTrail. Because the CloudTrail user specified an S3 bucket with an empty prefix, events that occur on any object in that bucket are logged. The trail processes and logs the event.
3. Another user uploads an object to `bucket-2`.
4. The `PutObject` API operation occurred on an object in an S3 bucket that wasn't specified for the trail. The trail doesn't log the event.

**Logging data events for specific S3 objects**

The following example demonstrates how logging works when you configure a trail to log events for specific S3 objects. In this example, the CloudTrail user specified an S3 bucket named `bucket-3`, with the prefix `my-images`, and the option to log only **Write** data events.

1. A user deletes an object that begins with the `my-images` prefix in the bucket, such as `arn:aws:s3:::bucket-3/my-images/example.jpg`.
2. The `DeleteObject` API operation is an Amazon S3 object-level API. It is recorded as a **Write** data event in CloudTrail. The event occurred on an object that matches the S3 bucket and prefix specified in the trail. The trail processes and logs the event.
3. Another user deletes an object with a different prefix in the S3 bucket, such as `arn:aws:s3:::bucket-3/my-videos/example.avi`.
4. The event occurred on an object that doesn't match the prefix specified in your trail. The trail doesn't log the event.
5. A user calls the `GetObject` API operation for the object, `arn:aws:s3:::bucket-3/my-images/example.jpg`.
6. The event occurred on a bucket and prefix that are specified in the trail, but `GetObject` is a read-type Amazon S3 object-level API. It is recorded as a **Read** data event in CloudTrail, and the trail is not configured to log **Read** events. The trail doesn't log the event.

**Note**

If you are logging data events for specific Amazon S3 buckets, we recommend you do not use an Amazon S3 bucket for which you are logging data events to receive log files that you have specified in the data events section. Using the same Amazon S3 bucket causes your trail or event data store to log a data event each time log files are delivered to your Amazon S3 bucket. Log files are aggregated events delivered at intervals, so this is not a 1:1 ratio of event to log file; the event is logged in the next log file. For example, when CloudTrail delivers logs, the `PutObject` event occurs on the S3 bucket. If the S3 bucket is also specified in the data events section, the trail processes and logs the `PutObject` event as a data event. That action is another `PutObject` event, and the trail processes and logs the event again. For more information, see **How CloudTrail works** (p. 1).
To avoid logging data events for the Amazon S3 bucket where you receive log files if you configure a trail to log all Amazon S3 data events in your AWS account, consider configuring delivery of log files to an Amazon S3 bucket that belongs to another AWS account. For more information, see Receiving CloudTrail log files from multiple accounts (p. 307).

Logging data events for S3 objects in other AWS accounts

When you configure your trail to log data events, you can also specify S3 objects that belong to other AWS accounts. When an event occurs on a specified object, CloudTrail evaluates whether the event matches any trails in each account. If the event matches the settings for a trail, the trail processes and logs the event for that account. Generally, both API callers and resource owners can receive events.

If you own an S3 object and you specify it in your trail, your trail logs events that occur on the object in your account. Because you own the object, your trail also logs events when other accounts call the object.

If you specify an S3 object in your trail, and another account owns the object, your trail only logs events that occur on that object in your account. Your trail doesn't log events that occur in other accounts.

Example: Logging data events for an Amazon S3 object for two AWS accounts

The following example shows how two AWS accounts configure CloudTrail to log events for the same S3 object.

1. In your account, you want your trail to log data events for all objects in your S3 bucket named owner-bucket. You configure the trail by specifying the S3 bucket with an empty object prefix.
2. Bob has a separate account that has been granted access to the S3 bucket. Bob also wants to log data events for all objects in the same S3 bucket. For his trail, he configures his trail and specifies the same S3 bucket with an empty object prefix.
3. Bob uploads an object to the S3 bucket with the PutObject API operation.
4. This event occurred in his account and it matches the settings for his trail. Bob's trail processes and logs the event.
5. Because you own the S3 bucket and the event matches the settings for your trail, your trail also processes and logs the same event. Because there are now two copies of the event (one logged in Bob's trail, and one logged in yours), CloudTrail charges for two copies of the data event.
6. You upload an object to the S3 bucket.
7. This event occurs in your account and it matches the settings for your trail. Your trail processes and logs the event.
8. Because the event didn't occur in Bob's account, and he doesn't own the S3 bucket, Bob's trail doesn't log the event. CloudTrail charges for only one copy of this data event.

Example: Logging data events for all buckets, including an S3 bucket used by two AWS accounts

The following example shows the logging behavior when Select all S3 buckets in your account is enabled for trails that collect data events in an AWS account.

1. In your account, you want your trail to log data events for all S3 buckets. You configure the trail by choosing Read events, Write events, or both for All current and future S3 buckets in Data events.
2. Bob has a separate account that has been granted access to an S3 bucket in your account. He wants to log data events for the bucket to which he has access. He configures his trail to get data events for all S3 buckets.
3. Bob uploads an object to the S3 bucket with the PutObject API operation.
4. This event occurred in his account and it matches the settings for his trail. Bob's trail processes and logs the event.
5. Because you own the S3 bucket and the event matches the settings for your trail, your trail also processes and logs the event. Because there are now two copies of the event (one logged in Bob's trail, and one logged in yours), CloudTrail charges each account for a copy of the data event.

6. You upload an object to the S3 bucket.

7. This event occurs in your account and it matches the settings for your trail. Your trail processes and logs the event.

8. Because the event didn't occur in Bob's account, and he doesn't own the S3 bucket, Bob's trail doesn't log the event. CloudTrail charges for only one copy of this data event in your account.

9. A third user, Mary, has access to the S3 bucket, and runs a GetObject operation on the bucket. She has a trail configured to log data events on all S3 buckets in her account. Because she is the API caller, CloudTrail logs a data event in her trail. Though Bob has access to the bucket, he is not the resource owner, so no event is logged in his trail this time. As the resource owner, you receive an event in your trail about the GetObject operation that Mary called. CloudTrail charges your account and Mary's account for each copy of the data event: one in Mary's trail, and one in yours.

Read-only and write-only events

When you configure your trail or event data store to log data and management events, you can specify whether you want read-only events, write-only events, or both.

- **Read**
  
  Read events include API operations that read your resources, but don't make changes. For example, read-only events include the Amazon EC2 DescribeSecurityGroups and DescribeSubnets API operations. These operations return only information about your Amazon EC2 resources and don't change your configurations.

- **Write**
  
  Write events include API operations that modify (or might modify) your resources. For example, the Amazon EC2 RunInstances and TerminateInstances API operations modify your instances.

Example: Logging read and write events for separate trails

The following example shows how you can configure trails to split log activity for an account into separate S3 buckets: one bucket receives read-only events and a second bucket receives write-only events.

1. You create a trail and choose an S3 bucket named read-only-bucket to receive log files. You then update the trail to specify that you want Read management events and data events.

2. You create a second trail and choose an S3 bucket named write-only-bucket to receive log files. You then update the trail to specify that you want Write management events and data events.

3. The Amazon EC2 DescribeInstances and TerminateInstances API operations occur in your account.

4. The DescribeInstances API operation is a read-only event and it matches the settings for the first trail. The trail logs and delivers the event to the read-only-bucket.

5. The TerminateInstances API operation is a write-only event and it matches the settings for the second trail. The trail logs and delivers the event to the write-only-bucket.
Logging data events with the AWS Command Line Interface

You can configure your trails or event data stores to log data events using the AWS CLI.

Topics
- Examples: Logging data events for trails (p. 269)
- Examples: Logging data events for event data stores (p. 282)

Examples: Logging data events for trails

You can configure your trails to log management and data events using the AWS CLI. To see whether your trail is logging management and data events, run the `get-event-selectors` command.

**Note**
Be aware that if your account is logging more than one copy of management events, you incur charges. There is always a charge for logging data events. For more information, see AWS CloudTrail Pricing.

```
aws cloudtrail get-event-selectors --trail-name TrailName
```

The command returns the default settings for a trail.

Topics
- Log events by using basic event selectors (p. 269)
- Log events by using advanced event selectors (p. 270)
- Log all Amazon S3 events for a bucket by using advanced event selectors (p. 271)
- Log Amazon S3 on AWS Outposts events by using advanced event selectors (p. 272)
- Log all data events by using advanced event selectors (p. 273)

Log events by using basic event selectors

The following is an example result of the `get-event-selectors` command showing basic event selectors. By default, when you create a trail by using the AWS CLI, a trail logs all management events. By default, trails do not log data events.

```
{
    "EventSelectors": [
        {
            "IncludeManagementEvents": true,
            "DataResources": [],
            "ReadWriteType": "All"
        }
    ]
}
```

To configure your trail to log management and data events, run the `put-event-selectors` command.

The following example shows how to use basic event selectors to configure your trail to include all management and data events for the S3 objects in two S3 bucket prefixes. You can specify from 1 to 5 event selectors for a trail. You can specify from 1 to 250 data resources for a trail.
Note
The maximum number of S3 data resources is 250, if you choose to limit data events by using basic event selectors.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --event-selectors
'[
  {
    "ReadWriteType": "All",
    "IncludeManagementEvents": true,
    "DataResources": [
      {
        "Type": "AWS::S3::Object",
        "Values": ["arn:aws:s3:::mybucket/prefix", "arn:aws:s3:::mybucket2/prefix2"]
      }
    ]
  }
]
```

The command returns the event selectors that are configured for the trail.

```json
{
  "EventSelectors": [
    {
      "IncludeManagementEvents": true,
      "DataResources": [
        {
          "Values": [
            "arn:aws:s3:::mybucket/prefix",
            "arn:aws:s3:::mybucket2/prefix2"
          ],
          "Type": "AWS::S3::Object"
        }
      ],
      "ReadWriteType": "All"
    }
  ]
}
```

Log events by using advanced event selectors

If you have opted to use advanced event selectors, the `get-event-selectors` command returns results similar to the following. By default, no advanced event selectors are configured for a trail.

```json
{
  "AdvancedEventSelectors": []
}
```

The following example shows how to use advanced event selectors to log all management events (both `readOnly` and `writeOnly`), and include PutObject and DeleteObject events for the S3 objects in the same two S3 bucket prefixes. As shown here, you can use advanced event selectors to select not only the S3 prefix names by ARN, but the names of the specific events that you want to log. You can add up to 500 conditions to advanced event selectors per trail, including all selector values. You can specify from 1 to 250 data resources for a trail.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --advanced-event-selectors
'[
  {
    "Name": "Log readOnly and writeOnly management events",
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Management"] }
    ]
  },
  {
    "Name": "Log PutObject and DeleteObject events for two S3 prefixes",
```
The result shows the advanced event selectors that are configured for the trail.

```json
{
  "AdvancedEventSelectors": [
    {
      "Name": "Log readOnly and writeOnly management events",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": ["Management"
        }]
    },
    {
      "Name": "Log PutObject and DeleteObject events for two S3 prefixes",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": ["Data"
        },
        {
          "Field": "resources.type",
          "Equals": ["AWS::S3::Object"
        },
        {
          "Field": "resources.ARN",
          "StartsWith": ["arn:aws:s3:::mybucket/prefix","arn:aws:s3:::mybucket2/prefix2"
        ]
      }]
    }
  ]
}
```

Log all Amazon S3 events for a bucket by using advanced event selectors

The following example shows how to configure your trail to include all data events for all Amazon S3 objects in a specific S3 bucket. The value for S3 events for the `resources.type` field is `AWS::S3::Object`. Because the ARN values for S3 objects and S3 buckets are slightly different, you must add the `StartsWith` operator for `resources.ARN` to capture all events.

```
aws cloudtrail put-event-selectors --trail-name TrailName --region region \
--advanced-event-selectors \
'[
  {
    "FieldSelectors": [
      { "Field": "eventCategory", "Equals": ["Data"] },
      { "Field": "resources.type", "Equals": ["AWS::S3::Object"] },
      { "Field": "eventName", "Equals": ["PutObject","DeleteObject"] },
      { "Field": "resources.ARN", "StartsWith": ["arn:aws:s3:::mybucket/prefix","arn:aws:s3:::mybucket2/prefix2"] }
    ]
  }
]'
```
Log Amazon S3 on AWS Outposts events by using advanced event selectors

The following example shows how to configure your trail to include all data events for all Amazon S3 on Outposts objects in your outpost.

```bash
aws cloudtrail put-event-selectors --trail-name TrailName --region region \\ --advanced-event-selectors \'
  [
    "Name": "OutpostsEventSelector",
    "FieldSelectors": [
      {
        "Field": "eventCategory",
        "Equals": ["Data"]
      },
      {
        "Field": "resources.type",
        "Equals": ["AWS::S3Outposts::Object"]
      }
    ]
  ]
'
```

The command returns the following example output.

```json

{
  "TrailARN": "arn:aws:cloudtrail:region:account_ID:trail/TrailName",
  "AdvancedEventSelectors": [
    {
      "Name": "OutpostsEventSelector",
      "FieldSelectors": [
        {
          "Field": "eventCategory",
          "Equals": ["Data"]
        },
        {
          "Field": "resources.type",
          "Equals": ["AWS::S3Outposts::Object"]
        }
      ]
    }
  ]
}
```
Log all data events by using advanced event selectors

The following example shows how to configure your trail to include data events for all S3 buckets, AWS Lambda functions, PutAuditEvents calls on CloudTrail Lake channels, DynamoDB tables, Amazon S3 on Outposts, Amazon Managed Blockchain JSON-RPC calls on Ethereum nodes, S3 Object Lambda access points, Amazon EBS direct APIs on EBS snapshots, S3 access points, DynamoDB streams, AWS Glue tables created by Lake Formation, Amazon FinSpace environments, Amazon SageMaker metrics experiment trial components, Amazon SageMaker feature stores, Amazon Kendra rescore execution plans, Amazon Cognito identity pools, Amazon GuardDuty detectors, Amazon EMR write-ahead log workspaces, Amazon CodeWhisperer profiles, Amazon Verified Permissions policy stores, AWS Systems Manager control channels, Amazon Managed Blockchain networks, and AWS HealthImaging data stores.

**Note**

If the trail applies only to one Region, only events in that Region are logged, even though the event selector parameters specify all Amazon S3 buckets and Lambda functions. In a single-Region trail, event selectors apply only to the Region where the trail is created.

```
aws cloudtrail put-event-selectors --trail-name TrailName \
--advanced-event-selectors '  
[  
  {  
    "Name": "Log all events for all Amazon S3 buckets",  
    "FieldSelectors": [  
      {  
        "Field": "eventCategory",  
        "Equals": ["Data"]  
      },  
      {  
        "Field": "resources.type",  
        "Equals": ["AWS::S3::Object"]  
      }  
    ]  
  },  
  {  
    "Name": "Log all events for Lambda functions",  
    "FieldSelectors": [  
      {  
        "Field": "eventCategory",  
        "Equals": ["Data"]  
      },  
      {  
        "Field": "resources.type",  
        "Equals": ["AWS::Lambda::Function"]  
      }  
    ]  
  },  
  {  
    "Name": "Log all events for DynamoDB tables",  
    "FieldSelectors": [  
      {  
        "Field": "eventCategory",  
        "Equals": ["Data"]  
      },  
      {  
        "Field": "resources.type",  
        "Equals": ["AWS::DynamoDB::Table"]  
      }  
    ]  
  },  
  {  
    "Name": "OutpostsEventSelector",  
    "FieldSelectors": [  
      {  
        "Field": "eventCategory",  
        "Equals": ["Data"]  
      },  
      {  
        "Field": "resources.type",  
        "Equals": ["AWS::S3Outposts::Object"]  
      }  
    ]  
  }  
]'
```
"Name": "Log all CloudTrail PutAuditEvents activity on a CloudTrail Lake channel",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::CloudTrail::Channel"] }
],

"Name": "Log all events for Amazon S3 on Outposts",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3Outposts::Object"] }
],

"Name": "Log all JSON-RPC calls for Ethereum nodes in Amazon Managed Blockchain",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::ManagedBlockchain::Node"] }
],

"Name": "Log all events for Amazon S3 Object Lambda access points",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3ObjectLambda::AccessPoint"] }
],

"Name": "Log all Amazon EBS direct API calls on snapshots",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::EC2::Snapshot"] }
],

"Name": "Log all events for Amazon S3 access points",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::S3::AccessPoint"] }
],

"Name": "Log all events for DynamoDB streams",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::DynamoDB::Stream"] }
],

"Name": "Log all events for AWS Glue tables created by Lake Formation",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::Glue::Table"] }
],

"Name": "Log all events for FinSpace environments",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::FinSpace::Environment"] }
],

"Name": "Log all events for SageMaker metrics experiment trial components",
"FieldSelectors": [
  { "Field": "eventCategory", "Equals": ["Data"] },
  { "Field": "resources.type", "Equals": ["AWS::SageMaker::TrialComponent"] }
]
{ "Name": "Log all events for SageMaker feature stores",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::SageMaker::FeatureGroup"] }  
],  
},  
{ "Name": "Log all events for Amazon Kendra Intelligent Ranking rescore execution plans",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::KendraRanking::ExecutionPlan"] }  
],  
},  
{ "Name": "Log all events for Amazon Cognito identity pools",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::Cognito::IdentityPool"] }  
],  
},  
{ "Name": "Log all events for an Amazon GuardDuty detector",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::GuardDuty::Detector"] }  
],  
},  
{ "Name": "Log all events for Amazon EMR write-ahead log workspaces",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::EMRWAL::Workspace"] }  
],  
},  
{ "Name": "Log all events for Amazon CodeWhisperer profiles",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::CodeWhisperer::Profile"] }  
],  
},  
{ "Name": "Log all events for Amazon Verified Permissions policy stores",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::VerifiedPermissions::PolicyStore"] }  
],  
},  
{ "Name": "Log all events for AWS Systems Manager control channels",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::SSMMessages::ControlChannel"] }  
],  
},  
{ "Name": "Log all events for Amazon Managed Blockchain networks",  
"FieldSelectors": [  
{ "Field": "eventCategory", "Equals": ["Data"] },  
{ "Field": "resources.type", "Equals": ["AWS::ManagedBlockchain::Network"] }  
],  
}
The command returns the following example output.

```json
{
  "name": "Log all events for AWS HealthImaging data stores",
  "fieldselectors": [
    { "field": "eventcategory", "equals": ["Data"] },
    { "field": "resources.type", "equals": ["AWS::MedicalImaging::Datastore"] }
  ]
}
```

```json
"trailarn": "arn:aws:cloudtrail:us-east-1:11112222333:trail/TrailName",
"advancedeventselectors": [
  {
    "name": "Log all events for all Amazon S3 buckets",
    "fieldselectors": [
      { "field": "eventcategory", "equals": ["Data"] },
      { "field": "resources.type", "equals": ["AWS::S3::Object"] }
    ]
  },
  {
    "name": "Log all events for Lambda functions",
    "fieldselectors": [
      { "field": "eventcategory", "equals": ["Data"] },
      { "field": "resources.type", "equals": ["AWS::Lambda::Function"] }
    ]
  },
  {
    "name": "Log all events for DynamoDB tables",
    "fieldselectors": [
      { "field": "eventcategory", "equals": ["Data"] }
    ]
  }
],
```

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{  "Name": "Log all CloudTrail PutAuditEvents activity on a CloudTrail Lake channel",  "FieldSelectors": [    {      "Field": "eventCategory",      "Equals": [        "Data"      ]    },    {      "Field": "resources.type",      "Equals": [        "AWS::CloudTrail::Channel"      ]    }  ]},  {  "Name": "Log all events for Amazon S3 on Outposts",  "FieldSelectors": [    {      "Field": "eventCategory",      "Equals": [        "Data"      ]    },    {      "Field": "resources.type",      "Equals": [        "AWS::S3Outposts::Object"      ]    }  ]},  {  "Name": "Log all JSON-RPC calls for Ethereum nodes in Amazon Managed Blockchain",  "FieldSelectors": [    {      "Field": "eventCategory",      "Equals": [        "Data"      ]    },    {      "Field": "resources.type",      "Equals": [        "AWS::ManagedBlockchain::Node"      ]    }  ]},  {  "Name": "Log all events for Amazon S3 Object Lambda access points",  "FieldSelectors": [    {      "Field": "eventCategory",      "Equals": [        "Data"      ]    },    {      "Field": "resources.type",      "Equals": [        "AWS::S3ObjectLambda::AccessPoint"      ]    }  ]}
"Name": "Log all Amazon EBS direct API calls on snapshots",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::EC2::Snapshot"
    ]
  }
],
"Name": "Log all events for Amazon S3 access points",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::S3::AccessPoint"
    ]
  }
],
"Name": "Log all events for DynamoDB streams",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::DynamoDB::Stream"
    ]
  }
],
"Name": "Log all events for AWS Glue tables created by Lake Formation",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::Glue::Table"
    ]
  }
]
"Equals": [
  "AWS::Glue::Table"
]
],

"Name": "Log all events for FinSpace environments",
"FieldSelectors": [
{
  "Field": "eventCategory",
  "Equals": [
    "Data"
  ]
},
{
  "Field": "resources.type",
  "Equals": [
    "AWS::FinSpace::Environment"
  ]
}
],

"Name": "Log all events for SageMaker metrics experiment trial components",
"FieldSelectors": [
{
  "Field": "eventCategory",
  "Equals": [
    "Data"
  ]
},
{
  "Field": "resources.type",
  "Equals": [
    "AWS::SageMaker::ExperimentTrialComponent"
  ]
}
],

"Name": "Log all events for SageMaker feature stores",
"FieldSelectors": [
{
  "Field": "eventCategory",
  "Equals": [
    "Data"
  ]
},
{
  "Field": "resources.type",
  "Equals": [
    "AWS::SageMaker::FeatureGroup"
  ]
}
],

"Name": "Log all events for Amazon Kendra Intelligent Ranking rescore execution plans",
"FieldSelectors": [
{
  "Field": "eventCategory",
  "Equals": [
    "Data"
  ]
}
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},
{  "Field": "resources.type",
   "Equals": [
       "AWS::KendraRanking::ExecutionPlan"
   ]
 },
{  "Name": "Log all events for Amazon Cognito identity pools",
   "FieldSelectors": [
       {  "Field": "eventCategory",
           "Equals": [  "Data"
               ],
       }
     
   
   
   ]
 },
{  "Name": "Log all events for an Amazon GuardDuty detector",
   "FieldSelectors": [
       {  "Field": "eventCategory",
           "Equals": [  "Data"
               ],
       },
       {  "Field": "resources.type",
           "Equals": [  "AWS::GuardDuty::Detector"
               ]
       }
     
     
   ]
 },
{  "Name": "Log all events for Amazon EMR write-ahead log workspaces",
   "FieldSelectors": [
       {  "Field": "eventCategory",
           "Equals": [  "Data"
               ],
       },
       {  "Field": "resources.type",
           "Equals": [  "AWS::EMRWAL::Workspace"
               ]
       }
     
     
     
   ]
 },
{  "Name": "Log all events for Amazon CodeWhisperer profiles",
   "FieldSelectors": [
       {  "Field": "eventCategory",
           "Equals": [  
               ]
       }
   
     
     
   ]
}
```json
"Data"
}
,"Field": "resources.type",
"Equals": [
  "AWS::CodeWhisperer::Profile"
]
}
},
{
"Name": "Log all events for Amazon Verified Permissions policy stores",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::VerifiedPermissions::PolicyStore"
    ]
  }
}
},
{
"Name": "Log all events for AWS Systems Manager control channels",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::SSMMessages::ControlChannel"
    ]
  }
}
},
{
"Name": "Log all events for Amazon Managed Blockchain networks",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  },
  {
    "Field": "resources.type",
    "Equals": [
      "AWS::ManagedBlockchain::Network"
    ]
  }
}
},
{
"Name": "Log all events for AWS HealthImaging data stores",
"FieldSelectors": [
  {
    "Field": "eventCategory",
    "Equals": [
      "Data"
    ]
  }
}
]```

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Examples: Logging data events for event data stores

You can configure your event data stores to include data events using the AWS CLI. Use the `create-event-data-store` command to create a new event data store to log data events. Use the `update-event-data-store` command to update the advanced event selectors for an existing event data store.

To see whether your event data store includes data events, run the `get-event-data-store` command.

```bash
aws cloudtrail get-event-data-store --event-data-store EventDataStoreARN
```

The command returns the settings for the event data store.

```json
{
   "Name": "ebs-data-events",
   "Status": "ENABLED",
   "AdvancedEventSelectors": [
      {
         "Name": "Log all EBS direct APIs on EBS snapshots",
         "FieldSelectors": [
            {
               "Field": "eventCategory",
               "Equals": ["Data"
            }
         ]
      },
      {
         "Field": "resources.type",
         "Equals": ["AWS::EC2::Snapshot"
      ]
      }
   ],
   "MultiRegionEnabled": true,
   "OrganizationEnabled": false,
   "RetentionPeriod": 2557,
   "TerminationProtectionEnabled": true,
   "CreatedTimestamp": "2023-01-04T15:57:33.701000+00:00",
   "UpdatedTimestamp": "2023-02-20T20:37:34.228000+00:00"
}
```
• Include all Amazon S3 events for a bucket (p. 283)
• Include Amazon S3 on AWS Outposts events (p. 284)

Include all Amazon S3 events for a bucket

The following example shows how to create an event data store to include all data events for all Amazon S3 objects in a specific S3 bucket. The value for S3 events for the `resources.type` field is `AWS::S3::Object`. Because the ARN values for S3 objects and S3 buckets are slightly different, you must add the `StartsWith` operator for `resources.ARN` to capture all events.

```bash
aws cloudtrail create-event-data-store --name "EventDataStoreName" --multi-region-enabled \ 
--advanced-event-selectors \ 
'[
    { "Name": "S3EventSelector", "FieldSelectors": [
        { "Field": "eventCategory", "Equals": ["Data"] },
        { "Field": "resources.type", "Equals": ["AWS::S3::Object"] },
        { "Field": "resources.ARN", "StartsWith": ["arn:partition:s3:::bucket_name/"] }
    ]
]

The command returns the following example output.

```json
{
   "Name": "EventDataStoreName",
   "Status": "ENABLED",
   "AdvancedEventSelectors": [
      {
         "Name": "S3EventSelector",
         "FieldSelectors": [
            { "Field": "eventCategory", "Equals": ["Data"] },
            { "Field": "resources.ARN", "StartsWith": ["arn:partition:s3:::bucket_name/"] },
            { "Field": "resources.type", "Equals": ["AWS::S3::Object"] }
         ]
      }
   ],
   "MultiRegionEnabled": true,
   "OrganizationEnabled": false,
   "RetentionPeriod": 2557,
   "TerminationProtectionEnabled": true,
   "CreatedTimestamp": "2023-01-04T15:57:33.701000+00:00",
```
Include Amazon S3 on AWS Outposts events

The following example shows how to create an event data store that includes all data events for all Amazon S3 on Outposts objects in your outpost.

```bash
aws cloudtrail create-event-data-store --name EventDataStoreName \ --advanced-event-selectors '[
    {
        "Name": "OutpostsEventSelector",
        "FieldSelectors": [
            { "Field": "eventCategory", "Equals": ["Data"] },
            { "Field": "resources.type", "Equals": ["AWS::S3Outposts::Object"] }
        ]
    }
],

The command returns the following example output.

```

Logging data events for AWS Config compliance

If you are using AWS Config conformance packs to help your enterprise maintain compliance with formalized standards such as those required by Federal Risk and Authorization Management Program (FedRAMP) or National Institute of Standards and Technology (NIST), conformance packs for compliance frameworks generally require you to log data events for Amazon S3 buckets, at minimum. Conformance
Logging events with the AWS SDKs

Run the `GetEventSelectors` operation to see whether your trail is logging data events. You can configure your trails to log data events by running the `PutEventSelectors` operation. For more information, see the AWS CloudTrail API Reference.

Run the `GetEventDataStore` operation to see whether your event data store is logging data events. You can configure your event data stores to include data events by running the `CreateEventDataStore` or `UpdateEventDataStore` operations and specifying advanced event selectors. For more information, see Managing CloudTrail Lake by using the AWS CLI (p. 224) and the AWS CloudTrail API Reference.

Sending events to Amazon CloudWatch Logs

CloudTrail supports sending data events to CloudWatch Logs. When you configure your trail to send events to your CloudWatch Logs log group, CloudTrail sends only the events that you specify in your trail. For example, if you configure your trail to log data events only, your trail delivers data events only to your CloudWatch Logs log group. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).

Logging Insights events for trails

AWS CloudTrail Insights helps AWS users identify and respond to unusual activity associated with API calls and API error rates by continuously analyzing CloudTrail management events. CloudTrail Insights analyzes your normal patterns of API call volume and API error rates, also called the baseline, and generates Insights events when the call volume or error rates are outside normal patterns. Insights events on API call volume are generated for write management APIs, and Insights events on API error rate are generated for both read and write management APIs.

**Note**

To log Insights events on API call volume, the trail must log write management events. To log Insights events on API error rate, the trail must log read or write management events.

If you have CloudTrail Insights enabled and CloudTrail detects unusual activity, Insights events are delivered to the destination S3 bucket for your trail. You can also see the type of insight and the incident time period when you view Insights events on the CloudTrail console. Unlike other types of events...
Understanding CloudTrail Insights

CloudTrail Insights can help you detect unusual API volume or error rate activity in your AWS account by raising Insights events. CloudTrail Insights analyzes your normal patterns of API call volume and API error rates, also called the *baseline*, and generates Insights events when the call volume or error rates are outside normal patterns. Insights events on API call volume are generated for write management APIs, and Insights events on API error rate are generated for both read and write management APIs.

After you enable CloudTrail Insights for the first time on a trail, it can take up to 36 hours for CloudTrail to deliver the first Insights event, if unusual activity is detected. CloudTrail Insights analyzes management events that occur in a single Region, not globally. A CloudTrail Insights event is generated in the same Region as its supporting management events are generated.

The following image shows an example of Insights events. You open details pages for an Insights event by choosing an Insights event name from the Dashboard or Insights pages.

If you disable CloudTrail Insights on a trail, or stop logging on a trail (which disables CloudTrail Insights), you may have Insights events stored in your destination S3 bucket, or shown on the Insights page of the console, that date from the earlier time that you had Insights enabled.

Filter column

The left column lists Insights events that are related to the subject API, and that have the same Insights event type. The column lets you choose the Insights event about which you want more information.
When you choose an event in this column, the event is highlighted in the graph on the Insights graph tab. By default, CloudTrail applies a filter that limits events shown on the CloudTrail events tab to those about the specific API that was called during the period of unusual activity that triggered the Insights event. To show all CloudTrail events called during the period of unusual activity, including events unrelated to the Insights event, turn off the filter.

**Insights graph tab**

On the Insights graph tab, the details page for an Insights event shows a graph of an API's call volume or error rate that occurred over a period of time before and after one or more Insights events are logged. In the graph, Insights events are highlighted with vertical bars, with the width of the bar showing the start and end time of the Insights event.

In this example, a vertical highlighting band shows unusual numbers of AWS Systems Manager SendCommand API calls in an account. In the highlighted area, because the number of SendCommand calls rose above the account's baseline average of 0.0442 calls per minute, CloudTrail logged an Insights event when it detected the unusual activity. The Insights event recorded that as many as 15 SendCommand calls were made in a five-minute period between 5:50 and 5:55 a.m. This is about two more calls to that API per minute than is expected for the account. In this example, the graph's time span is three hours: 4:30 a.m. PDT on July 15, 2021 to 7:30 a.m. PDT on July 15, 2021. This event has a start time of 6:00 a.m. PDT on July 15, 2021, and an end time two minutes later. An ending Insights event, not highlighted, shows that the unusual activity ended at about 6:16 a.m.

The baseline is calculated over the seven days preceding the start of an Insights event. Though the value of the baseline duration—the period that CloudTrail analyzes for normal activity on APIs—is approximately seven days, CloudTrail rounds the baseline duration to a whole integer day, so the exact baseline duration can vary.

You can use the Zoom command on the toolbar to zoom in on the ending Insights event, showing the start and end time. In this example, choosing Zoom, then dragging the Zoom cursor a very short distance over one edge of the highlighted Insights event expands the Insights event and shows more timeline detail.
To view CloudTrail events that were analyzed to determine unusual activity, open the CloudTrail events tab. In this example, CloudTrail analyzed 12 events, four of which triggered the Insights event.

The following screenshot shows an Insights graph tab for an API error rate Insights event. The highlighted area shows that an Insights event was logged because occurrences of the NoSuchEntityException error on the GetRolePolicy IAM API call rose above the baseline average of 0.0017 NoSuchEntityException errors per minute on this API call, averaging 18 errors per minute during the insight period. The number of CloudTrail events that triggered the Insights event matches the Insights average of 18 NoSuchEntityException errors in one minute, in this example. Unlike an API call rate graph, the API error rate shows two lines, in contrasting colors: a line measuring calls to the IAM API, GetRolePolicy, that resulted in an unusual number of errors, and a line measuring the error on which unusual activity was logged, NoSuchEntityException.
The **Attributions** tab shows the following information about an Insights event. Information on the **Attributions** tab can help you identify the causes and sources of Insights activity. Expand the top baseline areas to compare user identity, user agent, and error code activity during normal periods with those attributed during the Insights activity. In **Top baseline user identity ARNs**, **Top baseline user agents**, and **Top baseline error codes**, only the **baseline average**—the historic average of events for the API that are logged by the user identity, user agent, or that result in the error code, in approximately the seven days before the Insights event start time—is shown.

<table>
<thead>
<tr>
<th>Top user identity ARNs during Insights event</th>
</tr>
</thead>
<tbody>
<tr>
<td>User identity ARN</td>
</tr>
<tr>
<td>aws-akc43tfkd[2][3][4][5][6]</td>
</tr>
<tr>
<td>3.0000 (100.00%)</td>
</tr>
<tr>
<td>Baseline average</td>
</tr>
<tr>
<td>0.0023 (100.00%)</td>
</tr>
<tr>
<td>Average API calls during Insights event</td>
</tr>
<tr>
<td>3.0000</td>
</tr>
<tr>
<td>Top baseline user identity ARNs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Top user agents during Insights event</th>
</tr>
</thead>
<tbody>
<tr>
<td>User agent</td>
</tr>
<tr>
<td>dynamodb.application-autoscaling</td>
</tr>
<tr>
<td>3.0000 (100.00%)</td>
</tr>
<tr>
<td>Baseline average</td>
</tr>
<tr>
<td>0.0023 (100.00%)</td>
</tr>
<tr>
<td>Average API calls during Insights event</td>
</tr>
<tr>
<td>3.0000</td>
</tr>
<tr>
<td>Top baseline user agents</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Top error codes during Insights event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error code</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>3.0000 (100.00%)</td>
</tr>
<tr>
<td>Baseline average</td>
</tr>
<tr>
<td>0.0023 (100.00%)</td>
</tr>
<tr>
<td>Average API calls during Insights event</td>
</tr>
<tr>
<td>3.0000</td>
</tr>
<tr>
<td>Top baseline error codes</td>
</tr>
</tbody>
</table>
The **Attributions** tab shows only top user identity ARNs and top user agents for an error rate Insights event, as shown in the following image. Top error codes are not necessary for error rate Insights events.

- **Top user identity ARNs** - This table shows up to the top five AWS users or IAM roles (user identities) that contributed to API calls during the unusual activity and baseline periods, in descending order by the average number of API calls contributed. The percentage of the averages as a total of activity that contributed to the unusual activity is shown in parentheses. If more than five user identity ARNs contributed to the unusual activity, their activity is summed up in an **Other** row.

- **Top user agents** - This table shows up to the top five AWS tools by which the user identity contributed to API calls during the unusual activity and baseline periods, in descending order by the average number of API calls contributed. These tools include the AWS Management Console, AWS CLI, or the AWS SDKs. For example, a user agent named `ec2.amazonaws.com` indicates that the Amazon EC2 console was among the tools used to call the API. The percentage of the averages as a total of activity that contributed to the unusual activity is shown in parentheses. If more than five user agents contributed to the unusual activity, their activity is summed up in an **Other** row.

- **Top error codes** - Only shown for **API call rate** Insights events. This table shows up to the top five error codes that occurred on API calls during the unusual activity and baseline periods, in descending order from largest number of API calls to smallest. The percentage of the averages as a total of activity that contributed to the unusual activity is shown in parentheses. If more than five error codes occurred during the unusual or baseline activity, their activity is summed up in an **Other** row.

A value of None as one of the top five error code values means that a significant percentage of the calls that contributed to the Insights event did not result in errors. If the error code value is None, and there are no other error codes in the table, the values in the **Insight average** and **Baseline average** columns are the same as those for the Insights event overall. You can also see those values displayed in the **Insight average** and **Baseline average** legend on the **Insights graph** tab, under **API calls per minute**.

**Baseline average and Insights average**

**Baseline average** and **Insights average** are shown for top user identities, top user agents, and top error codes.
• **Baseline average** - The typical rate of occurrences per minute on the API on which the Insights event was logged, as measured within approximately the preceding seven days, in a specific Region in your account.

• **Insights average** - The rate of calls to or errors on this API that triggered the Insights event. The CloudTrail Insights average for the start event is the rate of calls or errors per minute on the API that triggered the Insights event. Typically, this is the first minute of unusual activity. The Insights average for the end event is the rate of API calls or errors per minute over the duration of the unusual activity, between the start Insights event and the end Insights event.

**CloudTrail events tab**

On the CloudTrail events tab, view related events that CloudTrail analyzed to determine that unusual activity occurred. By default, a filter is already applied for the Insights event name, which is also the name of the related API. To show all CloudTrail events logged during the period of unusual activity, turn off Only show events for selected Insights event. The CloudTrail events tab shows CloudTrail management events related to the subject API that occurred between the start and end time of the Insights event. These events help you perform deeper analysis to determine the probable cause of an Insights event, and reasons for unusual API and error rate activity.

**Insights event record tab**

Like any CloudTrail event, a CloudTrail Insights event is a record in JSON format. The Insights event record tab shows the JSON structure and content of the Insights start and end events, sometimes called the event payload. For more information about the fields and content of the Insights event record, see Record fields for Insights events (p. 429) and CloudTrail Insights insightDetails element (p. 444) in this guide.

**Logging Insights events with the AWS Management Console**

Enable CloudTrail Insights events on an existing trail. By default, Insights events are not enabled.

1. In the left navigation pane of the CloudTrail console, open the Trails page, and choose a trail name.
2. In Insights events choose Edit.
   
   **Note**
   Additional charges apply for logging Insights events. For CloudTrail pricing, see AWS CloudTrail Pricing.

3. In Event type, choose Insights events.
4. In Insights events, under Choose Insights types, choose API call rate, API error rate, or both. Your trail must be logging Write management events to log Insights events for API call rate. Your trail must be logging Read or Write management events to log Insights events for API error rate.
5. Choose Save changes to save your changes.

It can take up to 36 hours for CloudTrail to deliver the first Insights events, if unusual activity is detected.

**Logging Insights events with the AWS Command Line Interface**

You can configure your trails to log Insights events using the AWS CLI.
Note
To log Insights events on API call volume, the trail must log write management events. To log Insights events on API error rate, the trail must log read or write management events.

To view whether your trail is logging Insights events, run the `get-insight-selectors` command.

```shell
aws cloudtrail get-insight-selectors --trail-name TrailName
```

The following result shows the default settings for a trail. By default, trails don't log Insights events. The `InsightType` attribute value is empty, and no Insight event selectors are specified, because Insights event collection is not enabled.

If you do not add Insights selectors, the `get-insight-selectors` command returns the following error message: "An error occurred (InsightNotEnabledException) when calling the GetInsightSelectors operation: Trail `name` does not have Insights enabled. Edit the trail settings to enable Insights, and then try the operation again."

```
{
    "InsightSelectors": [ ],
    "TrailARN": "arn:aws:cloudtrail:us-east-1:123456789012:trail/TrailName"
}
```

To configure your trail to log Insights events, run the `put-insight-selectors` command. The following example shows how to configure your trail to include Insights events. Insights selector values can be `ApiCallRateInsight`, `ApiErrorRateInsight`, or both.

```shell
aws cloudtrail put-insight-selectors --trail-name TrailName --insight-selectors
'[['"InsightType": "ApiCallRateInsight"],["InsightType": "ApiErrorRateInsight"]']
```

The following result shows the Insights event selector that is configured for the trail.

```
{
    "InsightSelectors": [
        {
            "InsightType": "ApiErrorRateInsight"
        },
        {
            "InsightType": "ApiCallRateInsight"
        }
    ],
    "TrailARN": "arn:aws:cloudtrail:us-east-1:123456789012:trail/TrailName"
}
```

Logging events with the AWS SDKs
Run the `GetInsightSelectors` operation to see whether your trail is logging Insights events for a trail. You can configure your trails to log Insights events with the `PutInsightSelectors` operation. For more information, see the AWS CloudTrail API Reference.

Sending events to Amazon CloudWatch Logs
CloudTrail supports sending Insights events to CloudWatch Logs. When you configure your trail to send Insights events to your CloudWatch Logs log group, CloudTrail Insights sends only the events that you specify in your trail. For example, if you configure your trail to log management and Insights events, your trail delivers management and Insights events to your CloudWatch Logs log group. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).
You can use the Amazon EventBridge console or API to create a rule to deliver Insights events. When you create a rule using the EventBridge console, choose the AWS Insight via CloudTrail event type.

The following image shows an example rule, Insights-test-rule, created in EventBridge. When CloudTrail logs Insights events, the rule targets an Amazon SNS topic to send notifications to recipients who are specified in the SNS topic. For more information about creating rules in EventBridge, see Create a rule in Amazon EventBridge in the Amazon EventBridge User Guide.

When CloudTrail logs Insights events, recipients of the SNS topic should receive SNS notifications.

Receiving CloudTrail log files from multiple Regions

You can configure CloudTrail to deliver log files from multiple Regions to a single S3 bucket for a single account. For example, you have a trail in the US West (Oregon) Region that is configured to deliver log files to a S3 bucket, and a CloudWatch Logs log group. When you change an existing single-Region trail to log all Regions, CloudTrail logs events from all Regions that are in a single AWS partition in your account. CloudTrail delivers log files to the same S3 bucket and CloudWatch Logs log group. As long as CloudTrail has permissions to write to an S3 bucket, the bucket for a multi-Region trail does not have to be in the trail’s home Region.

To log events across all Regions in all AWS partitions in your account, create a multi-Region trail in each partition.

In the console, by default, you create a trail that logs events in all AWS Regions. This is a recommended best practice. To log events in a single Region (not recommended), use the AWS CLI (p. 107). To configure an existing single-Region trail to log in all Regions, you must use the AWS CLI.

To change an existing trail so that it applies to all Regions, add the --is-multi-region-trail option to the update-trail (p. 108) command.

```
aws cloudtrail update-trail --name my-trail --is-multi-region-trail
```

To confirm that the trail now applies to all Regions, the IsMultiRegionTrail element in the output shows true.
Managing data consistency in CloudTrail

CloudTrail uses a distributed computing model called **eventual consistency**. Any change that you make to your CloudTrail configuration (or other AWS services), including tags used in **attribute-based access control (ABAC)**, takes time to become visible from all possible endpoints. Some of the delay results from the time it takes to send the data from server to server, from replication zone to replication zone, and from Region to Region around the world. CloudTrail also uses caching to improve performance, but in some cases this can add time. The change might not be visible until the previously cached data times out.

You must design your applications to account for these potential delays. Ensure that they work as expected, even when a change made in one location is not instantly visible at another. Such changes include creating or updating trails or event data stores, updating event selectors, and starting or stopping logging. When you create or update a trail or event data store, CloudTrail delivers logs to the S3 bucket or event data store based on the last known configuration until the changes propagate to all locations.

For more information about how this affects other AWS services, see the following resources:

- **Amazon DynamoDB**: What is the consistency model of DynamoDB? in the DynamoDB FAQ, and Read consistency in the Amazon DynamoDB Developer Guide.
- **Amazon EC2**: Eventual consistency in the Amazon Elastic Compute Cloud API Reference.
- **Amazon EMR**: Ensuring Consistency When Using Amazon S3 and Amazon Elastic MapReduce for ETL Workflows in the AWS Big Data Blog.
- **AWS Identity and Access Management (IAM)**: Changes that I make are not always immediately visible in the IAM User Guide.
- **Amazon Redshift**: Managing data consistency in the Amazon Redshift Database Developer Guide.
- **Amazon S3**: Amazon S3 data consistency model in the Amazon Simple Storage Service User Guide.

Monitoring CloudTrail Log Files with Amazon CloudWatch Logs

You can configure CloudTrail with CloudWatch Logs to monitor your trail logs and be notified when specific activity occurs.
1. Configure your trail to send log events to CloudWatch Logs.
2. Define CloudWatch Logs metric filters to evaluate log events for matches in terms, phrases, or values. For example, you can monitor for ConsoleLogin events.
3. Assign CloudWatch metrics to the metric filters.
4. Create CloudWatch alarms that are triggered according to thresholds and time periods that you specify. You can configure alarms to send notifications when alarms are triggered, so that you can take action.
5. You can also configure CloudWatch to automatically perform an action in response to an alarm.

Standard pricing for Amazon CloudWatch and Amazon CloudWatch Logs applies. For more information, see Amazon CloudWatch Pricing.

For more information about the Regions in which you can configure your trails to send logs to CloudWatch Logs, see Amazon CloudWatch Logs Regions and Quotas in the AWS General Reference.

The AWS GovCloud (US-West) Region requires a separate account. For more information, see AWS GovCloud (US-West).

Topics
- Sending events to CloudWatch Logs (p. 295)
- Creating CloudWatch alarms for CloudTrail events: examples (p. 300)
- Stopping CloudTrail from sending events to CloudWatch Logs (p. 305)
- CloudWatch log group and log stream naming for CloudTrail (p. 306)
- Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306)

Sending events to CloudWatch Logs

When you configure your trail to send events to CloudWatch Logs, CloudTrail sends only the events that match your trail settings. For example, if you configure your trail to log data events only, your trail sends data events only to your CloudWatch Logs log group. CloudTrail supports sending data, Insights, and management events to CloudWatch Logs. For more information, see Working with CloudTrail log files (p. 246).

To send events to a CloudWatch Logs log group:

- Make sure you have sufficient permissions to create or specify an IAM role. For more information, see Granting permission to view and configure Amazon CloudWatch Logs information on the CloudTrail console (p. 378).
- Create a new trail or specify an existing one. For more information, see Creating and updating a trail with the console (p. 85).
- Create a log group or specify an existing one.
- Specify an IAM role. If you are modifying an existing IAM role for an organization trail, you must manually update the policy to allow logging for the organization trail. For more information, see this policy example (p. 299) and Creating a trail for an organization (p. 135).
- Attach a role policy or use the default.

Contents
- Configuring CloudWatch Logs monitoring with the console (p. 296)
  - Creating a log group or specifying an existing log group (p. 296)
  - Specifying an IAM role (p. 296)
Configuring CloudWatch Logs monitoring with the console

You can use the AWS Management Console to configure your trail to send events to CloudWatch Logs for monitoring.

Creating a log group or specifying an existing log group

CloudTrail uses a CloudWatch Logs log group as a delivery endpoint for log events. You can create a log group or specify an existing one.

To create or specify a log group for an existing trail

1. Make sure you log in with an administrative user or role with sufficient permissions to configure CloudWatch Logs integration. For more information, see Granting permission to view and configure Amazon CloudWatch Logs information on the CloudTrail console (p. 378).
2. Open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
3. Choose the trail name. If you choose a trail that applies to all Regions, you will be redirected to the Region in which the trail was created. You can create a log group or choose an existing log group in the same Region as the trail.
   
   **Note**
   
   A trail that applies to all Regions sends log files from all Regions to the CloudWatch Logs log group that you specify.

4. In **CloudWatch Logs**, choose **Edit**.
5. For **CloudWatch Logs**, choose **Enabled**.
6. For **Log group name**, choose **New** to create a new log group, or **Existing** to use an existing one. If you choose **New**, CloudTrail specifies a name for the new log group for you, or you can type a name. For more information about naming, see CloudWatch log group and log stream naming for CloudTrail (p. 306).
7. If you choose **Existing**, choose a log group from the drop-down list.
8. For **Role name**, choose **New** to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose **Existing** to choose an existing IAM role from the drop-down list. The policy statement for the new or existing role is displayed when you expand **Policy document**. For more information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).
   
   **Note**
   
   When you configure a trail, you can choose an S3 bucket and SNS topic that belong to another account. However, if you want CloudTrail to deliver events to a CloudWatch Logs log group, you must choose a log group that exists in your current account.

9. Choose **Save changes**.

Specifying an IAM role

You can specify a role for CloudTrail to assume to deliver events to the log stream.
To specify a role

1. By default, the CloudTrail_CloudWatchLogs_Role is specified for you. The default role policy has the required permissions to create a CloudWatch Logs log stream in a log group that you specify, and to deliver CloudTrail events to that log stream.

   **Note**
   If you want to use this role for a log group for an organization trail, you must manually modify the policy after you create the role. For more information, see this policy example (p. 299) and Creating a trail for an organization (p. 135).

   a. To verify the role, go to the AWS Identity and Access Management console at https://console.aws.amazon.com/iam/.
   b. Choose Roles and then choose the CloudTrail_CloudWatchLogs_Role.
   c. From the Permissions tab, expand the policy to view its contents.

2. You can specify another role, but you must attach the required role policy to the existing role if you want to use it to send events to CloudWatch Logs. For more information, see Role policy document for CloudTrail to use CloudWatch Logs for monitoring (p. 306).

Viewing events in the CloudWatch console

After you configure your trail to send events to your CloudWatch Logs log group, you can view the events in the CloudWatch console. CloudTrail typically delivers events to your log group within an average of about 5 minutes of an API call. This time is not guaranteed. Review the AWS CloudTrail Service Level Agreement for more information.

To view events in the CloudWatch console

2. In the left navigation pane, under Logs, choose Log groups.
3. Choose the log group that you specified for your trail.
4. Choose the log stream that you want to view.
5. To see the details of the event that your trail logged, choose an event.

   **Note**
   The Time (UTC) column in the CloudWatch console shows when the event was delivered to your log group. To see the actual time that the event was logged by CloudTrail, see the eventTime field.

Configuring CloudWatch Logs monitoring with the AWS CLI

You can use the AWS CLI to configure CloudTrail to send events to CloudWatch Logs for monitoring.

Creating a log group

1. If you don't have an existing log group, create a CloudWatch Logs log group as a delivery endpoint for log events using the CloudWatch Logs create-log-group command.

   ```bash
   aws logs create-log-group --log-group-name name
   ```

   The following example creates a log group named CloudTrail/logs:

   ```bash
   aws logs create-log-group --log-group-name CloudTrail/logs
   ```
2. Retrieve the log group Amazon Resource Name (ARN).

```
aws logs describe-log-groups
```

### Creating a role

Create a role for CloudTrail that enables it to send events to the CloudWatch Logs log group. The IAM `create-role` command takes two parameters: a role name and a file path to an assume role policy document in JSON format. The policy document that you use gives `AssumeRole` permissions to CloudTrail. The `create-role` command creates the role with the required permissions.

To create the JSON file that will contain the policy document, open a text editor and save the following policy contents in a file called `assume_role_policy_document.json`.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "",
         "Effect": "Allow",
         "Principal": {
            "Service": "cloudtrail.amazonaws.com"
         },
         "Action": "sts:AssumeRole"
      }
   ]
}
```

Run the following command to create the role with `AssumeRole` permissions for CloudTrail.

```
aws iam create-role --role-name role_name --assume-role-policy-document file://<path to assume_role_policy_document>.json
```

When the command completes, take a note of the role ARN in the output.

### Creating a policy document

Create the following role policy document for CloudTrail. This document grants CloudTrail the permissions required to create a CloudWatch Logs log stream in the log group you specify and to deliver CloudTrail events to that log stream.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "AWSCloudTrailCreateLogStream2014110",
         "Effect": "Allow",
         "Action": ["logs:CreateLogStream"],
         "Resource": [
         ]
      }
   ]
}
```

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Save the policy document in a file called `role-policy-document.json`.

If you're creating a policy that might be used for organization trails as well, you will need to configure it slightly differently. For example, the following policy grants CloudTrail the permissions required to create a CloudWatch Logs log stream in the log group you specify and to deliver CloudTrail events to that log stream for both trails in the AWS account 111111111111 and for organization trails created in the 111111111111 account that are applied to the AWS Organizations organization with the ID of `o-exampleorgid`:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSCloudTrailCreateLogStream20141101",
      "Effect": "Allow",
      "Action": ["logs:CreateLogStream"],
    },
    {
      "Sid": "AWSCloudTrailPutLogEvents20141101",
      "Effect": "Allow",
      "Action": ["logs:PutLogEvents"],
    }
  ]
}
```

For more information about organization trails, see [Creating a trail for an organization (p. 135)](https://docs.aws.amazon.com/strategyguide/latest/solution incontrailforanorganization.html).

Run the following command to apply the policy to the role:

```bash
aws iam put-role-policy --role-name role_name --policy-name cloudtrail-policy --policy-document file://<path to role-policy-document>.json
```
Updating the trail

Update the trail with the log group and role information using the CloudTrail update-trail command.

```
aws cloudtrail update-trail --name \(trail_name\) --cloud-watch-logs-log-group-arn \(log_group_arn\) --cloud-watch-logs-role-arn \(role_arn\)
```

For more information about the AWS CLI commands, see the [AWS CloudTrail Command Line Reference](#).

Limitation

CloudWatch Logs and EventBridge each allow a maximum event size of 256 KB. Although most service events have a maximum size of 256 KB, some services still have events that are larger. CloudTrail does not send these events to CloudWatch Logs or EventBridge.

Starting with CloudTrail event version 1.05, events have a maximum size of 256 KB. This is to help prevent exploitation by malicious actors, and allow events to be consumed by other AWS services, such as CloudWatch Logs and EventBridge.

Creating CloudWatch alarms for CloudTrail events: examples

This topic describes how to configure alarms for CloudTrail events, and includes examples.

Topics

- Prerequisites (p. 300)
- Create a metric filter and create an alarm (p. 300)
- Example security group configuration changes (p. 301)
- Example AWS Management Console sign-in failures (p. 302)
- Example: IAM policy changes (p. 303)
- Configuring notifications for CloudWatch Logs alarms (p. 305)

Prerequisites

Before you can use the examples in this topic, you must:

- Create a trail with the console or CLI.
- Create a log group, which you can do as part of creating a trail. For more information about creating a trail, see [Creating a trail (p. 85)](#).
- Specify or create an IAM role that grants CloudTrail the permissions to create a CloudWatch Logs log stream in the log group that you specify and to deliver CloudTrail events to that log stream. The default CloudTrail_CloudWatchLogs_Role does this for you.

For more information, see [Sending events to CloudWatch Logs (p. 295)](#). Examples in this section are performed in the Amazon CloudWatch Logs console. For more information about how to create metric filters and alarms, see [Creating metrics from log events using filters](#) and [Using Amazon CloudWatch alarms](#) in the *Amazon CloudWatch User Guide.*

Create a metric filter and create an alarm

To create an alarm, you must first create a metric filter, and then configure an alarm based on the filter. The procedures are shown for all examples. For more information about syntax for metric filters and
patterns for CloudTrail log events, see the JSON-related sections of Filter and pattern syntax in the Amazon CloudWatch Logs User Guide.

Example security group configuration changes

Follow this procedure to create an Amazon CloudWatch alarm that is triggered when configuration changes occur on security groups.

Create a metric filter

2. In the navigation pane, under Logs, choose Log groups.
3. In the list of log groups, choose the log group that you created for your trail.
4. From the Metric filters or Actions menu, choose Create metric filter.
5. On the Define pattern page, in Create filter pattern, enter the following for Filter pattern.

{ ($.eventName = AuthorizeSecurityGroupIngress) || ($.eventName = AuthorizeSecurityGroupEgress) || ($.eventName = RevokeSecurityGroupIngress) || ($.eventName = RevokeSecurityGroupEgress) || ($.eventName = CreateSecurityGroup) || ($.eventName = DeleteSecurityGroup) }

7. On the Assign metric page, for Filter name, enter SecurityGroupEvents.
8. In Metric details, turn on Create new, and then enter CloudTrailMetrics for Metric namespace.
10. For Metric value, type 1.
11. Leave Default value blank.
12. Choose Next.
13. On the Review and create page, review your choices. Choose Create metric filter to create the filter, or choose Edit to go back and change values.

Create an alarm

After you create the metric filter, the CloudWatch Logs log group details page for your CloudTrail trail log group opens. Follow this procedure to create an alarm.

1. On the Metric filters tab, find the metric filter you created in the section called “Create a metric filter” (p. 301). Fill the check box for the metric filter. In the Metric filters bar, choose Create alarm.
2. For Specify metric and conditions, enter the following.
   a. For Graph, the line is set at 1 based on other settings you make when you create your alarm.
   b. For Metric name, keep the current metric name, SecurityGroupEventCount.
   c. For Statistic, keep the default, Sum.
   d. For Period, keep the default, 5 minutes.
   e. In Conditions, for Threshold type, choose Static.
   f. For Whenever metric_name is, choose Greater/Equal.
   g. For the threshold value, enter 1.
   h. In Additional configuration, leave defaults. Choose Next.
3. On the Configure actions page, choose Notification, and then choose In alarm, which indicates that the action is taken when the threshold of 1 change event in 5 minutes is crossed, and SecurityGroupEventCount is in an alarm state.
Creating CloudWatch alarms for CloudTrail events: examples

1. For **Send a notification to the following SNS topic**, choose **Create new topic**.
2. Enter **SecurityGroupChanges_CloudWatch_Alarms_Topic** as the name for the new Amazon SNS topic.
3. In **Email endpoints that will receive the notification**, enter the email addresses of users whom you want to receive notifications if this alarm is raised. Separate email addresses with commas.

   Each email recipient will receive an email asking them to confirm that they want to be subscribed to the Amazon SNS topic.
4. Choose **Create topic**.
5. On the **Add name and description** page, enter a friendly name for the alarm, and a description.

   For this example, enter **Security group configuration changes** for the name, and **Raises alarms if security group configuration changes occur** for the description. Choose **Next**.
6. On the **Preview and create** page, review your choices. Choose **Edit** to make changes, or choose **Create alarm** to create the alarm.

After you create the alarm, CloudWatch opens the **Alarms** page. The alarm's **Actions** column shows **Pending confirmation** until all email recipients on the SNS topic have confirmed that they want to subscribe to SNS notifications.

### Example AWS Management Console sign-in failures

Follow this procedure to create an Amazon CloudWatch alarm that is triggered when there are three or more AWS Management Console sign-in failures during a five minute period.

#### Create a metric filter

2. In the navigation pane, under **Logs**, choose **Log groups**.
3. In the list of log groups, choose the log group that you created for your trail.
4. From the **Metric filters or Actions** menu, choose **Create metric filter**.
5. On the **Define pattern** page, in **Create filter pattern**, enter the following for **Filter pattern**.

   ```
   { ($.eventName = ConsoleLogin) && ($.errorMessage = "Failed authentication") }
   ```

6. In **Test pattern**, leave defaults. Choose **Next**.
7. On the **Assign metric** page, for **Filter name**, enter **ConsoleSignInFailures**.
8. In **Metric details**, turn on **Create new**, and then enter **CloudTrailMetrics** for **Metric namespace**.
9. For **Metric name**, type **ConsoleSignInFailureCount**.
10. For **Metric value**, type **1**.
11. Leave **Default value** blank.
12. Choose **Next**.
13. On the **Review and create** page, review your choices. Choose **Create metric filter** to create the filter, or choose **Edit** to go back and change values.

#### Create an alarm

After you create the metric filter, the CloudWatch Logs log group details page for your CloudTrail trail log group opens. Follow this procedure to create an alarm.
Creating CloudWatch alarms for CloudTrail events: examples

1. On the Metric filters tab, find the metric filter you created in the section called “Create a metric filter” (p. 302). Fill the check box for the metric filter. In the Metric filters bar, choose Create alarm.

2. On the Create Alarm page, in Specify metric and conditions, enter the following.
   a. For Graph, the line is set at 3 based on other settings you make when you create your alarm.
   b. For Metric name, keep the current metric name, ConsoleSigninFailureCount.
   c. For Statistic, keep the default, Sum.
   d. For Period, keep the default, 5 minutes.
   e. In Conditions, for Threshold type, choose Static.
   f. For Whenever metric_name is, choose Greater/Equal.
   g. For the threshold value, enter 3.
   h. In Additional configuration, leave defaults. Choose Next.

3. On the Configure actions page, for Notification, choose In alarm, which indicates that the action is taken when the threshold of 3 change events in 5 minutes is crossed, and ConsoleSigninFailureCount is in an alarm state.
   a. For Send a notification to the following SNS topic, choose Create new topic.
   b. Enter ConsoleSignInFailures_CloudWatch_Alarms_Topic as the name for the new Amazon SNS topic.
   c. In Email endpoints that will receive the notification, enter the email addresses of users whom you want to receive notifications if this alarm is raised. Separate email addresses with commas.

   Each email recipient will receive an email asking them to confirm that they want to be subscribed to the Amazon SNS topic.
   d. Choose Create topic.

4. For this example, skip the other action types. Choose Next.

5. On the Add name and description page, enter a friendly name for the alarm, and a description. For this example, enter Console sign-in failures for the name, and Raises alarms if more than 3 console sign-in failures occur in 5 minutes for the description. Choose Next.

6. On the Preview and create page, review your choices. Choose Edit to make changes, or choose Create alarm to create the alarm.

   After you create the alarm, CloudWatch opens the Alarms page. The alarm's Actions column shows Pending confirmation until all email recipients on the SNS topic have confirmed that they want to subscribe to SNS notifications.

Example: IAM policy changes

Follow this procedure to create an Amazon CloudWatch alarm that is triggered when an API call is made to change an IAM policy.

Create a metric filter

2. In the navigation pane, choose Logs.
3. In the list of log groups, choose the log group that you created for your trail.
4. Choose Actions, and then choose Create metric filter.
5. On the Define pattern page, in Create filter pattern, enter the following for Filter pattern.

   ```
   { ($.eventName=DeleteGroupPolicy) || ($.eventName=DeleteRolePolicy) ||
   ($.eventName=DeleteUserPolicy) || ($.eventName=PutGroupPolicy) ||
   ```
7. On the Assign metric page, for Filter name, enter IAMPolicyChanges.
8. In Metric details, turn on Create new, and then enter CloudTrailMetrics for Metric namespace.
9. For Metric name, type IAMPolicyEventCount.
10. For Metric value, type 1.
11. Leave Default value blank.
12. Choose Next.
13. On the Review and create page, review your choices. Choose Create metric filter to create the filter, or choose Edit to go back and change values.

Create an alarm

After you create the metric filter, the CloudWatch Logs log group details page for your CloudTrail trail log group opens. Follow this procedure to create an alarm.

1. On the Metric filters tab, find the metric filter you created in the section called “Create a metric filter” (p. 303). Fill the check box for the metric filter. In the Metric filters bar, choose Create alarm.
2. On the Create Alarm page, in Specify metric and conditions, enter the following.
   a. For Graph, the line is set at 1 based on other settings you make when you create your alarm.
   b. For Metric name, keep the current metric name, IAMPolicyEventCount.
   c. For Statistic, keep the default, Sum.
   d. For Period, keep the default, 5 minutes.
   e. In Conditions, for Threshold type, choose Static.
   f. For Whenever metric_name is, choose Greater/Equal.
   g. For the threshold value, enter 1.
   h. In Additional configuration, leave defaults. Choose Next.
3. On the Configure actions page, for Notification, choose In alarm, which indicates that the action is taken when the threshold of 1 change event in 5 minutes is crossed, and IAMPolicyEventCount is in an alarm state.
   a. For Send a notification to the following SNS topic, choose Create new topic.
   b. Enter IAM_Policy_Changes_CloudWatch_Alarms_Topic as the name for the new Amazon SNS topic.
   c. In Email endpoints that will receive the notification, enter the email addresses of users whom you want to receive notifications if this alarm is raised. Separate email addresses with commas.

   Each email recipient will receive an email asking them to confirm that they want to be subscribed to the Amazon SNS topic.
   d. Choose Create topic.
4. For this example, skip the other action types. Choose Next.
5. On the **Add name and description** page, enter a friendly name for the alarm, and a description. For this example, enter **IAM Policy Changes** for the name, and **Raises alarms if IAM policy changes occur** for the description. Choose **Next**.

6. On the **Preview and create** page, review your choices. Choose **Edit** to make changes, or choose **Create alarm** to create the alarm.

After you create the alarm, CloudWatch opens the **Alarms** page. The alarm's **Actions** column shows **Pending confirmation** until all email recipients on the SNS topic have confirmed that they want to subscribe to SNS notifications.

### Configuring notifications for CloudWatch Logs alarms

You can configure CloudWatch Logs to send a notification whenever an alarm is triggered for CloudTrail. Doing so enables you to respond quickly to critical operational events captured in CloudTrail events and detected by CloudWatch Logs. CloudWatch uses Amazon Simple Notification Service (SNS) to send email. For more information, see [Set Up Amazon SNS](https://docs.aws.amazon.com/cloudwatch/latest/developerguide/set-notification-sns.html) in the *CloudWatch Developer Guide*.

### Stopping CloudTrail from sending events to CloudWatch Logs

You can stop sending AWS CloudTrail events to Amazon CloudWatch Logs by updating a trail to disable CloudWatch Logs settings.

#### Stop sending events to CloudWatch Logs (console)

**To stop sending CloudTrail events to CloudWatch Logs**

1. Sign in to the AWS Management Console and open the CloudTrail console at [https://console.aws.amazon.com/cloudtrail/](https://console.aws.amazon.com/cloudtrail/).
2. In the navigation pane, choose **Trails**.
3. Choose the name of the trail for which you want to disable CloudWatch Logs integration.
4. In **CloudWatch Logs**, choose **Edit**.
5. Clear the **Enabled** check box.
6. Choose **Save changes**.

#### Stop sending events to CloudWatch Logs (CLI)

You can remove the CloudWatch Logs log group as a delivery endpoint by running the `update-trail (p. 108)` command. The following command clears the log group and role from the trail configuration by replacing the values for the log group ARN and CloudWatch Logs role ARN with empty values.

```bash
aws cloudtrail update-trail --name trail_name --cloud-watch-logs-log-group-arn="" --cloud-watch-logs-role-arn=""
```
CloudWatch log group and log stream naming for CloudTrail

Amazon CloudWatch will display the log group that you created for CloudTrail events alongside any other log groups you have in a Region. We recommend that you use a log group name that helps you easily distinguish the log group from others. For example, `CloudTrail/logs`.

Follow these guidelines when naming a log group:

- Log group names must be unique within a Region for an AWS account.
- Log group names can be between 1 and 512 characters long.
- Log group names consist of the following characters: a-z, A-Z, 0-9, '_' (underscore), '-' (hyphen), '/' (forward slash), '.' (period), and '#' (number sign).

When CloudTrail creates the log stream for the log group, it names the log stream according to the following format: `account_ID_CloudTrail_trail_region`.

**Note**

If the volume of CloudTrail logs is large, multiple log streams may be created to deliver log data to your log group. When there are multiple log streams, CloudTrail names each log stream according to the following format: `account_ID_CloudTrail_trail_region_number`.

For more information about CloudWatch log groups, see Working with log groups and log streams in the Amazon CloudWatch Logs User Guide and CreateLogGroup in the Amazon CloudWatch Logs API Reference.

Role policy document for CloudTrail to use CloudWatch Logs for monitoring

This section describes the permissions policy required for the CloudTrail role to send log events to CloudWatch Logs. You can attach a policy document to a role when you configure CloudTrail to send events, as described in Sending events to CloudWatch Logs (p. 295). You can also create a role using IAM. For more information, see Creating a Role for an AWS Service (AWS Management Console) or Creating a Role (CLI and API).

The following example policy document contains the permissions required to create a CloudWatch log stream in the log group that you specify and to deliver CloudTrail events to that log stream in the US East (Ohio) Region. (This is the default policy for the default IAM role CloudTrail_CloudWatchLogs_Role.)

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AWSCloudTrailCreateLogStream2014110",
            "Effect": "Allow",
            "Action": ["logs:CreateLogStream"],
        }
    ]
}
```
Receiving CloudTrail log files from multiple accounts

You can have CloudTrail deliver log files from multiple AWS accounts into a single Amazon S3 bucket. For example, you have four AWS accounts with account IDs 111111111111, 222222222222, 333333333333,
and 123456789012, and 222222222222, and 333333333333, and 444444444444, and you want to configure CloudTrail to deliver log files from all four of these accounts to a bucket belonging to account 111111111111. To accomplish this, complete the following steps in order:

1. Turn on CloudTrail in the account where the destination bucket will belong (111111111111 in this example). Do not turn on CloudTrail in any other accounts yet.
   
   For instructions, see Creating a trail (p. 85).

2. Update the bucket policy on your destination bucket to grant cross-account permissions to CloudTrail.
   
   For instructions, see Setting bucket policy for multiple accounts (p. 309).

3. Turn on CloudTrail in the other accounts you want (222222222222, 333333333333, and 444444444444 in this example). Configure CloudTrail in these accounts to use the same bucket belonging to the account that you specified in step 1 (111111111111 in this example).
   
   For instructions, see Turning on CloudTrail in additional accounts (p. 310).

Redacting bucket owner account IDs for data events called by other accounts

Historically, if CloudTrail data events were enabled in the AWS account of an Amazon S3 data event API caller, CloudTrail showed the account ID of the S3 bucket owner in the data event (such as PutObject). This occurred even if the bucket owner account did not have S3 data events enabled.

Now, CloudTrail removes the account ID of the S3 bucket owner in the resources block if both of the following conditions are met:

- The data event API call is from a different AWS account than the Amazon S3 bucket owner.
- The API caller received an AccessDenied error that was only for the caller account.

The owner of the resource on which the API call was made still receives the full event.

The following event record snippets are an example of the expected behavior. In the Historic snippet, the account ID 123456789012 of the S3 bucket owner is shown to an API caller from a different account. In the example of current behavior, the account ID of the bucket owner is not shown.

```json
# Historic
"resources": [
  {
    "type": "AWS::S3::Object",
    "ARNPrefix": "arn:aws:s3:::test-my-bucket-2/"
  },
  {
    "accountId": "123456789012",
    "type": "AWS::S3::Bucket",
    "ARN": "arn:aws:s3:::test-my-bucket-2"
  }
]
```

The following is the current behavior.

```json
# Current
"resources": [
```
For a bucket to receive log files from multiple accounts, its bucket policy must grant CloudTrail permission to write log files from all the accounts you specify. This means that you must modify the bucket policy on your destination bucket to grant CloudTrail permission to write log files from each specified account.

**Note**

For security reasons, unauthorized users cannot create a trail that includes `AWSLogs/` as the `S3KeyPrefix` parameter.

**To modify bucket permissions so that files can be received from multiple accounts**

1. Sign in to the AWS Management Console using the account that owns the bucket (111111111111 in this example) and open the Amazon S3 console.
2. Choose the bucket where CloudTrail delivers your log files and then choose **Permissions**.
3. For **Bucket policy**, choose **Edit**.
4. Modify the existing policy to add a line for each additional account whose log files you want delivered to this bucket. See the following example policy and note the underlined `Resource` line specifying a second account ID. As a security best practice, add an `aws:SourceArn` condition key to the Amazon S3 bucket policy. This helps prevent unauthorized access to your S3 bucket. If you have existing trails, be sure to add one or more condition keys.

**Note**

An AWS account ID is a twelve-digit number, including leading zeros.
Turning on CloudTrail in additional accounts

You can use the console or the command line interface to turn on CloudTrail in additional AWS accounts.

Using the console to turn on CloudTrail in additional AWS accounts

You can use the CloudTrail console to turn on CloudTrail in additional accounts.

1. Sign into the AWS management console using account 222222222222 credentials and open the AWS CloudTrail console. In the navigation bar, select the Region where you want to turn on CloudTrail.

2. On the CloudTrail service home page, the Trails page, or the Trails section of the Dashboard page, choose Create trail.

3. On the Create Trail page, for Trail name, type a name for your trail. For more information, see CloudTrail naming requirements (p. 161).

4. If this is an AWS Organizations organization trail, you can choose to enable the trail for all accounts in your organization. You only see this option if you sign in to the console with a user or role in the management account or a delegated administrator account. To create an organization trail, the user or role must have sufficient permissions (p. 138). For more information, see Creating a trail for an organization (p. 135).

5. For Storage location, choose Use existing S3 bucket. Use the text box to enter the name of the bucket you created previously for storing log files when you signed in using account 111111111111 credentials.

   **Note**
   The bucket policy must grant CloudTrail permission to write to it. For information about manually editing the bucket policy, see Amazon S3 bucket policy for CloudTrail (p. 380).
   To make it easier to find your logs, create a new folder (also known as a prefix) in an existing bucket to store your CloudTrail logs. Enter the prefix in Prefix.
For Prefix, enter the same prefix you entered for storing log files when you turned on CloudTrail using account 111111111111 credentials. If you choose to use a prefix that is different from the one you entered when you turned on CloudTrail in the first account, you must edit the bucket policy on your destination bucket to allow CloudTrail to write log files to your bucket using this new prefix.

For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

If you enable SSE-KMS encryption, choose a New or Existing AWS KMS key. In AWS KMS Alias, specify an alias, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414). CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

Note
You can also type the ARN of a key from another account. The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

In Additional settings, configure the following.

a. For Log file validation, choose Enabled to have log digests delivered to your S3 bucket. You can use the digest files to verify that your log files did not change after CloudTrail delivered them. For more information, see Validating CloudTrail log file integrity (p. 324).

b. For SNS notification delivery, choose Enabled to be notified each time a log is delivered to your bucket. CloudTrail stores multiple events in a log file. SNS notifications are sent for every log file, not for every event. For more information, see Configuring Amazon SNS notifications for CloudTrail (p. 157).

If you enable SNS notifications, for Create a new SNS topic, choose New to create a topic, or choose Existing to use an existing topic. If you are creating a trail that applies to all Regions, SNS notifications for log file deliveries from all Regions are sent to the single SNS topic that you create.

If you choose New, CloudTrail specifies a name for the new topic for you, or you can type a name. If you choose Existing, choose an SNS topic from the drop-down list. You can also enter the ARN of a topic from another Region or from an account with appropriate permissions. For more information, see Amazon SNS topic policy for CloudTrail (p. 387).

If you create a topic, you must subscribe to the topic to be notified of log file delivery. You can subscribe from the Amazon SNS console. Due to the frequency of notifications, we recommend that you configure the subscription to use an Amazon SQS queue to handle notifications programmatically. For more information, see the Amazon Simple Notification Service Getting Started Guide.

9. Optionally, configure CloudTrail to send log files to CloudWatch Logs by choosing Enabled in CloudWatch Logs. For more information, see Sending events to CloudWatch Logs (p. 295).

a. If you enable integration with CloudWatch Logs, choose New to create a new log group, or Existing to use an existing one. If you choose New, CloudTrail specifies a name for the new log group for you, or you can type a name.

b. If you choose Existing, choose a log group from the drop-down list.

c. Choose New to create a new IAM role for permissions to send logs to CloudWatch Logs. Choose Existing to choose an existing IAM role from the drop-down list. The policy statement for the new or existing role is displayed when you expand Policy document. For more
information about this role, see Role policy document for CloudTrail to use CloudWatch Logs for
monitoring (p. 306).

**Note**
When you configure a trail, you can choose an S3 bucket and SNS topic that belong to
another account. However, if you want CloudTrail to deliver events to a CloudWatch
Logs log group, you must choose a log group that exists in your current account.

10. For **Tags**, add one or more custom tags (key-value pairs) to your trail. Tags can help you identify
both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then
use resource groups for your CloudTrail resources. For more information, see [AWS Resource Groups
and Why use tags for trails?](p. 15).

11. On the **Choose log events** page, choose the event types that you want to log. For **Management
events**, do the following.

   a. For **API activity**, choose if you want your trail to log **Read** events, **Write** events, or both. For
   more information, see [Management events](p. 249).

   b. Choose **Exclude AWS KMS events** to filter AWS Key Management Service (AWS KMS) events out
   of your trail. The default setting is to include all AWS KMS events.

   The option to log or exclude AWS KMS events is available only if you log management events
   on your trail. If you choose not to log management events, AWS KMS events are not logged, and
   you cannot change AWS KMS event logging settings.

   AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey typically generate a
   large volume (more than 99%) of events. These actions are now logged as **Read** events. Low-
   volume, relevant AWS KMS actions such as Disable, Delete, and ScheduleKey (which
typically account for less than 0.5% of AWS KMS event volume) are logged as **Write** events.

   To exclude high-volume events like Encrypt, Decrypt, and GenerateDataKey, but still
   log relevant events such as Disable, Delete and ScheduleKey, choose to log **Write**
management events, and clear the check box for **Exclude AWS KMS events**.

   c. Choose **Exclude Amazon RDS Data API events** to filter Amazon Relational Database Service
   Data API events out of your trail. The default setting is to include all Amazon RDS Data API
   events. For more information about Amazon RDS Data API events, see [Logging Data API calls
   with AWS CloudTrail](in the Amazon RDS User Guide for Aurora).

12. For **Data events**, you can specify logging data events for Amazon S3 buckets, AWS Lambda
functions, Amazon DynamoDB tables, or a combination of these resource types. By default, trails
don't log data events. Additional charges apply for logging data events. For more information, see
[Data events](p. 257). For CloudTrail pricing, see [AWS CloudTrail Pricing]. More data event types
are available if you use advanced event selectors; for more information, see [Creating a trail in the
console (advanced event selectors)](p. 90) in this topic.

   For Amazon S3 buckets:

   a. For **Data event source**, choose **S3**.

   b. You can choose to log **All current and future S3 buckets**, or you can specify individual buckets
   or functions. By default, data events are logged for all current and future S3 buckets.

   **Note**
   Keeping the default **All current and future S3 buckets** option enables data event
logging for all buckets currently in your AWS account and any buckets you create after
you finish creating the trail. It also enables logging of data event activity performed
by any IAM identity in your AWS account, even if that activity is performed on a bucket
that belongs to another AWS account.

   If you are creating a trail for a single Region (done by using the AWS CLI), choosing **All
current and future S3 buckets** enables data event logging for all buckets in the same
Region as your trail and any buckets you create later in that Region. It will not log data events for Amazon S3 buckets in other Regions in your AWS account.

c. If you leave the default, **All current and future S3 buckets**, choose to log **Read** events, **Write** events, or both.

d. To select individual buckets, empty the **Read** and **Write** check boxes for **All current and future S3 buckets**. In **Individual bucket selection**, browse for a bucket on which to log data events. Find specific buckets by typing a bucket prefix for the bucket you want. You can select multiple buckets in this window. Choose **Add bucket** to log data events for more buckets. Choose to log **Read** events, such as GetObject, **Write** events, such as PutObject, or both.

This setting takes precedence over individual settings you configure for individual buckets. For example, if you specify logging **Read** events for all S3 buckets, and then choose to add a specific bucket for data event logging, **Read** is already selected for the bucket you added. You cannot clear the selection. You can only configure the option for **Write**.

To remove a bucket from logging, choose **X**.

13. To add another data type on which to log data events, choose **Add data event type**.

14. For Lambda functions:
   
   a. For **Data event source**, choose Lambda.
   
   b. In **Lambda function**, choose **All regions** to log all Lambda functions, or **Input function as ARN** to log data events on a specific function.

To log data events for all Lambda functions in your AWS account, select **Log all current and future functions**. This setting takes precedence over individual settings you configure for individual functions. All functions are logged, even if all functions are not displayed.

   **Note**
   
   If you are creating a trail for all Regions, this selection enables data event logging for all functions currently in your AWS account, and any Lambda functions you might create in any Region after you finish creating the trail. If you are creating a trail for a single Region (done by using the AWS CLI), this selection enables data event logging for all functions currently in that Region in your AWS account, and any Lambda functions you might create in that Region after you finish creating the trail. It does not enable data event logging for Lambda functions created in other Regions. Logging data events for all functions also enables logging of data event activity performed by any IAM identity in your AWS account, even if that activity is performed on a function that belongs to another AWS account.

   c. If you choose **Input function as ARN**, enter the ARN of a Lambda function.

       **Note**
       
       If you have more than 15,000 Lambda functions in your account, you cannot view or select all functions in the CloudTrail console when creating a trail. You can still select the option to log all functions, even if they are not displayed. If you want to log data events for specific functions, you can manually add a function if you know its ARN. You can also finish creating the trail in the console, and then use the AWS CLI and the **put-event-selectors** command to configure data event logging for specific Lambda functions. For more information, see [Managing trails with the AWS CLI (p. 111)](https://docs.aws.amazon.com/autoscaling/latest/userguide/put-event-selectors.html).

15. For DynamoDB tables:
   
   a. For **Data event source**, choose DynamoDB.
   
   b. In **DynamoDB table selection**, choose **Browse** to select a table, or paste in the ARN of a DynamoDB table to which you have access. A DynamoDB table ARN uses the following format:

   ```
   arn:partition:dynamodb:region:account_ID:table/table_name
   ```
To add another table, choose **Add row**, and browse for a table or paste in the ARN of a table to which you have access.

16. **Choose Insights events** if you want your trail to log CloudTrail Insights events.

   In **Event type**, select **Insights events**. In **Insights events**, choose **API call rate**, **API error rate**, or both. You must be logging **Write** management events to log Insights events for **API call rate**. You must be logging **Read** or **Write** management events to log Insights events for **API error rate**.

   CloudTrail Insights analyzes management events for unusual activity, and logs events when anomalies are detected. By default, trails don't log Insights events. For more information about Insights events, see [Logging Insights events for trails](p. 285). Additional charges apply for logging Insights events. For CloudTrail pricing, see [AWS CloudTrail Pricing](#).

   Insights events are delivered to a different folder named `/CloudTrail-Insight` of the same S3 bucket that is specified in the **Storage location** area of the trail details page. CloudTrail creates the new prefix for you. For example, if your current destination S3 bucket is named `S3bucketName/AWSLogs/CloudTrail/`, the S3 bucket name with a new prefix is named `S3bucketName/AWSLogs/CloudTrail-Insight/`.

17. When you are finished choosing event types to log, choose **Next**.

18. On the **Review and create** page, review your choices. Choose **Edit** in a section to change the trail settings shown in that section. When you are ready to create the trail, choose **Create trail**.

19. The new trail appears on the **Trails** page. The **Trails** page shows the trails in your account from all Regions. In about 5 minutes, CloudTrail publishes log files that show the AWS API calls made in your account. You can see the log files in the S3 bucket that you specified. It can take up to 36 hours for CloudTrail to deliver the first Insights event, if you have enabled Insights event logging, and unusual activity is detected.

CloudTrail starts publishing log files that show the AWS calls made in your accounts in this Region. CloudTrail typically delivers logs within an average of about 5 minutes of an API call. This time is not guaranteed. Review the [AWS CloudTrail Service Level Agreement](#) for more information.

### Using the CLI to turn on CloudTrail in additional AWS accounts

You can use the AWS command line tools to turn on CloudTrail in additional accounts and aggregate their log files to one Amazon S3 bucket. For more information about these tools, see the [AWS Command Line Interface User Guide](#).

Turn on CloudTrail in your additional accounts by using the `create-trail` command, specifying the following:

- **--name** specifies the name of the trail.
- **--s3-bucket-name** specifies the existing Amazon S3 bucket you created when you turned on CloudTrail in your first account (111111111111 in this example).
- **--s3-prefix** specifies a prefix for the log file delivery path (optional).
- **--is-multi-region-trail** specifies that this trail will log events in all AWS Regions.

In contrast to trails that you create using the console, you must give every trail you create with the AWS CLI a name. You can create one trail for each Region in which an account is running AWS resources.

The following example command shows how to create a trail for your additional accounts by using the AWS CLI. To have log files for these account delivered to the bucket you created in your first account (111111111111 in this example), specify the bucket name in the **--s3-bucket-name** option. Amazon S3 bucket names are globally unique.
Sharing CloudTrail log files between AWS accounts

This section explains how to share CloudTrail log files between multiple AWS accounts. We will assume that the log files have all been received in a single Amazon S3 bucket, which is the default setting for a trail created in the CloudTrail console. In the first scenario, you will learn how to grant read-only access to the accounts that generated the log files that have been placed into your Amazon S3 bucket. In the second scenario, you will learn how to grant access to all of the log files to a third-party account that can analyze the files for you.

To share log files between multiple AWS accounts, you must perform the following general steps. These steps are explained in detail later in this section.

- Create an IAM role for each account that you want to share log files with.
- For each of these IAM roles, create an access policy that grants read-only access to the account you want to share the log files with.
- Have a user in each account programmatically assume the appropriate role and retrieve the log files.

This section walks you through the preceding steps in the context of two different sharing scenarios: granting access to the log files to each account that generated those files, and sharing log files with a third party. Most of the steps you take for the two scenarios are the same; the important difference is in what kind of permissions the IAM role grants to each account. That is, you can grant permission for an account to read only its own log files, or you can grant an account permission to read all log files. For details about permissions management for IAM roles, see IAM roles in IAM User Guide.

Scenario 1: Granting access to the account that generated the log files

In this scenario, we'll assume that your enterprise is made up of two business units and that it maintains three AWS accounts. The first account, Account A, is the top-level account. For example, it might be managed by your enterprise's IT department and therefore be responsible for collecting log files from all other departments and business units into a single bucket. The other two accounts, B and C, correspond to your enterprise's business units.

This scenario assumes that you have already configured the log files from all three accounts to be delivered to a single Amazon S3 bucket, and that account A has full control over that bucket, as shown in the following illustration.
Scenario 1: Granting access to the account that generated the log files

Although the Amazon S3 bucket contains log files that were generated by Accounts A, B and C, accounts B and C do not initially have access to the log files that accounts B and C generated. You will give each business unit read-only access to the log files that it generated, as shown in the following illustration.

To grant read-only access to the log files generated by accounts B and C, you must do the following in the account Account A. Remember that Account A has full control of the Amazon S3 bucket.

- Create an IAM role for account B and another IAM role for account C. For details, see [Creating a role](p. 318)
Scenario 2: Granting access to all logs

In this scenario, we'll assume that your enterprise is structured as it was in the previous scenario, that is, it is made up of two business units and it maintains three AWS accounts. The first account, Account A, is the top-level account. For example, it might be managed by your enterprise's IT department and therefore be responsible for placing all other log files into a single bucket. The other two accounts, B and C, correspond to each of your enterprise's business units.

Like the previous scenario, this scenario assumes that you have already placed the log files from all three accounts into a single Amazon S3 bucket, and that account A has full control over that bucket.

Finally, we'll also assume that your enterprise wants to share all the log files from all accounts (A, B, and C) with a third party. We'll say that the third party has an AWS account called Account Z, as shown in the following illustration.

To share all of the log files from your enterprise with Account Z, you must do the following in the Account A, the account that has full control over the Amazon S3 bucket.

- Create an IAM role for Account Z. How: Creating a role (p. 318)
- For the IAM role created for Account Z, create an access policy that grants read-only access to the log files generated by accounts A, B, and C. How: Creating an access policy to grant access to a third party (p. 320)
Creating a role

When you aggregate log files from multiple accounts into a single Amazon S3 bucket, only the account that has full control of the bucket, Account A in our example, has full read access to all of the log files in the bucket. Accounts B, C, and Z in our example do not have any rights until granted. Therefore, to share your AWS CloudTrail log files from one account to another (that is, to complete either Scenario 1 or Scenario 2 described previously in this section), you must enable cross-account access. You can do this by creating IAM roles and their associated access policies.

Roles

Create an IAM role for each account to which you want to give access. In our example, you will have three roles, one each for accounts B, C, and Z. Each IAM role defines an access or permissions policy that enables the accounts to access the resources (log files) owned by account A. The permissions are attached to each role and are associated with each account (B, C, or Z) only when the role is assumed.

For details about permissions management for IAM roles, see IAM Roles in the IAM User Guide. For more information about how to assume a role, see Assuming a role (p. 322).

Policies

There are two policies for each IAM role you create. The trust policy specifies a trusted entity or principal. In our example, accounts B, C, and Z are trusted entities, and a user with the proper permissions in those accounts can assume the role.

You automatically create the trust policy when you use the console to create the role. If you use the SDK to create the role, you must supply the trust policy as a parameter to the CreateRole API. If you use the AWS CLI to create the role, you must specify the trust policy in the create-role AWS CLI command.

The role access (or permissions) policy that you must create as the owner of Account A defines what actions and resources the principal or trusted entity is allowed access to (in this case, the CloudTrail log files). For Scenario 1, this grants log file access to the account that generated the log files, as discussed in Creating an access policy to grant access to accounts you own (p. 319). For Scenario 2, this grants read access to all log files to a third party, as discussed in Creating an access policy to grant access to a third party (p. 320).

For further details about creating and working with IAM policies, see Access Management in the IAM User Guide.

Creating a role

To create a role by using the console

1. Sign into the AWS Management Console as an administrator of Account A.
2. Navigate to the IAM console.
3. In the navigation pane, choose Roles.
4. Choose Create role.
5. For Trusted entity type, choose AWS account.
6. Choose Another AWS account.
7. For Scenario 1, do the following to provide access between accounts you own:
   a. Enter the twelve-digit account ID of the account (B, C, or Z) to be granted access.
   b. Check the **Require MFA** box if you want the user to provide multi-factor authentication before assuming the role.

For Scenario 2, do the following to provide access to a third-party account. In our example, you would perform these steps for Account Z, the third-party log analyzer:
   a. Enter the twelve-digit account ID of the account (Account Z) to be granted access.
   b. Enter an external ID that provides additional control over who can assume the role. For more information, see How to Use an External ID When Granting Access to Your AWS Resources to a Third Party in the IAM User Guide.

8. Choose **Next** to attach a policy that sets the permissions for this role.

9. Under **Permissions policies**, choose the **AmazonS3ReadOnlyAccess** policy.

   **Note**
   By default, the **AmazonS3ReadOnlyAccess** policy grants retrieval and list rights to all Amazon S3 buckets within your account.

   - To grant an account access to only that account's log files (Scenario 1), see Creating an access policy to grant access to accounts you own (p. 319).
   - To grant an account access to all of the log files in the Amazon S3 bucket (Scenario 2), see Creating an access policy to grant access to a third party (p. 320).

10. Choose **Next** to provide a role name and description.

11. Type a name and description for the new role, and then choose **Next**.

12. Choose **Create role**. When the role creation process completes, the role you created appears in the role list.

### Creating an access policy to grant access to accounts you own

In Scenario 1, as an administrative user in Account A, you have full control over the Amazon S3 bucket to which CloudTrail writes log files for accounts B and C. You want to share each business unit's log files back to business unit that created them. But, you don't want a unit to be able to read any other unit's log files.

For example, to share Account B's log files with Account B but not with Account C, you must create a new IAM role in Account A that specifies that Account B is a trusted account. This role trust policy specifies that Account B is trusted to assume the role created by Account A, and should look like the following example. The trust policy is automatically created if you create the role by using the console. If you use the SDK to create the role, you must supply the trust policy as a parameter to the `CreateRole` API. If you use the CLI to create the role, you must specify the trust policy in the `create-role` CLI command.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "",
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::account-B-id:root"
            },
            "Action": "sts:AssumeRole"
        }
    ]
}
```

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You must also create an access policy to specify that Account B can read from only the location to which B wrote its log files. The access policy will look something like the following. Note that the Resource ARN includes the twelve-digit account ID for Account B, and the prefix you specified, if any, when you turned on CloudTrail for Account B during the aggregation process. For more information about specifying a prefix, see Turning on CloudTrail in additional accounts (p. 310).

Important
You must ensure that the prefix in the access policy is exactly the same as the prefix that you specified when you turned on CloudTrail for Account B. If it is not, then you must edit the IAM role access policy in Account A to incorporate the actual prefix for Account B. If the prefix in the role access policy is not exactly the same as the prefix you specified when you turned on CloudTrail in Account B, then Account B will not be able to access its log files.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "s3:Get*",
        "s3:List*"
      ],
      "Resource": "arn:aws:s3:::bucket-name/prefix/AWSLogs/account-B-id/*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "s3:Get*",
        "s3:List*"
      ],
      "Resource": "arn:aws:s3:::bucket-name"
    }
  ]
}
```

The role you create for Account C will be nearly identical to the one you created for Account B. The access policy for each role must include the appropriate account ID and prefix so that each account can read from only the location to which CloudTrail wrote that account's log files.

After you create roles for each account and specify the appropriate trust and access policies, and after an IAM user in each account has been granted access by the administrator of that account, an IAM user in accounts B or C can programmatically assume the role.

After you create roles for each account and specify the appropriate trust and access policies, an IAM user in one of the newly trusted accounts (B or C) must programmatically assume the role in order to read log files from the Amazon S3 bucket.

For more information, see Assuming a role (p. 322).

Creating an access policy to grant access to a third party

Account A must create a separate IAM role for Account Z, the third-party analyzer in Scenario 2. When you create the role, AWS automatically creates the trust relationship, which specifies that Account Z will
be trusted to assume the role. The access policy for the role specifies what actions Account Z can take. For more information about creating roles and role policies, see Creating a role (p. 318).

For example, the trust relationship created by AWS specifies that Account Z is trusted to assume the role created by Account A. The following is an example trust policy:

```json
{
  "Version": "2012-10-17",
  "Statement": [{
    "Sid": "",
    "Effect": "Allow",
    "Principal": {"AWS": "arn:aws:iam::account-Z-id:root"},
    "Action": "sts:AssumeRole"
  }]
}
```

If you specified an external ID when you created the role for Account Z, your access policy contains an added Condition element that tests the unique ID assigned by Account Z. The test is performed when the role is assumed. The following example access policy has a Condition element.

For more information, see How to use an external ID when granting access to your AWS resources to a third party in the IAM User Guide.

```json
{
  "Version": "2012-10-17",
  "Statement": [{
    "Sid": "",
    "Effect": "Allow",
    "Principal": {"AWS": "arn:aws:iam::account-Z-id:root"},
    "Action": "sts:AssumeRole",
    "Condition": {"StringEquals": {"sts:ExternalId": "external-ID-issued-by-account-Z"}}
  }]
}
```

You must also create an access policy for the Account A role to specify that Account Z can read all logs from the Amazon S3 bucket. The access policy should look something like the following example. The wild card (*) at the end of the Resource value indicates that Account Z can access any log file in the S3 bucket to which it has been granted access.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": ["s3:Get*", "s3:List*"],
      "Resource": "arn:aws:s3:::bucket-name/*"
    },
    {
      "Effect": "Allow",
      "Action": ["s3:Get*", "s3:List*"],
      "Resource": "arn:aws:s3:::bucket-name"
    }
  ]
}
```
After you create a role for Account Z and specify the appropriate trust relationship and access policy, an IAM user in Account Z must programmatically assume the role to be able to read log files from the bucket. For more information, see Assumming a role (p. 322).

Assuming a role

You must designate a separate IAM user to assume each role you create in each account. You must then ensure that each IAM user has appropriate permissions.

IAM users and roles

After you create the necessary roles and policies in Account A for scenarios 1 and 2, you must designate an IAM user in each of the accounts B, C, and Z. Each IAM user programmatically assumes the appropriate role to access the log files. That is, the user in account B assumes the role created for account B, the user in account C assumes the role created for account C, and the user in account Z assumes the role created for account Z. When a user assumes a role, AWS returns temporary security credentials to that user. They can then make requests to list, retrieve, copy, or delete log files depending on the permissions granted by the access policy associated with the role.

For more information about working with IAM identities, see IAM Identities (users, user groups, and roles).

The primary difference between scenarios 1 and 2 is in the access policy that you create for each IAM role in each scenario.

- In scenario 1, the access policies for accounts B and C limit each account to reading only its own log files. For more information, see Creating an access policy to grant access to accounts you own (p. 319).
- In scenario 2, the access policy for Account Z allows it to read all the log files that are aggregated in the Amazon S3 bucket. For more information, see Creating an access policy to grant access to a third party (p. 320).

Creating permissions policies for IAM users

To perform the actions permitted by a role, the IAM user must have permission to call the AWS STS AssumeRole API. You must edit the policy for each user to grant them the appropriate permissions. To do this, you set a Resource element in the policy that you attach to the IAM user. The following example shows a policy for an IAM user in Account B that allows the user to assume a role named Test created earlier by Account A.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": ["sts:AssumeRole"],
            "Resource": "arn:aws:iam::account-A-id:role/Test"
        }
    ]
}
```

To edit a customer managed policy (console)

1. Sign in to the AWS Management Console and open the IAM console at https://console.aws.amazon.com/iam/.
2. In the navigation pane, choose **Policies**.
3. In the list of policies, choose the policy name of the policy to edit. You can use the search box to filter the list of policies.
4. Choose the **Permissions** tab, and then choose **Edit**.
5. Do one of the following:
   - Choose the **Visual** option to change your policy without understanding JSON syntax. You can make changes to the service, actions, resources, or optional conditions for each permission block in your policy. You can also import a policy to add additional permissions to the bottom of your policy. When you are finished making changes, choose **Next** to continue.
   - Choose the **JSON** option to modify your policy by typing or pasting text in the JSON text box. You can also import a policy to add additional permissions to the bottom of your policy. Resolve any security warnings, errors, or general warnings generated during **policy validation**, and then choose **Next**.

   **Note**
   You can switch between the **Visual** and **JSON** editor options any time. However, if you make changes or choose **Next** in the **Visual** editor, IAM might restructure your policy to optimize it for the visual editor. For more information, see **Policy restructuring** in the **IAM User Guide**.
6. On the **Review and save** page, review **Permissions defined in this policy** and then choose **Save changes** to save your work.
7. If the managed policy already has the maximum of five versions, choosing **Save changes** displays a dialog box. To save your new version, the oldest non-default version of the policy is removed and replaced with this new version. Optionally, you can set the new version as the default policy version.

   Choose **Save changes** to save your new policy version.

### Calling AssumeRole

A user in accounts B, C, or Z can assume a role by creating an application that calls the AWS STS **AssumeRole** API and passes the role session name, the Amazon Resource Number (ARN) of the role to assume, and an optional external ID. The role session name is defined by Account A when it creates the role to assume. The external ID, if any, is defined by Account Z and passed to Account A for inclusion during role creation. For more information, see [How to Use an External ID When Granting Access to Your AWS Resources to a Third Party](https://docs.aws.amazon.com/IAM/latest/userguide/idp-external-id.html) in the **IAM User Guide**. You can retrieve the ARN from the Account A by opening the IAM console.

#### To find the ARN Value in Account A with the IAM console

1. Choose **Roles**
2. Choose the role you want to examine.
3. Look for the **Role ARN** in the **Summary** section.

The AssumeRole API returns temporary credentials that a user in accounts B, C, or Z can use to access resources in Account A. In this example, the resources you want to access are the Amazon S3 bucket and the log files that the bucket contains. The temporary credentials have the permissions that you defined in the role access policy.

The following Python example (using the [AWS SDK for Python (Boto)](https://aws.amazon.com/sdk-for-python/)) shows how to call AssumeRole and how to use the temporary security credentials returned to list all Amazon S3 buckets controlled by Account A.

```python
def list_buckets_from_assumed_role(user_key, assume_role_arn, session_name):
```
Stop sharing CloudTrail log files between AWS accounts

To stop sharing log files to another AWS account, you delete the role that you created for that account in Creating a role (p. 318).

1. Sign in to the AWS Management Console with administrative permissions for Account A.
2. Navigate to the IAM console.
3. In the navigation pane, choose Roles.
4. Select the role you want to delete.
5. Choose Delete.

Validating CloudTrail log file integrity

To determine whether a log file was modified, deleted, or unchanged after CloudTrail delivered it, you can use CloudTrail log file integrity validation. This feature is built using industry standard algorithms: SHA-256 for hashing and SHA-256 with RSA for digital signing. This makes it computationally infeasible to modify, delete or forge CloudTrail log files without detection. You can use the AWS CLI to validate the files in the location where CloudTrail delivered them.
Why use it?

Validated log files are invaluable in security and forensic investigations. For example, a validated log file enables you to assert positively that the log file itself has not changed, or that particular user credentials performed specific API activity. The CloudTrail log file integrity validation process also lets you know if a log file has been deleted or changed, or assert positively that no log files were delivered to your account during a given period of time.

How it works

When you enable log file integrity validation, CloudTrail creates a hash for every log file that it delivers. Every hour, CloudTrail also creates and delivers a file that references the log files for the last hour and contains a hash of each. This file is called a digest file. CloudTrail signs each digest file using the private key of a public and private key pair. After delivery, you can use the public key to validate the digest file. CloudTrail uses different key pairs for each AWS Region.

The digest files are delivered to the same Amazon S3 bucket associated with your trail as your CloudTrail log files. If your log files are delivered from all Regions or from multiple accounts into a single Amazon S3 bucket, CloudTrail will deliver the digest files from those Regions and accounts into the same bucket.

The digest files are put into a folder separate from the log files. This separation of digest files and log files enables you to enforce granular security policies and permits existing log processing solutions to continue to operate without modification. Each digest file also contains the digital signature of the previous digest file if one exists. The signature for the current digest file is in the metadata properties of the digest file Amazon S3 object. For more information about digest file contents, see CloudTrail digest file structure (p. 331).

Storing log and digest files

You can store the CloudTrail log files and digest files in Amazon S3 or S3 Glacier securely, durably and inexpensively for an indefinite period of time. To enhance the security of the digest files stored in Amazon S3, you can use Amazon S3 MFA Delete.

Enabling validation and validating files

To enable log file integrity validation, you can use the AWS Management Console, the AWS CLI, or CloudTrail API. Enabling log file integrity validation allows CloudTrail to deliver digest log files to your Amazon S3 bucket, but does not validate the integrity of the files. For more information, see Enabling log file integrity validation for CloudTrail (p. 325).

To validate the integrity of CloudTrail log files, you can use the AWS CLI or create your own solution. The AWS CLI will validate files in the location where CloudTrail delivered them. If you want to validate logs that you have moved to a different location, either in Amazon S3 or elsewhere, you can create your own validation tools.

For information on validating logs by using the AWS CLI, see Validating CloudTrail log file integrity with the AWS CLI (p. 326). For information on developing custom implementations of CloudTrail log file validation, see Custom implementations of CloudTrail log file integrity validation (p. 336).

Enabling log file integrity validation for CloudTrail

You can enable log file integrity validation by using the AWS Management Console, AWS Command Line Interface (AWS CLI), or CloudTrail API. CloudTrail starts delivering digest files in about an hour.
AWS Management Console

To enable log file integrity validation with the CloudTrail console, choose Yes for the Enable log file validation option when you create or update a trail. By default, this feature is enabled for new trails. For more information, see Creating and updating a trail with the console (p. 85).

AWS CLI

To enable log file integrity validation with the AWS CLI, use the --enable-log-file-validation option with the create-trail or update-trail commands. To disable log file integrity validation, use the --no-enable-log-file-validation option.

Example

The following update-trail command enables log file validation and starts delivering digest files to the Amazon S3 bucket for the specified trail.

```
aws cloudtrail update-trail --name your-trail-name --enable-log-file-validation
```

CloudTrail API

To enable log file integrity validation with the CloudTrail API, set the EnableLogFileValidation request parameter to true when calling CreateTrail or UpdateTrail.

For more information, see CreateTrail and UpdateTrail in the AWS CloudTrail API Reference.

Validating CloudTrail log file integrity with the AWS CLI

To validate logs with the AWS Command Line Interface, use the CloudTrail validate-logs command. The command uses the digest files delivered to your Amazon S3 bucket to perform the validation. For information about digest files, see CloudTrail digest file structure (p. 331).

The AWS CLI allows you to detect the following types of changes:

- Modification or deletion of CloudTrail log files
- Modification or deletion of CloudTrail digest files
- Modification or deletion of both of the above

**Note**
The AWS CLI validates only log files that are referenced by digest files. For more information, see Checking whether a particular file was delivered by CloudTrail (p. 331).

Prerequisites

To validate log file integrity with the AWS CLI, the following conditions must be met:

- You must have online connectivity to AWS.
- You must have read access to the Amazon S3 bucket that contains the digest and log files.
- The digest and log files must not have been moved from the original Amazon S3 location where CloudTrail delivered them.
Note
Log files that have been downloaded to local disk cannot be validated with the AWS CLI. For guidance on creating your own tools for validation, see Custom implementations of CloudTrail log file integrity validation (p. 336).

validate-logs

Syntax

The following is the syntax for validate-logs. Optional parameters are shown in brackets.

aws cloudtrail validate-logs --trail-arn <trailARN> --start-time <start-time> [--end-time <end-time>] [--s3-bucket <bucket-name>] [--s3-prefix <prefix>] [--account-id <account-id>] [--verbose]

Note
The validate-logs command is Region specific. You must specify the --region global option to validate logs for a specific AWS Region.

Options

The following are the command-line options for validate-logs. The --trail-arn and --start-time options are required. The --account-id option is additionally required for organizational trails.

--start-time

Specifies that log files delivered on or after the specified UTC timestamp value will be validated. Example: 2015-01-08T05:21:42Z.

--end-time

Optionally specifies that log files delivered on or before the specified UTC timestamp value will be validated. The default value is the current UTC time (Date.now()). Example: 2015-01-08T12:31:41Z.

Note
For the time range specified, the validate-logs command checks only the log files that are referenced in their corresponding digest files. No other log files in the Amazon S3 bucket are checked. For more information, see Checking whether a particular file was delivered by CloudTrail (p. 331).

--s3-bucket

Optionally specifies the Amazon S3 bucket where the digest files are stored. If a bucket name is not specified, the AWS CLI will retrieve it by calling DescribeTrails().

--s3-prefix

Optionally specifies the Amazon S3 prefix where the digest files are stored. If not specified, the AWS CLI will retrieve it by calling DescribeTrails().

Note
You should use this option only if your current prefix is different from the prefix that was in use during the time range that you specify.
--account-id

Optionally specifies the account for validating logs. This parameter is required for organization trails for validating logs for the specific account inside an organization.

--trail-arn

Specifies the Amazon Resource Name (ARN) of the trail to be validated. The format of a trail ARN follows.

```
arn:aws:cloudtrail:us-east-2:111111111111:trail/MyTrailName
```

**Note**
To obtain the trail ARN for a trail, you can use the `describe-trails` command before running `validate-logs`. You may want to specify the bucket name and prefix in addition to the trail ARN if log files have been delivered to more than one bucket in the time range that you specified, and you want to restrict the validation to the log files in only one of the buckets.

--verbose

Optionally outputs validation information for every log or digest file in the specified time range. The output indicates whether the file remains unchanged or has been modified or deleted. In non-verbose mode (the default), information is returned only for those cases in which there was a validation failure.

**Example**

The following example validates log files from the specified start time to the present, using the Amazon S3 bucket configured for the current trail and specifying verbose output.

```
aws cloutrail validate-logs --start-time 2015-08-27T00:00:00Z --end-time 2015-08-28T00:00:00Z --trail-arn arn:aws:cloudtrail:us-east-2:111111111111:trail/my-trail-name --verbose
```

**How validate-logs works**

The `validate-logs` command starts by validating the most recent digest file in the specified time range. First, it verifies that the digest file has been downloaded from the location to which it claims to belong. In other words, if the CLI downloads digest file `df1` from the S3 location `p1`, `validate-logs` will verify that `p1 == df1.digestS3Bucket + '/' + df1.digestS3Object`.

If the signature of the digest file is valid, it checks the hash value of each of the logs referenced in the digest file. The command then goes back in time, validating the previous digest files and their referenced log files in succession. It continues until the specified value for `start-time` is reached, or until the digest chain ends. If a digest file is missing or not valid, the time range that cannot be validated is indicated in the output.

**Validation results**

Validation results begin with a summary header in the following format:

```
Validating log files for trail trail_ARN between time_stamp and time_stamp
```
Each line of the main output contains the validation results for a single digest or log file in the following format:

```
<Digest file | Log file> <S3 path> <Validation Message>
```

The following table describes the possible validation messages for log and digest files.

<table>
<thead>
<tr>
<th>File Type</th>
<th>Validation Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digest file</td>
<td>valid</td>
<td>The digest file signature is valid. The log files it references can be checked. This message is included only in verbose mode.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: has been moved from its original location</td>
<td>The S3 bucket or S3 object from which the digest file was retrieved do not match the S3 bucket or S3 object locations that are recorded in the digest file itself.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: invalid format</td>
<td>The format of the digest file is invalid. The log files corresponding to the time range that the digest file represents cannot be validated.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: not found</td>
<td>The digest file was not found. The log files corresponding to the time range that the digest file represents cannot be validated.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: public key not found for fingerprint fingerprint</td>
<td>The public key corresponding to the fingerprint recorded in the digest file was not found. The digest file cannot be validated.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: signature verification failed</td>
<td>The digest file signature is not valid. Because the digest file is not valid, the log files it references cannot be validated, and no assertions can be made about the API activity in them.</td>
</tr>
<tr>
<td>Digest file</td>
<td>INVALID: Unable to load PKCS #1 key with fingerprint fingerprint</td>
<td>Because the DER encoded public key in PKCS #1 format having the specified fingerprint could not be loaded, the digest file cannot be validated.</td>
</tr>
<tr>
<td>Log file</td>
<td>valid</td>
<td>The log file has been validated and has not been modified since the time of delivery. This message is included only in verbose mode.</td>
</tr>
<tr>
<td>Log file</td>
<td>INVALID: hash value doesn’t match</td>
<td>The hash for the log file does not match. The log file has been modified after delivery by CloudTrail.</td>
</tr>
<tr>
<td>Log file</td>
<td>INVALID: invalid format</td>
<td>The format of the log file is invalid. The log file cannot be validated.</td>
</tr>
<tr>
<td>Log file</td>
<td>INVALID: not found</td>
<td>The log file was not found and cannot be validated.</td>
</tr>
</tbody>
</table>

The output includes summary information about the results returned.
Example outputs

Verbose

The following example `validate-logs` command uses the `--verbose` flag and produces the sample output that follows. [...] indicates the sample output has been abbreviated.

```bash
```

Validating log files for trail arn:aws:cloudtrail:us-east-2:111111111111:trail/example-trail-name between 2015-08-31T22:00:00Z and 2015-09-01T19:17:29Z

Digest file s3://example-bucket/AWSLogs/111111111111/CloudTrail-Digest/us-east-2/2015/09/01/111111111111_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T201728Z.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1925Z_WZZwiRymnjCRjxXc.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1915Z_POuvV87nu6pfAV2W.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1930Z_l2QgXhAKVm1QXiIA.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1920Z_eQJteBBrfpBCqOqw.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1950Z_9g5A6qlRZBSKaRdq.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1920Z_i4DNCC12BuXd6Ru7.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/09/01/111111111111_CloudTrail_us-east-2_20150901T1915Z_Sg5caf2RH63dx0EJ.json.gz valid
Digest file s3://example-bucket/AWSLogs/111111111111/CloudTrail-Digest/us-east-2/2015/09/01/111111111111_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T191728Z.json.gz INVALID: signature verification failed
Digest file s3://example-bucket/AWSLogs/111111111111/CloudTrail-Digest/us-east-2/2015/09/01/111111111111_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T091728Z.json.gz valid
 [...]
Log file s3://example-bucket/AWSLogs/144218288521/CloudTrail/us-east-2/2015/09/01/144218288521_CloudTrail_us-east-2_20150901T0830Z_YYSFiuFQk4nrttEW.json.gz valid
Log file s3://example-bucket/AWSLogs/144218288521/CloudTrail/us-east-2/2015/09/01/144218288521_CloudTrail_us-east-2_20150901T1055Z_05fy6m9f6iBzmoPF.json.gz valid
Log file s3://example-bucket/AWSLogs/144218288521/CloudTrail/us-east-2/2015/09/01/144218288521_CloudTrail_us-east-2_20150901T1040Z_La3QzVLP0ed7iR.json.gz valid
Digest file s3://example-bucket/AWSLogs/144218288521/CloudTrail-Digest/us-east-2/2015/09/01/144218288521_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T101728Z.json.gz INVALID: signature verification failed
 [...]
Log file s3://example-bucket/AWSLogs/144218288521/CloudTrail/us-east-2/2015/09/01/144218288521_CloudTrail_us-east-2_20150901T0830Z_eaFvO3dWo4Ncqqc.json.gz valid
Log file s3://example-bucket/AWSLogs/144218288521/CloudTrail/us-east-2/2015/09/01/144218288521_CloudTrail_us-east-2_20150901T091728Z.json.gz valid
CloudTrail digest file structure

Each digest file contains the names of the log files that were delivered to your Amazon S3 bucket during the last hour, the hash values for those log files, and the digital signature of the previous digest file. The

Non-verbose

The following example validate-logs command does not use the --verbose flag. In the sample output that follows, one error was found. Only the header, error, and summary information are returned.


Validating log files for trail arn:aws:cloudtrail:us-east-2:111111111111:trail/example-trail-name between 2015-08-31T22:00:00Z and 2015-09-01T19:17:29Z

Digest file s3://example-bucket/AWSLogs/144218288521/CloudTrail-Digest/us-east-2/2015/09/01/144218288521_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T081728Z.json.gz valid
Digest file s3://example-bucket/AWSLogs/144218288521/CloudTrail-Digest/us-east-2/2015/09/01/144218288521_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150901T071728Z.json.gz valid
[...]
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/08/31/111111111111_CloudTrail_us-east-2_20150831T2245Z_mb3KE05kNcDnVhGh.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/08/31/111111111111_CloudTrail_us-east-2_20150831T2225Z_IQ6kXy8SKU03RSPr.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/08/31/111111111111_CloudTrail_us-east-2_20150831T2230Z_eRPVRTxHQ5498ROA.json.gz valid
Log file s3://example-bucket/AWSLogs/111111111111/CloudTrail/us-east-2/2015/08/31/111111111111_CloudTrail_us-east-2_20150831T2255Z_ILWawY7zWb5vYN.json.gz valid
Digest file s3://example-bucket/AWSLogs/111111111111/CloudTrail-Digest/us-east-2/2015/08/31/111111111111_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150831T221728Z.json.gz valid

Results requested for 2015-08-31T22:00:00Z to 2015-09-01T19:17:29Z
Results found for 2015-08-31T22:17:28Z to 2015-09-01T20:17:28Z:
22/23 digest files valid, 1/23 digest files INVALID
63/63 log files valid

Checking whether a particular file was delivered by CloudTrail

To check if a particular file in your bucket was delivered by CloudTrail, run validate-logs in verbose mode for the time period that includes the file. If the file appears in the output of validate-logs, then the file was delivered by CloudTrail.

CloudTrail digest file structure

Each digest file contains the names of the log files that were delivered to your Amazon S3 bucket during the last hour, the hash values for those log files, and the digital signature of the previous digest file. The
signature for the current digest file is stored in the metadata properties of the digest file object. The digital signatures and hashes are used for validating the integrity of the log files and of the digest file itself.

**Digest file location**

Digest files are delivered to an Amazon S3 bucket location that follows this syntax.

```s3://s3-bucket-name/optional-prefix/AWSLogs/aws-account-id/CloudTrail-Digest/region/digest-end-year/digest-end-month/digest-end-date/aws-account-id_CloudTrail-Digest-region_trail-name_region_digest_end_timestamp.json.gz
```

**Note**

For organization trails, the bucket location also includes the organization unit ID, as follows:

```s3://s3-bucket-name/optional-prefix/AWSLogs/O-ID/aws-account-id/CloudTrail-Digest/region/digest-end-year/digest-end-month/digest-end-date/aws-account-id_CloudTrail-Digest-region_trail-name_region_digest_end_timestamp.json.gz
```

**Sample digest file contents**

The following example digest file contains information for a CloudTrail log.

```json
{
  "awsAccountId": "111122223333",
  "digestStartTime": "2015-08-17T14:01:31Z",
  "digestEndTime": "2015-08-17T15:01:31Z",
  "digestS3Bucket": "S3-bucket-name",
  "digestS3Object": "AWSLogs/111122223333/CloudTrail-Digest/us-east-2/2015/08/17/111122223333_CloudTrail-Digest_us-east-2_your-trail-name_us-east-2_20150817T150131Z.json.gz",
  "digestPublicKeyFingerprint": "31e8b5433410dfb61a9dc45cc65b22ff",
  "digestSignatureAlgorithm": "SHA256withRSA",
  "newestEventTime": "2015-08-17T14:52:27Z",
  "oldestEventTime": "2015-08-17T14:42:27Z",
  "previousDigestS3Bucket": "S3-bucket-name",
  "previousDigestS3Object": "AWSLogs/111122223333/CloudTrail-Digest/us-east-2/2015/08/17/111122223333_CloudTrail-Digest_us-east-2_your-trail-name_us-east-2_20150817T140131Z.json.gz",
  "previousDigestHashValue": "97fb791cf91ff448d274f8190dbd9aa09c34432aba82739df18b6d3c13df2d",
  "previousDigestHashAlgorithm": "SHA-256",
  "previousDigestSignature": "50887ccffad600297caad...a2fd8848d428e46e8456328a",
  "logFiles": [
    {
      "s3Bucket": "S3-bucket-name",
      "s3Object": "AWSLogs/111122223333/CloudTrail/us-east-2/2015/08/17/111122223333_CloudTrail_us-east-2_20150817T140131Z.json.gz",
      "hashValue": "9bb6196fc6b84d6f075a56548feca262bd99ba3c2de41b618e5b6e22c1fc71f6",
      "hashAlgorithm": "SHA-256",
      "newestEventTime": "2015-08-17T14:52:27Z",
      "oldestEventTime": "2015-08-17T14:42:27Z"
    }
  ]
}
```
# Digest file field descriptions

The following are descriptions for each field in the digest file:

**awsAccountId**

The AWS account ID for which the digest file has been delivered.

**digestStartTime**

The starting UTC time range that the digest file covers, taking as a reference the time in which log files have been delivered by CloudTrail. This means that if the time range is \([T_a, T_b]\), the digest will contain all the log files delivered to the customer between \(T_a\) and \(T_b\).

**digestEndTime**

The ending UTC time range that the digest file covers, taking as a reference the time in which log files have been delivered by CloudTrail. This means that if the time range is \([T_a, T_b]\), the digest will contain all the log files delivered to the customer between \(T_a\) and \(T_b\).

**digestS3Bucket**

The name of the Amazon S3 bucket to which the current digest file has been delivered.

**digestS3Object**

The Amazon S3 object key (that is, the Amazon S3 bucket location) of the current digest file. The first two Regions in the string show the Region from which the digest file was delivered. The last Region (after \(\text{your-trail-name}\)) is the home Region of the trail. The home Region is the Region in which the trail was created. In the case of a multi-Region trail, this can be different from the Region from which the digest file was delivered.

**newestEventTime**

The UTC time of the most recent event among all of the events in the log files in the digest.

**oldestEventTime**

The UTC time of the oldest event among all of the events in the log files in the digest.

**previousDigestS3Bucket**

The Amazon S3 bucket to which the previous digest file was delivered.

**previousDigestS3Object**

The Amazon S3 object key (that is, the Amazon S3 bucket location) of the previous digest file.

**previousDigestHashValue**

The hexadecimal encoded hash value of the uncompressed contents of the previous digest file.

---

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previousDigestHashAlgorithm

The name of the hash algorithm that was used to hash the previous digest file.

publicKeyFingerprint

The hexadecimal encoded fingerprint of the public key that matches the private key used to sign this digest file. You can retrieve the public keys for the time range corresponding to the digest file by using the AWS CLI or the CloudTrail API. Of the public keys returned, the one whose fingerprint matches this value can be used for validating the digest file. For information about retrieving public keys for digest files, see the AWS CLI list-public-keys command or the CloudTrail ListPublicKeys API.

Note
CloudTrail uses different private/public key pairs per Region. Each digest file is signed with a private key unique to its Region. Therefore, when you validate a digest file from a particular Region, you must look in the same Region for its corresponding public key.

digestSignatureAlgorithm

The algorithm used to sign the digest file.

logFiles.s3Bucket

The name of the Amazon S3 bucket for the log file.

logFiles.s3Object

The Amazon S3 object key of the current log file.

logFiles.newestEventTime

The UTC time of the most recent event in the log file. This time also corresponds to the time stamp of the log file itself.

logFiles.oldestEventTime

The UTC time of the oldest event in the log file.

logFiles.hashValue

The hexadecimal encoded hash value of the uncompressed log file content.

logFiles.hashAlgorithm

The hash algorithm used to hash the log file.

Starting digest file

When log file integrity validation is started, a starting digest file will be generated. A starting digest file will also be generated when log file integrity validation is restarted (by either disabling and then reenabling log file integrity validation, or by stopping logging and then restarting logging with validation enabled). In a starting digest file, the following fields relating to the previous digest file will be null:
CloudTrail digest file structure

- previousDigestS3Bucket
- previousDigestS3Object
- previousDigestHashValue
- previousDigestHashAlgorithm
- previousDigestSignature

'Empty' digest files

CloudTrail will deliver a digest file even when there has been no API activity in your account during the one hour period that the digest file represents. This can be useful when you need to assert that no log files were delivered during the hour reported by the digest file.

The following example shows the contents of a digest file that recorded an hour when no API activity occurred. Note that the logFiles:[] field at the end of the digest file contents is empty.

```json
{
  "awsAccountId": "111122223333",
  "digestStartTime": "2015-08-20T17:01:31Z",
  "digestEndTime": "2015-08-20T18:01:31Z",
  "digestS3Bucket": "example-bucket-name",
  "digestS3Object": "AWSLogs/111122223333/CloudTrail-Digest/us-east-2/2015/08/20/111122223333_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150820T180131Z.json.gz",
  "digestPublicKeyFingerprint": "31e8b5433410dfb61a9dc45cc65b22ff",
  "digestSignatureAlgorithm": "SHA256withRSA",
  "newestEventTime": null,
  "oldestEventTime": null,
  "previousDigestS3Bucket": "example-bucket-name",
  "previousDigestS3Object": "AWSLogs/111122223333/CloudTrail-Digest/us-east-2/2015/08/20/111122223333_CloudTrail-Digest_us-east-2_example-trail-name_us-east-2_20150820T170131Z.json.gz",
  "previousDigestHashValue": "ed96c4bac9eaa8fe9716ca0e515da51938be65b22ff",
  "previousDigestHashAlgorithm": "SHA-256",
  "previousDigestSignature": "82705525fb0fe7f919f9434e5b7138cb41793c776c7414f3520c0242902daa8cc8286b29263d2627f2f259471c745b1654af7e5f5c4ad85e3f3b17f3f38ae0eb886e15a41b608f27e2a26602db5e56ba65ca79c12506b87c8a1b2a4416a9d05cdfa",
  "logFiles": []
}
```

Signature of the digest file

The signature information for a digest file is located in two object metadata properties of the Amazon S3 digest file object. Each digest file has the following metadata entries:

- x-amz-meta-signature
  The hexadecimal encoded value of the digest file signature. The following is an example signature:
  ```
  3be472336fa2989ef34de1b3c1bf851f59eb030eaff3e2fb6600a082a23f4c6a82966565b994f9de4a5989d055d9d15d20fc5928f1cc2c57f372264a51b6110c01da429565de0f7053539f47e1009051769a69231b22232fa260dfb02740047af532229885e472bc05d3fcb5d2dd5dc28f8bb5b7993938ea5f912a82b44a367eccb2ec0f198ba71e23eb0b97278cf65f3c8d1e652c6de33a22
  ```

- x-amz-meta-signature-algorithm
  The following shows an example value of the algorithm used to generate the digest signature:
Custom implementations of CloudTrail log file integrity validation

Because CloudTrail uses industry standard, openly available cryptographic algorithms and hash functions, you can create your own tools to validate the integrity of CloudTrail log files. When log file integrity validation is enabled, CloudTrail delivers digest files to your Amazon S3 bucket. You can use these files to implement your own validation solution. For more information about digest files, see CloudTrail digest file structure (p. 331).

This topic describes how digest files are signed, and then details the steps that you will need to take to implement a solution that validates the digest files and the log files that they reference.

Understanding how CloudTrail digest files are signed

CloudTrail digest files are signed with RSA digital signatures. For each digest file, CloudTrail does the following:

1. Creates a string for data signing based on designated digest file fields (described in the next section).
2. Gets a private key unique to the Region.
3. Passes the SHA-256 hash of the string and the private key to the RSA signing algorithm, which produces a digital signature.
4. Encodes the byte code of the signature into hexadecimal format.
5. Puts the digital signature into the x-amz-meta-signature metadata property of the Amazon S3 digest file object.

Contents of the data signing string

The following CloudTrail objects are included in the string for data signing:

- The ending timestamp of the digest file in UTC extended format (for example, 2015-05-08T07:19:37Z)
- The current digest file S3 path
- The hexadecimal-encoded SHA-256 hash of the current digest file
Custom implementations of CloudTrail log file integrity validation

- The hexadecimal-encoded signature of the previous digest file

The format for calculating this string and an example string are provided later in this document.

**Custom validation implementation steps**

When implementing a custom validation solution, you will need to validate the digest file first, and then the log files that it references.

**Validate the digest file**

To validate a digest file, you need its signature, the public key whose private key was used to signed it, and a data signing string that you compute.

1. Get the digest file.
2. Verify that the digest file has been retrieved from its original location.
4. Get the hexadecimal-encoded fingerprint of the public key whose private key was used to sign the digest file.
5. Retrieve the public keys for the time range corresponding to the digest file.
6. From among the public keys retrieved, choose the public key whose fingerprint matches the fingerprint in the digest file.
7. Using the digest file hash and other digest file fields, recreate the data signing string used to verify the digest file signature.
8. Validate the signature by passing in the SHA-256 hash of the string, the public key, and the signature as parameters to the RSA signature verification algorithm. If the result is true, the digest file is valid.

**Validate the log files**

If the digest file is valid, validate each of the log files that the digest file references.

1. To validate the integrity of a log file, compute its SHA-256 hash value on its uncompressed content and compare the results with the hash for the log file recorded in hexadecimal in the digest. If the hashes match, the log file is valid.
2. By using the information about the previous digest file that is included in the current digest file, validate the previous digest files and their corresponding log files in succession.

The following sections describe these steps in detail.

**A. Get the digest file**

The first steps are to get the most recent digest file, verify that you have retrieved it from its original location, verify its digital signature, and get the fingerprint of the public key.

1. Using `S3.Get` or the AmazonS3Client class (for example), get the most recent digest file from your Amazon S3 bucket for the time range that you want to validate.
2. Check that the S3 bucket and S3 object used to retrieve the file match the S3 bucket S3 object locations that are recorded in the digest file itself.
3. Next, get the digital signature of the digest file from the `x-amz-meta-signature` metadata property of the digest file object in Amazon S3.
4. In the digest file, get the fingerprint of the public key whose private key was used to sign the digest file from the `digestPublicKeyFingerprint` field.
B. Retrieve the public key for validating the digest file

To get the public key to validate the digest file, you can use either the AWS CLI or the CloudTrail API. In both cases, you specify a time range (that is, a start time and end time) for the digest files that you want to validate. One or more public keys may be returned for the time range that you specify. The returned keys may have validity time ranges that overlap.

**Note**

Because CloudTrail uses different private/public key pairs per Region, each digest file is signed with a private key unique to its Region. Therefore, when you validate a digest file from a particular Region, you must retrieve its public key from the same Region.

**Use the AWS CLI to retrieve public keys**

To retrieve public keys for digest files by using the AWS CLI, use the `cloudtrail list-public-keys` command. The command has the following format:

```
aws cloudtrail list-public-keys [--start-time <start-time>] [--end-time <end-time>]
```

The start-time and end-time parameters are UTC timestamps and are optional. If not specified, the current time is used, and the currently active public key or keys are returned.

**Sample Response**

The response will be a list of JSON objects representing the key (or keys) returned:

```
{
  "publicKeyList": [ {
    "ValidityStartTime": "1436317441.0",
    "ValidityEndTime": "1438909441.0",
    "Value": "MIIBCgKCAQEAn11L2YZ9h7onug2iLIiMyHlIRsTqjfwE+pHVRk1QjfwH1n+1p0a8f8r0wz/7sAh5hN6L6hezouU0XTDsfmnnP97mcy7z/upfZdS/AAHyGcay7n6Wc/RRBUvMjPiC+u0j56k6/GjyA810PSYdU8vTzaxarULP1r9k1AdP+L+zRfR5psekE9h1Izc5HuW07S0y+KunqX6j9Q8n9gX9TmxfPB80Fiy1tGWTfks/4YSKGqmgH0YDcawP9GGDAEClqPWXDLG1j0jR9RZwFea0D13Ukz8V7s8h4qz/5ZxRFE77
    "Fingerprint": "8eba5db5b64d6d1c96a7756fe7f2"
  }, {
    "ValidityStartTime": "1434589460.0",
    "ValidityEndTime": "1437181460.0",
    "Value": "MIIBCgKCAQEApfYL2FiZhpN74LmNiVWjR-V+HveYhwhMy6b0n5f6619syxSKAwKWEvnMnAQG7Bv5s5g2MqQFXQ52fW7NWV441vFJ2xGXT+wT+DgR6ZQ+6yxsksQNHV5YxJy4Aa5z4j3kJFsYj8u02MDTZN1zNhBzaBJ+i2WIAJ/XqS4kyF63B6E58V+k0eDE7n5dFQeU06FLP1nvgggYe2YmRefez71wNCJKY+q0h1BShrSMRWrUJ1w7MXw9f1Qcng9yyjUlN3omozQzA5sw5Rfbp1cCYNY40vXgD/aAmO0m++YXFM1kwtLLcsehPv8j43qVn06x48JH9bNwhoPo9sdsb50iK3QIDAQAB",
    "Fingerprint": "a893b399dc64d266e14ff66566ee4"
  }, {
    "ValidityStartTime": "1434589370.0",
    "ValidityEndTime": "1437181370.0",
    "Value": "MIIBCgKCAQEAn11L2YZ9h7onug2iLIiMyHlIRsTqjfwE+pHVRk1QjfwH1n+1p0a8f8r0wz/7sAh5hN6L6hezouU0XTDsfmnnP97mcy7z/upfZdS/AAHyGcay7n6Wc/RRBUvMjPiC+u0j56k6/GjyA810PSYdU8vTzaxarULP1r9k1AdP+L+zRfR5psekE9h1Izc5HuW07S0y+KunqX6j9Q8n9gX9TmxfPB80Fiy1tGWTfks/4YSKGqmgH0YDcawP9GGDAEClqPWXDLG1j0jR9RZwFea0D13Ukz8V7s8h4qz/5ZxRFE77
    "Fingerprint": "31e8b5433410dfb61a9dc45cc65b22ff"
  }
}
```

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Use the CloudTrail API to retrieve public keys

To retrieve public keys for digest files by using the CloudTrail API, pass in start time and end time values to the ListPublicKeys API. The ListPublicKeys API returns the public keys whose private keys were used to sign digest files within the specified time range. For each public key, the API also returns the corresponding fingerprint.

**ListPublicKeys**

This section describes the request parameters and response elements for the ListPublicKeys API.

*Note*

The encoding for the binary fields for ListPublicKeys is subject to change.

**Request Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>StartTime</td>
<td>Optionally specifies, in UTC, the start of the time range to look up public keys for CloudTrail digest files. If StartTime is not specified, the current time is used, and the current public key is returned. Type: DateTime</td>
</tr>
<tr>
<td>EndTime</td>
<td>Optionally specifies, in UTC, the end of the time range to look up public keys for CloudTrail digest files. If EndTime is not specified, the current time is used. Type: DateTime</td>
</tr>
</tbody>
</table>

**Response Elements**

PublicKeyList, an array of PublicKey objects that contains:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>The DER encoded public key value in PKCS #1 format. Type: Blob</td>
</tr>
<tr>
<td>ValidityStartTime</td>
<td>The starting time of validity of the public key. Type: DateTime</td>
</tr>
<tr>
<td>ValidityEndTime</td>
<td>The ending time of validity of the public key. Type: DateTime</td>
</tr>
<tr>
<td>Fingerprint</td>
<td>The fingerprint of the public key. The fingerprint can be used to identify the public key that you must use to validate the digest file. Type: String</td>
</tr>
</tbody>
</table>

C. Choose the public key to use for validation

From among the public keys retrieved by list-public-keys or ListPublicKeys, choose the public key returned whose fingerprint matches the fingerprint recorded in the digestPublicKeyFingerprint field of the digest file. This is the public key that you will use to validate the digest file.
D. Recreate the data signing string

Now that you have the signature of the digest file and associated public key, you need to calculate the data signing string. After you have calculated the data signing string, you will have the inputs needed to verify the signature.

The data signing string has the following format:

\[
\text{Data\_To\_Sign\_String} = \\
\text{Digest\_End\_Timestamp\_in\_UTC\_Extended\_format} + \text{Current\_Digest\_File\_S3\_Path} + \text{Hex(Sha256(current-digest-file-content))} + \text{Previous\_digest\_signature\_in\_hex}
\]

An example Data\_To\_Sign\_String follows.

```
2015-08-12T04:01:31Z
S3-bucket-name/AWSLogs/111122223333/CloudTrail-Digest/us-east-2/20150812T040131Z.json.gz
4ff08d7c6ecd6eb313257e839645d20363ee3784a2328a7d7b6b9b53cc9bacd
6e8540b83c3ac86a80312d971a225361d28ed0aaf20d78c211a2d405e32abf529a8145c2966e3bb47362338a52441545ed091f8b1f
64c7c90dd152b84e79999c7a9ec35d2b264eb92eb8e90f1e5ec5d40ec8a0729cf2ff57f9e30d5343a8591638f8b794972ce199
8b0aee2c1c8af74ec620261529265e83a9834ebf6054979d5e9a6767dafa6f64b4ae153436c567d6ae208f98847cccfc8e5e41f
```

After you recreate this string, you can validate the digest file.

E. Validate the digest file

Pass the SHA-256 hash of the recreated data signing string, digital signature, and public key to the RSA signature verification algorithm. If the output is true, the signature of the digest file is verified and the digest file is valid.

F. Validate the log files

After you have validated the digest file, you can validate the log files it references. The digest file contains the SHA-256 hashes of the log files. If one of the log files was modified after CloudTrail delivered it, the SHA-256 hashes will change, and the signature of digest file will not match.

The following shows how validate the log files:

1. Do an S3 Get of the log file using the S3 location information in the digest file's logFiles.s3Bucket and logFiles.s3Object fields.
2. If the S3 Get operation is successful, iterate through the log files listed in the digest file's logFiles array using the following steps:
   a. Retrieve the original hash of the file from the logFiles.hashValue field of the corresponding log in the digest file.
   b. Hash the uncompressed contents of the log file with the hashing algorithm specified in logFiles.hashAlgorithm.
   c. Compare the hash value that you generated with the one for the log in the digest file. If the hashes match, the log file is valid.

G. Validate additional digest and log files

In each digest file, the following fields provide the location and signature of the previous digest file:
Custom implementations of CloudTrail log file integrity validation

- previousDigestS3Bucket
- previousDigestS3Object
- previousDigestSignature

Use this information to visit previous digest files sequentially, validating the signature of each and the log files that they reference by using the steps in the previous sections. The only difference is that for previous digest files, you do not need to retrieve the digital signature from the digest file object's Amazon S3 metadata properties. The signature for the previous digest file is provided for you in the previousDigestSignature field.

You can go back until the starting digest file is reached, or until the chain of digest files is broken, whichever comes first.

Validating digest and log files offline

When validating digest and log files offline, you can generally follow the procedures described in the previous sections. However, you must take into account the following areas:

Handling the most recent digest file

The digital signature of the most recent (that is, "current") digest file is in the Amazon S3 metadata properties of the digest file object. In an offline scenario, the digital signature for the current digest file will not be available.

Two possible ways of handling this are:

- Since the digital signature for the previous digest file is in the current digest file, start validating from the next-to-last digest file. With this method, the most recent digest file cannot be validated.
- As a preliminary step, obtain the signature for the current digest file from the digest file object's metadata properties and then store it securely offline. This would allow the current digest file to be validated in addition to the previous files in the chain.

Path resolution

Fields in the downloaded digest files like s3Object and previousDigestS3Object will still be pointing to Amazon S3 online locations for log files and digest files. An offline solution must find a way to reroute these to the current path of the downloaded log and digest files.

Public keys

In order to validate offline, all of the public keys that you need for validating log files in a given time range must first be obtained online (by calling ListPublicKeys, for example) and then stored securely offline. This step must be repeated whenever you want to validate additional files outside the initial time range that you specified.

Sample validation snippet

The following sample snippet provides skeleton code for validating CloudTrail digest and log files. The skeleton code is online/offline agnostic; that is, it is up to you to decide whether to implement it with or without online connectivity to AWS. The suggested implementation uses the Java Cryptography Extension (JCE) and Bouncy Castle as a security provider.

The sample snippet shows:

- How to create the data signing string used to validate the digest file signature.
Custom implementations of CloudTrail log file integrity validation

- How to verify the digest file signature.
- How to verify the log file hashes.
- A code structure for validating a chain of digest files.

```java
import java.util.Arrays;
import java.security.MessageDigest;
import java.security.KeyFactory;
import java.security.PublicKey;
import java.security.Security;
import java.security.Signature;
import java.security.spec.X509EncodedKeySpec;
import org.json.JSONObject;
import org.bouncycastle.jce.provider.BouncyCastleProvider;
import org.apache.commons.codec.binary.Hex;

public class DigestFileValidator {
    public void validateDigestFile(String digestS3Bucket, String digestS3Object, String digestSignature) {
        Security.addProvider(new BouncyCastleProvider());
        JSONObject digestFile = loadDigestFileInMemory(digestS3Bucket, digestS3Object);
        if (!digestFile.getString("digestS3Bucket").equals(digestS3Bucket) ||
            !digestFile.getString("digestS3Object").equals(digestS3Object)) {
            System.err.println("Digest file has been moved from its original location.");
        } else {
            MessageDigest messageDigest = MessageDigest.getInstance("SHA-256");
            byte[] digestFileHash = messageDigest.update(convertToByteArray(digestFile)).digest();
            messageDigest.reset();

            String dataToSign = String.format("%s%n%s/%s%n%s%n%s",
                digestFile.getString("digestEndTime"),
                digestFile.getString("digestS3Bucket"),
                digestFile.getString("digestS3Object"),
                Hex.encodeHexString(digestFileHash),
                digestFile.getString("previousDigestSignature"));

            byte[] signatureContent = Hex.decodeHex(digestSignature);

            PublicKey publicKey = null;
            Security.addProvider(new BouncyCastleProvider());
            KeyFactory keyFactory = KeyFactory.getInstance("RSA");
            try {
                publicKey = keyFactory.generatePublic(new X509EncodedKeySpec(signatureContent));
            } catch (Exception e) {
                e.printStackTrace();
            }

            Signature signature = Signature.getInstance("SHA-256");
            signature.initVerify(publicKey);
            signature.update(dataToSign.getBytes());
            if (!signature.verify(signatureContent)) {
                System.err.println("Signature verification failed.");
            }
        }
    }
}
```
AlgorithmIdentifier ::= SEQUENCE {
  algorithm       OBJECT IDENTIFIER,
  parameters      ANY DEFINED BY algorithm OPTIONAL
}

pkcs1PublicKeyBytes =
getPublicKey(digestFile.getString("digestPublicKeyFingerprint"));

// Transform the PKCS#1 formatted public key to x.509 format.
RSAPublickey rsaPublicKey = RSAPublickey.getInstance(pkcs1PublicKeyBytes);
AlgorithmIdentifier rsaEncryption = new AlgorithmIdentifier(PKCSObjectIdentifiers.rsaEncryption, null);
SubjectPublicKeyInfo publicKeyInfo = new SubjectPublicKeyInfo(rsaEncryption, rsaPublickey);

// Create the PublicKey object needed for the signature validation
PublicKey publicKey = KeyFactory.getInstance("RSA", "BC").generatePublic(new X509EncodedKeySpec(publicKeyInfo.getEncoded()));

// Verify signature
Signature signature = Signature.getInstance("SHA256withRSA", "BC");
signature.initVerify(publicKey);
signature.update(dataToSign.getBytes("UTF-8"));

if (signature.verify(signatureContent)) {
  System.out.println("Digest file signature is valid, validating log files...");
  for (int i = 0; i < digestFile.getJSONArray("logFiles").length(); i++) {
    JSONObject logFileMetadata =
    digestFile.getJSONArray("logFiles").getJSONObject(i);
    
    // Compute log file hash
    byte[] logFileContent = loadUncompressedLogFileInMemory(
      logFileMetadata.getString("s3Bucket"),
      logFileMetadata.getString("s3Object")
    );
    messageDigest.update(logFileContent);
    byte[] logFileHash = messageDigest.digest();
    messageDigest.reset();
    
    // Retrieve expected hash for the log file being processed
    byte[] expectedHash =
    Hex.decodeHex(logFileMetadata.getString("hashValue"));
    boolean signaturesMatch = Arrays.equals(expectedHash, logFileHash);
    if (!signaturesMatch) {
      System.err.println(String.format("Log file: %s/%s hash doesn't match.
    Expected: %s Actual: %s",
      logFileMetadata.getString("s3Bucket"),
      logFileMetadata.getString("s3Object"),
      Hex.encodeHexString(expectedHash),
      Hex.encodeHexString(logFileHash)));
    } else {
      System.out.println(String.format("Log file: %s/%s hash match",
        logFileMetadata.getString("s3Bucket"),
        logFileMetadata.getString("s3Object")));
    }
  }
} else {
  System.err.println("Digest signature failed validation.");
}

System.out.println("Digest file validation completed.");
Using the CloudTrail Processing Library

The CloudTrail Processing Library is a Java library that provides an easy way to process AWS CloudTrail logs. You provide configuration details about your CloudTrail SQS queue and write code to process events. The CloudTrail Processing Library does the rest. It polls your Amazon SQS queue, reads and parses queue messages, downloads CloudTrail log files, parses events in the log files, and passes the events to your code as Java objects.

The CloudTrail Processing Library is highly scalable and fault-tolerant. It handles parallel processing of log files so that you can process as many logs as needed. It handles network failures related to network timeouts and inaccessible resources.

The following topic shows you how to use the CloudTrail Processing Library to process CloudTrail logs in your Java projects.

The library is provided as an Apache-licensed open-source project, available on GitHub: [https://github.com/aws/aws-cloudtrail-processing-library](https://github.com/aws/aws-cloudtrail-processing-library). The library source includes sample code that you can use as a base for your own projects.

Topics
- Minimum requirements (p. 344)
- Processing CloudTrail logs (p. 344)
- Advanced topics (p. 348)
- Additional resources (p. 352)

Minimum requirements

To use the CloudTrail Processing Library, you must have the following:

- AWS SDK for Java 1.11.830
- Java 1.8 (Java SE 8)

Processing CloudTrail logs

To process CloudTrail logs in your Java application:

1. Adding the CloudTrail Processing Library to your project (p. 345)
2. Configuring the CloudTrail Processing Library (p. 346)
3. Implementing the events processor (p. 347)
4.  **Instantiating and running the processing executor (p. 348)**

**Adding the CloudTrail Processing Library to your project**

To use the CloudTrail Processing Library, add it to your Java project's classpath.

**Contents**

- Adding the library to an Apache Ant project (p. 345)
- Adding the library to an Apache Maven project (p. 345)
- Adding the library to an Eclipse project (p. 345)
- Adding the library to an IntelliJ project (p. 346)

**Adding the library to an Apache Ant project**

**To add the CloudTrail Processing Library to an Apache Ant project**

1. Download or clone the CloudTrail Processing Library source code from GitHub:
   
   ```
   https://github.com/aws/aws-cloudtrail-processing-library
   ```

2. Build the .jar file from source as described in the [README](https://github.com/aws/aws-cloudtrail-processing-library):
   ```
   mvn clean install -Dgpg.skip=true
   ```

3. Copy the resulting .jar file into your project and add it to your project's `build.xml` file. For example:
   ```xml
   <classpath>
     <pathelement path="${classpath}"/>
     <pathelement location="lib/aws-cloudtrail-processing-library-1.6.1.jar"/>
   </classpath>
   ```

**Adding the library to an Apache Maven project**

The CloudTrail Processing Library is available for [Apache Maven](https://maven.apache.org). You can add it to your project by writing a single dependency in your project's `pom.xml` file.

**To add the CloudTrail Processing Library to a Maven project**

1. Open your Maven project's `pom.xml` file and add the following dependency:
   ```xml
   <dependency>
     <groupId>com.amazonaws</groupId>
     <artifactId>aws-cloudtrail-processing-library</artifactId>
     <version>1.6.1</version>
   </dependency>
   ```

**Adding the library to an Eclipse project**

**To add the CloudTrail Processing Library to an Eclipse project**

1. Download or clone the CloudTrail Processing Library source code from GitHub:
AWS CloudTrail User Guide
Processing CloudTrail logs

- [https://github.com/aws/aws-cloudtrail-processing-library](https://github.com/aws/aws-cloudtrail-processing-library)

2. Build the .jar file from source as described in the README:

```
mvn clean install -Dgpg.skip=true
```

3. Copy the built aws-cloudtrail-processing-library-1.6.1.jar to a directory in your project (typically lib).

4. Right-click your project's name in the Eclipse Project Explorer, choose Build Path, and then choose Configure

5. In the Java Build Path window, choose the Libraries tab.

6. Choose Add JARs... and navigate to the path where you copied aws-cloudtrail-processing-library-1.6.1.jar.

7. Choose OK to complete adding the .jar to your project.

### Adding the library to an IntelliJ project

**To add the CloudTrail Processing Library to an IntelliJ project**

1. Download or clone the CloudTrail Processing Library source code from GitHub:

   - [https://github.com/aws/aws-cloudtrail-processing-library](https://github.com/aws/aws-cloudtrail-processing-library)

2. Build the .jar file from source as described in the README:

```
mvn clean install -Dgpg.skip=true
```

3. From File, choose Project Structure.

4. Choose Modules and then choose Dependencies.

5. Choose + JARS or Directories and then go to the path where you built the aws-cloudtrail-processing-library-1.6.1.jar.

6. Choose Apply and then choose OK to complete adding the .jar to your project.

### Configuring the CloudTrail Processing Library

You can configure the CloudTrail Processing Library by creating a classpath properties file that is loaded at runtime, or by creating a **ClientConfiguration** object and setting options manually.

#### Providing a properties file

You can write a classpath properties file that provides configuration options to your application. The following example file shows the options you can set:

```
# AWS access key. (Required)
accessKey = your_access_key

# AWS secret key. (Required)
secretKey = your_secret_key

# The SQS URL used to pull CloudTrail notification from. (Required)
sqsUrl = your_sqs_queue_url

# The SQS end point specific to a region.
sqsRegion = us-east-1
```
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`# A period of time during which Amazon SQS prevents other consuming components`  
`# from receiving and processing that message.`  
`visibilityTimeout = 60`

`# The S3 region to use.`  
`s3Region = us-east-1`

`# Number of threads used to download S3 files in parallel. Callbacks can be`  
`# invoked from any thread.`  
`threadCount = 1`

`# The time allowed, in seconds, for threads to shut down after`  
`# AWSCloudTrailEventProcessingExecutor.stop() is called. If they are still`  
`# running beyond this time, they will be forcibly terminated.`  
`threadTerminationDelaySeconds = 60`

`# The maximum number of AWSCloudTrailClientEvents sent to a single invocation`  
`# of processEvents().`  
`maxEventsPerEmit = 10`

`# Whether to include raw event information in CloudTrailDeliveryInfo.`  
`enableRawEventInfo = false`

`# Whether to delete SQS message when the CloudTrail Processing Library is unable to process`  
`# the notification.`  
`deleteMessageUponFailure = false`

The following parameters are required:

- `sqsUrl` – Provides the URL from which to pull your CloudTrail notifications. If you don't specify this value, the `AWSCloudTrailProcessingExecutor` throws an `IllegalStateException`.
- `accessKey` – A unique identifier for your account, such as AKIAIOSFODNN7EXAMPLE.
- `secretKey` – A unique identifier for your account, such as wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY.

The `accessKey` and `secretKey` parameters provide your AWS credentials to the library so the library can access AWS on your behalf.

Defaults for the other parameters are set by the library. For more information, see the [AWS CloudTrail Processing Library Reference](#).

### Creating a ClientConfiguration

Instead of setting options in the classpath properties, you can provide options to the `AWSCloudTrailProcessingExecutor` by initializing and setting options on a `ClientConfiguration` object, as shown in the following example:

```java
ClientConfiguration basicConfig = new ClientConfiguration(  
    "http://sqs.us-east-1.amazonaws.com/123456789012/queue2",  
    new DefaultAWSCredentialsProviderChain());

basicConfig.setEnableRawEventInfo(true);
basicConfig.setThreadCount(4);
basicConfig.setMaxEventsPerEmit(20);
```

### Implementing the events processor

To process CloudTrail logs, you must implement an `EventsProcessor` that receives the CloudTrail log data. The following is an example implementation:
When implementing an EventsProcessor, you implement the process() callback that the AWSCloudTrailProcessingExecutor uses to send you CloudTrail events. Events are provided in a list of CloudTrailClientEvent objects.

The CloudTrailClientEvent object provides a CloudTrailEvent and CloudTrailEventMetadata that you can use to read the CloudTrail event and delivery information.

This simple example prints the event information for each event passed to SampleEventsProcessor. In your own implementation, you can process logs as you see fit. The AWSCloudTrailProcessingExecutor continues to send events to your EventsProcessor as long as it has events to send and is still running.

**Instantiating and running the processing executor**

After you write an EventsProcessor and set configuration values for the CloudTrail Processing Library (either in a properties file or by using the ClientConfiguration class), you can use these elements to initialize and use an AWSCloudTrailProcessingExecutor.

**To use AWSCloudTrailProcessingExecutor to process CloudTrail events**

1. Instantiate an AWSCloudTrailProcessingExecutor.Builder object. Builder's constructor takes an EventsProcessor object and a classpath properties file name.
2. Call the Builder's build() factory method to configure and obtain an AWSCloudTrailProcessingExecutor object.
3. Use the AWSCloudTrailProcessingExecutor's start() and stop() methods to begin and end CloudTrail event processing.

---

```java
public class SampleEventsProcessor implements EventsProcessor {
    public void process(List<CloudTrailEvent> events) {
        int i = 0;
        for (CloudTrailEvent event : events) {
            System.out.println(String.format("Process event %d : %s", i++,
                                             event.getEventData()));
        }
    }
}
```

---

Advanced topics

**Topics**

- Filtering the events to process (p. 349)
- Processing data events (p. 350)
Filtering the events to process

By default, all logs in your Amazon SQS queue's S3 bucket and all events that they contain are sent to your EventsProcessor. The CloudTrail Processing Library provides optional interfaces that you can implement to filter the sources used to obtain CloudTrail logs and to filter the events that you are interested in processing.

SourceFilter

You can implement the SourceFilter interface to choose whether you want to process logs from a provided source. SourceFilter declares a single callback method, filterSource(), that receives a CloudTrailSource object. To keep events from a source from being processed, return false from filterSource().

The CloudTrail Processing Library calls the filterSource() method after the library polls for logs on the Amazon SQS queue. This occurs before the library starts event filtering or processing for the logs.

The following is an example implementation:

```java
public class SampleSourceFilter implements SourceFilter{
    private static final int MAX_RECEIVED_COUNT = 3;

    private static List<String> accountIDs ;
    static {
        accountIDs = new ArrayList<>();
        accountIDs.add("123456789012");
        accountIDs.add("234567890123");
    }

    @Override
    public boolean filterSource(CloudTrailSource source) throws CallbackException {
        source = (SQSBasedSource) source;
        Map<String, String> sourceAttributes = source.getSourceAttributes();

        String accountId = sourceAttributes.get(
            SourceAttributeKeys.ACCOUNT_ID.getAttributeKey());

        String receivedCount = sourceAttributes.get(
            SourceAttributeKeys.APPROXIMATE_RECEIVE_COUNT.getAttributeKey());

        int approximateReceivedCount = Integer.parseInt(receivedCount);

        return approximateReceivedCount <= MAX_RECEIVED_COUNT &&
               accountIDs.contains(accountId);
    }
}
```

If you don't provide your own SourceFilter, then DefaultSourceFilter is used, which allows all sources to be processed (it always returns true).

EventFilter

You can implement the EventFilter interface to choose whether a CloudTrail event is sent to your EventsProcessor. EventFilter declares a single callback method, filterEvent(), that receives a CloudTrailEvent object. To keep the event from being processed, return false from filterEvent().
The CloudTrail Processing Library calls the `filterEvent()` method after the library polls for logs on the Amazon SQS queue and after source filtering. This occurs before the library starts event processing for the logs.

See the following example implementation:

```java
public class SampleEventFilter implements EventFilter{
    private static final String EC2_EVENTS = "ec2.amazonaws.com";

    @Override
    public boolean filterEvent(CloudTrailClientEvent clientEvent) throws CallbackException {
        CloudTrailEvent event = clientEvent.getEvent();
        String eventSource = event.getEventSource();
        String eventName = event.getEventName();
        return eventSource.equals(EC2_EVENTS) && eventName.startsWith("Delete");
    }
}
```

If you don’t provide your own `EventFilter`, then `DefaultEventFilter` is used, which allows all events to be processed (it always returns true).

### Processing data events

When CloudTrail processes data events, it preserves numbers in their original format, whether that is an integer (int) or a float (a number that contains a decimal). In events that have integers in the fields of a data event, CloudTrail historically processed these numbers as floats. Currently, CloudTrail processes numbers in these fields by keeping their original format.

As a best practice, to avoid breaking your automations, be flexible in any code or automation that you are using to process or filter CloudTrail data events, and allow both int and float formatted numbers. For best results, use version 1.4.0 or higher of the CloudTrail Processing Library.

The following example snippet shows a float formatted number, 2.0, for the `desiredCount` parameter in the `ResponseParameters` block of a data event.

```
"desiredCount": 2.0
```

The following example snippet shows an int formatted number, 2, for the `desiredCount` parameter in the `ResponseParameters` block of a data event.

```
"desiredCount": 2
```
Reporting progress

Implement the ProgressReporter interface to customize the reporting of CloudTrail Processing Library progress. ProgressReporter declares two methods: reportStart() and reportEnd(), which are called at the beginning and end of the following operations:

- Polling messages from Amazon SQS
- Parsing messages from Amazon SQS
- Processing an Amazon SQS source for CloudTrail logs
- Deleting messages from Amazon SQS
- Downloading a CloudTrail log file
- Processing a CloudTrail log file

Both methods receive a ProgressStatus object that contains information about the operation that was performed. The progressState member holds a member of the ProgressState enumeration that identifies the current operation. This member can contain additional information in the progressInfo member. Additionally, any object that you return from reportStart() is passed to reportEnd(), so you can provide contextual information such as the time when the event began processing.

The following is an example implementation that provides information about how long an operation took to complete:

```java
public class SampleProgressReporter implements ProgressReporter {
    private static final Log logger = LogFactory.getLog(DefaultProgressReporter.class);

    @Override
    public Object reportStart(ProgressStatus status) {
        return new Date();
    }

    @Override
    public void reportEnd(ProgressStatus status, Object startDate) {
        System.out.println(status.getProgressState().toString() + " is " + status.getProgressInfo().isSuccess() + ", and latency is " + Math.abs(((Date) startDate).getTime()-new Date().getTime()) + " milliseconds.";
    }
}
```

If you don't implement your own ProgressReporter, then DefaultExceptionHandler, which prints the name of the state being run, is used instead.

Handling errors

The ExceptionHandler interface allows you to provide special handling when an exception occurs during log processing. ExceptionHandler declares a single callback method, handleException(), which receives a ProcessingLibraryException object with context about the exception that occurred.

You can use the passed-in ProcessingLibraryException's getStatus() method to find out what operation was executed when the exception occurred and get additional information about the status of
the operation. \texttt{ProcessingLibraryException} is derived from Java's standard \texttt{Exception} class, so you can also retrieve information about the exception by invoking any of the exception methods.

See the following example implementation:

```java
public class SampleExceptionHandler implements ExceptionHandler{
    private static final Log logger =
        LogFactory.getLog(DefaultProgressReporter.class);

    @Override
    public void handleException(ProcessingLibraryException exception) {
        ProgressStatus status = exception.getStatus();
        ProgressState state = status.getProgressState();
        ProgressInfo info = status.getProgressInfo();

        System.err.println(String.format(
            "Exception. Progress State: %s. Progress Information: %s.", state, info));
    }
}
```

If you don't provide your own \texttt{ExceptionHandler}, then \texttt{DefaultExceptionHandler}, which prints a standard error message, is used instead.

\textbf{Note}

If the \texttt{deleteMessageUponFailure} parameter is \texttt{true}, the CloudTrail Processing Library does not distinguish general exceptions from processing errors and may delete queue messages.

1. For example, you use the \texttt{SourceFilter} to filter messages by timestamp.

2. However, you don't have the required permissions to access the S3 bucket that receives the CloudTrail log files. Because you don't have the required permissions, an \texttt{AmazonServiceException} is thrown. The CloudTrail Processing Library wraps this in a \texttt{CallbackException}.

3. The \texttt{DefaultExceptionHandler} logs this as an error, but does not identify the root cause, which is that you don't have the required permissions. The CloudTrail Processing Library considers this a processing error and deletes the message, even if the message includes a valid CloudTrail log file.

If you want to filter messages with \texttt{SourceFilter}, verify that your \texttt{ExceptionHandler} can distinguish service exceptions from processing errors.

\section*{Additional resources}

For more information about the CloudTrail Processing Library, see the following:

- \texttt{CloudTrail Processing Library} GitHub project, which includes \texttt{sample} code that demonstrates how to implement a CloudTrail Processing Library application.
- \texttt{CloudTrail Processing Library Java Package Documentation}.
Settings

You can use the **Settings** page to review configured CloudTrail settings.

**To access settings**

1. Choose **Settings** in the left navigation pane of the CloudTrail console.
2. Review and update your settings as needed.

**The following settings are available:**

- Organization delegated administrator (p. 353)

Organization delegated administrator

When you use CloudTrail with an AWS Organizations organization, you can assign any account within the organization to act as a CloudTrail delegated administrator to manage the organization’s trails and event data stores on behalf of the organization. A delegated administrator is a member account in an organization that can perform the same administrative tasks in CloudTrail as the management account. Only the organization management account can assign a CloudTrail delegated administrator.

If you choose a delegated administrator, this member account has administrative permissions on all trails and event data stores in the organization. Adding a delegated administrator does not disrupt the management or operation of the organization's trails or event data stores.

The first time you add a delegated administrator in the CloudTrail console, or by using the AWS CLI or CloudTrail API, CloudTrail checks whether the organization's management account has a service-linked role. If the management account does not have a service-linked role, CloudTrail creates the service-linked role for the management account. For more information about service-linked roles, see **Using service-linked roles for AWS CloudTrail** (p. 394).

**Note**

When you add a delegated administrator using the AWS Organizations CLI or API operation, the service-linked role doesn't get created if it does not exist. The service-linked role is only created when you make a call from the management account directly to the CloudTrail service, such as when you add a delegated administrator or create an organization trail or event data store using the CloudTrail console, AWS CLI or CloudTrail API.

Take note of the following factors that define how the delegated administrator operates in CloudTrail.

**The management account remains the owner of any CloudTrail organization resources the delegated administrator creates.**

The organization’s management account remains the owner of any CloudTrail organization resources the delegated administrator creates, such as trails and event data stores. This provides continuity for the organization in the event the delegated administrator changes.

**Removing a delegated administrator account does not delete any CloudTrail organization resources they created.**

Organization trails and event data stores created by the delegated administrator are not deleted when you remove the delegated administrator, because the management account always serves as
the owner of the CloudTrail organization resources regardless of whether they are created by the delegated administrator or the management account.

An organization can have a maximum of three CloudTrail delegated administrators.

You can have a maximum of three CloudTrail delegated administrators per organization. For more information about removing a delegated administrator, see Remove a CloudTrail delegated administrator (p. 355).

Topics
• Required permissions to assign a delegated administrator (p. 354)
• Add a CloudTrail delegated administrator (p. 354)
• Remove a CloudTrail delegated administrator (p. 355)

Required permissions to assign a delegated administrator

When assigning a CloudTrail delegated administrator, you must have the permissions to add and remove the delegated administrator in CloudTrail, as well as certain AWS Organizations API actions and IAM permissions listed in the following policy statement.

You can add the following statement to the end of an IAM policy to grant these permissions:

```
{
   "Sid": "Permissions",
   "Effect": "Allow",
   "Action": [
      "cloudtrail:RegisterOrganizationDelegatedAdmin",
      "cloudtrail:DeregisterOrganizationDelegatedAdmin",
      "organizations:RegisterDelegatedAdministrator",
      "organizations:DeregisterDelegatedAdministrator",
      "organizations:ListAWSServiceAccessForOrganization",
      "iam:CreateServiceLinkedRole",
      "iam:GetRole"
   ],
   "Resource": "*"
}
```

Add a CloudTrail delegated administrator

You can add a delegated administrator to manage an organization's CloudTrail resources, such as trails and event data stores.

You can add a CloudTrail delegated administrator for your AWS organization using the CloudTrail console or the AWS CLI.

Before you add a delegated administrator, be sure they have an account in your organization and you are signed in with the management account for your organization. For information about how to create a new AWS account for your organization, see Creating an AWS account in your organization. For information about how to invite an existing AWS account to your organization, see Inviting an AWS account to join your organization.

CloudTrail Console

The following procedure shows you how to add a CloudTrail delegated administrator using the CloudTrail console.
1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. Choose **Settings** in the left navigation pane of the CloudTrail console.
3. In the **Organization delegated administrators** section, choose **Register administrator**.
4. Enter the twelve-digit AWS account ID of the account that you want to assign as the CloudTrail delegated administrator for the organization's trails and event data stores.
5. Choose **Register administrator**.

After you add the delegated administrator, you only need to use the organization's management account to change or remove the delegated administrator account.

**AWS CLI**

The following example adds a CloudTrail delegated administrator.

```
aws cloudtrail register-organization-delegated-admin
   --member-account-id="memberAccountId"
```

This command produces no output if it's successful.

---

## Remove a CloudTrail delegated administrator

You can remove a CloudTrail delegated administrator using the CloudTrail console or the AWS CLI.

### CloudTrail Console

The following procedure shows you how to remove a CloudTrail delegated administrator using the CloudTrail console.

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. Choose **Settings** in the left navigation pane of the CloudTrail console.
3. In the **Organization delegated administrators** section, choose the delegated administrator that you want to remove.
4. Choose **Remove administrator**.
5. Confirm you want to remove the delegated administrator and then choose **Remove administrator**.

### AWS CLI

The following command removes a CloudTrail delegated administrator.

```
aws cloudtrail deregister-organization-delegated-admin
   --delegated-admin-account-id="delegatedAdminAccountId"
```

This command produces no output if it's successful.
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. Third-party auditors regularly test and verify the effectiveness of our security as part of the AWS compliance programs. To learn about the compliance programs that apply to AWS CloudTrail, 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 company’s requirements, and applicable laws and regulations.

This documentation helps you understand how to apply the shared responsibility model when using CloudTrail. The following topics show you how to configure CloudTrail to meet your security and compliance objectives. You also learn how to use other AWS services that help you to monitor and secure your CloudTrail resources.

**Topics**

- Data protection in AWS CloudTrail (p. 356)
- Identity and Access Management for AWS CloudTrail (p. 357)
- Compliance validation for AWS CloudTrail (p. 397)
- Resilience in AWS CloudTrail (p. 397)
- Infrastructure security in AWS CloudTrail (p. 398)
- Cross-service confused deputy prevention (p. 398)
- Security best practices in AWS CloudTrail (p. 399)
- Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403)

### Data protection in AWS CloudTrail

The AWS shared responsibility model applies to data protection in AWS CloudTrail. As described in this model, AWS is responsible for protecting the global infrastructure that runs all of the AWS Cloud. You are responsible for maintaining control over your content that is hosted on this infrastructure. This content includes the security configuration and management tasks for the AWS services that you use. For more information about data privacy, see the Data Privacy FAQ. For information about data protection in Europe, see the AWS Shared Responsibility Model and GDPR blog post on the AWS Security Blog.

For data protection purposes, we recommend that you protect AWS account credentials and set up individual users with AWS IAM Identity Center (successor to AWS Single Sign-On) or AWS Identity and Access Management (IAM). That way, each user is given only the permissions necessary to fulfill their job duties. We also recommend that you secure your data in the following ways:

- Use multi-factor authentication (MFA) with each account.
• Use SSL/TLS to communicate with AWS resources. We require TLS 1.2 and recommend TLS 1.3.
• 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 sensitive data that is stored in Amazon S3.
• If you require FIPS 140-2 validated cryptographic modules when accessing AWS through a command line interface or an API, use a FIPS endpoint. For more information about the available FIPS endpoints, see Federal Information Processing Standard (FIPS) 140-2.

We strongly recommend that you never put confidential or sensitive information, such as your customers' email addresses, into tags or free-form text fields such as a Name field. This includes when you work with CloudTrail or other AWS services using the console, API, AWS CLI, or AWS SDKs. Any data that you enter into tags or free-form text fields used for names may be used for billing or diagnostic logs. If you provide a URL to an external server, we strongly recommend that you do not include credentials information in the URL to validate your request to that server.

By default, CloudTrail event log files are encrypted using Amazon S3 server-side encryption (SSE). You can also choose to encrypt your log files with an AWS Key Management Service (AWS KMS) key. You can store your log files in your bucket for as long as you want. You can also define Amazon S3 lifecycle rules to archive or delete log files automatically. If you want notifications about log file delivery and validation, you can set up Amazon SNS notifications.

The following security best practices also address data protection in CloudTrail:

• Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403)
• Amazon S3 bucket policy for CloudTrail (p. 380)
• Validating CloudTrail log file integrity (p. 324)
• Sharing CloudTrail log files between AWS accounts (p. 315)

Because CloudTrail logs files are stored in a bucket or buckets in Amazon S3, you should also review the data protection information in the Amazon Simple Storage Service User Guide. For more information, see Protecting Data in Amazon S3.

Identity and Access Management for AWS CloudTrail

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 CloudTrail resources. IAM is an AWS service that you can use with no additional charge.

Topics
• Audience (p. 358)
• Authenticating with identities (p. 358)
• Managing access using policies (p. 360)
• How AWS CloudTrail works with IAM (p. 362)
• Identity-based policy examples for AWS CloudTrail (p. 368)
• AWS CloudTrail resource-based policy examples (p. 378)
Audience

How you use AWS Identity and Access Management (IAM) differs, depending on the work that you do in CloudTrail.

**Service user** – If you use the CloudTrail service to do your job, then your administrator provides you with the credentials and permissions that you need. As you use more CloudTrail features to do your work, you might need additional permissions. Understanding how access is managed can help you request the right permissions from your administrator. If you cannot access a feature in CloudTrail, see [Troubleshooting AWS CloudTrail identity and access](p. 391).

**Service administrator** – If you're in charge of CloudTrail resources at your company, you probably have full access to CloudTrail. It's your job to determine which CloudTrail features and resources your service users should access. You must then submit requests to your IAM administrator to change the permissions of your service users. Review the information on this page to understand the basic concepts of IAM. To learn more about how your company can use IAM with CloudTrail, see [How AWS CloudTrail works with IAM](p. 362).

**IAM administrator** – If you're an IAM administrator, you might want to learn details about how you can write policies to manage access to CloudTrail. To view example CloudTrail identity-based policies that you can use in IAM, see [Identity-based policy examples for AWS CloudTrail](p. 368).

## Authenticating with identities

Authentication is how you sign in to AWS using your identity credentials. You must be *authenticated* (signed in to AWS) as the AWS account root user, as an IAM user, or by assuming an IAM role.

You can sign in to AWS as a federated identity by using credentials provided through an identity source. AWS IAM Identity Center (successor to AWS Single Sign-On) (IAM Identity Center) users, your company's single sign-on authentication, and your Google or Facebook credentials are examples of federated identities. When you sign in as a federated identity, your administrator previously set up identity federation using IAM roles. When you access AWS by using federation, you are indirectly assuming a role.

Depending on the type of user you are, you can sign in to the AWS Management Console or the AWS access portal. For more information about signing in to AWS, see [How to sign in to your AWS account](p. 362) in the AWS Sign-In User Guide.

If you access AWS programmatically, AWS provides a software development kit (SDK) and a command line interface (CLI) to cryptographically sign your requests by using your credentials. If you don't use AWS tools, you must sign requests yourself. For more information about using the recommended method to sign requests yourself, see [Signing AWS API requests](p. 367) in the IAM User Guide.

Regardless of the authentication method that you use, you might 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 [Multi-factor authentication](p. 368) in the AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide and [Using multi-factor authentication (MFA) in AWS](p. 368) in the IAM User Guide.
AWS account root user

When you create an AWS account, you begin with one 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 don't use the root user for your everyday tasks. Safeguard your root user credentials and use them to perform the tasks that only the root user can perform. For the complete list of tasks that require you to sign in as the root user, see Tasks that require root user credentials in the AWS Account Management Reference Guide.

Federated identity

As a best practice, require human users, including users that require administrator access, to use federation with an identity provider to access AWS services by using temporary credentials.

A federated identity is a user from your enterprise user directory, a web identity provider, the AWS Directory Service, the Identity Center directory, or any user that accesses AWS services by using credentials provided through an identity source. When federated identities access AWS accounts, they assume roles, and the roles provide temporary credentials.

For centralized access management, we recommend that you use AWS IAM Identity Center (successor to AWS Single Sign-On). You can create users and groups in IAM Identity Center, or you can connect and synchronize to a set of users and groups in your own identity source for use across all your AWS accounts and applications. For information about IAM Identity Center, see What is IAM Identity Center? in the AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide.

IAM users and groups

An IAM user is an identity within your AWS account that has specific permissions for a single person or application. Where possible, we recommend relying on temporary credentials instead of creating IAM users who have long-term credentials such as passwords and access keys. However, if you have specific use cases that require long-term credentials with IAM users, we recommend that you rotate access keys. For more information, see Rotate access keys regularly for use cases that require long-term credentials in the IAM User Guide.

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:

- **Federated user access** – To assign permissions to a federated identity, you create a role and define permissions for the role. When a federated identity authenticates, the identity is associated with the role and is granted the permissions that are defined by the role. For information about roles for
federation, see Creating a role for a third-party Identity Provider in the IAM User Guide. If you use IAM Identity Center, you configure a permission set. To control what your identities can access after they authenticate, IAM Identity Center correlates the permission set to a role in IAM. For information about permissions sets, see Permission sets in the AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide.

• **Temporary IAM user permissions** – An IAM user or role can assume an IAM role to temporarily take on different permissions for a specific task.

• **Cross-account access** – You can use an IAM role to allow someone (a trusted principal) in a different account to access resources in your account. Roles are the primary way to grant cross-account access. However, with some AWS services, you can attach a policy directly to a resource (instead of using a role as a proxy). To learn the difference between roles and resource-based policies for cross-account access, see How IAM roles differ from resource-based policies in the IAM User Guide.

• **Cross-service access** – Some AWS services use features in other AWS services. For example, when you make a call in a service, it's common for that service to run applications in Amazon EC2 or store objects in Amazon S3. A service might do this using the calling principal's permissions, using a service role, or using a service-linked role.

• **Principal permissions** – When you use an IAM user or role to perform actions in AWS, you are considered a principal. Policies grant permissions to a principal. When you use some services, you might perform an action that then triggers another action in a different service. In this case, you must have permissions to perform both actions. To see whether an action requires additional dependent actions in a policy, see Actions, Resources, and Condition Keys for AWS CloudTrail in the Service Authorization Reference.

• **Service role** – A service role is an IAM role that a service assumes to perform actions on your behalf. An IAM administrator can create, modify, and delete a service role from within IAM. For more information, see Creating a role to delegate permissions to an AWS service in the IAM User Guide.

• **Service-linked role** – A service-linked role is a type of service role that is linked to an AWS service. The service can assume the role to perform an action on your behalf. Service-linked roles appear in your AWS account and are owned by the service. An IAM administrator can view, but not edit the permissions for service-linked roles.

• **Applications running on Amazon EC2** – You can use an IAM role to manage temporary credentials for applications that are running on an EC2 instance and making AWS CLI or AWS API requests. This is preferable to storing access keys within the EC2 instance. To assign an AWS role to an EC2 instance and make it available to all of its applications, you create an instance profile that is attached to the instance. An instance profile contains the role and enables programs that are running on the EC2 instance to get temporary credentials. For more information, see Using an IAM role to grant permissions to applications running on Amazon EC2 instances in the IAM User Guide.

To learn whether to use IAM roles or IAM users, see When to create an IAM role (instead of a user) in the IAM User Guide.

### Managing access using policies

You control access in AWS by creating policies and attaching them to AWS identities or resources. A policy is an object in AWS that, when associated with an identity or resource, defines their permissions. AWS evaluates these policies when a principal (user, root user, or role session) 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.

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

By default, users and roles have no permissions. To grant users permission to perform actions on the resources that they need, an IAM administrator can create IAM policies. The administrator can then add the IAM policies to roles, and users can assume the roles.
IAM policies define permissions for an action regardless of the method that you use to perform the operation. For example, suppose that you have a policy that allows the `iam:GetRole` action. A user with that policy can get role information from the AWS Management Console, the AWS CLI, or the AWS API.

**Identity-based policies**

Identity-based policies are JSON permissions policy documents that you can attach to an identity, such as an IAM user, group of users, or role. These policies control what actions users and roles can perform, on which resources, and under what conditions. To learn how to create an identity-based policy, see [Creating IAM policies](#) in the IAM User Guide.

Identity-based policies can be further categorized as *inline policies* or *managed policies*. Inline policies are embedded directly into a single user, group, or role. Managed policies are standalone policies that you can attach to multiple users, groups, and roles in your AWS account. Managed policies include AWS managed policies and customer managed policies. To learn how to choose between a managed policy or an inline policy, see [Choosing between managed policies and inline policies](#) in the IAM User Guide.

**Resource-based policies**

Resource-based policies are JSON policy documents that you attach to a resource. Examples of resource-based policies are IAM role trust policies and Amazon S3 bucket policies. In services that support resource-based policies, service administrators can use them to control access to a specific resource. For the resource where the policy is attached, the policy defines what actions a specified principal can perform on that resource and under what conditions. You must specify a principal in a resource-based policy. Principals can include accounts, users, roles, federated users, or AWS services.

Resource-based policies are inline policies that are located in that service. You can't use AWS managed policies from IAM in a resource-based policy.

**Access control lists (ACLs)**

Access control lists (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they do not use the JSON policy document format.

Amazon S3, AWS WAF, and Amazon VPC are examples of services that support ACLs. To learn more about ACLs, see [Access control list (ACL) overview](#) in the Amazon Simple Storage Service Developer Guide.

**Other policy types**

AWS supports additional, less-common policy types. These policy types can set the maximum permissions granted to you by the more common policy types.

- **Permissions boundaries** – A permissions boundary is an advanced feature in which you set the maximum permissions that an identity-based policy can grant to an IAM entity (IAM user or role). You can set a permissions boundary for an entity. The resulting permissions are the intersection of an 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](#).

**How AWS CloudTrail works with IAM**

Before you use IAM to manage access to CloudTrail, learn what IAM features are available to use with CloudTrail.

**IAM features you can use with AWS CloudTrail**

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<th>IAM feature</th>
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</thead>
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<tr>
<td>Resource-based policies (p. 363)</td>
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<td>Policy actions (p. 363)</td>
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<td>Yes</td>
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<td>Policy condition keys (service-specific) (p. 365)</td>
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<td>ACLs (p. 366)</td>
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<td>ABAC (tags in policies) (p. 366)</td>
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<tr>
<td>Principal permissions (p. 367)</td>
<td>Yes</td>
</tr>
<tr>
<td>Service roles (p. 367)</td>
<td>Yes</td>
</tr>
<tr>
<td>Service-linked roles (p. 367)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

To get a high-level view of how CloudTrail and other AWS services work with most IAM features, see [AWS services that work with IAM](#) in the [IAM User Guide](#).

**Identity-based policies for CloudTrail**

| Supports identity-based policies | Yes |

Identity-based policies are JSON permissions policy documents that you can attach to an identity, such as an IAM user, group of users, or role. These policies control what actions users and roles can perform, on which resources, and under what conditions. To learn how to create an identity-based policy, see [Creating IAM policies](#) in the [IAM User Guide](#).
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. You can't specify the principal in an identity-based policy because it applies to the user or role to which it is attached. To learn about all of the elements that you can use in a JSON policy, see IAM JSON policy elements reference in the IAM User Guide.

Identity-based policy examples for CloudTrail

To view examples of CloudTrail identity-based policies, see Identity-based policy examples for AWS CloudTrail (p. 368).

Resource-based policies within CloudTrail

<table>
<thead>
<tr>
<th>Supports resource-based policies</th>
<th>Partial</th>
</tr>
</thead>
</table>

Resource-based policies are JSON policy documents that you attach to a resource. Examples of resource-based policies are IAM role trust policies and Amazon S3 bucket policies. In services that support resource-based policies, service administrators can use them to control access to a specific resource. For the resource where the policy is attached, the policy defines what actions a specified principal can perform on that resource and under what conditions. You must specify a principal in a resource-based policy. Principals can include accounts, users, roles, federated users, or AWS services.

To enable cross-account access, you can specify an entire account or IAM entities in another account as the principal in a resource-based policy. Adding a cross-account principal to a resource-based policy is only half of establishing the trust relationship. When the principal and the resource are in different AWS accounts, an IAM administrator in the trusted account must also grant the principal entity (user or role) permission to access the resource. They grant permission by attaching an identity-based policy to the entity. However, if a resource-based policy grants access to a principal in the same account, no additional identity-based policy is required. For more information, see How IAM roles differ from resource-based policies in the IAM User Guide.

CloudTrail supports resource-based policies on channels used for CloudTrail Lake integrations with event sources outside of AWS. The resource-based policy for the channel defines which principal entities (accounts, users, roles, and federated users) can call PutAuditEvents on the channel to deliver events to the destination event data store. For more information about creating integrations with CloudTrail Lake, see Create an integration with an event source outside of AWS (p. 190).

Examples

To view examples of CloudTrail resource-based policies, see AWS CloudTrail resource-based policy examples (p. 378).

Policy actions for CloudTrail

<table>
<thead>
<tr>
<th>Supports policy actions</th>
<th>Yes</th>
</tr>
</thead>
</table>

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Action element of a JSON policy describes the actions that you can use to allow or deny access in a policy. Policy actions usually have the same name as the associated AWS API operation. There are some exceptions, such as permission-only actions that don't have a matching API operation. There are also some operations that require multiple actions in a policy. These additional actions are called dependent actions.
Include actions in a policy to grant permissions to perform the associated operation.

To see a list of CloudTrail actions, see Actions Defined by AWS CloudTrail in the Service Authorization Reference.

Policy actions in CloudTrail use the following prefix before the action:

```
cloudtrail
```

For example, to grant someone permission to list tags for a trail with the ListTags API operation, you include the cloudtrail:ListTags action in their policy. Policy statements must include either an Action or NotAction element. CloudTrail 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": [
    "cloudtrail:AddTags",
    "cloudtrail:ListTags",
    "cloudtrail:RemoveTags"
]
```

You can specify multiple actions using wildcards (*). For example, to specify all actions that begin with the word Get, include the following action:

```
"Action": "cloudtrail:Get*"
```

### Policy resources for CloudTrail

<table>
<thead>
<tr>
<th>Supports policy resources</th>
<th>Yes</th>
</tr>
</thead>
</table>

Administrators can use AWS JSON policies to specify who has access to what. That is, which principal can perform actions on what resources, and under what conditions.

The Resource JSON policy element specifies the object or objects to which the action applies. Statements must include either a Resource or a NotResource element. As a best practice, specify a resource using its Amazon Resource Name (ARN). You can do this for actions that support a specific resource type, known as resource-level permissions.

For actions that don't support resource-level permissions, such as listing operations, use a wildcard (*) to indicate that the statement applies to all resources.

```
"Resource": "*"
```

To see a list of CloudTrail resource types and their ARNs, see Resources Defined by AWS CloudTrail in the Service Authorization Reference. To learn with which actions you can specify the ARN of each resource, see Actions Defined by AWS CloudTrail.

In CloudTrail, there are three resource types: trails, event data stores, and channels. Each resource has a unique Amazon Resource Name (ARN) associated with it. In a policy, you use an ARN to identify the
resource that the policy applies to. CloudTrail does not currently support other resource types, which are sometimes referred to as subsources.

The CloudTrail trail resource has the following ARN:

```plaintext
arn:${Partition}:cloudtrail:${Region}:${Account}:trail/{TrailName}
```

The CloudTrail event data store resource has the following ARN:

```plaintext
arn:${Partition}:cloudtrail:${Region}:${Account}:eventdatastore/{EventDataStoreId}
```

The CloudTrail channel resource has the following ARN:

```plaintext
arn:${Partition}:cloudtrail:${Region}:${Account}:channel/{ChannelId}
```

For more information about the format of ARNs, see [Amazon Resource Names (ARNs) and AWS Service Namespaces](https://docs.aws.amazon.com/updated). For example, for an AWS account with the ID 123456789012, to specify a trail named My-Trail that exists in the US East (Ohio) Region in your statement, use the following ARN:

```plaintext
```

To specify all trails that belong to a specific account in that AWS Region, use the wildcard (*):

```plaintext
```

Some CloudTrail actions, such as those for creating resources, can't be performed on a specific resource. In those cases, you must use the wildcard (*).

```plaintext
"Resource": "*
```

Many CloudTrail API actions involve multiple resources. For example, CreateTrail requires an Amazon S3 bucket for storing log files, so a user must have permissions to write to the bucket. To specify multiple resources in a single statement, separate the ARNs with commas.

```plaintext
"Resource": [  "resource1",  "resource2"
```

### Policy condition keys for CloudTrail

| Supports service-specific policy condition keys | No |

Administrators can use AWS JSON policies to specify who has access to what. That is, which **principal** can perform **actions** on what **resources**, and under what **conditions**.

The Condition element (or Condition block) lets you specify conditions in which a statement is in effect. The Condition element is optional. You can create conditional expressions that use **condition operators**, such as equals or less than, to match the condition in the policy with values in the request.

If you specify multiple Condition elements in a statement, or multiple keys in a single Condition element, AWS evaluates them using a logical AND operation. If you specify multiple values for a single
condition key, AWS evaluates the condition using a logical OR operation. All of the conditions must be met before the statement's permissions are granted.

You can also use placeholder variables when you specify conditions. For example, you can grant an IAM user permission to access a resource only if it is tagged with their IAM user name. For more information, see IAM policy elements: variables and tags in the IAM User Guide.

AWS supports global condition keys and service-specific condition keys. To see all AWS global condition keys, see AWS global condition context keys in the IAM User Guide. CloudTrail doesn't define its own condition keys, but it supports using some global condition keys. To see all AWS global condition keys, see AWS Global Condition Context Keys in the IAM User Guide.

To see a list of CloudTrail condition keys, see Condition Keys for AWS CloudTrail in the Service Authorization Reference. To learn with which actions and resources you can use a condition key, see Actions Defined by AWS CloudTrail.

### ACLs in CloudTrail

| Supports ACLs | No |

Access control lists (ACLs) control which principals (account members, users, or roles) have permissions to access a resource. ACLs are similar to resource-based policies, although they do not use the JSON policy document format.

### ABAC with CloudTrail

| Supports ABAC (tags in policies) | Yes |

Attribute-based access control (ABAC) is an authorization strategy that defines permissions based on attributes. In AWS, these attributes are called tags. You can attach tags to IAM entities (users or roles) and to many AWS resources. Tagging entities and resources is the first step of ABAC. Then you design ABAC policies to allow operations when the principal's tag matches the tag on the resource that they are trying to access.

ABAC is helpful in environments that are growing rapidly and helps with situations where policy management becomes cumbersome.

To control access based on tags, you provide tag information in the condition element of a policy using the aws:ResourceTag/key-name, aws:RequestTag/key-name, or aws:TagKeys condition keys.

If a service supports all three condition keys for every resource type, then the value is Yes for the service. If a service supports all three condition keys for only some resource types, then the value is Partial.

For more information about ABAC, see What is ABAC? in the IAM User Guide. To view a tutorial with steps for setting up ABAC, see Use attribute-based access control (ABAC) in the IAM User Guide.

Although you can attach tags to CloudTrail resources, CloudTrail only supports controlling access to CloudTrail Lake (p. 166) event data stores based on tags. You cannot control access to trails based on tags.

You can attach tags to CloudTrail resources or pass tags in a request to CloudTrail. For more information about tagging CloudTrail resources, see Creating a trail (p. 85) and Creating, updating, and managing trails with the AWS Command Line Interface (p. 104).
Using temporary credentials with CloudTrail

| Supports temporary credentials | Yes |

Some AWS services don't work when you sign in using temporary credentials. For additional information, including which AWS services work with temporary credentials, see AWS services that work with IAM in the IAM User Guide.

You are using temporary credentials if you sign in to the AWS Management Console using any method except a user name and password. For example, when you access AWS using your company's single sign-on (SSO) link, that process automatically creates temporary credentials. You also automatically create temporary credentials when you sign in to the console as a user and then switch roles. For more information about switching roles, see Switching to a role (console) in the IAM User Guide.

You can manually create temporary credentials using the AWS CLI or AWS API. You can then use those temporary credentials to access AWS. AWS recommends that you dynamically generate temporary credentials instead of using long-term access keys. For more information, see Temporary security credentials in IAM.

Principal permissions for CloudTrail

| Supports principal permissions | Yes |

When you use an IAM user or role to perform actions in AWS, you are considered a principal. Policies grant permissions to a principal. When you use some services, you might perform an action that then triggers another action in a different service. In this case, you must have permissions to perform both actions. To see whether an action requires additional dependent actions in a policy, see Actions, Resources, and Condition Keys for AWS CloudTrail in the Service Authorization Reference.

Service roles for CloudTrail

| Supports service roles | Yes |

A service role is an IAM role that a service assumes to perform actions on your behalf. An IAM administrator can create, modify, and delete a service role from within IAM. For more information, see Creating a role to delegate permissions to an AWS service in the IAM User Guide.

Warning

Changing the permissions for a service role might break CloudTrail functionality. Edit service roles only when CloudTrail provides guidance to do so.

Service-linked roles for CloudTrail

| Supports service-linked roles | Yes |

A service-linked role is a type of service role that is linked to an AWS service. The service can assume the role to perform an action on your behalf. Service-linked roles appear in your AWS account and are owned by the service. An IAM administrator can view, but not edit the permissions for service-linked roles.

CloudTrail supports a service-linked role for integration with AWS Organizations. This role is required for the creation of an organization trail or event data store. Organization trails and event data stores
Identity-based policy examples for AWS CloudTrail

By default, users and roles don’t have permission to create or modify CloudTrail resources. They also can’t perform tasks by using the AWS Management Console, AWS Command Line Interface (AWS CLI), or AWS API. To grant users permission to perform actions on the resources that they need, an IAM administrator can create IAM policies. The administrator can then add the IAM policies to roles, and users can assume the roles.

To learn how to create an IAM identity-based policy by using these example JSON policy documents, see Creating IAM policies in the IAM User Guide.

For details about actions and resource types defined by CloudTrail, including the format of the ARNs for each of the resource types, see Actions, Resources, and Condition Keys for AWS CloudTrail in the Service Authorization Reference.

Topics
- Policy best practices (p. 368)
- Example: Allowing and denying actions for a specified trail (p. 369)
- Examples: Creating and applying policies for actions on specific trails (p. 369)
- Examples: Denying access to create or delete event data stores based on tags (p. 371)
- Using the CloudTrail console (p. 372)
- Allow users to view their own permissions (p. 374)
- Granting custom permissions for CloudTrail users (p. 374)

Policy best practices

Identity-based policies determine whether someone can create, access, or delete CloudTrail resources in your account. These actions can incur costs for your AWS account. When you create or edit identity-based policies, follow these guidelines and recommendations:

- **Get started with AWS managed policies and move toward least-privilege permissions** – To get started granting permissions to your users and workloads, use the AWS managed policies that grant permissions for many common use cases. They are available in your AWS account. We recommend that you reduce permissions further by defining AWS customer managed policies that are specific to your use cases. For more information, see AWS managed policies or AWS managed policies for job functions in the IAM User Guide.

- **Apply least-privilege permissions** – When you set permissions with IAM policies, grant only the permissions required to perform a task. You do this by defining the actions that can be taken on specific resources under specific conditions, also known as least-privilege permissions. For more information about using IAM to apply permissions, see Policies and permissions in IAM in the IAM User Guide.

- **Use conditions in IAM policies to further restrict access** – You can add a condition to your policies to limit access to actions and resources. For example, you can write a policy condition to specify that all requests must be sent using SSL. You can also use conditions to grant access to service actions if they are used through a specific AWS service, such as AWS CloudFormation. For more information, see IAM JSON policy elements: Condition in the IAM User Guide.

- **Use IAM Access Analyzer to validate your IAM policies to ensure secure and functional permissions** – IAM Access Analyzer validates new and existing policies so that the policies adhere to the IAM policy language (JSON) and IAM best practices. IAM Access Analyzer provides more than 100 policy checks and actionable recommendations to help you author secure and functional policies. For more information, see IAM Access Analyzer policy validation in the IAM User Guide.
• **Require multi-factor authentication (MFA)** – If you have a scenario that requires IAM users or a root user in your AWS account, turn on MFA for additional security. To require MFA when API operations are called, add MFA conditions to your policies. For more information, see Configuring MFA-protected API access in the IAM User Guide.

For more information about best practices in IAM, see Security best practices in IAM in the IAM User Guide.

CloudTrail doesn't have service-specific context keys that you can use in the Condition element of policy statements.

**Example: Allowing and denying actions for a specified trail**

The following example demonstrates a policy that allows users with the policy to view the status and configuration of a trail and start and stop logging for a trail named **My-First-Trail**. This trail was created in the US East (Ohio) Region (its home Region) in the AWS account with the ID **123456789012**.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "cloudtrail:StartLogging",
                "cloudtrail:StopLogging",
                "cloudtrail:GetTrail",
                "cloudtrail:GetTrailStatus",
                "cloudtrail:GetEventSelectors"
            ],
            "Resource": [
                "arn:aws:cloudtrail:us-east-2:123456789012:trail/My-First-Trail"
            ]
        }
    ]
}
```

The following example demonstrates a policy that explicitly denies CloudTrail actions for any trail not named **My-First-Trail**.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Deny",
            "Action": [
                "cloudtrail:*"
            ],
            "NotResource": [
                "arn:aws:cloudtrail:us-east-2:123456789012:trail/My-First-Trail"
            ]
        }
    ]
}
```

**Examples: Creating and applying policies for actions on specific trails**

You can use permissions and policies to control a user's ability to perform specific actions on CloudTrail trails.
For example, you don’t want users of your company’s developer group to start or stop logging on a specific trail. However, you might want to grant them permission to perform the DescribeTrails and GetTrailStatus actions on the trail. You want the users of the developer group to perform the StartLogging or StopLogging actions on trails that they manage.

You can create two policy statements and attach them to the developer group you create in IAM. For more information about groups in IAM, see IAM Groups in the IAM User Guide.

In the first policy, you deny the StartLogging and StopLogging actions for the trail ARN that you specify. In the following example, the trail ARN is arn:aws:cloudtrail:us-east-2:123456789012:trail/Example-Trail.

```json
{
"Version": "2012-10-17",
"Statement": [
{
"Sid": "Stmt1446057698000",
"Effect": "Deny",
"Action": [
"cloudtrail:StartLogging",
"cloudtrail:StopLogging"
],
"Resource": [
]
}
}
```

In the second policy, the DescribeTrails and GetTrailStatus actions are allowed on all CloudTrail resources:

```json
{
"Version": "2012-10-17",
"Statement": [
{
"Sid": "Stmt1446072643000",
"Effect": "Allow",
"Action": [
"cloudtrail:DescribeTrails",
"cloudtrail:GetTrail",
"cloudtrail:GetTrailStatus"
],
"Resource": [
"*
]
}
}
```

If a user of the developer group tries to start or stop logging on the trail that you specified in the first policy, that user gets an access denied exception. Users of the developer group can start and stop logging on trails that they create and manage.

The following examples show that the configured developer group in an AWS CLI profile named devgroup. First, a user of devgroup runs the describe-trails command.

```
$ aws --profile devgroup cloudtrail describe-trails
```

The command complete successfully with the following output:
The user then runs the `get-trail-status` command on the trail that you specified in the first policy.

```bash
$ aws --profile devgroup cloudtrail get-trail-status --name Example-Trail
```

The command complete successfully with the following output:

```json
{
  "LatestDeliveryTime": 1449517556.256,
  "LatestDeliveryAttemptTime": "2015-12-07T19:45:56Z",
  "LatestNotificationAttemptSucceeded": "",
  "LatestDeliveryAttemptSucceeded": "2015-12-07T19:45:56Z",
  "IsLogging": true,
  "TimeLoggingStarted": "2015-12-07T19:36:27Z",
  "StartLoggingTime": 1449516987.685,
  "StopLoggingTime": 1449516977.332,
  "LatestNotificationAttemptTime": "",
  "TimeLoggingStopped": "2015-12-07T19:36:17Z"
}
```

Next, a user in the `devgroup` group runs the `stop-logging` command on the same trail.

```bash
$ aws --profile devgroup cloudtrail stop-logging --name Example-Trail
```

The command returns an access denied exception, such as the following:

```
A client error (AccessDeniedException) occurred when calling the StopLogging operation: Unknown
```

The user runs the `start-logging` command on the same trail.

```bash
$ aws --profile devgroup cloudtrail start-logging --name Example-Trail
```

Again the command returns an access denied exception, such as the following:

```
A client error (AccessDeniedException) occurred when calling the StartLogging operation: Unknown
```

**Examples: Denying access to create or delete event data stores based on tags**

In the following policy example, permission to create an event data store with `CreateEventDataStore` is denied if at least one of the following conditions aren't met:
- The event data store doesn't have a tag key of stage applied to itself
- The value of the stage tag isn't alpha, beta, gamma, or prod.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Deny",
      "Action": "cloudtrail:CreateEventDataStore",
      "Resource": "*",
      "Condition": {
        "Null": {
          "aws:RequestTag/stage": "true"
        }
      }
    },
    {
      "Effect": "Deny",
      "Action": "cloudtrail:CreateEventDataStore",
      "Resource": "*",
      "Condition": {
        "ForAnyValue:StringNotEquals": {
          "aws:RequestTag/stage": [
            "alpha",
            "beta",
            "gamma",
            "prod"
          ]
        }
      }
    }
  ]
}
```

In the following policy example, permission to delete an event data store with `DeleteEventDataStore` is denied if the event data store has a `stage` tag with a value of `prod`. A policy like this one can help protect an event data store from accidental deletion.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Deny",
      "Action": "cloudtrail:DeleteEventDataStore",
      "Resource": "*",
      "Condition": {
        "StringEquals": {
          "aws:ResourceTag/stage": "prod"
        }
      }
    }
  ]
}
```

**Using the CloudTrail console**

To access the AWS CloudTrail console, you must have a minimum set of permissions. These permissions must allow you to list and view details about the CloudTrail resources in your AWS account. If you create an identity-based policy that is more restrictive than the minimum required permissions, the console won't function as intended for entities (users or roles) with that policy.
You don't need to allow minimum console permissions for users that are making calls only to the AWS CLI or the AWS API. Instead, allow access to only the actions that match the API operation that they're trying to perform.

**Granting permissions for CloudTrail administration**

To allow IAM roles or users to administer a CloudTrail resource, such as a trail, event data store, or channel, you must grant explicit permissions to perform the actions associated with CloudTrail tasks. In most situations, you can use an AWS managed policy that contains predefined permissions.

**Note**
The permissions you grant to users to perform CloudTrail administration tasks aren't the same as the permissions that CloudTrail requires to deliver log files to Amazon S3 buckets or send notifications to Amazon SNS topics. For more information about those permissions, see [Amazon S3 bucket policy for CloudTrail](p. 380).

If you configure integration with Amazon CloudWatch Logs, CloudTrail also requires a role that it can assume to deliver events to an Amazon CloudWatch Logs log group. You must create the role that CloudTrail uses. For more information, see [Granting permission to view and configure Amazon CloudWatch Logs information on the CloudTrail console](p. 378) and [Sending events to CloudWatch Logs](p. 295).

The following AWS managed policies are available for CloudTrail:

- **AWSCloudTrail_FullAccess** – This policy provides full access to CloudTrail actions on CloudTrail resources, such as trails, event data stores, and channels. This policy provides the required permissions to create, update, and delete CloudTrail trails, event data stores, and channels.

  This policy also provides permissions to manage the Amazon S3 bucket, the log group for CloudWatch Logs, and an Amazon SNS topic for a trail. However, the AWSCloudTrail_FullAccess managed policy doesn't provide permissions to delete the Amazon S3 bucket, the log group for CloudWatch Logs, or an Amazon SNS topic. For information about managed policies for other AWS services, see the [AWS Managed Policy Reference Guide](p. 381).

  **Note**
The AWSCloudTrail_FullAccess policy isn’t intended to be shared broadly across your AWS account. Users with this role can turn off or reconfigure the most sensitive and important auditing functions in their AWS accounts. For this reason, you must only apply this policy to account administrators. You must closely control and monitor use of this policy.

- **AWSCloudTrail_ReadOnlyAccess** – This policy grants permissions to view the CloudTrail console, including recent events and event history. This policy also allows you to view existing trails, event data stores, and channels. Roles and users with this policy can [download the event history](p. 295), but they can't create or update trails, event data stores, or channels.

To provide access, add permissions to your users, groups, or roles:

- Users and groups in AWS IAM Identity Center (successor to AWS Single Sign-On):
  
  Create a permission set. Follow the instructions in [Create a permission set](p. 381) in the [AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide](p. 381).

  Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in [Creating a role for a third-party identity provider (federation)](p. 381) in the [IAM User Guide](p. 381).

- IAM users:
  
  Create a role that your user can assume. Follow the instructions in [Creating a role for an IAM user](p. 381) in the [IAM User Guide](p. 381).

  (Not recommended) Attach a policy directly to a user or add a user to a user group. Follow the instructions in [Adding permissions to a user (console)](p. 381) in the [IAM User Guide](p. 381).
Additional resources

To learn more about using IAM to give identities, such as users and roles, access to resources in your account, see Getting set up with IAM and Access management for AWS resources in the IAM User Guide.

You don't need to allow minimum console permissions for users that are making calls only to the AWS CLI or the AWS API. Instead, allow access to only the actions that match the API operation that you're trying to perform.

Allow users to view their own permissions

This example shows how you might create a policy that allows IAM users to view the inline and managed policies that are attached to their user identity. This policy includes permissions to complete this action on the console or programmatically using the AWS CLI or AWS API.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ViewOwnUserInfo",
            "Effect": "Allow",
            "Action": [
                "iam:GetUserPolicy",
                "iam:ListGroupsForUser",
                "iam:ListAttachedUserPolicies",
                "iam:ListUserPolicies",
                "iam:GetUser"
            ],
            "Resource": ["arn:aws:iam::*:user/${aws:username}"],
        },
        {
            "Sid": "NavigateInConsole",
            "Effect": "Allow",
            "Action": [
                "iam:GetGroupPolicy",
                "iam:GetPolicyVersion",
                "iam:GetPolicy",
                "iam:ListAttachedGroupPolicies",
                "iam:ListGroupPolicies",
                "iam:ListPolicyVersions",
                "iam:ListPolicies",
                "iam:ListUsers"
            ],
            "Resource": "*"
        }
    ]
}
```

Granting custom permissions for CloudTrail users

CloudTrail policies grant permissions to users who work with CloudTrail. If you need to grant different permissions to users, you can attach a CloudTrail policy to an IAM group or to a user. You can edit the policy to include or exclude specific permissions. You can also create your own custom policy. Policies are JSON documents that define the actions a user is allowed to perform and the resources that the user is allowed to perform those actions on. For specific examples, see Example: Allowing and denying actions for a specified trail (p. 369) and Examples: Creating and applying policies for actions on specific trails (p. 369).

Contents
- Read-only access (p. 375)
- Full access (p. 375)
• Granting permission to view AWS Config information on the CloudTrail console (p. 377)
• Granting permission to view and configure Amazon CloudWatch Logs information on the CloudTrail console (p. 378)
• Additional information (p. 378)

Read-only access

The following example shows a policy that grants read-only access to CloudTrail trails. This is equivalent to the managed policy `AWSCloudTrail_ReadOnlyAccess`. It grants users permission to see trail information, but not to create or update trails.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "cloudtrail:Get*",
                "cloudtrail:Describe*",
                "cloudtrail:List*",
                "cloudtrail:LookupEvents"
            ],
            "Resource": "*"
        }
    ]
}
```

In the policy statements, the Effect element specifies whether the actions are allowed or denied. The Action element lists the specific actions that the user is allowed to perform. The Resource element lists the AWS resources the user is allowed to perform those actions on. For policies that control access to CloudTrail actions, the Resource element is usually set to *, a wildcard that means "all resources."

The values in the Action element correspond to the APIs that the services support. The actions are preceded by `cloudtrail:` to indicate that they refer to CloudTrail actions. You can use the * wildcard character in the Action element, such as in the following examples:

• "Action": ["cloudtrail:*Logging"]
  This allows all CloudTrail actions that end with "Logging" (StartLogging, StopLogging).
• "Action": ["cloudtrail:*"]
  This allows all CloudTrail actions, but not actions for other AWS services.
• "Action": ["*"]
  This allows all AWS actions. This permission is suitable for a user who acts as an AWS administrator for your account.

The read-only policy doesn't grant user permission for the CreateTrail, UpdateTrail, StartLogging, and StopLogging actions. Users with this policy are not allowed to create trails, update trails, or turn logging on and off. For the list of CloudTrail actions, see the AWS CloudTrail API Reference.

Full access

The following example shows a policy that grants full access to CloudTrail. This is equivalent to the managed policy `AWSCloudTrail_FullAccess`. It grants users the permission to perform all CloudTrail actions. It also lets users log data events in Amazon S3 and AWS Lambda, manage files in Amazon S3

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buckets, manage how CloudWatch Logs monitors CloudTrail log events, and manage Amazon SNS topics in the account that the user is associated with.

**Important**
The *AWSCloudTrail_FullAccess* policy or equivalent permissions are not intended to be shared broadly across your AWS account. Users with this role or equivalent access have the ability to disable or reconfigure the most sensitive and important auditing functions in their AWS accounts. For this reason, this policy should be applied only to account administrators, and use of this policy should be closely controlled and monitored.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "sns:AddPermission",
            "sns:CreateTopic",
            "sns:SetTopicAttributes",
            "sns:GetTopicAttributes"
         ],
         "Resource": [
            "arn:aws:sns:*:*:aws-cloudtrail-logs*"
         ]
      },
      {
         "Effect": "Allow",
         "Action": [
            "sns:ListTopics"
         ],
         "Resource": "*"
      },
      {
         "Effect": "Allow",
         "Action": [
            "s3:CreateBucket",
            "s3:PutBucketPolicy"
         ],
         "Resource": [
            "arn:aws:s3:::aws-cloudtrail-logs*"
         ]
      },
      {
         "Effect": "Allow",
         "Action": [
            "s3:ListAllMyBuckets",
            "s3:GetBucketLocation",
            "s3:GetBucketPolicy"
         ],
         "Resource": "*"
      },
      {
         "Effect": "Allow",
         "Action": "cloudtrail:*",
         "Resource": "*"
      },
      {
         "Effect": "Allow",
         "Action": [
            "logs:CreateLogGroup"
         ],
         "Resource": [
            "arn:aws:logs:*:*:log-group:aws-cloudtrail-logs*"
         ]
      }
   ]
}
```
Granting permission to view AWS Config information on the CloudTrail console

You can view event information on the CloudTrail console, including resources that are related to that event. For these resources, you can choose the AWS Config icon to view the timeline for that resource in the AWS Config console. Attach this policy to your users to grant them read-only AWS Config access. The policy doesn't grant them permission to change settings in AWS Config.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "config:Get*",
        "config:Describe*",
        "config:List*"
      ],
      "Resource": "*"
    }
  ]
}
```
Resource-based policy examples

CloudTrail supports resource-based permissions policies for CloudTrail channels used for CloudTrail Lake integrations. For more information about creating integrations with CloudTrail Lake, see Create an integration with an event source outside of AWS (p. 190).

The information required for the policy is determined by the integration type.

- For a direction integration, CloudTrail requires the policy to contain the partner's AWS account IDs, and requires you to enter the unique external ID provided by the partner. CloudTrail automatically adds the partner's AWS account IDs to the resource policy when you create an integration using the CloudTrail console. Refer to the partner's documentation to learn how to get the AWS account numbers required for the policy.

- For a solution integration, you must specify at least one AWS account ID as principal, and can optionally enter an external ID to prevent against confused deputy.

Additional information

To learn more about using IAM to give identities, such as users and roles, access to resources in your account, see Getting started and Access management for AWS resources in the IAM User Guide.
The following are requirements for the resource-based policy:

- The resource ARN defined in the policy must match the channel ARN the policy is attached to.
- The policy contains only one action: `cloudtrail-data:PutAuditEvents`
- The policy contains at least one statement. The policy can have a maximum of 20 statements.
- Each statement contains at least one principal. A statement can have a maximum of 50 principals.

The channel owner can call the `PutAuditEvents` API on the channel unless the policy denies the owner access to the resource.

**Topics**

- **Example: Providing channel access to principals (p. 379)**
- **Example: Using an external ID to prevent against confused deputy (p. 379)**

### Example: Providing channel access to principals

The following example grants permissions to the principals with the ARNs `arn:aws:iam::111122223333:root`, `arn:aws:iam::444455556666:root`, and `arn:aws:iam::123456789012:root` to call the `PutAuditEvents` API on the CloudTrail channel with the ARN `arn:aws:cloudtrail:us-east-1:777788889999:channel/EXAMPLE-80b5-40a7-ae65-6e099392355b`.

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ChannelPolicy",
            "Effect": "Allow",
            "Principal": {
                "AWS": [
                    "arn:aws:iam::111122223333:root",
                    "arn:aws:iam::444455556666:root",
                    "arn:aws:iam::123456789012:root"
                ],
            "Action": "cloudtrail-data:PutAuditEvents",
            "Resource": "arn:aws:cloudtrail:us-east-1:777788889999:channel/EXAMPLE-80b5-40a7-ae65-6e099392355b"
        }
    ]
}
```

### Example: Using an external ID to prevent against confused deputy

The following example uses an external ID to address and prevent against confused deputy. The confused deputy problem is a security issue where an entity that doesn't have permission to perform an action can coerce a more-privileged entity to perform the action.

The integration partner creates the external ID to use in the policy. Then, it provides the external ID to you as part of creating the integration. The value can be any unique string, such as a passphrase or account number.
The example grants permissions to the principals with the ARNs `arn:aws:iam::111122223333:root`, `arn:aws:iam::444455556666:root`, and `arn:aws:iam::123456789012:root` to call the `PutAuditEvents` API on the CloudTrail channel resource if the call to the `PutAuditEvents` API includes the external ID value defined in the policy.

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "ChannelPolicy",
      "Effect": "Allow",
      "Principal": {
        "AWS": [
          "arn:aws:iam::111122223333:root",
          "arn:aws:iam::444455556666:root",
          "arn:aws:iam::123456789012:root"
        ]
      },
      "Action": "cloudtrail-data:PutAuditEvents",
      "Resource": "arn:aws:cloudtrail:us-east-1:777788889999:channel/EXAMPLE-80b5-40a7-ae65-6e09392355b",
      "Condition": {
        "StringEquals": {
          "cloudtrail:ExternalId": "uniquePartnerExternalID"
        }
      }
    }
  ]
}
```

Amazon S3 bucket policy for CloudTrail

By default, Amazon S3 buckets and objects are private. Only the resource owner (the AWS account that created the bucket) can access the bucket and objects it contains. The resource owner can grant access permissions to other resources and users by writing an access policy.

To create or modify an Amazon S3 bucket to receive log files for an organization trail, you must change the bucket policy. For more information, see [Creating a trail for an organization with the AWS Command Line Interface (p. 145)](https://docs.aws.amazon.com/albumuidp-512003014458768752/p/creating-a-trail-for-an-organization-with-the-aws-command-line-interface-p-145).

To deliver log files to an S3 bucket, CloudTrail must have the required permissions, and it cannot be configured as a [Requester Pays](https://docs.aws.amazon.com/albumuidp-512003014458768752/p/requester-pays) bucket.

CloudTrail adds the following fields in the policy for you:

- The allowed SIDs
- The bucket name
- The service principal name for CloudTrail
- The name of the folder where the log files are stored, including the bucket name, a prefix (if you specified one), and your AWS account ID

As a security best practice, add an `aws:SourceArn` condition key to the Amazon S3 bucket policy. The IAM global condition key `aws:SourceArn` helps ensure that CloudTrail writes to the S3 bucket only for a
specific trail or trails. The value of aws:SourceArn is always the ARN of the trail (or array of trail ARNs) that is using the bucket to store logs. Be sure to add the aws:SourceArn condition key to S3 bucket policies for existing trails.

The following policy allows CloudTrail to write log files to the bucket from supported AWS Regions. Replace myBucketName, [optionalPrefix]/, myAccountID, region, and trailName with the appropriate values for your configuration.

**S3 bucket policy**

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "AWSCloudTrailAclCheck20150319",
         "Effect": "Allow",
         "Principal": {"Service": "cloudtrail.amazonaws.com"},
         "Action": "s3:GetBucketAcl",
         "Resource": "arn:aws:s3:::
            myBucketName",
         "Condition": {
            "StringEquals": {
               "aws:SourceArn":
               "arn:aws:cloudtrail:
               region:myAccountID:trail/trailName"
            }
         }
      },
      {
         "Sid": "AWSCloudTrailWrite20150319",
         "Effect": "Allow",
         "Principal": {"Service": "cloudtrail.amazonaws.com"},
         "Action": "s3:PutObject",
         "Resource": "arn:aws:s3:::
            myBucketName/[optionalPrefix]/AWSLogs/myAccountID/",
         "Condition": {
            "StringEquals": {
               "s3:x-amz-acl": "bucket-owner-full-control",
               "aws:SourceArn":
               "arn:aws:cloudtrail:
               region:myAccountID:trail/trailName"
            }
         }
      }
   ]
}
```

For more information about AWS Regions, see [CloudTrail supported Regions](p. 19).

**Contents**

- Specifying an existing bucket for CloudTrail log delivery (p. 381)
- Receiving log files from other accounts (p. 382)
- Create or update an Amazon S3 bucket to use to store the log files for an organization trail (p. 145)
- Troubleshooting the Amazon S3 bucket policy (p. 383)
  - Common Amazon S3 policy configuration errors (p. 383)
  - Changing a prefix for an existing bucket (p. 384)
- Additional resources (p. 385)

**Specifying an existing bucket for CloudTrail log delivery**

If you specified an existing S3 bucket as the storage location for log file delivery, you must attach a policy to the bucket that allows CloudTrail to write to the bucket.
Note
As a best practice, use a dedicated S3 bucket for CloudTrail logs.

To add the required CloudTrail policy to an Amazon S3 bucket

1. Open the Amazon S3 console at https://console.aws.amazon.com/s3/.
2. Choose the bucket where you want CloudTrail to deliver your log files, and then choose Permissions.
3. Choose Edit.
4. Copy the S3 bucket policy (p. 381) to the Bucket Policy Editor window. Replace the placeholders in italics with the names of your bucket, prefix, and account number. If you specified a prefix when you created your trail, include it here. The prefix is an optional addition to the S3 object key that creates a folder-like organization in your bucket.

Note
If the existing bucket already has one or more policies attached, add the statements for CloudTrail access to that policy or policies. Evaluate the resulting set of permissions to be sure that they are appropriate for the users who will access the bucket.

Receiving log files from other accounts

You can configure CloudTrail to deliver log files from multiple AWS accounts to a single S3 bucket. For more information, see Receiving CloudTrail log files from multiple accounts (p. 307).

Create or update an Amazon S3 bucket to use to store the log files for an organization trail

You must specify an Amazon S3 bucket to receive the log files for an organization trail. This bucket must have a policy that allows CloudTrail to put the log files for the organization into the bucket.

The following is an example policy for an Amazon S3 bucket named myOrganizationBucket. This bucket is in an AWS account with the ID 111111111111, which is the management account for an organization with the ID o-exampleorgid that allows logging for an organization trail. It also allows logging for the 111111111111 account in the event that the trail is changed from an organization trail to a trail for that account only. Replace myOrganizationBucket, 111111111111, region, and trailName with the appropriate values for your configuration.

The example policy includes an aws:SourceArn condition key for the Amazon S3 bucket policy. The IAM global condition key aws:SourceArn helps ensure that CloudTrail writes to the S3 bucket only for a specific trail or trails. In an organization trail, the value of aws:SourceArn must be a trail ARN that is owned by the management account, and uses the management account ID.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "AWSCloudTrailAclCheck20150319",
         "Effect": "Allow",
         "Principal": {
            "Service": ["cloudtrail.amazonaws.com"]
         },
         "Action": "s3:GetBucketAcl",
         "Resource": "arn:aws:s3:::myOrganizationBucket",
         "Condition": {
            "StringEquals": {
               "aws:SourceArn": "arn:aws:cloudtrail:region:1111111111:trail/trailName"
            }
         }
      }
   ]
}
```
This example policy does not allow any users from member accounts to access the log files created for the organization. By default, organization log files are accessible only to the management account. For information about how to allow read access to the Amazon S3 bucket for IAM users in member accounts, see Sharing CloudTrail log files between AWS accounts (p. 315).

Troubleshooting the Amazon S3 bucket policy

The following sections describe how to troubleshoot the S3 bucket policy.

Common Amazon S3 policy configuration errors

When you create a new bucket as part of creating or updating a trail, CloudTrail attaches the required permissions to your bucket. The bucket policy uses the service principal name, "cloudtrail.amazonaws.com", which allows CloudTrail to deliver logs for all Regions.

If CloudTrail is not delivering logs for a Region, it's possible that your bucket has an older policy that specifies CloudTrail account IDs for each Region. This policy gives CloudTrail permission to deliver logs only for the Regions specified.

As a best practice, update the policy to use a permission with the CloudTrail service principal. To do this, replace the account ID ARNs with the service principal name: "cloudtrail.amazonaws.com". This
gives CloudTrail permission to deliver logs for current and new Regions. As a security best practice, add an `aws:SourceArn` or `aws:SourceAccount` condition key to the Amazon S3 bucket policy. This helps prevent unauthorized account access to your S3 bucket. If you have existing trails, be sure to add one or more condition keys. The following example shows a recommended policy configuration. Replace `myBucketName`, `[optionalPrefix]/`, `myAccountID`, `region`, and `trailName` with the appropriate values for your configuration.

**Example Example bucket policy with service principal name**

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSCloudTrailAclCheck20150319",
      "Effect": "Allow",
      "Principal": {
        "Service": "cloudtrail.amazonaws.com"
      },
      "Action": "s3:GetBucketAcl",
      "Resource": "arn:aws:s3:::myBucketName",
      "Condition": {
        "StringEquals": {
          "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:trail/trailName"
        }
      }
    },
    {
      "Sid": "AWSCloudTrailWrite20150319",
      "Effect": "Allow",
      "Principal": {
        "Service": "cloudtrail.amazonaws.com"
      },
      "Action": "s3:PutObject",
      "Resource": "arn:aws:s3:::myBucketName/[optionalPrefix]/AWSLogs/myAccountID/*",
      "Condition": {
        "StringEquals": {
          "s3:x-amz-acl": "bucket-owner-full-control",
          "aws:SourceArn": "arn:aws:cloudtrail:region:myAccountID:trail/trailName"
        }
      }
    }
  ]
}
```

**Changing a prefix for an existing bucket**

If you try to add, modify, or remove a log file prefix for an S3 bucket that receives logs from a trail, you might see the error: **There is a problem with the bucket policy.** A bucket policy with an incorrect prefix can prevent your trail from delivering logs to the bucket. To resolve this issue, use the Amazon S3 console to update the prefix in the bucket policy, and then use the CloudTrail console to specify the same prefix for the bucket in the trail.

**To update the log file prefix for an Amazon S3 bucket**

1. Open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).
2. Choose the bucket for which you want to modify the prefix, and then choose **Permissions**.
3. Choose **Edit**.
4. In the bucket policy, under the `s3:PutObject` action, edit the `Resource` entry to add, modify, or remove the log file `prefix/` as needed.

```json
"Action": "s3:PutObject",
"Resource": "arn:aws:s3:::myBucketName/prefix/AWSLogs/myAccountID/*",
```
5. Choose **Save**.
7. Choose your trail and for **Storage location**, click the pencil icon to edit the settings for your bucket.
8. For **S3 bucket**, choose the bucket with the prefix you are changing.
9. For **Log file prefix**, update the prefix to match the prefix that you entered in the bucket policy.
10. Choose **Save**.

**Additional resources**

For more information about S3 buckets and policies, see the [Amazon Simple Storage Service User Guide](https://docs.aws.amazon.com/AmazonS3/latest/userguide/).

**Amazon S3 bucket policy for CloudTrail Lake query results**

By default, Amazon S3 buckets and objects are private. Only the resource owner (the AWS account that created the bucket) can access the bucket and objects it contains. The resource owner can grant access permissions to other resources and users by writing an access policy.

To deliver CloudTrail Lake query results to an S3 bucket, CloudTrail must have the required permissions, and it cannot be configured as a [Requester Pays](https://docs.aws.amazon.com/AmazonS3/latest/userguide/requester-pays.html) bucket.

CloudTrail adds the following fields in the policy for you:

- The allowed SIDs
- The bucket name
- The service principal name for CloudTrail

As a security best practice, add an `aws:SourceArn` condition key to the Amazon S3 bucket policy. The IAM global condition key `aws:SourceArn` helps ensure that CloudTrail writes to the S3 bucket only for the event data store.

The following policy allows CloudTrail to deliver query results to the bucket from supported AWS Regions. Replace `myBucketName`, `myAccountID`, and `myQueryRunningRegion` with the appropriate values for your configuration. The `myAccountID` is the AWS account ID used for CloudTrail, which may not be the same as the AWS account ID for the S3 bucket.

**Note**

If this is an organization event data store, you must use the AWS account ID for the management account.

**S3 bucket policy**

```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AWSCloudTrailLake1",
            "Effect": "Allow",
            "Principal": {"Service": "cloudtrail.amazonaws.com"},
            "Action": [
                "s3:PutObject*",
                "s3:Abort*"
            ],
            "Resource": [
                "arn:aws:s3:::myBucketName",
            ]
        }
    ]
}
```
Specifying an existing bucket for CloudTrail Lake query results

If you specified an existing S3 bucket as the storage location for CloudTrail Lake query results delivery, you must attach a policy to the bucket that allows CloudTrail to deliver the query results to the bucket.

**Note**
As a best practice, use a dedicated S3 bucket for CloudTrail Lake query results.

**To add the required CloudTrail policy to an Amazon S3 bucket**

1. Open the Amazon S3 console at [https://console.aws.amazon.com/s3/](https://console.aws.amazon.com/s3/).
2. Choose the bucket where you want CloudTrail to deliver your Lake query results, and then choose Permissions.
3. Choose Edit.
4. Copy the S3 bucket policy for query results (p. 385) to the Bucket Policy Editor window. Replace the placeholders in italics with the names of your bucket, Region, and account ID.

**Note**
If the existing bucket already has one or more policies attached, add the statements for CloudTrail access to that policy or policies. Evaluate the resulting set of permissions to be sure that they are appropriate for the users who access the bucket.

**Additional resources**

For more information about S3 buckets and policies, see Using bucket policies in the Amazon Simple Storage Service User Guide.
Amazon SNS topic policy for CloudTrail

To send notifications to an SNS topic, CloudTrail must have the required permissions. CloudTrail automatically attaches the required permissions to the topic when you create an Amazon SNS topic as part of creating or updating a trail in the CloudTrail console.

**Important**

As a security best practice, to restrict access to your SNS topic, we strongly recommend that after you create or update a trail to send SNS notifications, you manually edit the IAM policy that is attached to the SNS topic to add condition keys. For more information, see the section called “Security best practice for SNS topic policy” (p. 388) in this topic.

CloudTrail adds the following statement to the policy for you with the following fields:

- The allowed SIDs.
- The service principal name for CloudTrail.
- The SNS topic, including Region, account ID, and topic name.

The following policy allows CloudTrail to send notifications about log file delivery from supported Regions. For more information, see CloudTrail supported Regions (p. 19). This is the default policy that is attached to a new or existing SNS topic policy when you create or update a trail, and choose to enable SNS notifications.

**SNS topic policy**

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Sid": "AWSCloudTrailSNSPolicy20131101",
         "Effect": "Allow",
         "Principal": {
            "Service": "cloudtrail.amazonaws.com"
         },
         "Action": ["SNS:Publish"],
         "Resource": "arn:aws:sns:region:SNSTopicOwnerAccountId:SNSTopicName"
      }
   ]
}
```

To use an AWS KMS-encrypted Amazon SNS topic to send notifications, you must also enable compatibility between the event source (CloudTrail) and the encrypted topic by adding the following statement to the policy of the AWS KMS key.

**KMS key policy**

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Principal": {
            "Service": "cloudtrail.amazonaws.com"
         },
         "Action": ["kms:GenerateDataKey*", "kms:Decrypt"],
         "Resource": "arn:aws:kms:region:KMSKeyId:SNSTopicOwnerKeyId:SNSTopicName"
      }
   ]
}
```
Security best practice for SNS topic policy

By default, the IAM policy statement that CloudTrail attaches to your Amazon SNS topic allows the CloudTrail service principal to publish to an SNS topic, identified by an ARN. To help prevent an attacker from gaining access to your SNS topic, and sending notifications on behalf of CloudTrail to topic recipients, manually edit your CloudTrail SNS topic policy to add an `aws:SourceArn` condition key to the policy statement attached by CloudTrail. The value of this key is the ARN of the trail, or an array of trail ARNs that are using the SNS topic. Because it includes both the specific trail ID and the ID of the account that owns the trail, it restricts SNS topic access to only those accounts that have permission to manage the trail. Before you add condition keys to your SNS topic policy, get the SNS topic name from your trail's settings in the CloudTrail console.

The `aws:SourceAccount` condition key is also supported, but is not recommended.

To add the `aws:SourceArn` condition key to your SNS topic policy

2. In the navigation pane, choose Topics.
3. Choose the SNS topic that is shown in your trail settings, and then choose Edit.
5. In the Access policy JSON editor, look for a block that resembles the following example.

```json
{
  "Sid": "AWSCloudTrailSNSPolicy20150319",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "SNS:Publish",
}
```

6. Add a new block for a condition, `aws:SourceArn`, as shown in the following example. The value of `aws:SourceArn` is the ARN of the trail about which you are sending notifications to SNS.

```json
{
  "Sid": "AWSCloudTrailSNSPolicy20150319",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "SNS:Publish",
}
```

For more information, see Enable Compatibility between Event Sources from AWS Services and Encrypted Topics.

Contents

- Security best practice for SNS topic policy (p. 388)
- Specifying an existing topic for sending notifications (p. 389)
- Troubleshooting the SNS topic policy (p. 390)
  - Common SNS policy configuration errors (p. 390)
  - Additional resources (p. 391)
Amazon SNS topic policy for CloudTrail

7. When you are finished editing the SNS topic policy, choose **Save changes**.

**To add the `aws:SourceAccount` condition key to your SNS topic policy**

2. In the navigation pane, choose **Topics**.
3. Choose the SNS topic that is shown in your trail settings, and then choose **Edit**.
4. Expand **Access policy**.
5. In the **Access policy** JSON editor, look for a block that resembles the following example.

```json
{
    "Sid": "AWSCloudTrailSNSPolicy20150319",
    "Effect": "Allow",
    "Principal": {
        "Service": "cloudtrail.amazonaws.com"
    },
    "Action": "SNS:Publish",
    "Condition": {
        "StringEquals": {
            "aws:SourceArn": "arn:aws:cloudtrail:us-west-2:123456789012:trail/Trail3"
        }
    }
}
```

6. Add a new block for a condition, `aws:SourceAccount`, as shown in the following example. The value of `aws:SourceAccount` is the ID of the account that owns the CloudTrail trail. This example restricts access to the SNS topic to only those users who can sign in to the AWS account 123456789012.

```json
{
    "Sid": "AWSCloudTrailSNSPolicy20150319",
    "Effect": "Allow",
    "Principal": {
        "Service": "cloudtrail.amazonaws.com"
    },
    "Action": "SNS:Publish",
    "Condition": {
        "StringEquals": {
            "aws:SourceAccount": "123456789012"
        }
    }
}
```

7. When you are finished editing the SNS topic policy, choose **Save changes**.

**Specifying an existing topic for sending notifications**

You can manually add the permissions for an Amazon SNS topic to your topic policy in the Amazon SNS console and then specify the topic in the CloudTrail console.
To manually update an SNS topic policy

2. Choose Topics and then choose the topic.
3. Choose Other topic actions and then choose Edit topic policy.
4. Choose Advanced view, and add the statement from SNS topic policy (p. 387) with the appropriate values for the Region, account ID, and topic name.
5. Choose Update policy.
6. If your topic is an encrypted topic, you must allow CloudTrail to have kms:GenerateDataKey* and the kms:Decrypt permissions. For more information, see Encrypted SNS topic KMS key policy (p. 387).
7. Return to the CloudTrail console and specify the topic for the trail.

Troubleshooting the SNS topic policy

The following sections describe how to troubleshoot the SNS topic policy.

Common SNS policy configuration errors

When you create a new topic as part of creating or updating a trail, CloudTrail attaches the required permissions to your topic. The topic policy uses the service principal name, "cloudtrail.amazonaws.com", which allows CloudTrail to send notifications for all Regions.

If CloudTrail is not sending notifications for a Region, it's possible that your topic has an older policy that specifies CloudTrail account IDs for each Region. This policy gives CloudTrail permission to send notifications only for the Regions specified.

The following topic policy allows CloudTrail to send notifications for the specified nine Regions only:

Example topic policy with account IDs

```json
{
  "Version": "2012-10-17",
  "Statement": [{
    "Sid": "AWSCloudTrailSNSPolicy20131101",
    "Effect": "Allow",
    "Principal": {"AWS": [
      "arn:aws:iam::903692715234:root",
      "arn:aws:iam::035531147821:root",
      "arn:aws:iam::859597730677:root",
      "arn:aws:iam::814480443879:root",
      "arn:aws:iam::216624486486:root",
      "arn:aws:iam::086441151436:root",
      "arn:aws:iam::388751089494:root",
      "arn:aws:iam::284668455005:root",
      "arn:aws:iam::113285607260:root"
    ]},
    "Action": "SNS:Publish",
    "Resource": "aws:arn:sns:us-east-1:123456789012:myTopic"
  }]
}
```

This policy uses a permission based on individual CloudTrail account IDs. To deliver logs for a new Region, you must manually update the policy to include the CloudTrail account ID for that Region. For example, because CloudTrail added support for the US East (Ohio) Region, you must update the policy to add the account ID ARN for that Region: "arn:aws:iam::475085895292:root".
As a best practice, update the policy to use a permission with the CloudTrail service principal. To do this, replace the account ID ARNs with the service principal name: "cloudtrail.amazonaws.com".

This gives CloudTrail permission to send notifications for current and new Regions. The following is an updated version of the previous policy:

**Example topic policy with service principal name**

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSCloudTrailSNSPolicy20131101",
      "Effect": "Allow",
      "Principal": {"Service": "cloudtrail.amazonaws.com"},
      "Action": "SNS:Publish",
    }
  ]
}
```

Verify that the policy has the correct values:

- In the Resource field, specify the account number of the topic owner. For topics that you create, specify your account number.
- Specify the appropriate values for the Region and SNS topic name.

**Additional resources**

For more information about SNS topics and subscribing to them, see the [Amazon Simple Notification Service Developer Guide](https://docs.aws.amazon.com/sns/latest/dg/)

**Troubleshooting AWS CloudTrail identity and access**

Use the following information to help you diagnose and fix common issues that you might encounter when working with CloudTrail and IAM.

**Topics**

- I am not authorized to perform an action in CloudTrail (p. 391)
- I am not authorized to perform iam:PassRole (p. 392)
- I want to allow people outside of my AWS account to access my CloudTrail resources (p. 392)
- I am not authorized to perform iam:PassRole (p. 392)
- I am getting a NoManagementAccountSLRExistsException exception when I try to create an organization trail or event data store (p. 393)

**I am not authorized to perform an action in CloudTrail**

If you receive an error that you're not authorized to perform an action, your policies must be updated to allow you to perform the action.

The following example error occurs when the mateojackson IAM user tries to use the console to view details about a fictional my-example-widget resource but doesn't have the fictional cloudtrail:GetWidget permissions.

```plaintext
User: arn:aws:iam::123456789012:user/mateojackson is not authorized to perform: cloudtrail:GetWidget on resource: my-example-widget
```
In this case, the policy for the mateojackson user must be updated to allow access to the my-example-widget resource by using the cloudtrail:GetWidget action.

If you need help, contact your AWS administrator. Your administrator is the person who provided you with your sign-in credentials.

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 sign-in credentials.

The following example error occurs when the mateojackson IAM user tries to use the console to view details about a trail but doesn't have either the appropriate CloudTrail managed policy (AWSCloudTrail_FullAccess or AWSCloudTrail_ReadOnlyAccess) or the equivalent permissions applied to his account.

```
User: arn:aws:iam::123456789012:user/mateojackson is not authorized to perform: cloudtrail:GetTrailStatus on resource: My-Trail
```

In this case, Mateo asks his administrator to update his policies to allow him to access trail information and status in the console.

If you sign in with an IAM user or role that has the AWSCloudTrail_FullAccess managed policy or its equivalent permissions, and you can't configure AWS Config or Amazon CloudWatch Logs integration with a trail, you might be missing the required permissions for integration with those services. For more information, see Granting permission to view AWS Config information on the CloudTrail console (p. 377) and Granting permission to view and configure Amazon CloudWatch Logs information on the CloudTrail console (p. 378).

**I am not authorized to perform iam:PassRole**

If you receive an error that you're not authorized to perform the iam:PassRole action, your policies must be updated to allow you to pass a role to CloudTrail.

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 CloudTrail. However, the action requires the service to have permissions that are 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's policies must be updated to allow her to perform the iam:PassRole action.

If you need help, contact your AWS administrator. Your administrator is the person who provided you with your sign-in credentials.

**I want to allow people outside of my AWS account to access my CloudTrail resources**

You can create a role and share CloudTrail information between multiple AWS accounts. For more information, see Sharing CloudTrail log files between AWS accounts (p. 315).

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 CloudTrail supports these features, see [How AWS CloudTrail works with IAM](p. 362).
- 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).

**I am not authorized to perform iam:PassRole**

If you receive an error that you're not authorized to perform the `iam:PassRole` action, your policies must be updated to allow you to pass a role to CloudTrail.

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 CloudTrail. However, the action requires the service to have permissions that are 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's policies must be updated to allow her to perform the `iam:PassRole` action.

If you need help, contact your AWS administrator. Your administrator is the person who provided you with your sign-in credentials.

**I am getting a NoManagementAccountSLRExistsException exception when I try to create an organization trail or event data store**

The `NoManagementAccountSLRExistsException` exception is thrown when the management account does not have a service-linked role. When you add a delegated administrator using the AWS Organizations AWS CLI or API operation, the service-linked role doesn't get created if it does not exist.

When you use your organization's management account to add a delegated administrator or create an organization trail or event data store in the CloudTrail console, or by using the AWS CLI or CloudTrail API, CloudTrail automatically creates a service-linked role for your management account if one does not already exist.

If you haven't added a delegated administrator, use the CloudTrail console, AWS CLI or CloudTrail API to add the delegated administrator. For more information about adding a delegated administrator, see [Add a CloudTrail delegated administrator (p. 354)] and [RegisterOrganizationDelegatedAdmin (API)].

If you've already added the delegated administrator, use the management account to create the organization trail or event data store in the CloudTrail console, or by using the AWS CLI or CloudTrail API. For more information about creating an organization trail, see [Creating a trail for your organization in the console (p. 140)], [Creating a trail for an organization with the AWS Command Line Interface (p. 145)], and [CreateTrail (API)].
Using service-linked roles for AWS CloudTrail

AWS CloudTrail uses AWS Identity and Access Management (IAM) service-linked roles. A service-linked role is a unique type of IAM role that is linked directly to CloudTrail. Service-linked roles are predefined by CloudTrail and include all the permissions that the service requires to call other AWS services on your behalf.

A service-linked role makes setting up CloudTrail easier because you don't have to manually add the necessary permissions. CloudTrail defines the permissions of its service-linked roles, and unless defined otherwise, only CloudTrail can assume its roles. The defined permissions include the trust policy and the permissions policy, and that permissions policy cannot be attached to any other IAM entity.

For information about other services that support service-linked roles, see AWS Services That Work with IAM and look for the services that have Yes in the Service-Linked Role column. Choose a Yes with a link to view the service-linked role documentation for that service.

Service-linked role permissions for CloudTrail

CloudTrail uses the service-linked role named AWSServiceRoleForCloudTrail – This service linked role is used for supporting the organization trail feature.

The AWSServiceRoleForCloudTrail service-linked role trusts the following services to assume the role:

- cloudtrail.amazonaws.com

This role is used to support the creation and management of organization trails in CloudTrail. For more information, see Creating a trail for an organization (p. 135).

The role permissions policy allows CloudTrail to complete the following actions on the specified resources:

- Actions on all CloudTrail resources:
  - All
- Actions on all Organizations resources:
  - organizations:DescribeAccount
  - organizations:DescribeOrganization
  - organizations:ListAccounts
  - organizations:ListAWSServiceAccessForOrganization
- Actions on all Organizations resources for the CloudTrail service principal:
  - organizations:ListDelegatedAdministrators

You must configure permissions to allow an IAM entity (such as a user, group, or role) to create, edit, or delete a service-linked role. For more information, see Service-Linked Role Permissions in the IAM User Guide.

Creating a service-linked role for CloudTrail

You don't need to manually create a service-linked role. When you create an organization trail or add a delegated administrator in the CloudTrail console, or by using the AWS CLI or API operation, CloudTrail creates the service-linked role for you if it does not already exist.

If you delete this service-linked role, and then need to create it again, you can use the same process to recreate the role in your account. When you create an organization trail or add a delegated administrator, CloudTrail creates the service-linked role for you again.
Editing a service-linked role for CloudTrail

CloudTrail does not allow you to edit the AWSServiceRoleForCloudTrail service-linked role. After you create a service-linked role, you cannot change the name of the role because various entities might reference the role. However, you can edit the description of the role using IAM. For more information, see Editing a Service-Linked Role in the IAM User Guide.

Deleting a service-linked role for CloudTrail

You don't need to manually delete the AWSServiceRoleForCloudTrail role. If an AWS account is removed from an Organizations organization, the AWSServiceRoleForCloudTrail role is automatically removed from that AWS account. You cannot detach or remove policies from the AWSServiceRoleForCloudTrail service-linked role in an organization management account without removing the account from the organization.

You can also use the IAM console, the AWS CLI or the AWS API to manually delete the service-linked role. To do this, you must first manually clean up the resources for your service-linked role, and then you can manually delete it.

**Note**

If the CloudTrail service is using the role when you try to delete the resources, then deletion might fail. If that happens, wait for a few minutes and try the operation again.

To remove a resource being used by the AWSServiceRoleForCloudTrail role, you can do one of the following:

- Remove the AWS account from the organization in Organizations.
- Update the trail so that it is no longer an organization trail.
- Delete the trail.

For more information, see Creating a trail for an organization (p. 135), Updating a trail (p. 96), and Deleting a trail (p. 104).

**To manually delete the service-linked role using IAM**

Use the IAM console, the AWS CLI, or the AWS API to delete the AWSServiceRoleForCloudTrail service-linked role. For more information, see Deleting a Service-Linked Role in the IAM User Guide.

Supported Regions for CloudTrail service-linked roles

CloudTrail supports using service-linked roles in all of the Regions where CloudTrail and Organizations are both available. For more information, see AWS Regions and Endpoints.

AWS managed policies for AWS CloudTrail

To add permissions to users, groups, and roles, it is easier to use AWS managed policies than to write policies yourself. It takes time and expertise to create IAM customer managed policies that provide your team with only the permissions they need. To get started quickly, you can use AWS managed policies. These policies cover common use cases and are available in your AWS account. For more information about AWS managed policies, see AWS managed policies in the IAM User Guide.

AWS services maintain and update AWS managed policies. You can't change the permissions in AWS managed policies. Services occasionally add additional permissions to an AWS managed policy to support new features. This type of update affects all identities (users, groups, and roles) where the policy is attached. Services are most likely to update an AWS managed policy when a new feature is launched.
or when new operations become available. Services do not remove permissions from an AWS managed policy, so policy updates won’t break your existing permissions.

Additionally, AWS supports managed policies for job functions that span multiple services. For example, the **ReadOnlyAccess** AWS managed policy provides read-only access to all AWS services and resources. When a service launches a new feature, AWS adds read-only permissions for new operations and resources. For a list and descriptions of job function policies, see [AWS managed policies for job functions](https://docs.aws.amazon.com/IAM/latest/UserGuide/id_mfa-managed-policies.html) in the IAM User Guide.

### AWS managed policy: AWSCloudTrail_ReadOnlyAccess

A user identity that has the AWSCloudTrail_ReadOnlyAccess policy attached to its role can perform read-only actions in CloudTrail, such as `Get*`, `List*`, and `Describe*` actions on trails, CloudTrail Lake event data stores, or Lake queries.

#### Permissions details

This policy includes the following permissions.

- cloudtrail – Allows user identities to perform read-only API operations in the CloudTrail console, the AWS SDKs, and the AWS CLI, including `Get*` operations such as `GetEventDataStores`, `List*` operations such as `ListTrails`, and `Describe*` operations such as `DescribeTrails`.

```json
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "cloudtrail:Get*",
            "cloudtrail:Describe*",
            "cloudtrail:List*",
            "cloudtrail:LookupEvents"
         ],
         "Resource": "*"
      }
   ]
}
```

### CloudTrail updates to AWS managed policies

View details about updates to AWS managed policies for CloudTrail. For automatic alerts about changes to this page, subscribe to the RSS feed on the CloudTrail Document history (p. 458) page.

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AWSCloudTrail_ReadOnlyAccess</strong> – Update to an existing policy</td>
<td>CloudTrail changed the name of the AWSCloudTrailReadOnlyAccess policy to AWSCloudTrail_ReadOnlyAccess. Also, the scope of permissions in the policy has been reduced to CloudTrail actions. It no longer includes Amazon S3, AWS KMS, or AWS Lambda action permissions.</td>
<td>June 6, 2022</td>
</tr>
</tbody>
</table>
Compliance validation for AWS CloudTrail

Third-party auditors assess the security and compliance of AWS CloudTrail as part of multiple AWS compliance programs. These include SOC, PCI, FedRAMP, HIPAA, and others.

To learn whether an AWS service is within the scope of specific compliance programs, see AWS services in Scope by Compliance Program and choose the compliance program that you are interested in. 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 AWS services 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 baseline environments on AWS that are security and compliance focused.
- **Architecting for HIPAA Security and Compliance on Amazon Web Services** – This whitepaper describes how companies can use AWS to create HIPAA-eligible applications.

  **Note**
  Not all AWS services are HIPAA eligible. For more information, see the HIPAA Eligible Services Reference.

- **AWS Compliance Resources** – This collection of workbooks and guides might apply to your industry and location.
- **Evaluating Resources with Rules** in the AWS Config Developer Guide – The AWS Config 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. Security Hub uses security controls to evaluate your AWS resources and to check your compliance against security industry standards and best practices. For a list of supported services and controls, see Security Hub controls reference.
- **AWS Audit Manager** – This AWS service helps you continuously audit your AWS usage to simplify how you manage risk and compliance with regulations and industry standards.

Resilience in AWS CloudTrail

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. If you specifically need to replicate your CloudTrail log files over greater geographic distances, you can use Cross-Region Replication for your trail Amazon S3 buckets, which enables automatic, asynchronous copying of objects across buckets in different AWS Regions.
For more information about AWS Regions and Availability Zones, see AWS Global Infrastructure.

In addition to the AWS global infrastructure, CloudTrail offers several features to help support your data resiliency and backup needs.

**Trails and event data stores that log events in all AWS Regions**

When you apply a trail to all AWS Regions, CloudTrail creates trails with identical configurations in all other AWS Regions in your account. When AWS adds a new Region, that trail configuration is automatically created in the new Region.

When you create a multi-Region event data store, CloudTrail collects events that occur in all AWS Regions.

**Versioning, lifecycle configuration, and object lock protection for CloudTrail log data**

Because CloudTrail uses Amazon S3 buckets to store log files, you can also use the features provided by Amazon S3 to help support your data resiliency and backup needs. For more information, see Resilience in Amazon S3.

**Infrastructure security in AWS CloudTrail**

As a managed service, AWS CloudTrail is protected by AWS global network security. For information about AWS security services and how AWS protects infrastructure, see AWS Cloud Security. To design your AWS environment using the best practices for infrastructure security, see Infrastructure Protection in Security Pillar AWS Well-Architected Framework.

You use AWS published API calls to access CloudTrail through the network. Clients must support the following:

- Transport Layer Security (TLS). We require TLS 1.2 and recommend TLS 1.3.
- Cipher suites with perfect forward secrecy (PFS) such as DHE (Ephemeral Diffie-Hellman) or ECDHE (Elliptic Curve Ephemeral Diffie-Hellman). 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.

The following security best practices also address infrastructure security in CloudTrail:

- Consider Amazon VPC endpoints for trail access. (p. 162)
- Consider Amazon VPC endpoints for Amazon S3 bucket access. For more information, see Example Bucket Policies for VPC Endpoints for Amazon S3.
- Identify and audit all Amazon S3 buckets that contain CloudTrail log files. Consider using tags to help identify both your CloudTrail trails and the Amazon S3 buckets that contain CloudTrail log files. You can then use resource groups for your CloudTrail resources. For more information, see AWS Resource Groups.

**Cross-service confused deputy prevention**

The confused deputy problem is a security issue where an entity that doesn't have permission to perform an action can coerce a more-privileged entity to perform the action. In AWS, cross-service impersonation
can result in the confused deputy problem. Cross-service impersonation can occur when one service (the calling service) calls another service (the called service). The calling service can be manipulated to use its permissions to act on another customer’s resources in a way it should not otherwise have permission to access. To prevent this, AWS provides tools that help you protect your data for all services with service principals that have been given access to resources in your account.

We recommend using the `aws:SourceArn` and `aws:SourceAccount` global condition context keys in resource policies to limit the permissions that AWS CloudTrail gives another service to the resource. Use `aws:SourceArn` if you want only one resource to be associated with the cross-service access. Use `aws:SourceAccount` if you want to allow any resource in that account to be associated with the cross-service use.

The most effective way to protect against the confused deputy problem is to use the `aws:SourceArn` global condition context key with the full ARN of the resource. If you don’t know the full ARN of the resource or if you are specifying multiple resources, use the `aws:SourceArn` global context condition key with wildcards (*) for the unknown portions of the ARN. For example, “arn:aws:cloudtrail:*:AccountID:trail/*”. When you include a wildcard, you must also use the StringLike condition operator.

The value of `aws:SourceArn` must be the ARN of the trail, event data store, or channel that is using the resource.

The following example shows how you can use the `aws:SourceArn` and `aws:SourceAccount` global condition context keys in CloudTrail to prevent the confused deputy problem: [Amazon S3 bucket policy for CloudTrail Lake query results](p. 385).

## Security best practices in AWS CloudTrail

AWS CloudTrail 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.

### Topics
- [CloudTrail detective security best practices](p. 399)
- [CloudTrail preventative security best practices](p. 401)

## CloudTrail detective security best practices

### Create a trail

For an ongoing record of events in your AWS account, you must create a trail. Although CloudTrail provides 90 days of event history information for management events in the CloudTrail console without creating a trail, it is not a permanent record, and it does not provide information about all possible types of events. For an ongoing record, and for a record that contains all the event types you specify, you must create a trail, which delivers log files to an Amazon S3 bucket that you specify.

To help manage your CloudTrail data, consider creating one trail that logs management events in all AWS Regions, and then creating additional trails that log specific event types for resources, such as Amazon S3 bucket activity or AWS Lambda functions.

The following are some steps you can take:

- [Create a trail for your AWS account](p. 85)
• Create a trail for an organization. (p. 135)

Apply trails to all AWS Regions

To obtain a complete record of events taken by an IAM identity, or service in your AWS account, each trail should be configured to log events in all AWS Regions. By logging events in all AWS Regions, you ensure that all events that occur in your AWS account are logged, regardless of which AWS Region where they occurred. This includes logging global service events (p. 18), which are logged to an AWS Region specific to that service. When you create a trail that applies to all Regions, CloudTrail records events in each Region and delivers the CloudTrail event log files to an S3 bucket that you specify. If an AWS Region is added after you create a trail that applies to all Regions, that new Region is automatically included, and events in that Region are logged. This is the default option when you create a trail in the CloudTrail console.

The following are some steps you can take:

• Create a trail for your AWS account. (p. 85)
• Update an existing trail (p. 96) to log events in all AWS Regions.
• Implement ongoing detective controls to help ensure all trails created are logging events in all AWS Regions by using the multi-region-cloud-trail-enabled rule in AWS Config.

Enable CloudTrail log file integrity

Validated log files are especially valuable in security and forensic investigations. For example, a validated log file enables you to assert positively that the log file itself has not changed, or that particular IAM identity credentials performed specific API activity. The CloudTrail log file integrity validation process also lets you know if a log file has been deleted or changed, or assert positively that no log files were delivered to your account during a given period of time. CloudTrail log file integrity validation uses industry standard algorithms: SHA-256 for hashing and SHA-256 with RSA for digital signing. This makes it computationally unfeasible to modify, delete or forge CloudTrail log files without detection. For more information, see Enabling validation and validating files (p. 325).

Integrate with Amazon CloudWatch Logs

CloudWatch Logs allows you to monitor and receive alerts for specific events captured by CloudTrail. The events sent to CloudWatch Logs are those configured to be logged by your trail, so make sure you have configured your trail or trails to log the event types (management events and/or data events) that you are interested in monitoring.

For example, you can monitor key security and network-related management events, such as failed AWS Management Console sign-in events (p. 302).

The following are some steps you can take:

• Review example CloudWatch Logs integrations for CloudTrail (p. 300).
• Configure your trail to send events to CloudWatch Logs (p. 294).
• Consider implementing ongoing detective controls to help ensure all trails are sending events to CloudWatch Logs for monitoring by using the cloud-trail-cloud-watch-logs-enabled rule in AWS Config.

Use AWS Security Hub

CloudTrail preventative security best practices

The following best practices for CloudTrail can help prevent security incidents.

**Log to a dedicated and centralized Amazon S3 bucket**

CloudTrail log files are an audit log of actions taken by an IAM identity or an AWS service. The integrity, completeness and availability of these logs is crucial for forensic and auditing purposes. By logging to a dedicated and centralized Amazon S3 bucket, you can enforce strict security controls, access, and segregation of duties.

The following are some steps you can take:

- Create a separate AWS account as a log archive account. If you use AWS Organizations, enroll this account in the organization, and consider [creating an organization trail](p. 135) to log data for all AWS accounts in your organization.
- If you do not use Organizations but want to log data for multiple AWS accounts, [create a trail](p. 85) to log activity in this log archive account. Restrict access to this account to only trusted administrative users who should have access to account and auditing data.
- As part of creating a trail, whether it is an organization trail or a trail for a single AWS account, create a dedicated Amazon S3 bucket to store log files for this trail.
- If you want to log activity for more than one AWS account, [modify the bucket policy](p. 309) to allow logging and storing log files for all AWS accounts that you want to log AWS account activity.
- If you are not using an organization trail, create trails in all of your AWS accounts, specifying the Amazon S3 bucket in the log archive account.

**Use server-side encryption with AWS KMS managed keys**

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. To use SSE-KMS with CloudTrail, you create and manage an [AWS KMS key](p. 404), also known as a KMS key.

---

**Note**

If you use SSE-KMS and log file validation, and you have modified your Amazon S3 bucket policy to only allow SSE-KMS encrypted files, you will not be able to create trails that utilize that bucket unless you modify your bucket policy to specifically allow AES256 encryption, as shown in the following example policy line.

```
"StringNotEquals": { "s3:x-amz-server-side-encryption": ["aws:kms", "AES256"] }
```

The following are some steps you can take:

- Review the advantages of encrypting your log files with SSE-KMS (p. 403).
- Create a KMS key to use for encrypting log files (p. 404).
- Configure log file encryption for your trails. (p. 414)
- Consider implementing ongoing detective controls to help ensure all trails are encrypting log files with SSE-KMS by using the [cloud-trail-encryption-enabled](p. 404) rule in AWS Config.

**Add a condition key to the default Amazon SNS topic policy**

When you configure a trail to send notifications to Amazon SNS, CloudTrail adds a policy statement to your SNS topic access policy that allows CloudTrail to send content to an SNS topic. As a security best
practice, we recommend adding an `aws:SourceArn` (or optionally `aws:SourceAccount`) condition key to the CloudTrail policy statement. This helps prevent unauthorized account access to your SNS topic. For more information, see Amazon SNS topic policy for CloudTrail (p. 387).

**Implement least privilege access to Amazon S3 buckets where you store log files**

CloudTrail trails log events to an Amazon S3 bucket that you specify. These log files contain an audit log of actions taken by IAM identities and AWS services. The integrity and completeness of these log files are crucial for auditing and forensic purposes. In order to help ensure that integrity, you should adhere to the principle of least privilege when creating or modifying access to any Amazon S3 bucket used for storing CloudTrail log files.

Take the following steps:

- Review the [Amazon S3 bucket policy](p. 380) for any and all buckets where you store log files and adjust it if necessary to remove any unnecessary access. This bucket policy will be generated for you if you create a trail using the CloudTrail console, but can also be created and managed manually.
- As a security best practice, be sure to manually add a `aws:SourceArn` condition key to the bucket policy. For more information, see Amazon S3 bucket policy for CloudTrail (p. 380).
- If you are using the same Amazon S3 bucket to store log files for multiple AWS accounts, follow the guidance for receiving log files for multiple accounts (p. 307).
- If you are using an organization trail, make sure you follow the guidance for organization trails (p. 135), and review the example policy for an Amazon S3 bucket for an organization trail in Creating a trail for an organization with the AWS Command Line Interface (p. 145).
- Review the [Amazon S3 security documentation](#) and the example walkthrough for securing a bucket.

**Enable MFA delete on the Amazon S3 bucket where you store log files**

When you configure multi-factor authentication (MFA), attempts to change the versioning state of bucket, or delete an object version in a bucket, require additional authentication. This way, even if a user acquires the password of an IAM user with permissions to permanently delete Amazon S3 objects, you can still prevent operations that could compromise your log files.

The following are some steps you can take:

- Review the [MFA delete](#) guidance in the Amazon Simple Storage Service User Guide.
- [Add an Amazon S3 bucket policy](#) to require MFA.

**Note**

You cannot use MFA delete with lifecycle configurations. For more information about lifecycle configurations and how they interact with other configurations, see Lifecycle and other bucket configurations in the Amazon Simple Storage Service User Guide.

**Configure object lifecycle management on the Amazon S3 bucket where you store log files**

The CloudTrail trail default is to store log files indefinitely in the Amazon S3 bucket configured for the trail. You can use the [Amazon S3 object lifecycle management rules](#) to define your own retention policy to better meet your business and auditing needs. For example, you might want to archive log files that are more than a year old to Amazon Glacier, or delete log files after a certain amount of time has passed.

**Note**

Lifecycle configuration on multi-factor authentication (MFA)-enabled buckets is not supported.

**Limit access to the AWSCloudTrail_FullAccess policy**

Users with the AWSCloudTrail_FullAccess (p. 375) policy have the ability to disable or reconfigure the most sensitive and important auditing functions in their AWS accounts. This policy is not intended to be
shared or applied broadly to IAM identities in your AWS account. Limit application of this policy to as few individuals as possible, those you expect to act as AWS account administrators.

Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS)

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 keys (SSE-KMS) for your CloudTrail log files.

Note

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).

If you are using an existing S3 bucket with an S3 Bucket Key, CloudTrail must be allowed permission in the key policy to use the AWS KMS actions GenerateDataKey and DescribeKey. If cloudtrail.amazonaws.com is not granted those permissions in the key policy, you cannot create or update a trail.

To use SSE-KMS with CloudTrail, you create and manage a KMS key, also known as an AWS KMS key. You attach a policy to the key that determines which users can use the key for encrypting and decrypting CloudTrail log files. The decryption is seamless through S3. When authorized users of the key read CloudTrail log files, S3 manages the decryption, and the authorized users are able to read log files in unencrypted form.

This approach has the following advantages:

• You can create and manage the KMS key encryption keys yourself.
• You can use a single KMS key to encrypt and decrypt log files for multiple accounts across all Regions.
• You have control over who can use your key for encrypting and decrypting CloudTrail log files. You can assign permissions for the key to the users in your organization according to your requirements.
• You have enhanced security. With this feature, to read log files, the following permissions are required:
  • A user must have S3 read permissions for the bucket that contains the log files.
  • A user must also have a policy or role applied that allows decrypt permissions by the KMS key policy.
• Because S3 automatically decrypts the log files for requests from users authorized to use the KMS key, SSE-KMS encryption for CloudTrail log files is backward-compatible with applications that read CloudTrail log data.

Note

The KMS key that you choose must be created in the same AWS Region as the Amazon S3 bucket that receives your log files. For example, if the log files will be stored in a bucket in the US East (Ohio) Region, you must create or choose a KMS key that was created in that Region. To verify the Region for an Amazon S3 bucket, inspect its properties in the Amazon S3 console.

Enabling log file encryption

Note

If you create a KMS key in the CloudTrail console, CloudTrail adds the required KMS key policy sections for you. Follow these procedures if you created a key in the IAM console or AWS CLI and you need to manually add the required policy sections.

To enable SSE-KMS encryption for CloudTrail log files, perform the following high-level steps:

1. Create a KMS key.
Granting permissions to create a KMS key

You can grant users permission to create an AWS KMS key with the AWSKeyManagementServicePowerUser policy.

To grant permission to create a KMS key

1. Open the IAM console at https://console.aws.amazon.com/iam/.
2. Choose the group or user that you want to give permission.
3. Choose Permissions, and then choose Attach Policy.
4. Search for AWSKeyManagementServicePowerUser, choose the policy, and then choose Attach policy.

The user now has permission to create a KMS key. If you want to create custom policies for your users, see Creating Customer Managed Policies in the IAM User Guide.

Configure AWS KMS key policies for CloudTrail

You can create an AWS KMS key in three ways:

CloudTrail also supports AWS KMS multi-Region keys. For more information about multi-Region keys, see Using multi-Region keys in the AWS Key Management Service Developer Guide.

The next section describes the policy sections that your KMS key policy requires for use with CloudTrail.

Granting permissions to create a KMS key

You can grant users permission to create a KMS key with the AWS Management Console, see Creating Keys in the AWS Key Management Service Developer Guide.

For information about creating a KMS key with the AWS CLI, see create-key.

Note
The KMS key that you choose must be in the same Region as the S3 bucket that receives your log files. To verify the Region for an S3 bucket, inspect the bucket's properties in the S3 console.

2. Add policy sections to the key that enable CloudTrail to encrypt and users to decrypt log files.

• For information about what to include in the policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

Warning
Be sure to include decrypt permissions in the policy for all users who need to read log files. If you do not perform this step before adding the key to your trail configuration, users without decrypt permissions cannot read encrypted files until you grant them those permissions.

• For information about editing a policy with the IAM console, see Editing a Key Policy in the AWS Key Management Service Developer Guide.
• For information about attaching a policy to a KMS key with the AWS CLI, see put-key-policy.

3. Update your trail to use the KMS key whose policy you modified for CloudTrail.

• To update your trail configuration by using the CloudTrail console, see Updating a resource to use your KMS key (p. 414).
• To update your trail configuration by using the AWS CLI, see Enabling and disabling CloudTrail log file encryption with the AWS CLI (p. 416).
Configure AWS KMS key policies for CloudTrail

- The CloudTrail console
- The AWS Management console
- The AWS CLI

**Note**
If you create a KMS key in the CloudTrail console, CloudTrail adds the required KMS key policy for you. You do not need to manually add the policy statements. See Default KMS key policy created in CloudTrail console (p. 411).

If you create a KMS key in the AWS Management console or the AWS CLI, you must add policy sections to the key so that you can use it with CloudTrail. The policy must allow CloudTrail to use the key to encrypt your log files and event data stores, and allow the users you specify to read log files in unencrypted form.

See the following resources:
- To create a KMS key with the AWS CLI, see `create-key`.
- To edit a KMS key policy for CloudTrail, see Editing a Key Policy in the AWS Key Management Service Developer Guide.
- For technical details on how CloudTrail uses AWS KMS, see How AWS CloudTrail Uses AWS KMS in the AWS Key Management Service Developer Guide.

**Required KMS key policy sections for use with CloudTrail**

If you created a KMS key with the AWS Management console or the AWS CLI, then you must, at minimum, add the following statements to your KMS key policy for it to work with CloudTrail.

**Topics**
- Required KMS key policy elements for trails (p. 405)
- Required KMS key policy elements for event data stores (p. 406)

**Required KMS key policy elements for trails**

1. Enable CloudTrail log encrypt permissions. See Granting encrypt permissions (p. 406).
2. Enable CloudTrail log decrypt permissions. See Granting decrypt permissions (p. 408). If you are using an existing S3 bucket with an S3 Bucket Key, kms:Decrypt permissions are required to create or update a trail with SSE-KMS encryption enabled.
3. Enable CloudTrail to describe KMS key properties. See Enable CloudTrail to describe KMS key properties (p. 411).

As a security best practice, add an `aws:SourceArn` condition key to the KMS key policy. The IAM global condition key `aws:SourceArn` helps ensure that CloudTrail uses the KMS key only for a specific trail or trails. The value of `aws:SourceArn` is always the trail ARN (or array of trail ARNs) that is using the KMS key. Be sure to add the `aws:SourceArn` condition key to KMS key policies for existing trails.

The `aws:SourceAccount` condition key is also supported, but not recommended. The value of `aws:SourceAccount` is the account ID of the trail owner, or for organization trails, the management account ID.

**Important**
When you add the new sections to your KMS key policy, do not change any existing sections in the policy.
If encryption is enabled on a trail, and the KMS key is disabled, or the KMS key policy is not correctly configured for CloudTrail, CloudTrail cannot deliver logs.
Required KMS key policy elements for event data stores

1. Enable CloudTrail log encrypt permissions. See Granting encrypt permissions (p. 406).
2. Enable CloudTrail log decrypt permissions. See Granting decrypt permissions (p. 408).
3. Grant users and roles permission to encrypt and decrypt event data store data with the KMS key.
   
   When you create an event data store and encrypt it with a KMS key, or run queries on an event data store that you're encrypting with a KMS key, you should have write access to the KMS key. The KMS key policy must have access to CloudTrail, and the KMS key should be manageable by users who run operations (such as queries) on the event data store.
4. Enable CloudTrail to describe KMS key properties. See Enable CloudTrail to describe KMS key properties (p. 411).

The aws:SourceArn and aws:SourceAccount condition keys are not supported in KMS key policies for event data stores.

Important
When you add the new sections to your KMS key policy, do not change any existing sections in the policy.

If encryption is enabled on an event data store, and the KMS key is disabled or deleted, or the KMS key policy is not correctly configured for CloudTrail, CloudTrail cannot deliver events to your event data store.

Granting encrypt permissions

Example Allow CloudTrail to encrypt logs on behalf of specific accounts

CloudTrail needs explicit permission to use the KMS key to encrypt logs on behalf of specific accounts. To specify an account, add the following required statement to your KMS key policy and replace account-id, region, and trailName with the appropriate values for your configuration. You can add additional account IDs to the EncryptionContext section to enable those accounts to use CloudTrail to use your KMS key to encrypt log files.

As a security best practice, add an aws:SourceArn condition key to the KMS key policy for a trail. The IAM global condition key aws:SourceArn helps ensure that CloudTrail uses the KMS key only for a specific trail or trails.

```json
{
   "Sid": "Allow CloudTrail to encrypt logs",
   "Effect": "Allow",
   "Principal": {
      "Service": "cloudtrail.amazonaws.com"
   },
   "Action": "kms:GenerateDataKey*",
   "Resource": "*",
   "Condition": {
      "StringEquals": {
         "aws:SourceArn": "arn:aws:cloudtrail:region:account-id:trail/trail-name"
      },
      "StringLike": {
      }
   }
}
```

A policy for a KMS key used to encrypt CloudTrail Lake event data store logs cannot use the condition keys aws:SourceArn or aws:SourceAccount. The following is an example of a KMS key policy for an event data store.
Configure AWS KMS key policies for CloudTrail

Example

The following example policy statement illustrates how another account can use your KMS key to encrypt CloudTrail logs.

Scenario

- Your KMS key is in account 111111111111.
- Both you and account 222222222222 will encrypt logs.

In the policy, you add one or more accounts that encrypt with your key to the CloudTrail EncryptionContext. This restricts CloudTrail to using your key to encrypt logs only for the accounts that you specify. When you give the root of account 222222222222 permission to encrypt logs, it delegates permission to the account administrator to encrypt the necessary permissions to other users in that account. The account administrator does this by changing the policies associated with those IAM users.

As a security best practice, add an aws:SourceArn condition key to the KMS key policy. The IAM global condition key aws:SourceArn helps ensure that CloudTrail uses the KMS key only for the specified trails. This condition isn't supported in KMS key policies for event data stores.

KMS key policy statement:

```json
{
    "Sid": "Enable CloudTrail encrypt permissions",
    "Effect": "Allow",
    "Principal": {
        "Service": "cloudtrail.amazonaws.com"
    },
    "Action": [
        "kms:GenerateDataKey",
        "kms:Decrypt"
    ],
    "Resource": "*",
    "Condition": {
        "StringLike": {
            "kms:EncryptionContext:aws:cloudtrail:arn": [
                "arn:aws:cloudtrail:*:111111111111:trail/**",
                "arn:aws:cloudtrail:*:222222222222:trail/**
            ]
        },
        "StringEquals": {
            "aws:SourceArn": "arn:aws:cloudtrail:region:account-id:trail/trail-name"
        }
    }
}
```

For more information about editing a KMS key policy for use with CloudTrail, see Editing a key policy in the AWS Key Management Service Developer Guide.
Granting decrypt permissions

Before you add your KMS key to your CloudTrail configuration, it is important to give decrypt permissions to all users who require them. Users who have encrypt permissions but no decrypt permissions cannot read encrypted logs. If you are using an existing S3 bucket with an S3 Bucket Key, kms:Decrypt permissions are required to create or update a trail with SSE-KMS encryption enabled.

Enable CloudTrail log decrypt permissions

Users of your key must be given explicit permissions to read the log files that CloudTrail has encrypted. To enable users to read encrypted logs, add the following required statement to your KMS key policy, modifying the Principal section to add a line for every principal that you want to be able decrypt by using your KMS key.

```json
{
  "Sid": "Enable CloudTrail log decrypt permissions",
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::<account-id>:user/username"
  },
  "Action": "kms:Decrypt",
  "Resource": "*",
  "Condition": {
    "Null": {
      "kms:EncryptionContext:aws:cloudtrail:arn": "false"
    }
  }
}
```

The following is an example policy that is required to allow the CloudTrail service principal to decrypt trail logs.

```json
{
  "Sid": "Allow CloudTrail to decrypt a trail",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "kms:Decrypt",
  "Resource": "*"
}
```

A decrypt policy for a KMS key that is used with a CloudTrail Lake event data store is similar to the following. The user or role ARNs specified as values for Principal need decrypt permissions to create or update event data stores, run queries, or get query results.

```json
{
  "Sid": "Enable user key permissions for event data stores",
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::<account-id>:user/username"
  },
  "Action": [
    "kms:Decrypt",
    "kms:GenerateDataKey"
  ],
  "Resource": "*"
}
```

The following is an example policy that is required to allow the CloudTrail service principal to decrypt event data store logs.

```json
{
  "Sid": "Enable user key permissions for event data stores",
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::<account-id>:user/username"
  },
  "Action": [
    "kms:Decrypt",
    "kms:GenerateDataKey"
  ],
  "Resource": "*"
}
```
{ 
  "Sid": "Allow CloudTrail to decrypt an event data store",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "kms:Decrypt",
  "Resource": "*"
}

Allow users in your account to decrypt trail logs with your KMS key

Example

This policy statement illustrates how to allow a user or role in your account to use your key to read the encrypted logs in your account's S3 bucket.

Example Scenario

- Your KMS key, S3 bucket, and IAM user Bob are in account 111111111111.
- You give IAM user Bob permission to decrypt CloudTrail logs in the S3 bucket.

In the key policy, you enable CloudTrail log decrypt permissions for IAM user Bob.

KMS key policy statement:

{ 
  "Sid": "Enable CloudTrail log decrypt permissions",
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::111111111111:user/Bob"
  },
  "Action": "kms:Decrypt",
  "Resource": "arn:aws:kms:region:account-id:key/key-id",
  "Condition": {
    "Null": {
      "kms:EncryptionContext:aws:cloudtrail:arn": "false"
    }
  }
}

Allow users in other accounts to decrypt trail logs with your KMS key

You can allow users in other accounts to use your KMS key to decrypt trail logs, but not event data store logs. The changes required to your key policy depend on whether the S3 bucket is in your account or in another account.

Allow users of a bucket in a different account to decrypt logs

Example

This policy statement illustrates how to allow an IAM user or role in another account to use your key to read encrypted logs from an S3 bucket in the other account.

Scenario

- Your KMS key is in account 111111111111.
- The IAM user Alice and S3 bucket are in account 222222222222.
In this case, you give CloudTrail permission to decrypt logs under account 222222222222, and you give Alice's IAM user policy permission to use your key KeyA, which is in account 111111111111.

KMS key policy statement:

```json
{
  "Sid": "Enable encrypted CloudTrail log read access",
  "Effect": "Allow",
  "Principal": {
    "AWS": [
      "arn:aws:iam::222222222222:root"
    ],
  },
  "Action": "kms:Decrypt",
  "Resource": "arn:aws:kms:region:account-id:key/key-id",
  "Condition": {
    "Null": {
      "kms:EncryptionContext:aws:cloudtrail:arn": "false"
    }
  }
}
```

Alice's IAM user policy statement:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kms:Decrypt",
      "Resource": "arn:aws:kms:us-west-2:111111111111:key/KeyA"
    }
  ]
}
```

Allow users in a different account to decrypt trail logs from your bucket

**Example**

This policy illustrates how another account can use your key to read encrypted logs from your S3 bucket.

**Example Scenario**

- Your KMS key and S3 bucket are in account 111111111111.
- The user who reads logs from your bucket is in account 222222222222.

To enable this scenario, you enable decrypt permissions for the IAM role CloudTrailReadRole in your account, and then give the other account permission to assume that role.

KMS key policy statement:

```json
{
  "Sid": "Enable encrypted CloudTrail log read access",
  "Effect": "Allow",
  "Principal": {
    "AWS": [
      "arn:aws:iam::11111111111:role/CloudTrailReadRole"
    ],
  },
  "Action": "kms:Decrypt",
  "Condition": {
    "Null": {
      "kms:EncryptionContext:aws:cloudtrail:arn": "false"
    }
  }
}
```
Configure AWS KMS key policies for CloudTrail

```json
"Resource": "arn:aws:kms:region:account-id:key/key-id",
"Condition": {
  "Null": {
    "kms:EncryptionContext:aws:cloudtrail:arn": "false"
  }
}
```

**CloudTrailReadRole** trust entity policy statement:

```json
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "Allow CloudTrail access",
      "Effect": "Allow",
      "Principal": {
        "AWS": "arn:aws:iam::222222222222:root"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

For information about editing a KMS key policy for use with CloudTrail, see Editing a Key Policy in the AWS Key Management Service Developer Guide.

**Enable CloudTrail to describe KMS key properties**

CloudTrail requires the ability to describe the properties of the KMS key. To enable this functionality, add the following required statement as is to your KMS key policy. This statement does not grant CloudTrail any permissions beyond the other permissions that you specify.

As a security best practice, add an `aws:SourceArn` condition key to the KMS key policy. The IAM global condition key `aws:SourceArn` helps ensure that CloudTrail uses the KMS key only for a specific trail or trails.

```json
{
  "Sid": "Allow CloudTrail access",
  "Effect": "Allow",
  "Principal": {
    "Service": "cloudtrail.amazonaws.com"
  },
  "Action": "kms:DescribeKey",
  "Resource": "arn:aws:kms:region:account-id:key/key-id",
  "Condition": {
    "StringEquals": {
      "aws:SourceArn": "arn:aws:cloudtrail:region:account-id:trail/trail-name"
    }
  }
}
```

For more information about editing KMS key policies, see Editing a Key Policy in the AWS Key Management Service Developer Guide.

**Default KMS key policy created in CloudTrail console**

If you create an AWS KMS key in the CloudTrail console, the following policies are automatically created for you. The policy allows these permissions:
Configure AWS KMS key policies for CloudTrail

- Allows AWS account (root) permissions for the KMS key.
- Allows CloudTrail to encrypt log files under the KMS key and describe the KMS key.
- Allows all users in the specified accounts to decrypt log files.
- Allows all users in the specified account to create a KMS alias for the KMS key.
- Enables cross-account log decryption for the account ID of the account that created the trail.

Topics

- Default KMS key policy for CloudTrail Lake event data stores (p. 412)
- Default KMS key policy for trails (p. 412)

Default KMS key policy for CloudTrail Lake event data stores

The following is the default policy created for a AWS KMS key that you use with an event data store in CloudTrail Lake.

```
{
    "Version": "2012-10-17",
    "Id": "Key policy created by CloudTrail",
    "Statement": [
        {
            "Sid": "The key created by CloudTrail to encrypt event data stores. Created ${new Date().toUTCString()}",
            "Effect": "Allow",
            "Principal": { "Service": "cloudtrail.amazonaws.com" },
            "Action": [ "kms:GenerateDataKey", "kms:Decrypt" ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM user permissions",
            "Effect": "Allow",
            "Principal": { "AWS": "arn:aws:iam::account-id:root" },
            "Action": [ "kms:*" ],
            "Resource": "*"
        },
        {
            "Sid": "Enable user to have permissions",
            "Effect": "Allow",
            "Principal": { "AWS": "arn:aws:sts::account-id:role-arn" },
            "Action": [ "kms:Decrypt", "kms:GenerateDataKey" ],
            "Resource": "*"
        }
    ]
}
```

Default KMS key policy for trails

The following is the default policy created for a AWS KMS key that you use with a trail.
Note
The policy includes a statement to allow cross accounts to decrypt log files with the KMS key.

```
{
    "Version": "2012-10-17",
    "Id": "Key policy created by CloudTrail",
    "Statement": [
        {
            "Sid": "Enable IAM user permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": [
                    "arn:aws:iam::account-id:root",
                    "arn:aws:iam::account-id:user/username"
                ]
            },
            "Action": "kms:*",
            "Resource": "*"
        },
        {
            "Sid": "Allow CloudTrail to encrypt logs",
            "Effect": "Allow",
            "Principal": {
                "Service": "cloudtrail.amazonaws.com"
            },
            "Action": "kms:GenerateDataKey*",
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:SourceArn": "arn:aws:cloudtrail:region:account-id:trail/trail-name"
                },
                "StringLike": {
                    "account-id:trail/*"
                }
            }
        },
        {
            "Sid": "Allow CloudTrail to describe key",
            "Effect": "Allow",
            "Principal": {
                "Service": "cloudtrail.amazonaws.com"
            },
            "Action": "kms:DescribeKey",
            "Resource": "*"
        },
        {
            "Sid": "Allow principals in the account to decrypt log files",
            "Effect": "Allow",
            "Principal": {
                "AWS": "*"
            },
            "Action": [
                "kms:Decrypt",
                "kms:ReEncryptFrom"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "kms:CallerAccount": "account-id"
                }
            },
            "StringLike": {
            }
        }
    ]
}
```
AWS CloudTrail User Guide
Updating a resource to use your KMS key

In the AWS CloudTrail console, update a trail or an event data store to use an AWS Key Management Service key. Be aware that using your own KMS key incurs AWS KMS costs for encryption and decryption. For more information, see AWS Key Management Service Pricing.

Topics
- Update a trail to use a KMS key (p. 414)
- Update an event data store to use a KMS key (p. 416)

Update a trail to use a KMS key

To update a trail to use the AWS KMS key that you modified for CloudTrail, complete the following steps in the CloudTrail console.

Note
Updating a trail with the following procedure encrypts the log files but not the digest files with SSE-KMS. Digest files are encrypted with Amazon S3-managed encryption keys (SSE-S3).
If you are using an existing S3 bucket with an S3 Bucket Key, CloudTrail must be allowed permission in the key policy to use the AWS KMS actions GenerateDataKey and DescribeKey. If cloudtrail.amazonaws.com is not granted those permissions in the key policy, you cannot create or update a trail.

To update a trail using the AWS CLI, see Enabling and disabling CloudTrail log file encryption with the AWS CLI (p. 416).

To update a trail to use your KMS key

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. Choose Trails and then choose a trail name.
3. In General details, choose Edit.
4. For Log file SSE-KMS encryption, choose Enabled if you want to encrypt your log files using SSE-KMS encryption instead of SSE-S3 encryption. The default is Enabled. If you don't enable SSE-KMS encryption, your logs are encrypted using SSE-S3 encryption. For more information about SSE-KMS encryption, see Using server-side encryption with AWS Key Management Service (SSE-KMS). For more information about SSE-S3 encryption, see Using Server-Side Encryption with Amazon S3-Managed Encryption Keys (SSE-S3).

Choose Existing to update your trail with your AWS KMS key. Choose a KMS key that is in the same Region as the S3 bucket that receives your log files. To verify the Region for an S3 bucket, view its properties in the S3 console.

Note
You can also type the ARN of a key from another account. For more information, see Updating a resource to use your KMS key (p. 414). The key policy must allow CloudTrail to use the key to encrypt your log files, and allow the users you specify to read log files in unencrypted form. For information about manually editing the key policy, see Configure AWS KMS key policies for CloudTrail (p. 404).

In AWS KMS Alias, specify the alias for which you changed the policy for use with CloudTrail, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414).

You can type the alias name, ARN, or the globally unique key ID. If the KMS key belongs to another account, verify that the key policy has permissions that enable you to use it. The value can be one of the following formats:

- **Alias Name**: alias/MyAliasName
- **Alias ARN**: arn:aws:kms:region:123456789012:alias/MyAliasName
- **Key ARN**: arn:aws:kms:region:123456789012:key/12345678-1234-1234-1234-123456789012
- **Globally unique key ID**: 12345678-1234-1234-1234-123456789012

5. Choose Update trail.

Note
If the KMS key that you chose is disabled or is pending deletion, you cannot save the trail with that KMS key. You can enable the KMS key or choose another one. For more information, see Key state: Effect on your KMS key in the AWS Key Management Service Developer Guide.
Update an event data store to use a KMS key

To update an event data store to use the AWS KMS key that you modified for CloudTrail, complete the following steps in the CloudTrail console.

To update an event data store by using the AWS CLI, see Update an event data store (p. 232).

Important
Disabling or deleting the KMS key, or removing CloudTrail permissions on the key, prevents CloudTrail from ingesting events into the event data store, and prevents users from querying data in the event data store that was encrypted with the key. After you associate an event data store with a KMS key, the KMS key cannot be removed or changed. Before you disable or delete a KMS key that you are using with an event data store, delete or back up your event data store.

To update an event data store to use your KMS key

1. Sign in to the AWS Management Console and open the CloudTrail console at https://console.aws.amazon.com/cloudtrail/.
2. In the navigation pane, choose Event data stores in Lake. Choose an event data store to update.
3. In General details, choose Edit.
4. For Encryption, if it is not already enabled, choose Use my own AWS KMS key to encrypt your log files with your own KMS key.
   Choose Existing to update your event data store with your KMS key. Choose a KMS key that is in the same Region as the event data store. A key from another account is not supported.
   In Enter AWS KMSAlias, specify the alias for which you changed the policy for use with CloudTrail, in the format alias/MyAliasName. For more information, see Updating a resource to use your KMS key (p. 414).
   You can choose an alias, or use the globally unique key ID. The value can be one of the following formats:
   • Alias Name: alias/MyAliasName
   • Alias ARN: arn:aws:kms:region:123456789012:alias/MyAliasName
   • Key ARN: arn:aws:kms:region:123456789012:key/12345678-1234-1234-1234-123456789012
   • Globally unique key ID: 12345678-1234-1234-1234-123456789012
5. Choose Save changes.
   Note
   If the KMS key that you chose is disabled or is pending deletion, you cannot save the event data store configuration with that KMS key. You can enable the KMS key, or choose a different key. For more information, see Key state: Effect on your KMS key in the AWS Key Management Service Developer Guide.

Enabling and disabling CloudTrail log file encryption with the AWS CLI

This topic describes how to enable and disable SSE-KMS log file encryption for CloudTrail by using the AWS CLI. For background information, see Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403).

Topics
Enabling CloudTrail log file encryption by using the AWS CLI (p. 417)
Disabling CloudTrail log file encryption by using the AWS CLI (p. 419)

Enabling CloudTrail log file encryption by using the AWS CLI

- Enable log file encryption for a trail (p. 417)
- Enable log file encryption for an event data store (p. 417)

Enable log file encryption for a trail

1. Create a key with the AWS CLI. The key that you create must be in the same Region as the S3 bucket that receives your CloudTrail log files. For this step, you use the AWS KMS create-key command.
2. Get the existing key policy so that you can modify it for use with CloudTrail. You can retrieve the key policy with the AWS KMS get-key-policy command.
3. Add required sections to the key policy so that CloudTrail can encrypt and users can decrypt your log files. Be sure that all users who read the log files are granted decrypt permissions. Do not change existing sections of the policy. For information about the policy sections to include, see Configure AWS KMS key policies for CloudTrail (p. 404).
4. Attach the modified JSON policy file to the key by using the AWS KMS put-key-policy command.
5. Run the CloudTrail create-trail or update-trail command with the --kms-key-id parameter. This command enables log encryption.

```bash
aws cloudtrail update-trail --name Default --kms-key-id alias/MyKmsKey
```

The --kms-key-id parameter specifies the key whose policy you modified for CloudTrail. It can be any one of the following formats:

- **Alias Name.** Example: alias/MyAliasName
- **Alias ARN.** Example: arn:aws:kms:us-east-2:123456789012:alias/MyAliasName
- **Key ARN.** Example: arn:aws:kms:us-east-2:123456789012:key/12345678-1234-1234-1234-123456789012
- **Globally unique key ID.** Example: 12345678-1234-1234-1234-123456789012

The following is an example response:

```json
{
    "IncludeGlobalServiceEvents": true,
    "Name": "Default",
    "LogFileValidationEnabled": false,
    "KmsKeyId": "arn:aws:kms:us-east-2:123456789012:key/12345678-1234-1234-1234-123456789012",
    "S3BucketName": "my-bucket-name"
}
```

The presence of the KmsKeyId element indicates that log file encryption has been enabled. The encrypted log files should appear in your bucket in about 5 minutes.
Enable log file encryption for an event data store

1. Create a key with the AWS CLI. The key that you create must be in the same Region as the event data store. For this step, run the AWS KMS `create-key` command.
2. Get the existing key policy to edit for use with CloudTrail. You can get the key policy by running the AWS KMS `get-key-policy` command.
3. Add required sections to the key policy so that CloudTrail can encrypt and users can decrypt your log files. Be sure that all users who read the log files are granted decrypt permissions. Do not change existing sections of the policy. For information about the policy sections to include, see Configure AWS KMS key policies for CloudTrail (p. 404).
4. Attach the edited JSON policy file to the key by running the AWS KMS `put-key-policy` command.
5. Run the CloudTrail `create-event-data-store` or `update-event-data-store` command, and add the `--kms-key-id` parameter. This command enables log encryption.

```
aws cloudtrail update-event-data-store --name my-event-data-store --kms-key-id alias/MyKmsKey
```

The `--kms-key-id` parameter specifies the key whose policy you modified for CloudTrail. It can be any one of the following four formats:

- **Alias Name.** Example: `alias/MyAliasName`
- **Alias ARN.** Example: `arn:aws:kms:us-east-2:123456789012:alias/MyAliasName`
- **Key ARN.** Example: `arn:aws:kms:us-east-1:123456789012:key/12345678-1234-1234-1234-123456789012`
- **Globally unique key ID.** Example: `12345678-1234-1234-1234-123456789012`

The following is an example response:

```
{
   "Name": "my-event-data-store",
   "ARN": "arn:aws:cloudtrail:us-east-1:12345678910:eventdatastore/EXAMPLEf852-4e8f-8bd1-bcf6cEXAMPLE",
   "RetentionPeriod": "90",
   "KmsKeyId": "arn:aws:kms:us-east-1:123456789012:key/12345678-1234-1234-1234-123456789012",
   "MultiRegionEnabled": false,
   "OrganizationEnabled": false,
   "TerminationProtectionEnabled": true,
   "AdvancedEventSelectors": [{
      "Name": "Select all external events",
      "FieldSelectors": [{
         "Field": "eventCategory",
         "Equals": [
            "ActivityAuditLog"
         ]
      ]
   }]
}
```

The presence of the `KmsKeyId` element indicates that log file encryption has been enabled. The encrypted log files should appear in your event data store in about 5 minutes.
Disabling CloudTrail log file encryption by using the AWS CLI

To stop encrypting logs on a trail, run `update-trail` and pass an empty string to the `kms-key-id` parameter:

```
aws cloudtrail update-trail --name my-test-trail --kms-key-id ""
```

The following is an example response:

```
{
   "IncludeGlobalServiceEvents": true,
   "Name": "Default",
   "LogFileValidationEnabled": false,
   "S3BucketName": "my-bucket-name"
}
```

The absence of the `KmsKeyId` value indicates that log file encryption is no longer enabled.

**Important**

You cannot stop log file encryption on an event data store.
CloudTrail log event reference

A CloudTrail log is a record in JSON format. The log contains information about requests for resources in your account, such as who made the request, the services used, the actions performed, and parameters for the action. The event data is enclosed in a Records array.

The following example shows a single log record of an event. In this event, an IAM user named Mary_Major called the CloudTrail StartLogging API from the CloudTrail console to start the logging process.

```
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "AIDAJDPLRKLG7UEXAMPLE",
    "arn": "arn:aws:iam::123456789012:user/Mary_Major",
    "accountId": "123456789012",
    "accessKeyId": "AKIAIOSFODNN7EXAMPLE",
    "userName": "Mary_Major",
    "sessionContext": {
      "sessionIssuer": {},
      "webIdFederationData": {},
      "attributes": {
        "mfaAuthenticated": "false",
        "creationDate": "2019-06-18T22:28:31Z"
      }
    },
    "invokedBy": "signin.amazonaws.com"
  },
  "eventTime": "2019-06-19T00:18:31Z",
  "eventSource": "cloudtrail.amazonaws.com",
  "eventName": "StartLogging",
  "awsRegion": "us-east-2",
  "sourceIPAddress": "203.0.113.64",
  "userAgent": "signin.amazonaws.com",
  "requestParameters": {
    "name": "arn:aws:cloudtrail:us-east-2:123456789012:trail/My-First-Trail"
  },
  "responseElements": null,
  "requestID": "ddf5140f-EXAMPLE",
  "eventID": "abcd00b0-ccfe-422d-961c-98a2198a408x",
  "readOnly": false,
  "eventType": "AwsApiCall",
  "recipientAccountId": "123456789012"
}
```

There are two events logged to show unusual activity in CloudTrail Insights: a start event and an end event. The following example shows a single log record of a starting Insights event that occurred when the Application Auto Scaling API CompleteLifecycleAction was called an unusual number of times. For Insights events, the value of eventCategory is Insight. An insightDetails block identifies the event state, source, name, Insights type, and context, including statistics and attributions. For more information about the insightDetails block, see CloudTrail Insights insightDetails element (p. 444).

```
{
  "eventVersion": "1.07",
  "eventTime": "2020-07-21T20:56:00Z",
  "awsRegion": "us-east-1",
  "eventID": "abcd00b0-ccfe-422d-961c-98a2198a408x",
  "errorType": "CustomErrorType",
  "insightDetails": {
    "state": "Starting",
    "source": "ApplicationAutoScaling",
    "name": "CompleteLifecycleAction",
    "insightType": "Insight",
    "context": {
      "attributes": {
        "eventCategory": "Insight",
        "eventType": "Insight",
        "requestParameters": {
          "name": "arn:aws:cloudtrail:us-east-2:123456789012:trail/My-First-Trail"
        },
        "responseElements": null,
        "requestID": "ddf5140f-EXAMPLE",
        "eventID": "abcd00b0-ccfe-422d-961c-98a2198a408x",
        "readOnly": false,
        "eventType": "AwsApiCall",
        "recipientAccountId": "123456789012"
      }
    }
  }
}
```
"eventType": "AwsCloudTrailInsight",
"recipientAccountId": "838185438692",
"sharedEventID": "7bb000gg-22b3-4c03-94af-c74tj0cBm7c0",
"insightDetails": {
  "state": "Start",
  "eventSource": "autoscaling.amazonaws.com",
  "eventName": "CompleteLifecycleAction",
  "insightType": "ApiCallRateInsight",
  "insightContext": {
    "statistics": {
      "baseline": {
        "average": 0.0000882145
      },
      "insight": {
        "average": 0.6
      },
      "insightDuration": 5,
      "baselineDuration": 11336
    },
    "attributions": [
      {
        "attribute": "userIdentityArn",
        "insight": [{
          "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
          "average": 0.2
        }]
      },
      {
        "attribute": "userIdentityArn",
        "insight": [{
          "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole2",
          "average": 0.2
        }]
      },
      {
        "attribute": "userIdentityArn",
        "insight": [{
          "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole3",
          "average": 0.2
        }]
      },
      {
        "attribute": "userAgent",
        "insight": [{
          "value": "codedeploy.amazonaws.com",
          "average": 0.6
        }]
      }
    ]
  }
},
"attributions": []}
The following topics list the data fields that CloudTrail captures for each AWS API call and sign-in event.

**Topics**
- [CloudTrail record contents](#)
- [CloudTrail userIdentity element](#)
- [CloudTrail Insights insightDetails element](#)
- [Non-API events captured by CloudTrail](#)

**CloudTrail record contents**

The body of the record contains fields that help you determine the requested action as well as when and where the request was made. When the value of **Optional** is **True**, the field is only present when it applies to the service, API, or event type. An **Optional** value of **False** means that the field is either always present, or that its presence does not depend on the service, API, or event type. An example is `responseElements`, which is present in events for actions that make changes (create, update, or delete actions).

**eventTime**

The date and time the request was completed, in coordinated universal time (UTC). An event's time stamp comes from the local host that provides the service API endpoint on which the API call was made. For example, a `CreateBucket` API event that is run in the US West (Oregon) Region would get its time stamp from the time on an AWS host running the Amazon S3 endpoint, s3.us-west-2.amazonaws.com. In general, AWS services use Network Time Protocol (NTP) to synchronize their system clocks.

**Since**: 1.0

**Optional**: False

**eventVersion**

The version of the log event format. The current version is 1.09.

The `eventVersion` value is a major and minor version in the form `major_version.minor_version`. For example, you can have an `eventVersion` value of 1.08, where 1 is the major version, and 08 is the minor version.

CloudTrail increments the major version if a change is made to the event structure that is not backward-compatible. This includes removing a JSON field that already exists, or changing how the contents of a field are represented (for example, a date format). CloudTrail increments the minor version if a change adds new fields to the event structure. This can occur if new information is available for some or all existing events, or if new information is available only for new event types. Applications can ignore new fields to stay compatible with new minor versions of the event structure.
If CloudTrail introduces new event types, but the structure of the event is otherwise unchanged, the event version does not change.

To be sure that your applications can parse the event structure, we recommend that you perform an equal-to comparison on the major version number. To be sure that fields that are expected by your application exist, we also recommend performing a greater-than-or-equal-to comparison on the minor version. There are no leading zeroes in the minor version. You can interpret both major_version and minor_version as numbers, and perform comparison operations.

Since: 1.0
Optional: False

**userIdentity**

Information about the IAM identity that made a request. For more information, see CloudTrail userIdentity element (p. 436).

Since: 1.0
Optional: False

**eventSource**

The service that the request was made to. This name is typically a short form of the service name without spaces plus .amazonaws.com. For example:

- AWS CloudFormation is cloudformation.amazonaws.com.
- Amazon EC2 is ec2.amazonaws.com.
- Amazon Simple Workflow Service is swf.amazonaws.com.

This convention has some exceptions. For example, the eventSource for Amazon CloudWatch is monitoring.amazonaws.com.

Since: 1.0
Optional: False

**eventName**

The requested action, which is one of the actions in the API for that service.

Since: 1.0
Optional: False

**awsRegion**

The AWS Region that the request was made to, such as us-east-2. See CloudTrail supported Regions (p. 19).

Since: 1.0
Optional: False

**sourceIPAddress**

The IP address that the request was made from. For actions that originate from the service console, the address reported is for the underlying customer resource, not the console web server. For services in AWS, only the DNS name is displayed.
Since: 1.0

Optional: False

Note
For events originated by AWS, this field is usually AWS Internal/#, where # is a number used for internal purposes.

userAgent

The agent through which the request was made, such as the AWS Management Console, an AWS service, the AWS SDKs or the AWS CLI. This field has a maximum size of 1 KB; content exceeding that limit is truncated. The following are example values:

- signin.amazonaws.com – The request was made by an IAM user with the AWS Management Console.
- console.amazonaws.com – The request was made by a root user with the AWS Management Console.
- lambda.amazonaws.com – The request was made with AWS Lambda.
- aws-sdk-java – The request was made with the AWS SDK for Java.
- aws-sdk-ruby – The request was made with the AWS SDK for Ruby.
- aws-cli/1.3.23 Python/2.7.6 Linux/2.6.18-164.el5 – The request was made with the AWS CLI installed on Linux.

Note
For events originated by AWS, this field is usually AWS Internal/#, where # is a number used for internal purposes.

Since: 1.0

Optional: True

errorCode

The AWS service error if the request returns an error. For an example that shows this field, see Error code and message log example (p. 26). This field has a maximum size of 1 KB; content exceeding that limit is truncated.

Since: 1.0

Optional: True

errorMessage

If the request returns an error, the description of the error. This message includes messages for authorization failures. CloudTrail captures the message logged by the service in its exception handling. For an example, see Error code and message log example (p. 26). This field has a maximum size of 1 KB; content exceeding that limit is truncated.

Note
Some AWS services provide the errorCode and errorMessage as top-level fields in the event. Other AWS services provide error information as part of responseElements.

Since: 1.0

Optional: True
**requestParameters**

The parameters, if any, that were sent with the request. These parameters are documented in the API reference documentation for the appropriate AWS service. This field has a maximum size of 100 KB; content exceeding that limit is truncated.

Since: 1.0  
Optional: False

**responseElements**

The response element for actions that make changes (create, update, or delete actions). If an action does not change state (for example, a request to get or list objects), this element is omitted. These actions are documented in the API reference documentation for the appropriate AWS service. This field has a maximum size of 100 KB; content exceeding that limit is truncated.

The responseElements value is useful to help you trace a request with AWS Support. Both x-amz-request-id and x-amz-id-2 contain information that helps you trace a request with AWS Support. These values are the same as those that the service returns in the response to the request that initiates the events, so you can use them to match the event to the request.

Since: 1.0  
Optional: False

**additionalEventData**

Additional data about the event that was not part of the request or response. This field has a maximum size of 28 KB; content exceeding that limit is truncated.

Support for this field begins with eventVersion 1.00.

Since: 1.0  
Optional: True

**requestID**

The value that identifies the request. The service being called generates this value. This field has a maximum size of 1 KB; content exceeding that limit is truncated.

Support for this field begins with eventVersion 1.01.

Since: 1.01  
Optional: False

**eventID**

GUID generated by CloudTrail to uniquely identify each event. You can use this value to identify a single event. For example, you can use the ID as a primary key to retrieve log data from a searchable database.

Since: 1.01  
Optional: False
**eventType**

Identifies the type of event that generated the event record. This can be one of the following values:

- **AwsApiCall** – An API was called.
- **AwsServiceEvent** *(p. 450)* – The service generated an event related to your trail. For example, this can occur when another account made a call with a resource that you own.
- **AwsConsoleAction** – An action was taken in the console that was not an API call.
- **AwsConsoleSignIn** *(p. 451)* – A user in your account (root, IAM, federated, SAML, or SwitchRole) signed in to the AWS Management Console.
- **AwsCloudTrailInsight** *(p. 285)* – If Insights events are enabled for the trail, CloudTrail generates Insights events when CloudTrail detects unusual operational activity such as spikes in resource provisioning or bursts of AWS Identity and Access Management (IAM) actions.

**AwsCloudTrailInsight** events do not use the following fields:

- eventName
- eventSource
- sourceIPAddress
- userAgent
- userIdentity

**Since:** 1.02

**Optional:** False

**apiVersion**

Identifies the API version associated with the **AwsApiCall** eventType value.

**Since:** 1.01

**Optional:** True

**managementEvent**

A Boolean value that identifies whether the event is a management event. **managementEvent** is shown in an event record if eventVersion is 1.06 or higher, and the event type is one of the following:

- **AwsApiCall**
- **AwsConsoleAction**
- **AwsConsoleSignIn**
- **AwsServiceEvent**

**Since:** 1.06

**Optional:** True

**readOnly**

Identifies whether this operation is a read-only operation. This can be one of the following values:

- **true** – The operation is read-only (for example, DescribeTrails).
- **false** – The operation is write-only (for example, DeleteTrail).
**resources**

A list of resources accessed in the event. The field can contain the following information:

- Resource ARNs
- Account ID of the resource owner
- Resource type identifier in the format: `AWS::aws-service-name::data-type-name`

For example, when an `AssumeRole` event is logged, the `resources` field can appear like the following:

- ARN: `arn:aws:iam::123456789012:role/myRole`
- Account ID: `123456789012`
- Resource type identifier: `AWS::IAM::Role`

For example logs with the `resources` field, see [AWS STS API Event in CloudTrail Log File](#) in the [IAM User Guide](#) or [Logging AWS KMS API Calls](#) in the [AWS Key Management Service Developer Guide](#).

**recipientAccountId**

Represents the account ID that received this event. The `recipientAccountId` may be different from the `CloudTrail userIdentity element` (p. 436) `accountId`. This can occur in cross-account resource access. For example, if a KMS key, also known as an `AWS KMS key`, was used by a separate account to call the `Encrypt API`, the `accountId` and `recipientAccountId` values will be the same for the event delivered to the account that made the call, but the values will be different for the event that is delivered to the account that owns the KMS key.

**serviceEventDetails**

Identifies the service event, including what triggered the event and the result. For more information, see [AWS service events](#). This field has a maximum size of 100 KB; content exceeding that limit is truncated.

**sharedEventID**

GUID generated by CloudTrail to uniquely identify CloudTrail events from the same AWS action that is sent to different AWS accounts.

For example, when an account uses an `AWS KMS key` that belongs to another account, the account that used the KMS key and the account that owns the KMS key receive separate CloudTrail events for the same action. Each CloudTrail event delivered for this AWS action shares the same `sharedEventID`, but also has a unique `eventID` and `recipientAccountId`. 
For more information, see Example sharedEventID (p. 430).

**Note**
The sharedEventID field is present only when CloudTrail events are delivered to multiple accounts. If the caller and owner are the same AWS account, CloudTrail sends only one event, and the sharedEventID field is not present.

**Since:** 1.03

**Optional:** True

**vpcEndpointId**
Identifies the VPC endpoint in which requests were made from a VPC to another AWS service, such as Amazon S3.

**Since:** 1.04

**Optional:** True

**eventCategory**
Shows the event category that is used in LookupEvents calls.
- For management events, the value is Management.
- For data events, the value is Data.
- For Insights events, the value is Insight.

**Since:** 1.07

**Optional:** False

**addendum**
If an event delivery was delayed, or additional information about an existing event becomes available after the event is logged, an addendum field shows information about why the event was delayed. If information was missing from an existing event, the addendum field includes the missing information and a reason for why it was missing. Contents include the following.
- **reason** - The reason that the event or some of its contents were missing. Values can be any of the following.
  - DELIVERY_DELAY – There was a delay delivering events. This could be caused by high network traffic, connectivity issues, or a CloudTrail service issue.
  - UPDATED_DATA – A field in the event record was missing or had an incorrect value.
  - SERVICE_OUTAGE – A service that logs events to CloudTrail had an outage, and couldn't log events to CloudTrail. This is exceptionally rare.
- **updatedFields** - The event record fields that are updated by the addendum. This is only provided if the reason is UPDATED_DATA.
- **originalRequestId** - The original unique ID of the request. This is only provided if the reason is UPDATED_DATA.
- **originalEventId** - The original event ID. This is only provided if the reason is UPDATED_DATA.

**Since:** 1.08

**Optional:** True

**sessionCredentialFromConsole**
Shows whether or not an event originated from an AWS Management Console session. This field is not shown unless the value is true, meaning that the client that was used to make the API call was either a proxy or an external client. If a proxy client was used, the tlsDetails event field is not shown.
Record fields for Insights events

The following are attributes shown in the JSON structure of an Insights event that differ from those in a management or data event.

**sharedEventId**

A `sharedEventId` for CloudTrail Insights events differs from the `sharedEventId` for the management and data types of CloudTrail events. In Insights events, a `sharedEventId` is a GUID that is generated by CloudTrail Insights to uniquely identify an Insights event. `sharedEventId` is common between the start and the end Insights events, and helps to connect both events to uniquely identify unusual activity. You can think of the `sharedEventId` as the overall Insights event ID.

**Optional**: False

**insightDetails**

Insights events only. Shows information about the underlying triggers of an Insights event, such as event source, user agent, statistics, API name, and whether the event is the start or end of the Insights event. For more information about the contents of the `insightDetails` block, see [CloudTrail Insights insightDetails element](p. 444).
Example sharedEventID

The following is an example that describes how CloudTrail delivers two events for the same action:

1. Alice has AWS account (111111111111) and creates an AWS KMS key. She is the owner of this KMS key.
2. Bob has AWS account (222222222222). Alice gives Bob permission to use the KMS key.
3. Each account has a trail and a separate bucket.
4. Bob uses the KMS key to call the Encrypt API.
5. CloudTrail sends two separate events.
   - One event is sent to Bob. The event shows that he used the KMS key.
   - One event is sent to Alice. The event shows that Bob used the KMS key.
   - The events have the same sharedEventID, but the eventID and recipientAccountID are unique.

Shared event IDs in CloudTrail Insights

A sharedEventID for CloudTrail Insights events differs from the sharedEventID for the management and data types of CloudTrail events. In Insights events, a sharedEventID is a GUID that is generated.
by CloudTrail Insights to uniquely identify a start and end pair of Insights events. `sharedEventID` is common between the start and the end Insights event, and helps to create a correlation between both events to uniquely identify unusual activity.

You can think of the `sharedEventID` as the overall Insights event ID.

**Services that support TLS details in CloudTrail**

Starting on June 28, 2023, AWS requires the Transport Layer Security (TLS) configuration for all AWS service API endpoints to have a minimum version of TLS 1.2. For more information, see the blog post, [TLS 1.2 to become the minimum TLS protocol level for all AWS API endpoints](https://aws.amazon.com/blogs/security/tls-1-2-to-become-the-minimum-tls-protocol-level-for-all-aws-api-endpoints/). The `tlsDetails` structure in each CloudTrail record contains the TLS version, cipher suite, and the client-provided host name used in the service API call, which is typically the fully qualified domain name (FQDN) of the service endpoint. You can then use the data in the records to help you pinpoint your client software that is using an older TLS version, and update it accordingly. Nearly half of AWS services currently provide the TLS information in the CloudTrail `tlsDetails` field. The following table shows AWS services that display TLS information in CloudTrail records.

<table>
<thead>
<tr>
<th>Services that support TLS details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexa for Business</td>
</tr>
<tr>
<td>AWS Activate</td>
</tr>
<tr>
<td>AWS AppConfig</td>
</tr>
<tr>
<td>AWS App Mesh</td>
</tr>
<tr>
<td>AWS App Runner</td>
</tr>
<tr>
<td>Amazon AppStream 2.0</td>
</tr>
<tr>
<td>AWS Auto Scaling</td>
</tr>
<tr>
<td>AWS Backup</td>
</tr>
<tr>
<td>AWS Backup Gateway</td>
</tr>
<tr>
<td>AWS Billing</td>
</tr>
<tr>
<td>AWS Certificate Manager</td>
</tr>
<tr>
<td>AWS Cloud9</td>
</tr>
<tr>
<td>Amazon Cloud Directory</td>
</tr>
<tr>
<td>AWS CloudFormation</td>
</tr>
<tr>
<td>Amazon CloudFront</td>
</tr>
<tr>
<td>AWS Cloud Map</td>
</tr>
<tr>
<td>Amazon CloudSearch</td>
</tr>
<tr>
<td>AWS CloudTrail</td>
</tr>
<tr>
<td>Amazon CloudWatch</td>
</tr>
<tr>
<td>Amazon CloudWatch Application Insights</td>
</tr>
<tr>
<td>Amazon CloudWatch Events</td>
</tr>
</tbody>
</table>
## Services that support TLS details

<table>
<thead>
<tr>
<th>Service Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon CloudWatch Logs</td>
</tr>
<tr>
<td>AWS CodeArtifact</td>
</tr>
<tr>
<td>AWS CodeBuild</td>
</tr>
<tr>
<td>AWS CodeCommit</td>
</tr>
<tr>
<td>AWS CodeDeploy</td>
</tr>
<tr>
<td>AWS CodePipeline</td>
</tr>
<tr>
<td>AWS CodeStar</td>
</tr>
<tr>
<td>AWS CodeStar Connections</td>
</tr>
<tr>
<td>Amazon Comprehend</td>
</tr>
<tr>
<td>Amazon Comprehend Medical</td>
</tr>
<tr>
<td>AWS Compute Optimizer</td>
</tr>
<tr>
<td>Amazon Connect Voice ID</td>
</tr>
<tr>
<td>AWS Control Tower</td>
</tr>
<tr>
<td>AWS Cost and Usage Report</td>
</tr>
<tr>
<td>AWS Cost Explorer</td>
</tr>
<tr>
<td>AWS Database Migration Service (DMS)</td>
</tr>
<tr>
<td>AWS Data Pipeline</td>
</tr>
<tr>
<td>AWS DataSync</td>
</tr>
<tr>
<td>AWS DeepRacer</td>
</tr>
<tr>
<td>AWS Device Farm</td>
</tr>
<tr>
<td>AWS Diode</td>
</tr>
<tr>
<td>AWS Direct Connect</td>
</tr>
<tr>
<td>AWS Directory Service</td>
</tr>
<tr>
<td>Amazon DynamoDB</td>
</tr>
<tr>
<td>Amazon DynamoDB Accelerator (DAX)</td>
</tr>
<tr>
<td>Amazon Elastic Block Store (EBS)</td>
</tr>
<tr>
<td>Amazon Elastic Compute Cloud (EC2)</td>
</tr>
<tr>
<td>Amazon EC2 Instance Connect</td>
</tr>
<tr>
<td>Amazon Elastic Container Registry (ECR)</td>
</tr>
<tr>
<td>Amazon Elastic Container Registry (ECR) Public</td>
</tr>
<tr>
<td>Amazon Elastic Container Service (ECS)</td>
</tr>
</tbody>
</table>
### Services that support TLS details

<table>
<thead>
<tr>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon ElastiCache</td>
</tr>
<tr>
<td>Amazon Elastic File System (EFS)</td>
</tr>
<tr>
<td>Amazon Elastic Transcoder</td>
</tr>
<tr>
<td>AWS Elastic Load Balancing (ELB)</td>
</tr>
<tr>
<td>AWS Elastic Load Balancing (ELBV2)</td>
</tr>
<tr>
<td>AWS Elemental MediaStore</td>
</tr>
<tr>
<td>Amazon EMR</td>
</tr>
<tr>
<td>Amazon EventBridge</td>
</tr>
<tr>
<td>AWS Firewall Manager</td>
</tr>
<tr>
<td>Amazon Forecast</td>
</tr>
<tr>
<td>Amazon Fraud Detector</td>
</tr>
<tr>
<td>Amazon FSx</td>
</tr>
<tr>
<td>Amazon GameLift</td>
</tr>
<tr>
<td>AWS Global Accelerator</td>
</tr>
<tr>
<td>AWS Glue (Lake Formation)</td>
</tr>
<tr>
<td>Amazon HealthLake</td>
</tr>
<tr>
<td>AWS Identity and Access Management (IAM)</td>
</tr>
<tr>
<td>AWS Identity Store</td>
</tr>
<tr>
<td>Amazon Inspector</td>
</tr>
<tr>
<td>AWS IoT Analytics</td>
</tr>
<tr>
<td>AWS IoT Core</td>
</tr>
<tr>
<td>AWS IoT Events</td>
</tr>
<tr>
<td>AWS IoT Secure Tunneling</td>
</tr>
<tr>
<td>AWS IoT SiteWise</td>
</tr>
<tr>
<td>AWS IoT Wireless</td>
</tr>
<tr>
<td>Amazon Kendra</td>
</tr>
<tr>
<td>AWS Key Management Service (KMS)</td>
</tr>
<tr>
<td>Amazon Kinesis</td>
</tr>
<tr>
<td>Amazon Kinesis Data Analytics</td>
</tr>
<tr>
<td>Amazon Kinesis Data Firehose</td>
</tr>
<tr>
<td>Amazon Kinesis Data Streams</td>
</tr>
<tr>
<td>Services that support TLS details</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Amazon Kinesis Video Streams</td>
</tr>
<tr>
<td>AWS Lambda</td>
</tr>
<tr>
<td>AWS License Manager</td>
</tr>
<tr>
<td>Amazon Lightsail</td>
</tr>
<tr>
<td>Amazon Lookout for Equipment</td>
</tr>
<tr>
<td>Amazon Machine Learning</td>
</tr>
<tr>
<td>Amazon Managed Service for Prometheus</td>
</tr>
<tr>
<td>AWS Managed Services</td>
</tr>
<tr>
<td>AWS Marketplace Commerce Analytics</td>
</tr>
<tr>
<td>AWS Marketplace Discovery</td>
</tr>
<tr>
<td>AWS Marketplace Entitlement Service</td>
</tr>
<tr>
<td>AWS Marketplace Metering Service</td>
</tr>
<tr>
<td>Amazon Mechanical Turk</td>
</tr>
<tr>
<td>Amazon MemoryDB for Redis</td>
</tr>
<tr>
<td>AWS Migration Hub</td>
</tr>
<tr>
<td>AWS Network Firewall</td>
</tr>
<tr>
<td>Amazon OpenSearch Service</td>
</tr>
<tr>
<td>AWS OpsWorks CM</td>
</tr>
<tr>
<td>AWS Organizations</td>
</tr>
<tr>
<td>Amazon Polly</td>
</tr>
<tr>
<td>AWS Price List</td>
</tr>
<tr>
<td>AWS Private Certificate Authority</td>
</tr>
<tr>
<td>AWS Proton</td>
</tr>
<tr>
<td>Amazon QuickSight</td>
</tr>
<tr>
<td>Amazon Redshift</td>
</tr>
<tr>
<td>Amazon Rekognition</td>
</tr>
<tr>
<td>Amazon Relational Database Service (RDS)</td>
</tr>
<tr>
<td>Amazon Relational Database Service (RDS) Data API</td>
</tr>
<tr>
<td>AWS Resource Groups Tagging</td>
</tr>
<tr>
<td>Amazon Route 53</td>
</tr>
<tr>
<td>Amazon Route 53 Domains</td>
</tr>
</tbody>
</table>
### Services that support TLS details

<table>
<thead>
<tr>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Route 53 Resolver</td>
</tr>
<tr>
<td>Amazon SageMaker</td>
</tr>
<tr>
<td>Amazon SageMaker-Edge</td>
</tr>
<tr>
<td>AWS Secrets Manager</td>
</tr>
<tr>
<td>AWS Security Token Service (STS)</td>
</tr>
<tr>
<td>AWS Service Catalog</td>
</tr>
<tr>
<td>AWS Service Quotas</td>
</tr>
<tr>
<td>AWS Shield</td>
</tr>
<tr>
<td>Amazon SimpleDB</td>
</tr>
<tr>
<td>Amazon Simple Email Service (SES)</td>
</tr>
<tr>
<td>Amazon Simple Notification Service (SNS)</td>
</tr>
<tr>
<td>Amazon Simple Queue Service (SQS)</td>
</tr>
<tr>
<td>Amazon Simple Storage Service (S3)</td>
</tr>
<tr>
<td>Amazon S3 Glacier</td>
</tr>
<tr>
<td>Amazon Simple Workflow Service (SWF)</td>
</tr>
<tr>
<td>AWS Snowball</td>
</tr>
<tr>
<td>AWS Step Functions</td>
</tr>
<tr>
<td>AWS Storage Gateway</td>
</tr>
<tr>
<td>AWS Support</td>
</tr>
<tr>
<td>AWS Systems Manager</td>
</tr>
<tr>
<td>Amazon Textract</td>
</tr>
<tr>
<td>Amazon Timestream</td>
</tr>
<tr>
<td>Amazon Transcribe Streaming Service</td>
</tr>
<tr>
<td>AWS Transfer Family</td>
</tr>
<tr>
<td>Amazon Translate</td>
</tr>
<tr>
<td>AWS Trusted Advisor</td>
</tr>
<tr>
<td>AWS WAF</td>
</tr>
<tr>
<td>Amazon WorkDocs</td>
</tr>
<tr>
<td>Amazon WorkMail</td>
</tr>
<tr>
<td>Amazon WorkMail Message Flow</td>
</tr>
<tr>
<td>Amazon WorkSpaces</td>
</tr>
</tbody>
</table>
CloudTrail userIdentity element

AWS Identity and Access Management (IAM) provides different types of identities. The userIdentity element contains details about the type of IAM identity that made the request, and which credentials were used. If temporary credentials were used, the element shows how the credentials were obtained.

Contents

- Examples (p. 436)
- Fields (p. 437)
- Values for AWS STS APIs with SAML and web identity federation (p. 441)
- AWS STS source identity (p. 442)

Examples

userIdentity with IAM user credentials

The following example shows the userIdentity element of a simple request made with the credentials of the IAM user named Alice.

```
"userIdentity": {
    "type": "IAMUser",
    "principalId": "AIDAJ45Q7YFFAREXAMPLE",
    "arn": "arn:aws:iam::123456789012:user/Alice",
    "accountId": "123456789012",
    "accessKeyId": "",
    "userName": "Alice"
}
```

userIdentity with temporary security credentials

The following example shows a userIdentity element for a request made with temporary security credentials obtained by assuming an IAM role. The element contains additional details about the role that was assumed to get credentials.

```
"userIdentity": {
    "type": "AssumedRole",
    "principalId": "AROAIDPPEZ5S5WEXAMPLE:AssumedRoleSessionName",
    "arn": "arn:aws:sts::123456789012:assumed-role/RoleToBeAssumed/MySessionName",
    "accountId": "123456789012",
    "accessKeyId": "",
    "sessionContext": {
        "attributes": {
            "mfaAuthenticated": "false",
            "creationDate": "20131102T010628Z"
        },
        "sessionIssuer": {
            "type": "Role",
            "principalId": "AROAIDPPEZ5S5WEXAMPLE",
            "arn": "arn:aws:iam::123456789012:role/RoleToBeAssumed",
            "accountId": "123456789012",
```
"userName": "RoleToBeAssumed"
}
)
)

userIdentity

for a request made on behalf of an IAM Identity Center user

The following example shows a userIdentity element for a request made on behalf of an IAM Identity Center user.

"userIdentity": {
    "type": "IdentityCenterUser",
    "accountId": "123456789012",
    "onBehalfOf": {
        "userId": "544894e8-80c1-707f-60e3-3ba6510dfac1",
        "identityStoreArn": "arn:aws:identitystore::123456789012:identitystore/d-9067642ac7"
    },
    "credentialId": "EXAMPLEVHULjJldTdP3fofVa1sufHDoj7aYcOYcxFVllWR_Whr1fEXAMPLE"
}

Fields

The following fields can appear in a userIdentity element.

**type**

The type of the identity. The following values are possible:

- **Root** – The request was made with your AWS account credentials. If the userIdentity type is Root, and you set an alias for your account, the userName field contains your account alias. For more information, see [Your AWS account ID and its alias](#).
- **IAMUser** – The request was made with the credentials of an IAM user.
- **AssumedRole** – The request was made with temporary security credentials that were obtained with a role by making a call to the AWS Security Token Service (AWS STS) [AssumeRole](#) API. This can include roles for Amazon EC2 and cross-account API access.
- **Role** – The request was made with a persistent IAM identity that has specific permissions. The issuer of the role sessions is always the role. For more information about roles, see [Roles terms and concepts](#) in the [IAM User Guide](#).
- **FederatedUser** – The request was made with temporary security credentials obtained from a call to the AWS STS [GetFederationToken](#) API. The sessionIssuer element indicates if the API was called with root or IAM user credentials.

For more information about temporary security credentials, see [Temporary Security Credentials](#) in the [IAM User Guide](#).

- **Directory** – The request was made to a directory service, and the type is unknown. Directory services include the following: Amazon WorkDocs and Amazon QuickSight.
- **AWSAccount** – The request was made by another AWS account.
- **AWSService** – The request was made by an AWS account that belongs to an AWS service. For example, AWS Elastic Beanstalk assumes an IAM role in your account to call other AWS services on your behalf.
- **IdentityCenterUser** – The request was made on behalf of an IAM Identity Center user.
- **Unknown** – The request was made with an identity type that CloudTrail can't determine.

Optional: False
AWSAccount and AWSService appear for type in your logs when there is cross-account access using an IAM role that you own.

**Example: Cross-account access initiated by another AWS account**

1. You own an IAM role in your account.
2. Another AWS account switches to that role to assume the role for your account.
3. Because you own the IAM role, you receive a log that shows the other account assumed the role. The type is AWSAccount. For an example log entry, see [AWS STS API event in CloudTrail log file](#).

**Example: Cross-account access initiated by an AWS service**

1. You own an IAM role in your account.
2. An AWS account owned by an AWS service assumes that role.
3. Because you own the IAM role, you receive a log that shows the AWS service assumed the role. The type is AWSService.

**userName**

The friendly name of the identity that made the call. The value that appears in userName is based on the value in type. The following table shows the relationship between type and userName:

<table>
<thead>
<tr>
<th>type</th>
<th>userName</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root (no alias set)</td>
<td>Not present</td>
<td>If you haven't set up an alias for your AWS account, the userName field doesn't appear. For more information about account aliases, see Your AWS account ID and its alias. Note that the userName field can't contain Root, because Root is an identity type and not a user name.</td>
</tr>
<tr>
<td>Root (alias set)</td>
<td>The account alias</td>
<td>For more information about AWS account aliases, see Your AWS account ID and its alias.</td>
</tr>
<tr>
<td>IAMUser</td>
<td>The user name of the IAM user</td>
<td></td>
</tr>
<tr>
<td>AssumedRole</td>
<td>Not present</td>
<td>For the AssumedRole type, you can find the userName field in sessionContext as part of the sessionIssuer (p. 440) element. For an example entry, see Examples (p. 436).</td>
</tr>
<tr>
<td>Role</td>
<td>User-defined</td>
<td>The sessionContext and sessionIssuer section contains information about the identity that issued the session for the role.</td>
</tr>
<tr>
<td>FederatedUser</td>
<td>Not present</td>
<td>The sessionContext and sessionIssuer section contains information about the identity that issued the session for the federated user.</td>
</tr>
<tr>
<td>Directory</td>
<td>Can be present</td>
<td>For example, the value can be the account alias or email address of the associated AWS account ID.</td>
</tr>
<tr>
<td>AWSService</td>
<td>Not present</td>
<td></td>
</tr>
</tbody>
</table>
### AWS CloudTrail User Guide

**Fields**

<table>
<thead>
<tr>
<th>type</th>
<th>userName</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWSAccount</td>
<td>Not present</td>
<td></td>
</tr>
<tr>
<td>IdentityCenterUser</td>
<td>Not present</td>
<td>The <code>onBehalfOf</code> section contains information about the IAM Identity Center user ID and identity store ARN for which the call was made. For more information about IAM Identity Center, see the <a href="https://docs.aws.amazon.com/IAM/latest/userguide/idc-center.html">AWS IAM Identity Center (successor to AWS Single Sign-On) User Guide</a>.</td>
</tr>
<tr>
<td>Unknown</td>
<td>Can be present</td>
<td>For example, the value can be the account alias or email address of the associated AWS account ID.</td>
</tr>
</tbody>
</table>

**Optional:** True

**Note**

The `userName` field contains the string `HIDDEN_DUE_TO_SECURITY_REASONS` when the recorded event is a console sign-in failure caused by incorrect user name input. CloudTrail does not record the contents in this case because the text could contain sensitive information, as in the following examples:

- A user accidentally types a password in the user name field.
- A user clicks the link for one AWS account’s sign-in page, but then types the account number for a different one.
- A user accidentally types the account name of a personal email account, a bank sign-in identifier, or some other private ID.

**principalId**

A unique identifier for the entity that made the call. For requests made with temporary security credentials, this value includes the session name that is passed to the `AssumeRole`, `AssumeRoleWithWebIdentity`, or `GetFederationToken` API call.

**Optional:** True

**arn**

The Amazon Resource Name (ARN) of the principal that made the call. The last section of the arn contains the user or role that made the call.

**Optional:** True

**accountId**

The account that owns the entity that granted permissions for the request. If the request was made with temporary security credentials, this is the account that owns the IAM user or role used to obtain credentials.

If the request was made with an IAM Identity Center authorized access token, this is the account that owns the IAM Identity Center instance.

**Optional:** True

**accessKeyId**

The access key ID that was used to sign the request. If the request was made with temporary security credentials, this is the access key ID of the temporary credentials. For security reasons, `accessKeyId` might not be present, or might be displayed as an empty string.

**Optional:** True
sessionContext

If the request was made with temporary security credentials, sessionContext provides information about the session created for those credentials. You create a session when you call any API that returns temporary credentials. Users also create sessions when they work in the console and make requests with APIs that include multi-factor authentication. This element has the following attributes:

- **creationDate** – The date and time when the temporary security credentials were issued. Represented in ISO 8601 basic notation.
- **mfaAuthenticated** – The value is true if the root user or IAM user who used their credentials for the request also authenticated with an MFA device; otherwise, false.
- **sourceIdentity** – See AWS STS source identity (p. 442) in this topic. The sourceIdentity field occurs in events when users assume an IAM role to perform an action. sourceIdentity identifies the original user identity making the request, whether that user's identity is an IAM user, an IAM role, a user authenticated through SAML-based federation, or a user authenticated through OpenID Connect (OIDC)-compliant web identity federation. For more information about configuring AWS STS to collect source identity information, see Monitor and control actions taken with assumed roles in the IAM User Guide.
- **ec2RoleDelivery** – The value is 1.0 if the credentials were provided by Amazon EC2 Instance Metadata Service Version 1 (IMDSv1). The value is 2.0 if the credentials were provided using the new IMDS scheme.

AWS credentials provided by the Amazon EC2 Instance Metadata Service (IMDS) include an ec2:RoleDelivery IAM context key. This context key makes it easy to enforce use of the new scheme on a service-by-service or resource-by-resource basis by using the context key as a condition in IAM policies, resource policies, or AWS Organizations service control policies. For more information, see Instance metadata and user data in the Amazon EC2 User Guide for Linux Instances.

Optional: True

invokedBy

The name of the AWS service that made the request, such as Amazon EC2 Auto Scaling or AWS Elastic Beanstalk.

Optional: True

sessionIssuer

If a user make a request with temporary security credentials, sessionIssuer provides information about how the user obtained credentials. For example, if the they obtained temporary security credentials by assuming a role, this element provides information about the assumed role. If they obtained credentials with root or IAM user credentials to call AWS STS GetFederationToken, the element provides information about the root account or IAM user. This element has the following attributes:

- **type** – The source of the temporary security credentials, such as Root, IAMUser, or Role.
- **userName** – The friendly name of the user or role that issued the session. The value that appears depends on the sessionIssuer identity type. The following table shows the relationship between sessionIssuer type and userName:

<table>
<thead>
<tr>
<th>sessionIssuer type</th>
<th>userName</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root (no alias set)</td>
<td>Not present</td>
<td>If you have not set up an alias for your account, the userName field does not appear. For more information about AWS account aliases, see Your AWS account ID and its alias. Note that the</td>
</tr>
</tbody>
</table>
Values for AWS STS APIs with SAML and web identity federation

AWS CloudTrail supports logging AWS Security Token Service (AWS STS) API calls made with Security Assertion Markup Language (SAML) and web identity federation. When a user makes a call to the

<table>
<thead>
<tr>
<th>sessionIssuer type</th>
<th>userName</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root (alias set)</td>
<td>The account alias</td>
<td>For more information about AWS account aliases, see <a href="#">Your AWS account ID and its alias</a>.</td>
</tr>
<tr>
<td>IAMUser</td>
<td>The user name of the IAM user</td>
<td>This also applies when a federated user is using a session issued by IAMUser.</td>
</tr>
<tr>
<td>Role</td>
<td>The role name</td>
<td>A role assumed by an IAM user, AWS service, or web identity federated user in a role session.</td>
</tr>
</tbody>
</table>

- **principalId** – The internal ID of the entity used to get credentials.
- **arn** – The ARN of the source (account, IAM user, or role) that was used to get temporary security credentials.
- **accountId** – The account that owns the entity that was used to get credentials.

**Optional**: True

### onBe halfOf

If the request was made by an IAM Identity Center caller, onBehalfOf provides information about the IAM Identity Center user ID and identity store ARN for which the call was made. This element has the following attributes:

- **userId** – The ID of the IAM Identity Center user who the call was made on behalf of.
- **identityStoreArn** – The ARN of the IAM Identity Center identity store that the call was made on behalf of.

**Optional**: True

### credentialId

The credential ID for the request. This is only set when the caller uses a bearer token, such as an IAM Identity Center authorized access token.

**Optional**: True

### webIdFederationData

If the request was made with temporary security credentials obtained by [web identity federation](#), webIdFederationData lists information about the identity provider. This element has the following attributes:

- **federatedProvider** – The principal name of the identity provider (for example, www.amazon.com for Login with Amazon or accounts.google.com for Google).
- **attributes** – The application ID and user ID as reported by the provider (for example, www.amazon.com:app_id and www.amazon.com:user_id for Login with Amazon).

**Optional**: True
AssumeRoleWithSAML and AssumeRoleWithWebIdentity APIs, CloudTrail records the call and delivers the event to your Amazon S3 bucket.

The userIdentity element for these APIs contains the following values.

**type**
The identity type.
- SAMLUser – The request was made with SAML assertion.
- WebIdentityUser – The request was made by a web identity federation provider.

**principalId**
A unique identifier for the entity that made the call.
- For SAMLUser, this is a combination of the saml:nameQualifier and saml:sub keys.
- For WebIdentityUser, this is a combination of the issuer, application ID, and user ID.

**userName**
The name of the identity that made the call.
- For SAMLUser, this is the saml:sub key.
- For WebIdentityUser, this is the user ID.

**identityProvider**
The principal name of the external identity provider. This field appears only for SAMLUser or WebIdentityUser types.
- For SAMLUser, this is the saml:nameQualifier key for the SAML assertion.
- For WebIdentityUser, this is the issuer name of the web identity federation provider. This can be a provider that you configured, such as the following:
  - cognito-identity.amazon.com for Amazon Cognito
  - www.amazon.com for Login with Amazon
  - accounts.google.com for Google
  - graph.facebook.com for Facebook

The following is an example userIdentity element for the AssumeRoleWithWebIdentity action.

```json
"userIdentity": {
    "type": "WebIdentityUser",
    "principalId": "accounts.google.com:application-id.apps.googleusercontent.com:user-id",
    "userName": "user-id",
    "identityProvider": "accounts.google.com"
}
```

For example logs of how the userIdentity element appears for SAMLUser and WebIdentityUser types, see [Logging IAM and AWS STS API calls with AWS CloudTrail](#).

## AWS STS source identity

An IAM administrator can configure AWS Security Token Service to require that users specify their identity when they use temporary credentials to assume roles. The sourceIdentity field occurs in events when users assume an IAM role or perform any actions with the assumed role.
The `sourceIdentity` field identifies the original user identity making the request, whether that user's identity is an IAM user, an IAM role, a user authenticated by using SAML-based federation, or a user authenticated by using OpenID Connect (OIDC)-compliant web identity federation. After the IAM administrator configures AWS STS, CloudTrail logs `sourceIdentity` information in the following events and locations within the event record:

- The AWS STS `AssumeRole`, `AssumeRoleWithSAML`, or `AssumeRoleWithWebIdentity` calls that a user identity makes when it assumes a role. `sourceIdentity` is found in the `requestParameters` block of the AWS STS calls.
- The AWS STS `AssumeRole`, `AssumeRoleWithSAML`, or `AssumeRoleWithWebIdentity` calls that a user identity makes if it uses a role to assume another role, known as **role chaining**. `sourceIdentity` is found in the `requestParameters` block of the AWS STS calls.
- The AWS service API calls that the user identity makes while assuming a role and using the temporary credentials assigned by AWS STS. In service API events, `sourceIdentity` is found in the `sessionContext` block. For example, if a user identity creates a new S3 bucket, `sourceIdentity` occurs in the `sessionContext` block of the `CreateBucket` event.

For more information about how to configure AWS STS to collect source identity information, see [Monitor and control actions taken with assumed roles](https://docs.aws.amazon.com/IAM/latest/UserGuide/id_collect-policy-view-events.html) in the IAM User Guide. For more information about AWS STS events that are logged to CloudTrail, see [Logging IAM and AWS STS API calls with AWS CloudTrail](https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/CloudTrail.html) in the IAM User Guide.

The following are example snippets of events that show the `sourceIdentity` field.

### Example requestParameters section

In the following example event snippet, a user makes an AWS STS `AssumeRole` request, and sets a source identity, represented here by `source-identity-value-set`. The user assumes a role represented by the role ARN `arn:aws:iam::123456789012:role/Assumed_Role`. The `sourceIdentity` field is in the `requestParameters` block of the event.

```
"eventVersion": "1.05",
"userIdentity": {
  "type": "AWSAccount",
  "principalId": "AIDAJ45Q7YFFAREXAMPLE",
  "accountId": "123456789012"
},
"eventTime": "2020-04-02T18:20:53Z",
"eventSource": "sts.amazonaws.com",
"eventName": "AssumeRole",
"awsRegion": "us-east-1",
"sourceIPAddress": "203.0.113.64",
"userAgent": "aws-cli/1.16.96 Python/3.6.0 Windows/10 botocore/1.12.86",
"requestParameters": {
  "roleArn": "arn:aws:iam::123456789012:role/Assumed_Role",
  "roleSessionName": "Test1",
  "sourceIdentity": "source-identity-value-set",
},
```

### Example responseElements section

In the following example event snippet, a user makes an AWS STS `AssumeRole` request to assume a role named `Developer_Role`, and sets a source identity, `Admin`. The user assumes a role represented by the role ARN `arn:aws:iam::111122223333:role/Developer_Role`. The `sourceIdentity` field is shown in both the `requestParameters` and `responseElements` blocks of the event. The temporary credentials used to assume the role, the session token string, and the assumed role ID, session name, and session ARN are shown in the `responseElements` block, along with the source identity.

```
"eventVersion": "1.05",
"userIdentity": {
  "type": "AWSAccount",
  "principalId": "AIDAJ45Q7YFFAREXAMPLE",
  "accountId": "123456789012"
},
"eventTime": "2020-04-02T18:20:53Z",
"eventSource": "sts.amazonaws.com",
"eventName": "AssumeRole",
"awsRegion": "us-east-1",
"sourceIPAddress": "203.0.113.64",
"userAgent": "aws-cli/1.16.96 Python/3.6.0 Windows/10 botocore/1.12.86",
"requestParameters": {
  "roleArn": "arn:aws:iam::123456789012:role/Assumed_Role",
  "roleSessionName": "Test1",
  "sourceIdentity": "source-identity-value-set",
},
```

```
"principalId": "AIDAJ45Q7YFFAREXAMPLE",
"responseElements": {
  "assumedRoleUser": {
    "arn": "arn:aws:sts::123456789012:assumed-role/Developer_Role/Assumed_Role",
    "principalId": "AIDAJ45Q7YFFAREXAMPLE",
    "accountId": "123456789012"
  },
  "sessionContext": {
    "cognitoIdentityPoolId": null,
    "cognitoIdentityId": null,
    "cognitoAuthenticationType": null,
    "cognitoIdentityProvider": null,
    "sessionIssuer": "sts.amazonaws.com",
    "awsRegion": "us-east-1",
    "userName": null
  },
  "credentialsValidity": {
    "sessionIssuer": "sts.amazonaws.com",
    "validUntil": "2020-04-02T18:20:58Z"
  },
  "credentials": {
    "AccessKeyId": "AKIASDFGJKHJDFGHJSDFG",
    "SecretAccessKey": "sdfghjkl; sdflkajsdfg",
    "SessionToken": "sdfghjkl; sdflkajsdfg"
  }
}
```

In the following example event snippet, a user is assuming a role named DevRole to call an AWS service API. The user sets a source identity, represented here by `source-identity-value-set`. The `sourceIdentity` field is in the `sessionContext` block, within the `userIdentity` block of the event.

```json
{
  "eventVersion": "1.08",
  "userIdentity": {
    "type": "AssumedRole",
    "principalId": "AROA45Q7YFFAREXAMPLE: Dev1",
    "accountId": "123456789012",
    "accessKeyId": "ASIAIOSFODNN7EXAMPLE",
    "sessionContext": {
      "sessionIssuer": {
        "type": "Role",
        "principalId": "AROA45Q7YFFAREXAMPLE",
        "accountId": "123456789012",
        "userName": "DevRole"
      },
      "webIdFederationData": {},
      "attributes": {
        "mfaAuthenticated": "false",
        "creationDate": "2021-02-21T23: 46: 28Z"
      },
      "sourceIdentity": "source-identity-value-set"
    }
  }
}
```

---

**CloudTrail Insights insightDetails element**

AWS CloudTrail Insights event records include fields that are different from other CloudTrail events in their JSON structure, sometimes called `payload`. A CloudTrail Insights event record includes an `insightDetails` block that contains information about the underlying triggers of an Insights event, such as event source, user identities, user agents, historical averages or `baselines`, statistics, API name,
and whether the event is the start or end of the Insights event. The insightDetails block contains the following information.

- **state** - Whether the event is the starting or ending Insights event. The value can be `Start` or `End`.
  
  Since: 1.07

  Optional: False

- **eventSource** - The AWS service endpoint that was the source of the unusual activity, such as `ec2.amazonaws.com`.
  
  Since: 1.07

  Optional: False

- **eventName** - The name of the Insights event, typically the name of the API that was the source of the unusual activity.
  
  Since: 1.07

  Optional: False

- **insightType** - The type of Insights event. This value can be `ApiCallRateInsight`, `ApiErrorRateInsight`, or both.
  
  Since: 1.07

  Optional: False

- **insightContext** - Information about the AWS tools (called *user agents*), IAM users and roles (called *user identities*), and error codes associated with the events that CloudTrail analyzed to generate the Insights event. This element also includes statistics that show how the unusual activity in an Insights event compares to baseline, or normal, activity.
  
  Since: 1.07

  Optional: False

- **statistics** - Includes data about the baseline, or typical average rate of calls to or errors on the subject API by an account as measured during the baseline period, the average rate of calls or errors that triggered the Insights event over the first minute of the Insights event, the duration, in minutes, of the Insights event, and the duration, in minutes, of the baseline measuring period.
  
  Since: 1.07

  Optional: False

- **baseline** - The average number of API calls or errors per minute during the baseline duration on the Insights event's subject API for the account, calculated over the seven days preceding the start of the Insights event.
  
  Since: 1.07

  Optional: False

- **insight** - For a starting Insights event, this value is the average number of API calls or errors per minute during the start of the unusual activity. For an ending Insights event, this value is the average number of API calls or errors per minute over the duration of the unusual activity.
  
  Since: 1.07
Optional: False

- **insightDuration** - The duration, in minutes, of an Insights event (the time period from the start to the end of unusual activity on the subject API). `insightDuration` occurs in both starting and ending Insights events.

Since: 1.07

Optional: False

- **baselineDuration** - The duration, in minutes, of the baseline period (the time period that normal activity is measured on the subject API). `baselineDuration` is at minimum the seven days (10080 minutes) preceding an Insights event. This field occurs in both starting and ending Insights events. The ending time of `baselineDuration` measurement is always the start of an Insights event.

Since: 1.07

Optional: False

- **attributions** - This block includes information about the user identities, user agents, and error codes correlated with unusual and baseline activity. A maximum of five user identities, five user agents, and five error codes are captured in an Insights event `attributions` block, sorted by an average of the count of activity, in descending order from highest to lowest.

Since: 1.07

Optional: True

- **attribute** - Contains the attribute type. Value can be `userIdentityArn`, `userAgent`, or `errorCode`.

  - **userIdentityArn** - A block that shows up to the top five AWS users or IAM roles that contributed to API calls or errors during the unusual activity and baseline periods. See also `userIdentity` in CloudTrail record contents (p. 422).

Since: 1.07

Optional: False

- **insight** - A block that shows up to the top five user identity ARNs that contributed to the API calls made during the unusual activity period, in descending order from largest number of API calls to smallest. It also shows the average number of API calls made by the user identities during the unusual activity period.

Since: 1.07

Optional: False

- **value** - The ARN of one of the top five user identities that contributed to the API calls made during the unusual activity period.

Since: 1.07

Optional: False

- **average** - The number of API calls or errors per minute during the unusual activity period for the user identity in the `value` field.

Since: 1.07

Optional: False
• **baseline** - A block that shows up to the top five user identity ARNs that contributed the most to the API calls or errors during the normal activity period. It also shows the average number of API calls or errors logged by the user identities during the normal activity period.

  **Since:** 1.07

  **Optional:** False

  • **value** - The ARN of one of the top five user identities that contributed to the API calls or errors during the normal activity period.

  **Since:** 1.07

  **Optional:** False

  • **average** - The historic average of API calls or errors per minute during the seven days preceding the Insights activity start time for the user identity in the value field.

  **Since:** 1.07

  **Optional:** False

• **userAgent** - A block that shows up to the top five AWS tools by which the user identity contributed to API calls during the unusual activity and baseline periods. These tools include the AWS Management Console, AWS CLI, or the AWS SDKs. See also `userAgent` in CloudTrail record contents (p. 422).

  **Since:** 1.07

  **Optional:** False

• **insight** - A block that shows up to the top five user agents that contributed to the API calls made during the unusual activity period, in descending order from largest number of API calls to smallest. It also shows the average number of API calls or errors logged by the user agents during the unusual activity period.

  **Since:** 1.07

  **Optional:** False

  • **value** - One of the top five user agents that contributed to the API calls made during the unusual activity period.

  **Since:** 1.07

  **Optional:** False

  • **average** - The number of API calls or errors logged per minute during the unusual activity period for the user agent in the value field.

  **Since:** 1.07

  **Optional:** False

• **baseline** - A block that shows up to the top five user agents that contributed the most to the API calls made during the normal activity period. It also shows the average number of API calls or errors logged by the user agents during the normal activity period.

  **Since:** 1.07

  **Optional:** False

  • **value** - One of the top five user agents that contributed to the API calls or errors logged during the normal activity period.
Since: 1.07

Optional: False

- **average** - The historic average of API calls or errors per minute during the seven days preceding the Insights activity start time for the user agent in the value field.

Since: 1.07

Optional: False

- **errorCode** - A block that shows up to the top five error codes that occurred on API calls during the unusual activity and baseline periods, in descending order from largest number of API calls to smallest. See also `errorCode` in CloudTrail record contents (p. 422).

Since: 1.07

Optional: False

- **insight** - A block that shows up to the top five error codes that occurred on the API calls made during the unusual activity period, in descending order from largest number of associated API calls to smallest. It also shows the average number of API calls on which the errors occurred during the unusual activity period.

Since: 1.07

Optional: False

- **value** - One of the top five error codes that occurred on the API calls made during the unusual activity period, such as AccessDeniedException.

If none of the calls that triggered the Insights event resulted in errors, this value is null.

Since: 1.07

Optional: False

- **average** - The number of API calls per minute during the unusual activity period for the error code in the value field.

If the error code value is null, and there are no other error codes in the `insight` block, the value of the average is the same as that in the `statistics` block for the Insights event overall.

Since: 1.07

Optional: False

- **baseline** - A block that shows up to the top five error codes that occurred on the API calls made during the normal activity period. It also shows the average number of API calls made by the user agents during the normal activity period.

Since: 1.07

Optional: False

- **value** - One of the top five error codes that occurred on the API calls made during the normal activity period, such as AccessDeniedException.

Since: 1.07

Optional: False

- **average** - The historic average of API calls or errors per minute during the seven days preceding the Insights activity start time for the error code in the value field.
Example insightDetails block

The following is an example of an Insights event insightDetails block for an Insights event that occurred when the Application Auto Scaling API CompleteLifecycleAction was called an unusual number of times. For an example of a full Insights event, see [CloudTrail log event reference (p. 420)](p.420).

This example is from a starting Insights event, indicated by "state": "Start". The top user identities that called the APIs associated with the Insights event, CodeDeployRole1, CodeDeployRole2, and CodeDeployRole3, are shown in the attributions block, along with their average API call rates for this Insights event, and the baseline for the CodeDeployRole1 role. The attributions block also shows that the user agent is codedeploy.amazonaws.com, meaning the top user identities used the AWS CodeDeploy console to run the API calls.

Because there are no error codes associated with the events that were analyzed to generate the Insights event (the value is null), the insight average for the error code is the same as the overall insight average for the entire Insights event, shown in the statistics block.

```
"insightDetails": {
  "state": "Start",
  "eventSource": "autoscaling.amazonaws.com",
  "eventName": "CompleteLifecycleAction",
  "insightType": "ApiCallRateInsight",
  "insightContext": {
    "statistics": {
      "baseline": {
        "average": 0.0000882145
      },
      "insight": {
        "average": 0.6
      },
      "insightDuration": 5,
      "baselineDuration": 11336
    },
    "attributions": [
      {
        "attribute": "userIdentityArn",
        "insight": [
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
            "average": 0.2
          },
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole2",
            "average": 0.2
          },
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole3",
            "average": 0.2
          }
        ],
        "baseline": [
          {
            "value": "arn:aws:sts::012345678901:assumed-role/CodeDeployRole1",
            "average": 0.0000882145
          }
        ]
      }
    ]
  }
```

Non-API events captured by CloudTrail

In addition to logging AWS API calls, CloudTrail captures other related events that might have a security or compliance impact on your AWS account or that might help you troubleshoot operational problems.

Topics
- AWS service events (p. 450)
- AWS Management Console sign-in events (p. 451)

AWS service events

CloudTrail supports logging non-API service events. These events are created by AWS services but are not directly triggered by a request to a public AWS API. For these events, the eventType field is AwsServiceEvent.

The following is an example scenario of an AWS service event when a customer managed key is automatically rotated in AWS Key Management Service (AWS KMS). For more information about rotating KMS keys, see Rotating KMS keys.

```json
{
    "eventVersion": "1.05",
    "userIdentity": {
        "accountId": "123456789012",
        "version": "1.05",
        "type": "Root",
        "principalId": "A8268315AF2AD7288099B3056AE1B9CA936C4658BE9C2B6C7B0D7442ABD05B3A",
        "reason": "Root",
        "primaryAccountId": "123456789012",
    },
    "eventSource": "aws.kms",
    "eventSourceArn": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
    "eventTime": "2023-01-01T00:00:00Z",
    "=eventVersion": "1.05",
    "userIdentity": {
        "accountId": "123456789012",
        "version": "1.05",
        "type": "Root",
        "principalId": "A8268315AF2AD7288099B3056AE1B9CA936C4658BE9C2B6C7B0D7442ABD05B3A",
        "reason": "Root",
        "primaryAccountId": "123456789012",
    },
    "eventSource": "aws.kms",
    "eventSourceArn": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
    "eventTime": "2023-01-01T00:00:00Z",
    "eventRecordId": "123456789012",
    "requestParameters": {
        "kmsKeyId": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
        "keyUsage": "ENCRYPT_DECRYPT",
        "keyName": "example-key"
    },
    "responseElements": {
        "kmsKeyId": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
        "keyUsage": "ENCRYPT_DECRYPT",
        "keyName": "example-key"
    },
    "eventDetail": {
        "eventSource": "aws.kms",
        "eventSourceArn": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
        "eventTime": "2023-01-01T00:00:00Z",
        "requestParameters": {
            "kmsKeyId": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
            "keyUsage": "ENCRYPT_DECRYPT",
            "keyName": "example-key"
        },
        "responseElements": {
            "kmsKeyId": "arn:aws:kms:us-east-1:123456789012:alias/example-key",
            "keyUsage": "ENCRYPT_DECRYPT",
            "keyName": "example-key"
        }
    },
    "eventBusName": "default",
    "language": "en-US"
```
AWS Management Console sign-in events

**Important**
As of November 22, 2021, AWS CloudTrail changed how trails capture global service events. Now, events created by Amazon CloudFront, AWS Identity and Access Management, and AWS STS are recorded in the Region in which they were created, the US East (N. Virginia) Region, us-east-1. This makes how CloudTrail treats these services consistent with that of other AWS global services. To continue receiving global service events outside of US East (N. Virginia), be sure to convert *single-Region trails* using global service events outside of US East (N. Virginia) into *multi-Region trails*. For more information about capturing global service events, see Enabling and disabling global service event logging (p. 109) later in this section.

CloudTrail logs attempts to sign in to the AWS Management Console, the AWS Discussion Forums, and the AWS Support Center. All IAM user and root user sign-in events, as well as all federated user sign-in events, generate records in CloudTrail log files. AWS Management Console sign-in events are global service events. For information about getting and viewing logs, see Getting and viewing your CloudTrail log files (p. 154).

**Topics**
- Example records for IAM users (p. 451)
- Example event records for root users (p. 454)

**Example records for IAM users**

The following examples show event records for several IAM user sign-in scenarios.

**Topics**
- IAM user, successful sign-in without MFA (p. 452)
- IAM user, successful sign-in with MFA (p. 452)
- IAM user, unsuccessful sign-in (p. 453)
- IAM user, sign-in process checks for MFA (single MFA device type) (p. 453)
IAM user, sign-in process checks for MFA (multiple MFA device types) (p. 454)

IAM user, successful sign-in without MFA

The following record shows that a user named Anaya successfully signed in to the AWS Management Console without using multi-factor authentication (MFA).

```
{
  "Records": [
    {
      "eventVersion": "1.05",
      "userIdentity": {
        "type": "IAMUser",
        "principalId": "AIDACKCEVSQ6C2EXAMPLE",
        "arn": "arn:aws:iam::111122223333:user/anaya",
        "accountId": "111122223333",
        "userName": "anaya"
      },
      "eventTime": "2022-11-10T16:24:34Z",
      "eventSource": "signin.amazonaws.com",
      "eventName": "ConsoleLogin",
      "awsRegion": "us-east-2",
      "sourceIPAddress": "192.0.2.0",
      "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:62.0) Gecko/20100101 Firefox/62.0",
      "requestParameters": null,
      "responseElements": {
        "ConsoleLogin": "Success"
      },
      "additionalEventData": {
        "MobileVersion": "No",
        "LoginTo": "https://console.aws.amazon.com/sns",
        "MFAUsed": "No"
      },
      "eventID": "3fcfb182-98f8-4744-bd45-10a395ab61cb",
      "eventType": "AwsConsoleSignIn"
    }
  ]
}
```

IAM user, successful sign-in with MFA

The following record shows that an IAM user named Anaya successfully signed in to the AWS Management Console using multi-factor authentication (MFA).

```
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "IAMUser",
    "principalId": "AIDACKCEVSQ6C2EXAMPLE",
    "arn": "arn:aws:iam::111122223333:user/anaya",
    "accountId": "111122223333",
    "userName": "anaya"
  },
  "eventTime": "2022-11-10T16:24:34Z",
  "eventSource": "signin.amazonaws.com",
  "eventName": "ConsoleLogin",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "192.0.2.0",
  "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.99 Safari/537.36",
  "requestParameters": null,
}
IAM user, unsuccessful sign-in

The following record shows an unsuccessful sign-in attempt from an IAM user.

```
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "AIDACKCEVSQ6C2EXAMPLE",
        "accountId": "111122223333",
        "accessKeyId": "",
        "userName": "anaya"
    },
    "eventTime": "2022-11-10T16:24:34Z",
    "eventSource": "signin.amazonaws.com",
    "eventName": "ConsoleLogin",
    "awsRegion": "us-east-1",
    "sourceIPAddress": "192.0.2.0",
    "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.99 Safari/537.36",
    "errorMessage": "Failed authentication",
    "requestParameters": null,
    "responseElements": {
        "ConsoleLogin": "Failure"
    },
    "additionalEventData": {
        "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
        "MobileVersion": "No",
        "MFAIdentifier": "arn:aws:iam::111122223333:u2f/user/anaya/default-AAAAAABBABBABBBCCCCCCCDDD",
        "MFAUsed": "Yes"
    },
    "eventID": "d38ce1b3-4575-4cb8-a632-611b8243bfc3",
    "eventType": "AwsConsoleSignIn",
    "recipientAccountId": "111122223333"
}
```

IAM user, sign-in process checks for MFA (single MFA device type)

The following shows that the sign-in process checked whether multi-factor authentication (MFA) is required for an IAM user during sign-in. In this example, the mfaType value is U2F MFA, which indicates that the IAM user enabled either a single MFA device or multiple MFA devices of the same type (U2F MFA).

```
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "AIDACKCEVSQ6C2EXAMPLE",
        "accountId": "111122223333",
        "accessKeyId": "",
        "userName": "anaya"
    },
    "eventTime": "2022-11-10T16:24:34Z",
    "eventSource": "signin.amazonaws.com",
    "eventName": "ConsoleLogin",
    "awsRegion": "us-east-1",
    "sourceIPAddress": "192.0.2.0",
    "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.99 Safari/537.36",
    "errorMessage": "Failed authentication",
    "requestParameters": null,
    "responseElements": {
        "ConsoleLogin": "Failure"
    },
    "additionalEventData": {
        "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
        "MobileVersion": "No",
        "MFAUsed": "Yes"
    },
    "eventID": "d38ce1b3-4575-4cb8-a632-611b8243bfc3",
    "eventType": "AwsConsoleSignIn",
    "recipientAccountId": "111122223333"
}
```
IAM user, sign-in process checks for MFA (multiple MFA device types)

The following shows that the sign-process checked whether multi-factor authentication (MFA) is required for an IAM user during sign-in. In this example, the mfaType value is Multiple MFA Devices, which indicates that the IAM user enabled multiple MFA device types.

```json
{
"eventVersion": "1.05",
"userIdentity": {
  "type": "IAMUser",
  "principalId": "AIDACKCEVSQ6C2EXAMPLE",
  "accountId": "111122223333",
  "accessKeyId": "",
  "userName": "anaya"
},
"eventTime": "2022-11-10T16:24:34Z",
"eventSource": "signin.amazonaws.com",
"eventName": "CheckMfa",
"awsRegion": "us-east-1",
"sourceIPAddress": "192.0.2.0",
"userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.99 Safari/537.36",
"requestParameters": null,
"responseElements": {
  "CheckMfa": "Success"
},
"additionalEventData": {
  "MfaType": "U2F MFA"
},
"eventID": "f8ef8fc5-e3e8-4ee1-9d52-2f412ddf17e3",
"eventType": "AwsConsoleSignIn",
"recipientAccountId": "111122223333"
}
```

Example event records for root users

The following examples show event records for several root user sign-in scenarios.

Topics
Root user, successful sign-in without MFA

The following shows a successful sign-in event for a root user not using multi-factor authentication (MFA).

```json
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "Root",
    "principalId": "AIDACKCEVSQ6C2EXAMPLE",
    "arn": "arn:aws:iam::111122223333:root",
    "accountId": "111122223333",
    "accessKeyId": ""
  },
  "eventTime": "2022-11-10T16:24:34Z",
  "eventSource": "signin.amazonaws.com",
  "eventName": "ConsoleLogin",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "192.0.2.0",
  "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:62.0) Gecko/20100101 Firefox/62.0",
  "requestParameters": null,
  "responseElements": {
    "ConsoleLogin": "Success"
  },
  "additionalEventData": {
    "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
    "MobileVersion": "No",
    "MFAUsed": "No"
  },
  "eventID": "deb1e1f9-c99b-4612-8e9f-21f93b5d79c0",
  "eventType": "AwsConsoleSignIn",
  "recipientAccountId": "111122223333"
}
```

Root user, successful sign-in with MFA

The following shows a successful sign-in event for a root user using multi-factor authentication (MFA).

```json
{
  "eventVersion": "1.05",
  "userIdentity": {
    "type": "Root",
    "principalId": "AIDACKCEVSQ6C2EXAMPLE",
    "arn": "arn:aws:iam::111122223333:root",
    "accountId": "111122223333",
    "accessKeyId": ""
  },
  "eventTime": "2022-11-10T16:24:34Z",
  "eventSource": "signin.amazonaws.com",
  "eventName": "ConsoleLogin",
  "awsRegion": "us-east-1",
  "sourceIPAddress": "192.0.2.0",
  "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10.12; rv:62.0) Gecko/20100101 Firefox/62.0",
  "requestParameters": null,
  "responseElements": {
    "ConsoleLogin": "Success"
  },
  "additionalEventData": {
    "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
    "MobileVersion": "No",
    "MFAUsed": "Yes"
  },
  "eventID": "deb1e1f9-c99b-4612-8e9f-21f93b5d79c0",
  "eventType": "AwsConsoleSignIn",
  "recipientAccountId": "111122223333"
}
```
Root user, unsuccessful sign-in

The following shows an unsuccessful sign-in event for a root user not using MFA.

```json
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "Root",
        "principalId": "AIDACKCEVSQ6C2EXAMPLE",
        "arn": "arn:aws:iam::111122223333:root",
        "accountId": "111122223333",
        "accessKeyId": "",
    },
    "eventTime": "2022-11-10T16:24:34Z",
    "eventSource": "signin.amazonaws.com",
    "eventName": "ConsoleLogin",
    "awsRegion": "us-east-1",
    "sourceIPAddress": "192.0.2.0",
    "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/68.0.3440.106 Safari/537.36",
    "errorMessage": "Failed authentication",
    "requestParameters": null,
    "responseElements": {
        "ConsoleLogin": "Failure"
    },
    "additionalEventData": {
        "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
        "MobileVersion": "No",
        "MFAIdentifier": "arn:aws:iam::111122223333:mfa/root-account-mfa-device",
        "MFAUsed": "No"
    },
    "eventID": "a4fbbe77-91a0-4238-804a-64314184ed6b",
    "eventType": "AwsConsoleSignIn",
    "recipientAccountId": "111122223333"
}
```

Root user, MFA changed

The following shows an example event for a root user changing multi-factor authentication (MFA) settings.

```json
{
    "eventVersion": "1.05",
    "userIdentity": {
        "type": "Root",
        "principalId": "AIDACKCEVSQ6C2EXAMPLE",
        "arn": "arn:aws:iam::111122223333:root",
        "accountId": "111122223333",
        "accessKeyId": ""
    },
    "eventTime": "2022-11-10T16:24:34Z",
    "eventSource": "signin.amazonaws.com",
    "eventName": "ConsoleLogin",
    "awsRegion": "us-east-1",
    "sourceIPAddress": "192.0.2.0",
    "userAgent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_6) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/68.0.3440.106 Safari/537.36",
    "errorMessage": "Failed authentication",
    "requestParameters": null,
    "responseElements": {
        "ConsoleLogin": "Failure"
    },
    "additionalEventData": {
        "LoginTo": "https://console.aws.amazon.com/console/home?state=hashArgs%23&isauthcode=true",
        "MobileVersion": "Yes",
        "MFAIdentifier": "arn:aws:iam::111122223333:mfa/root-account-mfa-device",
        "MFAUsed": "YES"
    },
    "eventID": "deb1e1f9-c99b-4612-8e9f-21f93b5d79c0",
    "eventType": "AwsConsoleSignIn",
    "recipientAccountId": "111122223333"
}
```
"type": "Root",
"principalId": "AIDACKCEVSQ6C2EXAMPLE",
"arn": "arn:aws:iam::111122223333:root",
"accountId": "111122223333",
"accessKeyId": "EXAMPLE",
"sessionContext": {
  "sessionIssuer": {},
  "webIdFederationData": {},
  "attributes": {
    "mfaAuthenticated": "false",
    "creationDate": "2020-10-13T21:05:40Z"
  }
},
"eventTime": "2022-11-10T16:24:34Z",
"eventSource": "iam.amazonaws.com",
"eventName": "EnableMFADevice",
"awsRegion": "us-east-1",
"sourceIPAddress": "192.0.2.0",
"userAgent": "Coral/Netty4",
"requestParameters": {
  "userName": "AWS ROOT USER",
  "serialNumber": "arn:aws:iam::111122223333:mfa/root-account-mfa-device"
},
"responseElements": null,
"requestId": "EXAMPLE4-2cf7-4a44-af00-f61f0EXAMPLE",
"eventName": "PasswordUpdated",
"awsRegion": "us-east-1",
"sourceIPAddress": "192.0.2.0",
"userAgent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:78.0) Gecko/20100101 Firefox/78.0",
"requestParameters": null,
"responseElements": {
  "PasswordUpdated": "Success"
},
"eventTime": "2022-11-10T16:24:34Z",
"eventSource": "signin.amazonaws.com",
"eventName": "PasswordUpdated",
"awsRegion": "us-east-1",
"sourceIPAddress": "192.0.2.0",
"userAgent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:78.0) Gecko/20100101 Firefox/78.0",
"requestParameters": null,
"responseElements": {
  "PasswordUpdated": "Success"
},
"eventTime": "2022-11-10T16:24:34Z",
"eventSource": "signin.amazonaws.com",
"eventName": "PasswordUpdated",
"awsRegion": "us-east-1",
"sourceIPAddress": "192.0.2.0",
"userAgent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:78.0) Gecko/20100101 Firefox/78.0",
"requestParameters": null,
"responseElements": {
  "PasswordUpdated": "Success"
}
# Document history

The following table describes the important changes to the documentation for AWS CloudTrail. For notification about updates to this documentation, you can subscribe to an RSS feed.

- **API version**: 2013-11-01
- **Latest documentation update**: 2023-07-26

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Added service support (p. 458)</strong></td>
<td>This release supports AWS HealthImaging. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-healthimaging-supported-services-integrations.html">CloudTrail supported services and integrations</a> and <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-healthimaging-api-cloudtrail.html">Logging AWS HealthImaging API calls using AWS CloudTrail</a>.</td>
<td>July 26, 2023</td>
</tr>
<tr>
<td><strong>Added functionality (p. 458)</strong></td>
<td>You can now log CloudTrail data events on AWS HealthImaging data stores by using advanced event selectors. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-healthimaging-api-cloudtrail.html">Logging data events</a>.</td>
<td>July 26, 2023</td>
</tr>
<tr>
<td><strong>Added functionality (p. 458)</strong></td>
<td>You can now log CloudTrail data events on AWS Systems Manager control channels and Amazon Managed Blockchain networks by using advanced event selectors. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-healthimaging-api-cloudtrail.html">Logging data events</a>.</td>
<td>June 21, 2023</td>
</tr>
<tr>
<td><strong>Added functionality (p. 458)</strong></td>
<td>You can now verify your CloudTrail Lake saved query results using the <code>aws cloudtrail verify-query-results</code> command. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-cloudtrail-api-query-results.html">Validate saved query results with the AWS CLI</a>.</td>
<td>June 21, 2023</td>
</tr>
<tr>
<td><strong>Added service support (p. 458)</strong></td>
<td>This release supports Amazon Verified Permissions. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-verified-permissions-supported-services-integrations.html">CloudTrail supported services and integrations</a> and <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-verified-permissions-api-cloudtrail.html">Logging Amazon Verified Permissions API calls using AWS CloudTrail</a>.</td>
<td>June 13, 2023</td>
</tr>
<tr>
<td><strong>Added functionality (p. 458)</strong></td>
<td>You can now use CloudTrail Lake dashboards to visualize the events in an event data store. For more information, see <a href="https://docs.aws.amazon.com/awscrt/latest/userguide/aws-cloudtrail-api-query-results.html">View Lake dashboards</a>.</td>
<td>June 13, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on Amazon Verified Permissions policy stores by using advanced event selectors. For more information, see Logging data events.</td>
<td>June 13, 2023</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on an Amazon CodeWhisperer profile by using advanced event selectors. For more information, see Logging data events.</td>
<td>June 6, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now start and stop event ingestion on CloudTrail event data stores. For information about stopping event ingestion using the console, see Stop an event data store from ingesting events. For information about stopping event ingestion using the AWS CLI, see Stop ingestion on an event data store.</td>
<td>June 2, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on an Amazon EMR write-ahead log workspace by using advanced event selectors. For more information, see Logging data events.</td>
<td>May 31, 2023</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Security Lake. For more information, see CloudTrail supported services and integrations and Logging Amazon Security Lake API calls using AWS CloudTrail.</td>
<td>May 30, 2023</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Updated CloudTrail userIdentity element topic to include an example and field descriptions for a request made on behalf of an IAM Identity Center user. For more information, see CloudTrail userIdentity element.</td>
<td>May 23, 2023</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>This update supports the following patch release for the CloudTrail Processing Library: aws-cloudtrail-processing-library-1.6.1.jar. For more information, see Using the CloudTrail Processing Library and the CloudTrail Processing Library on GitHub.</td>
<td>May 23, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>CloudTrail Lake now supports all Presto functions and operators. For more information, see <a href="#">CloudTrail Lake SQL constraints</a>.</td>
<td>May 9, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on an Amazon GuardDuty detector by using advanced event selectors. For more information, see <a href="#">Logging data events</a> and <a href="#">Logging Amazon GuardDuty API calls with AWS CloudTrail</a>.</td>
<td>March 30, 2023</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Added new section about creating user-defined cost allocation tags for event data stores. For more information, see <a href="#">Creating user-defined cost allocation tags for CloudTrail Lake event data stores</a>.</td>
<td>March 24, 2023</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Telco Network Builder (AWS TNB). For more information, see <a href="#">CloudTrail supported services and integrations</a> and <a href="#">Logging AWS Telco Network Builder API calls using AWS CloudTrail</a>.</td>
<td>February 21, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on Amazon Cognito identity pools by using advanced event selectors. For more information, see <a href="#">Logging data events</a>.</td>
<td>February 15, 2023</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Added new section about the learning resources available for CloudTrail Lake. For more information, see <a href="#">Learning resources</a>.</td>
<td>February 9, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now create CloudTrail Lake integrations with event sources outside of AWS. You can log and store user activity data from any source in your hybrid environments, such as in-house or SaaS applications hosted on-premises or in the cloud, virtual machines, or containers. For more information, see <a href="#">Create an integration with an event source outside of AWS</a>.</td>
<td>January 31, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on CloudTrail PutAuditEvents activity on a CloudTrail Lake channel by using advanced event selectors. For more information, see Logging data events.</td>
<td>January 31, 2023</td>
</tr>
<tr>
<td>----------------------------</td>
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</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Asia Pacific (Melbourne) Region. For more information, see CloudTrail supported Regions.</td>
<td>January 24, 2023</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Added new section about managing data consistency in CloudTrail, see Managing data consistency in CloudTrail.</td>
<td>January 18, 2023</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on Amazon SageMaker feature stores by using advanced event selectors. For more information, see Logging data events.</td>
<td>December 27, 2022</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Marketplace Discovery. See AWS CloudTrail Supported Services and Integrations.</td>
<td>December 15, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on Amazon SageMaker metrics experiment trial components by using advanced event selectors. For more information, see Logging data events.</td>
<td>December 15, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now create an event data store to include AWS Config configuration items, and use the event data store to investigate non-compliant changes to your production environments. For more information, see Create an event data store for AWS Config configuration items.</td>
<td>November 28, 2022</td>
</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Asia Pacific (Hyderabad) Region. For more information, see CloudTrail supported Regions.</td>
<td>November 22, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on Amazon FinSpace environments by using advanced event selectors. For more information, see <a href="#">Logging data events</a>.</td>
<td>November 18, 2022</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Europe (Spain) Region. For more information, see <a href="#">CloudTrail supported Regions</a>.</td>
<td>November 16, 2022</td>
</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Europe (Zurich) Region. For more information, see <a href="#">CloudTrail supported Regions</a>.</td>
<td>November 9, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>The management account for an AWS Organizations organization can now add a delegated administrator to manage the organization's CloudTrail trails and event data stores. For more information, see <a href="#">Organization delegated administrator</a>.</td>
<td>November 7, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now enable AWS Key Management Service encryption for a CloudTrail Lake event data store. For more information, see <a href="#">Create an event data store</a>.</td>
<td>November 7, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now save CloudTrail Lake query results to an Amazon S3 bucket when you run a query. For more information about running a query, see <a href="#">Run a query and save query results</a>. For more information about downloading query results, see <a href="#">Get and download saved query results</a>.</td>
<td>October 21, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now copy CloudTrail trail events to a CloudTrail Lake event data store. For more information, see <a href="#">Copying trail events to CloudTrail Lake</a>.</td>
<td>September 19, 2022</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Added list of supported Amazon CloudWatch metrics for CloudTrail Lake. For more information, see <a href="#">Supported CloudWatch metrics</a>.</td>
<td>September 16, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now view CloudTrail service-linked channels using the AWS CLI. For more information, see Viewing service-linked channels for CloudTrail by using the AWS CLI.</td>
<td>September 9, 2022</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Middle East (UAE) Region. For more information, see CloudTrail supported Regions.</td>
<td>August 30, 2022</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>Added list of services that report TLS details to CloudTrail. For more information, see Services that support TLS details in CloudTrail.</td>
<td>July 19, 2022</td>
</tr>
<tr>
<td>Changed functionality (p. 458)</td>
<td>CloudTrail has changed the name of the managed policy AWSCloudTrailReadOnlyAccess to AWSCloudTrail_ReadOnlyAccess. Permissions in this policy have been scoped down. By default, the policy no longer grants permission to list all Amazon S3 buckets, AWS Lambda functions, or AWS KMS aliases. For more information, see Read-only access.</td>
<td>June 6, 2022</td>
</tr>
<tr>
<td>Changed functionality (p. 458)</td>
<td>As a security best practice, you can now add an aws:SourceArn or aws:SourceAccount condition key to an s3:GetBucketAcl ACL checking block in Amazon S3 bucket policies. For more information, see Configure Amazon S3 bucket policies for CloudTrail.</td>
<td>May 11, 2022</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>April 12, 2022</td>
<td>Added service support (p. 458) This release supports Amazon GameSparks. See AWS CloudTrail Supported Services and Integrations.</td>
<td></td>
</tr>
<tr>
<td>March 24, 2022</td>
<td>Added service support (p. 458) This release supports AWS App Mesh Envoy Management Service. See AWS CloudTrail Supported Services and Integrations.</td>
<td></td>
</tr>
<tr>
<td>March 18, 2022</td>
<td>Updated documentation (p. 458) New query examples have been added for CloudTrail Lake, a new feature that lets you run fine-grained, multiple-field SQL queries on your events. Also, a new field, BytesScanned, has been added to the query metadata results of DescribeQuery and GetQueryResults operations. For more information, see Working with CloudTrail Lake.</td>
<td></td>
</tr>
<tr>
<td>March 4, 2022</td>
<td>Changed functionality (p. 458) CloudTrail now removes the account ID of the Amazon S3 bucket owner in the resources block of a data event if both of the following conditions are met: the data event API call is from a different AWS account than the Amazon S3 bucket owner, and the API caller received an AccessDenied error that was only for the caller account. For more information, see Redacting bucket owner account IDs for data events called by other accounts.</td>
<td></td>
</tr>
<tr>
<td>March 3, 2022</td>
<td>Changed functionality (p. 458) Starting Feb 24, 2022, AWS CloudTrail began changing the userAgent and sourceIPAddress field values in any event that originated from an AWS Management Console session where a proxy client was used. For these events, CloudTrail replaces the values of the userAgent and sourceIPAddress fields with AWS Internal. CloudTrail made this change to standardize how it logs information for service actions across all AWS services. For more information, see CloudTrail record contents.</td>
<td></td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>This update supports the following release for the CloudTrail Processing Library: Added support for implementing a custom S3 manager, event logging to log file parsing-related exceptions, support for parsing an optional <code>errorCode</code> field in <code>insightDetails</code>, and updated the account ID parsing regex to accept non-numerical values. For more information, see <a href="https://docs.aws.amazon.com/AmazonCloudTrail/latest/APIReference/API_UsingTheProcessingLibrary.html">Using the CloudTrail Processing Library</a> and the <a href="https://github.com/aws/aws-cloudtrail-processing-library">CloudTrail Processing Library</a> on GitHub.</td>
<td>January 28, 2022</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>CloudTrail introduces CloudTrail Lake, a new feature that lets you run fine-grained, multiple-field SQL queries on your events. Events are aggregated into event data stores, which are immutable collections of events based on criteria that you select by applying advanced event selectors. For more information, see <a href="https://docs.aws.amazon.com/AmazonCloudTrail/latest/UserGuide/working-with-cloudtrail-lake.html">Working with CloudTrail Lake</a>.</td>
<td>January 5, 2022</td>
</tr>
<tr>
<td>New Region support (p. 458)</td>
<td>CloudTrail expanded support to a new Region, the Asia Pacific (Jakarta) Region. For more information, see <a href="https://docs.aws.amazon.com/AmazonCloudTrail/latest/UserGuide/cloudtrail-supported-regions.html">CloudTrail supported Regions</a>.</td>
<td>December 13, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon WorkSpaces Web. See <a href="https://docs.aws.amazon.com/AmazonCloudTrail/latest/UserGuide/cloudtrail-supported-sources.html">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 3, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on AWS Glue tables created by Lake Formation by using advanced event selectors. For more information, see <a href="https://docs.aws.amazon.com/AmazonCloudTrail/latest/UserGuide/working-with-cloudtrail-lake.html">Logging data events</a>.</td>
<td>November 30, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Resilience Hub. See AWS CloudTrail Supported Services and Integrations.</td>
<td>November 10, 2021</td>
</tr>
<tr>
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</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>A new CloudTrail Insights event type is available: error rate Insights events. An error rate Insights event captures unusual activity on an error that occurs on APIs called in your account. For more information, see Logging Insights events for trails.</td>
<td>November 10, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log CloudTrail data events on DynamoDB streams by using advanced event selectors. For more information, see Logging data events.</td>
<td>September 22, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on Amazon S3 access points. You can log Amazon S3 access point data events by using advanced event selectors. For more information, see Logging data events.</td>
<td>August 24, 2021</td>
</tr>
<tr>
<td>Changed functionality (p. 458)</td>
<td>When you configure a trail to send notifications to Amazon SNS, CloudTrail adds a policy statement to your SNS topic access policy that allows CloudTrail to send content to an SNS topic. As a security best practice, we recommend adding an <code>aws:SourceArn</code> or <code>aws:SourceAccount</code> condition key to the CloudTrail policy statement. For more information, see Amazon SNS topic policy for CloudTrail.</td>
<td>August 16, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Route 53 Application Recovery Controller. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>July 27, 2021</td>
</tr>
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</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on Amazon EBS direct APIs run on EBS snapshots. You can log Amazon EBS direct API data events by using advanced event selectors. For more information, see <a href="#">Logging data events</a>.</td>
<td>July 27, 2021</td>
</tr>
<tr>
<td>Changed functionality (p. 458)</td>
<td>When CloudTrail processes data events, it preserves numbers in their original format, whether that is an integer (int) or a float. In events that have integers in the fields of a data event, CloudTrail historically processed these numbers as floats. Now, CloudTrail keeps the original format of integers in data events. For more information, see <a href="#">Using the CloudTrail Processing Library</a>.</td>
<td>July 13, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now exclude Amazon RDS Data API management events from your trails. For more information, see <a href="#">Logging management events for trails</a>.</td>
<td>July 1, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS BugBust. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>June 24, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Managed Grafana and Amazon Managed Service for Prometheus. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>June 2, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS App Runner. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>May 18, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Systems Manager Incident Manager. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>May 10, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Service Quotas and Amazon EBS direct APIs. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>April 13, 2021</td>
</tr>
<tr>
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</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>After an IAM administrator configures <a href="#">AWS STS</a>, CloudTrail logs sourceIdentity information in events when users assume an IAM role, or perform any actions with the assumed role. For more information, see <a href="#">CloudTrail userIdentity Element</a>.</td>
<td>April 13, 2021</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>This update documents limits, in kilobytes (KB), for content in some CloudTrail event record fields. For more information, see <a href="#">CloudTrail record contents</a>.</td>
<td>April 8, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>After an IAM administrator configures <a href="#">AWS STS</a>, CloudTrail logs sourceIdentity information in events when users assume an IAM role, or perform any actions with the assumed role. For more information, see <a href="#">CloudTrail userIdentity Element</a>.</td>
<td>April 6, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on Amazon DynamoDB tables. You can log DynamoDB data events by using either event selectors or advanced event selectors. For more information, see <a href="#">Logging data events</a>.</td>
<td>March 23, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Managed Workflows for Apache Airflow. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>March 22, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on S3 Object Lambda access points if you have opted in to use advanced event selectors. For more information, see Logging data events.</td>
<td>March 18, 2021</td>
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</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Fault Injection Simulator. See AWS CloudTrail Supported Services and Integrations.</td>
<td>March 15, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on Ethereum nodes in Amazon Managed Blockchain if you have opted in to use advanced event selectors. For more information, see Logging data events.</td>
<td>March 1, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Managed Blockchain and the preview of Ethereum for Managed Blockchain. See AWS CloudTrail Supported Services and Integrations.</td>
<td>February 4, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Amplify. See AWS CloudTrail Supported Services and Integrations.</td>
<td>February 3, 2021</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Lookout for Metrics. See AWS CloudTrail Supported Services and Integrations.</td>
<td>February 1, 2021</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>This update supports the following patch release for the CloudTrail Processing Library: Update the .jar file references in the user guide to use the latest version, aws-cloudtrail-processing-library-1.4.0.jar. For more information, see Using the CloudTrail Processing Library and the CloudTrail Processing Library on GitHub.</td>
<td>January 12, 2021</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>You can now log data events on Amazon S3 on AWS Outposts. For more information, see Logging data events.</td>
<td>December 21, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Lookout for Equipment, AWS Well-Architected Tool, and Amazon Location Service. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 16, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS IoT Greengrass V2. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 15, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon EMR on EKS. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 10, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Audit Manager and Amazon HealthLake. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 8, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Lookout for Vision. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 1, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>The AWS CloudTrail event version is now 1.08. Version 1.08 introduces new fields for CloudTrail. For more information, see <a href="#">CloudTrail record contents</a>.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>AWS CloudTrail introduces advanced event selectors for data events. Advanced event selectors allow finer-grained control over the data events that you log to your trail. You can include or exclude data events for specific AWS resources, and select specific APIs on those resources to log to your trail. For more information, see <a href="#">Logging data events</a>.</td>
<td>November 24, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Network Firewall. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>November 17, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Trusted Advisor. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>October 22, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>Added two new examples of event records for root user sign-in events. For more information, see <a href="#">AWS Console sign-in events</a>.</td>
<td>October 13, 2020</td>
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</tr>
<tr>
<td>Changed functionality (p. 458)</td>
<td>Permissions in the AWSCloudTrail_FullAccess policy have been narrowed. This policy no longer allows you to delete Amazon SNS topics or Amazon S3 buckets, and the getObject action has been removed. For more information, see <a href="#">Granting custom permissions for CloudTrail users</a>.</td>
<td>September 29, 2020</td>
</tr>
<tr>
<td>Updated documentation (p. 458)</td>
<td>This update supports the following patch release for the CloudTrail Processing Library: Update the .jar file references in the user guide to use the latest version, aws-cloudtrail-processing-library-1.3.0.jar. For more information, see <a href="#">Using the CloudTrail Processing Library</a> and the <a href="#">CloudTrail Processing Library on GitHub</a>.</td>
<td>August 28, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Outposts. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>August 28, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>AWS CloudTrail Insights introduces attribution fields for CloudTrail Insights events. Attribution fields show the top user identities, user agents, and error codes that are associated with the anomalous activity that triggers Insights events. For comparison, attribution fields also show the top user identities, user agents, and error codes associated with normal, or baseline, activity. For more information, see <a href="#">Logging Insights events for trails</a>.</td>
<td>August 13, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>The AWS CloudTrail console has a new look that's designed to make it easier to use. The AWS CloudTrail User Guide has been updated with changes to procedures for how to perform tasks in the console, such as creating trails, updating trails, and downloading event history.</td>
<td>August 13, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Interactive Video Service. See AWS CloudTrail Supported Services and Integrations.</td>
<td>July 15, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Honeycode. See AWS CloudTrail Supported Services and Integrations.</td>
<td>June 24, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Macie. See AWS CloudTrail Supported Services and Integrations.</td>
<td>May 19, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Kendra. See AWS CloudTrail Supported Services and Integrations.</td>
<td>May 13, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS IoT SiteWise. See AWS CloudTrail Supported Services and Integrations.</td>
<td>April 29, 2020</td>
</tr>
<tr>
<td>Added Region support (p. 458)</td>
<td>This release supports an additional Region: Europe (Milan). See AWS CloudTrail Supported Regions.</td>
<td>April 28, 2020</td>
</tr>
<tr>
<td>Added service and Region support (p. 458)</td>
<td>This release supports Amazon AppFlow. See AWS CloudTrail Supported Services and Integrations. Support has also been added for the Africa (Cape Town) Region. See AWS CloudTrail Supported Regions.</td>
<td>April 22, 2020</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>High-volume AWS KMS actions such as Encrypt, Decrypt, and GenerateDataKey are now logged as Read events. If you choose to log all AWS KMS events on your trail, and also choose to log Write management events, your trail logs relevant AWS KMS actions like Disable, Delete and ScheduleKey.</td>
<td>April 7, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon CodeGuru Reviewer. See AWS CloudTrail Supported Services and Integrations.</td>
<td>February 7, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
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<tr>
<td>This release supports Amazon Managed Apache Cassandra Service. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>This release supports Amazon Connect. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>January 17, 2020</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
</tr>
<tr>
<td>This release supports Amazon Connect. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>This update supports the following patch release for the CloudTrail Processing Library: Update the .jar file references in the user guide to use the latest version, aws-cloudtrail-processing-library-1.2.0.jar. For more information, see Using the CloudTrail Processing Library and the CloudTrail Processing Library on GitHub.</td>
<td>November 21, 2019</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>Added functionality (p. 458)</td>
<td>Added functionality (p. 458)</td>
</tr>
<tr>
<td>This release supports AWS CloudTrail Insights for helping you detect unusual activity in your account. See Logging Insights events for Trails.</td>
<td>This release adds an option for filtering AWS Key Management Service events out of a trail. See Creating a Trail.</td>
<td>November 20, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
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<tr>
<td>This release supports AWS CodeStar Notifications. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>This release supports adding tags when you create a trail in CloudTrail, whether you use the CloudTrail console or API. This release adds two new APIs, GetTrail and ListTrails.</td>
<td>November 7, 2019</td>
</tr>
<tr>
<td>Added functionality (p. 458)</td>
<td>Added service support (p. 458)</td>
<td>Added service support (p. 458)</td>
</tr>
<tr>
<td>This release supports AWS App Mesh. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>This release supports Amazon Translate. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>October 17, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
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<td></td>
</tr>
<tr>
<td>This release supports Amazon App Mesh. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td></td>
<td>October 17, 2019</td>
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<td>Date</td>
<td>Description</td>
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</tr>
<tr>
<td>October 7, 2019</td>
<td>The Unsupported Services topic has been restored and updated to include only those AWS services that do not currently log events in CloudTrail. See <a href="#">CloudTrail Unsupported Services</a>.</td>
<td></td>
</tr>
<tr>
<td>September 24, 2019</td>
<td>The documentation has been updated with changes to the AWSCloudTrailFullAccess policy. A policy example that shows equivalent permissions to AWSCloudTrailFullAccess has been updated to restrict the resources on which the iam:PassRole action can act to those matching the following condition statement: &quot;iam:PassedToService&quot;: &quot;cloudtrail.amazonaws.com&quot;. See <a href="#">AWS CloudTrail Identity-Based Policy Examples</a>.</td>
<td></td>
</tr>
<tr>
<td>September 3, 2019</td>
<td>The documentation has been updated with a new topic, <a href="#">Managing CloudTrail Costs</a>, to help you get the log data you need out of CloudTrail while staying within a budget.</td>
<td></td>
</tr>
<tr>
<td>August 13, 2019</td>
<td>This release supports AWS Control Tower. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td></td>
</tr>
<tr>
<td>July 29, 2019</td>
<td>This release supports an additional Region: Middle East (Bahrain). See <a href="#">AWS CloudTrail Supported Regions</a>.</td>
<td></td>
</tr>
<tr>
<td>July 3, 2019</td>
<td>The documentation has been updated with information about security for CloudTrail. See <a href="#">Security in AWS CloudTrail</a>.</td>
<td></td>
</tr>
<tr>
<td>June 6, 2019</td>
<td>This release supports AWS Ground Station. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
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</tr>
<tr>
<td>June 4, 2019</td>
<td>This release supports AWS IoT Things Graph. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td></td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon AppStream 2.0. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>April 25, 2019</td>
</tr>
<tr>
<td>Added Region support (p. 458)</td>
<td>This release supports an additional Region: Asia Pacific (Hong Kong). See <a href="https://aws.amazon.com/cloudtrail/supported-regions/">AWS CloudTrail Supported Regions</a>.</td>
<td>April 24, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Kinesis Data Analytics. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>March 22, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Backup. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>February 4, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon WorkLink. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>January 23, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Cloud9. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>January 21, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Elemental MediaLive. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>January 19, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports Amazon Comprehend. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>January 18, 2019</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Elemental MediaPackage. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 21, 2018</td>
</tr>
<tr>
<td>Added Region support (p. 458)</td>
<td>This release supports an additional Region: EU (Stockholm). See <a href="https://aws.amazon.com/cloudtrail/supported-regions/">AWS CloudTrail Supported Regions</a>.</td>
<td>December 11, 2018</td>
</tr>
<tr>
<td>Documentation update (p. 458)</td>
<td>The documentation has been updated with information about supported and unsupported services. See <a href="https://aws.amazon.com/cloudtrail/supported-services/">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>December 3, 2018</td>
</tr>
</tbody>
</table>
### Added service support (p. 458)

This release supports AWS Resource Access Manager (AWS RAM). See [AWS CloudTrail Supported Services and Integrations](#).

**November 20, 2018**

### Updated functionality (p. 458)

This release supports creating a trail in CloudTrail that logs events for all AWS accounts in an organization in AWS Organizations. See [Creating a Trail for an Organization](#).

**November 19, 2018**

### Added service support (p. 458)

This release supports Amazon Pinpoint SMS and Voice API. See [AWS CloudTrail Supported Services and Integrations](#).

**November 16, 2018**

### Added service support (p. 458)

This release supports AWS IoT Greengrass. See [AWS CloudTrail Supported Services and Integrations](#).

**October 29, 2018**

### Updated documentation (p. 458)

This update supports the following patch release for the CloudTrail Processing Library: Update the .jar file references in the user guide to use the latest version, aws-cloudtrail-processing-library-1.1.3.jar. For more information, see [Using the CloudTrail Processing Library](#) and the [CloudTrail Processing Library](#) on GitHub.

**October 18, 2018**

### Added functionality (p. 458)

This release supports using additional filters in Event history. See [Viewing CloudTrail Events in the CloudTrail Console](#).

**October 18, 2018**

### Added functionality (p. 458)

This release supports using Amazon Virtual Private Cloud (Amazon VPC) to establish a private connection between your VPC and AWS CloudTrail. See [Using AWS CloudTrail with Interface VPC Endpoints](#).

**August 9, 2018**

### Added service support (p. 458)

This release supports Amazon Data Lifecycle Manager. See [AWS CloudTrail Supported Services and Integrations](#).

**July 24, 2018**

### Added service support (p. 458)

This release supports Amazon MQ. See [AWS CloudTrail Supported Services and Integrations](#).

**July 19, 2018**
### Earlier updates

The following table describes the documentation release history of AWS CloudTrail prior to June 29, 2018.

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added service support (p. 458)</td>
<td>This release supports AWS Mobile CLI. See <a href="#">AWS CloudTrail Supported Services and Integrations</a>.</td>
<td>June 29, 2018</td>
</tr>
<tr>
<td>Added service support (p. 458)</td>
<td>You can now receive notification about updates to the AWS CloudTrail documentation by subscribing to an RSS feed.</td>
<td>June 29, 2018</td>
</tr>
</tbody>
</table>

### More information

- [AWS CloudTrail Supported Services and Integrations](#)
- [Viewing events with CloudTrail Event history (p. 57)](#)
- [Using the CloudTrail Processing Library (p. 344)](#)
- [CloudTrail Processing Library](#)
- [AWS CloudTrail documentation history notification available through RSS feed (p. 458)](#)

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**Version 1.0**

477
<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added service support</td>
<td>This release supports AWS X-Ray. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 25, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS IoT Analytics. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 23, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Secrets Manager. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 10, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Rekognition. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 6, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Private Certificate Authority (PCA). See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 4, 2018</td>
</tr>
<tr>
<td>Added functionality</td>
<td>This release supports making it easier to search CloudTrail log files with Amazon Athena. You can automatically create tables for querying logs directly from the CloudTrail console, and use those tables to run queries in Athena. For more information, see [CloudTrail supported services and integrations](p. 27) and [Creating a Table for CloudTrail Logs in the CloudTrail Console](p. 27).</td>
<td>March 15, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS AppSync. See [CloudTrail supported services and integrations](p. 27).</td>
<td>February 13, 2018</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports an additional Region: Asia Pacific (Osaka) (ap-northeast-3). See [CloudTrail supported Regions](p. 19).</td>
<td>February 12, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Shield. See [CloudTrail supported services and integrations](p. 27).</td>
<td>February 12, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon SageMaker. See [CloudTrail supported services and integrations](p. 27).</td>
<td>January 11, 2018</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Batch. See [CloudTrail supported services and integrations](p. 27).</td>
<td>January 10, 2018</td>
</tr>
<tr>
<td>Added functionality</td>
<td>This release supports extending the amount of account activity that is available in CloudTrail event history to 90 days. You can also customize the display of columns to improve the view of your CloudTrail events. For more information, see [Viewing events with CloudTrail Event history](p. 57).</td>
<td>December 12, 2017</td>
</tr>
</tbody>
</table>
## Earlier updates

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Added service support</strong></td>
<td>This release supports Amazon WorkMail. See [CloudTrail supported services and integrations (p. 27)]</td>
<td>December 12, 2017</td>
</tr>
<tr>
<td><strong>Added service support</strong></td>
<td>This release supports Alexa for Business, AWS Elemental MediaConvert, and AWS Elemental MediaStore. See [CloudTrail supported services and integrations (p. 27)]</td>
<td>December 1, 2017</td>
</tr>
<tr>
<td><strong>Added functionality and documentation</strong></td>
<td>This release supports logging data events for AWS Lambda functions. For more information, see [Logging data events (p. 256)]</td>
<td>November 30, 2017</td>
</tr>
<tr>
<td><strong>Added functionality and documentation</strong></td>
<td>This release supports logging data events for AWS Lambda functions. For more information, see [Logging data events (p. 256)]</td>
<td>November 30, 2017</td>
</tr>
</tbody>
</table>
| **Added functionality and documentation** | This release supports the following updates to the CloudTrail Processing Library:  
• Add support for Boolean identification of management events.  
• Update the CloudTrail event version to 1.06.
For more information, see [Using the CloudTrail Processing Library (p. 344)] and the [CloudTrail Processing Library](https://github.com/aws/aws-cloudtrail) on GitHub. | November 30, 2017 |
<p>| <strong>Added service support</strong>       | This release supports AWS Glue. See [CloudTrail supported services and integrations (p. 27)]                                               | November 7, 2017 |
| <strong>New documentation</strong>           | This release adds a new topic, [Quotas in AWS CloudTrail (p. 42)]                                                                           | October 19, 2017 |
| <strong>Updated documentation</strong>       | This release updates the documentation of APIs supported in CloudTrail event history for Amazon Athena, AWS CodeBuild, Amazon Elastic Container Registry, and AWS Migration Hub. | October 13, 2017 |
| <strong>Added service support</strong>       | This release supports Amazon Chime. See [CloudTrail supported services and integrations (p. 27)]                                           | September 27, 2017 |
| <strong>Added functionality and documentation</strong> | This release supports configuring data event logging for all Amazon S3 buckets in your AWS account. See [Logging data events (p. 256)] | September 20, 2017 |
| <strong>Added service support</strong>       | This release supports Amazon Lex. See [CloudTrail supported services and integrations (p. 27)]                                           | August 15, 2017  |
| <strong>Added service support</strong>       | This release supports AWS Migration Hub. See [CloudTrail supported services and integrations (p. 27)]                                        | August 14, 2017  |</p>
<table>
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<tr>
<th>Change</th>
<th>Description</th>
<th>Release Date</th>
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</thead>
<tbody>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports CloudTrail being enabled by default for all AWS accounts. The past seven days of account activity are available in CloudTrail event history, and the most recent events appear on the console dashboard. The feature formerly known as API activity history has been replaced by Event history.</td>
<td>August 14, 2017</td>
</tr>
<tr>
<td></td>
<td>For more information, see <a href="#">How CloudTrail works</a>.</td>
<td></td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports downloading events from the CloudTrail console on the API activity history page. You can download events in JSON or CSV format.</td>
<td>July 27, 2017</td>
</tr>
<tr>
<td></td>
<td>For more information, see <a href="#">Downloading events</a>.</td>
<td></td>
</tr>
<tr>
<td>Added functionality</td>
<td>This release supports logging Amazon S3 object level API operations in two additional Regions, Europe (London) and Canada (Central).</td>
<td>July 19, 2017</td>
</tr>
<tr>
<td></td>
<td>For more information, see <a href="#">Working with CloudTrail log files</a>.</td>
<td></td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports looking up APIs for Amazon CloudWatch Events in the CloudTrail API activity history feature.</td>
<td>June 27, 2017</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports additional APIs in the CloudTrail API activity history feature for the following services:</td>
<td>June 27, 2017</td>
</tr>
<tr>
<td></td>
<td>• AWS CloudHSM</td>
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<td></td>
<td>• Amazon Cognito</td>
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<td></td>
<td>• Amazon DynamoDB</td>
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<td></td>
<td>• Amazon EC2</td>
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<td></td>
<td>• Kinesis</td>
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<td></td>
<td>• AWS Storage Gateway</td>
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</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS CodeStar. See <a href="#">CloudTrail supported services and integrations</a>.</td>
<td>June 14, 2017</td>
</tr>
</tbody>
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### Earlier updates

<table>
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<tr>
<th>Change</th>
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<th>Release Date</th>
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<tbody>
<tr>
<td>Added functionality and</td>
<td>This release supports the following updates to the CloudTrail Processing Library:</td>
<td>June 1, 2017</td>
</tr>
<tr>
<td>documentation</td>
<td>• Add support for different formats for SQS messages from the same SQS queue to identify CloudTrail log files. The following formats are supported:</td>
<td></td>
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<tr>
<td></td>
<td>• Notifications that CloudTrail sends to an SNS topic</td>
<td></td>
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<tr>
<td></td>
<td>• Notifications that Amazon S3 sends to an SNS topic</td>
<td></td>
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<tr>
<td></td>
<td>• Notifications that Amazon S3 sends directly to an SQS queue</td>
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<td></td>
<td>• Add support for the <code>deleteMessageUponFailure</code> property, which you can use to delete messages that can't be processed.</td>
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</tr>
<tr>
<td></td>
<td>For more information, see [Using the CloudTrail Processing Library](p. 344) and the <a href="https://github.com/aws/aws-iot">CloudTrail Processing Library</a> on GitHub.</td>
<td></td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Athena. See [CloudTrail supported services and integrations](p. 27).</td>
<td>May 19, 2017</td>
</tr>
<tr>
<td>Added functionality</td>
<td>This release supports sending data events to Amazon CloudWatch Logs.</td>
<td>May 9, 2017</td>
</tr>
<tr>
<td></td>
<td>For more information about configuring your trail to log data events, see [Data events](p. 257).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>For more information about sending events to CloudWatch Logs, see [Monitoring CloudTrail Log Files with Amazon CloudWatch Logs](p. 294).</td>
<td></td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports the AWS Marketplace Metering Service. See [CloudTrail supported services and integrations](p. 27).</td>
<td>May 2, 2017</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon QuickSight. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 28, 2017</td>
</tr>
<tr>
<td>Added functionality and</td>
<td>This release supports an updated console experience for creating new trails. You can now configure a new trail to log management and data events. For more information, see [Creating a trail](p. 85).</td>
<td>April 11, 2017</td>
</tr>
<tr>
<td>documentation</td>
<td>If CloudTrail is not delivering logs to your S3 bucket or sending SNS notifications from some Regions in your account, you may need to update the policies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To learn more about updating your S3 bucket policy, see [Common Amazon S3 policy configuration errors](p. 383).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To learn more about updating your SNS topic policy, see [Common SNS policy configuration errors](p. 390).</td>
<td></td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Release Date</td>
</tr>
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</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Organizations. See [CloudTrail supported services and integrations](p. 27).</td>
<td>February 27, 2017</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports an updated console experience for configuring trails for logging management and data events. For more information, see [Working with CloudTrail log files](p. 246).</td>
<td>February 10, 2017</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Cloud Directory. See [CloudTrail supported services and integrations](p. 27).</td>
<td>January 26, 2017</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports looking up APIs for AWS CodeCommit, Amazon GameLift, and AWS Managed Services in the CloudTrail API activity history.</td>
<td>January 26, 2017</td>
</tr>
<tr>
<td>Added functionality</td>
<td>This release supports integration with the AWS Health Dashboard. You can use the AWS Health Dashboard to identify if your trails are unable to deliver logs to an SNS topic or S3 bucket. This can occur when there is an issue with the policy for the S3 bucket or SNS topic. AWS Health Dashboard notifies you about the affected trails and recommends ways to fix the policy. For more information, see the [AWS Health User Guide](p. 474).</td>
<td>January 24, 2017</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports filtering by event source in the CloudTrail console. Event source shows the AWS service to which the request was made. For more information, see [Viewing CloudTrail events in the CloudTrail console](p. 58).</td>
<td>January 12, 2017</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS CodeCommit. See [CloudTrail supported services and integrations](p. 27).</td>
<td>January 11, 2017</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Lightsail. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 23, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Managed Services. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 21, 2016</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports the Europe (London) Region. See [CloudTrail supported Regions](p. 19).</td>
<td>December 13, 2016</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports the Canada (Central) Region. See [CloudTrail supported Regions](p. 19).</td>
<td>December 8, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS CodeBuild. See [CloudTrail supported services and integrations](p. 27). This release supports AWS Health. See [CloudTrail supported services and integrations](p. 27). This release supports AWS Step Functions. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 1, 2016</td>
</tr>
</tbody>
</table>
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<tbody>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Polly. See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>November 30, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS OpsWorks for Chef Automate. See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>November 23, 2016</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports configuring your trail to log read-only, write-only, or all events. CloudTrail supports logging Amazon S3 object level API operations such as GetObject, PutObject, and DeleteObject. You can configure your trails to log object level API operations. For more information, see <a href="https://docs.aws.amazon.com/">Working with CloudTrail log files (p. 246)</a>.</td>
<td>November 21, 2016</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports additional values for the type field in the userIdentity element: AWSAccount and AWSService. For more information, see the <a href="https://docs.aws.amazon.com/">Fields (p. 437)</a> for userIdentity.</td>
<td>November 16, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Application Auto Scaling. See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>October 31, 2016</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports the US East (Ohio) Region. See <a href="https://docs.aws.amazon.com/">CloudTrail supported Regions (p. 19)</a>.</td>
<td>October 17, 2016</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports logging non-API AWS service events. For more information, see <a href="https://docs.aws.amazon.com/">AWS service events (p. 450)</a>.</td>
<td>September 23, 2016</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports using the CloudTrail console to view resource types that are supported by AWS Config. For more information, see <a href="https://docs.aws.amazon.com/">Viewing resources referenced with AWS Config (p. 62)</a>.</td>
<td>July 7, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Service Catalog. See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>July 6, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Elastic File System (Amazon EFS). See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>June 28, 2016</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports one additional Region: ap-south-1 (Asia Pacific (Mumbai)). See <a href="https://docs.aws.amazon.com/">CloudTrail supported Regions (p. 19)</a>.</td>
<td>June 27, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Application Discovery Service. See <a href="https://docs.aws.amazon.com/">CloudTrail supported services and integrations (p. 27)</a>.</td>
<td>May 12, 2016</td>
</tr>
<tr>
<td>Change</td>
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<td>-----------------------------------------</td>
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</tr>
<tr>
<td>Added service support</td>
<td>This release supports CloudWatch Logs in the South America (São Paulo) Region. For more information, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).</td>
<td>May 6, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS WAF. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 28, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Support. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 21, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Inspector. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 20, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS IoT. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 11, 2016</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports logging AWS Security Token Service (AWS STS) API calls made with Security Assertion Markup Language (SAML) and web identity federation. For more information, see Values for AWS STS APIs with SAML and web identity federation (p. 441).</td>
<td>March 28, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Certificate Manager. See CloudTrail supported services and integrations (p. 27).</td>
<td>March 25, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Kinesis Data Firehose. See CloudTrail supported services and integrations (p. 27).</td>
<td>March 17, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon CloudWatch Logs. See CloudTrail supported services and integrations (p. 27).</td>
<td>March 10, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Cognito. See CloudTrail supported services and integrations (p. 27).</td>
<td>February 18, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Database Migration Service. See CloudTrail supported services and integrations (p. 27).</td>
<td>February 4, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon GameLift (Amazon GameLift). See CloudTrail supported services and integrations (p. 27).</td>
<td>January 27, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon CloudWatch Events. See CloudTrail supported services and integrations (p. 27).</td>
<td>January 16, 2016</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports one additional Region: ap-northeast-2 (Asia Pacific (Seoul)). See CloudTrail supported Regions (p. 19).</td>
<td>January 6, 2016</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Elastic Container Registry (Amazon ECR). See CloudTrail supported services and integrations (p. 27).</td>
<td>December 21, 2015</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Release Date</td>
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<td>--------</td>
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</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports turning on CloudTrail across all Regions and support for multiple trails per Region. For more information, see How does CloudTrail behave regionally and globally? (p. 16).</td>
<td>December 17, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Machine Learning. See CloudTrail supported services and integrations (p. 27).</td>
<td>December 10, 2015</td>
</tr>
<tr>
<td>Added functionality and documentation</td>
<td>This release supports log file encryption, log file integrity validation, and tagging. For more information, see Encrypting CloudTrail log files with AWS KMS keys (SSE-KMS) (p. 403), Validating CloudTrail log file integrity (p. 324), and Updating a trail (p. 96).</td>
<td>October 1, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon OpenSearch Service. See CloudTrail supported services and integrations (p. 27).</td>
<td>October 1, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon S3 bucket level events. See CloudTrail supported services and integrations (p. 27).</td>
<td>September 1, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Device Farm. See CloudTrail supported services and integrations (p. 27).</td>
<td>July 13, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon API Gateway. See CloudTrail supported services and integrations (p. 27).</td>
<td>July 9, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports CodePipeline. See CloudTrail supported services and integrations (p. 27).</td>
<td>July 9, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon DynamoDB. See CloudTrail supported services and integrations (p. 27).</td>
<td>May 28, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports CloudWatch Logs in the US West (N. California) Region. See the CloudTrail release notes. For more information about CloudTrail support for CloudWatch Logs monitoring, see Monitoring CloudTrail Log Files with Amazon CloudWatch Logs (p. 294).</td>
<td>May 19, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Directory Service. See CloudTrail supported services and integrations (p. 27).</td>
<td>May 14, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Simple Email Service (Amazon SES). See CloudTrail supported services and integrations (p. 27).</td>
<td>May 7, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Elastic Container Service See CloudTrail supported services and integrations (p. 27).</td>
<td>April 9, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Lambda. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 9, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon WorkSpaces. See CloudTrail supported services and integrations (p. 27).</td>
<td>April 9, 2015</td>
</tr>
</tbody>
</table>
## AWS CloudTrail User Guide

### Earlier updates

<table>
<thead>
<tr>
<th>Change</th>
<th>Description</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>This release supports the lookup of AWS activity captured by CloudTrail (CloudTrail events). You can look up and filter events in your account related to creation, modification, or deletion. To look up these events, you can use the CloudTrail console, the AWS Command Line Interface (AWS CLI), or the AWS SDK. For more information, see [Viewing events with CloudTrail Event history](p. 57).</td>
<td>March 12, 2015</td>
<td></td>
</tr>
<tr>
<td>Added service support and new documentation</td>
<td>This release supports Amazon CloudWatch Logs in the Asia Pacific (Singapore), Asia Pacific (Sydney), Asia Pacific (Tokyo), and Europe (Frankfurt) Regions. For more information, see [Sending events to CloudWatch Logs](p. 57).</td>
<td>March 5, 2015</td>
</tr>
<tr>
<td>New documentation</td>
<td>A new section that describes CloudTrail support for AWS Security Token Service (AWS STS) regional endpoints has been added to the [CloudTrail Concepts](p. 57) page.</td>
<td>February 17, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Route 53. See [CloudTrail supported services and integrations](p. 27).</td>
<td>February 11, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Config. See [CloudTrail supported services and integrations](p. 27).</td>
<td>February 10, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS CloudHSM. See [CloudTrail supported services and integrations](p. 27).</td>
<td>January 8, 2015</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS CodeDeploy. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 17, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Storage Gateway. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 16, 2014</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports one additional Region: us-gov-west-1 (AWS GovCloud (US-West)). See [CloudTrail supported Regions](p. 19).</td>
<td>December 16, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon S3 Glacier. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 11, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Data Pipeline. See [CloudTrail supported services and integrations](p. 27).</td>
<td>December 2, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports AWS Key Management Service. See [CloudTrail supported services and integrations](p. 27).</td>
<td>November 12, 2014</td>
</tr>
<tr>
<td>New documentation</td>
<td>A new section, [Monitoring CloudTrail Log Files with Amazon CloudWatch Logs](p. 294), has been added to the guide. It describes how to use Amazon CloudWatch Logs to monitor CloudTrail log events.</td>
<td>November 10, 2014</td>
</tr>
<tr>
<td>New documentation</td>
<td>A new section, [Using the CloudTrail Processing Library](p. 344), has been added to the guide. It provides information about how to write a CloudTrail log processor in Java using the AWS CloudTrail Processing Library.</td>
<td>November 5, 2014</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Release Date</td>
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<tr>
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</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Elastic Transcoder. See CloudTrail supported services and integrations (p. 27).</td>
<td>October 27, 2014</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports one additional region: eu-central-1 (Europe (Frankfurt)). See CloudTrail supported Regions (p. 19).</td>
<td>October 23, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon CloudSearch. See CloudTrail supported services and integrations (p. 27).</td>
<td>October 16, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Simple Notification Service. See CloudTrail supported services and integrations (p. 27).</td>
<td>October 09, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon ElastiCache. See CloudTrail supported services and integrations (p. 27).</td>
<td>September 15, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon WorkDocs. See CloudTrail supported services and integrations (p. 27).</td>
<td>August 27, 2014</td>
</tr>
<tr>
<td>Added new content</td>
<td>This release includes a topic that discusses logging sign-in events. See AWS Management Console sign-in events (p. 451).</td>
<td>July 24, 2014</td>
</tr>
<tr>
<td>Added new content</td>
<td>The eventVersion element for this release has been upgraded to version 1.02 and three new fields have been added. See CloudTrail record contents (p. 422).</td>
<td>July 18, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Auto Scaling (see CloudTrail supported services and integrations (p. 27)).</td>
<td>July 17, 2014</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports three additional Regions: ap-southeast-1 (Asia Pacific (Singapore)), ap-northeast-1 (Asia Pacific (Tokyo)), sa-east-1 (South America (São Paulo)). See CloudTrail supported Regions (p. 19).</td>
<td>June 30, 2014</td>
</tr>
<tr>
<td>Additional service support</td>
<td>This release supports Amazon Redshift. See CloudTrail supported services and integrations (p. 27).</td>
<td>June 10, 2014</td>
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<tr>
<td>Added service support</td>
<td>This release supports AWS OpsWorks. See CloudTrail supported services and integrations (p. 27).</td>
<td>June 5, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon CloudFront. See CloudTrail supported services and integrations (p. 27).</td>
<td>May 28, 2014</td>
</tr>
<tr>
<td>Added Region support</td>
<td>This release supports three additional Regions: us-west-1 (US West (N. California)), eu-west-1 (Europe (Ireland)), ap-southeast-2 (Asia Pacific (Sydney)). See CloudTrail supported Regions (p. 19).</td>
<td>May 13, 2014</td>
</tr>
<tr>
<td>Added service support</td>
<td>This release supports Amazon Simple Workflow Service. See CloudTrail supported services and integrations (p. 27).</td>
<td>May 9, 2014</td>
</tr>
<tr>
<td>Added new content</td>
<td>This release includes topics that discuss sharing log files between accounts. See Sharing CloudTrail log files between AWS accounts (p. 315).</td>
<td>May 2, 2014</td>
</tr>
<tr>
<td>Change</td>
<td>Description</td>
<td>Release Date</td>
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<tr>
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<tr>
<td>Added service support</td>
<td>This release supports Amazon CloudWatch. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 28, 2014</td>
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<tr>
<td>Added service support</td>
<td>This release supports Amazon Kinesis. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 22, 2014</td>
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<tr>
<td>Added service support</td>
<td>This release supports AWS Direct Connect. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 11, 2014</td>
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<tr>
<td>Added service support</td>
<td>This release supports Amazon EMR. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 4, 2014</td>
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<tr>
<td>Added service support</td>
<td>This release supports Elastic Beanstalk. See [CloudTrail supported services and integrations](p. 27).</td>
<td>April 2, 2014</td>
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<tr>
<td>Additional service support</td>
<td>This release supports AWS CloudFormation. See [CloudTrail supported services and integrations](p. 27).</td>
<td>March 7, 2014</td>
</tr>
<tr>
<td>New guide</td>
<td>This release introduces AWS CloudTrail.</td>
<td>November 13, 2013</td>
</tr>
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</table>
AWS glossary

For the latest AWS terminology, see the AWS glossary in the AWS Glossary Reference.