亚马逊云科技

User Guide

Amazon CloudWatch Logs

Amazon CloudWatch Logs: User Guide

Table of Contents

What is Amazon CloudWatch Logs?

You can use Amazon CloudWatch Logs to monitor, store, and access your log files from Amazon Elastic Compute Cloud (Amazon EC2) instances, Amazon CloudTrail, Route 53, and other sources.

CloudWatch Logs enables you to centralize the logs from all of your systems, applications, and Amazon services that you use, in a single, highly scalable service. You can then easily view them, search them for specific error codes or patterns, filter them based on specific fields, or archive them securely for future analysis. CloudWatch Logs enables you to see all of your logs, regardless of their source, as a single and consistent flow of events ordered by time.

CloudWatch Logs also supports querying your logs with a powerful query language, auditing and masking sensitive data in logs, and generating metrics from logs using filters or an embedded log format.

CloudWatch Logs supports two *log classes*. Log groups in the *CloudWatch Logs Standard log class* support all CloudWatch Logs features. Log groups in the *CloudWatch Logs Infrequent Access log class* incur lower ingestion charges and support a subset of the Standard class capabilities. For more information, see Log classes.

Features

- **Two log classes for flexibility** – CloudWatch Logs offers two log classes so that you can have a cost-effective option for logs that you access infrequently. You also have a full-featured option for logs that require real-time monitoring or other features. For more information, see Log classes.
- **Query your log data** – You can use CloudWatch Logs Insights to interactively search and analyze your log data. You can perform queries to help you more efficiently and effectively respond to operational issues. CloudWatch Logs Insights includes a purpose-built query language with a few simple but powerful commands. We provide sample queries, command descriptions, query autocompletion, and log field discovery to help you get started. Sample queries are included for several types of Amazon service logs. To get started, see Analyzing log data with CloudWatch Logs Insights.
- **Create field indexes to make queries more efficient** – You can create *field indexes* of fields in your log events. When you then use a field index in a CloudWatch Logs Insights query, the query attempts to skip processing log events that are known to not include the indexed field. This

query reduces the scan volume of your queries, making it possible to return results faster. To get started, see Create field indexes to improve query performance and reduce scan volume.

- **Detect and debug using Live Tail** – You can use Live Tail to quickly troubleshoot incidents by viewing a streaming list of new log events as they are ingested. You can view, filter, and highlight ingested logs in near real time, helping you to detect and resolve issues quickly. You can filter the logs based on terms you specify, and also highlight logs that contain specified terms to help you quickly find what you are looking for. For more information, see Troubleshoot with CloudWatch Logs Live Tail.
- **Monitor logs from Amazon EC2 instances** – You can use CloudWatch Logs to monitor applications and systems using log data. For example, CloudWatch Logs can track the number of errors that occur in your application logs and send you a notification whenever the rate of errors exceeds a threshold you specify. CloudWatch Logs uses your log data for monitoring; so, no code changes are required. For example, you can monitor application logs for specific literal terms (such as "NullReferenceException") or count the number of occurrences of a literal term at a particular position in log data (such as "404" status codes in an Apache access log). When the term you are searching for is found, CloudWatch Logs reports the data to a CloudWatch metric that you specify. Log data is encrypted while in transit and while it is at rest. To get started, see Getting started with CloudWatch Logs.
- **Monitor Amazon CloudTrail logged events** – You can create alarms in CloudWatch and receive notifications of particular API activity as captured by CloudTrail and use the notification to perform troubleshooting. To get started, see Sending CloudTrail Events to CloudWatch Logs in the *Amazon CloudTrail User Guide*.
- **Audit and mask sensitive data** – If you have sensitive data in your logs, you can help safeguard it with *data protection policies*. These policies let you audit and mask the sensitive data. If you enable data protection, then by default, sensitive data that matches the data identifiers you select is masked. For more information, see Help protect sensitive log data with masking.
- **Log retention** – By default, logs are kept indefinitely and never expire. You can adjust the retention policy for each log group, keeping the indefinite retention, or choosing a retention period between 10 years and one day.
- **Archive log data** – You can use CloudWatch Logs to store your log data in highly durable storage. The CloudWatch Logs agent makes it easy to quickly send both rotated and non-rotated log data off of a host and into the log service. You can then access the raw log data when you need it.

- **Log Route 53 DNS queries** – You can use CloudWatch Logs to log information about the DNS queries that Route 53 receives. For more information, see Logging DNS Queries in the *Amazon Route 53 Developer Guide*.

Related Amazon services

The following services are used in conjunction with CloudWatch Logs:

- **Amazon CloudTrail** is a web service that enables you to monitor the calls made to the CloudWatch Logs API for your account, including calls made by the Amazon Web Services Management Console, Amazon Command Line Interface (Amazon CLI), and other services. When CloudTrail logging is turned on, CloudTrail captures API calls in your account and delivers the log files to the Amazon S3 bucket that you specify. Each log file can contain one or more records, depending on how many actions must be performed to satisfy a request. For more information about Amazon CloudTrail, see What Is Amazon CloudTrail? in the *Amazon CloudTrail User Guide*. For an example of the type of data that CloudWatch writes into CloudTrail log files, see Logging CloudWatch Logs API and console operations in Amazon CloudTrail.
- **Amazon Identity and Access Management (IAM)** is a web service that helps you securely control access to Amazon resources for your users. Use IAM to control who can use your Amazon resources (authentication) and what resources they can use in which ways (authorization). For more information, see What Is IAM? in the *IAM User Guide*.
- **Amazon Kinesis Data Streams** is a web service you can use for rapid and continuous data intake and aggregation. The type of data used includes IT infrastructure log data, application logs, social media, market data feeds, and web clickstream data. Because the response time for the data intake and processing is in real time, processing is typically lightweight. For more information, see What is Amazon Kinesis Data Streams? in the *Amazon Kinesis Data Streams Developer Guide*.
- **Amazon Lambda** is a web service you can use to build applications that respond quickly to new information. Upload your application code as Lambda functions and Lambda runs your code on high-availability compute infrastructure and performs all the administration of the compute resources, including server and operating system maintenance, capacity provisioning and automatic scaling, code and security patch deployment, and code monitoring and logging. All you need to do is supply your code in one of the languages that Lambda supports. For more information, see What is Amazon Lambda? in the *Amazon Lambda Developer Guide*.

Pricing

When you sign up for Amazon, you can get started with CloudWatch Logs for free using the Amazon Free Tier.

Standard rates apply for logs stored by other services using CloudWatch Logs (for example, Amazon VPC flow logs and Lambda logs).

For more information about pricing, see Amazon CloudWatch Pricing.

For more information about how to analyze your costs and usage for CloudWatch Logs and CloudWatch, and for best practices about how to reduce your costs, see CloudWatch billing and cost.

Amazon CloudWatch Logs concepts

The terminology and concepts that are central to your understanding and use of CloudWatch Logs are described below.

Log class

CloudWatch Logs offers two classes of log groups. The Standard log class is a full-featured option for logs that require real-time monitoring or logs that you access frequently. The Infrequent Access log class is a lower-cost option for logs that you access less frequently. It supports a subset of the Standard log class capabilities.

Log events

A log event is a record of some activity recorded by the application or resource being monitored. The log event record that CloudWatch Logs understands contains two properties: the timestamp of when the event occurred, and the raw event message. Event messages must be UTF-8 encoded.

Log streams

A log stream is a sequence of log events that share the same source. More specifically, a log stream is generally intended to represent the sequence of events coming from the application instance or resource being monitored. For example, a log stream may be associated with an Apache access log on a specific host. When you no longer need a log stream, you can delete it using the aws logs delete-log-stream command.

Log groups

Log groups define groups of log streams that share the same retention, monitoring, and access control settings. Each log stream has to belong to one log group. For example, if you have a separate log stream for the Apache access logs from each host, you could group those log streams into a single log group called `MyWebsite.com/Apache/access_log`.

There is no limit on the number of log streams that can belong to one log group.

Metric filters

You can use metric filters to extract metric observations from ingested events and transform them to data points in a CloudWatch metric. Metric filters are assigned to log groups, and all of the filters assigned to a log group are applied to their log streams.

Retention settings

Retention settings can be used to specify how long log events are kept in CloudWatch Logs. Expired log events get deleted automatically. Just like metric filters, retention settings are also assigned to log groups, and the retention assigned to a log group is applied to their log streams.

Amazon CloudWatch Logs billing and cost

For detailed information about how to analyze your costs and usage for CloudWatch Logs and CloudWatch, and for best practices about how to reduce your costs, see CloudWatch billing and cost.

For more information about pricing, see Amazon CloudWatch Pricing.

When you sign up for Amazon, you can get started with CloudWatch Logs for free using the Amazon Free Tier.

Standard rates apply for logs stored by other services using CloudWatch Logs (for example, Amazon VPC flow logs and Lambda logs).

Log classes

CloudWatch Logs offers two classes of log groups:

- The *CloudWatch Logs Standard* log class is a full-featured option for logs that require real-time monitoring or logs that you access frequently.
- The *CloudWatch Logs Infrequent Access* log class is a new log class that you can use to cost-effectively consolidate your logs. This log class offers a subset of CloudWatch Logs capabilities including managed ingestion, storage, cross-account log analytics, and encryption with a lower ingestion price per GB. The Infrequent Access log class is ideal for ad-hoc querying and after-the-fact forensic analysis on infrequently accessed logs.

Note

For charges, the Standard and Infrequent Access log classes differ in ingestion costs only. Storage charges and CloudWatch Logs Insights charges are the same in each log class.

For more information about CloudWatch Logs pricing, see Amazon CloudWatch Pricing.

Important

After a log group is created, its log class can't be changed.

Supported features

The following table lists the features for each log class.

Feature	Standard	Infrequent Access	
Fully managed log ingestion and storage	Yes ✓	Yes ✓	
Cross-account features	Yes ✓	Yes ✓	
Encryption with Amazon KMS	Yes ✓	Yes ✓	

Feature	Standard	Infrequent Access	
CloudWatch Logs Insights query commands	Yes ✓	Yes ✓ (Most commands–see Logs Insights QL commands supported in log classes.)	
CloudWatch Logs Insights discovered fields	Yes ✓	Yes ✓	
Using OpenSearch PPL or OpenSearch SQL to query in CloudWatch Logs Insights;	Yes ✓	No	
Natural language query assist	Yes ✓	No	
CloudWatch Logs Anomaly Detection	Yes ✓	No	
Live Tail	Yes ✓	No	
Field indexing	Yes ✓	No	
Compare to previous time range	Yes ✓	No	
Subscription filters	Yes ✓	No	
Export to Amazon S3	Yes ✓	No	

Feature	Standard	Infrequent Access	
GetLogEvents and FilterLogEvents API operations	Yes ✓	Not supported. Use CloudWatch Logs Insights to view log events stored in log groups in the Infrequent Access log class.	
Metric filters	Yes ✓	No	
Container Insights log ingestion	Yes ✓	No	
Lambda Insights log ingestion	Yes ✓	No	
Sensitive data protection with masking	Yes ✓	No	
Embedded metrics format	Yes ✓	No	

Note

In addition to these two log classes, there is a `Delivery` log class. Use the `Delivery` log class only for delivering Amazon Lambda logs to store in Amazon S3 or Amazon Data Firehose. Log events in log groups in the Delivery class are kept in CloudWatch Logs for only one day. This log class doesn't offer rich CloudWatch Logs capabilities such as CloudWatch Logs Insights queries.

Getting started with CloudWatch Logs

To collect logs from your Amazon EC2 instances and on-premises servers into CloudWatch Logs, use the unified CloudWatch agent. It enables you to collect both logs and advanced metrics with one agent. It offers support across operating systems, including servers running Windows Server. This agent also provides better performance.

If you're using the unified CloudWatch agent to collect CloudWatch metrics, it enables the collection of additional system metrics, for in-guest visibility. It also supports collecting custom metrics using `StatsD` or `collectd`.

For more information, see Installing the CloudWatch Agent in the *Amazon CloudWatch User Guide*.

The older CloudWatch Logs agent, which supports only the collection of logs from servers running Linux, is deprecated and is no longer supported. For information about migrating from the older CloudWatch Logs agent to the unified agent, see Create the CloudWatch agent configuration file with the wizard.

Contents

Prerequisites

To use Amazon CloudWatch Logs you need an Amazon account. Your Amazon account allows you to use services (for example, Amazon EC2) to generate logs that you can view in the CloudWatch console, a web-based interface. In addition, you can install and configure the Amazon Command Line Interface (Amazon CLI).

Sign up for an Amazon Web Services account

If you do not have an Amazon Web Services account, use the following procedure to create one.

To sign up for Amazon Web Services

1. Open http://www.amazonaws.cn/ and choose **Sign Up**.

2. Follow the on-screen instructions.

Amazon 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 http://www.amazonaws.cn/ and choosing **My Account**.

Secure IAM users

After you sign up for an Amazon Web Services account, safeguard your administrative user by turning on multi-factor authentication (MFA). For instructions, see Enable a virtual MFA device for an IAM user (console) in the *IAM User Guide*.

To give other users access to your Amazon Web Services account resources, create IAM users. To secure your IAM users, turn on MFA and only give the IAM users the permissions needed to perform their tasks.

For more information about creating and securing IAM users, see the following topics in the *IAM User Guide*:

- Creating an IAM user in your Amazon Web Services account
- Access management for Amazon resources
- Example IAM identity-based policies

Set up the Command Line Interface

You can use the Amazon CLI to perform CloudWatch Logs operations.

For information about how to install and configure the Amazon CLI, see Getting Set Up with the Amazon Command Line Interface in the *Amazon Command Line Interface User Guide*.

Use the unified CloudWatch agent to get started with CloudWatch Logs

For more information about using the unified CloudWatch agent to get started with CloudWatch Logs, see Collect Metrics and Logs from Amazon EC2 Instances and On-Premises Servers with the CloudWatch Agent in the *Amazon CloudWatch User Guide*. You complete the steps listed in this section to install, configure, and start the agent. If you are not using the agent to also collect CloudWatch metrics, you can ignore any sections that refer to metrics.

If you are currently using the older CloudWatch Logs agent and want to migrate to using the new unified agent, we recommend that you use the wizard included in the new agent package. This wizard can read your current CloudWatch Logs agent configuration file and set up the CloudWatch agent to collect the same logs. For more information about the wizard, see Create the CloudWatch Agent Configuration File with the Wizard in the *Amazon CloudWatch User Guide*.

Use the previous CloudWatch agent to get started with CloudWatch Logs

> **Important**
>
> CloudWatch includes a unified CloudWatch agent that can collect both logs and metrics from EC2 instances and on-premises servers. The older logs-only agent is deprecated and is no longer supported.
> For information about migrating from the older logs-only agent to the unified agent, see Create the CloudWatch agent configuration file with the wizard.
> The rest of this section explains the use of the older CloudWatch Logs agent for customers who are still using it.

Using the CloudWatch Logs agent, you can publish log data from Amazon EC2 instances running Linux or Windows Server, and logged events from Amazon CloudTrail. We recommend instead using the CloudWatch unified agent to publish your log data. For more information about the new agent, see Collect Metrics and Logs from Amazon EC2 Instances and On-Premises Servers with the CloudWatch Agent in the *Amazon CloudWatch User Guide*.

Contents

- Report the CloudWatch Logs agent status
- Start the CloudWatch Logs agent
- Stop the CloudWatch Logs agent

CloudWatch Logs agent prerequisites

The CloudWatch Logs agent requires Python version 2.7, 3.0, or 3.3, and any of the following versions of Linux:

- Amazon Linux version 2014.03.02 or later. Amazon Linux 2 is not supported
- Ubuntu Server version 12.04, 14.04, or 16.04
- CentOS version 6, 6.3, 6.4, 6.5, or 7.0
- Red Hat Enterprise Linux (RHEL) version 6.5 or 7.0
- Debian 8.0

Quick Start: Install and configure the CloudWatch Logs agent on a running EC2 Linux instance

Important

The older logs agent is deprecated. CloudWatch includes a unified agent that can collect both logs and metrics from EC2 instances and on-premises servers. For more information, see Getting started with CloudWatch Logs.

For information about migrating from the older CloudWatch Logs agent to the unified agent, see Create the CloudWatch agent configuration file with the wizard.

The older logs agent supports only versions 2.6 to 3.5 of Python. Additionally, the older CloudWatch Logs agent doesn't support Instance Metadata Service Version 2 (IMDSv2). If your server uses IMDSv2, you must use the newer unified agent instead of the older CloudWatch Logs agent.

The rest of this section explains the use of the older CloudWatch Logs agent for customers who are still using it.

Tip

CloudWatch includes a new unified agent that can collect both logs and metrics from EC2 instances and on-premises servers. If you are not already using the older CloudWatch Logs agent, we recommend that you use the newer unified CloudWatch agent. For more information, see Getting started with CloudWatch Logs.
Additionally, the older agent doesn't support Instance Metadata Service Version 2 (IMDSv2). If your server uses IMDSv2, you must use the newer unified agent instead of the older CloudWatch Logs agent.
The rest of this section explains the use of the older CloudWatch Logs agent.

Configure the older CloudWatch Logs agent on a running EC2 Linux instance

You can use the CloudWatch Logs agent installer on an existing EC2 instance to install and configure the CloudWatch Logs agent. After installation is complete, logs automatically flow from the instance to the log stream you create while installing the agent. The agent confirms that it has started and it stays running until you disable it.

In addition to using the agent, you can also publish log data using the Amazon CLI, CloudWatch Logs SDK, or the CloudWatch Logs API. The Amazon CLI is best suited for publishing data at the command line or through scripts. The CloudWatch Logs SDK is best suited for publishing log data directly from applications or building your own log publishing application.

Step 1: Configure your IAM role or user for CloudWatch Logs

The CloudWatch Logs agent supports IAM roles and users. If your instance already has an IAM role associated with it, make sure that you include the IAM policy below. If you don't already have an IAM role assigned to your instance, you can use your IAM credentials for the next steps or you can assign an IAM role to that instance. For more information, see Attaching an IAM Role to an Instance.

To configure your IAM role or user for CloudWatch Logs

1. Open the IAM console at https://console.amazonaws.cn/iam/.
2. In the navigation pane, choose **Roles**.
3. Choose the role by selecting the role name (do not select the check box next to the name).
4. Choose **Attach Policies**, **Create Policy**.

A new browser tab or window opens.

5. Choose the **JSON** tab and type the following JSON policy document.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:PutLogEvents",
        "logs:DescribeLogStreams"
    ],
      "Resource": [
        "*"
    ]
  }
 ]
}
```

6. When you are finished, choose **Review policy**. The Policy Validator reports any syntax errors.
7. On the **Review Policy** page, type a **Name** and a **Description** (optional) for the policy that you are creating. Review the policy **Summary** to see the permissions that are granted by your policy. Then choose **Create policy** to save your work.
8. Close the browser tab or window, and return to the **Add permissions** page for your role. Choose **Refresh**, and then choose the new policy to attach it to your role.
9. Choose **Attach Policy**.

Step 2: Install and configure CloudWatch Logs on an existing Amazon EC2 instance

The process for installing the CloudWatch Logs agent differs depending on whether your Amazon EC2 instance is running Amazon Linux, Ubuntu, CentOS, or Red Hat. Use the steps appropriate for the version of Linux on your instance.

To install and configure CloudWatch Logs on an existing Amazon Linux instance

Starting with Amazon Linux AMI 2014.09, the CloudWatch Logs agent is available as an RPM installation with the awslogs package. Earlier versions of Amazon Linux can access the awslogs

package by updating their instance with the `sudo yum update -y` command. By installing the awslogs package as an RPM instead of the using the CloudWatch Logs installer, your instance receives regular package updates and patches from Amazon without having to manually reinstall the CloudWatch Logs agent.

> **Warning**
>
> Do not update the CloudWatch Logs agent using the RPM installation method if you previously used the Python script to install the agent. Doing so may cause configuration issues that prevent the CloudWatch Logs agent from sending your logs to CloudWatch.

1. Connect to your Amazon Linux instance. For more information, see Connect to Your Instance in the *Amazon EC2 User Guide*.

   For more information about connection issues, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide*.
2. Update your Amazon Linux instance to pick up the latest changes in the package repositories.

   ```
   sudo yum update -y
   ```
3. Install the `awslogs` package. This is the recommended method for installing awslogs on Amazon Linux instances.

   ```
   sudo yum install -y awslogs
   ```
4. Edit the `/etc/awslogs/awslogs.conf` file to configure the logs to track. For more information about editing this file, see CloudWatch Logs agent reference.
5. By default, the `/etc/awslogs/awscli.conf` points to the us-east-1 Region. To push your logs to a different Region, edit the `awscli.conf` file and specify that Region.
6. Start the `awslogs` service.

   ```
   sudo service awslogs start
   ```

   If you are running Amazon Linux 2, start the `awslogs` service with the following command.

   ```
   sudo systemctl start awslogsd
   ```

7. (Optional) Check the `/var/log/awslogs.log` file for errors logged when starting the service.
8. (Optional) Run the following command to start the `awslogs` service at each system boot.

   ```
   sudo chkconfig awslogs on
   ```

   If you are running Amazon Linux 2, use the following command to start the service at each system boot.

   ```
   sudo systemctl enable awslogsd.service
   ```
9. You should see the newly created log group and log stream in the CloudWatch console after the agent has been running for a few moments.

   For more information, see View log data sent to CloudWatch Logs.

To install and configure CloudWatch Logs on an existing Ubuntu Server, CentOS, or Red Hat instance

If you're using an AMI running Ubuntu Server, CentOS, or Red Hat, use the following procedure to manually install the CloudWatch Logs agent on your instance.

1. Connect to your EC2 instance. For more information, see Connect to Your Instance in the *Amazon EC2 User Guide*.

   For more information about connection issues, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide*.
2. Run the CloudWatch Logs agent installer using one of two options. You can run it directly from the internet, or download the files and run it standalone.

   > **Note**
   >
   > If you are running CentOS 6.x, Red Hat 6.x, or Ubuntu 12.04, use the steps for downloading and running the installer standalone. Installing the CloudWatch Logs agent directly from the internet is not supported on these systems.

> **Note**
>
> On Ubuntu, run `apt-get update` before running the commands below.

To run it directly from the internet, use the following commands and follow the prompts:

```
curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-setup.py -O
```

```
sudo python ./awslogs-agent-setup.py --region us-east-1
```

If the preceding command does not work, try the following:

```
sudo python3 ./awslogs-agent-setup.py --region us-east-1
```

To download and run it standalone, use the following commands and follow the prompts:

```
curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-setup.py -O
```

```
curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/AgentDependencies.tar.gz -O
```

```
tar xvf AgentDependencies.tar.gz -C /tmp/
```

```
sudo python ./awslogs-agent-setup.py --region us-east-1 --dependency-path /tmp/AgentDependencies
```

You can install the CloudWatch Logs agent by specifying the us-east-1, us-west-1, us-west-2, ap-south-1, ap-northeast-2, ap-southeast-1, ap-southeast-2, ap-northeast-1, eu-central-1, eu-west-1, or sa-east-1 Regions.

> **Note**
>
> For more information about the current version and the version history of `awslogs-agent-setup`, see CHANGELOG.txt.

The CloudWatch Logs agent installer requires certain information during setup. Before you start, you need to know which log file to monitor and its time stamp format. You should also have the following information ready.

Item	Description
Amazon access key ID	Press Enter if using an IAM role. Otherwise, enter your Amazon access key ID.
Amazon secret access key	Press Enter if using an IAM role. Otherwise, enter your Amazon secret access key.
Default Region name	Press Enter. The default is us-west-2. You can set this to us-east-1 , us-west-1, us-west-2, ap-south-1, ap-northeast-2, ap-southeas t-1, ap-southeast-2, ap-northeast-1, eu-central-1, eu-west-1, or sa-east-1.
Default output format	Leave blank and press Enter.
Path of log file to upload	The location of the file that contains the log data to send. The installer suggests a path for you.
Destination Log Group name	The name for your log group. The installer suggests a log group name for you.
Destination Log Stream name	By default, this is the name of the host. The installer suggests a host name for you.
Timestamp format	Specify the format of the time stamp within the specified log file. Choose custom to specify your own format.

Item	Description
Initial position	How data is uploaded. Set this to start_of_file to upload everything in the data file. Set to end_of_file to upload only newly appended data.

After you have completed these steps, the installer asks about configuring another log file. You can run the process as many times as you like for each log file. If you have no more log files to monitor, choose **N** when prompted by the installer to set up another log. For more information about the settings in the agent configuration file, see CloudWatch Logs agent reference.

> **Note**
>
> Configuring multiple log sources to send data to a single log stream is not supported.

3. You should see the newly created log group and log stream in the CloudWatch console after the agent has been running for a few moments.

   For more information, see View log data sent to CloudWatch Logs.

Quick Start: Install and configure the CloudWatch Logs agent on an EC2 Linux instance at launch

> **Tip**
>
> The older CloudWatch Logs agent discussed in this section is on the path to deprecation. We strongly recommend that you instead use the new unified CloudWatch agent that can collect both logs and metrics. Additionally, the older CloudWatch Logs agent requires Python 3.3 or earlier, and these versions are not installed on new EC2 instances by default. For more information about the unified CloudWatch agent, see Installing the CloudWatch Agent.
> The rest of this section explains the use of the older CloudWatch Logs agent.

Installing the older CloudWatch Logs agent on an EC2 Linux instance at launch

You can use Amazon EC2 user data, a feature of Amazon EC2 that allows parametric information to be passed to the instance on launch, to install and configure the CloudWatch Logs agent on that instance. To pass the CloudWatch Logs agent installation and configuration information to Amazon EC2, you can provide the configuration file in a network location such as an Amazon S3 bucket.

Configuring multiple log sources to send data to a single log stream is not supported.

Prerequisite

Create an agent configuration file that describes all your log groups and log streams. This is a text file that describes the log files to monitor as well as the log groups and log streams to upload them to. The agent consumes this configuration file and starts monitoring and uploading all the log files described in it. For more information about the settings in the agent configuration file, see CloudWatch Logs agent reference.

The following is a sample agent configuration file for Amazon Linux 2

```
[general]
state_file = /var/lib/awslogs/state/agent-state

[/var/log/messages]
file = /var/log/messages
log_group_name = /var/log/messages
log_stream_name = {instance_id}
datetime_format = %b %d %H:%M:%S
```

The following is a sample agent configuration file for Ubuntu

```
[general]
state_file = /var/awslogs/state/agent-state

[/var/log/syslog]
file = /var/log/syslog
log_group_name = /var/log/syslog
log_stream_name = {instance_id}
datetime_format = %b %d %H:%M:%S
```

To configure your IAM role

1. Open the IAM console at https://console.amazonaws.cn/iam/.

2. In the navigation pane, choose **Policies**, **Create Policy**.
3. On the **Create Policy** page, for **Create Your Own Policy**, choose **Select**. For more information about creating custom policies, see IAM Policies for Amazon EC2 in the *Amazon EC2 User Guide*.
4. On the **Review Policy** page, for **Policy Name**, type a name for the policy.
5. For **Policy Document**, paste in the following policy:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "logs:CreateLogGroup",
                "logs:CreateLogStream",
                "logs:PutLogEvents",
                "logs:DescribeLogStreams"
            ],
            "Resource": [
                "arn:aws-cn:logs:*:*:*"
            ]
        },
        {
            "Effect": "Allow",
            "Action": [
                "s3:GetObject"
            ],
            "Resource": [
                "arn:aws-cn:s3:::amzn-s3-demo-bucket/*"
            ]
        }
    ]
}
```

6. Choose **Create Policy**.
7. In the navigation pane, choose **Roles**, **Create New Role**.
8. On the **Set Role Name** page, type a name for the role and then choose **Next Step**.
9. On the **Select Role Type** page, choose **Select** next to **Amazon EC2**.
10. On the **Attach Policy** page, in the table header, choose **Policy Type**, **Customer Managed**.
11. Select the IAM policy that you created and then choose **Next Step**.

12. Choose **Create Role**.

    For more information about users and policies, see IAM Users and Groups and Managing IAM Policies in the *IAM User Guide*.

To launch a new instance and enable CloudWatch Logs

1. Open the Amazon EC2 console at https://console.amazonaws.cn/ec2/.
2. Choose **Launch Instance**.

   For more information, see Launching an Instance in *Amazon EC2 User Guide*.
3. On the **Step 1: Choose an Amazon Machine Image (AMI)** page, select the Linux instance type to launch, and then on the **Step 2: Choose an Instance Type** page, choose **Next: Configure Instance Details**.

   Make sure that cloud-init is included in your Amazon Machine Image (AMI). Amazon Linux AMIs, and AMIs for Ubuntu and RHEL already include cloud-init, but CentOS and other AMIs in the Amazon Web Services Marketplace might not.
4. On the **Step 3: Configure Instance Details** page, for **IAM role**, select the IAM role that you created.
5. Under **Advanced Details**, for **User data**, paste the following script into the box. Then update that script by changing the value of the **-c** option to the location of your agent configuration file:

   ```
   #!/bin/bash
   curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-
   setup.py -O
   chmod +x ./awslogs-agent-setup.py
   ./awslogs-agent-setup.py -n -r us-east-1 -c s3://amzn-s3-demo-bucket/my-config-file
   ```
6. Make any other changes to the instance, review your launch settings, and then choose **Launch**.
7. You should see the newly created log group and log stream in the CloudWatch console after the agent has been running for a few moments.

   For more information, see View log data sent to CloudWatch Logs.

Quick Start: Enable your Amazon EC2 instances running Windows Server 2016 to send logs to CloudWatch Logs using the CloudWatch Logs agent

> **Tip**
>
> CloudWatch includes a new unified agent that can collect both logs and metrics from EC2 instances and on-premises servers. We recommend that you use the newer unified CloudWatch agent. For more information, see Getting started with CloudWatch Logs. The rest of this section explains the use of the older CloudWatch Logs agent.

Enable your Amazon EC2 instances running Windows Server 2016 to send logs to CloudWatch Logs using the older CloudWatch Logs agent

There are multiple methods you can use to enable instances running Windows Server 2016 to send logs to CloudWatch Logs. The steps in this section use Systems Manager Run Command. For information about the other possible methods, see Sending Logs, Events, and Performance Counters to Amazon CloudWatch.

Steps

- Download the sample configuration file
- Configure the JSON file for CloudWatch
- Create an IAM role for Systems Manager
- Verify Systems Manager prerequisites
- Verify internet access
- Enable CloudWatch Logs using Systems Manager Run Command

Download the sample configuration file

Download the following sample file to your computer: `AWS.EC2.Windows.CloudWatch.json`.

Configure the JSON file for CloudWatch

You determine which logs to send to CloudWatch by specifying your choices in a configuration file. The process of creating this file and specifying your choices can take 30 minutes or more to

complete. After you have completed this task once, you can reuse the configuration file on all of your instances.

Steps

- Step 1: Enable CloudWatch Logs
- Step 2: Configure settings for CloudWatch
- Step 3: Configure the data to send
- Step 4: Configure flow control
- Step 5: Save JSON content

Step 1: Enable CloudWatch Logs

At the top of the JSON file, change "false" to "true" for `IsEnabled`:

```
"IsEnabled": true,
```

Step 2: Configure settings for CloudWatch

Specify credentials, Region, a log group name, and a log stream namespace. This enables the instance to send log data to CloudWatch Logs. To send the same log data to different locations, you can add additional sections with unique IDs (for example, "CloudWatchLogs2" and CloudWatchLogs3") and a different Region for each ID.

To configure settings to send log data to CloudWatch Logs

1. In the JSON file, locate the `CloudWatchLogs` section.

```
{
    "Id": "CloudWatchLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CloudWatchLogsOutput,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "AccessKey": "",
        "SecretKey": "",
        "Region": "us-east-1",
        "LogGroup": "Default-Log-Group",
        "LogStream": "{instance_id}"
    }
},
```

2. Leave the `AccessKey` and `SecretKey` field blank. You configure credentials using an IAM role.
3. For `Region`, type the Region to which to send log data (for example, `us-east-2`).
4. For `LogGroup`, type the name for your log group. This name appears on the **Log Groups** screen in the CloudWatch console.
5. For `LogStream`, type the destination log stream. This name appears on the **Log Groups > Streams** screen in the CloudWatch console.

   If you use `{instance_id}`, the default, the log stream name is the instance ID of this instance.

   If you specify a log stream name that doesn't already exist, CloudWatch Logs automatically creates it for you. You can define a log stream name using a literal string, the predefined variables `{instance_id}`, `{hostname}`, and `{ip_address}`, or a combination of these.

Step 3: Configure the data to send

You can send event log data, Event Tracing for Windows (ETW) data, and other log data to CloudWatch Logs.

To send Windows application event log data to CloudWatch Logs

1. In the JSON file, locate the `ApplicationEventLog` section.

```
{
    "Id": "ApplicationEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Application",
        "Levels": "1"
    }
},
```

2. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.

- **4** - Upload only information messages.

You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send security log data to CloudWatch Logs

1. In the JSON file, locate the `SecurityEventLog` section.

```
{
    "Id": "SecurityEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Security",
        "Levels": "7"
    }
},
```

2. For `Levels`, type **7** to upload all messages.

To send system event log data to CloudWatch Logs

1. In the JSON file, locate the `SystemEventLog` section.

```
{
    "Id": "SystemEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "System",
        "Levels": "7"
    }
},
```

2. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

- **1** - Upload only error messages.

- **2** - Upload only warning messages.
- **4** - Upload only information messages.

You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send other types of event log data to CloudWatch Logs

1. In the JSON file, add a new section. Each section must have a unique `Id`.

```
{
    "Id": "Id-name",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Log-name",
        "Levels": "7"
    }
},
```

2. For `Id`, type a name for the log to upload (for example, **`WindowsBackup`**).
3. For `LogName`, type the name of the log to upload. You can find the name of the log as follows.

   a. Open Event Viewer.

   b. In the navigation pane, choose **Applications and Services Logs**.

   c. Navigate to the log, and then choose **Actions**, **Properties**.
4. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.
   - **4** - Upload only information messages.

   You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send Event Tracing for Windows data to CloudWatch Logs

ETW (Event Tracing for Windows) provides an efficient and detailed logging mechanism that applications can write logs to. Each ETW is controlled by a session manager that can start and stop the logging session. Each session has a provider and one or more consumers.

1. In the JSON file, locate the `ETW` section.

```
{
    "Id": "ETW",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Microsoft-Windows-WinINet/Analytic",
        "Levels": "7"
    }
},
```

2. For `LogName`, type the name of the log to upload.
3. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.
   - **4** - Upload only information messages.

   You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send custom logs (any text-based log file) to CloudWatch Logs

1. In the JSON file, locate the `CustomLogs` section.

```
{
    "Id": "CustomLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CustomLog.CustomLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
```

```
        "LogDirectoryPath": "C:\\CustomLogs\\",
        "TimestampFormat": "MM/dd/yyyy HH:mm:ss",
        "Encoding": "UTF-8",
        "Filter": "",
        "CultureName": "en-US",
        "TimeZoneKind": "Local",
        "LineCount": "5"
    }
},
```

2. For `LogDirectoryPath`, type the path where logs are stored on your instance.
3. For `TimestampFormat`, type the time stamp format to use. For more information about supported values, see the Custom Date and Time Format Strings topic on MSDN.

> **Important**
>
> Your source log file must have the time stamp at the beginning of each log line and there must be a space following the time stamp.

4. For `Encoding`, type the file encoding to use (for example, UTF-8). For a list of supported values, see the Encoding Class topic on MSDN.

> **Note**
>
> Use the encoding name, not the display name.

5. (Optional) For `Filter`, type the prefix of log names. Leave this parameter blank to monitor all files. For more information about supported values, see the FileSystemWatcherFilter Property topic on MSDN.
6. (Optional) For `CultureName`, type the locale where the time stamp is logged. If `CultureName` is blank, it defaults to the same locale currently used by your Windows instance. For more information about, see the `Language tag` column in the table in the Product Behavior topic on MSDN.

> **Note**
>
> The `div`, `div-MV`, hu, and `hu-HU` values are not supported.

7. (Optional) For `TimeZoneKind`, type `Local` or `UTC`. You can set this to provide time zone information when no time zone information is included in your log's time stamp. If this parameter is left blank and if your time stamp doesn't include time zone information, CloudWatch Logs defaults to the local time zone. This parameter is ignored if your time stamp already contains time zone information.
8. (Optional) For `LineCount`, type the number of lines in the header to identify the log file. For example, IIS log files have virtually identical headers. You could enter **5**, which would read the first three lines of the log file header to identify it. In IIS log files, the third line is the date and time stamp, but the time stamp is not always guaranteed to be different between log files. For this reason, we recommend including at least one line of actual log data to uniquely fingerprint the log file.

To send IIS log data to CloudWatch Logs

1. In the JSON file, locate the `IISLog` section.

```
{
    "Id": "IISLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CustomLog.CustomLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogDirectoryPath": "C:\\inetpub\\logs\\LogFiles\\W3SVC1",
        "TimestampFormat": "yyyy-MM-dd HH:mm:ss",
        "Encoding": "UTF-8",
        "Filter": "",
        "CultureName": "en-US",
        "TimeZoneKind": "UTC",
        "LineCount": "5"
    }
},
```

2. For `LogDirectoryPath`, type the folder where IIS logs are stored for an individual site (for example, `C:\inetpub\logs\LogFiles\W3SVC`*n*).

> **Note**
>
> Only W3C log format is supported. IIS, NCSA, and Custom formats are not supported.

3. For `TimestampFormat`, type the time stamp format to use. For more information about supported values, see the Custom Date and Time Format Strings topic on MSDN.
4. For `Encoding`, type the file encoding to use (for example, UTF-8). For more information about supported values, see the Encoding Class topic on MSDN.

   > **Note**
   >
   > Use the encoding name, not the display name.

5. (Optional) For `Filter`, type the prefix of log names. Leave this parameter blank to monitor all files. For more information about supported values, see the FileSystemWatcherFilter Property topic on MSDN.
6. (Optional) For `CultureName`, type the locale where the time stamp is logged. If `CultureName` is blank, it defaults to the same locale currently used by your Windows instance. For more information about supported values, see the `Language tag` column in the table in the Product Behavior topic on MSDN.

   > **Note**
   >
   > The `div`, `div-MV`, `hu`, and `hu-HU` values are not supported.

7. (Optional) For `TimeZoneKind`, enter `Local` or `UTC`. You can set this to provide time zone information when no time zone information is included in your log's time stamp. If this parameter is left blank and if your time stamp doesn't include time zone information, CloudWatch Logs defaults to the local time zone. This parameter is ignored if your time stamp already contains time zone information.
8. (Optional) For `LineCount`, type the number of lines in the header to identify the log file. For example, IIS log files have virtually identical headers. You could enter **5**, which would read the first five lines of the log file's header to identify it. In IIS log files, the third line is the date and time stamp, but the time stamp is not always guaranteed to be different between log files. For this reason, we recommend including at least one line of actual log data for uniquely fingerprinting the log file.

Step 4: Configure flow control

Each data type must have a corresponding destination in the `Flows` section. For example, to send the custom log, ETW log, and system log to CloudWatch Logs, add `(CustomLogs,ETW,SystemEventLog),CloudWatchLogs` to the `Flows` section.

> **Warning**
>
> Adding a step that is not valid blocks the flow. For example, if you add a disk metric step, but your instance doesn't have a disk, all steps in the flow are blocked.

You can send the same log file to more than one destination. For example, to send the application log to two different destinations that you defined in the `CloudWatchLogs` section, add `ApplicationEventLog,(CloudWatchLogs,CloudWatchLogs2)` to the `Flows` section.

To configure flow control

1. In the `AWS.EC2.Windows.CloudWatch.json` file, locate the `Flows` section.

```
"Flows": {
    "Flows": [
      "PerformanceCounter,CloudWatch",
      "(PerformanceCounter,PerformanceCounter2), CloudWatch2",
      "(CustomLogs, ETW, SystemEventLog),CloudWatchLogs",
      "CustomLogs, CloudWatchLogs2",
      "ApplicationEventLog,(CloudWatchLogs, CloudWatchLogs2)"
    ]
}
```

2. For `Flows`, add each data type that is to be uploaded (for example, `ApplicationEventLog`) and its destination (for example, `CloudWatchLogs`).

Step 5: Save JSON content

You are now finished editing the JSON file. Save it, and paste the file contents into a text editor in another window. You will need the file contents in a later step of this procedure.

Create an IAM role for Systems Manager

An IAM role for instance credentials is required when you use Systems Manager Run Command. This role enables Systems Manager to perform actions on the instance. For more information, see Configuring Security Roles for Systems Manager in the *Amazon Systems Manager User Guide*. For information about how to attach an IAM role to an existing instance, see Attaching an IAM Role to an Instance in the *Amazon EC2 User Guide*.

Verify Systems Manager prerequisites

Before you use Systems Manager Run Command to configure integration with CloudWatch Logs, verify that your instances meet the minimum requirements. For more information, see Systems Manager Prerequisites in the *Amazon Systems Manager User Guide*.

Verify internet access

Your Amazon EC2 Windows Server instances and managed instances must have outbound internet access in order to send log and event data to CloudWatch. For more information about how to configure internet access, see Internet Gateways in the *Amazon VPC User Guide*.

Enable CloudWatch Logs using Systems Manager Run Command

Run Command enables you to manage the configuration of your instances on demand. You specify a Systems Manager document, specify parameters, and execute the command on one or more instances. The SSM agent on the instance processes the command and configures the instance as specified.

To configure integration with CloudWatch Logs using Run Command

1. Open the Amazon EC2 console at https://console.amazonaws.cn/ec2/.
2. Open the SSM console at https://console.amazonaws.cn/systems-manager/.
3. In the navigation pane, choose **Run Command**.
4. Choose **Run a command**.
5. For **Command document**, choose **AWS-ConfigureCloudWatch**.
6. For **Target instances**, choose the instances to integrate with CloudWatch Logs. If you do not see an instance in this list, it might not be configured for Run Command. For more information, see Systems Manager Prerequisites in the *Amazon EC2 User Guide*.
7. For **Status**, choose **Enabled**.
8. For **Properties**, copy and paste the JSON content you created in the previous tasks.

9. Complete the remaining optional fields and choose **Run**.

Use the following procedure to view the results of command execution in the Amazon EC2 console.

To view command output in the console

1. Select a command.
2. Choose the **Output** tab.
3. Choose **View Output**. The command output page shows the results of your command execution.

Quick Start: Enable your Amazon EC2 instances running Windows Server 2012 and Windows Server 2008 to send logs to CloudWatch Logs

> **Tip**
>
> CloudWatch includes a new unified agent that can collect both logs and metrics from EC2 instances and on-premises servers. We recommend that you use the newer unified CloudWatch agent. For more information, see Getting started with CloudWatch Logs. The rest of this section explains the use of the older CloudWatch Logs agent.

Enable your Amazon EC2 instances running Windows Server 2012 and Windows Server 2008 to send logs to CloudWatch Logs

Use the following steps to enable your instances running Windows Server 2012 and Windows Server 2008 to send logs to CloudWatch Logs.

Download the sample configuration file

Download the following sample JSON file to your computer: `AWS.EC2.Windows.CloudWatch.json`. You edit it in the following steps.

Configure the JSON file for CloudWatch

You determine which logs to send to CloudWatch by specifying your choices in the JSON configuration file. The process of creating this file and specifying your choices can take 30 minutes

or more to complete. After you have completed this task once, you can reuse the configuration file on all of your instances.

Steps

- Step 1: Enable CloudWatch Logs
- Step 2: Configure settings for CloudWatch
- Step 3: Configure the data to send
- Step 4: Configure flow control

Step 1: Enable CloudWatch Logs

At the top of the JSON file, change "false" to "true" for `IsEnabled`:

```
"IsEnabled": true,
```

Step 2: Configure settings for CloudWatch

Specify credentials, Region, a log group name, and a log stream namespace. This enables the instance to send log data to CloudWatch Logs. To send the same log data to different locations, you can add additional sections with unique IDs (for example, "CloudWatchLogs2" and CloudWatchLogs3") and a different Region for each ID.

To configure settings to send log data to CloudWatch Logs

1. In the JSON file, locate the `CloudWatchLogs` section.

```
{
    "Id": "CloudWatchLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CloudWatchLogsOutput,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "AccessKey": "",
        "SecretKey": "",
        "Region": "us-east-1",
        "LogGroup": "Default-Log-Group",
        "LogStream": "{instance_id}"
    }
},
```

2. Leave the `AccessKey` and `SecretKey` field blank. You configure credentials using an IAM role.
3. For `Region`, type the Region to which to send log data (for example, `us-east-2`).
4. For `LogGroup`, type the name for your log group. This name appears on the **Log Groups** screen in the CloudWatch console.
5. For `LogStream`, type the destination log stream. This name appears on the **Log Groups > Streams** screen in the CloudWatch console.

   If you use `{instance_id}`, the default, the log stream name is the instance ID of this instance.

   If you specify a log stream name that doesn't already exist, CloudWatch Logs automatically creates it for you. You can define a log stream name using a literal string, the predefined variables `{instance_id}`, `{hostname}`, and `{ip_address}`, or a combination of these.

Step 3: Configure the data to send

You can send event log data, Event Tracing for Windows (ETW) data, and other log data to CloudWatch Logs.

To send Windows application event log data to CloudWatch Logs

1. In the JSON file, locate the `ApplicationEventLog` section.

```
{
    "Id": "ApplicationEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Application",
        "Levels": "1"
    }
},
```

2. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.

- **4** - Upload only information messages.

You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send security log data to CloudWatch Logs

1. In the JSON file, locate the `SecurityEventLog` section.

```
{
    "Id": "SecurityEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Security",
        "Levels": "7"
    }
},
```

2. For `Levels`, type **7** to upload all messages.

To send system event log data to CloudWatch Logs

1. In the JSON file, locate the `SystemEventLog` section.

```
{
    "Id": "SystemEventLog",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "System",
        "Levels": "7"
    }
},
```

2. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

- **1** - Upload only error messages.

- **2** - Upload only warning messages.
- **4** - Upload only information messages.

You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send other types of event log data to CloudWatch Logs

1. In the JSON file, add a new section. Each section must have a unique `Id`.

```
{
    "Id": "Id-name",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Log-name",
        "Levels": "7"
    }
},
```

2. For `Id`, type a name for the log to upload (for example, **`WindowsBackup`**).
3. For `LogName`, type the name of the log to upload. You can find the name of the log as follows.

   a. Open Event Viewer.

   b. In the navigation pane, choose **Applications and Services Logs**.

   c. Navigate to the log, and then choose **Actions**, **Properties**.
4. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.
   - **4** - Upload only information messages.

   You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send Event Tracing for Windows data to CloudWatch Logs

ETW (Event Tracing for Windows) provides an efficient and detailed logging mechanism that applications can write logs to. Each ETW is controlled by a session manager that can start and stop the logging session. Each session has a provider and one or more consumers.

1. In the JSON file, locate the `ETW` section.

```
{
    "Id": "ETW",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.EventLog.EventLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogName": "Microsoft-Windows-WinINet/Analytic",
        "Levels": "7"
    }
},
```

2. For `LogName`, type the name of the log to upload.
3. For `Levels`, specify the type of messages to upload. You can specify one of the following values:

   - **1** - Upload only error messages.
   - **2** - Upload only warning messages.
   - **4** - Upload only information messages.

   You can combine values to include more than one type of message. For example, a value of **3** uploads error messages (**1**) and warning messages (**2**). A value of **7** uploads error messages (**1**), warning messages (**2**), and information messages (**4**).

To send custom logs (any text-based log file) to CloudWatch Logs

1. In the JSON file, locate the `CustomLogs` section.

```
{
    "Id": "CustomLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CustomLog.CustomLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
```

```
        "LogDirectoryPath": "C:\\CustomLogs\\",
        "TimestampFormat": "MM/dd/yyyy HH:mm:ss",
        "Encoding": "UTF-8",
        "Filter": "",
        "CultureName": "en-US",
        "TimeZoneKind": "Local",
        "LineCount": "5"
    }
},
```

2. For `LogDirectoryPath`, type the path where logs are stored on your instance.
3. For `TimestampFormat`, type the time stamp format to use. For more information about supported values, see the Custom Date and Time Format Strings topic on MSDN.

> **Important**
>
> Your source log file must have the time stamp at the beginning of each log line and there must be a space following the time stamp.

4. For `Encoding`, type the file encoding to use (for example, UTF-8). For more information about supported values, see the Encoding Class topic on MSDN.

> **Note**
>
> Use the encoding name, not the display name.

5. (Optional) For `Filter`, type the prefix of log names. Leave this parameter blank to monitor all files. For more information about supported values, see the FileSystemWatcherFilter Property topic on MSDN.
6. (Optional) For `CultureName`, type the locale where the time stamp is logged. If `CultureName` is blank, it defaults to the same locale currently used by your Windows instance. For more information about supported values, see the `Language tag` column in the table in the Product Behavior topic on MSDN.

> **Note**
>
> The `div`, `div-MV`, hu, and `hu-HU` values are not supported.

7. (Optional) For `TimeZoneKind`, type `Local` or `UTC`. You can set this to provide time zone information when no time zone information is included in your log's time stamp. If this parameter is left blank and if your time stamp doesn't include time zone information, CloudWatch Logs defaults to the local time zone. This parameter is ignored if your time stamp already contains time zone information.
8. (Optional) For `LineCount`, type the number of lines in the header to identify the log file. For example, IIS log files have virtually identical headers. You could enter **5**, which would read the first three lines of the log file header to identify it. In IIS log files, the third line is the date and time stamp, but the time stamp is not always guaranteed to be different between log files. For this reason, we recommend including at least one line of actual log data to uniquely fingerprint the log file.

To send IIS log data to CloudWatch Logs

1. In the JSON file, locate the `IISLog` section.

```
{
    "Id": "IISLogs",
    "FullName":
 "AWS.EC2.Windows.CloudWatch.CustomLog.CustomLogInputComponent,AWS.EC2.Windows.CloudWatch",
    "Parameters": {
        "LogDirectoryPath": "C:\\inetpub\\logs\\LogFiles\\W3SVC1",
        "TimestampFormat": "yyyy-MM-dd HH:mm:ss",
        "Encoding": "UTF-8",
        "Filter": "",
        "CultureName": "en-US",
        "TimeZoneKind": "UTC",
        "LineCount": "5"
    }
},
```

2. For `LogDirectoryPath`, type the folder where IIS logs are stored for an individual site (for example, `C:\inetpub\logs\LogFiles\W3SVC`*n*).

> **Note**
>
> Only W3C log format is supported. IIS, NCSA, and Custom formats are not supported.

3. For `TimestampFormat`, type the time stamp format to use. For more information about supported values, see the Custom Date and Time Format Strings topic on MSDN.
4. For `Encoding`, type the file encoding to use (for example, UTF-8). For more information about supported values, see the Encoding Class topic on MSDN.

   > **Note**
   >
   > Use the encoding name, not the display name.

5. (Optional) For `Filter`, type the prefix of log names. Leave this parameter blank to monitor all files. For more information about supported values, see the FileSystemWatcherFilter Property topic on MSDN.
6. (Optional) For `CultureName`, type the locale where the time stamp is logged. If `CultureName` is blank, it defaults to the same locale currently used by your Windows instance. For more information about supported values, see the `Language tag` column in the table in the Product Behavior topic on MSDN.

   > **Note**
   >
   > The `div`, `div-MV`, `hu`, and `hu-HU` values are not supported.

7. (Optional) For `TimeZoneKind`, enter `Local` or `UTC`. You can set this to provide time zone information when no time zone information is included in your log's time stamp. If this parameter is left blank and if your time stamp doesn't include time zone information, CloudWatch Logs defaults to the local time zone. This parameter is ignored if your time stamp already contains time zone information.
8. (Optional) For `LineCount`, type the number of lines in the header to identify the log file. For example, IIS log files have virtually identical headers. You could enter **5**, which would read the first five lines of the log file's header to identify it. In IIS log files, the third line is the date and time stamp, but the time stamp is not always guaranteed to be different between log files. For this reason, we recommend including at least one line of actual log data for uniquely fingerprinting the log file.

Step 4: Configure flow control

Each data type must have a corresponding destination in the `Flows` section. For example, to send the custom log, ETW log, and system log to CloudWatch Logs, add `(CustomLogs,ETW,SystemEventLog),CloudWatchLogs` to the `Flows` section.

> **Warning**
>
> Adding a step that is not valid blocks the flow. For example, if you add a disk metric step, but your instance doesn't have a disk, all steps in the flow are blocked.

You can send the same log file to more than one destination. For example, to send the application log to two different destinations that you defined in the `CloudWatchLogs` section, add `ApplicationEventLog,(CloudWatchLogs,CloudWatchLogs2)` to the `Flows` section.

To configure flow control

1. In the `AWS.EC2.Windows.CloudWatch.json` file, locate the `Flows` section.

```
"Flows": {
    "Flows": [
      "PerformanceCounter,CloudWatch",
      "(PerformanceCounter,PerformanceCounter2), CloudWatch2",
      "(CustomLogs, ETW, SystemEventLog),CloudWatchLogs",
      "CustomLogs, CloudWatchLogs2",
      "ApplicationEventLog,(CloudWatchLogs, CloudWatchLogs2)"
    ]
}
```

2. For `Flows`, add each data type that is to be uploaded (for example, `ApplicationEventLog`) and its destination (for example, `CloudWatchLogs`).

You are now finished editing the JSON file. You use it in a later step.

Start the agent

To enable an Amazon EC2 instance running Windows Server 2012 or Windows Server 2008 to send logs to CloudWatch Logs, use the EC2Config service (`EC2Config.exe`). Your instance should have EC2Config 4.0 or later, and you can use this procedure.

To configure CloudWatch using EC2Config 4.x

1. Check the encoding of the `AWS.EC2.Windows.CloudWatch.json` file that you edited earlier in this procedure. Only UTF-8 without BOM encoding is supported. Then save the file in the following folder on your Windows Server 2008 - 2012 R2 instance: `C:\Program Files \Amazon\SSM\Plugins\awsCloudWatch\`.
2. Start or restart the SSM agent (`AmazonSSMAgent.exe`) using the Windows Services control panel or using the following PowerShell command:

   ```
   PS C:\> Restart-Service AmazonSSMAgent
   ```

After the SSM agent restarts, it detects the configuration file and configures the instance for CloudWatch integration. If you change parameters and settings in the local configuration file, you need to restart the SSM agent to pick up the changes. To disable CloudWatch integration on the instance, change `IsEnabled` to `false` and save your changes in the configuration file.

Quick Start: Install the CloudWatch Logs agent using Amazon OpsWorks and Chef

You can install the CloudWatch Logs agent and create log streams using Amazon OpsWorks and Chef, which is a third-party systems and cloud infrastructure automation tool. Chef uses "recipes," which you write to install and configure software on your computer, and "cookbooks," which are collections of recipes, to perform its configuration and policy distribution tasks. For more information, see Chef.

The Chef recipes examples below show how to monitor one log file on each EC2 instance. The recipes use the stack name as the log group and the instance's hostname as the log stream name. To monitor multiple log files, you need to extend the recipes to create multiple log groups and log streams.

Step 1: Create custom recipes

Create a repository to store your recipes. Amazon OpsWorks supports Git and Subversion, or you can store an archive in Amazon S3. The structure of your cookbook repository is described in Cookbook Repositories in the *Amazon OpsWorks User Guide*. The examples below assume that the cookbook is named `logs`. The install.rb recipe installs the CloudWatch Logs agent. You can also download the cookbook example (CloudWatchLogs-Cookbooks.zip).

Create a file named metadata.rb that contains the following code:

```
#metadata.rb

name             'logs'
version          '0.0.1'
```

Create the CloudWatch Logs configuration file:

```
#config.rb

template "/tmp/cwlogs.cfg" do
  cookbook "logs"
  source "cwlogs.cfg.erb"
  owner "root"
  group "root"
  mode 0644
end
```

Download and install the CloudWatch Logs agent:

```
# install.rb

directory "/opt/aws/cloudwatch" do
  recursive true
end

remote_file "/opt/aws/cloudwatch/awslogs-agent-setup.py" do
  source "https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-
setup.py"
  mode "0755"
end

  execute "Install CloudWatch Logs agent" do
  command "/opt/aws/cloudwatch/awslogs-agent-setup.py -n -r region -c /tmp/cwlogs.cfg"
  not_if { system "pgrep -f aws-logs-agent-setup" }
end
```

> **Note**
>
> In the above example, replace *region* with one of the following: us-east-1, us-west-1, us-west-2, ap-south-1, ap-northeast-2, ap-southeast-1, ap-southeast-2, ap-northeast-1, eu-central-1, eu-west-1, or sa-east-1.

If the installation of the agent fails, check to make sure that the `python-dev` package is installed. If it isn't, use the following command, and then retry the agent installation:

```
sudo apt-get -y install python-dev
```

This recipe uses a cwlogs.cfg.erb template file that you can modify to specify various attributes such as what files to log. For more information about these attributes, see CloudWatch Logs agent reference.

```
[general]
# Path to the AWSLogs agent's state file. Agent uses this file to maintain
# client side state across its executions.
state_file = /var/awslogs/state/agent-state


## Each log file is defined in its own section. The section name doesn't
## matter as long as its unique within this file.
#
#[kern.log]
#
## Path of log file for the agent to monitor and upload.
#
#file = /var/log/kern.log
#
## Name of the destination log group.
#
#log_group_name = kern.log
#
## Name of the destination log stream.
#
#log_stream_name = {instance_id}
#
## Format specifier for timestamp parsing.
#
```

```
#datetime_format = %b %d %H:%M:%S
#
#

[<%= node[:opsworks][:stack][:name] %>]
datetime_format = [%Y-%m-%d %H:%M:%S]
log_group_name = <%= node[:opsworks][:stack][:name].gsub(' ','_') %>
file = <%= node[:cwlogs][:logfile] %>
log_stream_name = <%= node[:opsworks][:instance][:hostname] %>
```

The template gets the stack name and host name by referencing the corresponding attributes in the stack configuration and deployment JSON. The attribute that specifies the file to log is defined in the cwlogs cookbook's default.rb attributes file (logs/attributes/default.rb).

```
default[:cwlogs][:logfile] = '/var/log/aws/opsworks/opsworks-agent.statistics.log'
```

Step 2: Create an Amazon OpsWorks stack

1. Open the Amazon OpsWorks console at https://console.amazonaws.cn/opsworks/.
2. On the **OpsWorks Dashboard**, choose **Add stack** to create an Amazon OpsWorks stack.
3. On the **Add stack** screen, choose **Chef 11 stack**.
4. For **Stack name**, enter a name.
5. For **Use custom Chef Cookbooks**, choose **Yes**.
6. For **Repository type**, select the repository type that you use. If you're using the above example, choose **Http Archive**.
7. For **Repository URL**, enter the repository where you stored the cookbook that you created in the previous step. If you're using the above example, enter **`https://s3.amazonaws.com/aws-cloudwatch/downloads/CloudWatchLogs-Cookbooks.zip`**.
8. Choose **Add Stack** to create the stack.

Step 3: Extend your IAM role

To use CloudWatch Logs with your Amazon OpsWorks instances, you need to extend the IAM role used by your instances.

1. Open the IAM console at https://console.amazonaws.cn/iam/.

2. In the navigation pane, choose **Policies**, **Create Policy**.
3. On the **Create Policy** page, under **Create Your Own Policy**, choose **Select**. For more information about creating custom policies, see IAM Policies for Amazon EC2 in the *Amazon EC2 User Guide*.
4. On the **Review Policy** page, for **Policy Name**, type a name for the policy.
5. For **Policy Document**, paste in the following policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
        "logs:PutLogEvents",
        "logs:DescribeLogStreams"
    ],
    "Resource": [
      "arn:aws-cn:logs:*:*:*"
    ]
  }
 ]
}
```

6. Choose **Create Policy**.
7. In the navigation pane, choose **Roles**, and then in the contents pane, for **Role Name**, select the name of the instance role used by your Amazon OpsWorks stack. You can find the one used by your stack in the stack settings (the default is `aws-opsworks-ec2-role`).

> **Note**
>
> Choose the role name, not the check box.

8. On the **Permissions** tab, under **Managed Policies**, choose **Attach Policy**.
9. On the **Attach Policy** page, in the table header (next to **Filter** and **Search**), choose **Policy Type**, **Customer Managed Policies**.
10. For **Customer Managed Policies**, select the IAM policy that you created above and choose **Attach Policy**.

For more information about users and policies, see IAM Users and Groups and Managing IAM Policies in the *IAM User Guide*.

Step 4: Add a layer

1. Open the Amazon OpsWorks console at https://console.amazonaws.cn/opsworks/.
2. In the navigation pane, choose **Layers**.
3. In the contents pane, select a layer and choose **Add layer**.
4. On the **OpsWorks** tab, for **Layer type**, choose **Custom**.
5. For the **Name** and **Short name** fields, enter the long and short name for the layer, and then choose **Add layer**.
6. On the **Recipes** tab, under **Custom Chef Recipes**, there are several headings—*Setup*, *Configure*, *Deploy*, *Undeploy*, and *Shutdown*—that correspond to Amazon OpsWorks lifecycle events. Amazon OpsWorks triggers these events at these key points in instance's lifecycle, which runs the associated recipes.

   > **Note**
   >
   > If the above headings aren't visible, under **Custom Chef Recipes**, choose **edit**.

7. Enter *logs::config, logs::install* next to **Setup**, choose **+** to add it to the list, and then choose **Save**.

   Amazon OpsWorks runs this recipe on each of the new instances in this layer, right after the instance boots.

Step 5: Add an instance

The layer only controls how to configure instances. You now need to add some instances to the layer and start them.

1. Open the Amazon OpsWorks console at https://console.amazonaws.cn/opsworks/.
2. In the navigation pane, choose **Instances** and then under your layer, choose **+ Instance**.
3. Accept the default settings and choose **Add Instance** to add the instance to the layer.
4. In the row's **Actions** column, click **start** to start the instance.

Amazon OpsWorks launches a new EC2 instance and configures CloudWatch Logs. The instance's status changes to online when it's ready.

Step 6: View your logs

You should see the newly created log group and log stream in the CloudWatch console after the agent has been running for a few moments.

For more information, see View log data sent to CloudWatch Logs.

Report the CloudWatch Logs agent status

Use the following procedure to report the status of the CloudWatch Logs agent on your EC2 instance.

To report the agent status

1. Connect to your EC2 instance. For more information, see Connect to Your Instance in the *Amazon EC2 User Guide*.

   For more information about connection issues, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide*

2. At a command prompt, type the following command:

   ```
   sudo service awslogs status
   ```

   If you are running Amazon Linux 2, type the following command:

   ```
   sudo service awslogsd status
   ```

3. Check the **/var/log/awslogs.log** file for any errors, warnings, or issues with the CloudWatch Logs agent.

Start the CloudWatch Logs agent

If the CloudWatch Logs agent on your EC2 instance did not start automatically after installation, or if you stopped the agent, you can use the following procedure to start the agent.

To start the agent

1. Connect to your EC2 instance. For more information, see Connect to Your Instance in the *Amazon EC2 User Guide*.

   For more information about connection issues, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide*.
2. At a command prompt, type the following command:

   ```
   sudo service awslogs start
   ```

   If you are running Amazon Linux 2, type the following command:

   ```
   sudo service awslogsd start
   ```

Stop the CloudWatch Logs agent

Use the following procedure to stop the CloudWatch Logs agent on your EC2 instance.

To stop the agent

1. Connect to your EC2 instance. For more information, see Connect to Your Instance in the *Amazon EC2 User Guide*.

   For more information about connection issues, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide*.
2. At a command prompt, type the following command:

   ```
   sudo service awslogs stop
   ```

   If you are running Amazon Linux 2, type the following command:

   ```
   sudo service awslogsd stop
   ```

Quick Start: Use Amazon CloudFormation to get started with CloudWatch Logs

Amazon CloudFormation enables you to describe and provision your Amazon resources in JSON format. The advantages of this method include being able to manage a collection of Amazon resources as a single unit, and easily replicating your Amazon resources across Regions.

When you provision Amazon using Amazon CloudFormation, you create templates that describe the Amazon resources to use. The following example is a template snippet that creates a log group and a metric filter that counts 404 occurrences and sends this count to the log group.

```
"WebServerLogGroup": {
    "Type": "AWS::Logs::LogGroup",
    "Properties": {
        "RetentionInDays": 7
    }
},

"404MetricFilter": {
    "Type": "AWS::Logs::MetricFilter",
    "Properties": {
        "LogGroupName": {
            "Ref": "WebServerLogGroup"
        },
        "FilterPattern": "[ip, identity, user_id, timestamp, request, status_code =
 404, size, ...]",
        "MetricTransformations": [
            {
                "MetricValue": "1",
                "MetricNamespace": "test/404s",
                "MetricName": "test404Count"
            }
        ]
    }
}
```

This is a basic example. You can set up much richer CloudWatch Logs deployments using Amazon CloudFormation. For more information about template examples, see Amazon CloudWatch Logs Template Snippets in the *Amazon CloudFormation User Guide*. For more information about getting started, see Getting Started with Amazon CloudFormation in the *Amazon CloudFormation User Guide*.

Using CloudWatch Logs with an Amazon SDK

Amazon software development kits (SDKs) are available for many popular programming languages. Each SDK provides an API, code examples, and documentation that make it easier for developers to build applications in their preferred language.

SDK documentation
Amazon CLI
Amazon SDK for Java
Amazon SDK for JavaScript
Amazon SDK for .NET
Amazon SDK for PHP
Amazon Tools for PowerShell
Amazon SDK for Python (Boto3)
Amazon SDK for Ruby
Amazon SDK for SAP ABAP

For examples specific to CloudWatch Logs, see Code examples for CloudWatch Logs using Amazon SDKs.

Analyzing log data with CloudWatch Logs Insights

With CloudWatch Logs Insights, you can interactively search and analyze your log data in Amazon CloudWatch Logs. You can perform queries to help you more efficiently and effectively respond to operational issues. If an issue occurs, you can use CloudWatch Logs Insights to identify potential causes and validate deployed fixes.

CloudWatch Logs Insights supports three query languages that you can use for your queries:

- A purpose-built **Logs Insights query language (Logs Insights QL)** with a few simple but powerful commands.
- **OpenSearch Service Piped Processing Language (PPL)**. OpenSearch PPL enables you to analyze your logs using a set of commands delimited by pipes (|).

  With OpenSearch PPL you can retrieve, query, and analyze data by using commands that are piped together, making it easier to understand and compose complex queries. The syntax enables the chaining of commands to transform and process data. With PPL, you can filter and aggregate data, and use a rich set of math, string, date, conditional and other functions for analysis.
- **OpenSearch Service Structured Query Language (SQL)**. With OpenSearch SQL queries, you can analyze your logs in a declarative manner. You can use commands such as SELECT, FROM, WHERE, GROUP BY, HAVING, and various other commands and functions available in SQL. You can execute JOINs across log groups, correlate data across logs using sub-queries, and use the rich set of JSON, Mathematical, String, Conditional and other SQL functions to perform powerful analysis on logs.

  When you use either SQL or PPL commands, make sure to enclose fields with special characters (non-alphabetic and non-numeric) in backticks to successfully query them. For example, enclose `@message`, `Operation.Export`, and `Test::Field` in backticks. You don't need to enclose fields with purely alphabetical names in backticks.

Important

To enhance security for CloudWatch Logs Insights queries, beginning on July 31, 2025 users must be signed on with both the `logs:StartQuery` and `logs:GetQueryResults` permissions to be able to run queries in the CloudWatch console. After this date, users who don't have both of these permissions won't be able to view query results in the console,

and will instead see a banner message when attempting to view query results in the console.
After the change, the required console experience permissions will be consistent with the current required permissions for SDK and Amazon CLI users who use the StartQuery and GetQueryResults APIs.
For information about how to create IAM policies or to add permissions to existing policies, see Define custom IAM permissions with customer managed policies and Edit IAM policies in the IAM User Guide.

CloudWatch Logs Insights offers the following features that are available for use with any of the query languages.

- Automatic *discovery of log fields* in logs from Amazon services such as Amazon Route 53, Amazon Lambda, Amazon CloudTrail, and Amazon VPC, and any application or custom log that emits log events as JSON.
- Creating *field indexes* to reduce costs and speed results, especially for queries of large number of log groups or log events. After creating field indexes of fields that are common in your log events, you can use them in in a query. The query skips processing log events that are known to not include the indexed field, and processes less data.

  Note

  The `filterIndex` command is available only in Logs Insights QL.

- *Detection and analysis of patterns* in your log events. A pattern is a shared text structure that recurs among your log fields. When you view the results of a query, you can choose the **Patterns** tab to see the patterns that CloudWatch Logs found based on a sample of your results.
- *Saving queries*, seeing your query history, and re-running saved queries. This can help you run complex queries when you need, without having to re-create them each time that you want to run them.
- *Adding queries to dashboards*.
- *Encrypting query results with Amazon Key Management Service*.

The following CloudWatch Logs Insights features are supported only when you use Logs Insights QL.

- Query generation using natural language.
- Querying logs in the Infrequent Access log class.
- Comparison queries that compare log events in a log group with log events from a previous time period.
- The *`filterIndex command`*, which forces the query to attempt to scan only log events that contain a *field index* that you specify.

> **Important**
>
> CloudWatch Logs Insights can't access log events with timestamps that pre-date the creation time of the log group.

If you are signed in to an account set up as a monitoring account in CloudWatch cross-account observability, you can run CloudWatch Logs Insights queries on log groups in source accounts linked to this monitoring account. You can run a query that queries multiple log groups located in different accounts. For more information, see CloudWatch cross-account observability.

When you create queries using Logs Insights QL, you can also use natural language to create CloudWatch Logs Insights queries. To do so, ask questions about or describe the data you're looking for. This AI-assisted capability generates a query based on your prompt and provides a line-by-line explanation of how the query works. For more information, see Use natural language to generate and update CloudWatch Logs Insights queries.

Queries using any of the supported query languages time out after 60 minutes, if they have not completed. Query results are available for seven days.

CloudWatch Logs Insights queries incur charges based on the amount of data that is queried, regardless of query language. For more information, see Amazon CloudWatch Pricing.

You can use CloudWatch Logs Insights to search log data that was sent to CloudWatch Logs on November 5, 2018 or later.

> **Important**
>
> If your network security team doesn't allow the use of web sockets, you can't currently access the CloudWatch Logs Insights portion of the CloudWatch console. You can use

the CloudWatch Logs Insights query capabilities using APIs. For more information, see StartQuery in the *Amazon CloudWatch Logs API Reference*.

Contents

Supported query languages

The following sections list the commands supported in each query language. They also describe the syntax format and provide sample queries.

Topics

CloudWatch Logs Insights query language (Logs Insights QL)

This section includes full documentation of Logs Insights QL commands and functions. It also includes sample queries for this language.

Topics

- Sample queries
- Compare (diff) with previous time ranges
- Visualize log data in graphs
- Use natural language to generate and update CloudWatch Logs Insights queries

CloudWatch Logs Insights language query syntax

This section provides details about the Logs Insights QL. The query syntax supports different functions and operations that include but aren't limited to general functions, arithmetic and comparison operations, and regular expressions.

Important

To avoid incurring excessive charges by running large queries, keep in mind the following best practices:

- Select only the necessary log groups for each query.
- Always specify the narrowest possible time range for your queries.
- When you use the console to run queries, cancel all your queries before you close the CloudWatch Logs Insights console page. Otherwise, queries continue to run until completion.
- When you add a CloudWatch Logs Insights widget to a dashboard, ensure that the dashboard is not refreshing at a high frequency, because each refresh starts a new query.

To create queries that contain multiple commands, separate the commands with the pipe character (**|**).

To create queries that contain comments, set off the comments with the hash character (**#**).

Note

CloudWatch Logs Insights automatically discovers fields for different log types and generates fields that start with the **@** character. For more information about these fields, see Supported logs and discovered fields in the *Amazon CloudWatch User Guide*.

The following table briefly describes each command. Following this table is a more comprehensive description of each command, with examples.

> **Note**
>
> All Logs Insights QL query commands are supported on log groups in the Standard log class. Log groups in the Infrequent Access log class support all Logs Insights QL query commands except `pattern`, `diff`, and `unmask`.

`display`	Displays a specific field or fields in query results.
`fields`	Displays specific fields in query results and supports functions and operations you can use to modify field values and create new fields to use in your query.
`filter`	Filters the query to return only the log events that match one or more conditions.
`filterIndex`	Forces a query to attempt to scan only the log groups that are both indexed on the field mentioned in a field index and also contain a value for the that field index. This reduces scanned volume by attempting to scan only log events from these log groups that contain the value specified in the query for this field index. This command is not supported for log groups in the Infrequent Access log class.
`pattern`	Automatically clusters your log data into patterns. A pattern is shared text structure that recurs among your log fields. CloudWatch Logs Insights provides ways for you to analyze the patterns found in your log events. For more information, see Pattern analysis.
`diff`	Compares the log events found in your requested time period with the log events from a previous time period of equal length, so that you can look for trends and find out if certain log events are new.

parse	Extracts data from a log field to create an extracted field that you can process in your query. **parse** supports both glob mode using wildcards , and regular expressions.
sort	Displays the returned log events in ascending (asc) or descending (desc) order.
SOURCE	Including SOURCE in a query is a useful way to specify a large amount of log groups based on log group name prefix, account identifiers, and log group class to include in a query. This command is supported only when you create a query in the Amazon CLI or programmatically, not in the CloudWatch console.
stats	Calculate aggregate statistics using values in the log fields.
limit	Specifies a maximum number of log events that you want your query to return. Useful with **sort** to return "top 20" or "most recent 20" results.
dedup	Removes duplicate results based on specific values in fields that you specify.
unmask	Displays all the content of a log event that has some content masked because of a data protection policy. For more information about data protection in log groups, see Help protect sensitive log data with masking.
unnest	Flattens a list taken as input to produce multiple records with a single record for each element in the list.
Other operations and functions	CloudWatch Logs Insights also supports many comparison, arithmeti c, datetime, numeric, string, IP address, and general functions and operations.

The following sections provide more details about the CloudWatch Logs Insights query commands.

Topics

- Logs Insights QL commands supported in log classes

- display
- fields
- filter
- filterIndex
- SOURCE
- pattern
- diff
- parse
- sort
- stats
- limit
- dedup
- unmask
- unnest
- Boolean, comparison, numeric, datetime, and other functions
- Fields that contain special characters
- Use aliases and comments in queries

Logs Insights QL commands supported in log classes

All Logs Insights QL query commands are supported on log groups in the Standard log class. Log groups in the Infrequent Access log class support all query commands except `pattern`, `diff`, `filterIndex`, and `unmask`.

display

Use `display` to show a specific field or fields in query results.

The `display` command shows only the fields you specify. If your query contains multiple `display` commands, the query results show only the field or fields that you specified in the final `display` command.

Example: Display one field

The code snippet shows an example of a query that uses the parse command to extract data from `@message` to create the extracted fields `loggingType` and `loggingMessage`. The query returns all log events where the values for `loggingType` are **ERROR**. `display` shows only the values for `loggingMessage` in the query results.

```
fields @message
| parse @message "[*] *" as loggingType, loggingMessage
| filter loggingType = "ERROR"
| display loggingMessage
```

> **Tip**
>
> Use `display` only once in a query. If you use `display` more than once in a query, the query results show the field specified in the last occurrence of `display` command being used.

fields

Use `fields` to show specific fields in query results.

If your query contains multiple `fields` commands and doesn't include a `display` command, the results display all of the fields that are specified in the `fields` commands.

Example: Display specific fields

The following example shows a query that returns 20 log events and displays them in descending order. The values for `@timestamp` and `@message` are shown in the query results.

```
fields @timestamp, @message
| sort @timestamp desc
| limit 20
```

Use `fields` instead of `display`. when you want to use the different functions and operations supported by `fields` for modifying field values and creating new fields that can be used in queries.

You can use the `fields` command with the keyword *as* to create extracted fields that use fields and functions in your log events. For example, `fields ispresent as isRes` creates an extracted field named `isRes`, and the extracted field can be used in the rest of your query.

filter

Use `filter` to get log events that match one or more conditions.

Example: Filter log events using one condition

The code snippet shows an example of a query that returns all log events where the value for `range` is greater than ***3000***. The query limits the results to 20 log events and sorts the logs events by `@timestamp` and in descending order.

```
fields @timestamp, @message
| filter (range>3000)
| sort @timestamp desc
| limit 20
```

Example: Filter log events using more than one condition

You can use the keywords `and` and `or` to combine more than one condition.

The code snippet shows an example of a query that returns log events where the value for `range` is greater than ***3000*** and value for `accountId` is equal to ***123456789012***. The query limits the results to 20 log events and sorts the logs events by `@timestamp` and in descending order.

```
fields @timestamp, @message
| filter (range>3000 and accountId=123456789012)
| sort @timestamp desc
| limit 20
```

Indexed fields and the filter command

If you have created field indexes for a log group, you can leverage those field indexes to make your `filter` queries more efficient and reduce scanned volume. For example, suppose you have created a field index for `requestId`. Then, any CloudWatch Logs Insights query on that log group that includes `filter requestId = value` or `filter requestId IN [value, value, ...]` will attempt to skip processing log events that are known not to include the indexed field. By attempting to scan only the log events that are known to contain that indexed field, scan volume can be reduced and the query is faster.

For more information about field indexes and how to create them, see Create field indexes to improve query performance and reduce scan volume.

> **Important**
>
> Only queries with `filter` *`fieldName`* `=...` and `filter` *`fieldName`* `IN...` will benefit from the field index improvements. Queries with `filter` *`fieldName`* `like` don't use indexes and always scan all log events in the selected log groups.

Example: Find log events that are related to a certain request ID, using indexes

This example assumes that you have created a field index on `requestId`. For log groups that use this field index, the query will leverage field indexes to attempt to scan the least amount of log events to find events with `requestId` with a value of `123456`

```
fields @timestamp, @message
| filter requestId = "1234656"
| limit 20
```

Matches and regular expressions in the filter command

The filter command supports the use of regular expressions. You can use the following comparison operators (=, `!=`, <, <=, >, >=) and Boolean operators (`and`, `or`, and `not`).

You can use the keyword `in` to test for set membership and check for elements in an array. To check for elements in an array, put the array after `in`. You can use the Boolean operator `not` with `in`. You can create queries that use `in` to return log events where fields are string matches. The fields must be complete strings. For example, the following code snippet shows a query that uses `in` to return log events where the field `logGroup` is the complete string `example_group`.

```
fields @timestamp, @message
| filter logGroup in ["example_group"]
```

You can use the keyword phrases `like` and `not like` to match substrings. You can use the regular expression operator =~ to match substrings. To match a substring with `like` and `not like`, enclose the substring that you want to match in single or double quotation marks. You can use regular expression patterns with `like` and `not like`. To match a substring with the regular expression operator, enclose the substring that you want to match in forward slashes. The following examples contain code snippets that show how you can match substrings using the `filter` command.

Examples: Match substrings

The following examples return log events where `f1` contains the word ***Exception***. All three examples are case sensitive.

The first example matches a substring with `like`.

```
fields f1, f2, f3
| filter f1 like "Exception"
```

The second example matches a substring with `like` and a regular expression pattern.

```
fields f1, f2, f3
| filter f1 like /Exception/
```

The third example matches a substring with a regular expression.

```
fields f1, f2, f3
| filter f1 =~ /Exception/
```

Example: Match substrings with wildcards

You can use the period symbol (`.`) as a wildcard in regular expressions to match substrings. In the following example, the query returns matches where the value for `f1` begins with the string `ServiceLog`.

```
fields f1, f2, f3
| filter f1 like /ServiceLog./
```

You can place the asterisk symbol after the period symbol (`.*`) to create a greedy quantifier that returns as many matches as possible. For example, the following query returns matches where the value for `f1` not only begins with the string `ServiceLog`, but also includes the string `ServiceLog`.

```
fields f1, f2, f3
| filter f1 like /ServiceLog.*/
```

Possible matches can be formatted like the following:

- `ServiceLogSampleApiLogGroup`

- `SampleApiLogGroupServiceLog`

Example: Exclude substrings from matches

The following example shows a query that returns log events where `f1` doesn't contain the word ***Exception***. The example is case senstive.

```
fields f1, f2, f3
| filter f1 not like "Exception"
```

Example: Match substrings with case-insensitive patterns

You can match substrings that are case insensitive with `like` and regular expressions. Place the following parameter (**?i**) before the substring you want to match. The following example shows a query that returns log events where `f1` contains the word ***Exception*** or ***exception***.

```
fields f1, f2, f3
| filter f1 like /(?i)Exception/
```

filterIndex

Use `filterIndex` to return indexed data only, by forcing a query to scan only log groups that are indexed on a field that you specify in the query. For these log groups that are indexed on this field, it further optimizes the query by skipping the log groups that do not have any log events containing the field specified in the query for the indexed field. It further reduces scanned volume by attempting to scan only log events from these log groups that match the value specified in the query for this field index. For more information about field indexes and how to create them, see Create field indexes to improve query performance and reduce scan volume.

Using `filterIndex` with indexed fields can help you query log groups that include petabytes of log data efficiently by limiting the actual search space to log groups and log events that have field indexes.

For example, suppose that you have created a field index for `IPaddress` in some of the log groups in your account. You can then create the following query and choose to query all log groups in the account to find log events that include the value `198.51.100.0` in the `IPaddress` field.

```
fields @timestamp, @message
| filterIndex IPaddress = "198.51.100.0"
```

```
| limit 20
```

The `filterIndex` command causes this query to attempt to skip all log groups that are not indexed for `IPaddress`. Additionally, within the log groups that are indexed, the query skips log events that have an `IPaddress` field but not observed `198.51.100.0` as the value for that field.

Use the `IN` operator to expand the results to any of multiple values for the indexed fields. The following example finds logs events that include either the value `198.51.100.0` or `198.51.100.1` in the `IPaddress` field.

```
fields @timestamp, @message
| filterIndex IPaddress in ["198.51.100.0", "198.51.100.1"]
| limit 20
```

filterIndex compared to filter

To illustrate the difference between `filterIndex` and `filter`, consider the following example queries. Assume that you have created a field index for `IPaddress`, for four of your log groups, but not for a fifth log group. The following query using `filterIndex` will skip scanning the log group that doesn't have the field indexed. For each indexed log group, it attempts to scan only log events that have the indexed field, and it also returns only results from after the field index was created.

```
fields @timestamp, @message
| filterIndex IPaddress = "198.51.100.0"
| limit 20
```

In contrast, if you use `filter` instead of `filterIndex` for a query of the same five log groups, the query will attempt to scan not only the log events that contain the value in the indexed log groups, but will also scan the fifth log group that isn't indexed, and it will scan every log event in that fifth log group.

```
fields @timestamp, @message
| filter IPaddress = "198.51.100.0"
| limit 20
```

SOURCE

Including SOURCE in a query is a useful way to specify the log groups to include in a query when you are using the Amazon CLI or API to create a query. The SOURCE command is supported only in

the Amazon CLI and API, not in the CloudWatch console. When you use the CloudWatch console to start a query, you use the console interface to specify the log groups.

To use SOURCE to specify the log groups to query, you can use the following keywords:

- `namePrefix` runs the query against log groups that have names that start with the string that you specify. If you omit this, all log groups are queried.

  You can include as many as five prefixes in the list.
- `accountIdentifiers` runs the query against log groups in the specified Amazon account. This works only when you run the query in a monitoring account. If you omit this, the default is to query all linked source accounts and the current monitoring account. For more information about cross-account observability, see CloudWatch cross-account observability.

  You can include as many as 20 account identifiers in the list.
- `logGroupClass` runs the query against log groups that are in the specified log class, either Standard or Infrequent Access. If you omit this, the default of Standard log class is used. For more information about log classes, see Log classes.

Because you can specify large numbers of log groups to query this way, we recommend that you use SOURCE only in queries that leverage field indexes that you have created. For more information about indexing fields in log groups, see Create field indexes to improve query performance and reduce scan volume

The following example selects all log groups in the account. If this is a monitoring account then the log groups across monitoring and all the source accounts will be selected. If the total number of log groups exceed 10,000 then you will see an error prompting you to reduce the number of log groups by using a different log group selection method.

```
SOURCE logGroups()
```

The following example selects the log groups in the 111122223333 source account. If you start a query in a monitoring account in CloudWatch cross-account observability, log groups in all source accounts and in the monitoring account are selected by default.

```
SOURCE logGroups(accountIdentifiers:['111122223333'])
```

The next example selects log groups based on name prefixes.

```
SOURCE logGroups(namePrefix: ['namePrefix1', 'namePrefix2'])
```

The following example selects all log groups in the Infrequent Access log class. If you don't include the `class` identifier, the query applies only to log groups in the Standard log class, which is the default.

```
SOURCE logGroups(class: ['INFREQUENT_ACCESS'])
```

The next example selects log groups in the 111122223333 account that start with specific name prefixes and are in the Standard log class. The class is not mentioned in the command because Standard is the default log class value.

```
SOURCE logGroups(accountIdentifiers:['111122223333'], namePrefix: ['namePrefix1',
 'namePrefix2']
```

The final example displays how to use the SOURCE command with the `start-query` Amazon CLI command.

```
aws logs start-query
--region us-east-1
--start-time 1729728200
--end-time 1729728215
--query-string "SOURCE logGroups(namePrefix: ['Query']) | fields @message | limit 5"
```

pattern

Use `pattern` to automatically cluster your log data into patterns.

A pattern is shared text structure that recurs among your log fields. You can use `pattern` to surface emerging trends, monitor known errors, and identify frequently occurring or high-cost log lines. CloudWatch Logs Insights also provides a console experience you can use to find and further analyze patterns in your log events. For more information, see Pattern analysis.

Because the `pattern` command automatically identifies common patterns, you can use it as a starting point to search and analyze yours logs. You can also combine `pattern` with the `filter`, `parse`, or `sort` commands to identify patterns in more fine-tuned queries.

Pattern Command Input

The `pattern` command expects one of the following inputs: the `@message` field, an extracted field created using the `parse` command, or a string manipulated using one or more String functions.

If CloudWatch Logs can't infer the type of data that a dynamic token represents, displays it as <Token-*number*>, and *number* indicates where in the pattern this token appears, compared to the other dynamic tokens.

Common examples of dynamic tokens include error codes, IP addresses, timestamps, and request IDs.

Pattern Command Output

The `pattern` command produces the following output:

- `@pattern`: A shared text structure that recurs among your log event fields. Fields that vary within a pattern, such as a request ID or timestamp, are represented by *tokens*. If CloudWatch Logs can determine the type of data that a dynamic token represents, it displays the token as <*string*-*number*>. The *string* is a description of the type of data that the token represents. The *number* shows where in the pattern this token appears, compared to the other dynamic tokens.

  CloudWatch Logs assigns the string part of the name based on analyzing the content of the log events that contain it.

  If CloudWatch Logs can't infer the type of data that a dynamic token represents, displays it as <Token-*number*>, and *number* indicates where in the pattern this token appears, compared to the other dynamic tokens.

  For example, `[INFO] Request time: <Time-1> ms` is a potential output for the log message `[INFO] Request time: 327 ms`.
- `@ratio`: The ratio of log events from a selected time period and specified log groups that match an identified pattern. For example, if half of the log events in the selected log groups and time period match the pattern, `@ratio` returns `0.50`
- `@sampleCount`: A count of the number of log events from a selected time period and specified log groups that match an identified pattern.
- `@severityLabel`: The log severity or level, which indicates the type of information contained in a log. For example, `Error`, `Warning`, `Info`, or `Debug`.

Examples

The following command identifies logs with similar structures in specified log group(s) over the selected time range, grouping them by pattern and count

```
pattern @message
```

The `pattern` command can be used in combination with the `filter` command

```
filter @message like /ERROR/
| pattern @message
```

The `pattern` command can be use with the `parse` and `sort` commands

```
filter @message like /ERROR/
| parse @message 'Failed to do: *' as cause
| pattern cause
| sort @sampleCount asc
```

diff

Compares the log events found in your requested time period with the log events from a previous time period of equal length. This way, you can look for trends and find whether specific log events are new.

Add a modifier to the `diff` command to specify the time period that you want to compare with:

- `diff` compares the log events in the currently selected time range to the log events of the immediately preceding time range.
- `diff previousDay` compares the log events in the currently selected time range to the log events from the same time the preceding day.
- `diff previousWeek` compares the log events in the currently selected time range to the log events from the same time the preceding week.
- `diff previousMonth` compares the log events in the currently selected time range to the log events from the same time the preceding month.

For more information, see Compare (diff) with previous time ranges.

parse

Use `parse` to extract data from a log field and create an extracted field that you can process in your query. **`parse`** supports both glob mode using wildcards, and regular expressions. For information about regular expression syntax, see Supported regular expressions (regex) syntax.

You can parse nested JSON fields with a regular expression.

Example: Parsing a nested JSON field

The code snippet shows how to parse a JSON log event that's been flattened during ingestion.

```
{'fieldsA': 'logs', 'fieldsB': [{'fA': 'a1'}, {'fA': 'a2'}]}
```

The code snippet shows a query with a regular expression that extracts the values for `fieldsA` and `fieldsB` to create the extracted fields `fld` and `array`.

```
parse @message "'fieldsA': '*', 'fieldsB': ['*']" as fld, array
```

Named capturing groups

When you use **`parse`** with a regular expression, you can use named capturing groups to capture a pattern into a field. The syntax is `parse @message (?<Name>pattern)`

The following example uses a capturing group on a VPC flow log to extract the ENI into a field named `NetworkInterface`.

```
parse @message /(?<NetworkInterface>eni-.*?) / | display NetworkInterface, @message
```

> **Note**
>
> JSON log events are flattened during ingestion. Currently, parsing nested JSON fields with a glob expression isn't supported. You can only parse JSON log events that include no more than 200 log event fields. When you parse nested JSON fields, you must format the regular expression in your query to match the format of your JSON log event.

Examples of the parse command

Use a glob expression to extract the fields `@user`, `@method`, and `@latency` from the log field `@message` and return the average latency for each unique combination of `@method` and `@user`.

```
parse @message "user=*, method:*, latency := *" as @user,
    @method, @latency | stats avg(@latency) by @method,
    @user
```

Use a regular expression to extract the fields `@user2`, `@method2`, and `@latency2` from the log field `@message` and return the average latency for each unique combination of `@method2` and `@user2`.

```
parse @message /user=(?<user2>.*?), method:(?<method2>.*?),
    latency := (?<latency2>.*?)/ | stats avg(latency2) by @method2,
    @user2
```

Extracts the fields `loggingTime`, `loggingType` and `loggingMessage`, filters down to log events that contain `ERROR` or `INFO` strings, and then displays only the `loggingMessage` and `loggingType` fields for events that contain an `ERROR` string.

```
FIELDS @message
    | PARSE @message "* [*] *" as loggingTime, loggingType, loggingMessage
    | FILTER loggingType IN ["ERROR", "INFO"]
    | DISPLAY loggingMessage, loggingType = "ERROR" as isError
```

sort

Use `sort` to display log events in ascending (`asc`) or descending (`desc`) order by a specified field. You can use this with the `limit` command to create "top N" or "bottom N" queries.

The sorting algorithm is an updated version of natural sorting. If you sort in ascending order, the following logic is used.

- All non-number values come before all number values. *Number values* are values that include only numbers, not a mix of numbers and other characters.
- For non-number values, the algorithm groups consecutive numeric characters and consecutive alphabetic characters into separate chunks for comparison. It orders non-numeric portions by their Unicode values, and it orders numeric portions by their length first and then by their numerical value.

For more information about Unicode order, see List of Unicode characters.

For example, the following is the result of a sort in ascending order.

```
!: >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> sorted by unicode order
#
*%04
0# >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Alphanumeric starting with numbers
5A
111A   >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  Starts with more digits than 5A, so it sorted
 to be later than 5A
2345_
@ >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> 2345 is compared with @ in the unicode order,
@_
A >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Values starting with letters
A9876fghj
a12345hfh
0 >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Number values
01
1
2
3
```

If you sort in descending order, the sort results are the reverse.

For example, the following query for Amazon VPC flow logs finds the top 15 packet transfers across hosts.

```
stats sum(packets) as packetsTransferred by srcAddr, dstAddr
    | sort packetsTransferred  desc
    | limit 15
```

stats

Use `stats` to create visualizations of your log data such as bar charts, line charts, and stacked area charts. This helps you more efficiently identify patterns in your log data. CloudWatch Logs Insights generates visualizations for queries that use the `stats` function and one or more aggregation functions.

For example, the following query in a Route 53 log group returns visualizations showing the distribution of Route 53 records per hour, by query type.

```
stats count(*) by queryType, bin(1h)
```

All such queries can produce bar charts. If your query uses the `bin()` function to group the data by one field over time, you can also see line charts and stacked area charts.

The following time units and abbreviations are supported with the `bin` function. For all units and abbreviations that include more than one character, adding `s` to pluralize is supported. So both `hr` and `hrs` work to specify hours.

- `millisecond` `ms` `msec`
- `second` `s` `sec`
- `minute` `m` `min`
- `hour` `h` `hr`
- `day` `d`
- `week` `w`
- `month` `mo` `mon`
- `quarter` `q` `qtr`
- `year` `y` `yr`

Topics

- Visualize time series data
- Visualize log data grouped by fields
- Use multiple stats commands in a single query
- Functions to use with stats

Visualize time series data

Time series visualizations work for queries with the following characteristics:

- The query contains one or more aggregation functions. For more information, see Aggregation Functions in the Stats Command.
- The query uses the `bin()` function to group the data by one field.

These queries can produce line charts, stacked area charts, bar charts, and pie charts.

Examples

For a complete tutorial, see the section called "Tutorial: Run a query that produces a time series visualization".

Here are more example queries that work for time series visualization.

The following query generates a visualization of the average values of the `myfield1` field, with a data point created every five minutes. Each data point is the aggregation of the averages of the `myfield1` values from the logs from the previous five minutes.

```
stats avg(myfield1) by bin(5m)
```

The following query generates a visualization of three values based on different fields, with a data point created every five minutes. The visualization is generated because the query contains aggregate functions and uses `bin()` as the grouping field.

```
stats avg(myfield1), min(myfield2), max(myfield3) by bin(5m)
```

Line chart and stacked area chart restrictions

Queries that aggregate log entry information but don't use the `bin()` function can generate bar charts. However, the queries cannot generate line charts or stacked area charts. For more information about these types of queries, see the section called "Visualize log data grouped by fields".

Visualize log data grouped by fields

You can produce bar charts for queries that use the `stats` function and one or more aggregation functions. For more information, see Aggregation Functions in the Stats Command.

To see the visualization, run your query. Then choose the **Visualization** tab, select the arrow next to **Line**, and choose **Bar**. Visualizations are limited to up to 100 bars in the bar chart.

Examples

For a complete tutorial, see the section called "Tutorial: Run a query that produces a visualization grouped by log fields". The following paragraphs include more example queries for visualization by fields.

The following VPC flow log query finds the average number of bytes transferred per session for each destination address.

```
stats avg(bytes) by dstAddr
```

You can also produce a chart that includes more than one bar for each resulting value. For example, the following VPC flow log query finds the average and maximum number of bytes transferred per session for each destination address.

```
stats avg(bytes), max(bytes) by dstAddr
```

The following query finds the number of Amazon Route 53 query logs for each query type.

```
stats count(*) by queryType
```

Use multiple stats commands in a single query

You can use as many as two `stats` commands in a single query. This enables you to perform an additional aggregation on the output of the first aggregation.

Example: Query with two `stats` commands

For example, the following query first find the total traffic volume in 5-minute bins, then calculates the highest, lowest, and average traffic volume among those 5-minute bins.

```
FIELDS strlen(@message) AS message_length
| STATS sum(message_length)/1024/1024 as logs_mb BY bin(5m)
| STATS max(logs_mb) AS peak_ingest_mb,
        min(logs_mb) AS min_ingest_mb,
        avg(logs_mb) AS avg_ingest_mb
```

Example: Combine multiple stats commands with other functions such as `filter`, `fields`, `bin`

You can combine two `stats` commands with other commands such as `filter` and `fields` in a single query. For example, the following query finds the number of distinct IP addresses in sessions and finds the number of sessions by client platform, filters those IP addresses, and then finally finds the average of session requests per client platform.

```
STATS count_distinct(client_ip) AS session_ips,
      count(*) AS requests BY session_id, client_platform
| FILTER session_ips > 1
```

```
| STATS count(*) AS multiple_ip_sessions,
        sum(requests) / count(*) AS avg_session_requests BY client_platform
```

You can use `bin` and `dateceil` functions in queries with multiple `stats` commands. For example, the following query first combines messages into 5-minute blocks, then aggregates those 5-minute blocks into 10-minute blocks and calculates the highest, lowest, and average traffic volumes within each 10-minute block.

```
FIELDS strlen(@message) AS message_length
| STATS sum(message_length) / 1024 / 1024 AS logs_mb BY BIN(5m) as @t
| STATS max(logs_mb) AS peak_ingest_mb,
        min(logs_mb) AS min_ingest_mb,
        avg(logs_mb) AS avg_ingest_mb BY dateceil(@t, 10m)
```

Notes and limitations

A query can have a maximum of two `stats` commands. This quota can't be changed.

If you use a `sort` or `limit` command, it must appear after the second `stats` command. If it is before the second `stats` command, the query is not valid.

When a query has two `stats` commands, the partial results from the query do not begin displaying until the first `stats` aggregation is complete.

In the second `stats` command in a single query, you can refer only to fields that are defined in the first `stats` command. For example, the following query is not valid because the `@message` field won't be available after the first `stats` aggregation.

```
FIELDS @message
| STATS SUM(Fault) by Operation
# You can only reference `SUM(Fault)` or Operation at this point
| STATS MAX(strlen(@message)) AS MaxMessageSize # Invalid reference to @message
```

Any fields that you reference after the first `stats` command must be defined in that first `stats` command.

```
STATS sum(x) as sum_x by y, z
| STATS max(sum_x) as max_x by z
# You can only reference `max(sum_x)`, max_x or z at this point
```

Important

The `bin` function always implicitly uses the `@timestamp` field. This means that you can't use `bin` in the second `stats` command without using the first `stats` command to propagate the `timestamp` field. For example, the following query is not valid.

```
FIELDS strlen(@message) AS message_length
 | STATS sum(message_length) AS ingested_bytes BY @logStream
 | STATS avg(ingested_bytes) BY bin(5m) # Invalid reference to @timestamp field
```

Instead, define the `@timestamp` field in the first `stats` command, and then you can use it with `dateceil` in the second `stats` command as in the following example.

```
FIELDS strlen(@message) AS message_length
 | STATS sum(message_length) AS ingested_bytes, max(@timestamp) as @t BY
 @logStream
 | STATS avg(ingested_bytes) BY dateceil(@t, 5m)
```

Functions to use with stats

CloudWatch Logs Insights supports both stats aggregation functions and stats non-aggregation functions.

Use statsaggregation functions in the `stats` command and as arguments for other functions.

Function	Result type	Description
`avg(fieldName: NumericLogField)`	number	The average of the values in the specified field.

`count()`
 	
`count(fieldName: LogField)`
	number	Counts the log events. `count()` (or `count(*)`) counts all events returned by the query, while `count(fieldName)` counts all records that include the specified field name.

`count_distinct(fieldName: LogField)`	number	Returns the number of unique values for the field. If the field has very high cardinality (contains many unique values), the value

Function	Result type	Description
		returned by `count_distinct` is just an approximation.
`max(fieldName: LogField)`	LogFieldValue	The maximum of the values for this log field in the queried logs.
`min(fieldName: LogField)`	LogFieldValue	The minimum of the values for this log field in the queried logs.
`pct(fieldName: LogFieldValue, percent: number)`	LogFieldValue	A percentile indicates the relative standing of a value in a dataset. For example, `pct(@duration, 95)` returns the `@duration` value at which 95 percent of the values of `@duration` are lower than this value, and 5 percent are higher than this value.
`stddev(fieldName: NumericLogField)`	number	The standard deviation of the values in the specified field.
`sum(fieldName: NumericLogField)`	number	The sum of the values in the specified field.

Stats non-aggregation functions

Use non-aggregation functions in the `stats` command and as arguments for other functions.

Function	Result type	Description
`earliest(fieldName: LogField)`	LogField	Returns the value of `fieldName` from the log event that has the earliest timestamp in the queried logs.
`latest(fieldName: LogField)`	LogField	Returns the value of `fieldName` from the log event that has the latest timestamp in the queried logs.

Function	Result type	Description
`sortsFirst(fieldName: LogField)`	LogField	Returns the value of `fieldName` that sorts first in the queried logs.
`sortsLast(fieldName: LogField)`	LogField	Returns the value of `fieldName` that sorts last in the queried logs.

limit

Use `limit` to specify the number of log events that you want your query to return. If you omit `limit`, the query will return as many as 10,000 log events in the results.

For example, the following example returns only the 25 most recent log events

```
fields @timestamp, @message | sort @timestamp desc | limit 25
```

dedup

Use `dedup` to remove duplicate results based on specific values in fields that you specify. You can use `dedup` with one or more fields. If you specify one field with `dedup`, only one log event is returned for each unique value of that field. If you specify multiple fields, then one log event is returned for each unique combination of values for those fields.

Duplicates are discarded based on the sort order, with only the first result in the sort order being kept. We recommend that you sort your results before putting them through the `dedup` command. If the results are not sorted before being run through `dedup`, then the default descending sort order using `@timestamp` is used.

Null values are not considered duplicates for evaluation. Log events with null values for any of the specified fields are retained. To eliminate fields with null values, use **`filter`** using the `isPresent(field)` function.

The only query command that you can use in a query after the `dedup` command is `limit`.

Example: See only the most recent log event for each unique value of the field named `server`

The following example displays the `timestamp`, `server`, `severity`, and `message` fields for only the most recent event for each unique value of `server`.

```
fields @timestamp, server, severity, message
| sort @timestamp desc
| dedup server
```

For more samples of CloudWatch Logs Insights queries, see General queries.

unmask

Use `unmask` to display all the content of a log event that has some content masked because of a data protection policy. To use this command, you must have the `logs:Unmask` permission.

For more information about data protection in log groups, see Help protect sensitive log data with masking.

unnest

Use `unnest` to flatten a list taken as input to produce multiple records with a single record for each element in the list. Based on the number of items a field contains, this command discards the current record and generates new records. Each record includes the `unnested_field`, which represents an item. All other fields come from the original record.

The input for `unnest` is `LIST`, which comes from the `jsonParse` function. For more information, see Structure types. Any other types, such as `MAP`, `String` and `numbers`, are treated as a list with one item in `unnest`.

Command structure

The following example describes the format of this command.

```
unnest field into unnested_field
```

Example query

The following example parses a JSON object string and expands a list of field events.

```
fields jsonParse(@message) as json_message
| unnest json_message.events into event
| display event.name
```

The log event for this example query could be a JSON string as follows:

```
{
   "events": [
        {
            "name": "exception"
        },
        {
            "name": "user action"
        }
   ]
}
```

In this case, the sample query produces two records in the query result, one with `event.name` as `exception` and another with `event.name` as **user action**

Example query

The following example flattens a list and then filters out items.

```
fields jsonParse(@message) as js
| unnest js.accounts into account
| filter account.type = "internal"
```

Example query

The following example flattens a list for aggregation.

```
fields jsonParse(trimmedData) as accounts
| unnest accounts into account
| stats sum(account.droppedSpans) as n by account.accountId
| sort n desc
| limit 10
```

Boolean, comparison, numeric, datetime, and other functions

CloudWatch Logs Insights supports many other operations and functions in queries, as explained in the following sections.

Topics

- Arithmetic operators
- Boolean operators

- Comparison operators
- Numeric operators
- Structure types
- Datetime functions
- General functions
- JSON functions
- IP address string functions
- String functions

Arithmetic operators

Arithmetic operators accept numeric data types as arguments and return numeric results. Use arithmetic operators in the `filter` and `fields` commands and as arguments for other functions.

Operation	Description
`a + b`	Addition
`a - b`	Subtraction
`a * b`	Multiplication
`a / b`	Division
`a ^ b`	Exponentiation (`2 ^ 3` returns 8)
`a % b`	Remainder or modulus (`10 % 3` returns 1)

Boolean operators

Use the Boolean operators **and**, **`or`**, and **`not`**.

> **Note**
>
> Use Boolean operators only in functions that return a value of **TRUE** or **FALSE**.

Comparison operators

Comparison operators accept all data types as arguments and return a Boolean result. Use comparison operations in the `filter` command and as arguments for other functions.

Operator	Description
=	Equal
!=	Not equal
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to

Numeric operators

Numeric operations accept numeric data types as arguments and return numeric results. Use numeric operations in the `filter` and `fields` commands and as arguments for other functions.

Operation	Result type	Description
`abs(a: number)`	number	Absolute value
`ceil(a: number)`	number	Round to ceiling (the smallest integer that is greater than the value of a)
`floor(a: number)`	number	Round to floor (the largest integer that is smaller than the value of a)
`greatest(a: number, ...numbers: number[])`	number	Returns the largest value

Operation	Result type	Description
`least(a: number, ...numbers: number[])`	number	Returns the smallest value
`log(a: number)`	number	Natural log
`sqrt(a: number)`	number	Square root

Structure types

A map or list is a structure type in CloudWatch Logs Insights that allows you to access and use attributes for queries.

Example: To get a map or list

Use `jsonParse` to parse a field that's a json string into a map or a list.

```
fields jsonParse(@message) as json_message
```

Example: To access attributes

Use the dot access operator (map.attribute) to access items in a map.. If an attribute in a map contains special characters, use backticks to enclose the attribute name (map.attributes.`special.char`).

```
fields jsonParse(@message) as json_message
| stats count() by json_message.status_code
```

Use the bracket access operator (list[index]) to retrieve an item at a specific position within the list.

```
fields jsonParse(@message) as json_message
| filter json_message.users[1].action = "PutData"
```

Wrap special characters in backticks (``) when special characters are present in the key name.

```
fields jsonParse(@message) as json_message
| filter json_message.`user.id` = "123"
```

Example: empty results

Maps and lists are treated as null for string, number, and datetime functions.

```
fields jsonParse(@message) as json_message
| display toupper(json_message)
```

Comparing map and list to any other fields result in `false`.

> **Note**
>
> Using map and list in dedup,`pattern`, `sort`, and `stats` isn't supported.

Datetime functions

Datetime functions

Use datetime functions in the `fields` and `filter`commands and as arguments for other functions. Use these functions to create time buckets for queries with aggregate functions. Use time periods that consist of a number and one of the following:

- `ms` for milliseconds
- `s` for seconds
- `m` for minutes
- `h` for hours

For example, `10m` is 10 minutes, and `1h` is 1 hour.

> **Note**
>
> Use the most appropriate time unit for your datetime function. CloudWatch Logs caps your request according to the time unit that you choose. For example, it caps 60 as the maximum value for any request that uses `s`. So, if you specify `bin(300s)`, CloudWatch Logs actually implements this as 60 seconds, because 60 is the number of seconds in a minute so CloudWatch Logs won't use a number higher than 60 with `s`. To create a 5-minute bucket, use `bin(5m)` instead.
> The cap for `ms` is 1000, the caps for `s` and `m` are 60, and the cap for `h` is 24.

The following table contains a list of the different datetime functions that you can use in query commands. The table lists each function's result type and contains a description of each function.

> **Tip**
>
> When you create a query command, you can use the time interval selector to select a time period that you want to query. For example, you can set a time period between 5 and 30-minute intervals; 1, 3, and 12-hour intervals; or a custom time frame. You also can set time periods between specific dates.

Function	Result type	Description

`bin(period: Period)`	Timestamp	Rounds the value of `@timestamp` to the given time period and then truncates. For example, `bin(5m)` rounds the value of `@timestamp` to the nearest 5 minutes.
		
		You can use this to group multiple log entries together in a query. The following example returns the count of exceptions per hour:
		
		`filter @message like /Exception/`
		`  | stats count(*) as exceptionCount`
		`by bin(1h)`
		`  | sort exceptionCount desc`
		
		The following time units and abbreviations are supported with the `bin` function. For all units and abbreviations that include more than one character, adding `s` to pluralize is supported. So both `hr` and `hrs` work to specify hours.
		
		• `millisecond ms msec`
		• `second s sec`
		• `minute m min`
		• `hour h hr`

Function	Result type	Description
		• day d • week w • month mo mon • quarter q qtr • year y yr
datefloor(timestamp: Timestamp, period: Period)	Timestamp	Truncates the timestamp to the given period. For example, datefloor(@timestamp, 1h) truncates all values of @timestamp to the bottom of the hour.
dateceil(timestamp : Timestamp, period: Period)	Timestamp	Rounds up the timestamp to the given period and then truncates. For example, dateceil(@timestamp, 1h) truncates all values of @timestamp to the top of the hour.
fromMillis(fieldNa me: number)	Timestamp	Interprets the input field as the number of milliseconds since the Unix epoch and converts it to a timestamp.
toMillis(fieldName: Timestamp)	number	Converts the timestamp found in the named field into a number representing the milliseco nds since the Unix epoch. For example, toMillis(@timestamp) converts the timestamp 2022-01-14T13:18:0 31.000-08:00 to 1642195111000 .

Function	Result type	Description

now( )	number	Returns the time that the query processing was started, in epoch seconds. This function takes no arguments.
		
		You can use this to filter your query results according to the current time.
		
		For example, the following query returns all 4xx errors from the past two hours:
		
		`parse @message "Status Code: *;" as statusCode\n`
		`| filter statusCode >= 400 and statusCode <= 499 \n`
		`| filter toMillis(@timestamp) >= (now() * 1000 - 7200000)`
		
		The following example returns all log entries from the past five hours that contain either the word `error` or `failure`
		
		`fields @timestamp, @message`
		`| filter @message like /(?i)(error|failure)/`
		`| filter toMillis(@timestamp) >= (now() * 1000 - 18000000)`

Note

Currently, CloudWatch Logs Insights doesn't support filtering logs with human readable timestamps.

General functions

General functions

Use general functions in the `fields` and `filter` commands and as arguments for other functions.

Function	Result type	Description
`ispresent(fieldName: LogField)`	Boolean	Returns `true` if the field exists
`coalesce(fieldName: LogField, ...fieldNames: LogField[])`	LogField	Returns the first non-null value from the list

JSON functions

JSON functions

Use JSON functions in the `fields` and `filter` commands and as arguments for other functions.

Function	Result type	Description
`jsonParse(fieldName: string)`	Map | List | Empty	Returns a map or list when the input is a string represent ation of JSON object or a JSON array. Returns an empty value, if the input is not one of the representation.
`jsonStringify(fieldName: Map | List)`	String	Returns a JSON string from a map or list data.

IP address string functions

IP address string functions

Use IP address string functions in the `filter` and `fields` commands and as arguments for other functions.

Function	Result type	Description
`isValidIp(fieldName: string)`	boolean	Returns `true` if the field is a valid IPv4 or IPv6 address.
`isValidIpV4(fieldName: string)`	boolean	Returns `true` if the field is a valid IPv4 address.
`isValidIpV6(fieldName: string)`	boolean	Returns `true` if the field is a valid IPv6 address.
`isIpInSubnet(fieldName: string, subnet: string)`	boolean	Returns `true` if the field is a valid IPv4 or IPv6 address within the specified v4 or v6 subnet. When you specify the subnet, use CIDR notation such as `192.0.2.0/24` or `2001:db8::/32` , where `192.0.2.0` or `2001:db8::` is the start of the CIDR block.
`isIpv4InSubnet(fieldName: string, subnet: string)`	boolean	Returns `true` if the field is a valid IPv4 address within the specified v4 subnet. When you specify the subnet, use CIDR notation such as `192.0.2.0/24` where `192.0.2.0` is the start of the CIDR block..
`isIpv6InSubnet(fieldName: string, subnet: string)`	boolean	Returns `true` if the field is a valid IPv6 address within the specified v6 subnet. When you specify the subnet, use CIDR notation such as `2001:db8::/32` where `2001:db8::` is the start of the CIDR block.

String functions

String functions

Use string functions in the `fields` and `filter` commands and as arguments for other functions.

Function	Result type	Description
`isempty(fieldName: string)`	Number	Returns 1 if the field is missing or is an empty string.
`isblank(fieldName: string)`	Number	Returns 1 if the field is missing, an empty string, or contains only white space.
`concat(str: string, ...strings: string[])`	string	Concatenates the strings.

`ltrim(str: string)`
 	
`ltrim(str: string, trimChars: string)`
	string	If the function does not have a second argument, it removes white space from the left of the string. If the function has a second string argument, it does not remove white space. Instead, it removes the characters in `trimChars` from the left of `str`. For example, `ltrim("xyZxyfooxyZ","xyZ")` returns `"fooxyZ"`.

`rtrim(str: string)`
 	
`rtrim(str: string, trimChars: string)`
	string	If the function does not have a second argument, it removes white space from the right of the string. If the function has a second string argument, it does not remove white space. Instead, it removes the characters of `trimChars` from the right of `str`. For example, `rtrim("xy`

Function	Result type	Description
		`ZfooxyxyZ","xyZ")` returns `"xyZfoo"`.

`trim(str: string)`
 	
`trim(str: string, trimChars: string)`
	string	If the function does not have a second argument, it removes white space from both ends of the string. If the function has a second string argument, it does not remove white space. Instead, it removes the characters of `trimChars` from both sides of `str`. For example, `trim("xyZxyfooxyxyZ","xyZ")` returns `"foo"`.

`strlen(str: string)`	number	Returns the length of the string in Unicode code points.
`toupper(str: string)`	string	Converts the string to uppercase.
`tolower(str: string)`	string	Converts the string to lowercase.

`substr(str: string, startIndex: number)`
 	
`substr(str: string, startIndex: number, length: number)`
	string	Returns a substring from the index specified by the number argument to the end of the string. If the function has a second number argument, it contains the length of the substring to be retrieved. For example, `substr("xyZfooxyZ",3, 3)` returns `"foo"`.

Function	Result type	Description
`replace(fieldName: string, searchValue: string, replaceValue: string)`	string	Replaces all instances of `searchValue` in `fieldName: string` with `replaceValue`. For example, the function `replace(logGroup,"smoke_test","Smoke")` searches for log events where the field `logGroup` contains the string value `smoke_test` and replaces the value with the string `Smoke`.
`strcontains(str: string, searchValue: string)`	number	Returns 1 if `str` contains `searchValue` and 0 otherwise.

Fields that contain special characters

If a field contains non-alphanumeric characters other than the @ symbol or the period (`.`), you must surround the field with backtick characters (`` ` ``). For example, the log field `foo-bar` must be enclosed in backticks (`` `foo-bar` ``) because it contains a non-alphanumeric character, the hyphen (-).

Use aliases and comments in queries

Create queries that contain aliases. Use aliases to rename log fields or when extracting values into fields. Use the keyword `as` to give a log field or result an alias. You can use more than one alias in a query. You can use aliases in the following commands:

- `fields`
- `parse`
- `sort`

- `stats`

The following examples show how to create queries that contain aliases.

Example

The query contains an alias in the `fields` command.

```
fields @timestamp, @message, accountId as ID
| sort @timestamp desc
| limit 20
```

The query returns the values for the fields `@timestamp`, `@message`, and `accountId`. The results are sorted in descending order and limited to 20. The values for `accountId` are listed under the alias `ID`.

Example

The query contains aliases in the `sort` and `stats` commands.

```
stats count(*) by duration as time
| sort time desc
```

The query counts the number of times the field `duration` occurs in the log group and sorts the results in descending order. The values for `duration` are listed under the alias `time`.

Use comments

CloudWatch Logs Insights supports comments in queries. Use the hash character (**#**) to set off comments. You can use comments to ignore lines in queries or document queries.

Example: Query

When the following query is run, the second line is ignored.

```
fields @timestamp, @message, accountId
# | filter accountId not like "7983124201998"
| sort @timestamp desc
| limit 20
```

Get started with Logs Insights QL: Query tutorials

The following sections include sample query tutorials to help you get started with Logs Insights QL.

Topics

Tutorial: Run and modify a sample query

The following tutorial helps you get started with CloudWatch Logs Insights. You run a sample query in Logs Insights QL, and then see how to modify and rerun it.

To run a query, you must already have logs stored in CloudWatch Logs. If you are already using CloudWatch Logs and have log groups and log streams set up, you are ready to start. You may also already have logs if you use services such as Amazon CloudTrail, Amazon Route 53, or Amazon VPC and you have set up logs from those services to go to CloudWatch Logs. For more information about sending logs to CloudWatch Logs, see Getting started with CloudWatch Logs.

Queries in CloudWatch Logs Insights return either a set of fields from log events or the result of a mathematical aggregation or other operation performed on log events. This tutorial demonstrates a query that returns a list of log events.

Run a sample query

To run a CloudWatch Logs Insights sample query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.

   On the **Logs Insights** page, the query editor contains a default query in Logs Insights QL that returns the 20 most recent log events.
3. In the **Select log group(s)** drop down, choose one or more log groups to query.

If this is a monitoring account in CloudWatch cross-account observability, you can select log groups in the source accounts as well as the monitoring account. A single query can query logs from different accounts at once.

You can filter the log groups by log group name, account ID, or account label.

When you select a log group in the Standard log class, CloudWatch Logs Insights automatically detects data fields in the group. To see discovered fields, select the **Fields** menu near the top right of the page.

> **Note**
>
> Discovered fields is supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

4. (Optional) Use the time interval selector to select a time period that you want to query.

   You can choose between 5 and 30-minute intervals; 1, 3, and 12-hour intervals; or a custom time frame.

5. Choose **Run** to view the results.

   For this tutorial, the results include the 20 most recently added log events.

   CloudWatch Logs displays a bar graph of log events in the log group over time. The bar graph shows not only the events in the table, but also the distribution of events in the log group that match the query and timeframe.

6. To see all fields for a returned log event, choose the triangular dropdown icon left of the numbered event.

Modify the sample query

In this tutorial, you modify the sample query to show the 50 most recent log events.

If you haven't already run the previous tutorial, do that now. This tutorial starts where that previous tutorial ends.

> **Note**
>
> Some sample queries provided with CloudWatch Logs Insights use `head` or `tail` commands instead of `limit`. These commands are being deprecated and have been replaced with `limit`. Use `limit` instead of `head` or `tail` in all queries that you write.

To modify the CloudWatch Logs Insights sample query

1. In the query editor, change **20** to **50**, and then choose **Run**.

   The results of the new query appear. Assuming there is enough data in the log group in the default time range, there are now 50 log events listed.
2. (Optional) You can save queries that you have created. To save this query, choose **Save**. For more information, see Save and re-run CloudWatch Logs Insights queries.

Add a filter command to the sample query

This tutorial shows how to make a more powerful change to the query in the query editor. In this tutorial, you filter the results of the previous query based on a field in the retrieved log events.

If you haven't already run the previous tutorials, do that now. This tutorial starts where that previous tutorial ends.

To add a filter command to the previous query

1. Decide on a field to filter. To see the most common fields that CloudWatch Logs has detected in the log events contained in the selected log groups in the past 15 minutes, and the percentage of those log events in which each field appears, select **Fields** on the right side of the page.

   To see the fields contained in a particular log event, choose the icon to the left of that row.

   The **awsRegion** field might appear in your log event, depending on which events are in your logs. For the rest of this tutorial, we use **awsRegion** as the filter field, but you can use a different field if that field isn't available.
2. In the query editor box, place your cursor after **50** and press Enter.
3. On the new line, first enter **|** (the pipe character) and a space. Commands in a CloudWatch Logs Insights query must be separated by the pipe character.

4. Enter **`filter awsRegion="us-east-1"`**.
5. Choose **Run**.

   The query runs again, and now displays the 50 most recent results that match the new filter.

   If you filtered on a different field and got an error result, you might need to escape the field name. If the field name includes non-alphanumeric characers, you must put backtick characters (`) before and after the field name (for example, **`` `error-code`="102" ``**).

   You must use the backtick characters for field names that contain non-alphanumeric characters, but not for values. Values are always contained in quotation marks (").

Logs Insights QL includes powerful query abilities, including several commands and support for regular expressions, mathematical, and statistical operations. For more information, see CloudWatch Logs Insights language query syntax.

Tutorial: Run a query with an aggregation function

You can use aggregation functions with the `stats` command and as arguments for other functions. In this tutorial, you run a query command that counts the number of log events containing a specified field. The query command returns a total count that's grouped by the specified field's value or values. For more information about aggregation functions, see Supported operations and functions in the *Amazon CloudWatch Logs User Guide*.

To run a query with an aggregation function

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. Confirm that the **Logs Insights QL** tab is selected.
4. In the **Select log group(s)** drop down, choose one or more log groups to query.

   If this is a monitoring account in CloudWatch cross-account observability, you can select log groups in the source accounts as well as the monitoring account. A single query can query logs from different accounts at once.

   You can filter the log groups by log group name, account ID, or account label.

When you select a log group, CloudWatch Logs Insights automatically detects data fields in the log group if it is a Standard class log group. To see discovered fields, select the **Fields** menu near the top right of the page.

5. Delete the default query in the query editor, and enter the following command:

```
stats count(*) by fieldName
```

6. Replace *fieldName* with a discovered field from the **Fields** menu.

   The **Fields** menu is located at the top right of the page and displays all of the discovered fields that CloudWatch Logs Insights detects in your log group.

7. Choose **Run** to view the query results.

   The query results show the number of records in your log group that match the query command and the total count that's grouped by the specified field's value or values.

Tutorial: Run a query that produces a visualization grouped by log fields

When you run a query that uses the `stats` function to group the returned results by the values of one or more fields in the log entries, you can view the results as a bar chart, pie chart, line graph or stacked area graph. This helps you more efficiently visualize trends in your logs.

To run a query for visualization

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. In the **Select log group(s)** drop down, choose one or more log groups to query.

   If this is a monitoring account in CloudWatch cross-account observability, you can select log groups in the source accounts as well as the monitoring account. A single query can query logs from different accounts at once.

   You can filter the log groups by log group name, account ID, or account label.

4. In the query editor, delete the current contents, enter the following `stats` function, and then choose **Run query**.

```
stats count(*) by @logStream
```

```
    | limit 100
```

The results show the number of log events in the log group for each log stream. The results are limited to only 100 rows.

5. Choose the **Visualization** tab.
6. Select the arrow next to **Line**, and then choose **Bar**.

   The bar chart appears, showing a bar for each log stream in the log group.

Tutorial: Run a query that produces a time series visualization

When you run a query that uses the `bin()` function to group the returned results by a time period, you can view the results as a line graph, stacked area graph, pie chart, or bar chart. This helps you more efficiently visualize trends in log events over time.

To run a query for visualization

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. Confirm that the **Logs Insights QL** tab is selected.
4. In the **Select log group(s)** drop down, choose one or more log groups to query.

   If this is a monitoring account in CloudWatch cross-account observability, you can select log groups in the source accounts as well as the monitoring account. A single query can query logs from different accounts at once.

   You can filter the log groups by log group name, account ID, or account label.
5. In the query editor, delete the current contents, enter the following `stats` function, and then choose **Run query**.

   ```
   stats count(*) by bin(30s)
   ```

   The results show the number of log events in the log group that were received by CloudWatch Logs for each 30-second period.
6. Choose the **Visualization** tab.

The results are shown as a line graph. To switch to a bar chart, pie chart, or stacked area chart, choose the arrow next to **Line** at the upper left of the graph.

Sample queries

This section contains a list of general and useful query commands that you can run in the CloudWatch console. For information about how to run a query command, see Tutorial: Run and modify a sample query in the *Amazon CloudWatch Logs User Guide*.

For more information about query syntax, see CloudWatch Logs Insights language query syntax.

Topics

General queries

Find the 25 most recently added log events.

```
fields @timestamp, @message | sort @timestamp desc | limit 25
```

Get a list of the number of exceptions per hour.

```
filter @message like /Exception/
    | stats count(*) as exceptionCount by bin(1h)
    | sort exceptionCount desc
```

Get a list of log events that aren't exceptions.

```
fields @message | filter @message not like /Exception/
```

Get the most recent log event for each unique value of the `server` field.

```
fields @timestamp, server, severity, message
| sort @timestamp asc
| dedup server
```

Get the most recent log event for each unique value of the `server` field for each `severity` type.

```
fields @timestamp, server, severity, message
| sort @timestamp desc
| dedup server, severity
```

Queries for Lambda logs

Determine the amount of overprovisioned memory.

```
filter @type = "REPORT"
    | stats max(@memorySize / 1000 / 1000) as provisonedMemoryMB,
        min(@maxMemoryUsed / 1000 / 1000) as smallestMemoryRequestMB,
        avg(@maxMemoryUsed / 1000 / 1000) as avgMemoryUsedMB,
        max(@maxMemoryUsed / 1000 / 1000) as maxMemoryUsedMB,
        provisonedMemoryMB - maxMemoryUsedMB as overProvisionedMB
```

Create a latency report.

```
filter @type = "REPORT" |
    stats avg(@duration), max(@duration), min(@duration) by bin(5m)
```

Search for slow function invocations, and eliminate duplicate requests that can arise from retries or client-side code. In this query, `@duration` is in milliseconds.

```
fields @timestamp, @requestId, @message, @logStream
| filter @type = "REPORT" and @duration > 1000
```

```
| sort @timestamp desc
| dedup @requestId
| limit 20
```

Queries for Amazon VPC flow logs

Find the top 15 packet transfers across hosts:

```
stats sum(packets) as packetsTransferred by srcAddr, dstAddr
    | sort packetsTransferred  desc
    | limit 15
```

Find the top 15 byte transfers for hosts on a given subnet.

```
filter isIpv4InSubnet(srcAddr, "192.0.2.0/24")
    | stats sum(bytes) as bytesTransferred by dstAddr
    | sort bytesTransferred desc
    | limit 15
```

Find the IP addresses that use UDP as a data transfer protocol.

```
filter protocol=17 | stats count(*) by srcAddr
```

Find the IP addresses where flow records were skipped during the capture window.

```
filter logStatus="SKIPDATA"
    | stats count(*) by bin(1h) as t
    | sort t
```

Find a single record for each connection, to help troubleshoot network connectivity issues.

```
fields @timestamp, srcAddr, dstAddr, srcPort, dstPort, protocol, bytes
| filter logStream = 'vpc-flow-logs' and interfaceId = 'eni-0123456789abcdef0'
| sort @timestamp desc
| dedup srcAddr, dstAddr, srcPort, dstPort, protocol
| limit 20
```

Queries for Route 53 logs

Find the distribution of records per hour by query type.

```
stats count(*) by queryType, bin(1h)
```

Find the 10 DNS resolvers with the highest number of requests.

```
stats count(*) as numRequests by resolverIp
    | sort numRequests desc
    | limit 10
```

Find the number of records by domain and subdomain where the server failed to complete the DNS request.

```
filter responseCode="SERVFAIL" | stats count(*) by queryName
```

Queries for CloudTrail logs

Find the number of log entries for each service, event type, and Amazon Region.

```
stats count(*) by eventSource, eventName, awsRegion
```

Find the Amazon EC2 hosts that were started or stopped in a given Amazon Region.

```
filter (eventName="StartInstances" or eventName="StopInstances") and awsRegion="us-
east-2"
```

Find the Amazon Regions, user names, and ARNs of newly created IAM users.

```
filter eventName="CreateUser"
    | fields awsRegion, requestParameters.userName, responseElements.user.arn
```

Find the number of records where an exception occurred while invoking the API `UpdateTrail`.

```
filter eventName="UpdateTrail" and ispresent(errorCode)
    | stats count(*) by errorCode, errorMessage
```

Find log entries where TLS 1.0 or 1.1 was used

```
filter tlsDetails.tlsVersion in [ "TLSv1", "TLSv1.1" ]
| stats count(*) as numOutdatedTlsCalls by userIdentity.accountId, recipientAccountId,
 eventSource, eventName, awsRegion, tlsDetails.tlsVersion, tlsDetails.cipherSuite,
 userAgent
| sort eventSource, eventName, awsRegion, tlsDetails.tlsVersion
```

Find the number of calls per service that used TLS versions 1.0 or 1.1

```
filter tlsDetails.tlsVersion in [ "TLSv1", "TLSv1.1" ]
| stats count(*) as numOutdatedTlsCalls by eventSource
| sort numOutdatedTlsCalls desc
```

Queries for Amazon API Gateway

Find the last 10 4XX errors

```
fields @timestamp, status, ip, path, httpMethod
| filter status>=400 and status<=499
| sort @timestamp desc
| limit 10
```

Identify the 10 longest-running Amazon API Gateway requests in your Amazon API Gateway access log group

```
fields @timestamp, status, ip, path, httpMethod, responseLatency
| sort responseLatency desc
| limit 10
```

Return the list of the most popular API paths in your Amazon API Gateway access log group

```
stats count(*) as requestCount by path
| sort requestCount desc
| limit 10
```

Create an integration latency report for your Amazon API Gateway access log group

```
filter status=200
```

```
| stats avg(integrationLatency), max(integrationLatency),
min(integrationLatency) by bin(1m)
```

Queries for NAT gateway

If you notice higher than normal costs in your Amazon bill, you can use CloudWatch Logs Insights to find the top contributors. For more information about the following query commands, see How can I find the top contributors to traffic through the NAT gateway in my VPC? at the Amazon premium support page.

> **Note**
>
> In the following query commands, replace "x.x.x.x" with the private IP of your NAT gateway, and replace "y.y" with the first two octets of your VPC CIDR range.

Find the instances that are sending the most traffic through your NAT gateway.

```
filter (dstAddr like 'x.x.x.x' and srcAddr like 'y.y.')
| stats sum(bytes) as bytesTransferred by srcAddr, dstAddr
| sort bytesTransferred desc
| limit 10
```

Determine the traffic that's going to and from the instances in your NAT gateways.

```
filter (dstAddr like 'x.x.x.x' and srcAddr like 'y.y.') or (srcAddr like 'xxx.xx.xx.xx'
 and dstAddr like 'y.y.')
| stats sum(bytes) as bytesTransferred by srcAddr, dstAddr
| sort bytesTransferred desc
| limit 10
```

Determine the internet destinations that the instances in your VPC communicate with most often for uploads and downloads.

For uploads

```
filter (srcAddr like 'x.x.x.x' and dstAddr not like 'y.y.')
| stats sum(bytes) as bytesTransferred by srcAddr, dstAddr
| sort bytesTransferred desc
| limit 10
```

For downloads

```
filter (dstAddr like 'x.x.x.x' and srcAddr not like 'y.y.')
| stats sum(bytes) as bytesTransferred by srcAddr, dstAddr
| sort bytesTransferred desc
| limit 10
```

Queries for Apache server logs

You can use CloudWatch Logs Insights to query Apache server logs. For more information about the following queries, see Simplifying Apache server logs with CloudWatch Logs Insights at the Amazon Cloud Operations & Migrations Blog.

Find the most relevant fields, so you can review your access logs and check for traffic in the */admin* path of your application.

```
fields @timestamp, remoteIP, request, status, filename| sort @timestamp desc
| filter filename="/var/www/html/admin"
| limit 20
```

Find the number unique GET requests that accessed your main page with status code "200" (success).

```
fields @timestamp, remoteIP, method, status
| filter status="200" and referrer= http://34.250.27.141/ and method= "GET"
| stats count_distinct(remoteIP) as UniqueVisits
| limit 10
```

Find the number of times your Apache service restarted.

```
fields @timestamp, function, process, message
| filter message like "resuming normal operations"
| sort @timestamp desc
| limit 20
```

Queries for Amazon EventBridge

Get the number of EventBridge events grouped by event detail type

```
fields @timestamp, @message
| stats count(*) as numberOfEvents by `detail-type`
```

```
| sort numberOfEvents desc
```

Examples of the parse command

Use a glob expression to extract the fields `@user`, `@method`, and `@latency` from the log field `@message` and return the average latency for each unique combination of `@method` and `@user`.

```
parse @message "user=*, method:*, latency := *" as @user,
    @method, @latency | stats avg(@latency) by @method,
    @user
```

Use a regular expression to extract the fields `@user2`, `@method2`, and `@latency2` from the log field `@message` and return the average latency for each unique combination of `@method2` and `@user2`.

```
parse @message /user=(?<user2>.*?), method:(?<method2>.*?),
    latency := (?<latency2>.*?)/ | stats avg(latency2) by @method2,
    @user2
```

Extracts the fields `loggingTime`, `loggingType` and `loggingMessage`, filters down to log events that contain `ERROR` or `INFO` strings, and then displays only the `loggingMessage` and `loggingType` fields for events that contain an `ERROR` string.

```
FIELDS @message
    | PARSE @message "* [*] *" as loggingTime, loggingType, loggingMessage
    | FILTER loggingType IN ["ERROR", "INFO"]
    | DISPLAY loggingMessage, loggingType = "ERROR" as isError
```

Compare (diff) with previous time ranges

You can use CloudWatch Logs Insights with the Logs Insights QL to compare changes in your log events over time. You can compare the log events ingested during a recent time range with the logs from the immediately previous time period. Alternatively, you can compare with similar past time periods. This can help you find whether an error in your logs was recently introduced or was already occurring, and can help you find other trends.

Comparison queries return only patterns in the results, not raw log events. The patterns returned will help you quickly see the trends and changes in the log events over time. After you run a comparison query and have the pattern results, you can see sample raw log events for the patterns that you're interested in. For more information about log patterns, see Pattern analysis.

When you run a comparison query, your query is analyzed against two different time periods: the original query period that you select, and the comparison period. The comparison period is always of equal length to your original query period. The default time intervals for the comparisons are the following.

- **Previous period**— Compares to the time period immediately before your query time period.
- **Previous day**— Compares to the time period one day before your query time period.
- **Previous week**— Compares to the time period one week before your query time period.
- **Previous month**— Compares to the time period one month before your query time period.

> **Note**
>
> Queries using comparisons incur charges similar to running a single CloudWatch Logs Insights query over the combined time range. For more information, see Amazon CloudWatch Pricing.

To run a comparison query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Logs Insights**.

   A default query appears in the query box.
3. Confirm that the **Logs Insights QL** tab is selected.
4. Keep the default query or enter a different query.
5. In the **Select log group(s)** drop-down, choose one or more log groups to query.
6. (Optional) Use the time interval selector to select a time period that you want to query. The default query is for the previous hour of log data.
7. By the time range selector, choose **Compare**. Then choose the previous time period that you want to compare the original logs with, and choose **Apply**.
8. Choose **Run query**.

   To cause the query to fetch the data from the comparison period, the `diff` command is appended to your query.
9. Choose the **Patterns** tab to see the results.

The table displays the following information:

- Each **Pattern**, with variable parts of the pattern replaced by the dynamic token symbol <*string*-*number*>. The *string* is a description of the type of data that the token represents. The *number* shows where in the pattern this token appears, compared to the other dynamic tokens. For more information, see Pattern analysis.
- **Event count** is the number of log events with that pattern in the original, more current time period.
- **Difference event count** is the difference between the number of matching log events in the current time period versus the comparison time period. A positive different means there are more such events in the current time period.
- **Difference description** briefly summarizes the change in that pattern between the current time period and the comparison period.
- **Severity type** is the probable severity of the logs events with this pattern, based on words found in the log events such as `FATAL`, `ERROR`, and `WARN`.

10. To further inspect one of the patterns in the list, choose the icon in the **Inspect** column for one of the patterns.

    The **Pattern inspect** pane appears and displays the following:

    - The **Pattern**. Select a token within the pattern to analyze that token's values.
    - A histogram showing the number of occurrences of the pattern over the queried time range. This can help you to identify interesting trends such as a sudden increase in occurrence of a pattern.
    - The **Log samples** tab displays a few of the log events that match the selected pattern.
    - The **Token Values** tab displays the values of the selected dynamic token, if you have selected one.

      > **Note**
      >
      > A maximum of 10 token values is captured for each token. Token counts might not be precise. CloudWatch Logs uses a probabilistic counter to generate the token count, not the absolute value.

    - The **Related patterns** tab displays other patterns that frequently occurred near the same time as the pattern that you are inspecting. For example, if a pattern for an `ERROR` message

was usually accompanied by another log event marked as `INFO` with additional details, that pattern is displayed here.

Visualize log data in graphs

You can use visualizations such as bar charts, line charts, and stacked area charts to more efficiently identify patterns in your log data. CloudWatch Logs Insights generates visualizations for queries that use the `stats` function and one or more aggregation functions. For more information, see stats.

Use natural language to generate and update CloudWatch Logs Insights queries

CloudWatch Logs supports a natural language query capability to help you generate and update queries for CloudWatch Logs Insights and CloudWatch Metrics Insights.

With this capability, you can ask questions about or describe the CloudWatch Logs data you're looking for in plain English. The natural language capability generates a query based on a prompt that you enter and provides a line-by-line explanation of how the query works. You can also update your query to further investigate your data.

Depending on your environment, you can enter prompts like "What are the top 100 source IP addresses by bytes transferred?" and "Find the 10 slowest Lambda function requests."

Note

The natural-language query feature is generally available in 10 Regions. For some Regions, the feature makes cross-Region calls to Regions in the United States to process the query prompts. The following table lists the supported Regions, and shows where each Region processes its prompts.

Supported Region	Region where prompt is processed
US East (N. Virginia)	US East (N. Virginia)
US East (Ohio)	US East (N. Virginia)
US West (Oregon)	US West (Oregon)

Supported Region	Region where prompt is processed
Asia Pacific (Hong Kong)	US West (Oregon)
Asia Pacific (Singapore)	US West (Oregon)
Asia Pacific (Sydney)	US West (Oregon)
Asia Pacific (Tokyo)	Asia Pacific (Tokyo)
Europe (Frankfurt)	Europe (Frankfurt)
Europe (Ireland)	US East (N. Virginia)
Europe (Stockholm)	US East (N. Virginia)

To generate a CloudWatch Logs Insights query with this capability, open the CloudWatch Logs Insights query editor, select the log group you want to query, and choose **Generate query**.

Important

To use the natural language query capability, you must be signed in with the CloudWatchLogsFullAccess, CloudWatchLogsReadOnlyAccess, AdministratorAccess, or ReadOnlyAccess IAM policies, or have the `cloudwatch:GenerateQuery` permission.

Example queries

The examples in this section describe how to generate and update queries using the natural language capability.

Note

For more information on the CloudWatch Logs Insights query editor and syntax, see CloudWatch Logs Insights query syntax.

Example: Generate a natural language query

To generate a query using natural language, enter a prompt and choose **Generate new query**. This example shows a query that performs a basic search.

Prompt

The following is an example of a prompt that directs the capability to search for the 10 slowest Lambda function invocations.

```
Find the 10 slowest requests
```

Query

The following is an example of a query that the natural language capability generates based on the prompt. Notice how the prompt appears in a comment before the query. After the query, you can read an explanation that describes how the query works.

```
# Find the 10 slowest requests
fields @timestamp, @message, @duration
| sort @duration desc
| limit 10
# This query retrieves the timestamp, message and duration fields from the logs and
 sorts them in descending order by duration to find the 10 slowest requests.
```

> **Note**
>
> To turn off the appearance of your prompt and the explanation of how the query works, use the gear icon in your editor.

Example: Update a natural language query

You can update a query by editing the initial prompt and then choosing **Update query**.

Updated prompt

The following example shows an updated version of the previous prompt. Instead of a prompt that searches for the 10 slowest Lambda function invocations, this prompt now directs the capability to

search for the 20 slowest Lambda function invocations and include another column for additional log events.

```
Show top 20 slowest requests instead and display requestId as a column
```

Updated query

The following is an example of the updated query. Notice how the updated prompt appears in a comment before the updated query. After the query, you can read an explanation that describes how the original query has been updated.

```
# Show top 20 slowest requests instead and display requestId as a column
fields @timestamp, @message, @requestId, @duration
| sort @duration desc
| limit 20
# This query modifies the original query by replacing the @message field with the
 @requestId field and changing the limit from 10 to 20 to return the top 20 log events
 by duration instead of the top 10.
```

Opting out of using your data for service improvement

The natural language prompt data you provide to train the AI model and generate relevant queries is used solely to provide and maintain your service. This data might be used to improve the quality of CloudWatch Logs Insights. Your trust and privacy, as well as the security of your content, is our highest priority. For more information, see Amazon Service Terms and Amazon responsible AI policy.

You can opt out of having your content used to develop or improve the quality of natural language queries by creating an AI service opt-out policy. To opt-out of data collection for all CloudWatch Logs AI features, including the query generation capability, you must create an opt-out policy for CloudWatch Logs. For more information, see AI services opt-out policies in the *Amazon Organizations User Guide*.

OpenSearch PPL language

This section contains a basic introduction to querying CloudWatch Logs using OpenSearch PPL. With PPL, you can retrieve, query, and analyze data using piped-together commands, making it easier to understand and compose complex queries. Its syntax is based on Unix pipes, and enables

chaining of commands to transform and process data. With PPL, you can filter and aggregate data, and use a rich set of math, string, date, conditional, and other functions for analysis.

You can use OpenSearch PPL only for queries of log groups in the Standard Log Class. When you select which log groups to query, you can select a single log group, a set of log groups that share a prefix, or select all log groups

> **Note**
>
> For information about all OpenSearch PPL query commands supported in CloudWatch Logs and detailed information about syntax and restrictions, see Supported PPL commands in the OpenSearch Service Developer Guide.

Command or function	Example query	Description
fields	`fields field1, field2`	Displays a set of fields which needs projection.
join	`LEFT JOIN left=l, right=r on l.id = r.id` `` `join_right_lg` `` `| fields l.field_1, r.field_2`	Joins two datasets together.
where	`where field1="success" | where field2 != "i-023fe0a90929d8822" | fields field3, field4, field5,field6 | head 1000`	Filters the data based on the conditions that you specify.
stats	`stats count(), count(field1), min(field 1), max(field1), avg(field1) by field2 | head 1000`	Performs aggregations and calculations
parse	`parse field1 ".*/(?<field2>[^/]+$)" | where field2 = "requestId" | fields field1, field2 | head 1000`	Extracts a regular expression (regex) pattern

Command or function	Example query	Description
		from a string and displays the extracted pattern. The extracted pattern can be further used to create new fields or filter data.
sort	`stats count(), count(field1), min(field 1) as field1Alias, max(`field1`), avg(`field1`) by field2 | sort -field1Al ias | head 1000`	Sort the displayed results by a field name. Use sort -FieldNam e to sort in descending order.
eval	`eval field2 = field1 * 2 | fields field1, field2 | head 20`	Modifies or processes the value of a field and stores it in a different field. This is useful to mathemati cally modify a column, apply string functions to a column, or apply date functions to a column.

Command or function	Example query	Description
rename	`rename field2 as field1 | fields field1;`	Renames one or more fields in the search result.
head	`fields `@message` | head 20`	Limits the displayed query results to the first N rows.
top	`top 2 field1 by field2`	Finds the most frequent values for a field.
dedup	`dedup field1 | fields field1, field2, field3`	Removes duplicate entries based on the fields that you specify.
rare	`rare field1 by field2`	Finds the least frequent values of all fields in the field list.
subquery	`where field_1 IN [ search source= `subquery_lg` | fields field_2 ] | fields id, field_1`	Performs complex, nested queries within your PPL statements.
trendline	`trendline sma(2, field1) as field1Alias`	Calculates the moving averages of fields.

Command or function	Example query	Description
eventStats	`eventstats sum(field1) by field2`	Enriches your event data with calculated summary statistics. It analyzes specified fields within your events, computes various statistical measures, and then appends these results to each original event as new fields.
expand	`eval tags_array_string = json_extract(`@message`, '$.tags')\| eval tags_array = json_array(json_extract(tags_string, '$[0]'), json_extract(tags_string, '$[1]'))| expand tags_array as color_tags`	Breaks down a field containing multiple values into separate rows, creating a new row for each value in the specified field.
fillnull	`fields `@timestamp`, error_code, status_code | fillnull using status_code = "UNKNOWN", error_code = "UNKNOWN"`	Fills null fields with the value that you provide. It can be used in one or more fields.

Command or function	Example query	Description
flatten	`eval metadata_struct = json_object('size', json_extract(metadata_string, '$.size'), 'color', json_extract(metadata_string, '$.color')) | flatten metadata_struct as (meta_size, meta_color)`	Flattens a field. The field must be of this type: `struct<?,?>` or `array<struct<?,?>>` .
cidrmatch	`where cidrmatch(ip, '2003:db8::/32') | fields ip`	Checks if the specified IP address is within the given CIDR range.
fieldsummary	`where field1 != 200 | fieldsummary includefields= field1 nulls=true`	Calculates basic statistics for each field (count, distinct count, min, max, avg, stddev, and mean).
grok	`grok email '.+@%{HOSTNAME:host}' | fields email, host`	Parses a text field with a grok pattern and appends the results to the search result.

Command or function	Example query	Description
String functions	`eval field1Len = LENGTH(field1) | fields field1Len`	Built-in functions in PPL that can manipulate and transform string and text data within PPL queries. For example, converting case, combining strings, extracting parts, and cleaning text.
Date-Time functions	`eval newDate = ADDDATE(DATE('2020-08-26'), 1) | fields newDate`	Built-in functions for handling and transforming date and timestamp data in PPL queries. For example, date_add, date_format, datediff, date-sub, timestampadd, timestampdiff, current_timezone, utc_timestamp, and current_date.

Command or function	Example query	Description
Condition functions	`eval field2 = isnull(field1) | fields field2, field1, field3`	Built-in functions that check for specific field conditions, and evaluate expressions conditionally. For example, if field1 is null, return field2.
Math functions	`eval field2 = ACOS(field1) | fields field1`	Built-in functions for performing mathematical calculations and transformations in PPL queries. For example, abs (absolute value), round (rounds numbers), sqrt (square root), pow (power calculation), and ceil (rounds up to nearest integer).
CryptoGraphic functions	`eval crypto = MD5(field)| head 1000`	To calculate the hash of given field

Command or function	Example query	Description
JSON functions	`eval valid_json = json('[1,2,3,{"f1":1,"f2":[5,6]},4]') | fields valid_json`	Built-in functions for handling JSON including arrays, extracting, and validation. For example, json_object, json_array, to_json_string, json_array_length, json_extract, json_keys, and json_valid.

OpenSearch SQL language

This section contains a basic introduction to querying CloudWatch Logs using OpenSearch SQL. It provides a familiar option if you're used to working with relational databases. OpenSearch SQL offers a subset of SQL functionality, making it a good choice for performing ad-hoc queries and data analysis tasks. With OpenSearch SQL, you can use commands such as SELECT, FROM, WHERE, GROUP BY, HAVING, and various other SQL commands and functions. You can execute JOINs across log groups, correlate data across log groups using sub-queries, and use the rich set of JSON, mathematical, string, conditional, and other SQL functions to perform powerful analysis on log and security data.

You can use OpenSearch SQL only for queries of log groups in the Standard Log Class. When you select which log groups to query, you can select a single log group, a set of log groups that share a prefix, or select all log groups

Note

The following table lists the SQL commands and functions supported in CloudWatch Logs For information about all OpenSearch SQL commands including syntax, see Supported SQL commands in the OpenSearch Service Developer Guide.

Supported SQL commands

Note

In the example query column, replace *<logGroup>* as needed depending on which data source you're querying.

Command or function	Example query	Description
SELECT	`SELECT \`@message\`, Operation FROM \`LogGroupA\``	Displays projected values.
FROM	`SELECT \`@message\`, Operation FROM \`LogGroupA\``	Built-in clause that specifies the source table(s) or view(s) from which to retrieve data, supportin g various types of joins and subqueries.
WHERE	`SELECT * FROM \`LogGroupA\` WHERE Operation = 'x'`	Filters log events based on the provided field criteria.

Command or function	Example query	Description
GROUP BY	`SELECT \`@logStream\`, COUNT(*) as log_count FROM \`LogGroupA\` GROUP BY \`@logStream\``	Groups log events based on category and finds the average based on stats.
HAVING	`SELECT \`@logStream\`, COUNT(*) as log_count FROM \`LogGroupA\` GROUP BY \`@logStream\` HAVING log_count > 100`	Filters the results based on grouping conditions.
ORDER BY	`SELECT * FROM \`LogGroupA\` ORDER BY \`@timestamp\` DESC`	Orders the results based on fields in the ORDER BY clause. You can sort in either descending or ascending order.
JOIN	`SELECT A.\`@message\`, B.\`@timestamp\`FROM \`LogGroupA\` as A INNER JOIN \`LogGroupB\` as B ON A.\`requestId\` = B.\`requestId\``	Joins the results for two tables based on common fields. Inner JOIN or Left Outer Join must be specified
LIMIT	`Select * from \`LogGroupA\` limit 10`	Limits the displayed query results to the first N rows.

Command or function	Example query	Description
String functions	`SELECT upper(Operation) , lower(Operation), Operation FROM `LogGroupA``	Built-in functions in SQL that can manipulate and transform string and text data within SQL queries. For example, converting case, combining strings, extracting parts, and cleaning text.
Date functions	`SELECT current_date() as today, date_add(current_date(), 30) as thirty_days_later, last_day(current_date()) as month_end FROM `LogGroupA``	Built-in functions for handling and transforming date and timestamp data in SQL queries. For example, date_add, date_format, datediff, and current_date.

Command or function	Example query	Description
Conditional functions	`SELECT Operation, IF(Error > 0, 'High', 'Low') as error_category FROM `LogGroup A`;`	Built-in functions that perform actions based on specified conditions, or that evaluate expressions conditionally. For example, CASE and IF.
Aggegrate functions	`SELECT AVG(bytes) as bytesWritten FROM `LogGroupA``	Built-in functions that perform calculations on multiple rows to produce a single summarize d value. For example, SUM, COUNT, AVG, MAX, and MIN.

Command or function	Example query	Description
JSON functions	`SELECT get_json_object(json_column, '$.name') as name FROM `LogGroupA``	Built-in functions for parsing, extracting, modifying, and querying JSON-formatted data within SQL queries (e.g., from_json , to_json, get_json_ object, json_tupl e) allowing manipulation of JSON structures in datasets.
Array functions	`SELECT scores, size(scores) as length, array_contains(scores, 90) as has_90 FROM `LogGroupA`;`	Built-in functions for working with array-type columns in SQL queries, allowing operations like accessing , modifying, and analyzing array data (e.g., size, explode, array_contains).

Command or function	Example query	Description
Window functions	`SELECT field1, field2, RANK() OVER (ORDER BY field2 DESC) as field2Rank FROM` `` `LogGroupA` ``;	Built-in functions that perform calculations across a specified set of rows related to the current row (window), enabling operations like ranking, running totals, and moving averages. For example, ROW_NUMBER, RANK, LAG, and LEAD

Command or function	Example query	Description
Conversion functions	`SELECT CAST('123' AS INT) as converted_number, CAST(123 AS STRING) as converted_string FROM `LogGroupA``	Built-in functions for converting data from one type to another within SQL queries, enabling data type transformations and format conversions. For example, CAST, TO_DATE, TO_TIMESTAMP, and BINARY.
Predicate functions	`SELECT scores, size(scores) as length, array_contains(scores, 90) as has_90 FROM `LogGroupA`;`	Built-in functions that evaluate conditions and return boolean values (true/false) based on specified criteria or patterns. For example, IN, LIKE, BETWEEN, IS NULL, and EXISTS.
Select multiple log groups	`SELECT lg1.field1, lg1.field2 from `logGroups(logGroupIdentifier: ['LogGroup1', 'LogGroup2'])` as lg1 where lg1.field3= "Success"`	Enables you to specify multiple log groups in a SELECT statement

Supported SQL for multi-log-group queries

To support the use case for querying multiple log groups in SQL, you can use the `logGroups` command. Using this syntax, you can query multiple log groups by specifying them in the FROM command.

Syntax:

```
`logGroups(
    logGroupIdentifier: ['LogGroup1','LogGroup2', ...'LogGroupn']
)
```

In this syntax, you can specify up to 50 log groups in the `logGroupIdentifier` parameter. To reference log groups in a monitoring account, use ARNs instead of `LogGroup` names.

Example query:

```
SELECT LG1.Column1, LG1.Column2 from `logGroups(
    logGroupIdentifier: ['LogGroup1', 'LogGroup2']
)` as LG1 WHERE LG1.Column1 = 'ABC'
```

The following syntax involving multiple log groups after the `FROM` statement is NOT supported when querying CloudWatch Logs.

```
SELECT Column1, Column2 FROM 'LogGroup1', 'LogGroup2', ...'LogGroupn'
WHERE Column1 = 'ABC'
```

Restrictions

The following restrictions apply when you use OpenSearch SQL to query in CloudWatch Logs Insights.

- You can include only one JOIN in a SELECT statement.
- Only one level of nested subqueries is supported.
- Multiple statement queries separated by semi-colons (;) aren't supported.
- Queries containing field names that are identical but differ only in case (such as field1 and FIELD1) are not supported.

  For example, the following query isn't supported:

```
Select AWSAccountId, AwsAccountId from LogGroup
```

However, the following query is supported because the field name (`@logStream`) is identical in both log groups:

```
Select a.`@logStream`, b.`@logStream` from Table A INNER Join Table B on a.id = b.id
```

- Functions and expressions must operate on field names and be part of a SELECT statement with a log group specified in the FROM clause.

  For example, this query is not supported:

  ```
  SELECT cos(10) FROM LogGroup
  ```

  This query is supported:

  ```
  SELECT cos(field1) FROM LogGroup
  ```

- When using SQL or PPL commands, enclose certain fields in backticks to successfully query them. Backticks are necessary for fields with special characters (non-alphabetic and non-numeric). For example, enclose `@message`, `Operation.Export`, and `Test::Field` in backticks. You don't need to enclose fields with purely alphabetic names in backticks.

  Example query with simple fields:

  ```
  SELECT SessionToken, Operation, StartTime  FROM `LogGroup-A`
  LIMIT 1000;
  ```

  Similar query with backticks appended:

  ```
  SELECT `@SessionToken`, `@Operation`, `@StartTime`  FROM `LogGroup-A` LIMIT 1000;
  ```

Supported logs and discovered fields

CloudWatch Logs Insights supports different log types. For every log that's sent to a Standard class log group in Amazon CloudWatch Logs, CloudWatch Logs Insights automatically generates five system fields:

- `@message` contains the raw unparsed log event. This is the equivalent to the `message` field in InputLogevent.
- `@timestamp` contains the event timestamp in the log event's `timestamp` field. This is the equivalent to the `timestamp` field in InputLogevent.
- `@ingestionTime` contains the time when CloudWatch Logs received the log event.
- `@logStream` contains the name of the log stream that the log event was added to. Log streams group logs through the same process that generated them.
- `@log` is a log group identifier in the form of *`account-id`*:*`log-group-name`*. When querying multiple log groups, this can be useful to identify which log group a particular event belongs to.
- `@entity` contains flattened JSON related to entities for the Explore related telemetry feature.

  For example, this JSON can represent an entity.

```
{
  "Entity": {
    "KeyAttributes": {
      "Type": "Service",
      "Name": "PetClinic"
    },
    "Attributes": {
      "PlatformType": "AWS::EC2",
      "EC2.InstanceId": "i-1234567890123"
    }
  }
}
```

  For this entity, the extracted system fields would be the following:

```
@entity.KeyAttributes.Type = Service
@entity.KeyAttributes.Name = PetClinic
@entity.Attributes.PlatformType = AWS::EC2
@entity.Attributes.EC2.InstanceId = i-1234567890123
```

Note

Field discovery is supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

CloudWatch Logs Insights inserts the **@** symbol at the start of fields that it generates.

For many log types, CloudWatch Logs also automatically discovers the log fields contained in the logs. These automatic discovery fields are shown in the following table.

For other types of logs with fields that CloudWatch Logs Insights doesn't automatically discover, you can use the `parse` command to extract and create extracted fields for use in that query. For more information, see CloudWatch Logs Insights language query syntax.

If the name of a discovered log field starts with the `@` character, CloudWatch Logs Insights displays it with an additional `@` appended to the beginning. For example, if a log field name is `@example.com`, this field name is displayed as `@@example.com`.

> **Note**
>
> Except for `@message`, `@timestamp`, or `@log`, you can create field indexes for discovered fields. For more information about field indexes, see Create field indexes to improve query performance and reduce scan volume.

Log type	Discovered log fields
Amazon VPC flow logs	`@timestamp` , `@logStream` , `@message`, `accountId` , `endTime`, `interfaceId` , `logStatus` , `startTime` , `version`, `action`, `bytes`, `dstAddr`, `dstPort`, `packets`, `protocol`, `srcAddr`, `srcPort`
Route 53 logs	`@timestamp` , `@logStream` , `@message`, `edgeLocation` , `ednsClientSubnet` , `hostZoneId` , `protocol`, `queryName` , `queryTimestamp` , `queryType` , `resolverIp` , `responseCode` , `version`
Lambda logs	`@timestamp` , `@logStream` , `@message`, `@requestId` , `@duration`, `@billedDuration` , `@type`, `@maxMemoryUsed` , `@memorySize` If a Lambda log line contains an X-Ray trace ID, it also includes the following fields: `@xrayTraceId` and `@xraySegmentId` . CloudWatch Logs Insights automatically discovers log fields in Lambda logs, but only for the first embedded JSON fragment in each log event. If a Lambda log event contains multiple JSON fragments, you can parse and

Log type	Discovered log fields
	extract the log fields by using the **`parse`** command. For more information, see Fields in JSON logs.
CloudTrail logs Logs in JSON format	For more information, see Fields in JSON logs.
Other log types	`@timestamp` , `@ingestionTime` , `@logStream` , `@message`, `@log`.

Fields in JSON logs

With CloudWatch Logs Insights, you use dot notation to represent JSON fields. This section contains an example JSON event and code snippet that show how you can access JSON fields using dot notation.

Example: JSON event

```
{
    "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": "192.0.2.255",
    "userAgent": "ec2-api-tools1.6.12.2",
    "requestParameters": {
        "instancesSet": {
            "items": [
                {
                    "instanceId": "i-abcde123"
```

```
                }
            ]
        }
    },
    "responseElements": {
        "instancesSet": {
            "items": [
                {
                    "instanceId": "i-abcde123",
                    "currentState": {
                        "code": 0,
                        "name": "pending"
                    },
                    "previousState": {
                        "code": 80,
                        "name": "stopped"
                    }
                }
            ]
        }
    }
}
```

The example JSON event contains an object that's named `userIdentity`. `userIdentity` contains a field that's named `type`. To represent value of `type` using dot notation, you use `userIdentity.type`.

The example JSON event contains arrays that flatten to lists of nested field names and values. To represent the value of `instanceId` for the first item in `requestParameters.instancesSet`, you use `requestParameters.instancesSet.items.0.instanceId`. The number `0` that's placed before the field `instanceID` refers to the position of values for the field `items`. The following example contains a code snippet that shows how you can access nested JSON fields in a JSON log event.

Example: Query

```
fields @timestamp, @message
| filter requestParameters.instancesSet.items.0.instanceId="i-abcde123"
| sort @timestamp desc
```

The code snippet shows a query that uses dot notation with the `filter` command to access the value of the nested JSON field `instanceId`. The query filters on messages where the value of

`instanceId` equals `"i-abcde123"` and returns all of the log events that contain the specified value.

> **Note**
>
> CloudWatch Logs Insights can extract a maximum of 200 log event fields from a JSON log. For additional fields that aren't extracted, you can use the `parse` command to extract the fields from the raw unparsed log event in the message field. For more information about the `parse` command, see Query syntax in the Amazon CloudWatch User Guide.

Create field indexes to improve query performance and reduce scan volume

You can create *field indexes* of fields in your log events for efficient equality-based searches. When you then use a field index in a CloudWatch Logs Insights query, the query attempts to skip processing log events that are known to not include the indexed field. This reduces the scan volume of your queries that use field indexes, making it possible to return results faster. This can help you quickly search petabytes of total logs across thousands of log groups, and hone in on relevant logs faster. Good fields to index are fields that you often need to query for. Fields that have high cardinality of values are also good candidates for field indexes because a query using these field indexes will complete faster because it limits the log events that are being matched to the target value.

For example, suppose you have created a field index for `requestId`. Then, any CloudWatch Logs Insights query on that log group that includes `requestId = value` or `requestId IN [value, value, ...]` will attempt to process only the log events that are known to contain that indexed field and the queried value, and that CloudWatch Logs has detected a value for that field in the past.

You can also leverage your field indexes to create efficient queries of larger numbers of log groups. When you use the `filterIndex` command in your query instead of the `filter` command, the query will run against selected log groups on log events that have field indexes. These queries can scan as many as 10,000 log groups which you choose by specifying as many as five log group name prefixes. If this is a monitoring account in CloudWatch cross-account observability, you can choose all the source accounts or specify individual source accounts to select the log groups".

Indexed fields are case-sensitive. For example, a field index of `RequestId` won't match a log event containing `requestId`.

Fields indexes are supported only for the structured log formats of JSON and service logs.

CloudWatch Logs indexes only the log events ingested after an index policy is created. It doesn't index log events ingested before the policy was created. After you create a field index, each matching log event remains indexed for 30 days from the log event's ingestion time.

> **Note**
>
> If you create a field index policy in a monitoring account, that policy is not used for log groups in linked source accounts. A field index policy applies only in the account where it is created.

The rest of the topics in this section explain how to create field indexes. For information about referring to field indexes in your queries, see filterIndex and filter.

Topics

Field index syntax and quotas

You create field indexes by creating *field index policies*. You can create account-level index policies that apply to your whole account, and you can also create policies that apply to only a single log group. For account-wide index policies, you can have one that applies to all log groups in the account. You can also create account-level index policies that apply to a subset of log groups in the account, selected by the prefixes of their log group names. If you have multiple account-level policies in the same account, the log group name prefixes for these policies can't overlap.

Log group-level field index policies override account-level field index policies: if you create log-group level index policy, that log group uses only that policy and ignores the account-level policies.

Matches of log events to the names of field indexes are case-sensitive. For example, a field index of `RequestId` won't match a log event containing `requestId`.

You can have as many as 20 account-level index policies. If you have multiple account-level index policies filtered to log group name prefixes, no two of them can use the same or overlapping log group name prefixes. For example, if you have one policy filtered to log groups that start with `my-log`, you can't have another field index policy filtered to `my-logpprod` or `my-logging`.

If you have an account-level index policy that has no name prefixes and applies to all log groups, then no other account-level index policy can be created.

Each index policy has the following quotas and restrictions:

- As many as 20 fields can be included in the policy.
- Each field name can include as many as 100 characters.
- To create an index of a custom field in your log groups that starts with `@`, you must specify the field with an extra `@` at the beginning of the field name. For example, if your log events include a field named `@userId`, you must specify `@@userId` to create an index for this field.

Generated fields and reserved fields

CloudWatch Logs Insights automatically generates system fields in each log event. These generated fields are prefixed with `@` For more information about generated fields, see Supported logs and discovered fields.

Of these generated fields, the following are supported for use as field indexes:

- `@logStream`
- `@ingestionTime`
- `@requestId`
- `@type`
- `@initDuration`
- `@duration`
- `@billedDuration`
- `@memorySize`
- `@maxMemoryUsed`
- `@xrayTraceId`

- `@xraySetmentId`

To index these generated fields, you don't need to add an extra `@` when specifying them, as you have to do for custom fields that start with `@`. For example, to create a field index for `@logStream`, just specify `@logStream` as the field index.

Child fields and array fields in JSON logs

You can index fields that are nested child fields or array fields in JSON logs.

For example, you can create an index of the `accessKeyId` child field within the `userIdentity` field within this log:

```
{
    "eventVersion": "1.0",
    "userIdentity": {
        "type": "IAMUser",
        "principalId": "EXAMPLE_PRINCIPAL_ID",
        "arn": "arn: aws: iam: : 123456789012: user/Alice",
        "accessKeyId": "11112222",
        "accountId": "123456789012",
        "userName": "Alice"
    },
    "eventTime": "2014-03-06T21: 22: 54Z",
    "eventSource": "ec2.amazonaws.com",
    "eventName": "StartInstances",
    "awsRegion": "us-east-2",
    "sourceIPAddress": "192.0.2.255",
    "userAgent": "ec2-api-tools1.6.12.2",
    "requestParameters": {
        "instancesSet": {
            "items": [{
                "instanceId": "i-abcde123",
                "currentState": {
                    "code": 0,
                    "name": "pending"
                },
                "previousState": {
                    "code": 80,
                    "name": "stopped"
                }
            }]
        }
```

```
    }
}
```

To create this field, you refer to it using dot notation (`userIdentity.accessKeyId`) both when creating the field index and when specifying it in a query. The query could look like this:

```
fields @timestamp, @message
| filterIndex userIdentity.accessKeyId = "11112222"
```

In the previous example event, the `instanceId` field is in an array within `requestParameters.instancesSet.items` To represent this field both when creating the field index and when querying, refer to it as `requestParameters.instancesSet.items.0.instanceId` The 0 refers to that field's place in the array.

Then a query for this field could be the following:

```
fields @timestamp, @message
| filterIndex requestParameters.instancesSet.items.0.instanceId="i-abcde123"
```

Create an account-level field index policy

Use the steps in this section to create a field index policy that applies to all log groups in the account, or to multiple log groups that have log group names that start with the same string.

To create an account-level field index policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Settings** and then choose the **Logs** tab.
3. In the **Account level index policies** section, choose **Manage**.
4. Choose **Create index policy**.
5. For **Policy name**, enter a name for your new poiicy.
6. For **Select log groups**, do one of the following:
   - Choose **All standard log groups** to have the index policy apply to all Standard Class log groups in the account.
   - choose **Select log group(s) by prefix match** to apply the policy to a subset of log groups that all have names that start with the same string. Then, enter the prefix for these log groups in **Enter a prefix name**.

After you enter your prefix, you can choose **Preview prefix matched log groups** to confirm that your prefix matches the log groups that you expected.

7. For **Custom index field configuration**, choose **Add field path** to enter the first field to index.

   Then enter the string to use as the value of the field name. This must be an exact case match to what appears in the log events. For example, if your log events include `requestId`, you must enter `requestId` here. `RequestId`, `requestID`, and `request Id` wouldn't match.

   If you want to index a custom log field that starts with the `@` character, you must include an extra `@` character when you enter the index string. For example, if you have a custom log field `@emailname`, enter `@@emailname` in the **Add field path** box.

   You can also create indexes for the `@ingestionTime` and `@logStream` fields that CloudWatch Logs automatically generates. If you do, you don't need to add an extra `@` when specifying them.

8. Repeat the previous step to add as many as 20 field indexes.
9. When you have finished, choose **Create**.

Create a log-group level field index policy

Use the steps in this section to create a field index policy that applies to a single log group.

To create a log-group level field index policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Logs**, **Log groups**.
3. Choose the name of the log group.
4. Choose the **Field indexes** tab.
5. Choose **Manage field indexes for this log group**
6. For **Manage log group level field indexes**, choose **Add field path** to enter the first field to index.

   Then enter the string to use as the value of the field name. This must be an exact case match to what appears in the log events. For example, if your log events include `requestId`, you must enter `requestId` here. `RequestId`, `requestID`, and `request Id` would not match.

If you want to index a custom log field that starts with the @ character, you must include an extra @ character when you enter the index string. For example, if you have a custom log field `@emailname`, enter `@@emailname` in the **Add field path** box.

You can also create indexes for the `@ingestionTime` and `@logStream` fields that CloudWatch Logs automatically generates. If you do, do not need to add an extra @ when specifying them.

7. Repeat the previous step to add as many as 20 field indexes.
8. When you have finished, choose **Save**.

Log group selection options when creating a query

This section explains the various ways that you can select log groups to include in a query.

To select log groups for a query in the console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Logs Insights**.
3. There are three ways to select log groups for the query:
   - Use the **Log group name** box. This is the default selection method. You can enter as many as 50 log group names with this method. If this is a monitoring account in CloudWatch cross-account observability, you can select log groups in the source accounts as well as the monitoring account. A single query can query logs from different accounts at once.
   - Use the **Log group criteria** section. In this section, you can choose log groups based on the prefix of the log group names. You can include as many as five prefixes in one query. Log groups having these prefixes in their names will be selected. Alternatively, the **All log groups** option selects all the log groups from the account.
   - If this is a monitoring account in CloudWatch cross-account observability, you can select **All accounts** in the account dropdown menu to select the log groups from all linked accounts. Alternatively, you can individually select which accounts should be included for this query.

   If your choices match more than 10,000 log groups, you'll see an error that prompts you to narrow your selection.

4. The default log class for a query is **Standard**. You can use **Log class** to change it to **Infrequent access**.

Using the Amazon CLI

To make these types of selections when you start a query from the command line, you can use the `source` command in your query. For more information and examples, see SOURCE.

Effects of deleting a field index policy

If you delete a field index policy that has been in effect for a time, the following happens:

- For up to 30 days after the policy is deleted, queries can still benefit from the indexed log events.
- If you delete a log-group level index policy, and there is already an account-level policy in place that would apply to that log group, the account-level policy will eventually apply to that log group.

Pattern analysis

CloudWatch Logs Insights uses machine learning algorithms to find *patterns* when you query your logs. A pattern is a shared text structure that recurs among your log fields. When you view the results of a query, you can choose the **Patterns** tab to see the patterns that CloudWatch Logs found based on a sample of your results. Alternatively, you can append the `pattern` command to your query to analyze the patterns in the entire set of matching log events.

Patterns are useful for analyzing large log sets because a large number of log events can often be compressed into a few patterns.

Consider the following sample of three log events.

```
2023-01-01 19:00:01 [INFO] Calling DynamoDB to store for resource id 12342342k124-12345
2023-01-01 19:00:02 [INFO] Calling DynamoDB to store for resource id 324892398123-12345
2023-01-01 19:00:03 [INFO] Calling DynamoDB to store for resource id 3ff231242342-12345
```

In the previous sample, all three log events follow one pattern:

```
<Time-1> [INFO] Calling DynamoDB to store for resource id <ID-2>
```

Fields within a pattern are called *tokens*. Fields that vary within a pattern, such as a request ID or timestamp, are *dynamic tokens*. Each dynamic token is represented by <*string*-*number*>. The *string* is a description of the type of data that the token represents. The *number* shows where in the pattern this token appears, compared to the other dynamic tokens.

Common examples of dynamic tokens include error codes, timestamps, and request IDs. A *token value* represents a particular value of a dynamic token. For example, if a dynamic token represents an HTTP error code, then a token value could be `501`.

Pattern detection is also used in the CloudWatch Logs anomaly detector and compare features. For more information, see Log anomaly detection and Compare (diff) with previous time ranges.

Getting started with pattern analysis

Pattern detection is automatically performed in any CloudWatch Logs Insights query. Queries that don't include the `pattern` command get both log events and patterns in the results.

If you include the `pattern` command in your query, pattern analysis is performed on the entire matched set of log events. This gives you more accurate pattern results, but the raw log events are not returned when you use the `pattern` command. When a query doesn't include `pattern`, the pattern results are based either on the first 1000 returned log events, or on the limit value you used in your query. If you include `pattern` in the query, then the results displayed in the **Patterns** tab are derived from all log events matched by the query.

To get started with pattern analysis in CloudWatch Logs Insights

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Logs Insights**.

   On the **Logs Insights** page, the query editor contains a default query that returns the 20 most recent log events.
3. Remove the `| limit 20` line in the query box, so that the query looks like the following:

   ```
   fields @timestamp, @message, @logStream, @log
   | sort @timestamp desc
   ```
4. In the **Select log group(s)** drop-down, choose one or more log groups to query.
5. (Optional) Use the time interval selector to select a time period that you want to query.

You can choose between 5-minute and 30-minute intervals; 1-hour, 3-hour, and 12-hour intervals; or a custom time frame.

6. Choose **Run query** to start the query.

   When the query finishes running, the **Logs** tab displays a table of log events returned by the query. Above the table is a message about how many records matched the query, similar to **Showing 10,000 of 71,101 records matched**.

7. Choose the **Patterns** tab.

8. The table now displays the patterns found in the query. Because the query did not include the `pattern` command, this tab displays only the patterns discovered among the 10,000 log events that were shown in the table in the **Logs** tab.

   For each pattern, the following information is displayed:

   - The **Pattern**, with each dynamic token displayed as <*string*-*number*>. The *string* is a description of the type of data that the token represents. The *number* shows where in the pattern this token appears, compared to the other dynamic tokens.
   - The **Event count**, which is the number of times that the pattern appeared in the queried log events. Choose the **Event count** column heading to sort the patterns by frequency.
   - The **Event ratio**, which is the percentage of the queried log events that contain this pattern.
   - The **Severity type**, which will be one of the following:
     - **ERROR** if the pattern contains the word **Error**.
     - **WARN** if the pattern contains the word **Warn** but doesn't contain **Error**.
     - **INFO** if the pattern doesn't contain either **Warn** or **Error**.

   Choose the **Severity info** column heading to sort the patterns by severity.

9. Now change the query. Replace the `| sort @timestamp desc` line in the query with `| pattern @message`, so that the complete query is as follows:

```
fields @timestamp, @message, @logStream, @log
| pattern @message
```

10. Choose **Run query**.

When the query finishes, there are no results in the **Logs** tab. However, the **Patterns** tab likely has a larger number of patterns listed, depending on the total number of log events that were queried.

11. Regardless of whether you included `pattern` in your query, you can further inspect the patterns that the query returns. To do so, choose the icon in the **Inspect** column for one of the patterns.

    The **Pattern inspect** pane appears and displays the following:

    - The **Pattern**. Select a token within the pattern to analyze that token's values.
    - A histogram showing the number of occurrences of the pattern over the queried time range. This can help you to identify interesting trends such as a sudden increase in occurrence of a pattern.
    - The **Log samples** tab displays a few of the log events that match the selected pattern.
    - The **Token Values** tab displays the values of the selected dynamic token, if you have selected one.

      > **Note**
      >
      > A maximum of 10 token values is captured for each token. Token counts might not be precise. CloudWatch Logs uses a probabilistic counter to generate the token count, not the absolute value.

    - The **Related patterns** tab displays other patterns that frequently occurred near the same time as the pattern that you are inspecting. For example, if a pattern for an `ERROR` message was usually accompanied by another log event marked as `INFO` with additional details, that pattern is displayed here.

Details about the pattern command

This section contains more details about the `pattern` command and its uses.

- In the previous tutorial, we removed the `sort` command when we added `pattern` because a query is not valid if it includes a `pattern` command after a `sort` command. It is valid to have a `pattern` before a `sort`.

  For more details about `pattern` syntax, see pattern.

- When you use `pattern` in a query, `@message` must be one of the fields selected in the `pattern` command.
- You can include the `filter` command before a `pattern` command to cause only the filtered set of log events to be used as input for pattern analysis.
- To see pattern results for a particular field, such as a field derived from the `parse` command, use `pattern @fieldname`.
- Queries with non-log output, such as queries with the `stats` command, do not return pattern results.

Save and re-run CloudWatch Logs Insights queries

After you create a query, you can save it, and run it again later. Queries are saved in a folder structure, so you can organize them. You can save as many as 1000 queries per region and per account.

Queries are saved on a Region-specific level, not a user-specific level. If you create and save a query, other users with access to CloudWatch Logs in the same Region can see all saved queries and their folder structures in the Region.

To save a query, you must be logged into a role that has the permission `logs:PutQueryDefinition`. To see a list of your saved queries, you must be logged into a role that has the permission`logs:DescribeQueryDefinitions`.

To save a query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. In the query editor, create a query.
4. Choose **Save**.

   If you don't see a **Save** button, you need to change to the new design for the CloudWatch Logs console. To do so:

   a. In the navigation pane, choose **Log groups**.
   b. Choose **Try the new design**.
   c. In the navigation pane, choose **Insights** and return to step 3 of this procedure.

5. Enter a name for the query.
6. (Optional) Choose a folder where you want to save the query. Select **Create new** to create a folder. If you create a new folder, you can use slash (/) characters in the folder name to define a folder structure. For example, naming a new folder **`folder-level-1/folder-level-2`** creates a top-level folder called **`folder-level-1`**, with another folder called **`folder-level-2`** inside that folder. The query is saved in **`folder-level-2`**.
7. (Optional) Change the query's log groups or query text.
8. Choose **Save**.

> **Tip**
>
> You can create a folder for saved queries with `PutQueryDefinition`. To create a folder for your saved queries, use a forward slash (/) to prefix your desired query name with your desired folder name: <*`folder-name`*>/<*`query-name`*>. For more information about this action, see PutQueryDefinition.

To run a saved query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. On the right, choose **Queries**.
4. Select your query from **Saved queries** list. It appears in the query editor.
5. Choose **Run**.

To save a new version of a saved query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. On the right, choose **Queries**.
4. Select your query from **Saved queries** list. It appears in the query editor.
5. Modify the query. If you need to run it to check your work, choose **Run query**.
6. When you are ready to save the new version, choose **Actions**, **Save as**.
7. Enter a name for the query.

8. (Optional) Choose a folder where you want to save the query. Select **Create new** to create a folder. If you create a new folder, you can use slash (/) characters in the folder name to define a folder structure. For example, naming a new folder **`folder-level-1/folder-level-2`** creates a top-level folder called **`folder-level-1`**, with another folder called **`folder-level-2`** inside that folder. The query is saved in **`folder-level-2`**.
9. (Optional) Change the query's log groups or query text.
10. Choose **Save**.

To delete a query, you must be logged in to a role that has the `logs:DeleteQueryDefinition` permission.

To edit or delete a saved query

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. On the right, choose **Queries**.
4. Select your query from **Saved queries** list. It appears in the query editor.
5. Choose **Actions**, **Edit** or **Actions**, **Delete**.

Add query to dashboard or export query results

After you run a query, you can add the query to a CloudWatch dashboard or copy the results to the clipboard.

Queries added to dashboards run every time you load the dashboard and every time that the dashboard refreshes. These queries count toward your limit of 30 concurrent CloudWatch Logs Insights queries.

To add query results to a dashboard

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. Choose one or more log groups and run a query.
4. Choose **Add to dashboard**.
5. Select the dashboard, or choose **Create new** to create a dashboard for the query results.

6. Select the widget type to use for the query results.
7. Enter a name for the widget.
8. Choose **Add to dashboard**.

To copy query results to the clipboard or download the query results

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. Choose one or more log groups and run a query.
4. Choose **Export results**, and then choose the option you want.

View running queries or query history

You can view the queries currently in progress as well as your recent query history.

Queries currently running includes queries you have added to a dashboard. You are limited to 30 concurrent CloudWatch Logs Insights queries per account, including queries added to dashboards. Only 15 of these 30 queries can use either OpenSearch Service PPL or OpenSearch Service SQL.

To view your recent query history

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Logs Insights**.
3. Choose **History**, if you are using the new design for the CloudWatch Logs console. If you are using the old design, choose **Actions**, **View query history for this account**.

   A list of your recent queries appears. You can run any of them again by selecting the query and choosing **Run**.

   Under **Status**, CloudWatch Logs displays **In progress** for any queries that are currently running.

Encrypt query results with Amazon Key Management Service

By default, CloudWatch Logs encrypts the stored results of your CloudWatch Logs Insights queries using the default CloudWatch Logs server-side encryption method. You can choose to use a Amazon KMS key to encrypt these results instead. If you associate a Amazon KMS key with your

encryption results, then CloudWatch Logs uses that key to encrypt the stored results of all queries in the account.

If you later disassociate a the key from your query results, CloudWatch Logs goes back to the default encryption method for later queries. But the queries that ran while the key was associated are still encrypted with that key. CloudWatch Logs can still return those results after the KMS key is disassociated, because CloudWatch Logs can still continue to reference the key. However, if the key is later disabled, then CloudWatch Logs is unable to read the query results that were encrypted with that key.

> **Important**
>
> CloudWatch Logs supports only symmetric KMS keys. Do not use an asymmetric key to encrypt your query results. For more information, see Using Symmetric and Asymmetric Keys.

Limits

- To perform the following steps, you must have the following permissions: `kms:CreateKey`, `kms:GetKeyPolicy`, and `kms:PutKeyPolicy`.
- After you associate or disassociate a key from your query results, it can take up to five minutes for the operation to take effect.
- If you revoke CloudWatch Logs access to an associated key or delete an associated KMS key, your encrypted data in CloudWatch Logs can no longer be retrieved.
- You can't use the CloudWatch console to associate a key, you must use the Amazon CLI or CloudWatch Logs API.

Step 1: Create an Amazon KMS key

To create a KMS key use the following create-key command:

```
aws kms create-key
```

The output contains the key ID and Amazon Resource Name (ARN) of the key. The following is example output:

```
{
    "KeyMetadata": {
        "Origin": "AWS_KMS",
        "KeyId": "1234abcd-12ab-34cd-56ef-1234567890ab",
        "Description": "",
        "KeyManager": "CUSTOMER",
        "Enabled": true,
        "CustomerMasterKeySpec": "SYMMETRIC_DEFAULT",
        "KeyUsage": "ENCRYPT_DECRYPT",
        "KeyState": "Enabled",
        "CreationDate": 1478910250.94,
        "Arn": "arn:aws:kms:us-west-2:123456789012:key/6f815f63-e628-448c-8251-
e40cb0d29f59",
        "AWSAccountId": "123456789012",
        "EncryptionAlgorithms": [
            "SYMMETRIC_DEFAULT"
        ]
    }
}
```

Step 2: Set permissions on the KMS key

By default, all KMS keys are private. Only the resource owner can use it to encrypt and decrypt data. However, the resource owner can grant permissions to access the key to other users and resources. With this step, you give the CloudWatch Logs service principal permission to use the key. This service principal must be in the same Amazon Region where the key is stored.

As a best practice, we recommend that you restrict the use of the key to only those Amazon accounts that you specify.

First, save the default policy for your KMS key as `policy.json` using the following get-key-policy command:

```
aws kms get-key-policy --key-id key-id --policy-name default --output text > ./
policy.json
```

Open the `policy.json` file in a text editor and add the section in bold from one of the following statements. Separate the existing statement from the new statement with a comma. These statements use `Condition` sections to enhance the security of the Amazon KMS key. For more information, see Amazon KMS keys and encryption context.

The `Condition` section in this example limits the use of the Amazon KMS key to the CloudWatch Logs Insights query results in the specified account.

```
{
 "Version": "2012-10-17",
    "Id": "key-default-1",
    "Statement": [
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::account_ID:root"
            },
            "Action": "kms:*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.region.amazonaws.com"
            },
            "Action": [
                "kms:Encrypt*",
                "kms:Decrypt*",
                "kms:ReEncrypt*",
                "kms:GenerateDataKey*",
                "kms:Describe*"
            ],
            "Resource": "*",
            "Condition": {
                "ArnEquals": {
                    "aws:SourceArn": "arn:aws:logs:region:account_ID:query-result:*"
                },
                "StringEquals": {
                    "aws:SourceAccount": "Your_account_ID"
                }
            }
        }
    ]
}
```

Finally, add the updated policy using the following put-key-policy command:

```
aws kms put-key-policy --key-id key-id --policy-name default --policy file://
policy.json
```

Step 3: Associate a KMS key with your query results

To associate the KMS key with the query results in the account

Use the disassociate-kms-key command as follows:

```
aws logs associate-kms-key --resource-identifier "arn:aws:logs:region:account-id:query-
result:*" --kms-key-id "key-arn"
```

Step 4: Disassociate a key from query results in the account

To disassociate the KMS key associated with query results, use the following disassociate-kms-key command:

```
aws logs disassociate-kms-key --resource-identifier "arn:aws:logs:region:account-
id:query-result:*"
```

Generate a natural language summary from CloudWatch Logs Insights query results

Analyzing log data is crucial for understanding your applications' behavior, but interpreting large volumes of log entries can be time-consuming. CloudWatch Logs Insights now offers a natural language summarization capability that transforms complex query results into clear, concise summaries. This capability helps you quickly identify issues and gain actionable insights from your log data.

How it works

CloudWatch Logs Insights can generate a human-readable summary from your query results using Amazon Bedrock. The feature supports all CloudWatch Logs Insights query languages and provides clear, actionable insights from your log data.

Regional availability and data processing

The natural language summary feature is currently available in US East (N. Virginia).

Regional Processing Information

Supported CloudWatch Logs geography	Possible Processing Region
United States (US)	US East (N. Virginia), US East (Ohio), US West (Oregon)

> **Important**
>
> When you use this feature, your query results might be processed in a different Amazon Web Services Region within the same continent as your origin region. For example, if you run a query in US East (N. Virginia), the summarization might occur in US West (Oregon), but your data remains within North America.

Getting started

To generate a natural language summary

1. Run your CloudWatch Logs Insights query.
2. After the query completes, select **Summarize results**.

Permissions

You must have one of the following:

- `CloudWatchLogsFullAccess` permission
- `CloudWatchLogsReadOnlyAccess` permission
- Custom IAM policy including the `cloudwatch:GenerateQueryResultsSummary`, `logs:GetQueryResults`, `logs:DescribeQueries` and `logs:FilterLogEvents` actions

Data privacy

Your query results are processed securely and aren't used to train or improve CloudWatch Logs Insights or Amazon Bedrock. If you choose to provide feedback on the query results summary

using the feedback buttons, your feedback indicates your level of satisfaction with the capability provided in CloudWatch Logs Insights.

Log anomaly detection

You can create a *log anomaly detector* for each log group. The anomaly detector scans the log events ingested into the log group and find anomalies in the log data. Anomaly detection uses machine-learning and pattern recognition to establish baselines of typical log content.

After you create an anomaly detector for a log group, it trains using the past two weeks of log events in the log group for training. The training period can take up to 15 minutes. After the training is complete, it begins to analyze incoming logs to identify anomalies, and the anomalies are displayed in the CloudWatch Logs console for you to examine.

CloudWatch Logs pattern recognition extracts log patterns by identifying static and dynamic content in your logs. Patterns are useful for analyzing large log sets because a large number of log events can often be compressed into a few patterns.

For example, see the following sample of three log events.

```
2023-01-01 19:00:01 [INFO] Calling DynamoDB to store for ResourceID: 12342342k124-12345
2023-01-01 19:00:02 [INFO] Calling DynamoDB to store for ResourceID: 324892398123-1234R
2023-01-01 19:00:03 [INFO] Calling DynamoDB to store for ResourceID: 3ff231242342-12345
```

In the previous sample, all three log events follow one pattern:

```
<Date-1> <Time-2> [INFO] Calling DynamoDB to store for resource id <ResourceID-3>
```

Fields within a pattern are called *tokens*. Fields that vary within a pattern, such as a request ID or timestamp, are referred to as *dynamic tokens*. Each different value found for a dynamic token is called a *token value*.

If CloudWatch Logs can infer the type of data that a dynamic token represents, it displays the token as <*string*-*number*>. The *string* is a description of the type of data that the token represents. The *number* shows where in the pattern this token appears, compared to the other dynamic tokens.

CloudWatch Logs assigns the string part of the name based on analyzing the content of the log events that contain it.

If CloudWatch Logs can't infer the type of data that a dynamic token represents, it displays the token as <Token-*number*>, and *number* indicates where in the pattern this token appears, compared to the other dynamic tokens.

Common examples of dynamic tokens include error codes, IP addresses, timestamps, and request IDs.

Logs anomaly detection uses these patterns to find anomalies. After the anomaly detector model training period, logs are evaluated against known trends. The anomaly detector flags significant fluctuations as anomalies.

This chapter describes how to enable anomaly detection, view anomalies, create alarms for log anomaly detectors, and metrics that log anomaly detectors publish. It also describes how to encrypt anomaly detector and its results with Amazon Key Management Service.

Creating log anomaly detectors doesn't incur charges.

Severity and priority of anomalies and patterns

Each anomaly found by a log anomaly detector is assigned a *priority*. Each pattern found is assigned a *severity*.

- *Priority* is automatically computed, and is based on both the severity level of the pattern and the amount of deviation from expected values. For example, if a certain token value suddenly increases by 500%, that anomaly might be designated as `HIGH` priority even if its severity is `NONE`.
- *Severity* is based only on keywords found in the patterns such as `FATAL`, `ERROR`, and `WARN`. If none of these keywords are found, the severity of a pattern is marked as `NONE`.

Anomaly visibility time

When you create an anomaly detector, you specify the maximum anomaly visibility period for it. This is the number of days that the anomaly is displayed in the console and is returned by the ListAnomalies API operation. After this time period has elapsed for an anomaly, if it continues to happen, it's automatically accepted as regular behavior and the anomaly detector model stops flagging it as an anomaly.

If you don't adjust the visibility time when you create an anomaly detector, 21 days is used as the default.

Suppressing an anomaly

After an anomaly has been found, you can choose to suppress it temporarily or permanently. Suppressing an anomaly causes the anomaly detector to stop flagging this occurrence as an anomaly for the amount of time that you specify. When you suppress an anomaly, you can choose to suppress only that specific anomaly, or suppress all anomalies related to the pattern that the anomaly was found in.

You can still view suppressed anomalies in the console. You can also choose to stop suppressing them.

Frequently asked questions

Does Amazon use my data to train machine-learning algorithms for Amazon use or for other customers?

No. The anomaly detection model created by the training is based on the log events in a log group and is used only within that log group and that Amazon account.

What types of log events work well with anomaly detection?

Log anomaly detection is well-suited for: Application logs and other types of logs where most log entries fit typical patterns. Log groups with events that contain a log level or severity keywords such as **INFO**, **ERROR**, and **DEBUG** are especially well-suited to log anomaly detection.

Log anomaly detection is not suited for: Log events with extremely long JSON structures, such as CloudTrail Logs. Pattern analysis analyzes only up to the first 1500 characters of a log line, so any characters beyond that limit are skipped.

Audit or access logs, such as VPC flow logs, will also have less success with anomaly detection. Anomaly detection is meant to find application issues, so it might not be well-suited for network or access anomalies.

To help you determine whether an anomaly detector is suited to a certain log group, use CloudWatch Logs pattern analysis to find the number of patterns in the log events in the group. If the number of patterns is no more than about 300, anomaly detection might work well. For more information about pattern analysis, see Pattern analysis.

What gets flagged as an anomaly?

The following occurrences can cause a log event to be flagged as an anomaly:

- A log event with a pattern not seen before in the log group.
- A significant variation to a known pattern.
- A new value for a dynamic token that has a discrete set of usual values.
- A large change in the number of occurrences of a value for a dynamic token.

While all the preceding items might be flagged as anomalies, they don't all mean that the application is performing poorly. For example, a higher-than-usual number of `200` success values might be flagged as an anomaly. In cases like this, you might consider suppressing these anomalies that don't indicate problems.

What happens with sensitive data that is being masked?

Any parts of log events that are masked as sensitive data are not scanned for anomalies. For more information about masking sensitive data, see Help protect sensitive log data with masking.

Enable anomaly detection on a log group

Use the following steps to use the CloudWatch console to create a log anomaly detector that scans a log group for anomalies.

You can also create anomaly detectors programmatically. For more information, see CreateLogAnomalyDetector.

To create a log anomaly detector

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. Choose **Logs**, **Log Anomalies**.
3. Choose **Create anomaly detector**.
4. Select the log group to create this anomaly detector for.
5. Enter a name for the detector in **Anomaly detector name**.
6. (Optional) Change the **Evaluation frequency** from the default of 5 minutes. Set this value according to the frequency that the log group receives new logs. For example, if the log group receives new log events in batches every 10 minutes, then setting the evaluation frequency to 15 minutes might be appropriate.

7. (Optional) To configure the anomaly detector to look for anomalies only in log events that contain certain words or strings, choose **Filter patterns**.

   Then, enter a pattern in **Anomaly detection filter pattern**. For more information about pattern syntax, Filter pattern syntax for metric filters, subscription filters, filter log events, and Live Tail.

   (Optional) To test your filter pattern, enter some log messages into **Log event messages** and then choose **Test Pattern**.

8. (Optional) To change the anomaly visibility period from the default or to associate an Amazon KMS key with this anomaly detector, choose **Advanced configuration**.

   a. To change the anomaly visibility period from the default, enter a new value in **Maximum anomaly visibility period (days)**.

   b. To associate an Amazon KMS key with this anomaly detector, enter the ARN in **KMS key ARN**. If you assign a key, the anomaly information found by this detector is encrypted at rest with the key. Users must have permissions for this key and for the anomaly detector to retrieve information about the anomalies that it finds.

      You must also ensure that the CloudWatch Logs service principal has permission to use the key. For more information, see Encrypt an anomaly detector and its results with Amazon KMS.

9. Choose **Enable Anomaly Detection**.

   The anomaly detector is created and starts training its model, based on the log events the log group is ingesting. After about 15 minutes, anomaly detection is active and begins to find and surface anomalies.

View anomalies that have been found

After you create one or more log anomaly detectors, you can use the CloudWatch console to view the anomalies that they have found.

You can view anomalies programmatically. For more information, see ListAnomalies.

To view the anomalies found by all of your log anomaly detectors

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.

2. Choose **Logs**, **Log Anomalies**.

   The **Logs anomalies** table appears. The number at the top next to **Log anomalies** displays how many log anomalies are listed in the table. Each row in the table displays the following information:

   - The **Anomaly** column displays a short summary of the anomaly. These summaries are generated by CloudWatch Logs.
   - The **Priority** of the anomaly. Priority is automatically computed based on the amount of change in the log events, key words such as `Exception` occurring in a log event, and more.
   - The **Log pattern** that the anomaly is based on. For more information about patterns, see Log anomaly detection.
   - **Anomaly log trend** displays a histogram depicting the volume of logs matching the pattern.
   - **Last detection time** displays the most recent time that this anomaly was found.
   - **First detection time** displays the first time that this anomaly was found.
   - **Anomaly detector** displays the name of the log group containing the log events related to this anomaly. You can choose this name to see the log group details page.

3. To further inspect one anomaly, choose the radio button in its row.

   The **Pattern inspect** pane appears and displays the following:

   - The **Pattern** that this anomaly is based on. Select a token within the pattern to analyze that token's values.
   - A histogram showing the number of occurrences of the anomaly over the queried time range.
   - The **Log samples** tab displays a few of the log events that are part of the anomaly.
   - The **Token Values** tab displays the values of the selected dynamic token, if you have selected one.

   > **Note**
   >
   > A maximum of 10 token values is captured for each token. Token counts might not be precise. CloudWatch Logs uses a probabilistic counter to generate the token count, not the absolute value.

4. To suppress an anomaly, choose the radio button in its row and then do the following:

a. Choose **Actions**, **Suppress Anomaly**.

b. Then specify how long you want the anomaly to be suppressed.

c. To suppress all anomalies related to this pattern, select **Suppress Pattern**.

d. Choose **Suppress anomaly**.

To view the anomalies found in a single log group

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. Choose **Logs**, **Log groups**.
3. Choose the name of a log group, and then choose the **Anomaly detection** tab.

   The **Anomaly detection** table appears. The number at the top next to **Log anomalies** displays how many log anomalies are listed in the table. Each row in the table displays the following information:

   - The **Anomaly** column displays a short summary of the anomaly. These summaries are generated by CloudWatch Logs.
   - The **Priority** of the anomaly. Priority is automatically computed based on the amount of change in the log events, key words such as `Exception` occurring in a log event, and more.
   - The **Log pattern** that the anomaly is based on. For more information about patterns, see Log anomaly detection.
   - **Anomaly log trend** displays a histogram depicting the volume of logs matching the pattern.
   - **Last detection time** displays the most recent time that this anomaly was found.
   - **First detection time** displays the first time that this anomaly was found.
4. To further inspect one anomaly, choose the radio button in its row.

   The **Pattern inspect** pane appears and displays the following:

   - The **Pattern** that this anomaly is based on. Select a token within the pattern to analyze that token's values.
   - A histogram showing the number of occurrences of the anomaly over the queried time range.
   - The **Log samples** tab displays a few of the log events that are part of the anomaly.

- The **Token Values** tab displays the values of the selected dynamic token, if you have selected one.

> **Note**
>
> A maximum of 10 token values is captured for each token. Token counts might not be precise. CloudWatch Logs uses a probabilistic counter to generate the token count, not the absolute value.

5. To suppress an anomaly, choose the radio button in its row and then do the following:

   a. Choose **Actions**, **Suppress Anomaly**.
   b. Then specify how long you want the anomaly to be suppressed.
   c. To suppress all anomalies related to this pattern, select **Suppress Pattern**.
   d. Choose **Suppress anomaly**.

Create alarms on log anomaly detectors

You can create an alarm for a log anomaly detector in a log group. You can specify for the alarm to go into ALARM state when a specified number of anomalies are found in the log group during a specified period of time. You can also use filters so that only anomalies of specified priorities are counted by the alarm.

To create an alarm for a log anomaly detector

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log Anomalies**.

   The table of log anomaly detectors appears.
3. Choose the radio button for the anomaly detector that you want to set the alarm for, and choose **Create alarm**.

   The CloudWatch alarm creation wizard appears. The **LogAnomalyDetector** field displays the name of the anomaly detector that you chose. The **Metric name** field displays **AnomalyCount**.
4. (Optional) To filter this alarm for anomaly priority, do one of the following:
   - To have the alarm count only high-priority anomalies, enter **`HIGH`** for **LogAnomalyPriority**.

- To have the alarm count only high- and medium-priority anomalies, enter **`MEDIUM`** for **LogAnomalyPriority**.

For more information about priority levels, see Severity and priority of anomalies and patterns.

5. Choose to use a static or metric anomaly detection threshold for the alarm. This selection determines how the alarm threshold is set. A **Static** threshold means that the alarm threshold is a static, constant number that you choose. An **Anomaly detection** threshold means that CloudWatch determines a range of usual values, and the alarm triggers if the actual count crosses the threshold of this band. You don't have to choose **Anomaly detection** for a log anomaly detection alarm. For more information about metric anomaly detection, see Using CloudWatch anomaly detection.
6. For **Whenever *`your-metric-name`* is . . .**, choose **Greater**, **Greater/Equal**, **Lower/Equal**, or **Lower**. Then for **than . . .**, specify a number for your threshold value. The alarm goes into `ALARM` state if the anomaly detector finds more than this number of alarms during a time specified by **Period**.
7. Choose **Additional configuration**. For **Datapoints to alarm**, specify how many evaluation periods (data points) must be in the `ALARM` state to trigger the alarm. If the two values here match, you create an alarm that goes to `ALARM` state if that many consecutive periods are breaching.

   To create an M out of N alarm, specify a number for the first value that is lower than the number for the second value. For more information, see Evaluating an alarm.
8. For **Missing data treatment**, choose how the alarm behaves when some data points are missing. For more information, see Configuring how CloudWatch alarms treat missing data.
9. Choose **Next**.
10. For **Notification**, choose **Add notification**, and then specify an Amazon SNS topic to notify when your alarm transitions to the `ALARM`, `OK`, or `INSUFFICIENT_DATA` state.

    a. (Optional) To send multiple notifications for the same alarm state or for different alarm states, choose **Add notification**.

> **Note**
>
> We recommend that you set the alarm to take actions when it goes into **Insufficient data** state in addition to when it goes into **Alarm** state. This is because

many issues with the Lambda function that connects to the data source can cause the alarm to transition to **Insufficient data**.

b. (Optional) To not send Amazon SNS notifications, choose **Remove**.

11. (Optional) If you want your alarm to perform actions for Amazon EC2 Auto Scaling, Amazon EC2, tickets, or Amazon Systems Manager, choose the appropriate button, and specify the alarm state and action.

> **Note**
>
> Your alarm can perform Systems Manager actions only when it's in the ALARM state. For information about Systems Manager actions, see Configuring CloudWatch to create OpsItems and Incident creation.

12. Choose **Next**.
13. Under **Name and description**, enter a name and description for your alarm, and choose **Next**. The name must contain only UTF-8 characters, and can't contain ASCII control characters. The description can include markdown formatting, which is displayed only in the alarm **Details** tab in the CloudWatch console. The markdown can be useful to add links to runbooks or other internal resources.

> **Tip**
>
> The alarm name must contain only UTF-8 characters. It can't contain ASCII control characters.

14. Under **Preview and create**, confirm that your alarm's information and conditions are correct, and choose **Create alarm**.

Metrics published by log anomaly detectors

CloudWatch Logs publishes the **AnomalyCount** metric to CloudWatch metrics. This metric is published to the AWS/Logs namespace.

The **AnomalyCount** metric is published with the following dimensions:

- **LogAnomalyDetector**– The name of the anomaly detector

- **LogAnomalyPriority**– The priority level of the anomaly

Encrypt an anomaly detector and its results with Amazon KMS

Anomaly detector data is always encrypted in CloudWatch Logs. By default, CloudWatch Logs uses server-side encryption for the data at rest. As an alternative, you can use Amazon Key Management Service for this encryption. If you do, the encryption is done using an Amazon KMS key. Encryption using Amazon KMS is enabled at the anomaly detector level, by associating a KMS key with an anomaly detector.

> **Important**
>
> CloudWatch Logs supports only symmetric KMS keys. Do not use an asymmetric key to encrypt the data in your log groups. For more information, see Using Symmetric and Asymmetric Keys.

Limits

- To perform the following steps, you must have the following permissions: `kms:CreateKey`, `kms:GetKeyPolicy`, and `kms:PutKeyPolicy`.
- After you associate or disassociate a key from an anomaly detector, it can take up to five minutes for the operation to take effect.
- If you revoke CloudWatch Logs access to an associated key or delete an associated KMS key, your encrypted data in CloudWatch Logs can no longer be retrieved.

Step 1: Create an Amazon KMS key

To create an KMS key, use the following create-key command:

```
aws kms create-key
```

The output contains the key ID and Amazon Resource Name (ARN) of the key. The following is example output:

```
{
```

```
    "KeyMetadata": {
        "Origin": "AWS_KMS",
        "KeyId": "key-default-1",
        "Description": "",
        "KeyManager": "CUSTOMER",
        "Enabled": true,
        "CustomerMasterKeySpec": "SYMMETRIC_DEFAULT",
        "KeyUsage": "ENCRYPT_DECRYPT",
        "KeyState": "Enabled",
        "CreationDate": 1478910250.94,
        "Arn": "arn:aws:kms:us-west-2:123456789012:key/key-default-1",
        "AWSAccountId": "123456789012",
        "EncryptionAlgorithms": [
            "SYMMETRIC_DEFAULT"
        ]
    }
}
```

Step 2: Set permissions on the KMS key

By default, all Amazon KMS keys are private. Only the resource owner can use it to encrypt and decrypt data. However, the resource owner can grant permissions to access the KMS key to other users and resources. With this step, you give the CloudWatch Logs service principal permission to use the key. This service principal must be in the same Amazon Region where the KMS key is stored.

As a best practice, we recommend that you restrict the use of the KMS key to only those Amazon accounts or anomaly detectors that you specify.

First, save the default policy for your KMS key as `policy.json` using the following get-key-policy command:

```
aws kms get-key-policy --key-id key-id --policy-name default --output text > ./
policy.json
```

Open the `policy.json` file in a text editor and add the section in bold from one of the following statements. Separate the existing statement from the new statement with a comma. These statements use `Condition` sections to enhance the security of the Amazon KMS key. For more information, see Amazon KMS keys and encryption context.

The `Condition` section in this example limits the use of the Amazon KMS key to the specified account, but it can be used for any anomaly detector.

```
{
  "Version": "2012-10-17",
  "Id": "key-default-1",
  "Statement": [
    {
      "Sid": "Enable IAM User Permissions",
      "Effect": "Allow",
      "Principal": {
        "AWS": "arn:aws:iam::Your_account_ID:root"
      },
      "Action": "kms:*",
      "Resource": "*"
    },
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "logs.REGION.amazonaws.com"
      },
      "Action": [
        "kms:Encrypt",
        "kms:Decrypt",
        "kms:GenerateDataKey*",
        "kms:DescribeKey"
      ],
      "Resource": "*",
      "Condition": {
        "ArnLike": {
          "kms:EncryptionContext:aws:logs:arn":
 "arn:aws:logs:REGION:Your_account_ID:anomaly-detector:*"
        }
      }
    },
    {
        "Effect": "Allow",
        "Principal": {
            "Service": "logs.REGION.amazonaws.com"
        },
        "Action": [
            "kms:Encrypt",
            "kms:Decrypt",
            "kms:ReEncrypt*",
            "kms:GenerateDataKey*",
            "kms:DescribeKey"
```

```
        ],
        "Resource": "*",
        "Condition": {
            "ArnLike": {
                "kms:EncryptionContext:aws-crypto-ec:aws:logs:arn":
 "arn:aws:logs:REGION:Your_account_ID:anomaly-detector:*"
            }
        }
    }
  ]
}
```

Finally, add the updated policy using the following put-key-policy command:

```
aws kms put-key-policy --key-id key-id --policy-name default --policy file://
policy.json
```

Step 3: Associate a KMS key with an anomaly detector

You can associate a KMS key with an anomaly detector when you create it in the console or using the Amazon CLI or APIs.

Step 4: Disassociate key from an anomaly detector

After a key has been associated with an anomaly detector, you can't update the key. The only way to remove the key is to delete the anomaly detector, and then re-create it.

Troubleshoot with CloudWatch Logs Live Tail

CloudWatch Logs Live Tail helps you quickly troubleshoot incidents by viewing a streaming list of new log events as they are ingested. You can view, filter, and highlight ingested logs in near real time, helping you to detect and resolve issues quickly. You can filter the logs based on terms you specify, and also highlight logs that contain specified terms to help you quickly find what you are looking for.

Live Tail sessions incur costs by session usage time, per minute. For more information about pricing, see the **Logs** tab at Amazon CloudWatch Pricing.

Live Tail is supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

The following sections explain how to use Live Tail in the console and in the Amazon CLI. You can also start a Live Tail session programatically. For more information, see StartLiveTail. For SDK examples, see Start a Live Tail session using an Amazon SDK.

You can also use Live Tail in the Amazon Toolkit for Visual Studio Code. To start a Live Tail session from the VS Code Command Palette, see the Amazon CloudWatch Logs Live Tail section of the Amazon Toolkit for Visual Studio Code User Guide.

The Live Tail feature is available in all commercial Amazon Regions. It is not available in the China Regions or the Amazon GovCloud (US) Regions.

> **Note**
>
> The `StartLiveTail` API routes requests to `streaming-logs.`*`Region`*`.amazonaws.com` using SDK host prefix injection. VPC endpoint support is not available for this API.

Start a Live Tail session using the Amazon CLI

The `start-live-tail` Amazon CLI command starts a Live Tail streaming session for one or more log groups in a terminal. A Live Tail session can last for up to three hours. If more than 500 log events per second match the filter, the log events that are displayed are a sample of the total log events, to provide a real-time tailing experience. For more information about the `start-live-tail` command, see start-live-tail

You can use the `start-live-tail` in two modes:

- **print-only**– this is the default mode
- **interactive**

print-only

In `print-only` mode, log events are streamed on the terminal. New events are added at the bottom every second, creating a near real-time tailing experience similar to `tail -f` on Linux.

To start a Live Tail session in print-only mode, enter the following command.

```
aws logs start-live-tail --log-group-identifiers arn:aws:logs:us-
east-1:111111222222:log-group:my-logs
```

When you use print-only mode, you can also pipe it with other Linux commands to increase its analytical capabilities. The following example filters log events with the `error` keyword and prints the second and fourth column of these events to help you extract particular information.

```
aws logs start-live-tail --log-group-identifiers arn:aws:logs:us-
east-1:111111222222:log-group:my-logs --mode print-only | grep "error" | awk '{print
 $2, $4}'
```

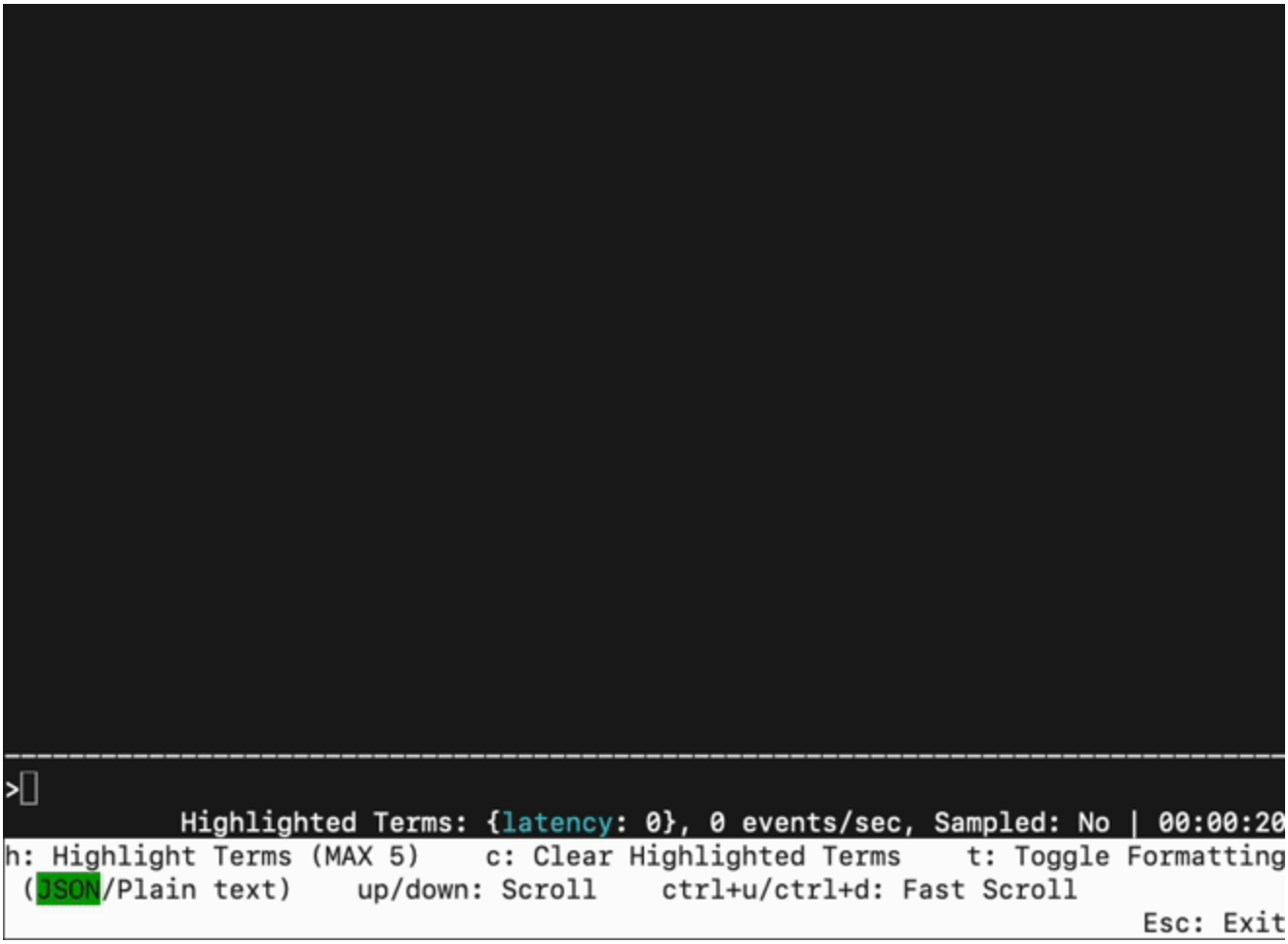
interactive

In `interactive` mode, you can highlight terms and toggle the format of the output log events between JSON and plain text. Interactive mode also displays information about the Live Tail session such as session duration, whether the session is being sampled, and the current highlighted terms and the count of the times they have been encountered.

To start a Live Tail session in interactive mode, enter the following command.

```
aws logs start-live-tail --log-group-identifiers arn:aws:logs:us-
east-1:111111222222:log-group:my-logs --mode interactive
```

The Live Tail session begins. The following video shows part of an example session.



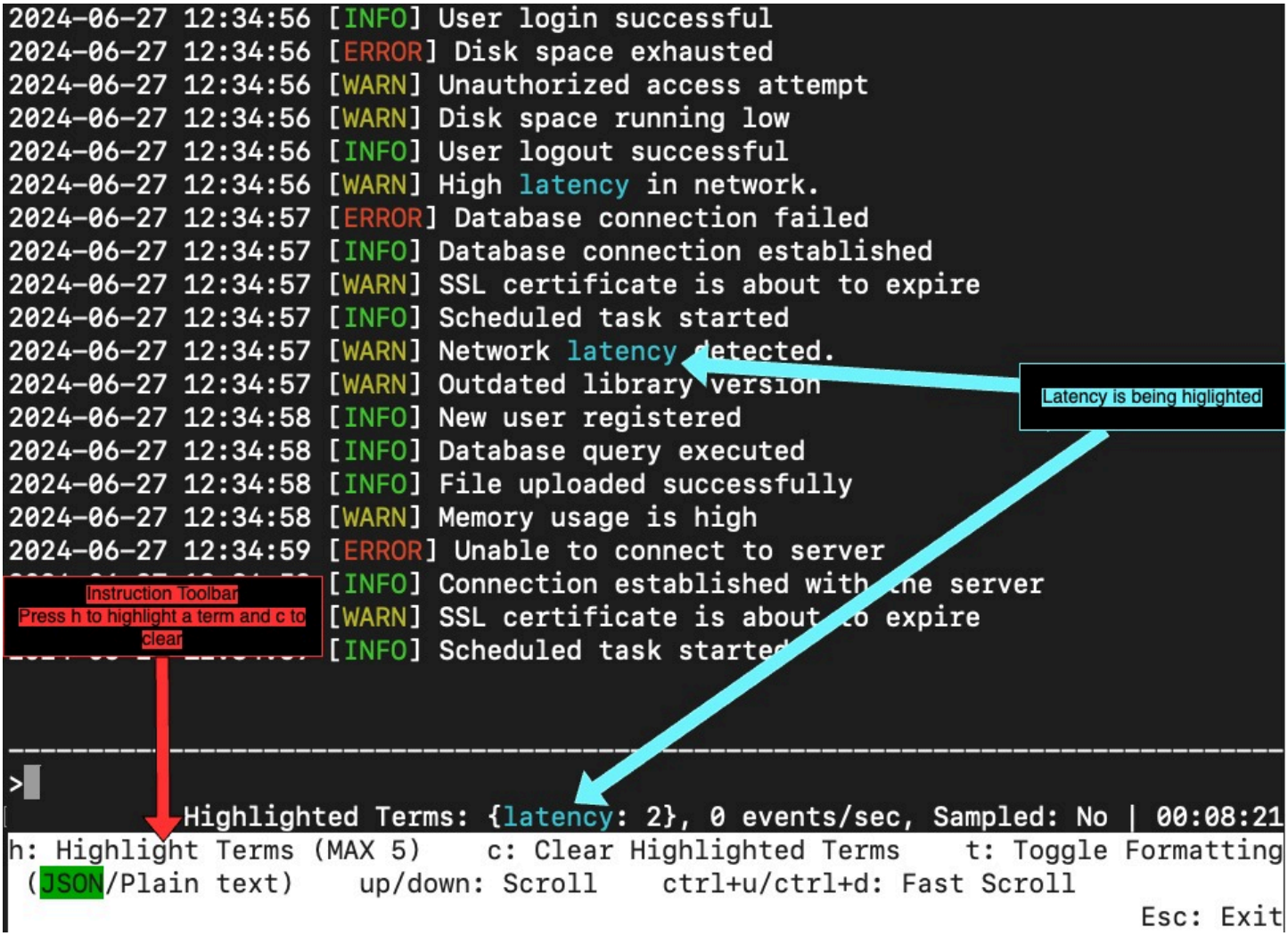
To highlight a term in the streaming logs, press **h** and then enter the term. The following shows the screen after the term `latency` has been highlighted.

To clear a highlighted term, press **c** and then type the number that represents the term that you want to stop highlighting.

You can press **t** to toggle the display format of incoming events between JSON and plain text. This toggle functionality is best-effort and happens only if the log event format is compatible.

You can use the up arrow and down arrow keys to scroll, and use `CTRL+u` and `CTRL+d` to scroll faster.

The following image displays the highlighting of the `latency` term during a Live Tail session.



Start a Live Tail session in the console

You use the CloudWatch console to start a Live Tail session. The following procedure explains how to start a Live Tail session by using the **Live tail** option in the left navigation pane. You can also start Live Tail sessions from the Log Groups page or the CloudWatch Logs Insights page.

If you are using data protection policies to mask sensitive data in a log group that you are viewing with Live Tail, the sensitive data always appears masked in the Live Tail session. For more information about masking sensitive data in log groups, see Help protect sensitive log data with masking.

Important

If your network security team doesn't allow the use of web sockets, you can't currently access the Live Tail portion of the CloudWatch console. You can use Live Tail with the Amazon CLI or APIs. For more information, see Start a Live Tail session using the Amazon CLI and StartLiveTail.

To start a Live Tail session

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Live tail**.
3. For **Select log groups**, select the log groups that you want to view events from, in the Live Tail session. You can select as many as 10 log groups.
4. (Optional) If you selected only one log group, you can filter your Live Tail session further by selecting one or more log streams to view log events from. To do so, under **Select log streams**, select the names of the log streams from the drop down list. Alternatively, you can use the second box under **Select log streams** to enter a log stream name prefix, and then all log streams with names that match the prefix will be selected.
5. (Optional) To display only log events that contain certain words or other strings, enter the word or string in `Add filter patterns`.

   For example, to display only log events that include the word `Warning`, enter **`Warning`**. The filters field is case-sensitive. You can include multiple terms and pattern operators in this field:

   - **`error 404`** displays only log events that include both `error` and `404`
   - **`?Error ?error`** displays log events that include either `Error` or `error`
   - **`-INFO`** displays all log events that don't include `INFO`
   - **`{ $.eventType = "UpdateTrail" }`** displays all JSON log events where the value of the event type field is `UpdateTrail`

   You can also use regular expression (regex) to filter:

   - **`%ERROR%`** uses regex to display all log events consisting of the **ERROR** keyword
   - **`{ $.names = %Steve% }`** uses regex to display JSON log events where **Steve** is in the property `"name"`

- **`[ w1 = %abc%, w2 ]`** uses regex to display space-delimited log events where the first word is **abc**

For more information about pattern syntax, see Filter pattern syntax.

6. (Optional) To highlight some of the displayed log events, enter a term to search for and highlight under **Live Tail**. Enter highlight terms one at a time. If you add multiple terms to highlight, a different color is assigned to represent each term. A highlight indicator is displayed to the left of any log event that contains the specified term, and also appears under the term itself when you expand the log event in the main window to view the full log event.

   You can use filtering along with highlighting to quickly troubleshoot issues. For example, you might filter the events to display only the events that contain `Error`, and then also highlight the events that contain `404`.

7. To start the session, choose **Apply filters**

   Matching log events begin appearing in the window. The following information is also displayed:

   - The timer displays how long the Live Tail session has been active.
   - **events/sec** displays how many ingested log events per second match the filters that you have set.
   - To keep the session from scrolling too fast because many events match the filters, CloudWatch Logs might display only some matching events. If this happens, the percentage of matching events that are displayed on screen is shown in **% displayed**.

8. To pause the flow of events to investigate what is currently displayed, click anywhere in the events window.

9. During the session, you can use the following to see more details about each log event.

   - To display the entire text for a log event in the main window, choose the arrow next to that log event.
   - To display the entire text for a log event in a side window, choose the **+** magnifying glass next to that log event. The event flow pauses and the side window appears.

     Displaying a log event text in the side window can be useful to compare its text to other events in the main window.

10. To stop the Live Tail session, choose **Stop**.

11. To restart the session, optionally use the **Filter** panel to modify the filtering criteria, and choose **Apply filters**. Then choose **Start**.

Working with log groups and log streams

A log stream is a sequence of log events that share the same source. Each separate source of logs in CloudWatch Logs makes up a separate log stream.

A log group is a group of log streams that share the same retention, monitoring, and access control settings. You can define log groups and specify which streams to put into each group. There is no limit on the number of log streams that can belong to one log group.

You can use the procedures in this section to work with log groups and log streams.

Create a log group in CloudWatch Logs

When you install the CloudWatch Logs agent on an Amazon EC2 instance using the steps in previous sections of the Amazon CloudWatch Logs User Guide, the log group is created as part of that process. You can also create a log group directly in the CloudWatch console.

To create a log group

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose **Actions**, and then choose **Create log group**.
4. Enter a name for the log group, and then choose **Create log group**.

> **Tip**
>
> You can favorite log groups, as well as dashboards and alarms, from the ***Favorites and recents*** menu in the navigation pane. Under the ***Recently visited*** column, hover over the log group that you want to favorite, and choose the star symbol next to it.

Send logs to a log group

CloudWatch Logs automatically receives log events from several Amazon services. You can also send other log events to CloudWatch Logs using one of the following methods:

- **CloudWatch agent**— The unified CloudWatch agent can send both metrics and logs to CloudWatch Logs. For information about installing and using the CloudWatch agent, see Collecting Metrics and Logs from Amazon EC2 Instances and On-Premises Servers with the CloudWatch Agent in the *Amazon CloudWatch User Guide*.
- **Amazon CLI**—The put-log-events uploads batches of log events to CloudWatch Logs.
- **Programmatically**— The PutLogEvents API enables you to programmatically upload batches of log events to CloudWatch Logs.

View log data sent to CloudWatch Logs

You can view and scroll through log data on a stream-by-stream basis as sent to CloudWatch Logs by the CloudWatch Logs agent. You can specify the time range for the log data to view.

To view log data

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. For **Log Groups**, choose the log group to view the streams.
4. In the list of log groups, choose the name of the log group that you want to view.
5. In the list of log streams, choose the name of the log stream that you want to view.
6. To change how the log data is displayed, do one of the following:

   - To expand a single log event, choose the arrow next to that log event.
   - To expand all log events and view them as plain text, above the list of log events, choose **Text**.
   - To filter the log events, enter the desired search filter in the search field. For more information, see Creating metrics from log events using filters.
   - To view log data for a specified date and time range, next to the search filter, choose the arrow next to the date and time. To specify a date and time range, choose **Absolute**. To choose a predefined number of minutes, hours, days, or weeks, choose **Relative**. You can also switch between UTC and local time zone.

Search log data using filter patterns

You can search your log data using the Filter pattern syntax for metric filters, subscription filters, filter log events, and Live Tail. You can search all the log streams within a log group, or by using the Amazon CLI you can also search specific log streams. When each search runs, it returns up to the first page of data found and a token to retrieve the next page of data or to continue searching. If no results are returned, you can continue searching.

You can set the time range you want to query to limit the scope of your search. You could start with a larger range to see where the log lines you are interested in fall, and then shorten the time range to scope the view to logs in the time range that interest you.

You can also pivot directly from your logs-extracted metrics to the corresponding logs.

If you are signed in to an account set up as a monitoring account in CloudWatch cross-account observability, you can search and filter log events from the source accounts linked to this monitoring account. For more information, see CloudWatch cross-account observability.

Search log entries using the console

You can search for log entries that meet a specified criteria using the console.

To search your logs using the console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. For **Log Groups**, choose the name of the log group containing the log stream to search.
4. For **Log Streams**, choose the name of the log stream to search.
5. Under **Log events**, enter the filter syntax to use.

To search all log entries for a time range using the console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. For **Log Groups**, choose the name of the log group containing the log stream to search.
4. Choose **Search log group**.
5. For **Log events**, select the date and time range, and enter the filter syntax.

Search log entries using the Amazon CLI

You can search for log entries that meet a specified criteria using the Amazon CLI.

To search log entries using the Amazon CLI

At a command prompt, run the following filter-log-events command. Use `--filter-pattern` to limit the results to the specified filter pattern and `--log-stream-names` to limit the results to the specified log streams.

```
aws logs filter-log-events --log-group-name my-group [--log-stream-
names LIST_OF_STREAMS_TO_SEARCH] [--filter-pattern VALID_METRIC_FILTER_PATTERN]
```

To search log entries over a given time range using the Amazon CLI

At a command prompt, run the following filter-log-events command:

```
aws logs filter-log-events --log-group-name my-group [--log-stream-
names LIST_OF_STREAMS_TO_SEARCH] [--start-time 1482197400000] [--end-
time 1482217558365] [--filter-pattern VALID_METRIC_FILTER_PATTERN]
```

Pivot from metrics to logs

You can get to specific log entries from other parts of the console.

To get from dashboard widgets to logs

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Dashboards**.
3. Choose a dashboard.
4. On the widget, choose the **View logs** icon, and then choose **View logs in this time range**. If there is more than one metric filter, select one from the list. If there are more metric filters than we can display in the list, choose **More metric filters** and select or search for a metric filter.

To get from metrics to logs

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.

2. In the navigation pane, choose **Metrics**.
3. In the search field on the **All metrics** tab, type the name of the metric and press Enter.
4. Select one or more metrics from the results of your search.
5. Choose **Actions**, **View logs**. If there is more than one metric filter, select one from the list. If there are more metric filters than we can display in the list, choose **More metric filters** and select or search for a metric filter.

Troubleshooting

Search takes too long to complete

If you have a lot of log data, search might take a long time to complete. To speed up a search, you can do the following:

- If you are using the Amazon CLI, you can limit the search to just the log streams you are interested in. For example, if your log group has 1000 log streams, but you just want to see three log streams that you know are relevant, you can use the Amazon CLI to limit your search to only those three log streams within the log group.
- Use a shorter, more granular time range, which reduces the amount of data to be searched and speeds up the query.

Change log data retention in CloudWatch Logs

By default, log data is stored in CloudWatch Logs indefinitely. However, you can configure how long to store log data in a log group. Any data older than the current retention setting is deleted. You can change the log retention for each log group at any time.

> **Note**
>
> CloudWatch Logs doesn't immediately delete log events when they reach their retention setting. It typically takes up to 72 hours after that before log events are deleted, but in rare situations might take longer.
>
> This means that if you change a log group to have a longer retention setting when it contains log events that are past the expiration date, but haven't been actually deleted, those log events will take up to 72 hours to be deleted after the new retention date is reached. To make sure that log data is deleted permanently, keep a log group at its lower

retention setting until 72 hours has passed after the end of the previous retention period, or you have confirmed that the older log events are deleted.
When log events reach their retention setting they are marked for deletion. After they are marked for deletion, they do not add to your archival storage costs anymore, even if they are not actually deleted until later. These log events marked for deletion are also not included when you use an API to retrieve the `storedBytes` value to see how many bytes a log group is storing.

To change the logs retention setting

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Find the log group to update.
4. In the **Retention** column for that log group, choose the current retention setting, such as **Never Expire**.
5. In **Retention setting**, for **Expire events after**, choose a log retention value, and then choose **Save**.

Tag log groups in Amazon CloudWatch Logs

You can assign your own metadata to the log groups you create in Amazon CloudWatch Logs in the form of *tags*. A tag is a key-value pair that you define for a log group. Using tags is a simple yet powerful way to manage Amazon resources and organize data, including billing data.

Note

You can use tags to control access to CloudWatch Logs resources, including log groups and destinations. Access to log streams is controlled at the log group level, because of the hierarchical relation between log groups and log streams. For more information about using tags to control access, see Controlling access to Amazon Web Services resources using tags.

Contents

- Tracking costs using tagging
- Tag restrictions
- Tagging log groups using the Amazon CLI
- Tagging log groups using the CloudWatch Logs API

Tag basics

You use Amazon CloudFormation the Amazon CLI, or CloudWatch Logs API to complete the following tasks:

- Add tags to a log group when you create it.
- Add tags to an existing log group.
- List the tags for a log group.
- Remove tags from a log group.

You can use tags to categorize your log groups. For example, you can categorize them by purpose, owner, or environment. Because you define the key and value for each tag, you can create a custom set of categories to meet your specific needs. For example, you might define a set of tags that helps you track log groups by owner and associated application. Here are several examples of tags:

- Project: Project name
- Owner: Name
- Purpose: Load testing
- Application: Application name
- Environment: Production

Tracking costs using tagging

You can use tags to categorize and track your Amazon costs. When you apply tags to your Amazon resources, including log groups, your Amazon cost allocation report includes usage and costs aggregated by tags. You can apply tags that represent business categories (such as cost centers, application names, or owners) to organize your costs across multiple services. For more information, see Use Cost Allocation Tags for Custom Billing Reports in the *Amazon Billing User Guide*.

Tag restrictions

The following restrictions apply to tags.

Basic restrictions

- The maximum number of tags per log group is 50.
- Tag keys and values are case sensitive.
- You can't change or edit tags for a deleted log group.

Tag key restrictions

- Each tag key must be unique. If you add a tag with a key that's already in use, your new tag overwrites the existing key-value pair.
- You can't start a tag key with `aws:` because this prefix is reserved for use by Amazon. Amazon creates tags that begin with this prefix on your behalf, but you can't edit or delete them.
- Tag keys must be between 1 and 128 Unicode characters in length.
- Tag keys must consist of the following characters: Unicode letters, digits, white space, and the following special characters: `_ . / = + - @`.

Tag value restrictions

- Tag values must be between 0 and 255 Unicode characters in length.
- Tag values can be blank. Otherwise, they must consist of the following characters: Unicode letters, digits, white space, and any of the following special characters: `_ . / = + - @`.

Tagging log groups using the Amazon CLI

You can add, list, and remove tags using the Amazon CLI. For examples, see the following documentation:

[create-log-group]

Creates a log group. You can optionally add tags when you create the log group.

[tag-resource]

Assigns one or more tags (key-value pairs) to the specified CloudWatch Logs resource.

list-tags-for-resource

Displays the tags the are associated with a CloudWatch Logs resource.

untag-resource

Removes one or more tags from the specified CloudWatch Logs resource.

Tagging log groups using the CloudWatch Logs API

You can add, list, and remove tags using the CloudWatch Logs API. For examples, see the following documentation:

CreateLogGroup

Creates a log group. You can optionally add tags when you create the log group.

TagResource

Assigns one or more tags (key-value pairs) to the specified CloudWatch Logs resource.

ListTagsForResource

Displays the tags the are associated with a CloudWatch Logs resource.

UntagResource

Removes one or more tags from the specified CloudWatch Logs resource.

Encrypt log data in CloudWatch Logs using Amazon Key Management Service

Log group data is always encrypted in CloudWatch Logs. By default, CloudWatch Logs uses server-side encryption with 256-bit Advanced Encryption Standard Galois/Counter Mode (AES-GCM) to encrypt log data at rest. As an alternative, you can use Amazon Key Management Service for this encryption. If you do, the encryption is done using an Amazon KMS key. Encryption using Amazon KMS is enabled at the log group level, by associating a KMS key with a log group, either when you create the log group or after it exists.

Important

CloudWatch Logs now supports encryption context, using `kms:EncryptionContext:aws:logs:arn` as the key and the ARN of the log group as the value for that key. If you have log groups that you have already encrypted with a KMS key, and you would like to restrict the key to be used with a single account and log group, you should assign a new KMS key that includes a condition in the IAM policy. For more information, see Amazon KMS keys and encryption context.

Important

CloudWatch Logs now supports `kms:ViaService` which allows logs to make Amazon KMS calls on your behalf. You should add this to your roles which call CloudWatch Logs in either your Key Policy or in IAM. For more information, see kms:ViaService.

After you associate a KMS key with a log group, all newly ingested data for the log group is encrypted using this key. This data is stored in encrypted format throughout its retention period. CloudWatch Logs decrypts this data whenever it is requested. CloudWatch Logs must have permissions for the KMS key whenever encrypted data is requested.

If you later disassociate a KMS key from a log group, CloudWatch Logs encrypts newly ingested data using the CloudWatch Logs default encryption method. All previously ingested data that was encrypted with the KMS key remains encrypted with the KMS key. CloudWatch Logs can still return that data after the KMS key is disassociated, because CloudWatch Logs can still continue to reference the key. However, if the key is later disabled, then CloudWatch Logs is unable to read the logs that were encrypted with that key.

Important

CloudWatch Logs supports only symmetric KMS keys. Do not use an asymmetric key to encrypt the data in your log groups. For more information, see Using Symmetric and Asymmetric Keys.

Limits

- To perform the following steps, you must have the following permissions: `kms:CreateKey`, `kms:GetKeyPolicy`, and `kms:PutKeyPolicy`.
- After you associate or disassociate a key from a log group, it can take up to five minutes for the operation to take effect.
- If you revoke CloudWatch Logs access to an associated key or delete an associated KMS key, your encrypted data in CloudWatch Logs can no longer be retrieved.
- You can't associate a KMS key with an existing log group using the CloudWatch console.

Step 1: Create an Amazon KMS key

To create an KMS key, use the following create-key command:

```
aws kms create-key
```

The output contains the key ID and Amazon Resource Name (ARN) of the key. The following is example output:

```
{
    "KeyMetadata": {
        "Origin": "AWS_KMS",
        "KeyId": "1234abcd-12ab-34cd-56ef-1234567890ab",
        "Description": "",
        "KeyManager": "CUSTOMER",
        "Enabled": true,
        "CustomerMasterKeySpec": "SYMMETRIC_DEFAULT",
        "KeyUsage": "ENCRYPT_DECRYPT",
        "KeyState": "Enabled",
        "CreationDate": 1478910250.94,
        "Arn": "arn:aws:kms:us-west-2:123456789012:key/6f815f63-e628-448c-8251-
e40cb0d29f59",
        "AWSAccountId": "123456789012",
        "EncryptionAlgorithms": [
            "SYMMETRIC_DEFAULT"
        ]
    }
}
```

Step 2: Set permissions on the KMS key

By default, all Amazon KMS keys are private. Only the resource owner can use it to encrypt and decrypt data. However, the resource owner can grant permissions to access the KMS key to other users and resources. With this step, you give the CloudWatch Logs service principal and the caller role permission to use the key. This service principal must be in the same Amazon Region where the KMS key is stored.

As a best practice, we recommend that you restrict the use of the KMS key to only those Amazon accounts or log groups you specify.

First, save the default policy for your KMS key as `policy.json` using the following get-key-policy command:

```
aws kms get-key-policy --key-id key-id --policy-name default --output text > ./
policy.json
```

Open the `policy.json` file in a text editor and add the section in bold from one of the following statements. Separate the existing statement from the new statement with a comma. These statements use `Condition` sections to enhance the security of the Amazon KMS key. For more information, see Amazon KMS keys and encryption context.

The `Condition` section in this example restricts the key to a single log group ARN.

```
{
 "Version": "2012-10-17",
    "Id": "key-default-1",
    "Statement": [
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::Your_account_ID:root"
            },
            "Action": "kms:*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.region.amazonaws.com"
```

```
            },
            "Action": [
                "kms:Encrypt",
                "kms:Decrypt",
                "kms:ReEncrypt*",
                "kms:GenerateDataKey*",
                "kms:Describe*"
            ],
            "Resource": "*",
            "Condition": {
                "ArnEquals": {
                    "kms:EncryptionContext:aws:logs:arn": "arn:aws:logs:region:account-
id:log-group:log-group-name"
                }
            }
        }
    ]
}
```

The `Condition` section in this example limits the use of the Amazon KMS key to the specified account, but it can be used for any log group.

```
{
    "Version": "2012-10-17",
    "Id": "key-default-1",
    "Statement": [
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::Your_account_ID:root"
            },
            "Action": "kms:*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.region.amazonaws.com"
            },
            "Action": [
                "kms:Encrypt",
                "kms:Decrypt",
```

```
                "kms:ReEncrypt*",
                "kms:GenerateDataKey*",
                "kms:Describe*"
            ],
            "Resource": "*",
            "Condition": {
                "ArnLike": {
                    "kms:EncryptionContext:aws:logs:arn": "arn:aws:logs:region:account-
id:*"
                }
            }
        }
    ]
}
```

Next, add permissions to the role which will be calling the CloudWatch Logs. You can do this by adding an additional statement to the Amazon KMS Key Policy or through IAM on the role itself. CloudWatch Logs uses `kms:ViaService` to make calls to Amazon KMS on the customer's behalf. For more information, see kms:ViaService.

To add permissions in the Amazon KMS Key Policy, add the following additional statement to your key policy. If you use this method, as best practice, scope the policy to only the roles that will be interacting with Amazon KMS encrypted log groups.

```
{
  "Effect": "Allow",
  "Principal": {
    "AWS": "arn:aws:iam::account_id:role/role_name"
  },
  "Action": [
    "kms:Encrypt",
    "kms:ReEncrypt*",
    "kms:Decrypt",
    "kms:GenerateDataKey*",
    "kms:Describe*"
  ],
  "Resource": "*",
  "Condition": {
    "StringEquals": {
      "kms:ViaService": [
        "logs.region.amazonaws.com"
      ]
    }
```

```
  }
}
```

Alternatively if you would like to manage role permissions in IAM, you can add equivalent permissions through the following policy. This can be added to an existing role policy or attached to a role as an additional separate policy. If you use this method, as best practice, scope the policy to only the Amazon KMS keys which will be used for log encryption. For more information, see Edit IAM policies.

```
{
   "Version": "2012-10-17",
   "Statement" : [
     {
        "Effect": "Allow",
        "Action": [
            "kms:Encrypt",
            "kms:ReEncrypt*",
            "kms:Decrypt",
            "kms:GenerateDataKey*",
            "kms:Describe*"
        ],
        "Condition":{
            "StringEquals":{
            "kms:ViaService": [
                "logs.region.amazonaws.com"
                ]
             }
        },
        "Resource": "arn:aws:kms:region:account_id:key/key_id"
     }
   ]
}
```

Finally, add the updated policy using the following put-key-policy command:

```
aws kms put-key-policy --key-id key-id --policy-name default --policy file://
policy.json
```

Step 3: Associate a KMS key with a log group

You can associate a KMS key with a log group when you create it or after it exists.

To find whether a log group already has a KMS key associated, use the following describe-log-groups command:

```
aws logs describe-log-groups --log-group-name-prefix "log-group-name-prefix"
```

If the output includes a `kmsKeyId` field, the log group is associated with the key displayed for the value of that field.

To associate the KMS key with a log group when you create it

Use the create-log-group command as follows:

```
aws logs create-log-group --log-group-name my-log-group --kms-key-id "key-arn"
```

To associate the KMS key with an existing log group

Use the associate-kms-key command as follows:

```
aws logs associate-kms-key --log-group-name my-log-group --kms-key-id "key-arn"
```

Step 4: Disassociate key from a log group

To disassociate the KMS key associated with a log group, use the following disassociate-kms-key command:

```
aws logs disassociate-kms-key --log-group-name my-log-group
```

Amazon KMS keys and encryption context

To enhance the security of your Amazon Key Management Service keys and your encrypted log groups, CloudWatch Logs now puts log group ARNs as part of the *encryption context* used to encrypt your log data. Encryption context is a set of key-value pairs that are used as additional authenticated data. The encryption context enables you to use IAM policy conditions to limit access to your Amazon KMS key by Amazon account and log group. For more information, see Encryption context and IAM JSON Policy Elements: Condition.

We recommend that you use different KMS keys for each of your encrypted log groups.

If you have a log group that you encrypted previously and now want to change the log group to use a new KMS key that works only for that log group, follow these steps.

To convert an encrypted log group to use a KMS key with a policy limiting it to that log group

1. Enter the following command to find the ARN of the log group's current key:

   ```
   aws logs describe-log-groups
   ```

   The output includes the following line. Make a note of the ARN. You need to use it in step 7.

   ```
   ...
   "kmsKeyId": "arn:aws:kms:us-west-2:123456789012:key/01234567-89ab-
   cdef-0123-456789abcdef"
   ...
   ```

2. Enter the following command to create a new KMS key:

   ```
   aws kms create-key
   ```

3. Enter the following command to save the new key's policy to a `policy.json` file:

   ```
   aws kms get-key-policy --key-id new-key-id --policy-name default --output text > ./
   policy.json
   ```

4. Use a text editor to open `policy.json` and add a `Condition` expression to the policy:

   ```
   {
       "Version": "2012-10-17",
       "Id": "key-default-1",
       "Statement": [
           {
               "Sid": "Enable IAM User Permissions",
               "Effect": "Allow",
               "Principal": {
                   "AWS": "arn:aws:iam::ACCOUNT-ID:root"
               },
               "Action": "kms:*",
               "Resource": "*"
           },
   ```

```
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.region.amazonaws.com"
            },
            "Action": [
                "kms:Encrypt",
                "kms:Decrypt",
                "kms:ReEncrypt*",
                "kms:GenerateDataKey*",
                "kms:Describe*"
            ],
            "Resource": "*",
            "Condition": {
                "ArnLike": {
                    "kms:EncryptionContext:aws:logs:arn":
 "arn:aws:logs:REGION:ACCOUNT-ID:log-
group:LOG-GROUP-NAME"
                }
            }
        }
    ]
}
```

5. Enter the following command to add the updated policy to the new KMS key:

```
aws kms put-key-policy --key-id new-key-ARN --policy-name default --policy file://
policy.json
```

6. Enter the following command to associate the policy with your log group:

```
aws logs associate-kms-key --log-group-name my-log-group --kms-key-id new-key-ARN
```

   CloudWatch Logs now encrypts all new data using the new key.

7. Next, revoke all permissions except `Decrypt` from the old key. First, enter the following command to retrieve the old policy:

```
aws kms get-key-policy --key-id old-key-ARN --policy-name default --output text
 > ./policy.json
```

8. Use a text editor to open `policy.json` and remove all values from the `Action` list, except for `kms:Decrypt`

```
{
    "Version": "2012-10-17",
    "Id": "key-default-1",
    "Statement": [
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::Your_account_ID:root"
            },
            "Action": "kms:*",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.region.amazonaws.com"
            },
            "Action": [
                "kms:Decrypt"
            ],
            "Resource": "*"
        }
    ]
}
```

9. Enter the following command to add the updated policy to the old key:

```
aws kms put-key-policy --key-id old-key-ARN --policy-name default --policy file://
policy.json
```

Help protect sensitive log data with masking

You can help safeguard sensitive data that's ingested by CloudWatch Logs by using log group *data protection policies*. These policies let you audit and mask sensitive data that appears in log events ingested by the log groups in your account.

When you create a data protection policy, then by default, sensitive data that matches the data identifiers you've selected is masked at all egress points, including CloudWatch Logs Insights,

metric filters, and subscription filters. Only users who have the `logs:Unmask` IAM permission can view unmasked data.

You can create a data protection policy for all log groups in your account, and you can also create a data protection policies for individual log groups. When you create a policy for your entire account, it applies to both existing log groups and log groups that are created in the future.

If you create a data protection policy for your entire account and you also create a policy for a single log group, both policies apply to that log group. All managed data identifiers that are specified in either policy are audited and masked in that log group.

> **Note**
>
> Masking sensitive data is supported only for log groups in the Standard log class. If you create a data protection policy for all log groups in your account, it applies only to log groups in the Standard log class. For more information about log classes, see Log classes.

Each log group can have only one log group-level data protection policy, but that policy can specify many managed data identifiers to audit and mask. The limit for a data protection policy is 30,720 characters.

> **Important**
>
> Sensitive data is detected and masked when it is ingested into the log group. When you set a data protection policy, log events ingested to the log group before that time are not masked.

CloudWatch Logs supports many *managed data identifiers*, which offer preconfigured data types you can select to protect financial data, personal health information (PHI), and personally identifiable information (PII). CloudWatch Logs data protection allows you to leverage pattern matching and machine learning models to detect sensitive data. For some types of managed data identifiers, the detection depends on also finding certain keywords in proximity with the sensitive data. You can also use custom data identifiers to create data identifiers tailored to your specific use case.

A metric is emitted to CloudWatch when sensitive data is detected that matches the data identifiers you select. This is the **LogEventsWithFindings** metric and it is emitted in the **AWS/Logs**

namespace. You can use this metric to create CloudWatch alarms, and you can visualize it in graphs and dashboards. Metrics emitted by data protection are vended metrics and are free of charge. For more information about metrics that CloudWatch Logs sends to CloudWatch, see Monitoring with CloudWatch metrics.

Each managed data identifier is designed to detect a specific type of sensitive data, such as credit card numbers, Amazon secret access keys, or passport numbers for a particular country or region. When you create a data protection policy, you can configure it to use these identifiers to analyze logs ingested by the log group, and take actions when they are detected.

CloudWatch Logs data protection can detect the following categories of sensitive data by using managed data identifiers:

- Credentials, such as private keys or Amazon secret access keys
- Financial information, such as credit card numbers
- Personally Identifiable Information (PII) such as driver's licenses or social security numbers
- Protected Health Information (PHI) such as health insurance or medical identification numbers
- Device identifiers, such as IP addresses or MAC addresses

For details about the types of data that you can protect, see Types of data that you can protect.

Contents

Understanding data protection policies

Topics

What are data protection policies?

CloudWatch Logs uses **data protection policies** to select the sensitive data for which you want to scan, and the actions that you want to take to protect that data. To select the sensitive data of interest, you use data identifiers. CloudWatch Logs data protection then detects the sensitive data by using machine learning and pattern matching. To act upon data identifiers that are found, you can define **audit** and **de-identify** operations. These operations let you log the sensitive data that is found (or not found), and to mask the sensitive data when the log events are viewed.

How is the data protection policy structured?

As illustrated in the following figure, a data protection policy document includes the following elements:

- Optional policy-wide information at the top of the document
- One statement that defines the audit and de-identify actions

Only one data protection policy can be defined per CloudWatch Logs log group. The data protection policy can have one or more deny or de-identify statements, but only one audit statement.

JSON properties for the data protection policy

A data protection policy requires the following basic policy information for identification:

- **Name** – The policy name.
- **Description** (Optional) – The policy description.
- **Version** – The policy language version. The current version is 2021-06-01.
- **Statement** – A list of statements that specifies data protection policy actions.

```
{
```

```
  "Name": "CloudWatchLogs-PersonalInformation-Protection",
  "Description": "Protect basic types of sensitive data",
  "Version": "2021-06-01",
  "Statement": [
        ...
  ]
}
```

JSON properties for a policy statement

A policy statement sets the detection context for the data protection operation.

- **Sid** (Optional) – The statement identifier.
- **DataIdentifier** – The sensitive data for which CloudWatch Logs should scan. For example, name, address, or phone number.
- **Operation** – The follow-on actions, either **Audit** or **De-identify**. CloudWatch Logs performs these actions when it finds sensitive data.

```
{
  ...
  "Statement": [
    {
      "Sid": "audit-policy",
      "DataIdentifier": [
        "arn:aws:dataprotection::aws:data-identifier/Address"
      ],
      "Operation": {
        "Audit": {
          "FindingsDestination": {}
        }
      }
    },
```

JSON properties for a policy statement operation

A policy statement sets one of the following data protection operations.

- **Audit** – Emits metrics and findings reports without interrupting logging. Strings that match increment the **LogEventsWithFindings** metric that CloudWatch Logs publishes to the **AWS/Logs** namespace in CloudWatch. You can use these metrics to create alarms.

For an example of a findings report, see Audit findings reports.

For more information about metrics that CloudWatch Logs sends to CloudWatch, see Monitoring with CloudWatch metrics.

- **De-identify** – Mask the sensitive data without interrupting logging.

IAM permissions required to create or work with a data protection policy

To be able to work with data protection policies for log groups, you must have certain permissions as shown in the following tables. The permissions are different for account-wide data protection policies and for data protection policies that apply to a single log group.

Permissions required for account-level data protection policies

> **Note**
>
> If you are performing any of these operations inside a Lambda function, the Lambda execution role and permissions boundary must also include the following permissions.

Operation	IAM permission needed	Resource
Create a data protection policy with no audit destinations	`logs:PutAccountPolicy`	*
	`logs:PutDataProtectionPolicy`	*
Create a data protection policy with CloudWatch Logs as an audit destination	`logs:PutAccountPolicy`	*
	`logs:PutDataProtectionPolicy`	*
	`logs:CreateLogDelivery`	*

Operation	IAM permission needed	Resource
	logs:PutResourcePolicy	*
	logs:DescribeResourcePolicies	*
	logs:DescribeLogGroups	*
Create a data protection policy with Firehose as an audit destination	logs:PutAccountPolicy	*
	logs:PutDataProtectionPolicy	*
	logs:CreateLogDelivery	*
	firehose:TagDeliveryStream	arn:aws:logs:::deliverystream/ *YOUR_DELIVERY_STREAM*
Create a data protection policy with Amazon S3 as an audit destination	logs:PutAccountPolicy	*
	logs:PutDataProtectionPolicy	*
	logs:CreateLogDelivery	*
	s3:GetBucketPolicy	arn:aws:s3::: *YOUR_BUCKET*
	s3:PutBucketPolicy	arn:aws:s3::: *YOUR_BUCKET*

Operation	IAM permission needed	Resource
Unmask masked log events in a specified log group	`logs:Unmask`	`arn:aws:logs:::log-group:*`
View an existing data protection policy	`logs:GetDataProtectionPolicy`	*
Delete a data protection policy	`logs:DeleteAccountPolicy`	*
	`logs:DeleteDataProtectionPolicy`	*

If any data protection audit logs are already being sent to a destination, then other policies that send logs to the same destination only need the `logs:PutDataProtectionPolicy` and `logs:CreateLogDelivery` permissions.

Permissions required for data protection policies for a single log group

> **Note**
>
> If you are performing any of these operations inside a Lambda function, the Lambda execution role and permissions boundary must also include the following permissions.

Operation	IAM permission needed	Resource
Create a data protection policy with no audit destinations	`logs:PutDataProtectionPolicy`	`arn:aws:logs:::log-group:` *YOUR_LOG_GROUP* `:*`

Create a data protection policy with CloudWatch Logs as an audit destination	`logs:PutDataProtectionPolicy`
	
	`logs:CreateLogDelivery`
		`arn:aws:logs:::log-group:` *YOUR_LOG_GROUP* `:*`
		
		*

Operation	IAM permission needed	Resource
	logs:PutResourcePolicy logs:DescribeResourcePolicies logs:DescribeLogGroups	* * *
Create a data protection policy with Firehose as an audit destination	logs:PutDataProtectionPolicy logs:CreateLogDelivery firehose:TagDeliveryStream	arn:aws:logs:::log-group: *YOUR_LOG_GROUP* :* * arn:aws:logs:::deliverystream/ *YOUR_DELIVERY_STREAM*
Create a data protection policy with Amazon S3 as an audit destination	logs:PutDataProtectionPolicy logs:CreateLogDelivery s3:GetBucketPolicy s3:PutBucketPolicy	arn:aws:logs:::log-group: *YOUR_LOG_GROUP* :* * arn:aws:s3::: *YOUR_BUCKET* arn:aws:s3::: *YOUR_BUCKET*
Unmask masked log events	logs:Unmask	arn:aws:logs:::log-group: *YOUR_LOG_GROUP* :*

Operation	IAM permission needed	Resource
View an existing data protection policy	`logs:GetDataProtectionPolicy`	`arn:aws:logs:::log-group:` *YOUR_LOG_GROUP* `:*`
Delete a data protection policy	`logs:DeleteDataProtectionPolicy`	`arn:aws:logs:::log-group:` *YOUR_LOG_GROUP* `:*`

If any data protection audit logs are already being sent to a destination, then other policies that send logs to the same destination only need the `logs:PutDataProtectionPolicy` and `logs:CreateLogDelivery` permissions.

Sample data protection policy

The following sample policy allows a user to create, view, and delete data protection policies that can sending audit findings to all three types of audit destinations. It does not permit the user to view unmasked data.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "YOUR_SID_1",
            "Effect": "Allow",
            "Action": [
                "logs:CreateLogDelivery",
                "logs:PutResourcePolicy",
                "logs:DescribeLogGroups",
                "logs:DescribeResourcePolicies"
            ],
            "Resource": "*"
        },
        {
            "Sid": "YOUR_SID_2",
            "Effect": "Allow",
            "Action": [
                "logs:GetDataProtectionPolicy",
                "logs:DeleteDataProtectionPolicy",
```

```
                "logs:PutDataProtectionPolicy",
                "s3:PutBucketPolicy",
                "firehose:TagDeliveryStream",
                "s3:GetBucketPolicy"
            ],
            "Resource": [
                "arn:aws:firehose:::deliverystream/YOUR_DELIVERY_STREAM",
                "arn:aws:s3:::YOUR_BUCKET",
                "arn:aws:logs:::log-group:YOUR_LOG_GROUP:*"
            ]
        }
    ]
}
```

Create an account-wide data protection policy

You can use the CloudWatch Logs console or Amazon CLI commands to create a data protection policy to mask sensitive data for all log groups in your account. Doing so affects both current log groups and log groups that you create in the future.

> **Important**
>
> Sensitive data is detected and masked when it is ingested into the log group. When you set a data protection policy, log events ingested to the log group before that time are not masked.

Topics

- Console
- Amazon CLI

Console

To use the console to create an account-wide data protection policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Settings**. It is located near the bottom of the list.
3. Choose the **Logs** tab.

4. Choose **Configure**.
5. For **Managed data identifiers**, select the types of data that you want to audit and mask for all of your log groups. You can type in the selection box to find the identifiers that you want.

   We recommend that you select only the data identifiers that are relevant for your log data and your business. Choosing many types of data can lead to false positives.

   For details about which types of data that you can protect, see Types of data that you can protect.
6. (Optional) If you want to audit and mask other types of data by using custom data identifiers, choose **Add custom data identifier**. Then enter a name for the data type and the regular expression to use to search for that type of data in the log events. For more information, see Custom data identifiers.

   A single data protection policy can include up to 10 custom data identifiers. Each regular expression that defines a custom data identifier must be 200 characters or fewer.
7. (Optional) Choose one or more services to send the audit findings to. Even if you choose not to send audit findings to any of these services, the sensitive data types that you select will still be masked.
8. Choose **Activate data protection**.

Amazon CLI

To use the Amazon CLI to create a data protection policy

1. Use a text editor to create a policy file named `DataProtectionPolicy.json`. For information about the policy syntax, see the following section.
2. Enter the following command:

```
aws logs put-account-policy \
--policy-name TEST_POLICY --policy-type "DATA_PROTECTION_POLICY" \
--policy-document file://policy.json \
--scope "ALL" \
--region us-west-2
```

Data protection policy syntax for Amazon CLI or API operations

When you create a JSON data protection policy to use in an Amazon CLI command or API operation, the policy must include two JSON blocks:

- The first block must include both a `DataIdentifer` array and an `Operation` property with an `Audit` action. The `DataIdentifer` array lists the types of sensitive data that you want to mask. For more information about the available options, see Types of data that you can protect.

  The `Operation` property with an `Audit` action is required to find the sensitive data terms. This `Audit` action must contain a `FindingsDestination` object. You can optionally use that `FindingsDestination` object to list one or more destinations to send audit findings reports to. If you specify destinations such as log groups, Amazon Data Firehose streams, and S3 buckets, they must already exist. For an example of an audit findins report, see Audit findings reports.
- The second block must include both a `DataIdentifer` array and an `Operation` property with an `Deidentify` action. The `DataIdentifer` array must exactly match the `DataIdentifer` array in the first block of the policy.

  The `Operation` property with the `Deidentify` action is what actually masks the data, and it must contain the `"MaskConfig": {}` object. The `"MaskConfig": {}` object must be empty.

The following is an example of a data protection policy using only managed data identifiers. This policy masks email addresses and United States driver's licenses.

For information about policies that specify custom data identifiers, see Using custom data identifiers in your data protection policy.

```
{
    "Name": "data-protection-policy",
    "Description": "test description",
    "Version": "2021-06-01",
    "Statement": [{
            "Sid": "audit-policy",
            "DataIdentifier": [
                "arn:aws:dataprotection::aws:data-identifier/EmailAddress",
                "arn:aws:dataprotection::aws:data-identifier/DriversLicense-US"
            ],
            "Operation": {
```

```
                "Audit": {
                    "FindingsDestination": {
                        "CloudWatchLogs": {
                            "LogGroup": "EXISTING_LOG_GROUP_IN_YOUR_ACCOUNT,"
                        },
                        "Firehose": {
                            "DeliveryStream": "EXISTING_STREAM_IN_YOUR_ACCOUNT"
                        },
                        "S3": {
                            "Bucket": "EXISTING_BUCKET"
                        }
                    }
                }
            },
            {
                "Sid": "redact-policy",
                "DataIdentifier": [
                    "arn:aws:dataprotection::aws:data-identifier/EmailAddress",
                    "arn:aws:dataprotection::aws:data-identifier/DriversLicense-US"
                ],
                "Operation": {
                    "Deidentify": {
                        "MaskConfig": {}
                    }
                }
            }
        ]
}
```

Create a data protection policy for a single log group

You can use the CloudWatch Logs console or Amazon CLI commands to create a data protection policy to mask sensitive data.

You can assign one data protection policy to each log group. Each data protection policy can audit for multiple types of information. Each data protection policy can include one audit statement.

Topics

- Console
- Amazon CLI

Console

To use the console to create a data protection policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Choose the name of the log group.
4. Choose **Actions**, **Create data protection policy**.
5. For **Managed data identifiers**, select the types of data that you want to audit and mask in this log group. You can type in the selection box to find the identifiers that you want.

   We recommend that you select only the data identifiers that are relevant for your log data and your business. Choosing many types of data can lead to false positives.

   For details about which types of data that you can protect by using managed data identifiers, see Types of data that you can protect.
6. (Optional) If you want to audit and mask other types of data by using custom data identifiers, choose **Add custom data identifier**. Then enter a name for the data type and the regular expression to use to search for that type of data in the log events. For more information, see Custom data identifiers.

   A single data protection policy can include up to 10 custom data identifiers. Each regular expression that defines a custom data identifier must be 200 characters or fewer.
7. (Optional) Choose one or more services to send the audit findings to. Even if you choose not to send audit findings to any of these services, the sensitive data types that you select will still be masked.
8. Choose **Activate data protection**.

Amazon CLI

To use the Amazon CLI to create a data protection policy

1. Use a text editor to create a policy file named `DataProtectionPolicy.json`. For information about the policy syntax, see the following section.
2. Enter the following command:

```
aws logs put-data-protection-policy --log-group-identifier "my-log-group" --policy-
document file:///Path/DataProtectionPolicy.json --region us-west-2
```

Data protection policy syntax for Amazon CLI or API operations

When you create a JSON data protection policy to use in an Amazon CLI command or API operation, the policy must include two JSON blocks:

- The first block must include both a `DataIdentifer` array and an `Operation` property with an `Audit` action. The `DataIdentifer` array lists the types of sensitive data that you want to mask. For more information about the available options, see Types of data that you can protect.

  The `Operation` property with an `Audit` action is required to find the sensitive data terms. This `Audit` action must contain a `FindingsDestination` object. You can optionally use that `FindingsDestination` object to list one or more destinations to send audit findings reports to. If you specify destinations such as log groups, Amazon Data Firehose streams, and S3 buckets, they must already exist. For an example of an audit findins report, see Audit findings reports.
- The second block must include both a `DataIdentifer` array and an `Operation` property with an `Deidentify` action. The `DataIdentifer` array must exactly match the `DataIdentifer` array in the first block of the policy.

  The `Operation` property with the `Deidentify` action is what actually masks the data, and it must contain the `"MaskConfig": {}` object. The `"MaskConfig": {}` object must be empty.

The following is an example of a data protection policy that masks email addresses and United States driver's licenses.

```
{
    "Name": "data-protection-policy",
    "Description": "test description",
    "Version": "2021-06-01",
    "Statement": [{
            "Sid": "audit-policy",
            "DataIdentifier": [
                "arn:aws:dataprotection::aws:data-identifier/EmailAddress",
```

```
                "arn:aws:dataprotection::aws:data-identifier/DriversLicense-US"
            ],
            "Operation": {
                "Audit": {
                    "FindingsDestination": {
                        "CloudWatchLogs": {
                            "LogGroup": "EXISTING_LOG_GROUP_IN_YOUR_ACCOUNT,"
                        },
                        "Firehose": {
                            "DeliveryStream": "EXISTING_STREAM_IN_YOUR_ACCOUNT"
                        },
                        "S3": {
                            "Bucket": "EXISTING_BUCKET"
                        }
                    }
                }
            }
        },
        {
            "Sid": "redact-policy",
            "DataIdentifier": [
                "arn:aws:dataprotection::aws:data-identifier/EmailAddress",
                "arn:aws:dataprotection::aws:data-identifier/DriversLicense-US"
            ],
            "Operation": {
                "Deidentify": {
                    "MaskConfig": {}
                }
            }
        }
    ]
}
```

View unmasked data

To view unmasked data, a user must have the `logs:Unmask` permission. Users with this permission can see the unmasked data in the following ways:

- When viewing the events in a log stream, choose **Display**, **Unmask**.
- Use a CloudWatch Logs Insights query that includes the **unmask(@message)** command. The following example query displays the 20 most recent log events in the stream, unmasked:

```
fields @timestamp, @message, unmask(@message)
| sort @timestamp desc
| limit 20
```

For more information about CloudWatch Logs Insights commands, see CloudWatch Logs Insights language query syntax.

- Use a GetLogEvents or FilterLogEvents operation with the `unmask` parameter.

The **CloudWatchLogsFullAccess** policy includes the `logs:Unmask` permission. To grant `logs:Unmask` to a user who does not have **CloudWatchLogsFullAccess**, you can attach a custom IAM policy to that user. For more information, see Adding permissions to a user (console).

Audit findings reports

If you set up CloudWatch Logs data protection audit policies to write audit reports to CloudWatch Logs, Amazon S3, or Firehose, these findings reports are similar to the following example. CloudWatch Logs writes one findings report for each log event that contains sensitive data.

```
{
    "auditTimestamp": "2023-01-23T21:11:20Z",
    "resourceArn": "arn:aws:logs:us-west-2:111122223333:log-group:/aws/lambda/
MyLogGroup:*",
    "dataIdentifiers": [
        {
            "name": "EmailAddress",
            "count": 2,
            "detections": [
                {
                    "start": 13,
                    "end": 26
                },
{
                    "start": 30,
                    "end": 43
                }
            ]
        }
    ]
}
```

The fields in the report are as follows:

- The `resourceArn` field displays the log group where the sensitive data was found.
- The `dataIdentifiers` object displays information about the findings for one type of senssitive data that you are auditing.
- The `name` field identifies which type of sensitive data this section is reporting about.
- The `count` field displays the number of times this type of sensitive data appears in the log event.
- The `start` and `end` fields show where in the log event, by character count, each occurrence of the sensitive data appears.

The previous example shows a report of finding two email addresses in one log event. The first email address starts at the 13th character of the log event and ends at the 26th character. The second email address runs from the 30th character to the 43rd character. Even though this log event has two email addresses, the value of the `LogEventsWithFindings` metric is incremented only by one, because that metric counts the number of log events that contain sensitive data, not the number of occurrences of sensitive data.

Required key policy to send audit findings to an bucket protected by Amazon KMS

You can protect the data in an Amazon S3 bucket by enabling either Server-Side Encryption with Amazon S3-Managed Keys (SSE-S3) or Server-Side Encryption with KMS Keys (SSE-KMS). For more information, see Protecting data using server-side encryption in the Amazon S3 User Guide.

If you send audit findings to a bucket that is protected with SSE-S3, no additional configuration is required. Amazon S3 handles the encryption key.

If you send audit findings to a bucket that is protected with SSE-KMS, you must update the key policy for your KMS key so that the log delivery account can write to your S3 bucket. For more information about the required key policy for use with SSE-KMS, see Amazon S3 in the Amazon CloudWatch Logs User Guide.

Types of data that you can protect

This section contains information about the types of data that you can protect in a CloudWatch Logs data protection policy. CloudWatch Logs managed data identifiers offer preconfigured data types for protecting financial data, personal health information (PHI), and personally identifiable

information (PII). You can also use custom data identifiers to create data identifiers tailored to your specific use case.

Contents

CloudWatch Logs managed data identifiers for sensitive data types

This section contains information about the types of data that you can protect using managed data identifiers, and which countries and regions are relevant for each of those types of data.

For some types of sensitive data, CloudWatch Logs data protection scans for keywords in the proximity of the data, and finds a match only if it finds that keyword. If a keyword has to be

in proximity of a particular type of data, the keyword typically has to be within 30 characters (inclusively) of the data.

If a keyword contains a space, CloudWatch Logs data protection automatically matches keyword variations that are missing the space or that contain an underscore (_) or hyphen (-) instead of the space. In some cases, CloudWatch Logs also expands or abbreviates a keyword to address common variations of the keyword.

The following tables lists the types of credential, device, financial, medical, and protected health information (PHI) that CloudWatch Logs can detect using managed data identifiers. These are in addition to certain types of data that might also qualify as personally identifiable information (PII).

Supported identifiers that are language and region independent

Identifier	Category
`Address`	Personal
`AwsSecretKey`	Credentials
`CreditCardExpiration`	Financial
`CreditCardNumber`	Financial
`CreditCardSecurityCode`	Financial
`EmailAddress`	Personal
`IpAddress`	Personal
`LatLong`	Personal
`Name`	Personal
`OpenSshPrivateKey`	Credentials
`PgpPrivateKey`	Credentials
`PkcsPrivateKey`	Credentials
`PuttyPrivateKey`	Credentials

Identifier	Category
VehicleIdentificationNumber	Personal

Region-dependent data identifiers must include the identifier name, then a hyphen, and then the two-letter (ISO 3166-1 alpha-2) codes. For example, DriversLicense-US.

Supported identifiers that must include a two-letter country or region code

Identifier	Category	Countries and languages
BankAccountNumber	Financial	DE, ES, FR, GB, IT, US
CepCode	Personal	BR
Cnpj	Personal	BR
CpfCode	Personal	BR
DriversLicense	Personal	AT, AU, BE, BG, CA, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IT, LT, LU, LV, MT, NL, PL, PT, RO, SE, SI, SK, US
DrugEnforcementAgencyNumber	Health	US
ElectoralRollNumber	Personal	GB
HealthInsuranceCardNumber	Health	EU
HealthInsuranceClaimNumber	Health	US
HealthInsuranceNumber	Health	FR
HealthcareProcedureCode	Health	US
IndividualTaxIdentificationNumber	Personal	US

Identifier	Category	Countries and languages
InseeCode	Personal	FR
MedicareBeneficiaryNumber	Health	US
NationalDrugCode	Health	US
NationalIdentificationNumber	Personal	DE, ES, IT
NationalInsuranceNumber	Personal	GB
NationalProviderId	Health	US
NhsNumber	Health	GB
NieNumber	Personal	ES
NifNumber	Personal	ES
PassportNumber	Personal	CA, DE, ES, FR, GB, IT, US
PermanentResidenceNumber	Personal	CA
PersonalHealthNumber	Health	CA
PhoneNumber	Personal	BR, DE, ES, FR, GB, IT, US
PostalCode	Personal	CA
RgNumber	Personal	BR
SocialInsuranceNumber	Personal	CA
Ssn	Personal	ES, US
TaxId	Personal	DE, ES, FR, GB
ZipCode	Personal	US

Credentials

CloudWatch Logs data protection can find the following types of credentials.

Type of data	Data identifier ID	Keyword required	Countries and regions
Amazon secret access key	`AwsSecretKey`	`aws_secret_access_key` , `credentials` , `secret access key`, `secret key`, `set-awscredential`	All
OpenSSH private key	`OpenSSHPrivateKey`	None	All
PGP private key	`PgpPrivateKey`	None	All
Pkcs Private Key	`PkcsPrivateKey`	None	All
PuTTY private key	`PuttyPrivateKey`	None	All

Data identifier ARNs for credential data types

The following lists the Amazon Resource Names (ARNs) for the data identifiers that you can add to your data protection policies.

Credential data identifier ARNs
`arn:aws-cn:dataprotection::aws:data-identifier/AwsSecretKey`
`arn:aws-cn:dataprotection::aws:data-identifier/OpenSshPrivateKey`
`arn:aws-cn:dataprotection::aws:data-identifier/PgpPrivateKey`
`arn:aws-cn:dataprotection::aws:data-identifier/PkcsPrivateKey`

Credential data identifier ARNs
`arn:aws-cn:dataprotection::aws:data-identifier/PuttyPrivateKey`

Device identifiers

CloudWatch Logs data protection can find the following types of device identifiers.

Type of data	Data identifier ID	Keyword required	Countries and regions
IP address	`IpAddress`	None	All

Data identifier ARNs for device data types

The following lists the Amazon Resource Names (ARNs) for the data identifiers that you can add to your data protection policies.

Device data identifier ARN
`arn:aws-cn:dataprotection::aws:data-identifier/IpAddress`

Financial information

CloudWatch Logs data protection can find the following types of financial information.

If you set a data protection policy, CloudWatch Logs scans for the data identifiers that you specify no matter what geolocation the log group is located in. The information in the **Countries and regions** column in this table designates whether two-letter country codes must be appended to the data identifier to detect the appropriate keywords for those countries and regions.

Type of data	Data identifier ID	Keyword required	Countries and regions	Notes
Bank account number	BankAccountNumber	Yes. Different keywords apply to different countries. For details, see the **Keywords for bank account numbers** table later in this section.	France, Germany, Italy, Spain, United Kingdom, United States	Includes International Bank Account Numbers (IBANs) that consist of up to 34 alphanumeric characters, including elements such as country codes.
Credit card expiration date	CreditCardExpiration	exp d, exp m, exp y, expiration , expiry	All	
Credit card number	CreditCardNumber	account number, american express, amex, bank card, card, card number, card num, cc #, ccn, check card, credit, credit card#, dankort,	All	Detection requires the data to be a 13–19 digit

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
		debit, debit card, diners club, discover, electron, japanese card bureau, jcb, mastercard , mc, pan, payment account number, payment card number, pcn, union pay, visa		sequence that adheres to the Luhn check formula, and uses a standard card number prefix for any of the following types of credit cards: American Express, Dankort, Diner's Club, Discover, Electron, Japanese Card Bureau (JCB), Mastercard,

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
				UnionPay, and Visa.
Credit card verification code	CreditCardSecurityCode	card id, card identification code, card identification number , card security code, card validation code , card validation number , card verification data , card verification value, cvc, cvc2, cvv, cvv2, elo verification code	All	

Keywords for bank account numbers

Use the following keywords to bank account numbers. This includes International Bank Account Numbers (IBANs) that consist of up to 34 alphanumeric characters, including elements such as country codes.

Country	Keywords
France	account code, account number, accountno# , accountnumber# , bban, code bancaire, compte bancaire, customer account id, customer account number, customer bank account id, iban, numéro de compte
Germany	account code, account number, accountno# , accountnumber# , bankleitzahl , bban, customer account id, customer account

Country	Keywords
	number, customer bank account id, geheimzahl , iban, kartennummer , kontonummer , kreditkartennummer , sepa
Italy	account code, account number, accountno# , accountnumber# , bban, codice bancario, conto bancario, customer account id, customer account number, customer bank account id, iban, numero di conto
Spain	account code, account number, accountno# , accountnumber# , bban, código cuenta, código cuenta bancaria, cuenta cliente id, customer account ID, customer account number, customer bank account id, iban, número cuenta bancaria cliente, número cuenta cliente
United Kingdom	account code, account number, accountno# , accountnumber# , bban, customer account ID, customer account number, customer bank account id, iban, sepa
United States	bank account, bank acct, checking account, checking acct, deposit account, deposit acct, savings account, savings acct, chequing account, chequing acct

CloudWatch Logs doesn't report occurrences of the following sequences, which credit card issuers have reserved for public testing.

```
122000000000003, 2222405343248877, 2222990905257051, 2223007648726984,
 2223577120017656,
30569309025904, 34343434343434, 3528000700000000, 3530111333300000, 3566002020360505,
 36148900647913,
36700102000000, 371449635398431, 378282246310005, 378734493671000, 38520000023237,
 4012888888881881,
4111111111111111, 4222222222222, 4444333322221111, 4462030000000000, 4484070000000000,
 4911830000000,
4917300800000000, 4917610000000000, 4917610000000000003, 5019717010103742,
 5105105105105100,
5111010030175156, 5185540810000019, 5200828282828210, 5204230080000017,
 5204740009900014, 5420923878724339,
```

```
5454545454545454, 5455330760000018, 5506900490000436, 5506900490000444,
 5506900510000234, 5506920809243667,
5506922400634930, 5506927427317625, 5553042241984105, 5555553753048194,
 5555555555554444, 5610591081018250,
6011000990139424, 6011000400000000, 6011111111111117, 630490017740292441,
 630495060000000000,
6331101999990016, 6759649826438453, 6799990100000000019, and 76009244561.
```

Data identifier ARNs for financial data types

The following lists the Amazon Resource Names (ARNs) for the data identifiers that you can add to your data protection policies.

Financial data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-DE
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-FR
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-IT
arn:aws-cn:dataprotection::aws:data-identifier/BankAccountNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/CreditCardExpiration
arn:aws-cn:dataprotection::aws:data-identifier/CreditCardNumber
arn:aws-cn:dataprotection::aws:data-identifier/CreditCardSecurityCode

Protected health information (PHI)

CloudWatch Logs data protection can find the following types of protected health information (PHI).

If you set a data protection policy, CloudWatch Logs scans for the data identifiers that you specify no matter what geolocation the log group is located in. The information in the **Countries and regions** column in this table designates whether two-letter country codes must be appended to the data identifier to detect the appropriate keywords for those countries and regions.

Type of data	Data identifier ID	Keyword required	Countries and regions
Drug Enforcement Agency (DEA) registration number	`DrugEnforcementAgencyNumber`	`dea number`, `dea registration`	United States
Health Insurance Card Number (EHIC)	`HealthInsuranceCardNumber`	`assicurazione sanitaria numero`, `carta assicurazione numero`, `carte d’assurance maladie` , `carte européenne d'assurance maladie` , `ceam`, `ehic`, `ehic#`, `finlandehicnumber#` , `gesundheitskarte` , `hälsokort` , `health card`, `health card number`, `health insurance card`, `health insurance number`, `insurance card number`, `krankenversicherungskarte` , `krankenversicherungsnummer` , `medical account number`, `numero conto medico`,	European Union

Type of data	Data identifier ID	Keyword required	Countries and regions
		numéro d’assurance maladie , numéro de carte d’assurance , numéro de compte medical, número de cuenta médica, número de seguro de salud, número de tarjeta de seguro, sairaanhoitokortin , sairausvakuutuskortti , sairausvakuutusnumero , sjukförsäkringnummer, sjukförsäkringskort , suomi ehic-numero , tarjeta de salud, terveyskortti , tessera sanitaria assicurazione numero , versicherungsnummer	
Health Insurance Claim Number (HICN)	HealthInsuranceClaimNumber	health insurance claim number, hic no, hic no., hic number, hic#, hicn, hicn#, hicno#	United States
Health insurance or medical identification number	HealthInsuranceNumber	carte d'assuré social, carte vitale, insurance card	France

Type of data	Data identifier ID	Keyword required	Countries and regions
Healthcare Common Procedure Coding System (HCPCS) code	HealthcareProcedureCode	current procedural terminology , hcpcs, healthcare common procedure coding system	United States
Medicare Beneficiary Number (MBN)	MedicareBeneficiaryNumber	mbi, medicare beneficiary	United States
National Drug Code (NDC)	NationalDrugCode	national drug code, ndc	United States
National Provider Identifier (NPI)	NationalProviderId	hipaa, n.p.i., national provider, npi	United States
National Health Service (NHS) number	NhsNumber	national health service, NHS	Great Britain
Personal Health Number	PersonalHealthNumber	canada healthcare number, msp number, care number, phn, soins de santé	Canada

Data identifier ARNs for protected health information data types (PHI)

The following lists the data identifier Amazon Resource Names (ARNs) that can be used in protected health information (PHI) data protection policies.

PHI data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/DrugEnforcementAgencyNumber-US

PHI data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/HealthcareProcedureCode-US
arn:aws-cn:dataprotection::aws:data-identifier/HealthInsuranceCardNumber-EU
arn:aws-cn:dataprotection::aws:data-identifier/HealthInsuranceClaimNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/HealthInsuranceNumber-FR
arn:aws-cn:dataprotection::aws:data-identifier/MedicareBeneficiaryNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/NationalDrugCode-US
arn:aws-cn:dataprotection::aws:data-identifier/NationalInsuranceNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/NationalProviderId-US
arn:aws-cn:dataprotection::aws:data-identifier/NhsNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/PersonalHealthNumber-CA

Personally identifiable information (PII)

CloudWatch Logs data protection can find the following types of personally identifiable information (PII).

If you set a data protection policy, CloudWatch Logs scans for the data identifiers that you specify no matter what geolocation the log group is located in. The information in the **Countries and**

regions column in this table designates whether two-letter country codes must be appended to the data identifier to detect the appropriate keywords for those countries and regions.

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Birth date	`DateOfBirth`	dob, `date of birth`, `birthdate` , `birth date`, `birthday`, `b-day`, `bday`	Any	Support includes most date formats, such as all digits and combinations of digits and names of months. Date components can be separated by spaces, slashes (/), or hyphens (-).
Código de Endereçamento Postal (CEP)	`CepCode`	`cep`, `código de endereçamento`	Brazil	

Type of data	Data identifier ID	Keyword required	Countries and regions	Notes
		`postal`, `codigo de endereçamento postal`		
Cadastro Nacional da Pessoa Jurídica (CNPJ)	`Cnpj`	`cadastro nacional da pessoa jurídica`, `cadastro nacional da pessoa juridica`, `cnpj`	Brazil	
Cadastro de Pessoas Físicas (CPF)	`CpfCode`	`Cadastro de pessoas fisicas`, `cadastro de pessoas físicas`, `cadastro de pessoa física`, `cadastro de pessoa fisica`, `cpf`	Brazil	
Driver's license identification number	`DriversLicense`	Yes. Different keywords apply to different countries. For details, see the **Drivers license identification numbers** table later in this section.	Many countries. For details, see the **Drivers license identification numbers** table.	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Electoral roll number	`ElectoralRollNumber`	`electoral #`, `electoral number`, `electoral roll #`, `electoral roll no.`, `electoral roll number`, `electoral rollno`	United Kingdom	
Individual taxpayer identification	`IndividualTaxIdentificationNumber`	Yes. Different keywords apply to different countries. For details, see the **Individual taxpayer identification numbers** table later in this section.	Brazil, France, Germany Spain, United Kingdom	
National Institute for Statistics and Economic Studies (INSEE)	`InseeCode`	Yes. Different keywords apply to different countries. For details, see the **Keywords for national identification numbers** table later in this section.	France	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
National Identification Number	`NationalIdentificationNumber`	Yes. For details, see the **Keywords for national identification numbers** table later in this section.	Germany Italy, Spain	This includes Documento Nacional de Identidad (DNI) identifiers (Spain), Codice fiscale codes (Italy), and National Identity Card numbers (German).
National Insurance Number (NINO)	`NationalInsuranceNumber`	`insurance no.`, `insurance number`, `insurance#` , `national insurance number`, `nationalinsurance#` , `nationalinsurancenumber` , `nin`, `nino`	United Kingdom	–

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Número de identidad de extranjero (NIE)	`NieNumber`	Yes. Different keywords apply to different countries. For details, see the **Individual taxpayer identification numbers** table later in this section.	Spain	
Número de Identificación Fiscal (NIF)	`NifNumber`	Yes. Different keywords apply to different countries. For details, see the **Individual taxpayer identification numbers** table later in this section.	Spain	
Passport number	`PassportNumber`	Yes. Different keywords apply to different countries. For details, see the **Keywords for passport numbers** table later in this section.	Canada, France, Germany Italy, Spain, United Kingdom United States	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Permanent residence number	Permanent Residence Number	carte résident permanent , numéro carte résident permanent , numéro résident permanent , permanent resident card, permanent resident card number, permanent resident no, permanent resident no., permanent resident number, pr no, pr no., pr non, pr number, résident permanent no., résident permanent non	Canada	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Phone number	PhoneNumber	Brazil: keywords also include: `cel`, `celular`, `fone`, `móvel`, `número residencial` , `numero residencial` , `telefone` Others: `cell`, `contact`, `fax`, `fax number`, `mobile`, phone, phone number, `tel`, `telephone` , `telephone number`	Brazil, Canada, France, Germany Italy, Spain, United Kingdom United States	This includes toll-free numbers in the United States and fax numbers. If a keyword is in proximity of the data, the number doesn't have to include a country code. If a keyword isn't in proximity of the data,

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
				the number has to include a country code.
Postal Code	`PostalCode`	None	Canada	
Registro Geral (RG)	`RgNumber`	Yes. Different keywords apply to different countries. For details, see the **Individual taxpayer identification numbers** table later in this section.	Brazil	
Social Insurance Number (SIN)	`SocialInsuranceNumber`	`canadian id`, `numéro d'assurance sociale`, `social insurance number`, `sin`	Canada	
Social Security Number (SSN)	`Ssn`	Spain – `número de la seguridad social`, `social security no.`, `social security no.` `número de la seguridad social`, `social security number`, `socialsecurityno#` , `ssn`, `ssn#` United States – `social security`, `ss#`, `ssn`	Spain, United States	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Taxpayer identification or reference number	`TaxId`	Yes. Different keywords apply to different countries. For details, see the **Individual taxpayer identification numbers** table later in this section. .	France, Germany Spain, United Kingdom	This includes TIN (France); Steueride ntifikati onsnummer (Germany) ; CIF (Spain); and TRN, UTR (United Kingdom).
ZIP code	`ZipCode`	`zip code`, `zip+4`	United States	United States postal code.

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Mailing address	`Address`	None	Australia, Canada, France, Germany Italy, Spain, United Kingdom United States	Although a keyword isn't required, detection requires the address to include the name of a city or place and a ZIP code or Postal Code.
Electronic mail address	`EmailAddress`	None	Any	

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Global Positioning System (GPS) coordinates	`LatLong`	`coordinate , coordinates ,lat long, latitude longitude ,location, position`	Any	CloudWatch Logs can detect GPS coordinates if the latitude and longitude coordinates are stored as a pair and they're in Decimal Degrees (DD) format, for example, 41.948614,-87.655311. Support doesn't include coordinat

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
				es in Degrees Decimal Minutes (DDM) format, for example 41°56.9168'N 87°39.3187'W, or Degrees, Minutes, Seconds (DMS) format, for example 41°56'55.0104"N 87°39'19.1196"W.

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Full name	`Name`	None	Any	CloudWatch Logs can detect full names only. Support is limited to Latin character sets.

Type of data	Data identifier ID	Keyword required	Countrie and regions	Notes
Vehicle Identification Number (VIN)	VehicleIdentificationNumber	Fahrgestellnummer , niv, numarul de identificare , numarul seriei de sasiu, serie sasiu, numer VIN, Número de Identificação do Veículo, Número de Identificación de Automóviles , numéro d'identification du véhicule, vehicle identification number, vin, VIN numeris	Any	CloudWatch Logs can detect VINs that consist of a 17-character sequence and adhere to the ISO 3779 and 3780 standards. These standards were designed for worldwide use.

Keywords for driver's license identification numbers

To detect various types of driver's license identification numbers, CloudWatch Logs requires a keyword to be in proximity of the numbers. The following table lists the keywords that CloudWatch Logs recognizes for specific countries and regions.

Country or region	Keywords
Australia	dl# dl:, dl :, dlno# driver licence, driver license, driver permit, drivers lic., drivers licence, driver's licence, drivers license, driver's license, drivers permit, driver's permit, drivers permit number, driving licence, driving license, driving permit
Austria	führerschein, fuhrerschein, führerschein republik österreich, fuhrerschein republik osterreich
Belgium	fuehrerschein, fuehrerschein- nr, fuehrersc heinnummer, fuhrerschein, führerschein, fuhrerschein- nr, führerschein- nr, fuhrersch einnummer, führerscheinnummer, numéro permis conduire, permis de conduire, rijbewijs, rijbewijsnummer
Bulgaria	превозно средство, свидетелство за управление на моторно, свидетелство за управление на мпс, сумпс, шофьорска книжка
Canada	dl#, dl:, dlno#, driver licence, driver licences, driver license, driver licenses, driver permit, drivers lic., drivers licence, driver's licence, drivers licences, driver's licences, drivers license, driver's license, drivers licenses, driver's licenses, drivers permit, driver's permit,

Country or region	Keywords
	drivers permit number, driving licence, driving license, driving permit, permis de conduire
Croatia	vozačka dozvola
Cyprus	άδεια οδήγησης
Czech Republic	číslo licence, číslo licence řidiče, číslo řidičskéh o průkazu, ovladače lic., povolení k jízdě, povolení řidiče, řidiči povolení, řidičský prúkaz, řidičský průkaz
Denmark	kørekort, kørekortnummer
Estonia	juhi litsentsi number, juhiloa number, juhiluba, juhiluba number
Finland	ajokortin numero, ajokortti, förare lic., körkort, körkort nummer, kuljettaja lic., permis de conduire
France	permis de conduire
Germany	fuehrerschein, fuehrerschein- nr, fuehrersc heinnummer, fuhrerschein, führerschein, fuhrerschein- nr, führerschein- nr, fuhrersch einnummer, führerscheinnummer
Greece	δεια οδήγησης, adeia odigisis
Hungary	illesztőprogramok lic, jogosítvány, jogsi, licencszám, vezető engedély, vezetői engedély
Ireland	ceadúnas tiomána
Italy	patente di guida, patente di guida numero, patente guida, patente guida numero

Country or region	Keywords
Latvia	autovadītāja apliecība, licences numurs, vadītāja apliecība, vadītāja apliecības numurs, vadītāja atļauja, vadītāja licences numurs, vadītāji lic.
Lithuania	vairuotojo pažymėjimas
Luxembourg	fahrerlaubnis, führerschäin
Malta	liċenzja tas-sewqan
Netherlands	permis de conduire, rijbewijs, rijbewijsnummer
Poland	numer licencyjny, prawo jazdy, zezwolenie na prowadzenie
Portugal	carta de condução, carteira de habilitação, carteira de motorist, carteira habilitação, carteira motorist, licença condução, licença de condução, número de licença, número licença, permissão condução, permissão de condução
Romania	numărul permisului de conducere, permis de conducere
Slovakia	číslo licencie, číslo vodičského preukazu, ovládače lic., povolenia vodičov, povolenie jazdu, povolenie na jazdu, povolenie vodiča, vodičský preukaz
Slovenia	vozniško dovoljenje

Country or region	Keywords
Spain	carnet conducer, el carnet de conducer, licencia conducer, licencia de manejo, número carnet conducer, número de carnet de conducer, número de permiso conducer, número de permiso de conducer, número licencia conducer, número permiso conducer, permiso conducción, permiso conducer, permiso de conducción
Sweden	ajokortin numero, dlno# ajokortti, drivere lic., förare lic., körkort, körkort nummer, körkortsn ummer, kuljettajat lic.
United Kingdom	dl#, dl:, dlno#, driver licence, driver licences, driver license, driver licenses, driver permit, drivers lic., drivers licence, driver's licence, drivers licences, driver's licences, drivers license, driver's license, drivers licenses, driver's licenses, drivers permit, driver's permit, drivers permit number, driving licence, driving license, driving permit
United States	dl#, dl:, dlno#, driver licence, driver licences, driver license, driver licenses, driver permit, drivers lic., drivers licence, driver's licence, drivers licences, driver's licences, drivers license, driver's license, drivers licenses, driver's licenses, drivers permit, driver's permit, drivers permit number, driving licence, driving license, driving permit

Keywords for national identification numbers

To detect various types of national identification numbers, CloudWatch Logs requires a keyword to be in close proximity to the numbers. This includes Documento Nacional de Identidad (DNI)

identifiers (Spain), French National Institute for Statistics and Economic Studies (INSEE) codes, German National Identity Card numbers, and Registro Geral (RG) numbers (Brazil).

The following table lists the keywords that CloudWatch Logs recognizes for specific countries and regions.

Country or region	Keywords
Brazil	registro geral, rg
France	assurance sociale, carte nationale d'identit é, cni, code sécurité sociale, French social security number, fssn#, insee, insurance number, national id number, nationalid#, numéro d'assurance, sécurité sociale, sécurité sociale non., sécurité sociale numéro, social, social security, social security number, socialsecuritynumber, ss#, ssn, ssn#
Germany	ausweisnummer, id number, identification number, identity number, insurance number, personal id, personalausweis
Italy	codice fiscal, dati anagrafici, ehic, health card, health insurance card, p. iva, partita i.v.a., personal data, tax code, tessera sanitaria
Spain	dni, dni#, dninúmero#, documento nacional de identidad, identidad único, identidad único#, insurance number, national identific ation number, national identity, nationalid#, nationalidno#, número nacional identidad , personal identification number, personal identity no, unique identity number, uniqueid#

Keywords for passport numbers

To detect various types of passport numbers, CloudWatch Logs requires a keyword to be in proximity of the numbers. The following table lists the keywords that CloudWatch Logs recognizes for specific countries and regions.

Country or region	Keywords
Canada	passeport, passeport#, passport, passport#, passportno, passportno#
France	numéro de passeport, passeport, passeport #, passeport #, passeportn °, passeport n °, passeportNon, passeport non
Germany	ausstellungsdatum, ausstellungsort, geburtsdatum, passport, passports, reisepass, reisepass–nr, reisepassnummer
Italy	italian passport number, numéro passeport , numéro passeport italien, passaporto, passaporto italiana, passaporto numero, passport number, repubblica italiana passaporto
Spain	españa pasaporte, libreta pasaporte, número pasaporte, pasaporte, passport, passport book, passport no, passport number, spain passport
United Kingdom	passeport #, passeport n °, passeportNon, passeport non, passeportn °, passport #, passport no, passport number, passport#, passportid
United States	passport, travel document

Keywords for taxpayer identification and reference numbers

To detect various types of taxpayer identification and reference numbers, CloudWatch Logs requires a keyword to be in proximity of the numbers. The following table lists the keywords that CloudWatch Logs recognizes for specific countries and regions.

Country or region	Keywords
Brazil	cadastro de pessoa física, cadastro de pessoa fisica, cadastro de pessoas físicas, cadastro de pessoas fisicas, cadastro nacional da pessoa jurídica, cadastro nacional da pessoa juridica, cnpj, cpf
France	numéro d'identification fiscale, tax id, tax identification number, tax number, tin, tin#
Germany	identifikationsnummer, steuer id, steueride ntifikationsnummer, steuernummer, tax id, tax identification number, tax number
Spain	cif, cif número, cifnúmero#, nie, nif, número de contribuyente, número de identidad de extranjero, número de identificación fiscal, número de impuesto corporativo, personal tax number, tax id, tax identification number, tax number, tin, tin#
United Kingdom	paye, tax id, tax id no., tax id number, tax identification, tax identification#, tax no., tax number, tax reference, tax#, taxid#, temporary reference number, tin, trn, unique tax reference, unique taxpayer reference, utr
United States	individual taxpayer identification number, itin, i.t.i.n.

Data identifier ARNs for personally identifiable information (PII)

The following table lists the Amazon Resource Names (ARNs) for the personally identifiable information (PII) data identifiers that you can add to your data protection policies.

PII data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/Address
arn:aws-cn:dataprotection::aws:data-identifier/CepCode-BR
arn:aws-cn:dataprotection::aws:data-identifier/Cnpj-BR
arn:aws-cn:dataprotection::aws:data-identifier/CpfCode-BR
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-AT
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-AU
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-BE
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-BG
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-CA
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-CY
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-CZ
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-DE
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-DK
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-EE
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-ES
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-FI
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-FR
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-GB

PII data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-GR
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-HR
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-HU
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-IE
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-IT
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-LT
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-LU
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-LV
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-MT
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-NL
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-PL
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-PT
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-RO
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-SE
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-SI
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-SK
arn:aws-cn:dataprotection::aws:data-identifier/DriversLicense-US
arn:aws-cn:dataprotection::aws:data-identifier/ElectoralRollNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/EmailAddress

PII data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/IndividualTaxIdentificationNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/InseeCode-FR
arn:aws-cn:dataprotection::aws:data-identifier/LatLong
arn:aws-cn:dataprotection::aws:data-identifier/Name
arn:aws-cn:dataprotection::aws:data-identifier/NationalIdentificationNumber-DE
arn:aws-cn:dataprotection::aws:data-identifier/NationalIdentificationNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/NationalIdentificationNumber-IT
arn:aws-cn:dataprotection::aws:data-identifier/NieNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/NifNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-CA
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-DE
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-FR
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-IT
arn:aws-cn:dataprotection::aws:data-identifier/PassportNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/PermanentResidenceNumber-CA

PII data identifier ARNs
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-BR
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-DE
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-ES
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-FR
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-GB
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-IT
arn:aws-cn:dataprotection::aws:data-identifier/PhoneNumber-US
arn:aws-cn:dataprotection::aws:data-identifier/PostalCode-CA
arn:aws-cn:dataprotection::aws:data-identifier/RgNumber-BR
arn:aws-cn:dataprotection::aws:data-identifier/SocialInsuranceNumber-CA
arn:aws-cn:dataprotection::aws:data-identifier/Ssn-ES
arn:aws-cn:dataprotection::aws:data-identifier/Ssn-US
arn:aws-cn:dataprotection::aws:data-identifier/TaxId-DE
arn:aws-cn:dataprotection::aws:data-identifier/TaxId-ES
arn:aws-cn:dataprotection::aws:data-identifier/TaxId-FR
arn:aws-cn:dataprotection::aws:data-identifier/TaxId-GB
arn:aws-cn:dataprotection::aws:data-identifier/VehicleIdentificationNumber
arn:aws-cn:dataprotection::aws:data-identifier/ZipCode-US

Custom data identifiers

Topics

What are custom data identifiers?

Custom data identifiers (CDIs) let you define your own custom regular expressions that can be used in your data protection policy. Using custom data identifiers, you can target business-specific personally identifiable information (PII) use cases that managed data identifiers can't provide. For example, you can use a custom data identifier to look for company-specific employee IDs. Custom data identifiers can be used in conjunction with managed data identifiers.

Custom data identifier constraints

CloudWatch Logs custom data identifiers have the following limitations:

- A maximum of 10 custom data identifiers are supported for each data protection policy.
- Custom data identifier names have a maximum length of 128 characters. The following characters are supported:
  - Alphanumeric: (a-zA-Z0-9)
  - Symbols: ('_' | '-')
- RegEx has a maximum length of 200 characters. The following characters are supported:
  - Alphanumeric: (a-zA-Z0-9)
  - Symbols: ('_' | '#' | '=' | '@' |'/' | ';' | ',' | '-' | ' ')
  - RegEx reserved characters: ('^' | '$' | '?' | '[' | ']' | '{' | '}' | '|' | '\\' | '*' | '+' | '.')
- Custom data identifiers cannot share the same name as a managed data identifier.
- Custom data identifiers can be specified within an account-level data protection policy or in log group-level data protection policies. Similar to managed data identifiers, custom data identifiers defined within an account-level policy work in combination with custom data identifiers defined in a log group-level policy.

Using custom data identifiers in the console

When you use the CloudWatch console to create or edit a data protection policy, to specify a custom data identifier you just enter a name and regular expression for the data identifier. For example, you might enter **`Employee_ID`** for the name and **`EmployeeID-\d{9}`** as the regular expression. This regular expression will detect and mask log events with nine numbers after `EmployeeID-`. For example, `EmployeeID-123456789`

Using custom data identifiers in your data protection policy

If you are using the Amazon CLI or Amazon API to specify a custom data identifier, you need to include the data identifier name and regular expression in the JSON policy used to define the data protection policy. The following data protection policy detects and masks log events that carry company-specific employee IDs.

1. Create a `Configuration` block within your data protection policy.
2. Enter a `Name` for your custom data identifier. For example, **`EmployeeId`**.
3. Enter a `Regex` for your custom data identifier. For example, **`EmployeeID-\d{9}`**. This regular expression will match log events containing `EmployeeID-` that have nine digits after `EmployeeID-`. For example, `EmployeeID-123456789`
4. Refer to the following custom data identifier in a policy statement.

```
{
    "Name": "example_data_protection_policy",
    "Description": "Example data protection policy with custom data identifiers",
    "Version": "2021-06-01",
    "Configuration": {
      "CustomDataIdentifier": [
        {"Name": "EmployeeId", "Regex": "EmployeeId-\\d{9}"}
      ]
    },
    "Statement": [
        {
            "Sid": "audit-policy",
            "DataIdentifier": [
                "EmployeeId"
            ],
            "Operation": {
                "Audit": {
                    "FindingsDestination": {
                        "S3": {
```

```
                            "Bucket": "EXISTING_BUCKET"
                        }
                    }
                }
            }
        },
        {
            "Sid": "redact-policy",
            "DataIdentifier": [
            "EmployeeId"
            ],
            "Operation": {
                "Deidentify": {
                    "MaskConfig": {
                    }
                }
            }
        }
    ]
}
```

5. (Optional) Continue to add additional **custom data identifiers** to the `Configuration` block as needed. Data protection policies currently support a maximum of 10 custom data identifiers.

Transform logs during ingestion

With logs transformation and enrichment, you can normalize all your logs in a consistent and context-rich format at the time of ingestion into CloudWatch Logs. You can add structure to your logs by using pre-configured templates for common Amazon services such as Amazon WAF and Amazon Route 53, or build custom transformers with native parsers such as Grok. You can also rename existing attributes and add additional metadata to your logs such as account ID, and Region.

Log transformation helps simplify and shorten your log queries across your applications, and helps simplify creating alerts on your logs. This feature provides transformation for common log types with out-of-the-box transformation templates for major Amazon log sources like VPC Flow logs, Route 53, and Amazon RDS for PostgreSQL. You can use pre-configured transformation templates or create custom transformers to suit your needs.

Log transformation helps you manage logs emitted from various sources that vary widely in format and attribute names.

After you create a transformer, ingested log events are converted and stored in a standard format. You can leverage these transformed logs to accelerate your analytics experience with the following features:

- Field indexes
- CloudWatch Logs Insights discovered fields
- Flexibility in alarming using metric filters
- Forwarding via subscription filters
- Creating metric data from log events with Contributor Insights, where you can choose to have the Contributor Insights rule evaluate log events either before or after they are transformed.

Transformations happen only during log ingestion. You can't transform log events that have already been ingested. Transformations are not reversible. Both original and transformed logs are stored in CloudWatch Logs with the same retention policy. Log transformation and enrichment capability is included in the existing Standard log class ingestion price. Log storage costs will be based on log size after transformation, which might exceed the original log volume.

Important

After log events have been transformed, you must use CloudWatch Logs Insights queries to view the transformed versions of the logs. The GetLogEvents and FilterLogEvents actions return only the original versions of the log events, before they were transformed.

In addition to transforming into different formats, you can also enrich your logs with additional context, such as account ID, Region, and keyword. These are extracted from the log group name and from static keywords.

Log transformation helps you with logs emitted from various sources that vary widely in format and attribute names.

Log transformation and enrichment is supported only for log groups in the Standard log class.

You can create transformers for individual log groups, and you can also create account-level transformers that apply to all or many log groups in your account. If a log group has a log group-level transformer, that transformer overrides any account-level transformer that would otherwise apply to that log group.

Topics

Create and manage log transformers

A log transformer includes one or more *processors* that are in a logical pipeline together. Each processor is applied to a log event, one after the other in the order that they are listed in the transformer configuration.

Some processors are of the *parser* type. Each transformer must have at least one parser, and the first processor in a transformer must be a parser.

Some of the parsers are built-in parsers that are configured for a certain type of Amazon vended log.

Other processor types are string mutators, JSON mutators, and data processors.

You can create transformers for individual log groups, and you can also create account-level transformers that apply to all or many log groups in your account. If a log group has a log group-level transformer, that transformer overrides any account-level transformer that would otherwise apply to that log group. You can have as many as 20 account-level transformers in a Region in your account.

You must follow these guidelines when you create a transformer:

- If you include a pre-configured parser for a type of Amazon vended logs, it must be the first processor listed in the transformer. You can include only one such processor in a transformer.
- You can include only one `grok` processor in a transformer.
- You must have at least one parser-type processor in a transformer. You can include as many as five parser-type processors. This limit of five includes both built-in parsers and configurable parsers.
- You can have as many as 20 processors in a transformer.
- You can include only one **addKeys** processor in a transformer.
- You can include only one **copyValue** processor in a transformer.
- Each transformer can extract up to 200 fields from a log event.

For more information about all supported processors and their syntax, see Processors that you can use.

Topics

Create an account-level transformer policy

Use the steps in this section to create a transformer policy that applies to all log groups in the account, or to multiple log groups that have log group names that start with the same string (prefix). You can have as many as 20 account-level transformer policies in a Region.

You can't create two transformer policies in the same Region that use the same prefix or have one prefix contained within another. For example, if you create one transformer policy for the string prefix `/aws/lambda`, you can't create another with the prefix `/aws`. But you could have one transformer for `/aws/lambda` and another for `/aws/waf`

To create an account-level transformer policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Settings** and then choose the **Logs** tab.
3. In the **Transformer policy for account** section, choose **Create transformer policy**.
4. For **Transformer policy name**, enter a name for your new poiicy.
5. For **Select log groups**, do one of the following:
   - Choose **All standard log groups** to have the transformer policy apply to all Standard Class log groups in the account.
   - choose **Log groups by prefix match** to apply the policy to a subset of log groups that all have names that start with the same string. Then, enter the prefix for these log groups in **Selection criteria**.
6. In the **Select parsers** area, use **Parsers** to select a parser to include in your transformer.

   If it is a pre-configured parser for a type of Amazon vended log, you don't have to specify any configuration for it.

   If it is a different parser, you need to specify its configuration. For more information, see the information for that processor in Configurable parser-type processors.
7. To add another processor, choose **Select processor**. Then select the processor that you want in the **Processor** box, and fill in the configuration parameters. For information about the configuration parameters, see the section for that processor in Processors that you can use.

   Remember that processors operate on the log events in the order that you add them to the transformer.
8. (Optional) To add additional processors, choose **+ Processor** and repeat the previous step.
9. (Optional) At any time, you can test the transformer that you have built so far on a sample log event. To do so, do one of the following in the **Transformer preview** section:
   - Select as many as five log groups in **Select log groups** and then choose **Load latest log events**. Then choose **Test transformer**.
   - Copy log events directly into **Sample log events** and then choose **Test transformer**.

The transformed version of the log then appears.

10. When you are finished adding processors and satisfied with the tests on sample logs, choose **Save**.
11. When you have finished, choose **Create**.

Edit or delete an account-level transformer policy

Use the steps in this section to edit or delete an account-level transformer policy.

To edit or delete an account-level transformer policy

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Settings** and then choose the **Logs** tab.
3. In the **Transformer account policy** section, choose **Manage**.
4. Select the button by the transformer policy that you want to manage, and then choose **Edit** or **Delete**.

   If you're editing the policy, see steps 5-11 in Configurable parser-type processors to see your options.

Create a log-group-level log transformer from scratch

Use these steps to create a log-group-level transformer from scratch.

To use the console to create a log transformer for a log group

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Choose the log group that you want to create the transformer for.
4. Choose the **Transformer** tab. You might have to scroll the tab list to the right to see it.
5. Choose **Create transformer**.
6. In the **Choose a parser** box, select a parser to include in your transformer.

   If it is a pre-configured parser for a type of Amazon vended log, you don't have to specify any configuration for it.

If it is a different parser, you need to specify its configuration. For more information, see the information for that processor in Configurable parser-type processors.

7. To add another processor, choose **+ Add processor**. Then select the processor that you want in the **Choose processors** box, and fill in the configuration parameters. For information about the configuration parameters, see the section for that processor in Processors that you can use.

   Remember that processors operate on the log events in the order that you add them to the transformer.

8. (Optional) At any time, you can test the transformer that you have built so far on a sample log event. To do so, do the following:

   - In the **Transformation preview** section, either choose **Load sample log** to load a sample log event from the log group that this transformer is for, or paste a log event into the text box.

     Choose **Test transformer**. The transformed version of the log appears

9. When you are finished adding processors and satisfied with the tests on sample logs, choose **Save**.

To use the Amazon CLI to create a log transformer from scratch

- Use the `aws logs put-transformer` command. When using `parseJSON` as the first processor, you must parse the entire log event using `@message` as the source field. After the initial JSON parsing, you can then manipulate specific fields in subsequent processors. The following is an example that creates a transformer that includes the `parseJSON` and `addKeys` processors:

```
 aws logs put-transformer \
  --transformer-config '[{"parseJSON":{"source":"@message"}},{"addKeys":
{"entries":[{"key":"metadata.transformed_in","value":"CloudWatchLogs"},
{"key":"feature","value":"Transformation"}]}},{"trimString":{"withKeys":
["status"]}}]' \
  --log-group-identifier my-log-group-name
```

Create a log-group-level transformer by copying an existing one

You can use the console to copy the JSON configuration of an existing transformer. You can then use that code to create an identical transformer by using the Amazon CLI, or you can modify the configuration first.

To create a log transformer by copying an existing one

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Choose the log group that has the transformer that you want to copy.
4. Choose the **Transformations** tab. You might have to scroll the tab list to the right to see it.
5. Choose **Manage transformer**.
6. Choose **Copy transformer**. This copies the transformer JSON to your clipboard.
7. Create a file and paste in the transformer configuration. In this example we'll call the file `CopiedTransformer.json`
8. Use the Amazon CLI to create a new transformer with that configuration.

```
aws logs put-transformer --log-group-identifier my-log-group-name \
--transformer-config file://CopiedTransformer.json
```

Edit a log-group-level transformer

Use these steps to edit an existing log transformer.

To edit a log transformer

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Choose the log group that has the transformer that you want to edit.
4. Choose the **Transformations** tab. You might have to scroll the tab list to the right to see it.
5. Choose **Manage transformer**.
6. In the **Parsers** and **Processors** sections, make your changes.

7. To add another processor, choose **+ Add Processor**. Then select the processor that you want in the **Processor** box, and fill in the configuration parameters. For information about the configuration parameters, see the section for that processor in Processors that you can use.

   Remember that processors operate on the log events in the order that you add them to the transformer.
8. (Optional) At any time, you can test the transformer that you have built so far on a sample log event. To do so, do the following:

   - In the **Transformation Preview** section, either choose **Load Sample Log** to load a sample log event from the log group that this transformer is for, or paste a log event into the text box.

     Choose **Test Transformation**. The transformed version of the log appears
9. When you are finished adding processors and satisfied with the tests on sample logs, choose **Save**.

Delete a log-group-level transformer

Use these steps to delete a log transformer.

To delete a log transformer

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, **Log groups**.
3. Choose the log group that has the transformer that you want to edit.
4. Choose the **Transformations** tab. You might have to scroll the tab list to the right to see it.
5. Choose **Delete**.
6. In the confirmation box, choose **Delete Policy**.

Processors that you can use

This section contains information about each processor that you can use in a log event transformer. The processors can be categorized into parsers, string mutators, JSON mutators, and date processors.

Contents

Configurable parser-type processors

parseJSON

The **parseJSON** processor parses JSON log events and inserts extracted JSON key-value pairs under the destination. If you don't specify a destination, the processor places the key-value pair under the root node. When using `parseJSON` as the first processor, you must parse the entire log event using `@message` as the source field. After the initial JSON parsing, you can then manipulate specific fields in subsequent processors.

The original `@message` content is not changed, the new keys are added to the message.

Field	Description	Required?	Default	Limits
source	Path to the field in the log event that will be parsed. Use dot notation to access child fields. For example, `store.book`	No	`@message`	Maximum length: 128 Maximum nested key depth: 3
destination	The destination field of the parsed JSON	No	`Parent JSON node`	Maximum length: 128 Maximum nested key depth: 3

Example

Suppose an ingested log event looks like this:

```
{
    "outer_key": {
        "inner_key": "inner_value"
    }
}
```

Then if we have this **parseJSON** processor:

```
[
   {
        "parseJSON": {
            "destination": "new_key"
        }
   }
]
```

The transformed log event would be the following.

```
{
    "new_key": {
        "outer_key": {
            "inner_key": "inner_value"
        }
    }
}
```

grok

Use the grok processor to parse and structure unstructured data using pattern matching. This processor can also extract fields from log messages.

Field	Description	Required	Default	Limits	Notes
source	Path of the field to apply Grok matching on	No	`@messag`	Maximum length: 128 Maximum nested key depth: 3	

Field	Description	Required	Default	Limits	Notes
match	The grok pattern to match against the log event	Yes		Maximum length: 512 Maximum grok patterns: 20 Some grok pattern types have individual usage limits. Any combination of the following patterns can be used as many as five times: {URI, URIPARAM, URIPATHPARAM, SPACE, DATA, GREEDYDATA, GREEDYDATA_MULTILINE} Grok patterns don't support type conversions. For common log format patterns (APACHE_ACCESS_LOG, NGINX_ACCESS_LOG, SYSLOG5424), only DATA, GREEDYDATA, or GREEDYDATA_MULTILINE	See all supported Grok patterns

Field	Description	Required	Default	Limits	Notes
				patterns are supported to be included after the common log pattern.	

Structure of a Grok Pattern

This is the supported grok pattern structure:

```
%{PATTERN_NAME:FIELD_NAME}
```

- **PATTERN_NAME**: Refers to a pre-defined regular expression for matching a specific type of data. Only predefined grok patterns from the supported grok patterns list are supported. Creating custom patterns is not allowed.
- **FIELD_NAME**: Assigns a name to the extracted value. `FIELD_NAME` is optional, but if you don't specify this value then the extracted data will be dropped from the transformed log event. If `FIELD_NAME` uses dotted notation (e.g., "parent.child"), it is considered as a JSON path.
- **Type Conversion**: Explicit type conversions are not be supported. Use TypeConverter processor to convert the datatype of any value extracted by grok.

To create more complex matching expressions, you can combine several grok patterns. As many as 20 grok patterns can be combined to match a log event. For example, this combination of patterns `%{NUMBER:timestamp} [%{NUMBER:db} %{IP:client_ip}:%{NUMBER:client_port}] %{GREEDYDATA:data}` can be used to extract fields from a Redis slow log entry like this:

```
1629860738.123456 [0 127.0.0.1:6379] "SET" "key1" "value1"
```

Grok examples

Example 1: Use grok to extract a field from unstructured logs

Sample log:

```
293750 server-01.internal-network.local OK "[Thread-000] token generated"
```

Transformer used:

```
[
     {
         "grok": {
             "match": "%{NUMBER:version} %{HOSTNAME:hostname} %{NOTSPACE:status}
 %{QUOTEDSTRING:logMsg}"
         }
    }
]
```

Output:

```
{
  "version": "293750",
  "hostname": "server-01.internal-network.local",
  "status": "OK",
  "logMsg": "[Thread-000] token generated"
}
```

Sample log:

```
23/Nov/2024:10:25:15 -0900 172.16.0.1 200
```

Transformer used:

```
[
    {
        "grok": {
            "match": "%{HTTPDATE:timestamp} %{IPORHOST:clientip}
 %{NUMBER:response_status}"
        }
    }
]
```

Output:

```
{
  "timestamp": "23/Nov/2024:10:25:15 -0900",
  "clientip": "172.16.0.1",
  "response_status": "200"
```

```
}
```

Example 2: Use grok in combination with parseJSON to extract fields from a JSON log event

Sample log:

```
{
    "timestamp": "2024-11-23T16:03:12Z",
    "level": "ERROR",
    "logMsg": "GET /page.html HTTP/1.1"
}
```

Transformer used:

```
[
     {
        "parseJSON": {}
    },
    {
         "grok": {
            "source": "logMsg",
             "match": "%{WORD:http_method} %{NOTSPACE:request} HTTP/
%{NUMBER:http_version}"
         }
    }
]
```

Output:

```
{
  "timestamp": "2024-11-23T16:03:12Z",
  "level": "ERROR",
  "logMsg": "GET /page.html HTTP/1.1",
  "http_method": "GET",
  "request": "/page.html",
  "http_version": "1.1"
}
```

Example 3: Grok pattern with dotted annotation in FIELD_NAME

Sample log:

```
192.168.1.1 GET /index.html?param=value 200 1234
```

Transformer used:

```
[
    {
        "grok": {
            "match": "%{IP:client.ip} %{WORD:method} %{URIPATHPARAM:request.uri}
 %{NUMBER:response.status} %{NUMBER:response.bytes}"
        }
    }
]
```

Output:

```
{
  "client": {
    "ip": "192.168.1.1"
  },
  "method": "GET",
  "request": {
    "uri": "/index.html?param=value"
  },
  "response": {
    "status": "200",
    "bytes": "1234"
  }
}
```

Supported grok patterns

The following tables list the patterns that are supported by the `grok` processor.

General grok patterns

Grok Pattern	Description	Maximum pattern limit	Example
USERNAME or USER	Matches one or more characters that can include lowercase letters (a-z),	20	Input: `user123.name-TEST`

Grok Pattern	Description	Maximum pattern limit	Example
	uppercase letters (A-Z), digits (0-9), dots (.), underscores (_), or hyphens (-)		Pattern: `%{USERNAME:name}` Output: `{"name": "user123.name-TEST"}`
INT	Matches an optional plus or minus sign followed by one or more digits.	20	Input: `-456` Pattern: `%{INT:num}` Output: `{"num": "-456"}`
BASE10NUM	Matches an integer or a floating-point number with optional sign and decimal point	20	Input: `-0.67` Pattern: `%{BASE10NUM:num}` Output: `{"num": "-0.67"}`
BASE16NUM	Matches decimal and hexadecimal numbers with an optional sign (+ or -) and an optional 0x prefix	20	Input: `+0xA1B2` Pattern: `%{BASE16NUM:num}` Output: `{"num": "+0xA1B2"}`
POSINT	Matches whole positive integers without leading zeros, consisting of one or more digits (1-9 followed by 0-9)	20	Input: `123` Pattern: `%{POSINT:num}` Output: `{"num": "123"}`

Grok Pattern	Description	Maximum pattern limit	Example
NONNEGINT	Matches any whole numbers (consisting of one or more digits 0-9) including zero and numbers with leading zeros.	20	Input: `007` Pattern: `%{NONNEGINT:num}` Output: `{"num": "007"}`
WORD	Matches whole words composed of one or more word characters (\w), including letters, digits, and underscores	20	Input: `user_123` Pattern: `%{WORD:user}` Output: `{"user": "user_123"}`
NOTSPACE	Matches one or more non-whitespace characters.	5	Input: `hello_world123` Pattern: `%{NOTSPACE:msg}` Output: `{"msg": "hello_world123"}`
SPACE	Matches zero or more whitespace characters.	5	Input: `" "` Pattern: `%{SPACE:extra}` Output: `{"extra": " "}`
DATA	Matches any character (except newline) zero or more times, non-greedy.	5	Input: `abc def ghi` Pattern: `%{DATA:x} %{DATA:y}` Output: `{"x": "abc", "y": "def ghi"}`

Grok Pattern	Description	Maximum pattern limit	Example
GREEDYDATA	Matches any character (except newline) zero or more times, greedy.	5	Input: `abc def ghi` Pattern: `%{GREEDYDATA:x} %{GREEDYDATA:y}` Output: `{"x": "abc def", "y": "ghi"}`

GREEDYDATA_MULTILINE	Matches any character (including newline) zero or more times, greedy.	1	Input:
			
			`abc`
			
			`def`
			
			`ghi`
			
			Pattern: `%{GREEDYDATA_MULTILINE:data}`
			
			Output: `{"data": "abc\ndef\nghi"}`

QUOTEDSTRING	Matches quoted strings (single or double quotes) with escaped characters.	20	Input: `"Hello, world!"` Pattern: `%{QUOTEDSTRING:msg}` Output: `{"msg": "Hello, world!"}`

Grok Pattern	Description	Maximum pattern limit	Example
UUID	Matches a standard UUID format: 8 hexadecimal characters, followed by three groups of 4 hexadecimal characters, and ending with 12 hexadecimal characters, all separated by hyphens.	20	Input: `550e8400-e29b-41d4-a716-446655440000` Pattern: `%{UUID:id}` Output: `{"id": "550e8400-e29b-41d4-a716-446655440000"}`
URN	Matches URN (Uniform Resource Name) syntax.	20	Input: `urn:isbn:0451450523` Pattern: `%{URN:urn}` Output: `{"urn": "urn:isbn:045145052 3"}`

Amazon grok patterns

Pattern	Description	Maximum pattern limit	Example
ARN	Matches Amazon Amazon Resource Names (ARNs), capturing the partition (`aws`, `aws-cn`, or `aws-us-gov`), service, Region, account ID, and up to 5 hierarchi cal resource identifiers separated by slashes. It will not match ARNs that are	5	Input: `arn:aws:iam:us-east-1:123456789012:user/johndoe` Pattern: `%{ARN:arn}` Output: `{"arn": "arn:aws:iam:us-east-1:123456789012:user/johndoe"}`

Pattern	Description	Maximum pattern limit	Example
	missing information between colons.		

Networking grok patterns

Grok Pattern	Description	Maximum pattern limit	Example
CISCOMAC	Matches a MAC address in 4-4-4 hexadecimal format.	20	Input: `0123.4567.89AB` Pattern: `%{CISCOMAC:MacAddress}` Output: `{"MacAddress": "0123.4567.89AB"}`
WINDOWSMAC	Matches a MAC address in hexadecimal format with hyphens	20	Input: `01-23-45-67-89-AB` Pattern: `%{WINDOWSMAC:MacAddress}` Output: `{"MacAddress": "01-23-45-67-89-AB"}`
COMMONMAC	Matches a MAC address in hexadecimal format with colons.	20	Input: `01:23:45:67:89:AB` Pattern: `%{COMMONMAC:MacAddress}` Output: `{"MacAddress": "01:23:45:67:89:AB"}`

Grok Pattern	Description	Maximum pattern limit	Example
MAC	Matches one of CISCOMAC, WINDOWSMAC or COMMONMAC grok patterns	20	Input: `01:23:45:67:89:AB` Pattern: `%{MAC:m1}` Output: `{"m1":"01:23:45:67:89:AB"}`
IPV6	Matches IPv6 addresses, including compressed forms and IPv4-mapped IPv6 addresses.	5	Input: `2001:db8:3333:4444:5555:6666:7777:8888` Pattern: `%{IPV6:ip}` Output: `{"ip": "2001:db8:3333:4444:5555:6666:7777:8888"}`
IPV4	Matches an IPv4 address.	20	Input: `192.168.0.1` Pattern: `%{IPV4:ip}` Output: `{"ip": "192.168.0.1"}`
IP	Matches either IPv6 addresses as supported by %{IPv6} or IPv4 addresses as supported by %{IPv4}	5	Input: `192.168.0.1` Pattern: `%{IP:ip}` Output: `{"ip": "192.168.0.1"}`

Grok Pattern	Description	Maximum pattern limit	Example
HOSTNAME or HOST	Matches domain names, including subdomains	5	Input: `server-01.internal-network.local` Pattern: `%{HOST:host}` Output: `{"host": "server-01.internal-network.local"}`
IPORHOST	Matches either a hostname or an IP address	5	Input: `2001:db8:3333:4444:5555:6666:7777:8888` Pattern: `%{IPORHOST:ip}` Output: `{"ip": "2001:db8:3333:4444:5555:6666:7777:8888"}`
HOSTPORT	Matches an IP address or hostname as supported by %{IPORHOST} pattern followed by a colon and a port number, capturing the port as "PORT" in the output.	5	Input: `192.168.1.1:8080` Pattern: `%{HOSTPORT:ip}` Output: `{"ip":"192.168.1.1:8080","PORT":"8080"}`

Grok Pattern	Description	Maximum pattern limit	Example
URIHOST	Matches an IP address or hostname as supported by %{IPORHOST} pattern, optionally followed by a colon and a port number, capturing the port as "port" if present.	5	Input: `example.com:443 10.0.0.1` Pattern: `%{URIHOST:host} %{URIHOST:ip}` Output: `{"host":" example.com:443","port":"443","ip":" 10.0.0.1"}`

Path grok patterns

Grok Pattern	Description	Maximum pattern limit	Example
UNIXPATH	Matches URL paths, potentially including query parameters.	20	Input: `/search?q=regex` Pattern: `%{UNIXPATH:path}` Output: `{"path":"/search?q=regex"}`
WINPATH	Matches Windows file paths.	5	Input: `C:\Users\John\Documents\file.txt` Pattern: `%{WINPATH:path}` Output: `{"path": "C:\\Users\\John\\Documents\\file.txt"}`

Grok Pattern	Description	Maximum pattern limit	Example
PATH	Matches either URL or Windows file paths	5	Input: `/search?q=regex` Pattern: `%{PATH:path}` Output: `{"path":"/search?q=regex"}`
TTY	Matches Unix device paths for terminals and pseudo-terminals.	20	Input: `/dev/tty1` Pattern: `%{TTY:path}` Output: `{"path":"/dev/tty1"}`
URIPROTO	Matches letters, optionally followed by a plus (+) character and additional letters or plus (+) characters	20	Input: `web+transformer` Pattern: `%{URIPROTO:protocol}` Output: `{"protocol":"web+transformer"}`
URIPATH	Matches the path component of a URI	20	Input: `/category/sub-category/product_name` Pattern: `%{URIPATH:path}` Output: `{"path":"/category/sub-category/product_name"}`

Grok Pattern	Description	Maximum pattern limit	Example
URIPARAM	Matches URL query parameters	5	Input: `?param1=value1&param2=value2` Pattern: `%{URIPARAM:url}` Output: `{"url":"?param1=value1&param2=value2"}`
URIPATHPARAM	Matches a URI path optionally followed by query parameters	5	Input: `/category/sub-category/product?id=12345&color=red` Pattern: `%{URIPATHPARAM:path}` Output: `{"path":"/category/sub-category/product?id=12345&color=red"}`
URI	Matches a complete URI	5	Input: `https://user:password@example.com/path/to/resource?param1=value1&param2=value2` Pattern: `%{URI:uri}` Output: `{"path":"https://user:password@example.com/path/to/resource?param1=value1&param2=value2"}`

Date and time grok patterns

Grok Pattern	Description	Maximum pattern limit	Example
MONTH	Matches full or abbreviated english month names as whole words	20	Input: `Jan` Pattern: `%{MONTH:month}` Output: `{"month": "Jan"}` Input: `January` Pattern: `%{MONTH:month}` Output: `{"month": "January"}`
MONTHNUM	Matches month numbers from 1 to 12, with optional leading zero for single-digit months.	20	Input: `5` Pattern: `%{MONTHNUM:month}` Output: `{"month": "5"}` Input: `05` Pattern: `%{MONTHNUM:month}` Output: `{"month": "05"}`
MONTHNUM	Matches two-digit month numbers from 01 to 12.	20	Input: `05` Pattern: `%{MONTHNUM2:month}`

Grok Pattern	Description	Maximum pattern limit	Example
			Output: `{"month": "05"}`
MONTHDAY	Matches day of the month from 1 to 31, with optional leading zero.	20	Input: `31` Pattern: `%{MONTHDAY:monthDay}` Output: `{"monthDay":"31"}`
YEAR	Matches year in two or four digits	20	Input: `2024` Pattern: `%{YEAR:year}` Output: `{"year":"2024"}` Input: `24` Pattern: `%{YEAR:year}` Output: `{"year":"24"}`
DAY	Matches full or abbreviated day names.	20	Input: `Tuesday` Pattern: `%{DAY:day}` Output: `{"day":"Tuesday"}`

Grok Pattern	Description	Maximum pattern limit	Example
HOUR	Matches hour in 24-hour format with an optional leading zero (0)0-23.	20	Input: 22 Pattern: `%{HOUR:hour}` Output: `{"hour":"22"}`
MINUTE	Matches minutes (00-59).	20	Input: 59 Pattern: `%{MINUTE:min}` Output: `{"min":"59"}`

Grok Pattern	Description	Maximum pattern limit	Example
SECOND	Matches a number representing seconds (0)0-60, optionally followed by a decimal point or colon and one or more digits for fractional minutes	20	Input: `3` Pattern: `%{SECOND:second}` Output: `{"second":"3"}` Input: `30.5` Pattern: `%{SECOND:minSec}` Output: `{"minSec":"30.5"}` Input: `30:5` Pattern: `%{SECOND:minSec}` Output: `{"minSec":"30:5"}`
TIME	Matches a time format with hours, minutes, and seconds in the format (H)H:mm:(s)s. Seconds include leap second (0)0-60.	20	Input: `09:45:32` Pattern: `%{TIME:time}` Output: `{"time":"09:45:32"}`

Grok Pattern	Description	Maximum pattern limit	Example
DATE_US	Matches a date in the format of (M)M/(d)d /(yy)yy or (M)M-(d)d-(yy)yy.	20	Input: `11/23/2024` Pattern: `%{DATE_US :date}` Output: `{"date":" 11/23/2024"}` Input: `1-01-24` Pattern: `%{DATE_US :date}` Output: `{"date":" 1-01-24"}`
DATE_EU	Matches date in format of (d)d/(M)M/(yy)yy, (d)d-(M)M-(yy)yy, or (d)d.(M)M.(yy)yy.	20	Input: `23/11/2024` Pattern: `%{DATE_EU :date}` Output: `{"date":" 23/11/2024"}` Input: `1.01.24` Pattern: `%{DATE_EU :date}` Output: `{"date":" 1.01.24"}`

Grok Pattern	Description	Maximum pattern limit	Example
ISO8601_TIMEZONE	Matches UTC offset 'Z' or time zone offset with optional colon in format [+-](H)H(:)mm.	20	Input: `+05:30` Pattern: `%{ISO8601_TIMEZONE:tz}` Output: `{"tz":"+05:30"}` Input: `-530` Pattern: `%{ISO8601_TIMEZONE:tz}` Output: `{"tz":"-530"}` Input: `Z` Pattern: `%{ISO8601_TIMEZONE:tz}` Output: `{"tz":"Z"}`
ISO8601_SECOND	Matches a number representing seconds (0)0-60, optionally followed by a decimal point or colon and one or more digits for fractional seconds	20	Input: `60` Pattern: `%{ISO8601_SECOND:second}` Output: `{"second":"60"}`

Grok Pattern	Description	Maximum pattern limit	Example
TIMESTAMP_ISO8601	Matches ISO8601 datetime format (yy)yy-(M)M-(d)dT(H)H:mm:((s)s)(Z|[+-](H)H:mm) with optional seconds and timezone.	20	Input: `2023-05-15T14:30:00+05:30` Pattern: `%{TIMESTAMP_ISO8601:timestamp}` Output: `{"timestamp":"2023-05-15T14:30:00+05:30"}` Input: `23-5-1T1:25+5:30` Pattern: `%{TIMESTAMP_ISO8601:timestamp}` Output: `{"timestamp":"23-5-1T1:25+5:30"}` Input: `23-5-1T1:25Z` Pattern: `%{TIMESTAMP_ISO8601:timestamp}` Output: `{"timestamp":"23-5-1T1:25Z"}`

Grok Pattern	Description	Maximum pattern limit	Example
DATE	Matches either a date in the US format using %{DATE_US} or in the EU format using %{DATE_EU}	20	Input: `11/29/2024` Pattern: `%{DATE:date}` Output: `{"date":"11/29/2024"}` Input: `29.11.2024` Pattern: `%{DATE:date}` Output: `{"date":"29.11.2024"}`
DATESTAMP	Matches %{DATE} followed by %{TIME} pattern, separated by space or hyphen.	20	Input: `29-11-2024 14:30:00` Pattern: `%{DATESTAMP:dateTime}` Output: `{"dateTime":"29-11-2024 14:30:00"}`
TZ	Matches common time zone abbreviations (PST, PDT, MST, MDT, CST CDT, EST, EDT, UTC).	20	Input: `PDT` Pattern: `%{TZ:tz}` Output: `{"tz":"PDT"}`

Grok Pattern	Description	Maximum pattern limit	Example
DATESTAMP_RFC822	Matches date and time in format: Day MonthName (D)D (YY)YY (H)H:mm:(s)s Timezone	20	Input: `Monday Jan 5 23 1:30:00 CDT` Pattern: `%{DATESTAMP_RFC822:dateTime}` Output: `{"dateTime":"Monday Jan 5 23 1:30:00 CDT"}` Input: `Mon January 15 2023 14:30:00 PST` Pattern: `%{DATESTAMP_RFC822:dateTime}` Output: `{"dateTime":"Mon January 15 2023 14:30:00 PST"}`

Grok Pattern	Description	Maximum pattern limit	Example
DATESTAMP_RFC2822	Matches RFC2822 date-time format: Day, (d)d MonthName (yy)yy (H)H:mm:(s)s Z|[+-](H)H:mm	20	Input: `Mon, 15 May 2023 14:30:00 +0530` Pattern: `%{DATESTAMP_RFC2822:dateTime}` Output: `{"dateTime":"Mon, 15 May 2023 14:30:00 +0530"}` Input: `Monday, 15 Jan 23 14:30:00 Z` Pattern: `%{DATESTAMP_RFC2822:dateTime}` Output: `{"dateTime":"Monday, 15 Jan 23 14:30:00 Z"}`
DATESTAMP_OTHER	Matches date and time in format: Day MonthName (d)d (H)H:mm:(s)s Timezone (yy)yy	20	Input: `Mon May 15 14:30:00 PST 2023` Pattern: `%{DATESTAMP_OTHER:dateTime}` Output: `{"dateTime":"Mon May 15 14:30:00 PST 2023"}`

Grok Pattern	Description	Maximum pattern limit	Example
DATESTAMP_EVENTLOG	Matches compact datetime format without separators: (yy)yyMM(d)d(H)Hmm(s)s	20	Input: `20230515143000` Pattern: `%{DATESTAMP_EVENTLOG:dateTime}` Output: `{"dateTime":"20230515143000"}`

Log grok patterns

Grok Pattern	Description	Maximum pattern limit	Example
LOGLEVEL	Matches standard log levels in different capitalizations and abbreviations, including the following: `Alert/ALERT` , `Trace/TRACE` , `Debug/DEBUG` , `Notice/NOTICE` , `Info/INFO` , `Warn/Warning/WARN/WARNING` , `Err/Error/ERR/ERROR` , `Crit/Critical/CRIT/CRITICAL` , `Fatal/FATAL` , `Severe/SEVERE` , `Emerg/Emergency/EMERG/EMERGENCY`	20	Input: `INFO` Pattern: `%{LOGLEVEL:logLevel}` Output: `{"logLevel":"INFO"}`

Grok Pattern	Description	Maximum pattern limit	Example
HTTPDATE	Matches date and time format often used in log files. Format: (d)d/MonthName/(yy)yy:(H)H:mm:(s)s Timezone MonthName: Matches full or abbreviated english month names (Example: "Jan" or "January") Timezone: Matches %{INT} grok pattern	20	Input: `23/Nov/20 24:14:30:00 +0640` Pattern: `%{HTTPDATE:date}` Output: `{"date":"23/Nov/20 24:14:30:00 +0640"}`
SYSLOGTIMESTAMP	Matches date format with MonthName (d)d (H)H:mm:(s)s MonthName: Matches full or abbreviated english month names (Example: "Jan" or "January")	20	Input: `Nov 29 14:30:00` Pattern: `%{SYSLOGTIMESTAMP:dateTime}` Output: `{"dateTime":"Nov 29 14:30:00"}`
PROG	Matches a program name consisting of string of letters, digits, dot, underscore, forward slash, percent sign, and hyphen characters.	20	Input: `user.profile/settings-page` Pattern: `%{PROG:program}` Output: `{"program":"user.profile/settings-page"}`

Grok Pattern	Description	Maximum pattern limit	Example
SYSLOGPROG	Matches PROG grok pattern optionally followed by a process ID in square brackets.	20	Input: `user.profile/settings-page[1234]` Pattern: `%{SYSLOGPROG:programWithId}` Output: `{"programWithId":"user.profile/settings-page[1234]","program":"user.profile/settings-page","pid":"1234"}`
SYSLOGHOST	Matches either a %{HOST} or %{IP} pattern	5	Input: `2001:db8:3333:4444:5555:6666:7777:8888` Pattern: `%{SYSLOGHOST:ip}` Output: `{"ip":"2001:db8:3333:4444:5555:6666:7777:8888"}`

Grok Pattern	Description	Maximum pattern limit	Example
SYSLOGFACILITY	Matches syslog priority in decimal format. The value should be enclosed in angular brackets (<>).	20	Input: `<13.6>` Pattern: `%{SYSLOGFACILITY:syslog}` Output: `{"syslog":"<13.6>","facility":"13","priority":"6"}`

Common log grok patterns

You can use pre-defined custom grok patterns to match Apache, NGINX and Syslog Protocol (RFC 5424) log formats. When you use these specific patterns, they must be the first patterns in your matching configuration, and no other patterns can precede them. Also, you can follow them only with exactly one **DATA**. **GREEDYDATA** or **GREEDYDATA_MULTILINE** pattern.

Grok pattern	Description	Maximum pattern limit
APACHE_ACCESS_LOG	Matches Apache access logs	1
NGINX_ACCESS_LOG	Matches NGINX access logs	1
SYSLOG5424	Matches Syslog Protocol (RFC 5424) logs	1

The following shows valid and invalid examples for using these common log format patterns.

```
"%{NGINX_ACCESS_LOG} %{DATA}" // Valid
"%{SYSLOG5424}%{DATA:logMsg}" // Valid
"%{APACHE_ACCESS_LOG} %{GREEDYDATA:logMsg}" // Valid
"%{APACHE_ACCESS_LOG} %{SYSLOG5424}" // Invalid (multiple common log patterns used)
"%{NGINX_ACCESS_LOG} %{NUMBER:num}" // Invalid (Only GREEDYDATA and DATA patterns are
 supported with common log patterns)
"%{GREEDYDATA:logMsg} %{SYSLOG5424}" // Invalid (GREEDYDATA and DATA patterns are
 supported only after common log patterns)
```

Common log format examples

Apache log example

Sample log:

```
127.0.0.1 - - [03/Aug/2023:12:34:56 +0000] "GET /page.html HTTP/1.1" 200 1234
```

Transformer:

```
[
     {
        "grok": {
            "match": "%{APACHE_ACCESS_LOG}"
        }
    }
]
```

Output:

```
{
    "request": "/page.html",
    "http_method": "GET",
    "status_code": 200,
    "http_version": "1.1",
    "response_size": 1234,
    "remote_host": "127.0.0.1",
    "timestamp": "2023-08-03T12:34:56Z"
}
```

NGINX log example

Sample log:

```
192.168.1.100 - Foo [03/Aug/2023:12:34:56 +0000] "GET /account/login.html HTTP/1.1"
 200 42 "https://www.amazon.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64)
 AppleWebKit/537.36 (KHTML, like Gecko) Chrome/92.0.4515.131 Safari/537.36"
```

Transformer:

```
[
     {
        "grok": {
            "match": "%{NGINX_ACCESS_LOG}"
        }
    }
]
```

Output:

```
{
    "request": "/account/login.html",
    "referrer": "https://www.amazon.com/",
    "agent": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like
 Gecko) Chrome/92.0.4515.131 Safari/537.36",
    "http_method": "GET",
    "status_code": 200,
    "auth_user": "Foo",
    "http_version": "1.1",
    "response_size": 42,
    "remote_host": "192.168.1.100",
    "timestamp": "2023-08-03T12:34:56Z"
}
```

Syslog Protocol (RFC 5424) log example

Sample log:

```
<165>1 2003-10-11T22:14:15.003Z mymachine.example.com evntslog - ID47
 [exampleSDID@32473 iut="3" eventSource= "Application" eventID="1011"]
[examplePriority@32473 class="high"]
```

Transformer:

```
[
```

```
    {
       "grok": {
           "match": "%{SYSLOG5424}"
       }
    }
]
```

Output:

```
{
  "pri": 165,
  "version": 1,
  "timestamp": "2003-10-11T22:14:15.003Z",
  "hostname": "mymachine.example.com",
  "app": "evntslog",
  "msg_id": "ID47",
  "structured_data": "exampleSDID@32473 iut=\"3\" eventSource= \"Application\" eventID=
\"1011\"",
  "message": "[examplePriority@32473 class=\"high\"]"
}
```

parseToOCSF

The **parseToOCSF** processor converts logs into Open Cybersecurity Schema Framework (OCSF) format.

The original `@message` content is not changed, the new keys are added to the message.

Field	Description	Required?	Default	Limits
eventSource	The service or process that produces the log events that will be converted with this processor. Valid values are the following: • `CloudTrail` for CloudTrail logging management events, Lambda data events in CloudTrail, , or Amazon S3 data events in CloudTrail.	Yes	-	-

Field	Description	Required?	Default	Limits
	• `Route53Resolver` for Route 53 Resolver query logs. • `VPCFlow` for Amazon VPC flow logs. • `EKSAudit` for Amazon EKS audit logs. • `AWSWAF` for Amazon WAF logs.			
ocsfVersion	The version of the OCSF schema to use for the transformed log events. Currently, the only supported value is `V1.1`	Yes	`V1.1`	-

Example

The following example transforms Amazon VPC flow logs to OCSF format.

```
[
 "parseToOCSF": {
   eventSource: "VPCFlow",
   version: "V1.1"
 }
]
```

csv

The **csv** processor parses comma-separated values (CSV) from the log events into columns.

Field	Description	Required?	Default	Limits
source	Path to the field in the log event that will be parsed	No	`@message`	Maximum length: 128 Maximum nested key depth: 3

Field	Description	Required?	Default	Limits
delimiter	The character used to separate each column in the original comma-separated value log event	No	,	Maximum length: 1
quoteCharacter	Character used as a text qualifier for a single column of data	No	"	Maximum length: 1
columns	List of names to use for the columns in the transformed log event.	No	[column_1, column_2	Maximum CSV columns: 100 Maximum length: 128 Maximum nested key depth: 3

Example

Suppose part of an ingested log event looks like this:

```
'Akua Mansa',28,'New York, USA'
```

Suppose we use only the **csv** processor:

```
[
   "csv": {
      "delimiter": ",",
      "quoteCharacter": ":""
   }
]
```

The transformed log event would be the following.

```
{
  "column_1": "Akua Mansa",
  "column_2": "28",
  "column_3": "New York: USA"
}
```

parseKeyValue

Use the **parseKeyValue** processor to parse a specified field into key-value pairs. You can customize the processor to parse field information with the following options.

Field	Description	Required?	Default	Limits
source	Path to the field in the log event that will be parsed	No	`@message`	Maximum length: 128 Maximum nested key depth: 3
destination	The destination field to put the extracted key-value pairs into	No		Maximum length: 128
fieldDelimiter	The field delimiter string that is used between key-value pairs in the original log events	No	&	Maximum length: 128
keyValueDelimiter	The delimiter string to use between the key and value in each pair in the transformed log event	No	=	Maximum length: 128
nonMatchValue	A value to insert into the value field in the result, when a key-value pair is not successfully split.	No		Maximum length: 128
keyPrefix	If you want to add a prefix toall transformed keys, specify it here.	No		Maximum length: 128
overwriteIfExists	Whether to overwrite the value if the destination key already exists	No	`false`	

Example

Take the following example log event:

```
key1:value1!key2:value2!key3:value3!key4
```

Suppose we use the following processor configuration:

```
[
    {
        "parseKeyValue": {
            "destination": "new_key",
            "fieldDelimiter": "!",
            "keyValueDelimiter": ":",
            "nonMatchValue": "defaultValue",
            "keyPrefix": "parsed_"
        }
    }
]
```

The transformed log event would be the following.

```
{
  "new_key": {
    "parsed_key1": "value1",
    "parsed_key2": "value2",
    "parsed_key3": "value3",
    "parsed_key4": "defaultValue"
  }
}
```

Built-in processors for Amazon vended logs

parseWAF

Use this processor to parse Amazon WAF vended logs, It takes the contents of `httpRequest.headers` and creates JSON keys from each header name, with the corresponding value. It also does the same for `labels`. These transformations can make querying Amazon WAF logs much easier. For more information about Amazon WAF log format, see Log examples for web ACL traffic.

This processor accepts only `@message` as the input.

> **Important**
>
> If you use this processor, it must be the first processor in your transformer.

Example

Take the following example log event:

```
{
  "timestamp": 1576280412771,
  "formatVersion": 1,
  "webaclId": "arn:aws:wafv2:ap-southeast-2:111122223333:regional/webacl/
STMTest/1EXAMPLE-2ARN-3ARN-4ARN-123456EXAMPLE",
  "terminatingRuleId": "STMTest_SQLi_XSS",
  "terminatingRuleType": "REGULAR",
  "action": "BLOCK",
  "terminatingRuleMatchDetails": [
    {
      "conditionType": "SQL_INJECTION",
      "sensitivityLevel": "HIGH",
      "location": "HEADER",
      "matchedData": ["10", "AND", "1"]
    }
  ],
  "httpSourceName": "-",
  "httpSourceId": "-",
  "ruleGroupList": [],
  "rateBasedRuleList": [],
  "nonTerminatingMatchingRules": [],
  "httpRequest": {
    "clientIp": "1.1.1.1",
    "country": "AU",
    "headers": [
      { "name": "Host", "value": "localhost:1989" },
      { "name": "User-Agent", "value": "curl/7.61.1" },
      { "name": "Accept", "value": "*/*" },
      { "name": "x-stm-test", "value": "10 AND 1=1" }
    ],
    "uri": "/myUri",
    "args": "",
    "httpVersion": "HTTP/1.1",
    "httpMethod": "GET",
    "requestId": "rid"
  },
  "labels": [{ "name": "value" }]
}
```

The processor configuration is this:

```
[
    {
        "parseWAF": {}
    }
]
```

The transformed log event would be the following.

```
{
  "httpRequest": {
    "headers": {
      "Host": "localhost:1989",
      "User-Agent": "curl/7.61.1",
      "Accept": "*/*",
      "x-stm-test": "10 AND 1=1"
    },
    "clientIp": "1.1.1.1",
    "country": "AU",
    "uri": "/myUri",
    "args": "",
    "httpVersion": "HTTP/1.1",
    "httpMethod": "GET",
    "requestId": "rid"
  },
  "labels": { "name": "value" },
  "timestamp": 1576280412771,
  "formatVersion": 1,
  "webaclId": "arn:aws:wafv2:ap-southeast-2:111122223333:regional/webacl/
STMTest/1EXAMPLE-2ARN-3ARN-4ARN-123456EXAMPLE",
  "terminatingRuleId": "STMTest_SQLi_XSS",
  "terminatingRuleType": "REGULAR",
  "action": "BLOCK",
  "terminatingRuleMatchDetails": [
    {
      "conditionType": "SQL_INJECTION",
      "sensitivityLevel": "HIGH",
      "location": "HEADER",
      "matchedData": ["10", "AND", "1"]
    }
  ],
  "httpSourceName": "-",
```

```
  "httpSourceId": "-",
  "ruleGroupList": [],
  "rateBasedRuleList": [],
  "nonTerminatingMatchingRules": []
}
```

parsePostgres

Use this processor to parse Amazon RDS for PostgreSQL vended logs, extract fields, and convert them to JSON format. For more information about RDS for PostgreSQL log format, see RDS for PostgreSQL database log files.

This processor accepts only `@message` as the input.

> **Important**
>
> If you use this processor, it must be the first processor in your transformer.

Example

Take the following example log event:

```
2019-03-10 03:54:59 UTC:10.0.0.123(52834):postgres@logtestdb:[20175]:ERROR: column
 "wrong_column_name" does not exist at character 8
```

The processor configuration is this:

```
[
    {
        "parsePostgres": {}
    }
]
```

The transformed log event would be the following.

```
{
  "logTime": "2019-03-10 03:54:59 UTC",
  "srcIp": "10.0.0.123(52834)",
  "userName": "postgres",
  "dbName": "logtestdb",
```

```
  "processId": "20175",
  "logLevel": "ERROR"
}
```

parseCloudfront

Use this processor to parse Amazon CloudFront vended logs, extract fields, and convert them into JSON format. Encoded field values are decoded. Values that are integers and doubles are treated as such. For more information about Amazon CloudFront log format, see Configure and use standard logs (access logs).

This processor accepts only `@message` as the input.

> **Important**
>
> If you use this processor, it must be the first processor in your transformer.

Example

Take the following example log event:

```
2019-12-04  21:02:31   LAX1   392    192.0.2.24    GET
 d111111abcdef8.cloudfront.net  /index.html    200    -  Mozilla/5.0%20(Windows
%20NT%2010.0;%20Win64;%20x64)%20AppleWebKit/537.36%20(KHTML,
%20like%20Gecko)%20Chrome/78.0.3904.108%20Safari/537.36  -  -  Hit
    SOX4xwn4XV6Q4rgb7XiVGOHms_BGlTAC4KyHmureZmBNrjGdRLiNIQ==
 d111111abcdef8.cloudfront.net  https  23 0.001  -  TLSv1.2    ECDHE-RSA-AES128-GCM-
SHA256    Hit    HTTP/2.0   -  -  11040  0.001  Hit    text/html  78 -  -
```

The processor configuration is this:

```
[
    {
        "parseCloudfront": {}
    }
]
```

The transformed log event would be the following.

```
{
```

```
  "date": "2019-12-04",
  "time": "21:02:31",
  "x-edge-location": "LAX1",
  "sc-bytes": 392,
  "c-ip": "192.0.2.24",
  "cs-method": "GET",
  "cs(Host)": "d111111abcdef8.cloudfront.net",
  "cs-uri-stem": "/index.html",
  "sc-status": 200,
  "cs(Referer)": "-",
  "cs(User-Agent)": "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36
 (KHTML, like Gecko) Chrome/78.0.3904.108 Safari/537.36",
  "cs-uri-query": "-",
  "cs(Cookie)": "-",
  "x-edge-result-type": "Hit",
  "x-edge-request-id": "SOX4xwn4XV6Q4rgb7XiVGOHms_BGlTAC4KyHmureZmBNrjGdRLiNIQ==",
  "x-host-header": "d111111abcdef8.cloudfront.net",
  "cs-protocol": "https",
  "cs-bytes": 23,
  "time-taken": 0.001,
  "x-forwarded-for": "-",
  "ssl-protocol": "TLSv1.2",
  "ssl-cipher": "ECDHE-RSA-AES128-GCM-SHA256",
  "x-edge-response-result-type": "Hit",
  "cs-protocol-version": "HTTP/2.0",
  "fle-status": "-",
  "fle-encrypted-fields": "-",
  "c-port": 11040,
  "time-to-first-byte": 0.001,
  "x-edge-detailed-result-type": "Hit",
  "sc-content-type": "text/html",
  "sc-content-len": 78,
  "sc-range-start": "-",
  "sc-range-end": "-"
}
```


parseRoute53

Use this processor to parse Amazon Route 53 Public Data Plane vended logs, extract fields, and convert them into JSON format. Encoded field values are decoded. This processor does not support Amazon Route 53 Resolver logs.

This processor accepts only `@message` as the input.

Important

If you use this processor, it must be the first processor in your transformer.

Example

Take the following example log event:

```
1.0 2017-12-13T08:15:50.235Z Z123412341234 example.com AAAA NOERROR TCP IAD12 192.0.2.0
 198.51.100.0/24
```

The processor configuration is this:

```
[
    {
        "parseRoute53": {}
    }
]
```

The transformed log event would be the following.

```
{
  "version": 1.0,
  "queryTimestamp": "2017-12-13T08:15:50.235Z",
  "hostZoneId": "Z123412341234",
  "queryName": "example.com",
  "queryType": "AAAA",
  "responseCode": "NOERROR",
  "protocol": "TCP",
  "edgeLocation": "IAD12",
  "resolverIp": "192.0.2.0",
  "ednsClientSubnet": "198.51.100.0/24"
}
```

parseVPC

Use this processor to parse Amazon VPC vended logs, extract fields, and convert them into JSON format. Encoded field values are decoded.

This processor accepts only `@message` as the input.

> **Important**
>
> If you use this processor, it must be the first processor in your transformer.

Example

Take the following example log event:

```
2 123456789010 eni-abc123de 192.0.2.0 192.0.2.24 20641 22 6 20 4249 1418530010
 1418530070 ACCEPT OK
```

The processor configuration is this:

```
[
    {
        "parseVPC": {}
    }
]
```

The transformed log event would be the following.

```
{
  "version": 2,
  "accountId": "123456789010",
  "interfaceId": "eni-abc123de",
  "srcAddr": "192.0.2.0",
  "dstAddr": "192.0.2.24",
  "srcPort": 20641,
  "dstPort": 22,
  "protocol": 6,
  "packets": 20,
  "bytes": 4249,
  "start": 1418530010,
  "end": 1418530070,
  "action": "ACCEPT",
  "logStatus": "OK"
}
```

String mutate processors

lowerCaseString

The `lowerCaseString` processor converts a string to its lowercase version.

Field	Description	Required?	Default	Limits
withKeys	A list of keys to convert to lowercase	Yes		Maximum entries: 10

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "INNER_VALUE"
    }
}
```

The transformer configuration is this, using `lowerCaseString` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "lowerCaseString": {
            "withKeys":["outer_key.inner_key"]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": "inner_value"
```

```
  }
}
```

upperCaseString

The `upperCaseString` processor converts a string to its uppercase version.

Field	Description	Required?	Default	Limits
withKeys	A list of keys to convert to uppercase	Yes		Maximum entries: 10

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "inner_value"
    }
}
```

The transformer configuration is this, using `upperCaseString` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "upperCaseString": {
            "withKeys":["outer_key.inner_key"]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": "INNER_VALUE"
```

```
  }
}
```

splitString

The `splitString` processor is a type of string mutate processor which splits a field into an array using a delimiting character.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array must contain `source` and `delimiter` fields.	Yes		Maximum entries: 10
source	The key of the field value to split	Yes		Maximum length: 128
delimiter	The delimiter string to split the field value on	Yes		Maximum length: 128

Example 1

Take the following example log event:

```
[
    {
        "parseJSON": {}
    },
    {
        "splitString": {
            "entries": [
                {
                    "source": "outer_key.inner_key",
                    "delimiter": "_"
                }
            ]
        }
    }
]
```

The transformer configuration is this, using `splitString` with `parseJSON`:

```
[
     {
        "parseJSON": {}
    },
    {
         "splitString": {
            "entries": [
                {
                    "source": "outer_key.inner_key",
                    "delimiter": "_"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": [
      "inner",
      "value"
    ]
  }
}
```

Example 2

The delimiter to split the string on can be multiple characters long.

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "item1, item2, item3"
    }
}
```

The transformer configuration is as follows:

```
[
```

```
     {
        "parseJSON": {}
    },
    {
         "splitString": {
            "entries": [
                {
                    "source": "outer_key.inner_key",
                    "delimiter": ", "
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": [
      "item1",
      "item2",
      "item3"
    ]
  }
}
```

substituteString

The `substituteString` processor is a type of string mutate processor which matches a key's value against a regular expression and replaces all matches with a replacement string.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array must contain `source`, `from`, and `to` fields.	Yes		Maximum entries: 10
source	The key of the field to modify	Yes		Maximum length: 128

Field	Description	Required?	Default	Limits
				Maximum nested key depth: 3
from	The regular expression string to be replaced. Special regex characters such as [and] must be escaped using \\ when using double quotes and with \ when using single quotes or when configured from the Amazon Web Services Management Console. For more information, see Class Pattern on the Oracle web site. You can wrap a pattern in `(...)` to create a numbered capturing group and create `(?P<group_name>...)` named capturing groups that can be referenced in the `to` field.	Yes		Maximum length: 128
to	The string to be substituted for each match of `from` Backrefer ences to capturing groups can be used. Use the form $n for numbered groups such as $1 and use `${group_name}` for named groups such as `${my_group}` .>	Yes		Maximum length: 128 Maximum number of backreferences: 10 Maximum number of duplicate backrefer ences: 2

Example 1

Take the following example log event:

```
{
    "outer_key": {
        "inner_key1": "[]",
```

```
        "inner_key2": "123-345-567",
        "inner_key3": "A cat takes a catnap."
    }
}
```

The transformer configuration is this, using `substituteString` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "substituteString": {
            "entries": [
                {
                    "source": "outer_key.inner_key1",
                    "from": "\\[\\]",
                    "to": "value1"
                },
                {
                    "source": "outer_key.inner_key2",
                    "from": "[0-9]{3}-[0-9]{3}-[0-9]{3}",
                    "to": "xxx-xxx-xxx"
                },
                {
                    "source": "outer_key.inner_key3",
                    "from": "cat",
                    "to": "dog"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key1": "value1",
    "inner_key2": "xxx-xxx-xxx",
    "inner_key3": "A dog takes a dognap."
  }
```

```
}
```

Example 2

Take the following example log event:

```
{
    "outer_key": {
        "inner_key1": "Tom, Dick, and Harry",
        "inner_key2": "arn:aws:sts::123456789012:assumed-role/MyImportantRole/
MySession"
    }
}
```

The transformer configuration is this, using `substituteString` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "substituteString": {
            "entries": [
                {
                    "source": "outer_key.inner_key1",
                    "from": "(\w+), (\w+), and (\w+)",
                    "to": "$1 and $3"
                },
                {
                    "source": "outer_key.inner_key2",
                    "from": "^arn:aws:sts::(?P<account_id>\\d{12}):assumed-role/(?
P<role_name>[\\w+=,.@-]+)/(?P<role_session_name>[\\w+=,.@-]+)$",
                    "to": "${account_id}:${role_name}:${role_session_name}"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
```

```
    "inner_key1": "Tom and Harry",
    "inner_key2": "123456789012:MyImportantRole:MySession"
  }
}
```

trimString

The `trimString` processor removes whitespace from the beginning and end of a key.

Field	Description	Required?	Default	Limits
withKeys	A list of keys to trim	Yes		Maximum entries: 10

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "   inner_value  "
    }
}
```

The transformer configuration is this, using `trimString` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "trimString": {
            "withKeys":["outer_key.inner_key"]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": "inner_value"
```

```
  }
}
```

JSON mutate processors

addKeys

Use the addKeys processor to add new key-value pairs to the log event.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array can contain key, value, and overwriteIfExists fields.	Yes		Maximum entries: 5
key	The key of the new entry to be added	Yes		Maximum length: 128 Maximum nested key depth: 3
value	The value of the new entry to be added	Yes		Maximum length: 256
overwriteIfExists	If you set this to true, the existing value is overwritten if key already exists in the event. The default value is false.	No	false	No limit

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "inner_value"
    }
}
```

The transformer configuration is this, using addKeys with parseJSON:

```
[
    {
        "parseJSON": {}
    },
    {
        "addKeys": {
            "entries": [
                {
                    "source": "outer_key.new_key",
                    "value": "new_value"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": "inner_value",
    "new_key": "new_value"
  }
}
```

deleteKeys

Use the `deleteKeys` processor to delete fields from a log event. These fields can include key-value pairs.

Field	Description	Required?	Default	Limits
withKeys	The list of keys to delete.	Yes	No limit	Maximum entries: 5

Example

Take the following example log event:

```
{
    "outer_key": {
```

```
        "inner_key": "inner_value"
    }
}
```

The transformer configuration is this, using `deleteKeys` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "deleteKeys": {
            "withKeys":["outer_key.inner_key"]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {}
}
```

moveKeys

Use the `moveKeys` processor to move a key from one field to another.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array can contain `source`, `target`, and `overwriteIfExists` fields.	Yes		Maximum entries: 5
source	The key to move	Yes		Maximum length: 128 Maximum nested key depth: 3
target	The key to move to	Yes		Maximum length: 128

Field	Description	Required?	Default	Limits
				Maximum nested key depth: 3
overwriteIfExists	If you set this to `true`, the existing value is overwritten if `key` already exists in the event. The default value is `false`.	No	false	No limit

Example

Take the following example log event:

```
{
    "outer_key1": {
        "inner_key1": "inner_value1"
    },
    "outer_key2": {
        "inner_key2": "inner_value2"
    }
}
```

The transformer configuration is this, using `moveKeys` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "moveKeys": {
            "entries": [
                {
                    "source": "outer_key1.inner_key1",
                    "target": "outer_key2"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key1": {},
  "outer_key2": {
    "inner_key2": "inner_value2",
    "inner_key1": "inner_value1"
  }
}
```

renameKeys

Use the `renameKeys` processor to rename keys in a log event.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array can contain `key`, `target`, and `overwriteIfExists` fields.	Yes	No limit	Maximum entries: 5
key	The key to rename	Yes	No limit	Maximum length: 128
target	The new key name	Yes	No limit	Maximum length: 128 Maximum nested key depth: 3
overwriteIfExists	If you set this to `true`, the existing value is overwritten if `key` already exists in the event. The default value is `false`.	No	false	No limit

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "inner_value"
```

```
    }
}
```

The transformer configuration is this, using `renameKeys` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "renameKeys": {
            "entries": [
                {
                    "key": "outer_key",
                    "target": "new_key"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "new_key": {
    "inner_key": "inner_value"
  }
}
```

copyValue

Use the `copyValue` processor to copy values within a log event. You can also use this processor to add metadata to log events, by copying the values of the following metadata keys into the log events: `@logGroupName`, `@logGroupStream`, `@accountId`, `@regionName`. This is illustrated in the following example.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array can contain `source`,	Yes		Maximum entries: 5

Field	Description	Required?	Default	Limits
	`target`, and `overwriteIfExists` fields.			
source	The key to copy	Yes		Maximum length: 128 Maximum nested key depth: 3
target	The key to copy the value to	Yes	No limit	Maximum length: 128 Maximum nested key depth: 3
overwriteIfExists	If you set this to `true`, the existing value is overwritten if `key` already exists in the event. The default value is `false`.	No	false	No limit

Example

Take the following example log event:

```
{
    "outer_key": {
        "inner_key": "inner_value"
    }
}
```

The transformer configuration is this, using `copyValue` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "copyValue": {
            "entries": [
                {
```

```
                    "source": "outer_key.new_key",
                    "target": "new_key"
                },
                {
                    "source": "@logGroupName",
                    "target": "log_group_name"
                },
                {
                    "source": "@logGroupStream",
                    "target": "log_group_stream"
                },
                {
                    "source": "@accountId",
                    "target": "account_id"
                },
                {
                    "source": "@regionName",
                    "target": "region_name"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
  "outer_key": {
    "inner_key": "inner_value"
  },
  "new_key": "inner_value",
  "log_group_name": "myLogGroupName",
  "log_group_stream": "myLogStreamName",
  "account_id": "012345678912",
  "region_name": "us-east-1"
}
```

listToMap

The `listToMap` processor takes a list of objects that contain key fields, and converts them into a map of target keys.

Field	Description	Required?	Default	Limits
source	The key in the ProcessingEvent with a list of objects that will be converted to a map	Yes		Maximum length: 128 Maximum nested key depth: 3
key	The key of the fields to be extracted as keys in the generated map	Yes		Maximum length: 128
valueKey	If this is specified, the values that you specify in this parameter will be extracted from the `source` objects and put into the values of the generated map. Otherwise, original objects in the source list will be put into the values of the generated map.	No		Maximum length: 128
target	The key of the field that will hold the generated map	No	Root node	Maximum length: 128 Maximum nested key depth: 3
flatten	A Boolean value to indicate whether the list will be flattened into single items or if the values in the generated map will be lists. By default the values for the matching keys will be represent ed in an array. Set `flatten` to `true` to convert the array to a single value based on the value of `flattenedElement` .	No	false	
flattened Element	If you set `flatten` to `true`, use `flattenedElement` to specify	Required when		Value can only be `first` or `last`

Field	Description	Required?	Default	Limits
	which element, `first` or `last`, to keep.	`flatten` is set to `true`		

Example

Take the following example log event:

```
{
    "outer_key": [
        {
            "inner_key": "a",
            "inner_value": "val-a"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b1"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b2"
        },
        {
            "inner_key": "c",
            "inner_value": "val-c"
        }
    ]
}
```

Transformer for use case 1: `flatten` is `false`

```
[
    {
        "parseJSON": {}
    },
    {
        "listToMap": {
            "source": "outer_key"
            "key": "inner_key",
```

```
            "valueKey": "inner_value",
            "flatten": false
        }
    }
]
```

The transformed log event would be the following.

```
{
    "outer_key": [
        {
            "inner_key": "a",
            "inner_value": "val-a"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b1"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b2"
        },
        {
            "inner_key": "c",
            "inner_value": "val-c"
        }
    ],
    "a": [
        "val-a"
    ],
    "b": [
        "val-b1",
        "val-b2"
    ],
    "c": [
        "val-c"
    ]
}
```

Transformer for use case 2: `flatten` is `true` and `flattenedElement` is `first`

```
[
    {
```

```
        "parseJSON": {}
    },
    {
        "listToMap": {
            "source": "outer_key"
            "key": "inner_key",
            "valueKey": "inner_value",
            "flatten": true,
            "flattenedElement": "first"
        }
    }
]
```

The transformed log event would be the following.

```
{
    "outer_key": [
        {
            "inner_key": "a",
            "inner_value": "val-a"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b1"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b2"
        },
        {
            "inner_key": "c",
            "inner_value": "val-c"
        }
    ],
    "a": "val-a",
    "b": "val-b1",
    "c": "val-c"
}
```

Transformer for use case 3: `flatten` is `true` and `flattenedElement` is `last`

```
[
    {
```

```
        "parseJSON": {}
    },
    {
        "listToMap": {
            "source": "outer_key"
            "key": "inner_key",
            "valueKey": "inner_value",
            "flatten": true,
            "flattenedElement": "last"
        }
    }
]
```

The transformed log event would be the following.

```
{
    "outer_key": [
        {
            "inner_key": "a",
            "inner_value": "val-a"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b1"
        },
        {
            "inner_key": "b",
            "inner_value": "val-b2"
        },
        {
            "inner_key": "c",
            "inner_value": "val-c"
        }
    ],
    "a": "val-a",
    "b": "val-b2",
    "c": "val-c"
}
```

Datatype converter processors

typeConverter

Use the `typeConverter` processor to convert a value type associated with the specified key to the specified type. It's a casting processor that changes the types of the specified fields. Values can be converted into one of the following datatypes: `integer`, `double`, `string` and `boolean`.

Field	Description	Required?	Default	Limits
entries	Array of entries. Each item in the array must contain `key` and `type` fields.	Yes		Maximum entries: 10
key	The key with the value that is to be converted to a different type	Yes		Maximum length: 128 Maximum nested key depth: 3
type	The type to convert to. Valid values are `integer`, `double`, `string` and `boolean`.	Yes		

Example

Take the following example log event:

```
{
    "name": "value",
    "status": "200"
}
```

The transformer configuration is this, using `typeConverter` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "typeConverter": {
```

```
            "entries": [
                {
                    "key": "status",
                    "type": "integer"
                }
            ]
        }
    }
]
```

The transformed log event would be the following.

```
{
    "name": "value",
    "status": 200
}
```

datetimeConverter

Use the `datetimeConverter` processor to convert a datetime string into a format that you specify.

Field	Description	Required?	Default	Limits
source	The key to apply the date conversion to.	Yes		Maximum entries: 10
matchPatterns	A list of patterns to match against the `source` field	Yes		Maximum entries: 5
target	The JSON field to store the result in.	Yes		Maximum length: 128 Maximum nested key depth: 3
targetFormat	The datetime format to use for the converted data in the target field.	No	`yyyy-MM-dd'T'HH:mm:ss.SSS'Z`	Maximum length:64

Field	Description	Required?	Default	Limits
sourceTimezone	The time zone of the source field. For a list of possible values, see Java Supported Zone Ids and Offsets.	No	UTC	Minimum length:1
targetTimezone	The time zone of the target field. For a list of possible values, see Java Supported Zone Ids and Offsets.	No	UTC	Minimum length:1
locale	The locale of the source field. For a list of possible values, see Locale getAvailableLocales() Method in Java with Examples.	Yes		Minimum length:1

Example

Take the following example log event:

```
{"german_datetime": "Samstag 05. Dezember 1998 11:00:00"}
```

The transformer configuration is this, using `dateTimeConverter` with `parseJSON`:

```
[
    {
        "parseJSON": {}
    },
    {
        "dateTimeConverter": {
            "source": "german_datetime",
            "target": "target_1",
            "locale": "de",
            "matchPatterns": ["EEEE dd. MMMM yyyy HH:mm:ss"],
            "sourceTimezone": "Europe/Berlin",
            "targetTimezone": "America/New_York",
```

```
            "targetFormat": "yyyy-MM-dd'T'HH:mm:ss z"
        }
    }
]
```

The transformed log event would be the following.

```
{
    "german_datetime": "Samstag 05. Dezember 1998 11:00:00",
    "target_1": "1998-12-05T17:00:00 MEZ"
}
```

Transformation metrics and errors

CloudWatch Logs publishes transformation metrics to CloudWatch. These metrics include `TransformedLogEvents`, `TransformedBytes`, and `TransformationErrors`. For more information, see Log transformer metrics and dimensions.

Whenever CloudWatch Logs tries and fails to transform a log event, it adds a `@transformationError` system field to that log event. When you run a CloudWatch Logs Insights query, you will see this field in all log events that had a transformation failure. You can query for this field with a query such as `filter ispresent(@transformationError)` to find all the failed transformation events.

Analyze with Amazon OpenSearch Service

CloudWatch Logs integrates with Amazon OpenSearch Service to enable you to create automatic curated dashboards that display key metrics that OpenSearch Service derives from logs vended from Amazon services. The following dashboards are available:

- An **Amazon VPC flow logs dashboard** captures network flow data for Amazon VPC. It helps you analyze network traffic, detect unusual patterns, and monitor resource usage. Key metrics displayed include the following:
  - Total flows and acceptance and rejection of these flows
  - Traffic patterns over time
  - A Sankey diagram that illustrates data flow between source and destination IPs (top talkers)
  - Top IPs by bytes and packets transferred

  > **Note**
  >
  > Currently only VPC version 2 fields format is supported.

- An **Amazon WAF logs dashboard** provides insights into web traffic being monitored by Amazon WAF. This dashboard helps you identify traffic patterns, blocked requests, and potential threats from specific regions or IPs. Key metrics displayed include the following:
  - Total requests, including by “ALLOW” and “BLOCK” counts.
  - Request history over time, displaying allowed and blocked requests.
  - Breakdowns of requests by Web ACL name, blocked requests by terminating rule, and source IPs.
  - A geographic distribution of request origins.
  - Top client IPs and terminating rules by request count.
- A **CloudTrail logs** dashboard provides an overview of API activity within your Amazon environment using CloudTrail logs. It’s useful for monitoring API activity, auditing actions, and identifying potential security or compliance issues. Key metrics displayed include the following:
  - Total event count and event history over time
  - A breakdown of events by account IDs, categories, and Regions.
  - Top APIs, services, and source IPs involved in generating events.

  - A table of the top users that are generating events, detailing user account information and event counts.
- An **Amazon Network Firewall** dashboard provides enhanced visibility into network traffic, offering valuable insights for security monitoring and analysis. This dashboard offers a comprehensive view of various network metrics and patterns, to quickly identify potential security issues and optimize network configurations. Key metrics displayed include the following:
  - Top talkers and protocols
  - Insights into PrivateLink endpoints
  - Allowed and blocked TLS Server Name Indication traffic

The metrics displayed in these curated dashboards are derived from Amazon OpenSearch Service analytics.

Before you can view these dashboards, you must create an IAM role and perform a one-time integration of CloudWatch Logs with Amazon OpenSearch Service. This one-time integration configures the Amazon OpenSearch Service resources needed to create and render the dashboard. You will incur charges for the OpenSearch services used. For more information, see Amazon CloudWatch Pricing.

You can create these curated dashboards only for log groups in the Standard Log Class.

> **Important**
>
> Don't use log transformers for any log groups that you want to create vended logs dashboards for. Transforming log events will cause the dashboards to have empty data.

Topics

- Step 1: Create the integration with OpenSearch Service
- Step 2: Create vended logs dashboards
- View, edit, or delete vended logs dashboards
- IAM policies for users
- Permissions that the integration needs

Step 1: Create the integration with OpenSearch Service

The first step is creating the integration with OpenSearch Service, which you need to do only once. Creating the integration will create the following resources in your account.

- **An OpenSearch Service time series collection** without high availability.

  A collection is a set of OpenSearch Service *indexes* that work together to support a workload.
- **Two security policies** for the collection. One defines the encryption type, which is either with a customer managed Amazon KMS key or a service owned key. The other policy defines network access, allowing the OpenSearch Service application to access the collection. For more information, see Encryption of data at rest for Amazon OpenSearch Service.
- **An OpenSearch Service data access policy** that defines who can access data in the collection.
- **An OpenSearch Service direct query data source** with CloudWatch Logs defined as the source.
- **An OpenSearch Service application** with the name `aws-analytics`. The application will be configured to allow the creation of a workspace. If an application named `aws-analytics` already exists, it will be updated to add this collection as a data source.
- **A OpenSearch Service workspace** that will host the dashboards and allows everyone who has been granted access to read from the workspace.

Topics

Required permissions

To create the integration, you must be signed on to an account that has the **CloudWatchOpenSearchDashboardsFullAccess** managed IAM policy or equivalent permissions, shown here. You must also have these permissions to delete the integration, create, edit, and delete dashboards, and to refresh the dashboard manually.

```
{
    "Version": "2012-10-17",
    "Statement": [{
            "Sid": "CloudWatchOpenSearchDashboardsIntegration",
            "Effect": "Allow",
```

```
            "Action": [
                "logs:ListIntegrations",
                "logs:GetIntegration",
                "logs:DeleteIntegration",
                "logs:PutIntegration",
                "logs:DescribeLogGroups",
                "opensearch:ApplicationAccessAll",
                "iam:ListRoles",
                "iam:ListUsers"
            ],
            "Resource": "*"
        },
        {
            "Sid": "CloudWatchLogsOpensearchReadAPIs",
            "Effect": "Allow",
            "Action": [
                "aoss:BatchGetCollection",
                "aoss:BatchGetLifecyclePolicy",
                "es:ListApplications"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsOpensearchCreateServiceLinkedAccess",
            "Effect": "Allow",
            "Action": [
                "iam:CreateServiceLinkedRole"
            ],
            "Resource": "arn:aws:iam::*:role/aws-service-role/
opensearchservice.amazonaws.com/AWSServiceRoleForAmazonOpenSearchService",
            "Condition": {
                "StringEquals": {
                    "iam:AWSServiceName": "opensearchservice.amazonaws.com",
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsObservabilityCreateServiceLinkedAccess",
```

```
            "Effect": "Allow",
            "Action": [
                "iam:CreateServiceLinkedRole"
            ],
            "Resource": "arn:aws:iam::*:role/aws-service-role/
observability.aoss.amazonaws.com/AWSServiceRoleForAmazonOpenSearchServerless",
            "Condition": {
                "StringEquals": {
                    "iam:AWSServiceName": "observability.aoss.amazonaws.com",
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsCollectionRequestAccess",
            "Effect": "Allow",
            "Action": [
                "aoss:CreateCollection"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com",
                    "aws:RequestTag/CloudWatchOpenSearchIntegration": [
                        "Dashboards"
                    ]
                },
                "ForAllValues:StringEquals": {
                    "aws:TagKeys": "CloudWatchOpenSearchIntegration"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsApplicationRequestAccess",
            "Effect": "Allow",
            "Action": [
                "es:CreateApplication"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com",
                    "aws:RequestTag/OpenSearchIntegration": [
                        "Dashboards"
```

```
                ]
            },
            "ForAllValues:StringEquals": {
                "aws:TagKeys": "OpenSearchIntegration"
            }
        }
    },
    {
        "Sid": "CloudWatchLogsCollectionResourceAccess",
        "Effect": "Allow",
        "Action": [
            "aoss:DeleteCollection"
        ],
        "Resource": "*",
        "Condition": {
            "StringEquals": {
                "aws:CalledViaFirst": "logs.amazonaws.com",
                "aws:ResourceTag/CloudWatchOpenSearchIntegration": [
                    "Dashboards"
                ]
            }
        }
    },
    {
        "Sid": "CloudWatchLogsApplicationResourceAccess",
        "Effect": "Allow",
        "Action": [
            "es:UpdateApplication",
            "es:GetApplication"
        ],
        "Resource": "*",
        "Condition": {
            "StringEquals": {
                "aws:CalledViaFirst": "logs.amazonaws.com",
                "aws:ResourceTag/OpenSearchIntegration": [
                    "Dashboards"
                ]
            }
        }
    },
    {
        "Sid": "CloudWatchLogsCollectionPolicyAccess",
        "Effect": "Allow",
        "Action": [
```

```
                "aoss:CreateSecurityPolicy",
                "aoss:CreateAccessPolicy",
                "aoss:DeleteAccessPolicy",
                "aoss:DeleteSecurityPolicy",
                "aoss:GetAccessPolicy",
                "aoss:GetSecurityPolicy"
            ],
            "Resource": "*",
            "Condition": {
                "StringLike": {
                    "aoss:collection": "cloudwatch-logs-*",
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsAPIAccessAll",
            "Effect": "Allow",
            "Action": [
                "aoss:APIAccessAll"
            ],
            "Resource": "*",
            "Condition": {
                "StringLike": {
                    "aoss:collection": "cloudwatch-logs-*"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsIndexPolicyAccess",
            "Effect": "Allow",
            "Action": [
                "aoss:CreateAccessPolicy",
                "aoss:DeleteAccessPolicy",
                "aoss:GetAccessPolicy",
                "aoss:CreateLifecyclePolicy",
                "aoss:DeleteLifecyclePolicy"
            ],
            "Resource": "*",
            "Condition": {
                "StringLike": {
                    "aoss:index": "cloudwatch-logs-*",
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
```

```
            }
        },
        {
            "Sid": "CloudWatchLogsDQSRequestQueryAccess",
            "Effect": "Allow",
            "Action": [
                "es:AddDirectQueryDataSource"
            ],
            "Resource": "arn:aws:opensearch:*:*:datasource/cloudwatch_logs_*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com",
                    "aws:RequestTag/CloudWatchOpenSearchIntegration": [
                        "Dashboards"
                    ]
                },
                "ForAllValues:StringEquals": {
                    "aws:TagKeys": "CloudWatchOpenSearchIntegration"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsStartDirectQueryAccess",
            "Effect": "Allow",
            "Action": [
                "opensearch:StartDirectQuery",
                "opensearch:GetDirectQuery"
            ],
            "Resource": "arn:aws:opensearch:*:*:datasource/cloudwatch_logs_*"
        },
        {
            "Sid": "CloudWatchLogsDQSResourceQueryAccess",
            "Effect": "Allow",
            "Action": [
                "es:GetDirectQueryDataSource",
                "es:DeleteDirectQueryDataSource"
            ],
            "Resource": "arn:aws:opensearch:*:*:datasource/cloudwatch_logs_*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com",
                    "aws:ResourceTag/CloudWatchOpenSearchIntegration": [
                        "Dashboards"
                    ]
```

```
                }
            }
        },
        {
            "Sid": "CloudWatchLogsPassRoleAccess",
            "Effect": "Allow",
            "Action": [
                "iam:PassRole"
            ],
            "Resource": "*",
            "Condition": {
                "StringLike": {
                    "iam:PassedToService":
"directquery.opensearchservice.amazonaws.com",
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsAossTagsAccess",
            "Effect": "Allow",
            "Action": [
                "aoss:TagResource"
            ],
            "Resource": "arn:aws:aoss:*:*:collection/*",
            "Condition": {
                "StringEquals": {
                    "aws:CalledViaFirst": "logs.amazonaws.com",
                    "aws:ResourceTag/CloudWatchOpenSearchIntegration": [
                        "Dashboards"
                    ]
                },
                "ForAllValues:StringEquals": {
                    "aws:TagKeys": "CloudWatchOpenSearchIntegration"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsEsApplicationTagsAccess",
            "Effect": "Allow",
            "Action": [
                "es:AddTags"
            ],
            "Resource": "arn:aws:opensearch:*:*:application/*",
```

```
            "Condition": {
                "StringEquals": {
                    "aws:ResourceTag/OpenSearchIntegration": [
                        "Dashboards"
                    ],
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                },
                "ForAllValues:StringEquals": {
                    "aws:TagKeys": "OpenSearchIntegration"
                }
            }
        },
        {
            "Sid": "CloudWatchLogsEsDataSourceTagsAccess",
            "Effect": "Allow",
            "Action": [
                "es:AddTags"
            ],
            "Resource": "arn:aws:opensearch:*:*:datasource/*",
            "Condition": {
                "StringEquals": {
                    "aws:ResourceTag/CloudWatchOpenSearchIntegration": [
                        "Dashboards"
                    ],
                    "aws:CalledViaFirst": "logs.amazonaws.com"
                },
                "ForAllValues:StringEquals": {
                    "aws:TagKeys": "CloudWatchOpenSearchIntegration"
                }
            }
        }
    ]
}
```

Create the integration

Use these steps to create the integration.

To integrate CloudWatch Logs with Amazon OpenSearch Service

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Logs Insights** and then choose the **Analyze with OpenSearch** tab.

3. Choose **Create integration**.
4. For **Integration name**, enter a name for the integration.
5. (Optional) To encrypt the data written to OpenSearch Service Serverless, enter the ARN of the Amazon KMS key that you want to use in **KMS key ARN**. For more information, see Encryption at rest in the Amazon OpenSearch Service Developer Guide.
6. For **Data retention**, enter the amount of time that you want the OpenSearch Service data indexes to be retained. This also defines the maximum time period for which you can view data in the dashboards. Choosing a longer data retention period will incur additional searching and indexing costs. For more information, see OpenSearch Service Serverless Pricing.

   The maximum retention period is 30 days.

   The data retention length will also be used to create the OpenSearch Service collection lifecycle policy.
7. For **IAM role for writing to OpenSearch collection**, create a new IAM role or select an existing IAM role to be used to write to the OpenSearch Service collection.

   Creating a new role is the simplest method, and the role will be created with the necessary permissions.

   > **Note**
   >
   > If you create a role, it will have permissions to read from all log groups in the account.

   If you want to select an existing role, it should have the permissions listed in Permissions that the integration needs. Alternatively, you can choose **Use an existing role** and then in the **Verify access permissions of the selected role** section you can choose **Create role**. This way you can use the permissions listed in Permissions that the integration needs as a template and modify it. For example, if you want to specify a finer-grain control of log groups.
8. For **IAM roles and users who can view dashboards**, you select how you want to grant access to IAM roles and IAM users for vended logs dashboard access:
   - To limit the dashboard access to just some users, choose **Select IAM roles and users who can view dashboards** and then in the text box search for and select the IAM roles and IAM users that you want to grant access to.

- To grant dashboard access to all users, choose **Allow all roles and users in this account to view dashboards**.

> **Important**
>
> Selecting roles or users, or choosing all users, only adds them to the data access policy needed for accessing OpenSearch Service collection that stores the dashboard data. **For them to be able to view the vended logs dashboards, you must also grant those roles and users the CloudWatchOpenSearchDashboardAccess managed IAM policy.**

9. Choose **Create integration**

   Creating the integration will take a few minutes.

Step 2: Create vended logs dashboards

After you have created the integration, you can create dashboards. Dashboards are available for Amazon VPC flow logs, CloudTrail logs, and Amazon WAF logs.

To create a vended log dashboard with metrics derived by OpenSearch Service

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Logs Insights** and then choose the **Analyze with OpenSearch** tab.
3. Choose **Create dashboard**.
4. Choose which type of logs to create the dashboard for, Amazon WAF, Amazon VPC flow logs, or CloudTrail.
5. Enter a name for the dashboard, and optionally enter a description.
6. For **Data synchronization frequency**, enter how often that you want OpenSearch Service to query CloudWatch so the metrics and indexes created in OpenSearch Service can be synchronized and updated with new data. OpenSearch Service creates metrics and indexes on your logs for rendering the dashboard.

   Choosing a shorter time keeps the data more up to date and incurs higher costs.
7. Select the log groups to collect data from for this dashboard. Be sure to select log groups that match the type of dashboard that you are creating.

You can use the **Browse log groups** button and the **View log samples from selected log groups** option as you make these choices, to make sure that you get the log groups that you want.

8. Choose **Create dashboard**.

   At first, the dashboard appears without any data. After a few minutes, data will appear in the dashboard. When the data first appears, it will be for the most recent 15 minutes of log entries.

View, edit, or delete vended logs dashboards

View vended logs dashboards in CloudWatch Logs or OpenSearch Service

To be able to view dashboards, you must be signed in to an IAM principal that has the **CloudWatchOpenSearchDashboardAccess** IAM policy.

To view vended log dashboards

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Logs Insights** and then choose the **Analyze with OpenSearch** tab.
3. Choose the dashboard in the **OpenSearch dashboards** box.
4. (Optional) In the upper right, choose **View in OpenSearch**.

   The OpenSearch Service console opens and you see the same dashboard there. In the OpenSearch Service console, you can make changes to the dashboard and its widgets, and these changes will also be visible when you view the dashboard in CloudWatch Logs.

Grant dashboard viewing access to additional IAM roles or IAM users

To grant access to additional IAM principals after you've created the integration, take the following steps.

To grant vended log dashboard access to additional IAM roles or users

1. Edit the data access policy for the collection to add these roles or users. For more information, see Data access control for Amazon OpenSearch Service Serverless in the OpenSearch Service Developer Guide.
2. Grant the **CloudWatchOpenSearchDashboardAccess** to these users. For more information about the contents of this policy, see CloudWatchOpenSearchDashboardAccess.

Edit dashboard configuration

You can edit the name, description, and synchronization frequency of existing vended log dashboards.

To edit a vended log dashboard

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Logs Insights** and then choose the **Analyze with OpenSearch** tab.
3. Choose the dashboard in the **OpenSearch dashboards** box.
4. Choose **Actions**, **Change dashboard details**.
5. Make your changes, then choose **Confirm changes**.

Delete a vended log dashboard

You can delete a vended log dashboard. If you do so, the dashboard, the metrics, and indexes created in the OpenSearch Service collection are all deleted.

> **Note**
>
> After you delete a vended log dashboard, wait at least six hours before trying to re-create that same dashboard. If you don't wait, the re-created dashboard won't work correctly.

To delete a vended log dashboard

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.

2. In the left navigation pane, choose **Logs Insights** and then choose the **Analyze with OpenSearch** tab.
3. Choose the dashboard in the **OpenSearch dashboards** box.
4. Choose **Actions**, **Delete**.
5. Confirm your decision by entering **`delete`**, then choose **Delete**.

Delete all vended log dashboard integration with OpenSearch Service

You can delete your entire OpenSearch integration. If you do, all vended logs dashboards and the data that was displayed in them is deleted.

> **Important**
>
> To avoid ongoing costs, we strongly recommend that you manually delete the following resources before you delete the integration. Deleting the integration doesn't automatically delete these resources, and after you delete the integration you won't be able to access these resources to delete them. To find the names of the resources to delete, see the following procedure.
>
> - The data source
> - The collection
> - The data access policy
> - The encryption policy
> - The network policy
> - The lifecycle policy

To delete your entire vended log dashboard integration with OpenSearch Service

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the left navigation pane, choose **Settings**.
3. Choose the **Logs** tab.
4. In the **OpenSearch integration** section, choose **Delete integration**.

   The next screen displays the names of the OpenSearch Service resources that you should delete before deleting the integration.

5. Confirm your decision by entering **`delete`**, then choose **Delete integration**.

IAM policies for users

CloudWatch Logs has created two IAM policies, **CloudWatchOpenSearchDashboardsFullAccess** and **CloudWatchOpenSearchDashboardAccess**. The following table lists which actions each of these policies enables.

Action	IAM policy	Additional permissions needed
Create integration	**CloudWatchOpenSearchDashboardsFullAccess**	
Delete integration	**CloudWatchOpenSearchDashboardsFullAccess**	
Create dashboard	**CloudWatchOpenSearchDashboardsFullAccess**	
Edit dashboard	**CloudWatchOpenSearchDashboardsFullAccess**	
Delete dashboard	**CloudWatchOpenSearchDashboardsFullAccess**	
Refresh dashboard using **Synchronize now**	**CloudWatchOpenSearchDashboardsFullAccess**	
View integration in **Settings**	**CloudWatchOpenSearchDashboardAccess** or **CloudWatchOpenSearchDashboardsFullAccess**	
View dashboard	**CloudWatchOpenSearchDashboardAccess** or **CloudWatchOpenSearchDashboardsFullAccess**	Specify the role or user when you create the integration, or edit the data access policy for the collection to

Action	IAM policy	Additional permissions needed
		add these roles or users. For more information, see Data access control for Amazon OpenSearch Service Serverless in the OpenSearch Service Developer Guide.
View dashboard in OpenSearch Service console	**CloudWatchOpenSearchDashboardAccess** or **CloudWatchOpenSearchDashboardsFullAccess**	Specify the role or user when you create the integration, or edit the data access policy for the collection to add these roles or users. For more information, see Data access control for Amazon OpenSearch Service Serverless in the OpenSearch Service Developer Guide.

Permissions that the integration needs

If you create an IAM role for the integration to use, instead of allowing CloudWatch Logs to create the role, it must include the following permissions and trust policy. For more information about how to create an IAM role, see Create a role to delegate permissions to an Amazon service.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "CloudWatchLogsAccess",
      "Effect": "Allow",
      "Action": [
        "logs:StartQuery",
        "logs:GetLogGroupFields",
        "logs:GetQueryResults"
      ],
```

```
      "Resource": [
        "*"
      ]
    },
    {
      "Sid": "CloudWatchLogsDescribeLogGroupsAccess",
      "Effect": "Allow",
      "Action": [
        "logs:DescribeLogGroups"
      ],
      "Resource": "*"
    },
    {
        "Sid": "AmazonOpenSearchCollectionAccess",
        "Effect": "Allow",
        "Action": [
            "aoss:APIAccessAll"
        ],
        "Resource": "*",
        "Condition": {
            "StringLike": {
                "aoss:collection": "cloudwatch-logs-*"
            }
        }
    }
  ]
}

//Trust Policy
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "TrustPolicyForAmazonOpenSearchDirectQueryService",
            "Effect": "Allow",
            "Principal": {
                "Service": "directquery.opensearchservice.amazonaws.com"
            },
            "Action": "sts:AssumeRole",
            "Condition": {
                "ArnLike": {
                    "aws:SourceArn": "arn:aws:opensearch:us-
east-1:123456789012:datasource/cloudwatch_logs_*"
                }
```

```
            }
        }
    ]
}
```

Note

The previous role grants access to read from all log groups in the account, to enable you to create dashboards for any log account, including cross-account log groups. If you want to restrict access to specific log groups and create dashboards for only those log groups, you can update the first statement in that policy to the following:

```
{
      "Sid": "CloudWatchLogsAccess",
      "Effect": "Allow",
      "Action": [
        "logs:StartQuery",
        "logs:GetLogGroupFields",
        "logs:GetQueryResults"
      ],
      "Resource": [
        "arn:aws:logs:us-east-1:123456789012:log-group:myLogGroup:*",
        "arn:aws:logs:us-east-1:123456789012:log-group:myLogGroup"
      ]
}
```

Creating metrics from log events using filters

You can search and filter the log data coming into CloudWatch Logs by creating one or more *metric filters*. Metric filters define the terms and patterns to look for in log data as it is sent to CloudWatch Logs. CloudWatch Logs uses these metric filters to turn log data into numerical CloudWatch metrics that you can graph or set an alarm on.

When you create a metric from a log filter, you can also choose to assign dimensions and a unit to the metric. If you specify a unit, be sure to specify the correct one when you create the filter. Changing the unit for the filter later will have no effect.

If a log group with a subscription uses log transformation, the filter pattern is applied to the transformed versions of the log events. For more information, see Transform logs during ingestion.

Note

Metric filters are supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

You can use any type of CloudWatch statistic, including percentile statistics, when viewing these metrics or setting alarms.

Note

Percentile statistics are supported for a metric only if none of the metric's values are negative. If you set up your metric filter so that it can report negative numbers, percentile statistics will not be available for that metric when it has negative numbers as values. For more information, see Percentiles.

Filters do not retroactively filter data. Filters only publish the metric data points for events that happen after the filter was created. Filtered results return the first 50 lines, which will not be displayed if the timestamp on the filtered results is earlier than the metric creation time.

Contents

- Filter pattern syntax for metric filters
- Creating metric filters
- Listing metric filters
- Deleting a metric filter

Concepts

Each metric filter is made up of the following key elements:

default value

The value reported to the metric filter during a period when logs are ingested but no matching logs are found. By setting this to 0, you ensure that data is reported during every such period, preventing "spotty" metrics with periods of no matching data. If no logs are ingested during a one-minute period, then no value is reported.

If you assign dimensions to a metric created by a metric filter, you can't assign a default value for that metric.

dimensions

Dimensions are the key-value pairs that further define a metric. You can assign dimensions to the metric created from a metric filter. Because dimensions are part of the unique identifier for a metric, whenever a unique name/value pair is extracted from your logs, you are creating a new variation of that metric.

filter pattern

A symbolic description of how CloudWatch Logs should interpret the data in each log event. For example, a log entry may contain timestamps, IP addresses, strings, and so on. You use the pattern to specify what to look for in the log file.

metric name

The name of the CloudWatch metric to which the monitored log information should be published. For example, you may publish to a metric called ErrorCount.

metric namespace

The destination namespace of the new CloudWatch metric.

metric value

The numerical value to publish to the metric each time a matching log is found. For example, if you're counting the occurrences of a particular term like "Error", the value will be "1" for each occurrence. If you're counting the bytes transferred, you can increment by the actual number of bytes found in the log event.

Filter pattern syntax for metric filters

Note

How metric filters differ from CloudWatch Logs Insights queries
Metric filters differ from CloudWatch Logs Insights queries in that a specified numerical value is added to a metric filter each time a matching log is found. For more information, see Configuring metric values for a metric filter.
For information about how to query your log groups with the Amazon CloudWatch Logs Insights query language, see CloudWatch Logs Insights language query syntax.
Generic filter pattern examples
For more information on generic filter pattern syntax applicable to metric filters as well as subscription filters and filter log events, see Filter pattern syntax for metric filters, subscription filters, and filter log events, which includes the following examples:

- Supported regular expressions (regex) syntax
- Matching terms in unstructured log events
- Matching terms in JSON log events
- Matching terms in space-delimited log events

Metric filters allow you to search and filter log data coming into CloudWatch Logs, extract metric observations from the filtered log data, and transform the data points into a CloudWatch Logs metric. You define the terms and patterns to look for in log data as it is sent to CloudWatch Logs. Metric filters are assigned to log groups, and all of the filters assigned to a log group are applied to their log streams.

When a metric filter matches a term, it increments the metric's count by a specified numerical value. For example, you can create a metric filter that counts the number of times the word ***ERROR*** occurs in your log events.

You can assign units of measure and dimensions to metrics. For example, if you create a metric filter that counts the number of times the word ***ERROR*** occurs in your log events, you can specify a dimension that's called `ErrorCode` to show the total number of log events that contain the word ***ERROR*** and filter data by reported error codes.

> **Tip**
>
> When you assign a unit of measure to a metric, make sure to specify the correct one. If you change the unit later, your change might not take effect. For the complete list of the units that CloudWatch supports, see MetricDatum in the Amazon CloudWatch API Reference.

Topics

Configuring metric values for a metric filter

When you create a metric filter, you define your filter pattern and specify your metric's value and default value. You can set metric values to numbers, named identifiers, or numeric identifiers. If you don't specify a default value, CloudWatch won't report data when your metric filter doesn't find a match. We recommend that you specify a default value, even if the value is 0. Setting a default value helps CloudWatch report data more accurately and prevents CloudWatch from aggregating spotty metrics. CloudWatch aggregates and reports metric values every minute.

When your metric filter finds a match in your log events, it increments your metric's count by your metric's value. If your metric filter doesn't find a match, CloudWatch reports the metric's default value. For example, your log group publishes two records every minute, the metric value is 1, and the default value is 0. If your metric filter finds matches in both log records within the first minute, the metric value for that minute is 2. If your metric filter doesn't find matches in either records during the second minute, the default value for that minute is 0. If you assign dimensions to metrics that metric filters generate, you can't specify default values for those metrics.

You also can set up a metric filter to increment a metric with a value extracted from a log event, instead of a static value. For more information, see Using values in log events to increment a metric's value.

Publishing dimensions with metrics from values in JSON or space-delimited log events

You can use the CloudWatch console or Amazon CLI to create metric filters that publish dimensions with metrics that JSON and space-delimited log events generate. Dimensions are name/value value pairs and only available for JSON and space-delimited filter patterns. You can create JSON and space-delimited metric filters with up to three dimensions. For more information about dimensions and information about how to assign dimensions to metrics, see the following sections:

- Dimensions in the *Amazon CloudWatch User guide*
- Example: Extract fields from an Apache log and assign dimensions in the *Amazon CloudWatch Logs User Guide*

> **Important**
>
> Dimensions contain values that gather charges the same as custom metrics. To prevent unexpected charges, don't specify high-cardinality fields, such as `IPAddress` or `requestID`, as dimensions.
>
> If you extract metrics from log events, you're charged for custom metrics. To prevent you from collecting accidental high charges, Amazon might disable your metric filter if it generates 1000 different name/value pairs for specified dimensions over a certain amount of time.
>
> You can create billing alarms that notify you of your estimated charges. For more information, see Creating a billing alarm to monitor your estimated Amazon charges.

Publishing dimensions with metrics from JSON log events

The following examples contain code snippets that describe how to specify dimensions in a JSON metric filter.

Example: JSON log event

```
{
  "eventType": "UpdateTrail",
  "sourceIPAddress": "111.111.111.111",
  "arrayKey": [
        "value",
```

```
        "another value"
  ],
  "objectList": [
       {"name": "a",
         "id": 1
       },
       {"name": "b",
         "id": 2
       }
  ]

}
```

> **Note**
>
> If you test the example metric filter with the example JSON log event, you must enter the example JSON log on a single line.

Example: Metric filter

The metric filter increments the metric whenever a JSON log event contain the properties `eventType` and `"sourceIPAddress"`.

```
{ $.eventType = "*" && $.sourceIPAddress != 123.123.* }
```

When you create a JSON metric filter, you can specify any of the properties in the metric filter as a dimension. For example, to set `eventType` as a dimension, use the following:

```
"eventType" : $.eventType
```

The example metric contains a dimension that's named `"eventType"`, and the dimension's value in the example log event is `"UpdateTrail"`.

Publishing dimensions with metrics from space-delimited log events

The following examples contain code snippets that describe how to specify dimensions in a space-delimited metric filter.

Example: Space-delimited log event

```
127.0.0.1 Prod frank [10/Oct/2000:13:25:15 -0700] "GET /index.html HTTP/1.0" 404
 1534
```

Example: Metric filter

```
[ip, server, username, timestamp, request, status_code, bytes > 1000]
```

The metric filter increments the metric when a space-delimited log event includes any of the fields that are specified in the filter. For example, the metric filter finds following fields and values in the example space-delimited log event.

```
{
   "$bytes": "1534",
   "$status_code": "404",

   "$request": "GET /index.html HTTP/1.0",
   "$timestamp": "10/Oct/2000:13:25:15 -0700",
   "$username": "frank",
   "$server": "Prod",
   "$ip": "127.0.0.1"
}
```

When you create a space-delimited metric filter, you can specify any of the fields in the metric filter as a dimension. For example, to set `server` as a dimension, use the following:

```
"server" : $server
```

The example metric filter has a dimension that's named `server`, and the dimension's value in the example log event is `"Prod"`.

Example: Match terms with AND (&&) and OR (||)

You can use the logical operators AND ("&&") and OR ("||") to create space-delimited metric filters that contain conditions. The following metric filter returns log events where the first word in the events is ERROR or any superstring of WARN.

```
[w1=ERROR || w1=%WARN%, w2]
```

Using values in log events to increment a metric's value

You can create metric filters that publish numeric values found in your log events. The procedure in this section uses the following example metric filter to show how you can publish a numeric value in a JSON log event to a metric.

```
{ $.latency = * } metricValue: $.latency
```

To create a metric filter that publishes a value in a log event

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Log groups**.
3. Select or create a log group.

   For information about how to create a log group, see Create a log group in CloudWatch Logs in the *Amazon CloudWatch Logs User Guide*.
4. Choose **Actions**, and then choose **Create metric filter**.
5. For **Filter Pattern**, enter **`{ $.latency = * }`**, and then choose **Next**.
6. For **Metric Name**, enter **myMetric**.
7. For **Metric Value**, enter **`$.latency`**.
8. (Optional) For **Default Value**, enter **0**, and then choose **Next**.

We recommend that you specify a default value, even if the value is 0. Setting a default value helps CloudWatch report data more accurately and prevents CloudWatch from aggregating spotty metrics. CloudWatch aggregates and reports metric values every minute.

9. Choose **Create metric filter**.

The example metric filter matches the term `"latency"` in the example JSON log event and publishes a numeric value of 50 to the metric **myMetric**.

```
{
"latency": 50,
"requestType": "GET"
}
```

Creating metric filters

The following procedure and examples show how to create metric filters.

Examples

- Create a metric filter for a log group
- Example: Count log events
- Example: Count occurrences of a term
- Example: Count HTTP 404 codes
- Example: Count HTTP 4xx codes
- Example: Extract fields from an Apache log and assign dimensions

Create a metric filter for a log group

To create a metric filter for a log group, follow these steps. The metric won't be visible until there are some data points for it.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Logs**, and then choose **Log groups**.
3. Choose the name of the log group.

4. Choose `Actions`, and then choose **Create metric filter**.
5. For **Filter pattern**, enter a filter pattern. For more information, see Filter pattern syntax for metric filters, subscription filters, filter log events, and Live Tail.
6. (Optional) To test your filter pattern, under **Test Pattern**, enter one or more log events to test the pattern. Each log event must be formatted on one line. Line breaks are used to separate log events in the **Log event messages** box.
7. Choose **Next**, and then enter a name for your metric filter.
8. Under **Metric details**, for **Metric namespace**, enter a name for the CloudWatch namespace where the metric will be published. If the namespace doesn't already exist, make sure that **Create new** is selected.
9. For **Metric name**, enter a name for the new metric.
10. For **Metric value**, if your metric filter is counting occurrences of the keywords in the filter, enter 1. This increments the metric by 1 for each log event that includes one of the keywords.

    Alternatively, enter a token, such as **`$size`**. This increments the metric by the value of the number in the `size` field for every log event that contains a `size` field.
11. (Optional) For **Unit**, select a unit to assign to the metric. If you do not specify a unit, the unit is set as None.
12. (Optional) Enter the names and tokens for as many as three dimensions for the metric. If you assign dimensions to metrics that metric filters create, you cannot assign default values for those metrics.

    > **Note**
    >
    > Dimensions are supported only in JSON or space-delimited metric filters.

13. Choose **Create metric filter**. You can find the metric filter that you created from the navigation pane. Choose **Logs**, and then choose **Log groups**. Choose the name of the log group that you created your metric filter for, and then select the **Metric filters** tab.

Example: Count log events

The simplest type of log event monitoring is to count the number of log events that occur. You might want to do this to keep a count of all events, to create a "heartbeat" style monitor or just to practice creating metric filters.

In the following CLI example, a metric filter called MyAppAccessCount is applied to the log group MyApp/access.log to create the metric EventCount in the CloudWatch namespace MyNamespace. The filter is configured to match any log event content and to increment the metric by "1".

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose the name of a log group.
4. Choose `Actions`, **Create metric filter**.
5. Leave **Filter Pattern** and **Select Log Data to Test** blank.
6. Choose **Next**, and then for **Filter Name**, type **`EventCount`**.
7. Under **Metric Details**, for **Metric Namespace**, type **`MyNameSpace`**.
8. For **Metric Name**, type **`MyAppEventCount`**.
9. Confirm that **Metric Value** is 1. This specifies that the count is incremented by 1 for every log event.
10. For **Default Value** enter 0, and then choose **Next**. Specifying a default value ensures that data is reported even during periods when no log events occur, preventing spotty metrics where data sometimes does not exist.
11. Choose **Create metric filter**.

To create a metric filter using the Amazon CLI

At a command prompt, run the following command:

```
aws logs put-metric-filter \
  --log-group-name MyApp/access.log \
  --filter-name EventCount \
  --filter-pattern " " \
  --metric-transformations \
  metricName=MyAppEventCount,metricNamespace=MyNamespace,metricValue=1,defaultValue=0
```

You can test this new policy by posting any event data. You should see data points published to the metric MyAppAccessEventCount.

To post event data using the Amazon CLI

At a command prompt, run the following command:

```
aws logs put-log-events \
  --log-group-name MyApp/access.log --log-stream-name TestStream1 \
  --log-events \
    timestamp=1394793518000,message="Test event 1" \
    timestamp=1394793518000,message="Test event 2" \
    timestamp=1394793528000,message="This message also contains an Error"
```

Example: Count occurrences of a term

Log events frequently include important messages that you want to count, maybe about the success or failure of operations. For example, an error may occur and be recorded to a log file if a given operation fails. You may want to monitor these entries to understand the trend of your errors.

In the example below, a metric filter is created to monitor for the term Error. The policy has been created and added to the log group **MyApp/message.log**. CloudWatch Logs publishes a data point to the CloudWatch custom metric ErrorCount in the **MyApp/message.log** namespace with a value of "1" for every event containing Error. If no event contains the word Error, then a value of 0 is published. When graphing this data in the CloudWatch console, be sure to use the sum statistic.

After you create a metric filter, you can view the metric in the CloudWatch console. When you are selecting the metric to view, select the metric namespace that matches the log group name. For more information, see Viewing Available Metrics.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose the name of the log group.
4. Choose **Actions**, **Create metric filter**.
5. For **Filter Pattern**, enter **`Error`**.

> **Note**
>
> All entries in **Filter Pattern** are case-sensitive.

6. (Optional) To test your filter pattern, under **Test Pattern**, enter one or more log events to use to test the pattern. Each log event must be within one line, because line breaks are used to separate log events in the **Log event messages** box.
7. Choose **Next**, and then on the **Assign metric** page, for **Filter Name**, type **`MyAppErrorCount`**.
8. Under **Metric Details**, for **Metric Namespace**, type **MyNameSpace**.
9. For **Metric Name**, type **ErrorCount**.
10. Confirm that **Metric Value** is 1. This specifies that the count is incremented by 1 for every log event containing "Error".
11. For **Default Value** type 0, and then choose **Next**.
12. Choose **Create metric filter**.

To create a metric filter using the Amazon CLI

At a command prompt, run the following command:

```
aws logs put-metric-filter \
  --log-group-name MyApp/message.log \
  --filter-name MyAppErrorCount \
  --filter-pattern 'Error' \
  --metric-transformations \
      metricName=ErrorCount,metricNamespace=MyNamespace,metricValue=1,defaultValue=0
```

You can test this new policy by posting events containing the word "Error" in the message.

To post events using the Amazon CLI

At a command prompt, run the following command. Note that patterns are case-sensitive.

```
aws logs put-log-events \
  --log-group-name MyApp/access.log --log-stream-name TestStream1 \
  --log-events \
    timestamp=1394793518000,message="This message contains an Error" \
    timestamp=1394793528000,message="This message also contains an Error"
```

Example: Count HTTP 404 codes

Using CloudWatch Logs, you can monitor how many times your Apache servers return a HTTP 404 response, which is the response code for page not found. You might want to monitor this to

understand how often your site visitors do not find the resource they are looking for. Assume that your log records are structured to include the following information for each log event (site visit):

- Requestor IP Address
- RFC 1413 Identity
- Username
- Timestamp
- Request method with requested resource and protocol
- HTTP response code to request
- Bytes transferred in request

An example of this might look like the following:

```
127.0.0.1 - frank [10/Oct/2000:13:55:36 -0700] "GET /apache_pb.gif HTTP/1.0" 404 2326
```

You could specify a rule which attempts to match events of that structure for HTTP 404 errors, as shown in the following example:

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose `Actions`, **Create metric filter**.
4. For **Filter Pattern**, type **`[IP, UserInfo, User, Timestamp, RequestInfo, StatusCode=404, Bytes]`**.
5. (Optional) To test your filter pattern, under **Test Pattern**, enter one or more log events to use to test the pattern. Each log event must be within one line, because line breaks are used to separate log events in the **Log event messages** box.
6. Choose **Next**, and then for **Filter Name**, type **HTTP404Errors**.
7. Under **Metric Details**, for **Metric Namespace**, enter **`MyNameSpace`**.
8. For **Metric Name**, enter **`ApacheNotFoundErrorCount`**.
9. Confirm that **Metric Value** is 1. This specifies that the count is incremented by 1 for every 404 Error event.
10. For **Default Value** enter 0, and then choose **Next**.

11. Choose **Create metric filter**.

To create a metric filter using the Amazon CLI

At a command prompt, run the following command:

```
aws logs put-metric-filter \
  --log-group-name MyApp/access.log \
  --filter-name HTTP404Errors \
  --filter-pattern '[ip, id, user, timestamp, request, status_code=404, size]' \
  --metric-transformations \
      metricName=ApacheNotFoundErrorCount,metricNamespace=MyNamespace,metricValue=1
```

In this example, literal characters such as the left and right square brackets, double quotes and character string 404 were used. The pattern needs to match with the entire log event message for the log event to be considered for monitoring.

You can verify the creation of the metric filter by using the **describe-metric-filters** command. You should see output that looks like this:

```
aws logs describe-metric-filters --log-group-name MyApp/access.log

{
    "metricFilters": [
        {
            "filterName": "HTTP404Errors",
            "metricTransformations": [
                {
                    "metricValue": "1",
                    "metricNamespace": "MyNamespace",
                    "metricName": "ApacheNotFoundErrorCount"
                }
            ],
            "creationTime": 1399277571078,
            "filterPattern": "[ip, id, user, timestamp, request, status_code=404,
 size]"
        }
    ]
}
```

Now you can post a few events manually:

```
aws logs put-log-events \
--log-group-name MyApp/access.log --log-stream-name hostname \
--log-events \
timestamp=1394793518000,message="127.0.0.1 - bob [10/Oct/2000:13:55:36 -0700] \"GET /
apache_pb.gif HTTP/1.0\" 404 2326" \
timestamp=1394793528000,message="127.0.0.1 - bob [10/Oct/2000:13:55:36 -0700] \"GET /
apache_pb2.gif HTTP/1.0\" 200 2326"
```

Soon after putting these sample log events, you can retrieve the metric named in the CloudWatch console as ApacheNotFoundErrorCount.

Example: Count HTTP 4xx codes

As in the previous example, you might want to monitor your web service access logs and monitor the HTTP response code levels. For example, you might want to monitor all of the HTTP 400-level errors. However, you might not want to specify a new metric filter for every return code.

The following example demonstrates how to create a metric that includes all 400-level HTTP code responses from an access log using the Apache access log format from the Example: Count HTTP 404 codes example.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose the name of the log group for the Apache server.
4. Choose `Actions`, **Create metric filter**.
5. For **Filter pattern**, enter **`[ip, id, user, timestamp, request, status_code=4*, size]`**.
6. (Optional) To test your filter pattern, under **Test Pattern**, enter one or more log events to use to test the pattern. Each log event must be within one line, because line breaks are used to separate log events in the **Log event messages** box.
7. Choose **Next**, and then for **Filter name**, type **`HTTP4xxErrors`**.
8. Under **Metric details**, for **Metric namespace**, enter **`MyNameSpace`**.
9. For **Metric name**, enter **HTTP4xxErrors**.
10. For **Metric value**, enter 1. This specifies that the count is incremented by 1 for every log containing a 4xx error.

11. For **Default value** enter 0, and then choose **Next**.
12. Choose **Create metric filter**.

To create a metric filter using the Amazon CLI

At a command prompt, run the following command:

```
aws logs put-metric-filter \
  --log-group-name MyApp/access.log \
  --filter-name HTTP4xxErrors \
  --filter-pattern '[ip, id, user, timestamp, request, status_code=4*, size]' \
  --metric-transformations \
  metricName=HTTP4xxErrors,metricNamespace=MyNamespace,metricValue=1,defaultValue=0
```

You can use the following data in put-event calls to test this rule. If you did not remove the monitoring rule in the previous example, you will generate two different metrics.

```
127.0.0.1 - - [24/Sep/2013:11:49:52 -0700] "GET /index.html HTTP/1.1" 404 287
127.0.0.1 - - [24/Sep/2013:11:49:52 -0700] "GET /index.html HTTP/1.1" 404 287
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /~test/ HTTP/1.1" 200 3
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /favicon.ico HTTP/1.1" 404 308
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /favicon.ico HTTP/1.1" 404 308
127.0.0.1 - - [24/Sep/2013:11:51:34 -0700] "GET /~test/index.html HTTP/1.1" 200 3
```

Example: Extract fields from an Apache log and assign dimensions

Sometimes, instead of counting, it is helpful to use values within individual log events for metric values. This example shows how you can create an extraction rule to create a metric that measures the bytes transferred by an Apache webserver.

This example also shows how to assign dimensions to the metric that you are creating.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Choose the name of the log group for the Apache server.
4. Choose `Actions`, **Create metric filter**.

5. For **Filter pattern**, enter **`[ip, id, user, timestamp, request, status_code, size]`**.
6. (Optional) To test your filter pattern, under **Test Pattern**, enter one or more log events to use to test the pattern. Each log event must be within one line, because line breaks are used to separate log events in the **Log event messages** box.
7. Choose **Next**, and then for **Filter name**, type **`size`**.
8. Under **Metric details**, for **Metric namespace**, enter **`MyNameSpace`**. Because this is a new namespace, be sure that **Create new** is selected.
9. For **Metric name**, enter **`BytesTransferred`**
10. For **Metric value**, enter **`$size`**.
11. For **Unit**, select **Bytes**.
12. For **Dimension Name**, type **`IP`**.
13. For **Dimension Value**, type **`$ip`** and then choose **Next**.
14. Choose **Create metric filter**.

To create this metric filter using the Amazon CLI

At a command prompt, run the following command

```
aws logs put-metric-filter \
--log-group-name MyApp/access.log \
 --filter-name BytesTransferred \
 --filter-pattern '[ip, id, user, timestamp, request, status_code, size]' \
 --metric-transformations  \
 metricName=BytesTransferred,metricNamespace=MyNamespace,metricValue='$size'
```

```
aws logs put-metric-filter \
--log-group-name MyApp/access.log \
--filter-name BytesTransferred \
--filter-pattern '[ip, id, user, timestamp, request, status_code, size]' \
--metric-transformations  \
metricName=BytesTransferred,metricNamespace=MyNamespace,metricValue='$size',unit=Bytes,dimensio
$ip}}'
```

Note

In this command, use this format to specify multiple dimensions.

```
aws logs put-metric-filter \
--log-group-name my-log-group-name \
--filter-name my-filter-name \
--filter-pattern 'my-filter-pattern' \
--metric-transformations  \
metricName=my-metric-name,metricNamespace=my-metric-namespace,metricValue=my-
token,unit=unit,dimensions='{dimension1=$dim,dimension2=$dim2,dim3=$dim3}'
```

You can use the following data in put-log-event calls to test this rule. This generates two different metrics if you did not remove monitoring rule in the previous example.

```
127.0.0.1 - - [24/Sep/2013:11:49:52 -0700] "GET /index.html HTTP/1.1" 404 287
127.0.0.1 - - [24/Sep/2013:11:49:52 -0700] "GET /index.html HTTP/1.1" 404 287
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /~test/ HTTP/1.1" 200 3
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /favicon.ico HTTP/1.1" 404 308
127.0.0.1 - - [24/Sep/2013:11:50:51 -0700] "GET /favicon.ico HTTP/1.1" 404 308
127.0.0.1 - - [24/Sep/2013:11:51:34 -0700] "GET /~test/index.html HTTP/1.1" 200 3
```

Listing metric filters

You can list all metric filters in a log group.

To list metric filters using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. In the contents pane, in the list of log groups, in the **Metric Filters** column, choose the number of filters.

   The **Log Groups > Filters for** screen lists all metric filters associated with the log group.

To list metric filters using the Amazon CLI

At a command prompt, run the following command:

```
aws logs describe-metric-filters --log-group-name MyApp/access.log
```

The following is example output:

```
{
    "metricFilters": [
        {
            "filterName": "HTTP404Errors",
            "metricTransformations": [
                {
                    "metricValue": "1",
                    "metricNamespace": "MyNamespace",
                    "metricName": "ApacheNotFoundErrorCount"
                }
            ],
            "creationTime": 1399277571078,
            "filterPattern": "[ip, id, user, timestamp, request, status_code=404,
 size]"
        }
    ]
}
```

Deleting a metric filter

A policy is identified by its name and the log group it belongs to.

To delete a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. In the contents pane, in the **Metric Filter** column, choose the number of metric filters for the log group.
4. Under **Metric Filters** screen, select the check box to the right of the name of the filter that you want to delete. Then choose **Delete**.
5. When prompted for confirmation, choose **Delete**.

To delete a metric filter using the Amazon CLI

At a command prompt, run the following command:

```
aws logs delete-metric-filter --log-group-name MyApp/access.log \
```

```
  --filter-name MyFilterName
```

Real-time processing of log data with subscriptions

You can use subscriptions to get access to a real-time feed of log events from CloudWatch Logs and have it delivered to other services such as an Amazon Kinesis stream, an Amazon Data Firehose stream, or Amazon Lambda for custom processing, analysis, or loading to other systems. When log events are sent to the receiving service, they are base64 encoded and compressed with the gzip format.

To begin subscribing to log events, create the receiving resource, such as a Kinesis Data Streams stream, where the events will be delivered. A subscription filter defines the filter pattern to use for filtering which log events get delivered to your Amazon resource, as well as information about where to send matching log events to. Log events are sent to the receiving resource soon after being ingested, usually less than three minutes.

Note

If a log group with a subscription uses log transformation, the filter pattern is compared to the transformed versions of the log events. For more information, see Transform logs during ingestion.

You can create subscriptions at the account level and at the log group level. Each account can have one account-level subscription filter per Region. Each log group can have up to two subscription filters associated with it.

Note

If the destination service returns a retryable error such as a throttling exception or a retryable service exception (HTTP 5xx for example), CloudWatch Logs continues to retry delivery for up to 24 hours. CloudWatch Logs doesn't try to re-deliver if the error is a non-retryable error, such as AccessDeniedException or ResourceNotFoundException. In these cases the subscription filter is disabled for up to 10 minutes, and then CloudWatch Logs retries sending logs to the destination. During this disabled period, logs are skipped.

CloudWatch Logs also produces CloudWatch metrics about the forwarding of log events to subscriptions. For more information, see Monitoring with CloudWatch metrics.

You can also use a CloudWatch Logs subscription to stream log data in near real time to an Amazon OpenSearch Service cluster. For more information, see Streaming CloudWatch Logs data to Amazon OpenSearch Service.

Subscriptions are supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

> **Note**
>
> Subscription filters might batch log events to optimize transmission and reduce the amount of calls made to the destination. Batching is not guaranteed but is used when possible.

Contents

Concepts

Each subscription filter is made up of the following key elements:

filter pattern

A symbolic description of how CloudWatch Logs should interpret the data in each log event, along with filtering expressions that restrict what gets delivered to the destination Amazon resource. For more information about the filter pattern syntax, see Filter pattern syntax for metric filters, subscription filters, filter log events, and Live Tail.

destination arn

The Amazon Resource Name (ARN) of the Kinesis Data Streams stream, Firehose stream, or Lambda function you want to use as the destination of the subscription feed.

role arn

An IAM role that grants CloudWatch Logs the necessary permissions to put data into the chosen destination. This role is not needed for Lambda destinations because CloudWatch Logs can get the necessary permissions from access control settings on the Lambda function itself.

distribution

The method used to distribute log data to the destination, when the destination is a stream in Amazon Kinesis Data Streams. By default, log data is grouped by log stream. For a more even distribution, you can group log data randomly.

For log group-level subscriptions, the following key element is also included:

log group name

The log group to associate the subscription filter with. All log events uploaded to this log group would be subject to the subscription filter, and those that match the filter are delivered to the destination service that is receiving the matching log events.

For account-level subscriptions, the following key element is also included:

selection criteria

The criteria used for selecting which log groups have the account-level subscription filter applied. If you don't specify this, the account-level subscription filter is applied to all log groups in the account. This field is used to prevent infinite log loops.. For more information about the infinite log loop issue, see Log recursion prevention.

Selection criteria has a size limit of 25 KB.

Log group-level subscription filters

You can use a subscription filter with Amazon Kinesis Data Streams, Amazon Lambda, Amazon Data Firehose, or Amazon OpenSearch Service. Logs sent to a service through a subscription filter are base64 encoded and compressed with the gzip format. This section provides examples you can follow to create a CloudWatch Logs subscription filter that sends log data to Firehose, Lambda, and Kinesis Data Streams.

Note

If you want to search your log data, see Filter and pattern syntax.

Examples

- Example 1: Subscription filters with Kinesis Data Streams
- Example 2: Subscription filters with Amazon Lambda
- Example 3: Subscription filters with Amazon Data Firehose
- Example 4: Subscription filters with Amazon OpenSearch Service

Example 1: Subscription filters with Kinesis Data Streams

The following example associates a subscription filter with a log group containing Amazon CloudTrail events. The subscription filter delivers every logged activity made by "Root" Amazon credentials to a stream in Kinesis Data Streams called "RootAccess." For more information about how to send Amazon CloudTrail events to CloudWatch Logs, see Sending CloudTrail Events to CloudWatch Logs in the *Amazon CloudTrail User Guide*.

Note

Before you create the stream, calculate the volume of log data that will be generated. Be sure to create a stream with enough shards to handle this volume. If the stream does not have enough shards, the log stream will be throttled. For more information about stream volume limits, see Quotas and Limits.
Throttled deliverables are retried for up to 24 hours. After 24 hours, the failed deliverables are dropped.
To mitigate the risk of throttling, you can take the following steps:

- Specify `random` for `distribution` when you create the subscription filter with PutSubscriptionFilter or put-subscription-filter. By default, the stream filter distribution is by log stream and this can cause throttling.
- Monitor your stream using CloudWatch metrics. This helps you identify any throttling and adjust your configuration accordingly. For example, the `DeliveryThrottling` metric can be used to track the number of log events for which CloudWatch Logs was

throttled when forwarding data to the subscription destination. For more information about monitoring, see Monitoring with CloudWatch metrics.

- Use the on-demand capacity mode for your stream in Kinesis Data Streams. On-demand mode instantly accommodates your workloads as they ramp up or down. More information about on-demand capacity mode, see On-demand mode.
- Restrict your CloudWatch subscription filter pattern to match the capacity of your stream in Kinesis Data Streams. If you are sending too much data to the stream, you might need to reduce the filter size or adjust the filter criteria.

To create a subscription filter for Kinesis Data Streams

1. Create a destination stream using the following command:

```
$ C:\>  aws kinesis create-stream --stream-name "RootAccess" --shard-count 1
```

2. Wait until the stream becomes Active (this might take a minute or two). You can use the following Kinesis Data Streams describe-stream command to check the **StreamDescription.StreamStatus** property. In addition, note the **StreamDescription.StreamARN** value, as you will need it in a later step:

```
aws kinesis describe-stream --stream-name "RootAccess"
```

The following is example output:

```
{
    "StreamDescription": {
        "StreamStatus": "ACTIVE",
        "StreamName": "RootAccess",
        "StreamARN": "arn:aws:kinesis:us-east-1:123456789012:stream/RootAccess",
        "Shards": [
            {
                "ShardId": "shardId-000000000000",
                "HashKeyRange": {
                    "EndingHashKey": "340282366920938463463374607431768211455",
                    "StartingHashKey": "0"
                },
                "SequenceNumberRange": {
                    "StartingSequenceNumber":
```

```
                    "495511352186888184566795038319814587845913527021815726l0"
                }
            }
        ]
    }
}
```

3. Create the IAM role that will grant CloudWatch Logs permission to put data into your stream. First, you'll need to create a trust policy in a file (for example, `~/TrustPolicyForCWL-Kinesis.json`). Use a text editor to create this policy. Do not use the IAM console to create it.

   This policy includes a `aws:SourceArn` global condition context key to help prevent the confused deputy security problem. For more information, see Confused deputy prevention.

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole",
    "Condition": {
        "StringLike": { "aws:SourceArn": "arn:aws:logs:region:123456789012:*" }
     }
   }
}
```

4. Use the **create-role** command to create the IAM role, specifying the trust policy file. Note the returned **Role.Arn** value, as you will also need it for a later step:

```
aws iam create-role --role-name CWLtoKinesisRole --assume-role-policy-document
 file://~/TrustPolicyForCWL-Kinesis.json
```

   The following is an example of the output.

```
{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.amazonaws.com"
                },
```

```
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": { "arn:aws:logs:region:123456789012:*" }
                    }
                }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2015-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisRole",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/CWLtoKinesisRole"
    }
}
```

5. Create a permissions policy to define what actions CloudWatch Logs can do on your account. First, you'll create a permissions policy in a file (for example, `~/PermissionsForCWL-Kinesis.json`). Use a text editor to create this policy. Do not use the IAM console to create it.

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:region:123456789012:stream/RootAccess"
    }
  ]
}
```

6. Associate the permissions policy with the role using the following put-role-policy command:

```
aws iam put-role-policy  --role-name CWLtoKinesisRole  --policy-name Permissions-Policy-For-CWL  --policy-document file://~/PermissionsForCWL-Kinesis.json
```

7. After the stream is in **Active** state and you have created the IAM role, you can create the CloudWatch Logs subscription filter. The subscription filter immediately starts the flow of real-time log data from the chosen log group to your stream:

```
aws logs put-subscription-filter \
    --log-group-name "CloudTrail/logs" \
    --filter-name "RootAccess" \
    --filter-pattern "{$.userIdentity.type = Root}" \
```

```
    --destination-arn "arn:aws:kinesis:region:123456789012:stream/RootAccess" \
    --role-arn "arn:aws:iam::123456789012:role/CWLtoKinesisRole"
```

8. After you set up the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern to your stream. You can verify that this is happening by grabbing a Kinesis Data Streams shard iterator and using the Kinesis Data Streams get-records command to fetch some Kinesis Data Streams records:

```
aws kinesis get-shard-iterator --stream-name RootAccess --shard-id
 shardId-000000000000 --shard-iterator-type TRIM_HORIZON
```

```
{
    "ShardIterator":
    "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL
+wev+e2P4djJg4L9wmXKvQYoE+rMUiFq
+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f+OIK8zM5My8ID
+g6rMo7UKWeI4+IWiK2OSh0uP"
}
```

```
aws kinesis get-records --limit 10 --shard-iterator "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL
+wev+e2P4djJg4L9wmXKvQYoE+rMUiFq
+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f+OIK8zM5My8ID
+g6rMo7UKWeI4+IWiK2OSh0uP"
```

Note that you might need to make this call a few times before Kinesis Data Streams starts to return data.

You should expect to see a response with an array of records. The **Data** attribute in a Kinesis Data Streams record is base64 encoded and compressed with the gzip format. You can examine the raw data from the command line using the following Unix commands:

```
echo -n "<Content of Data>" | base64 -d | zcat
```

The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
```

```
    "owner": "111111111111",
    "logGroup": "CloudTrail/logs",
    "logStream": "111111111111_CloudTrail/logs_us-east-1",
    "subscriptionFilters": [
        "Destination"
    ],
    "messageType": "DATA_MESSAGE",
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424298221568",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221569",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221570",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        }
    ]
}
```

The key elements in the above data structure are the following:

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

messageType

Data messages will use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs may emit Kinesis Data Streams records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

logEvents

The actual log data, represented as an array of log event records. The "id" property is a unique identifier for every log event.

Example 2: Subscription filters with Amazon Lambda

In this example, you'll create a CloudWatch Logs subscription filter that sends log data to your Amazon Lambda function.

> **Note**
>
> Before you create the Lambda function, calculate the volume of log data that will be generated. Be sure to create a function that can handle this volume. If the function does not have enough volume, the log stream will be throttled. For more information about Lambda limits, see Amazon Lambda Limits.

To create a subscription filter for Lambda

1. Create the Amazon Lambda function.

   Ensure that you have set up the Lambda execution role. For more information, see Step 2.2: Create an IAM Role (execution role) in the *Amazon Lambda Developer Guide*.

2. Open a text editor and create a file named `helloWorld.js` with the following contents:

```
var zlib = require('zlib');
exports.handler = function(input, context) {
    var payload = Buffer.from(input.awslogs.data, 'base64');
    zlib.gunzip(payload, function(e, result) {
```

```
        if (e) {
            context.fail(e);
        } else {
            result = JSON.parse(result.toString());
            console.log("Event Data:", JSON.stringify(result, null, 2));
            context.succeed();
        }
    });
};
```

3. Zip the file helloWorld.js and save it with the name `helloWorld.zip`.
4. Use the following command, where the role is the Lambda execution role you set up in the first step:

```
aws lambda create-function \
    --function-name helloworld \
    --zip-file fileb://file-path/helloWorld.zip \
    --role lambda-execution-role-arn \
    --handler helloWorld.handler \
    --runtime nodejs12.x
```

5. Grant CloudWatch Logs the permission to execute your function. Use the following command, replacing the placeholder account with your own account and the placeholder log group with the log group to process:

```
aws lambda add-permission \
    --function-name "helloworld" \
    --statement-id "helloworld" \
    --principal "logs.amazonaws.com" \
    --action "lambda:InvokeFunction" \
    --source-arn "arn:aws:logs:region:123456789123:log-group:TestLambda:*" \
    --source-account "123456789012"
```

6. Create a subscription filter using the following command, replacing the placeholder account with your own account and the placeholder log group with the log group to process:

```
aws logs put-subscription-filter \
    --log-group-name myLogGroup \
    --filter-name demo \
    --filter-pattern "" \
    --destination-arn arn:aws:lambda:region:123456789123:function:helloworld
```

7. (Optional) Test using a sample log event. At a command prompt, run the following command, which will put a simple log message into the subscribed stream.

   To see the output of your Lambda function, navigate to the Lambda function where you will see the output in /aws/lambda/helloworld:

```
aws logs put-log-events --log-group-name myLogGroup --log-stream-name stream1 --
log-events "[{\"timestamp\":<CURRENT TIMESTAMP MILLIS> , \"message\": \"Simple
 Lambda Test\"}]"
```

   You should expect to see a response with an array of Lambda. The **Data** attribute in the Lambda record is base64 encoded and compressed with the gzip format. The actual payload that Lambda receives is in the following format `{ "awslogs": {"data": "BASE64ENCODED_GZIP_COMPRESSED_DATA"} }` You can examine the raw data from the command line using the following Unix commands:

```
echo -n "<BASE64ENCODED_GZIP_COMPRESSED_DATA>" | base64 -d | zcat
```

   The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
    "owner": "123456789012",
    "logGroup": "CloudTrail",
    "logStream": "123456789012_CloudTrail_us-east-1",
    "subscriptionFilters": [
        "Destination"
    ],
    "messageType": "DATA_MESSAGE",
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424298221568",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221569",
            "timestamp": 1432826855000,
```

```
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221570",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        }
    ]
}
```

The key elements in the above data structure are the following:

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

messageType

Data messages will use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs may emit Lambda records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

logEvents

The actual log data, represented as an array of log event records. The "id" property is a unique identifier for every log event.

Example 3: Subscription filters with Amazon Data Firehose

In this example, you'll create a CloudWatch Logs subscription that sends any incoming log events that match your defined filters to your Amazon Data Firehose delivery stream. Data sent from CloudWatch Logs to Amazon Data Firehose is already compressed with gzip level 6 compression, so you do not need to use compression within your Firehose delivery stream. You can then use the decompression feature in Firehose to automatically decompress the logs. For more information, see Send CloudWatch Logs to Firehose.

> **Note**
>
> Before you create the Firehose stream, calculate the volume of log data that will be generated. Be sure to create a Firehose stream that can handle this volume. If the stream cannot handle the volume, the log stream will be throttled. For more information about Firehose stream volume limits, see Amazon Data Firehose Data Limits.

To create a subscription filter for Firehose

1. Create an Amazon Simple Storage Service (Amazon S3) bucket. We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, skip to step 2.

   Run the following command, replacing the placeholder Region with the Region you want to use:

   ```
   aws s3api create-bucket --bucket amzn-s3-demo-bucket2 --create-bucket-configuration
    LocationConstraint=region
   ```

   The following is example output:

   ```
   {
       "Location": "/amzn-s3-demo-bucket2"
   }
   ```

2. Create the IAM role that grants Amazon Data Firehose permission to put data into your Amazon S3 bucket.

For more information, see Controlling Access with Amazon Data Firehose in the *Amazon Data Firehose Developer Guide*.

First, use a text editor to create a trust policy in a file ~/TrustPolicyForFirehose.json as follows:

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "firehose.amazonaws.com" },
    "Action": "sts:AssumeRole"
    }
}
```

3. Use the **create-role** command to create the IAM role, specifying the trust policy file. Note of the returned **Role.Arn** value, as you will need it in a later step:

```
aws iam create-role \
 --role-name FirehosetoS3Role \
 --assume-role-policy-document file://~/TrustPolicyForFirehose.json

{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "firehose.amazonaws.com"
                }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2015-05-29T13:46:29.431Z",
        "RoleName": "FirehosetoS3Role",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/FirehosetoS3Role"
    }
}
```

4. Create a permissions policy to define what actions Firehose can do on your account. First, use a text editor to create a permissions policy in a file ~/PermissionsForFirehose.json:

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
          "s3:AbortMultipartUpload",
          "s3:GetBucketLocation",
          "s3:GetObject",
          "s3:ListBucket",
          "s3:ListBucketMultipartUploads",
          "s3:PutObject" ],
      "Resource": [
          "arn:aws:s3:::amzn-s3-demo-bucket2",
          "arn:aws:s3:::amzn-s3-demo-bucket2/*" ]
    }
  ]
}
```

5. Associate the permissions policy with the role using the following put-role-policy command:

```
aws iam put-role-policy --role-name FirehosetoS3Role --policy-name Permissions-
Policy-For-Firehose --policy-document file://~/PermissionsForFirehose.json
```

6. Create a destination Firehose delivery stream as follows, replacing the placeholder values for **RoleARN** and **BucketARN** with the role and bucket ARNs that you created:

```
aws firehose create-delivery-stream \
   --delivery-stream-name 'my-delivery-stream' \
   --s3-destination-configuration \
  '{"RoleARN": "arn:aws:iam::123456789012:role/FirehosetoS3Role", "BucketARN":
 "arn:aws:s3:::amzn-s3-demo-bucket2"}'
```

Note that Firehose automatically uses a prefix in YYYY/MM/DD/HH UTC time format for delivered Amazon S3 objects. You can specify an extra prefix to be added in front of the time format prefix. If the prefix ends with a forward slash (/), it appears as a folder in the Amazon S3 bucket.

7. Wait until the stream becomes active (this might take a few minutes). You can use the Firehose **describe-delivery-stream** command to check the

DeliveryStreamDescription.DeliveryStreamStatus property. In addition, note the **DeliveryStreamDescription.DeliveryStreamARN** value, as you will need it in a later step:

```
aws firehose describe-delivery-stream --delivery-stream-name "my-delivery-stream"
{
    "DeliveryStreamDescription": {
        "HasMoreDestinations": false,
        "VersionId": "1",
        "CreateTimestamp": 1446075815.822,
        "DeliveryStreamARN": "arn:aws:firehose:us-
east-1:123456789012:deliverystream/my-delivery-stream",
        "DeliveryStreamStatus": "ACTIVE",
        "DeliveryStreamName": "my-delivery-stream",
        "Destinations": [
            {
                "DestinationId": "destinationId-000000000001",
                "S3DestinationDescription": {
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "RoleARN": "delivery-stream-role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket2",
                    "BufferingHints": {
                        "IntervalInSeconds": 300,
                        "SizeInMBs": 5
                    }
                }
            }
        ]
    }
}
```

8. Create the IAM role that grants CloudWatch Logs permission to put data into your Firehose delivery stream. First, use a text editor to create a trust policy in a file `~/TrustPolicyForCWL.json`:

   This policy includes a `aws:SourceArn` global condition context key to help prevent the confused deputy security problem. For more information, see Confused deputy prevention.

```
{
  "Statement": {
```

```
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole",
    "Condition": {
         "StringLike": {
             "aws:SourceArn": "arn:aws:logs:region:123456789012:*"
         }
     }
  }
}
```

9. Use the **create-role** command to create the IAM role, specifying the trust policy file. Note of the returned **Role.Arn** value, as you will need it in a later step:

```
aws iam create-role \
--role-name CWLtoKinesisFirehoseRole \
--assume-role-policy-document file://~/TrustPolicyForCWL.json

{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.amazonaws.com"
                },
                "Condition": {
                     "StringLike": {
                         "aws:SourceArn": "arn:aws:logs:region:123456789012:*"
                     }
                 }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2015-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisFirehoseRole",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/CWLtoKinesisFirehoseRole"
    }
}
```

10. Create a permissions policy to define what actions CloudWatch Logs can do on your account. First, use a text editor to create a permissions policy file (for example, ~/PermissionsForCWL.json):

```
{
    "Statement":[
      {
        "Effect":"Allow",
        "Action":["firehose:PutRecord"],
        "Resource":[
            "arn:aws:firehose:region:account-id:deliverystream/delivery-stream-
name"]
      }
    ]
}
```

11. Associate the permissions policy with the role using the put-role-policy command:

```
aws iam put-role-policy --role-name CWLtoKinesisFirehoseRole --policy-
name Permissions-Policy-For-CWL --policy-document file://~/PermissionsForCWL.json
```

12. After the Amazon Data Firehose delivery stream is in active state and you have created the IAM role, you can create the CloudWatch Logs subscription filter. The subscription filter immediately starts the flow of real-time log data from the chosen log group to your Amazon Data Firehose delivery stream:

```
aws logs put-subscription-filter \
    --log-group-name "CloudTrail" \
    --filter-name "Destination" \
    --filter-pattern "{$.userIdentity.type = Root}" \
    --destination-arn "arn:aws:firehose:region:123456789012:deliverystream/my-
delivery-stream" \
    --role-arn "arn:aws:iam::123456789012:role/CWLtoKinesisFirehoseRole"
```

13. After you set up the subscription filter, CloudWatch Logs will forward all the incoming log events that match the filter pattern to your Amazon Data Firehose delivery stream. Your data will start appearing in your Amazon S3 based on the time buffer interval set on your Amazon Data Firehose delivery stream. Once enough time has passed, you can verify your data by checking your Amazon S3 Bucket.

```
aws s3api list-objects --bucket 'amzn-s3-demo-bucket2' --prefix 'firehose/'
```

```
{
    "Contents": [
        {
            "LastModified": "2015-10-29T00:01:25.000Z",
            "ETag": "\"a14589f8897f4089d3264d9e2d1f1610\"",
            "StorageClass": "STANDARD",
            "Key": "firehose/2015/10/29/00/my-delivery-stream-2015-10-29-00-01-21-
a188030a-62d2-49e6-b7c2-b11f1a7ba250",
            "Owner": {
                "DisplayName": "cloudwatch-logs",
                "ID": "1ec9cf700ef6be062b19584e0b7d84ecc19237f87b5"
            },
            "Size": 593
        },
        {
            "LastModified": "2015-10-29T00:35:41.000Z",
            "ETag": "\"a7035b65872bb2161388ffb63dd1aec5\"",
            "StorageClass": "STANDARD",
            "Key": "firehose/2015/10/29/00/my-delivery-
stream-2015-10-29-00-35-40-7cc92023-7e66-49bc-9fd4-fc9819cc8ed3",
            "Owner": {
                "DisplayName": "cloudwatch-logs",
                "ID": "1ec9cf700ef6be062b19584e0b7d84ecc19237f87b6"
            },
            "Size": 5752
        }
    ]
}
```

```
aws s3api get-object --bucket 'amzn-s3-demo-bucket2' --key 'firehose/2015/10/29/00/
my-delivery-stream-2015-10-29-00-01-21-a188030a-62d2-49e6-b7c2-b11f1a7ba250'
 testfile.gz

{
    "AcceptRanges": "bytes",
    "ContentType": "application/octet-stream",
    "LastModified": "Thu, 29 Oct 2015 00:07:06 GMT",
    "ContentLength": 593,
    "Metadata": {}
}
```

The data in the Amazon S3 object is compressed with the gzip format. You can examine the raw data from the command line using the following Unix command:

```
zcat testfile.gz
```

Example 4: Subscription filters with Amazon OpenSearch Service

In this example, you'll create a CloudWatch Logs subscription that sends incoming log events that match your defined filters to your OpenSearch Service domain.

To create a subscription filter for OpenSearch Service

1. Create an OpenSearch Service domain. For more information, see Creating OpenSearch Service domains
2. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
3. In the navigation pane, choose **Log groups**.
4. Select the name of the log group.
5. Choose **Actions**, **Subscription filters**, **Create Amazon OpenSearch Service subscription filter**.
6. Choose whether you want to stream to a cluster in this account or another account.
   - If you chose **This account**, select the domain that you created in step 1.
   - If you chose **Another account**, enter ARN and endpoint of that domain.
7. If you chose another account, provide the domain ARN and endpoint.
8. For **Lambda IAM Execution Role**, choose the IAM role that Lambda should use when executing calls to OpenSearch Service. The IAM role that you choose must fulfill these requirements:
   - It must have `lambda.amazonaws.com` in the trust relationship.
   - It must include the following policy:

```
{
    "Version": "2012-10-17",
    "Statement": [{
        "Action": [
            "es:*"
        ],
        "Effect": "Allow",
```

```
        "Resource": "arn:aws:es:region:account-id:domain/target-domain-name/*"
    }]
}
```

- If the target OpenSearch Service domain uses VPC accdess, the IAM role must also have the **AWSLambdaVPCAccessExecutionRole** policy attached. This Amazon-managed policy grants Lambda access to the customer's VPC, enabling Lambda to write to the OpenSearch endpoint in the VPC.

9. Choose a log format.
10. For **Subscription filter pattern**, enter the terms or pattern to find in your log events. This ensures that you send only the data that you're interested in to your OpenSearch Service cluster. For more information, see Filter pattern syntax for metric filters.
11. (Optional) For **Select log data to test**, select a log stream and then choose **Test pattern** to verify that your search filter is returning the results you expect.
12. Choose **Start streaming**.

Account-level subscription filters

> **Important**
>
> There is a risk of causing an infinite recursive loop with subscription filters that can lead to a large increase in ingestion billing if not addressed. To mitigate this risk, we recommend that you use selection criteria in your account-level subscription filters to exclude log groups that ingest log data from resources that are part of the subscription delivery workflow. For more information on this problem and determining which log groups to exclude, see Log recursion prevention.

You can set an account-level subscription policy that includes a subset of log groups in the account. The account subscription policy can work with Amazon Kinesis Data Streams, Amazon Lambda, or Amazon Data Firehose. Logs sent to a service through an account-level subscription policy are base64 encoded and compressed with the gzip format. This section provides examples you can follow to create an account-level subscription for Kinesis Data Streams, Lambda, and Firehose.

Note

To view a list of all subscription filter policies in your account, use the `describe-account-policies` command with a value of `SUBSCRIPTION_FILTER_POLICY` for the `--policy-type` parameter. For more information, see describe-account-policies¶.

Examples

- Example 1: Subscription filters with Kinesis Data Streams
- Example 2: Subscription filters with Amazon Lambda
- Example 3: Subscription filters with Amazon Data Firehose

Example 1: Subscription filters with Kinesis Data Streams

Before you create a Kinesis Data Streams data stream to use with an account-level subscription policy, calculate the volume of log data that will be generated. Be sure to create a stream with enough shards to handle this volume. If a stream doesn't have enough shards, it is throttled. For more information about stream volume limits, see Quotas and Limits in the Kinesis Data Streams documentation.

Warning

Because the log events of multiple log groups are forwarded to the destination, there is a risk of throttling. Throttled deliverables are retried for up to 24 hours. After 24 hours, the failed deliverables are dropped.
To mitigate the risk of throttling, you can take the following steps:

- Monitor your Kinesis Data Streams stream with CloudWatch metrics. This helps you identify throttling and adjust your configuration accordingly. For example, the `DeliveryThrottling` metric tracks the number of log events for which CloudWatch Logs was throttled when forwarding data to the subscription destination. For more information, see Monitoring with CloudWatch metrics.
- Use the on-demand capacity mode for your stream in Kinesis Data Streams. On-demand mode instantly accommodates your workloads as they ramp up or down. For more information, see On-demand mode.

- Restrict your CloudWatch Logs subscription filter pattern to match the capacity of your stream in Kinesis Data Streams. If you are sending too much data to the stream, you might need to reduce the filter size or adjust the filter criteria.

The following example uses an account-level subscription policy to forward all log events to a stream in Kinesis Data Streams. The filter pattern matches any log events with the text `Test` and forwards them to the stream in Kinesis Data Streams.

To create an account-level subscription policy for Kinesis Data Streams

1. Create a destination stream using the following command:

```
$ C:\>  aws kinesis create-stream –stream-name "TestStream" –shard-count 1
```

2. Wait a few minutes for the stream to become active. You can verify whether the stream is active by using the [describe-stream] command to check the **StreamDescription.StreamStatus** property.

```
aws kinesis describe-stream --stream-name "TestStream"
```

The following is example output:

```
{
    "StreamDescription": {
        "StreamStatus": "ACTIVE",
        "StreamName": "TestStream",
        "StreamARN": "arn:aws:kinesis:region:123456789012:stream/TestStream",
        "Shards": [
            {
                "ShardId": "shardId-000000000000",
                "HashKeyRange": {
                    "EndingHashKey": "EXAMPLE846346337460743176821145 5",
                    "StartingHashKey": "0"
                },
                "SequenceNumberRange": {
                    "StartingSequenceNumber":
                    "EXAMPLE688818456679503831981458784591352702181572610"
                }
            }
        ]
```

```
    }
}
```

3. Create the IAM role that will grant CloudWatch Logs permission to put data into your stream. First, you'll need to create a trust policy in a file (for example, `~/TrustPolicyForCWL-Kinesis.json`). Use a text editor to create this policy.

   This policy includes a `aws:SourceArn` global condition context key to help prevent the confused deputy security problem. For more information, see Confused deputy prevention.

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole",
    "Condition": {
        "StringLike": { "aws:SourceArn": "arn:aws:logs:region:123456789012:*" }
     }
   }
}
```

4. Use the **create-role** command to create the IAM role, specifying the trust policy file. Note the returned **Role.Arn** value, as you will also need it for a later step:

```
aws iam create-role --role-name CWLtoKinesisRole --assume-role-policy-document
 file://~/TrustPolicyForCWL-Kinesis.json
```

   The following is an example of the output.

```
{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.amazonaws.com"
                },
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": { "arn:aws:logs:region:123456789012:*" }
                    }
```

```
                }
            }
        },
        "RoleId": "EXAMPLE450GAB4HC5F431",
        "CreateDate": "2023-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisRole",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/CWLtoKinesisRole"
    }
}
```

5. Create a permissions policy to define what actions CloudWatch Logs can do on your account. First, you'll create a permissions policy in a file (for example, `~/PermissionsForCWL-Kinesis.json`). Use a text editor to create this policy. Don't use the IAM console to create it.

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:region:123456789012:stream/TestStream"
    }
  ]
}
```

6. Associate the permissions policy with the role using the following put-role-policy command:

```
aws iam put-role-policy  --role-name CWLtoKinesisRole  --policy-name Permissions-Policy-For-CWL  --policy-document file://~/PermissionsForCWL-Kinesis.json
```

7. After the stream is in the **Active** state and you have created the IAM role, you can create the CloudWatch Logs subscription filter policy. The policy immediately starts the flow of real-time log data to your stream. In this example, all log events that contain the string ERROR are streamed, except those in the log groups named `LogGroupToExclude1` and `LogGroupToExclude2`.

```
aws logs put-account-policy \
    --policy-name "ExamplePolicy" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document '{"RoleArn":"arn:aws:iam::123456789012:role/
CWLtoKinesisRole", "DestinationArn":"arn:aws:kinesis:region:123456789012:stream/
TestStream", "FilterPattern": "Test", "Distribution": "Random"}' \
```

```
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

8. After you set up the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern and selection criteria to your stream.

   The `selection-criteria` field is optional, but is important for excluding log groups that can cause an infinite log recursion from a subscription filter. For more information about this issue and determining which log groups to exclude, see Log recursion prevention. Currently, NOT IN is the only supported operator for `selection-criteria`.

   You can verify that the flow of log events by by using a Kinesis Data Streams shard iterator and using the Kinesis Data Streams `get-records` command to fetch some Kinesis Data Streams records::

```
aws kinesis get-shard-iterator --stream-name TestStream --shard-id
 shardId-000000000000 --shard-iterator-type TRIM_HORIZON
```

```
{
    "ShardIterator":
    "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL
+wev+e2P4djJg4L9wmXKvQYoE+rMUiFq
+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f+OIK8zM5My8ID
+g6rMo7UKWeI4+IWiK2OSh0uP"
}
```

```
aws kinesis get-records --limit 10 --shard-iterator "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL
+wev+e2P4djJg4L9wmXKvQYoE+rMUiFq
+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f+OIK8zM5My8ID
+g6rMo7UKWeI4+IWiK2OSh0uP"
```

   You might need to use this command a few times before Kinesis Data Streams starts to return data.

   You should expect to see a response with an array of records. The **Data** attribute in a Kinesis Data Streams record is base64 encoded and compressed with the gzip format. You can examine the raw data from the command line using the following Unix commands:

```
echo -n "<Content of Data>" | base64 -d | zcat
```

The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
    "messageType": "DATA_MESSAGE",
    "owner": "123456789012",
    "logGroup": "Example1",
    "logStream": "logStream1",
    "subscriptionFilters": [
        "ExamplePolicy"
    ],
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424298221568",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221569",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221570",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        }
    ],
    "policyLevel": "ACCOUNT_LEVEL_POLICY"
}
```

The key elements in the data structure are the following:

messageType

Data messages will use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs might emit Kinesis Data Streams records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

logEvents

The actual log data, represented as an array of log event records. The "id" property is a unique identifier for every log event.

policyLevel

The level at which the policy was enforced. "ACCOUNT_LEVEL_POLICY" is the `policyLevel` for an account-level subscription filter policy.

Example 2: Subscription filters with Amazon Lambda

In this example, you'll create a CloudWatch Logs account-level subscription filter policy that sends log data to your Amazon Lambda function.

> **Warning**
>
> Before you create the Lambda function, calculate the volume of log data that will be generated. Be sure to create a function that can handle this volume. If the function can't handle the volume, the log stream will be throttled. Because the log events of either all log

groups or a subset of the account's log groups are forwarded to the destination, there is a risk of throttling. For more information about Lambda limits, see Amazon Lambda Limits.

To create an account-level subscription filter policy for Lambda

1. Create the Amazon Lambda function.

   Ensure that you have set up the Lambda execution role. For more information, see Step 2.2: Create an IAM Role (execution role) in the *Amazon Lambda Developer Guide*.

2. Open a text editor and create a file named `helloWorld.js` with the following contents:

```
var zlib = require('zlib');
exports.handler = function(input, context) {
    var payload = Buffer.from(input.awslogs.data, 'base64');
    zlib.gunzip(payload, function(e, result) {
        if (e) {
            context.fail(e);
        } else {
            result = JSON.parse(result.toString());
            console.log("Event Data:", JSON.stringify(result, null, 2));
            context.succeed();
        }
    });
};
```

3. Zip the file helloWorld.js and save it with the name `helloWorld.zip`.

4. Use the following command, where the role is the Lambda execution role you set up in the first step:

```
aws lambda create-function \
    --function-name helloworld \
    --zip-file fileb://file-path/helloWorld.zip \
    --role lambda-execution-role-arn \
    --handler helloWorld.handler \
    --runtime nodejs18.x
```

5. Grant CloudWatch Logs the permission to execute your function. Use the following command, replacing the placeholder account with your own account.

```
aws lambda add-permission \
```

```
    --function-name "helloworld" \
    --statement-id "helloworld" \
    --principal "logs.amazonaws.com" \
    --action "lambda:InvokeFunction" \
    --source-arn "arn:aws:logs:region:123456789012:log-group:*" \
    --source-account "123456789012"
```

6. Create an account-level subscription filter policy using the following command, replacing the placeholder account with your own account. In this example, all log events that contain the string ERROR are streamed, except those in the log groups named `LogGroupToExclude1` and `LogGroupToExclude2`.

```
aws logs put-account-policy \
    --policy-name "ExamplePolicyLambda" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document
 '{"DestinationArn":"arn:aws:lambda:region:123456789012:function:helloWorld",
 "FilterPattern": "Test", "Distribution": "Random"}' \
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

   After you set up the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern and selection criteria to your stream.

   The `selection-criteria` field is optional, but is important for excluding log groups that can cause an infinite log recursion from a subscription filter. For more information about this issue and determining which log groups to exclude, see Log recursion prevention. Currently, NOT IN is the only supported operator for `selection-criteria`.

7. (Optional) Test using a sample log event. At a command prompt, run the following command, which will put a simple log message into the subscribed stream.

   To see the output of your Lambda function, navigate to the Lambda function where you will see the output in /aws/lambda/helloworld:

```
aws logs put-log-events --log-group-name Example1 --log-stream-name logStream1 --
log-events "[{\"timestamp\":CURRENT TIMESTAMP MILLIS , \"message\": \"Simple Lambda
 Test\"}]"
```

You should expect to see a response with an array of Lambda. The **Data** attribute in the Lambda record is base64 encoded and compressed with the gzip format. The actual payload that Lambda receives is in the following format `{ "awslogs": {"data": "BASE64ENCODED_GZIP_COMPRESSED_DATA"} }` You can examine the raw data from the command line using the following Unix commands:

```
echo -n "<BASE64ENCODED_GZIP_COMPRESSED_DATA>" | base64 -d | zcat
```

The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
    "messageType": "DATA_MESSAGE",
    "owner": "123456789012",
    "logGroup": "Example1",
    "logStream": "logStream1",
    "subscriptionFilters": [
        "ExamplePolicyLambda"
    ],
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424298221568",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221569",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298221570",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":
\"Root\"}"
        }
    ],
    "policyLevel": "ACCOUNT_LEVEL_POLICY"
```

```
}
```

> **Note**
>
> The account-level subscription filter will not be applied to the destination Lambda function's log group. This is to prevent an infinite log recursion that can lead to an increase in ingestion billing. For more information about this problem, see Log recursion prevention .

The key elements in the data structure are the following:

messageType

Data messages will use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs might emit Kinesis Data Streams records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

logEvents

The actual log data, represented as an array of log event records. The "id" property is a unique identifier for every log event.

policyLevel

The level at which the policy was enforced. "ACCOUNT_LEVEL_POLICY" is the `policyLevel` for an account-level subscription filter policy.

Example 3: Subscription filters with Amazon Data Firehose

In this example, you'll create a CloudWatch Logs account-level subscription filter policy that sends incoming log events that match your defined filters to your Amazon Data Firehose delivery stream. Data sent from CloudWatch Logs to Amazon Data Firehose is already compressed with gzip level 6 compression, so you do not need to use compression within your Firehose delivery stream. You can then use the decompression feature in Firehose to automatically decompress the logs. For more information, see Writing to Kinesis Data Firehose Using CloudWatch Logs.

Warning

Before you create the Firehose stream, calculate the volume of log data that will be generated. Be sure to create a Firehose stream that can handle this volume. If the stream cannot handle the volume, the log stream will be throttled. For more information about Firehose stream volume limits, see Amazon Data Firehose Data Limits.

To create a subscription filter for Firehose

1. Create an Amazon Simple Storage Service (Amazon S3) bucket. We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, skip to step 2.

   Run the following command, replacing the placeholder Region with the Region you want to use:

   ```
   aws s3api create-bucket --bucket amzn-s3-demo-bucket2 --create-bucket-configuration
    LocationConstraint=region
   ```

   The following is example output:

   ```
   {
       "Location": "/amzn-s3-demo-bucket2"
   }
   ```

2. Create the IAM role that grants Amazon Data Firehose permission to put data into your Amazon S3 bucket.

For more information, see Controlling Access with Amazon Data Firehose in the *Amazon Data Firehose Developer Guide*.

First, use a text editor to create a trust policy in a file ~/TrustPolicyForFirehose.json as follows:

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "firehose.amazonaws.com" },
    "Action": "sts:AssumeRole"
    }
}
```

3. Use the **create-role** command to create the IAM role, specifying the trust policy file. Keep a note of the returned **Role.Arn** value, as you will need it in a later step:

```
aws iam create-role \
 --role-name FirehosetoS3Role \
 --assume-role-policy-document file://~/TrustPolicyForFirehose.json

{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "firehose.amazonaws.com"
                }
            }
        },
        "RoleId": "EXAMPLE50GAB4HC5F431",
        "CreateDate": "2023-05-29T13:46:29.431Z",
        "RoleName": "FirehosetoS3Role",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/FirehosetoS3Role"
    }
}
```

4. Create a permissions policy to define what actions Firehose can do on your account. First, use a text editor to create a permissions policy in a file ~/PermissionsForFirehose.json:

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
          "s3:AbortMultipartUpload",
          "s3:GetBucketLocation",
          "s3:GetObject",
          "s3:ListBucket",
          "s3:ListBucketMultipartUploads",
          "s3:PutObject" ],
      "Resource": [
          "arn:aws:s3:::amzn-s3-demo-bucket2",
          "arn:aws:s3:::amzn-s3-demo-bucket2/*" ]
    }
  ]
}
```

5. Associate the permissions policy with the role using the following put-role-policy command:

```
aws iam put-role-policy --role-name FirehosetoS3Role --policy-name Permissions-
Policy-For-Firehose --policy-document file://~/PermissionsForFirehose.json
```

6. Create a destination Firehose delivery stream as follows, replacing the placeholder values for **RoleARN** and **BucketARN** with the role and bucket ARNs that you created:

```
aws firehose create-delivery-stream \
   --delivery-stream-name 'my-delivery-stream' \
   --s3-destination-configuration \
  '{"RoleARN": "arn:aws:iam::123456789012:role/FirehosetoS3Role", "BucketARN":
 "arn:aws:s3:::amzn-s3-demo-bucket2"}'
```

   NFirehose automatically uses a prefix in YYYY/MM/DD/HH UTC time format for delivered Amazon S3 objects. You can specify an extra prefix to be added in front of the time format prefix. If the prefix ends with a forward slash (/), it appears as a folder in the Amazon S3 bucket.

7. Wait a few minutes for the stream becomes active. You can use the Firehose **describe-delivery-stream** command to check the **DeliveryStreamDescription.DeliveryStreamStatus**

property. In addition, note the **DeliveryStreamDescription.DeliveryStreamARN** value, as you will need it in a later step:

```
aws firehose describe-delivery-stream --delivery-stream-name "my-delivery-stream"
{
    "DeliveryStreamDescription": {
        "HasMoreDestinations": false,
        "VersionId": "1",
        "CreateTimestamp": 1446075815.822,
        "DeliveryStreamARN": "arn:aws:firehose:us-
east-1:123456789012:deliverystream/my-delivery-stream",
        "DeliveryStreamStatus": "ACTIVE",
        "DeliveryStreamName": "my-delivery-stream",
        "Destinations": [
            {
                "DestinationId": "destinationId-000000000001",
                "S3DestinationDescription": {
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "RoleARN": "delivery-stream-role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket2",
                    "BufferingHints": {
                        "IntervalInSeconds": 300,
                        "SizeInMBs": 5
                    }
                }
            }
        ]
    }
}
```

8. Create the IAM role that grants CloudWatch Logs permission to put data into your Firehose delivery stream. First, use a text editor to create a trust policy in a file `~/TrustPolicyForCWL.json`:

   This policy includes a `aws:SourceArn` global condition context key to help prevent the confused deputy security problem. For more information, see Confused deputy prevention.

```
{
  "Statement": {
```

```
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole",
    "Condition": {
         "StringLike": {
             "aws:SourceArn": "arn:aws:logs:region:123456789012:*"
         }
     }
  }
}
```

9. Use the **create-role** command to create the IAM role, specifying the trust policy file. Make a note of the returned **Role.Arn** value, as you will need it in a later step:

```
aws iam create-role \
--role-name CWLtoKinesisFirehoseRole \
--assume-role-policy-document file://~/TrustPolicyForCWL.json

{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.amazonaws.com"
                },
                "Condition": {
                     "StringLike": {
                         "aws:SourceArn": "arn:aws:logs:region:123456789012:*"
                     }
                 }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2015-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisFirehoseRole",
        "Path": "/",
        "Arn": "arn:aws:iam::123456789012:role/CWLtoKinesisFirehoseRole"
    }
}
```

10. Create a permissions policy to define what actions CloudWatch Logs can do on your account. First, use a text editor to create a permissions policy file (for example, ~/PermissionsForCWL.json):

```
{
    "Statement":[
      {
        "Effect":"Allow",
        "Action":["firehose:PutRecord"],
        "Resource":[
            "arn:aws:firehose:region:account-id:deliverystream/delivery-stream-
name"]
      }
    ]
}
```

11. Associate the permissions policy with the role using the put-role-policy command:

```
aws iam put-role-policy --role-name CWLtoKinesisFirehoseRole --policy-
name Permissions-Policy-For-CWL --policy-document file://~/PermissionsForCWL.json
```

12. After the Amazon Data Firehose delivery stream is in the active state and you have created the IAM role, you can create the CloudWatch Logs account-level subscription filter policy. The policy immediately starts the flow of real-time log data from the chosen log group to your Amazon Data Firehose delivery stream:

```
aws logs put-account-policy \
    --policy-name "ExamplePolicyFirehose" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document '{"RoleArn":"arn:aws:iam::123456789012:role/
CWLtoKinesisFirehoseRole", "DestinationArn":"arn:aws:firehose:us-
east-1:123456789012:deliverystream/delivery-stream-name", "FilterPattern": "Test",
 "Distribution": "Random"}' \
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

13. After you set up the subscription filter, CloudWatch Logs forwards the incoming log events that match the filter pattern to your Amazon Data Firehose delivery stream.

    The `selection-criteria` field is optional, but is important for excluding log groups that can cause an infinite log recursion from a subscription filter. For more information about this

issue and determining which log groups to exclude, see Log recursion prevention. Currently, NOT IN is the only supported operator for `selection-criteria`.

Your data will start appearing in your Amazon S3 based on the time buffer interval set on your Amazon Data Firehose delivery stream. Once enough time has passed, you can verify your data by checking your Amazon S3 Bucket.

```
aws s3api list-objects --bucket 'amzn-s3-demo-bucket2' --prefix 'firehose/'
{
    "Contents": [
        {
            "LastModified": "2023-10-29T00:01:25.000Z",
            "ETag": "\"a14589f8897f4089d3264d9e2d1f1610\"",
            "StorageClass": "STANDARD",
            "Key": "firehose/2015/10/29/00/my-delivery-stream-2015-10-29-00-01-21-
a188030a-62d2-49e6-b7c2-b11f1a7ba250",
            "Owner": {
                "DisplayName": "cloudwatch-logs",
                "ID": "1ec9cf700ef6be062b19584e0b7d84ecc19237f87b5"
            },
            "Size": 593
        },
        {
            "LastModified": "2015-10-29T00:35:41.000Z",
            "ETag": "\"a7035b65872bb2161388ffb63dd1aec5\"",
            "StorageClass": "STANDARD",
            "Key": "firehose/2023/10/29/00/my-delivery-stream-2023-10-29-00-35-40-
EXAMPLE-7e66-49bc-9fd4-fc9819cc8ed3",
            "Owner": {
                "DisplayName": "cloudwatch-logs",
                "ID": "EXAMPLE6be062b19584e0b7d84ecc19237f87b6"
            },
            "Size": 5752
        }
    ]
}
```

```
aws s3api get-object --bucket 'amzn-s3-demo-bucket2' --key 'firehose/2023/10/29/00/
my-delivery-stream-2023-10-29-00-01-21-a188030a-62d2-49e6-b7c2-b11f1a7ba250'
 testfile.gz

{
```

```
    "AcceptRanges": "bytes",
    "ContentType": "application/octet-stream",
    "LastModified": "Thu, 29 Oct 2023 00:07:06 GMT",
    "ContentLength": 593,
    "Metadata": {}
}
```

The data in the Amazon S3 object is compressed with the gzip format. You can examine the raw data from the command line using the following Unix command:

```
zcat testfile.gz
```

Cross-account cross-Region subscriptions

You can collaborate with an owner of a different Amazon account and receive their log events on your Amazon resources, such as an Amazon Kinesis or Amazon Data Firehose stream (this is known as cross-account data sharing). For example, this log event data can be read from a centralized Kinesis Data Streams or Firehose stream to perform custom processing and analysis. Custom processing is especially useful when you collaborate and analyze data across many accounts.

For example, a company's information security group might want to analyze data for real-time intrusion detection or anomalous behaviors so it could conduct an audit of accounts in all divisions in the company by collecting their federated production logs for central processing. A real-time stream of event data across those accounts can be assembled and delivered to the information security groups, who can use Kinesis Data Streams to attach the data to their existing security analytic systems.

> **Note**
>
> The log group and the destination must be in the same Amazon Region. However, the Amazon resource that the destination points to can be located in a different Region. In the examples in the following sections, all Region-specific resources are created in US East (N. Virginia)).

Topics

- Cross-account cross-Region log data sharing using Kinesis Data Streams

Cross-account cross-Region log data sharing using Kinesis Data Streams

When you create a cross-account subscription, you can specify a single account or an organization to be the sender. If you specify an organization, then this procedure enables all accounts in the organization to send logs to the receiver account.

To share log data across accounts, you need to establish a log data sender and receiver:

- **Log data sender**—gets the destination information from the recipient and lets CloudWatch Logs know that it's ready to send its log events to the specified destination. In the procedures in the rest of this section, the log data sender is shown with a fictional Amazon account number of 111111111111.

  If you're going to have multiple accounts in one organization send logs to one recipient account, you can create a policy that grants all accounts in the organization the permission to send logs to the recipient account. You still have to set up separate subscription filters for each sender account.
- **Log data recipient**—sets up a destination that encapsulates a Kinesis Data Streams stream and lets CloudWatch Logs know that the recipient wants to receive log data. The recipient then shares the information about this destination with the sender. In the procedures in the rest of this section, the log data recipient is shown with a fictional Amazon account number of 999999999999.

To start receiving log events from cross-account users, the log data recipient first creates a CloudWatch Logs destination. Each destination consists of the following key elements:

Destination name

The name of the destination you want to create.

Target ARN

The Amazon Resource Name (ARN) of the Amazon resource that you want to use as the destination of the subscription feed.

Role ARN

An Amazon Identity and Access Management (IAM) role that grants CloudWatch Logs the necessary permissions to put data into the chosen stream.

Access policy

An IAM policy document (in JSON format, written using IAM policy grammar) that governs the set of users that are allowed to write to your destination.

> **Note**
>
> The log group and the destination must be in the same Amazon Region. However, the Amazon resource that the destination points to can be located in a different Region. In the examples in the following sections, all Region-specific resources are created in US East (N. Virginia).

Topics

Setting up a new cross-account subscription

Follow the steps in these sections to set up a new cross-account log subscription.

Topics

Step 1: Create a destination

> **Important**
>
> All steps in this procedure are to be done in the log data recipient account.

For this example, the log data recipient account has an Amazon account ID of 999999999999, while the log data sender Amazon account ID is 111111111111.

This example creates a destination using a Kinesis Data Streams stream called RecipientStream, and a role that enables CloudWatch Logs to write data to it.

When the destination is created, CloudWatch Logs sends a test message to the destination on the recipient account's behalf. When the subscription filter is active later, CloudWatch Logs sends log events to the destination on the source account's behalf.

To create a destination

1. In the recipient account, create a destination stream in Kinesis Data Streams. At a command prompt, type:

   ```
   aws kinesis create-stream --stream-name "RecipientStream" --shard-count 1
   ```

2. Wait until the stream becomes active. You can use the **aws kinesis describe-stream** command to check the **StreamDescription.StreamStatus** property. In addition, take note of the **StreamDescription.StreamARN** value because you will pass it to CloudWatch Logs later:

   ```
   aws kinesis describe-stream --stream-name "RecipientStream"
   {
     "StreamDescription": {
       "StreamStatus": "ACTIVE",
       "StreamName": "RecipientStream",
       "StreamARN": "arn:aws:kinesis:us-east-1:999999999999:stream/RecipientStream",
       "Shards": [
         {
           "ShardId": "shardId-000000000000",
           "HashKeyRange": {
             "EndingHashKey": "340282366920938463463374607431768EXAMPLE",
             "StartingHashKey": "0"
           },
   ```

```
        "SequenceNumberRange": {
          "StartingSequenceNumber":
 "49551135218688818456679503831981458784591352702 18EXAMPLE"
        }
      }
    ]
  }
}
```

It might take a minute or two for your stream to show up in the active state.

3. Create the IAM role that grants CloudWatch Logs the permission to put data into your stream. First, you'll need to create a trust policy in a file **~/TrustPolicyForCWL.json**. Use a text editor to create this policy file, do not use the IAM console.

   This policy includes a `aws:SourceArn` global condition context key that specifies the `sourceAccountId` to help prevent the confused deputy security problem. If you don't yet know the source account ID in the first call, we recommend that you put the destination ARN in the source ARN field. In the subsequent calls, you should set the source ARN to be the actual source ARN that you gathered from the first call. For more information, see Confused deputy prevention.

```
{
    "Statement": {
        "Effect": "Allow",
        "Principal": {
            "Service": "logs.amazonaws.com"
        },
        "Condition": {
            "StringLike": {
                "aws:SourceArn": [
                    "arn:aws:logs:region:sourceAccountId:*",
                    "arn:aws:logs:region:recipientAccountId:*"
                ]
            }
        },
        "Action": "sts:AssumeRole"
    }
}
```

4. Use the **aws iam create-role** command to create the IAM role, specifying the trust policy file. Take note of the returned Role.Arn value because it will also be passed to CloudWatch Logs later:

```
aws iam create-role \
--role-name CWLtoKinesisRole \
--assume-role-policy-document file://~/TrustPolicyForCWL.json

{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": [
                            "arn:aws:logs:region:sourceAccountId:*",
                            "arn:aws:logs:region:recipientAccountId:*"
                        ]
                    }
                },
                "Principal": {
                    "Service": "logs.amazonaws.com"
                }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2015-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisRole",
        "Path": "/",
        "Arn": "arn:aws:iam::999999999999:role/CWLtoKinesisRole"
    }
}
```

5. Create a permissions policy to define which actions CloudWatch Logs can perform on your account. First, use a text editor to create a permissions policy in a file **~/PermissionsForCWL.json**:

```
{
  "Statement": [
    {
```

```
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:region:999999999999:stream/RecipientStream"
    }
  ]
}
```

6. Associate the permissions policy with the role by using the **aws iam put-role-policy** command:

```
aws iam put-role-policy \
    --role-name CWLtoKinesisRole \
    --policy-name Permissions-Policy-For-CWL \
    --policy-document file://~/PermissionsForCWL.json
```

7. After the stream is in the active state and you have created the IAM role, you can create the CloudWatch Logs destination.

   a. This step doesn't associate an access policy with your destination and is only the first step out of two that completes a destination creation. Make a note of the **DestinationArn** that is returned in the payload:

```
aws logs put-destination \
    --destination-name "testDestination" \
    --target-arn "arn:aws:kinesis:region:999999999999:stream/RecipientStream" \
    --role-arn "arn:aws:iam::999999999999:role/CWLtoKinesisRole"

{
  "DestinationName" : "testDestination",
  "RoleArn" : "arn:aws:iam::999999999999:role/CWLtoKinesisRole",
  "DestinationArn" : "arn:aws:logs:us-
east-1:999999999999:destination:testDestination",
  "TargetArn" : "arn:aws:kinesis:us-east-1:999999999999:stream/RecipientStream"
}
```

   b. After step 7a is complete, in the log data recipient account, associate an access policy with the destination. This policy must specify the **logs:PutSubscriptionFilter** action and grants permission to the sender account to access the destination.

      The policy grants permission to the Amazon account that sends logs. You can specify just this one account in the policy, or if the sender account is a member of an organization, the policy can specify the organization ID of the organization. This way, you can create just

one policy to allow multiple accounts in one organization to send logs to this destination account.

Use a text editor to create a file named ~/AccessPolicy.json with one of the following policy statements.

This first example policy allows all accounts in the organization that have an ID of o-1234567890 to send logs to the recipient account.

```
{
    "Version" : "2012-10-17",
    "Statement" : [
        {
            "Sid" : "",
            "Effect" : "Allow",
            "Principal" : "*",
            "Action" : "logs:PutSubscriptionFilter",
            "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination",
            "Condition": {
               "StringEquals" : {
                   "aws:PrincipalOrgID" : ["o-1234567890"]
                }
            }
        }
    ]
}
```

This next example allows just the log data sender account (111111111111) to send logs to the log data recipient account.

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "111111111111"
      },
      "Action" : "logs:PutSubscriptionFilter",
```

```
      "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination"
    }
  ]
}
```

c. Attach the policy you created in the previous step to the destination.

```
aws logs put-destination-policy \
    --destination-name "testDestination" \
    --access-policy file://~/AccessPolicy.json
```

This access policy enables users in the Amazon Account with ID 111111111111 to call **PutSubscriptionFilter** against the destination with ARN arn:aws:logs:*region*:999999999999:destination:testDestination. Any other user's attempt to call PutSubscriptionFilter against this destination will be rejected.

To validate a user's privileges against an access policy, see Using Policy Validator in the *IAM User Guide*.

When you have finished, if you're using Amazon Organizations for your cross-account permissions, follow the steps in Step 2: (Only if using an organization) Create an IAM role. If you're granting permissions directly to the other account instead of using Organizations, you can skip that step and proceed to Step 4: Create a subscription filter.

Step 2: (Only if using an organization) Create an IAM role

In the previous section, if you created the destination by using an access policy that grants permissions to the organization that account 111111111111 is in, instead of granting permissions directly to account 111111111111, then follow the steps in this section. Otherwise, you can skip to Step 4: Create a subscription filter.

The steps in this section create an IAM role, which CloudWatch can assume and validate whether the sender account has permission to create a subscription filter against the recipient destination.

Perform the steps in this section in the sender account. The role must exist in the sender account, and you specify the ARN of this role in the subscription filter. In this example, the sender account is 111111111111.

To create the IAM role necessary for cross-account log subscriptions using Amazon Organizations

1. Create the following trust policy in a file `/TrustPolicyForCWLSubscriptionFilter.json`. Use a text editor to create this policy file; do not use the IAM console.

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole"
  }
}
```

2. Create the IAM role that uses this policy. Take note of the `Arn` value that is returned by the command, you will need it later in this procedure. In this example, we use `CWLtoSubscriptionFilterRole` for the name of the role we're creating.

```
aws iam create-role \
     --role-name CWLtoSubscriptionFilterRole \
     --assume-role-policy-document file://~/
TrustPolicyForCWLSubscriptionFilter.json
```

3. Create a permissions policy to define the actions that CloudWatch Logs can perform on your account.

   a. First, use a text editor to create the following permissions policy in a file named `~/PermissionsForCWLSubscriptionFilter.json`.

```
{
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "logs:PutLogEvents",
            "Resource": "arn:aws:logs:region:111111111111:log-
group:LogGroupOnWhichSubscriptionFilterIsCreated:*"
        }
    ]
}
```

b. Enter the following command to associate the permissions policy you just created with the role that you created in step 2.

```
aws iam put-role-policy
    --role-name CWLtoSubscriptionFilterRole
    --policy-name Permissions-Policy-For-CWL-Subscription-filter
    --policy-document file://~/PermissionsForCWLSubscriptionFilter.json
```

When you have finished, you can proceed to Step 4: Create a subscription filter.

Step 3: Add/validate IAM permissions for the cross-account destination

According to Amazon cross-account policy evaluation logic, in order to access any cross-account resource (such as an Kinesis or Firehose stream used as a destination for a subscription filter) you must have an identity-based policy in the sending account which provides explicit access to the cross-account destination resource. For more information about policy evaluation logic, see Cross-account policy evaluation logic.

You can attach the identity-based policy to the IAM role or IAM user that you are using to create the subscription filter. This policy must be present in the sending account. If you are using the Administrator role to create the subscription filter, you can skip this step and move on to Step 4: Create a subscription filter.

To add or validate the IAM permissions needed for cross-account

1. Enter the following command to check which IAM role or IAM user is being used to run Amazon logs commands.

   ```
   aws sts get-caller-identity
   ```

   The command returns output similar to the following:

   ```
   {
   "UserId": "User ID",
   "Account": "sending account id",
   "Arn": "arn:aws:sending account id:role/user:RoleName/UserName"
   }
   ```

   Make note of the value represented by *RoleName* or *UserName*.

2. Sign into the Amazon Web Services Management Console in the sending account and search for the attached policies with the IAM role or IAM user returned in the output of the command you entered in step 1.
3. Verify that the policies attached to this role or user provide explicit permissions to call `logs:PutSubscriptionFilter` on the cross-account destination resource. The following example policies show the recommended permissions.

   The following policy provides permissions to create a subscription filter on any destination resource only in a single Amazon account, account `123456789012`:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow subscription filters on any resource in one specific
 account",
            "Effect": "Allow",
            "Action": "logs:PutSubscriptionFilter",
            "Resource": [
                "arn:aws:logs:*:*:log-group:*",
                "arn:aws:logs:*:123456789012:destination:*"
            ]
        }
    ]
}
```

   The following policy provides permissions to create a subscription filter only on a specific destination resource named `sampleDestination` in single Amazon account, account `123456789012`:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow subscription filters on one specific resource in one
 specific account",
            "Effect": "Allow",
            "Action": "logs:PutSubscriptionFilter",
            "Resource": [
                "arn:aws:logs:*:*:log-group:*",
                "arn:aws:logs:*:123456789012:destination:sampleDestination"
```

```
            ]
        }
    ]
}
```

Step 4: Create a subscription filter

After you create a destination, the log data recipient account can share the destination ARN (arn:aws:logs:us-east-1:999999999999:destination:testDestination) with other Amazon accounts so that they can send log events to the same destination. These other sending accounts users then create a subscription filter on their respective log groups against this destination. The subscription filter immediately starts the flow of real-time log data from the chosen log group to the specified destination.

> **Note**
>
> If you are granting permissions for the subscription filter to an entire organization, you will need to use the ARN of the IAM role that you created in Step 2: (Only if using an organization) Create an IAM role.

In the following example, a subscription filter is created in a sending account. the filter is associated with a log group containing Amazon CloudTrail events so that every logged activity made by "Root" Amazon credentials is delivered to the destination you previously created. That destination encapsulates a stream called "RecipientStream".

The rest of the steps in the following sections assume that you have followed the directions in Sending CloudTrail Events to CloudWatch Logs in the *Amazon CloudTrail User Guide* and created a log group that contains your CloudTrail events. These steps assume that the name of this log group is `CloudTrail/logs`.

When you enter the following command, be sure you are signed in as the IAM user or using the IAM role that you added the policy for, in Step 3: Add/validate IAM permissions for the cross-account destination.

```
aws logs put-subscription-filter \
    --log-group-name "CloudTrail/logs" \
    --filter-name "RecipientStream" \
```

```
    --filter-pattern "{$.userIdentity.type = Root}" \
    --destination-arn "arn:aws:logs:region:999999999999:destination:testDestination"
```

The log group and the destination must be in the same Amazon Region. However, the destination can point to an Amazon resource such as a Kinesis Data Streams stream that is located in a different Region.

Validate the flow of log events

After you create the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern to the stream that is encapsulated within the destination stream called "**RecipientStream**". The destination owner can verify that this is happening by using the **aws kinesis get-shard-iterator** command to grab a Kinesis Data Streams shard, and using the **aws kinesis get-records** command to fetch some Kinesis Data Streams records:

```
aws kinesis get-shard-iterator \
      --stream-name RecipientStream \
      --shard-id shardId-000000000000 \
      --shard-iterator-type TRIM_HORIZON

{
    "ShardIterator":
    "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL+wev
+e2P4djJg4L9wmXKvQYoE+rMUiFq+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f
+OIK8zM5My8ID+g6rMo7UKWeI4+IWiKEXAMPLE"
}

aws kinesis get-records \
      --limit 10 \
      --shard-iterator
      "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL+wev
+e2P4djJg4L9wmXKvQYoE+rMUiFq+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f
+OIK8zM5My8ID+g6rMo7UKWeI4+IWiKEXAMPLE"
```

> **Note**
>
> You might need to rerun the get-records command a few times before Kinesis Data Streams starts to return data.

You should see a response with an array of Kinesis Data Streams records. The data attribute in the Kinesis Data Streams record is compressed in gzip format and then base64 encoded. You can examine the raw data from the command line using the following Unix command:

```
echo -n "<Content of Data>" | base64 -d | zcat
```

The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
    "owner": "111111111111",
    "logGroup": "CloudTrail/logs",
    "logStream": "111111111111_CloudTrail/logs_us-east-1",
    "subscriptionFilters": [
        "RecipientStream"
    ],
    "messageType": "DATA_MESSAGE",
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        }
    ]
}
```

The key elements in this data structure are as follows:

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

messageType

Data messages use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs may emit Kinesis Data Streams records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

logEvents

The actual log data, represented as an array of log event records. The ID property is a unique identifier for every log event.

Modify destination membership at runtime

You might encounter situations where you have to add or remove membership of some users from a destination that you own. You can use the `put-destination-policy` command on your destination with a new access policy. In the following example, a previously added account **111111111111** is stopped from sending any more log data, and account **222222222222** is enabled.

1. Fetch the policy that is currently associated with the destination **testDestination** and make a note of the **AccessPolicy**:

```
aws logs describe-destinations \
    --destination-name-prefix "testDestination"

{
 "Destinations": [
```

```
   {
     "DestinationName": "testDestination",
     "RoleArn": "arn:aws:iam::999999999999:role/CWLtoKinesisRole",
     "DestinationArn":
 "arn:aws:logs:region:999999999999:destination:testDestination",
     "TargetArn": "arn:aws:kinesis:region:999999999999:stream/RecipientStream",
     "AccessPolicy": "{\"Version\": \"2012-10-17\", \"Statement\":
 [{\"Sid\": \"\", \"Effect\": \"Allow\", \"Principal\": {\"AWS\":
 \"111111111111\"}, \"Action\": \"logs:PutSubscriptionFilter\", \"Resource\":
 \"arn:aws:logs:region:999999999999:destination:testDestination\"}] }"
   }
 ]
}
```

2. Update the policy to reflect that account **111111111111** is stopped, and that account **222222222222** is enabled. Put this policy in the **~/NewAccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "222222222222"
      },
      "Action" : "logs:PutSubscriptionFilter",
      "Resource" : "arn:aws:logs:region:999999999999:destination:testDestination"
    }
  ]
}
```

3. Call **PutDestinationPolicy** to associate the policy defined in the **NewAccessPolicy.json** file with the destination:

```
aws logs put-destination-policy \
--destination-name "testDestination" \
--access-policy file://~/NewAccessPolicy.json
```

This will eventually disable the log events from account ID **111111111111**. Log events from account ID **222222222222** start flowing to the destination as soon as the owner of account **222222222222** creates a subscription filter.

Updating an existing cross-account subscription

If you currently have a cross-account logs subscription where the destination account grants permissions only to specific sender accounts, and you want to update this subscription so that the destination account grants access to all accounts in an organization, follow the steps in this section.

Topics

Step 1: Update the subscription filters

> **Note**
>
> This step is needed only for cross-account subscriptions for logs that are created by the services listed in Enable logging from Amazon services. If you are not working with logs created by one of these log groups, you can skip to Step 2: Update the existing destination access policy.

In certain cases, you must update the subscription filters in all the sender accounts that are sending logs to the destination account. The update adds an IAM role, which CloudWatch can assume and validate that the sender account has permission to send logs to the recipient account.

Follow the steps in this section for every sender account that you want to update to use organization ID for the cross-account subscription permissions.

In the examples in this section, two accounts, 111111111111 and 222222222222 already have subscription filters created to send logs to account 999999999999. The existing subscription filter values are as follows:

```
## Existing Subscription Filter parameter values
    \ --log-group-name "my-log-group-name"
    \ --filter-name "RecipientStream"
    \ --filter-pattern "{$.userIdentity.type = Root}"
    \ --destination-arn "arn:aws:logs:region:999999999999:destination:testDestination"
```

If you need to find the current subscription filter parameter values, enter the following command.

```
aws logs describe-subscription-filters
    \ --log-group-name "my-log-group-name"
```

To update a subscription filter to start using organization IDs for cross-account log permissions

1. Create the following trust policy in a file ~/TrustPolicyForCWL.json. Use a text editor to create this policy file; do not use the IAM console.

   ```
   {
     "Statement": {
       "Effect": "Allow",
       "Principal": { "Service": "logs.amazonaws.com" },
       "Action": "sts:AssumeRole"
     }
   }
   ```

2. Create the IAM role that uses this policy. Take note of the Arn value of the Arn value that is returned by the command, you will need it later in this procedure. In this example, we use CWLtoSubscriptionFilterRole for the name of the role we're creating.

   ```
   aws iam create-role
       \ --role-name CWLtoSubscriptionFilterRole
       \ --assume-role-policy-document file://~/TrustPolicyForCWL.json
   ```

3. Create a permissions policy to define the actions that CloudWatch Logs can perform on your account.

   a. First, use a text editor to create the following permissions policy in a file named / PermissionsForCWLSubscriptionFilter.json.

      ```
      {
          "Statement": [
              {
                  "Effect": "Allow",
                  "Action": "logs:PutLogEvents",
                  "Resource": "arn:aws:logs:region:111111111111:log-
      group:LogGroupOnWhichSubscriptionFilterIsCreated:*"
              }
          ]
      }
      ```

b. Enter the following command to associate the permissions policy you just created with the role that you created in step 2.

```
aws iam put-role-policy
    --role-name CWLtoSubscriptionFilterRole
    --policy-name Permissions-Policy-For-CWL-Subscription-filter
    --policy-document file://~/PermissionsForCWLSubscriptionFilter.json
```

4. Enter the following command to update the subscription filter.

```
aws logs put-subscription-filter
    \ --log-group-name "my-log-group-name"
    \ --filter-name "RecipientStream"
    \ --filter-pattern "{$.userIdentity.type = Root}"
    \ --destination-arn
 "arn:aws:logs:region:999999999999:destination:testDestination"
    \ --role-arn "arn:aws:iam::111111111111:role/CWLtoSubscriptionFilterRole"
```

Step 2: Update the existing destination access policy

After you have updated the subscription filters in all of the sender accounts, you can update the destination access policy in the recipient account.

In the following examples, the recipient account is 999999999999 and the destination is named `testDestination`.

The update enables all accounts that are part of the organization with ID `o-1234567890` to send logs to the recipient account. Only the accounts that have subscription filters created will actually send logs to the recipient account.

To update the destination access policy in the recipient account to start using an organization ID for permissions

1. In the recipient account, use a text editor to create a `~/AccessPolicy.json` file with the following contents.

```
{
    "Version" : "2012-10-17",
    "Statement" : [
        {
```

```
            "Sid" : "",
            "Effect" : "Allow",
            "Principal" : "*",
            "Action" : "logs:PutSubscriptionFilter",
            "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination",
            "Condition": {
               "StringEquals" : {
                   "aws:PrincipalOrgID" : ["o-1234567890"]
                }
            }
        }
    ]
}
```

2. Enter the following command to attach the policy that you just created to the existing destination. To update a destination to use an access policy with an organization ID instead of an access policy that lists specific Amazon account IDs, include the `force` parameter.

> **Warning**
>
> If you are working with logs sent by an Amazon service listed in Enable logging from Amazon services, then before doing this step, you must have first updated the subscription filters in all the sender accounts as explained in Step 1: Update the subscription filters.

```
aws logs put-destination-policy
    \ --destination-name "testDestination"
    \ --access-policy file://~/AccessPolicy.json
    \ --force
```

Cross-account cross-Region log data sharing using Firehose

To share log data across accounts, you need to establish a log data sender and receiver:

- **Log data sender**—gets the destination information from the recipient and lets CloudWatch Logs know that it is ready to send its log events to the specified destination. In the procedures in the

rest of this section, the log data sender is shown with a fictional Amazon account number of 111111111111.

- **Log data recipient**—sets up a destination that encapsulates a Kinesis Data Streams stream and lets CloudWatch Logs know that the recipient wants to receive log data. The recipient then shares the information about this destination with the sender. In the procedures in the rest of this section, the log data recipient is shown with a fictional Amazon account number of 222222222222.

The example in this section uses a Firehose delivery stream with Amazon S3 storage. You can also set up Firehose delivery streams with different settings. For more information, see Creating a Firehose Delivery Stream.

> **Note**
>
> The log group and the destination must be in the same Amazon Region. However, the Amazon resource that the destination points to can be located in a different Region.

> **Note**
>
> Firehose subscription filter for a ***same account*** and ***cross-Region*** delivery stream is supported.

Topics

Step 1: Create a Firehose delivery stream

> **Important**
>
> Before you complete the following steps, you must use an access policy, so Firehose can access your Amazon S3 bucket. For more information, see Controlling Access in the *Amazon Data Firehose Developer Guide*.
> All of the steps in this section (Step 1) must be done in the log data recipient account.
> US East (N. Virginia) is used in the following sample commands. Replace this Region with the correct Region for your deployment.

To create a Firehose delivery stream to be used as the destination

1. Create an Amazon S3 bucket:

```
aws s3api create-bucket --bucket amzn-s3-demo-bucket --create-bucket-configuration
 LocationConstraint=us-east-1
```

2. Create the IAM role that grants Firehose permission to put data into the bucket.

   a. First, use a text editor to create a trust policy in a file `~/TrustPolicyForFirehose.json`.

```
{ "Statement": { "Effect": "Allow", "Principal": { "Service":
 "firehose.amazonaws.com" }, "Action": "sts:AssumeRole", "Condition":
 { "StringEquals": { "sts:ExternalId":"222222222222" } } } }
```

   b. Create the IAM role, specifying the trust policy file that you just made.

```
aws iam create-role \
    --role-name FirehosetoS3Role \
    --assume-role-policy-document file://~/TrustPolicyForFirehose.json
```

   c. The output of this command will look similar to the following. Make a note of the role name and the role ARN.

```
{
    "Role": {
        "Path": "/",
        "RoleName": "FirehosetoS3Role",
```

```
        "RoleId": "AROAR3BXASEKW7K635M53",
        "Arn": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
        "CreateDate": "2021-02-02T07:53:10+00:00",
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Effect": "Allow",
                "Principal": {
                    "Service": "firehose.amazonaws.com"
                },
                "Action": "sts:AssumeRole",
                "Condition": {
                    "StringEquals": {
                        "sts:ExternalId": "222222222222"
                    }
                }
            }
        }
    }
}
```

3. Create a permissions policy to define the actions that Firehose can perform in your account.

   a. First, use a text editor to create the following permissions policy in a file named ~/PermissionsForFirehose.json. Depending on your use case, you might need to add more permissions to this file.

```
{
    "Statement": [{
        "Effect": "Allow",
        "Action": [
            "s3:PutObject",
            "s3:PutObjectAcl",
            "s3:ListBucket"
        ],
        "Resource": [
            "arn:aws:s3:::amzn-s3-demo-bucket",
            "arn:aws:s3:::amzn-s3-demo-bucket/*"
        ]
    }]
}
```

   b. Enter the following command to associate the permissions policy that you just created with the IAM role.

```
aws iam put-role-policy --role-name FirehosetoS3Role --policy-name
 Permissions-Policy-For-Firehose-To-S3 --policy-document file://~/
PermissionsForFirehose.json
```

4. Enter the following command to create the Firehose delivery stream. Replace *my-role-arn* and *amzn-s3-demo-bucket2-arn* with the correct values for your deployment.

```
aws firehose create-delivery-stream \
   --delivery-stream-name 'my-delivery-stream' \
   --s3-destination-configuration \
  '{"RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role", "BucketARN":
 "arn:aws:s3:::amzn-s3-demo-bucket"}'
```

The output should look similar to the following:

```
{
    "DeliveryStreamARN": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream"
}
```

Step 2: Create a destination

> **Important**
>
> All steps in this procedure are to be done in the log data recipient account.

When the destination is created, CloudWatch Logs sends a test message to the destination on the recipient account's behalf. When the subscription filter is active later, CloudWatch Logs sends log events to the destination on the source account's behalf.

To create a destination

1. Wait until the Firehose stream that you created in Step 1: Create a Firehose delivery stream becomes active. You can use the following command to check the **StreamDescription.StreamStatus** property.

```
aws firehose describe-delivery-stream --delivery-stream-name "my-delivery-stream"
```

In addition, take note of the **DeliveryStreamDescription.DeliveryStreamARN** value, because you will need to use it in a later step. Sample output of this command:

```
{
    "DeliveryStreamDescription": {
        "DeliveryStreamName": "my-delivery-stream",
        "DeliveryStreamARN": "arn:aws:firehose:us-
east-1:222222222222:deliverystream/my-delivery-stream",
        "DeliveryStreamStatus": "ACTIVE",
        "DeliveryStreamEncryptionConfiguration": {
            "Status": "DISABLED"
        },
        "DeliveryStreamType": "DirectPut",
        "VersionId": "1",
        "CreateTimestamp": "2021-02-01T23:59:15.567000-08:00",
        "Destinations": [
            {
                "DestinationId": "destinationId-000000000001",
                "S3DestinationDescription": {
                    "RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket",
                    "BufferingHints": {
                        "SizeInMBs": 5,
                        "IntervalInSeconds": 300
                    },
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "CloudWatchLoggingOptions": {
                        "Enabled": false
                    }
                },
                "ExtendedS3DestinationDescription": {
                    "RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket",
                    "BufferingHints": {
                        "SizeInMBs": 5,
                        "IntervalInSeconds": 300
                    },
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
```

```
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "CloudWatchLoggingOptions": {
                        "Enabled": false
                    },
                    "S3BackupMode": "Disabled"
                }
            }
        ],
        "HasMoreDestinations": false
    }
}
```

It might take a minute or two for your delivery stream to show up in the active state.

2. When the delivery stream is active, create the IAM role that will grant CloudWatch Logs the permission to put data into your Firehose stream. First, you'll need to create a trust policy in a file **~/TrustPolicyForCWL.json**. Use a text editor to create this policy. For more information about CloudWatch Logs endpoints, see Amazon CloudWatch Logs endpoints and quotas.

   This policy includes a `aws:SourceArn` global condition context key that specifies the `sourceAccountId` to help prevent the confused deputy security problem. If you don't yet know the source account ID in the first call, we recommend that you put the destination ARN in the source ARN field. In the subsequent calls, you should set the source ARN to be the actual source ARN that you gathered from the first call. For more information, see Confused deputy prevention.

```
{
    "Statement": {
        "Effect": "Allow",
        "Principal": {
            "Service": "logs.region.amazonaws.com"
        },
        "Action": "sts:AssumeRole",
        "Condition": {
            "StringLike": {
                "aws:SourceArn": [
                    "arn:aws:logs:region:sourceAccountId:*",
                    "arn:aws:logs:region:recipientAccountId:*"
                ]
            }
        }
```

```
     }
}
```

3. Use the **aws iam create-role** command to create the IAM role, specifying the trust policy file that you just created.

```
aws iam create-role \
      --role-name CWLtoKinesisFirehoseRole \
      --assume-role-policy-document file://~/TrustPolicyForCWL.json
```

The following is a sample output. Take note of the returned `Role.Arn` value, because you will need to use it in a later step.

```
{
    "Role": {
        "Path": "/",
        "RoleName": "CWLtoKinesisFirehoseRole",
        "RoleId": "AROAR3BXASEKYJYWF243H",
        "Arn": "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole",
        "CreateDate": "2021-02-02T08:10:43+00:00",
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.region.amazonaws.com"
                },
                "Action": "sts:AssumeRole",
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": [
                            "arn:aws:logs:region:sourceAccountId:*",
                            "arn:aws:logs:region:recipientAccountId:*"
                        ]
                    }
                }
            }
        }
    }
}
```

4. Create a permissions policy to define which actions CloudWatch Logs can perform on your account. First, use a text editor to create a permissions policy in a file **~/PermissionsForCWL.json**:

```
{
    "Statement":[
      {
        "Effect":"Allow",
        "Action":["firehose:*"],
        "Resource":["arn:aws:firehose:region:222222222222:*"]
      }
    ]
}
```

5. Associate the permissions policy with the role by entering the following command:

```
aws iam put-role-policy --role-name CWLtoKinesisFirehoseRole --policy-name
 Permissions-Policy-For-CWL --policy-document file://~/PermissionsForCWL.json
```

6. After the Firehose delivery stream is in the active state and you have created the IAM role, you can create the CloudWatch Logs destination.

   a. This step will not associate an access policy with your destination and is only the first step out of two that completes a destination creation. Make a note of the ARN of the new destination that is returned in the payload, because you will use this as the `destination.arn` in a later step.

```
aws logs put-destination \

    --destination-name "testFirehoseDestination" \
    --target-arn "arn:aws:firehose:us-east-1:222222222222:deliverystream/my-
delivery-stream" \
    --role-arn "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole"

{
    "destination": {
        "destinationName": "testFirehoseDestination",
        "targetArn": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream",
        "roleArn": "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole",
        "arn": "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"}
```

```
}
```

b. After the previous step is complete, in the log data recipient account (222222222222), associate an access policy with the destination.

   This policy enables the log data sender account (111111111111) to access the destination in just the log data recipient account (222222222222). You can use a text editor to put this policy in the **~/AccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "111111111111"
      },
      "Action" : "logs:PutSubscriptionFilter",
      "Resource" : "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"
    }
  ]
}
```

c. This creates a policy that defines who has write access to the destination. This policy must specify the **logs:PutSubscriptionFilter** action to access the destination. Cross-account users will use the **PutSubscriptionFilter** action to send log events to the destination:

```
aws logs put-destination-policy \
    --destination-name "testFirehoseDestination" \
    --access-policy file://~/AccessPolicy.json
```

Step 3: Add/validate IAM permissions for the cross-account destination

According to Amazon cross-account policy evaluation logic, in order to access any cross-account resource (such as an Kinesis or Firehose stream used as a destination for a subscription filter) you must have an identity-based policy in the sending account which provides explicit access to the cross-account destination resource. For more information about policy evaluation logic, see Cross-account policy evaluation logic.

You can attach the identity-based policy to the IAM role or IAM user that you are using to create the subscription filter. This policy must be present in the sending account. If you are using the Administrator role to create the subscription filter, you can skip this step and move on to Step 4: Create a subscription filter.

To add or validate the IAM permissions needed for cross-account

1. Enter the following command to check which IAM role or IAM user is being used to run Amazon logs commands.

   ```
   aws sts get-caller-identity
   ```

   The command returns output similar to the following:

   ```
   {
   "UserId": "User ID",
   "Account": "sending account id",
   "Arn": "arn:aws:sending account id:role/user:RoleName/UserName"
   }
   ```

   Make note of the value represented by *RoleName* or *UserName*.

2. Sign into the Amazon Web Services Management Console in the sending account and search for the attached policies with the IAM role or IAM user returned in the output of the command you entered in step 1.

3. Verify that the policies attached to this role or user provide explicit permissions to call `logs:PutSubscriptionFilter` on the cross-account destination resource. The following example policies show the recommended permissions.

   The following policy provides permissions to create a subscription filter on any destination resource only in a single Amazon account, account 123456789012:

   ```
   {
       "Version": "2012-10-17",
       "Statement": [
           {
               "Sid": "Allow subscription filters on any resource in one specific
    account",
               "Effect": "Allow",
               "Action": "logs:PutSubscriptionFilter",
   ```

```
            "Resource": [
                "arn:aws:logs:*:*:log-group:*",
                "arn:aws:logs:*:123456789012:destination:*"
            ]
        }
    ]
}
```

The following policy provides permissions to create a subscription filter only on a specific destination resource named `sampleDestination` in single Amazon account, account `123456789012`:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow subscription filters on one specific resource in one
 specific account",
            "Effect": "Allow",
            "Action": "logs:PutSubscriptionFilter",
            "Resource": [
                "arn:aws:logs:*:*:log-group:*",
                "arn:aws:logs:*:123456789012:destination:sampleDestination"
            ]
        }
    ]
}
```

Step 4: Create a subscription filter

Switch to the sending account, which is 111111111111 in this example. You will now create the subscription filter in the sending account. In this example, the filter is associated with a log group containing Amazon CloudTrail events so that every logged activity made by "Root" Amazon credentials is delivered to the destination you previously created. For more information about how to send Amazon CloudTrail events to CloudWatch Logs, see Sending CloudTrail Events to CloudWatch Logs in the *Amazon CloudTrail User Guide*.

When you enter the following command, be sure you are signed in as the IAM user or using the IAM role that you added the policy for, in Step 3: Add/validate IAM permissions for the cross-account destination.

```
aws logs put-subscription-filter \
    --log-group-name "aws-cloudtrail-logs-111111111111-300a971e" \
    --filter-name "firehose_test" \
    --filter-pattern "{$.userIdentity.type = AssumedRole}" \
    --destination-arn "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"
```

The log group and the destination must be in the same Amazon Region. However, the destination can point to an Amazon resource such as a Firehose stream that is located in a different Region.

Validating the flow of log events

After you create the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern to the Firehose delivery stream. The data starts appearing in your Amazon S3 bucket based on the time buffer interval that is set on the Firehose delivery stream. Once enough time has passed, you can verify your data by checking the Amazon S3 bucket. To check the bucket, enter the following command:

```
aws s3api list-objects --bucket 'amzn-s3-demo-bucket'
```

The output of that command will be similar to the following:

```
{
    "Contents": [
        {
            "Key": "2021/02/02/08/my-delivery-
stream-1-2021-02-02-08-55-24-5e6dc317-071b-45ba-a9d3-4805ba39c2ba",
            "LastModified": "2021-02-02T09:00:26+00:00",
            "ETag": "\"EXAMPLEa817fb88fc770b81c8f990d\"",
            "Size": 198,
            "StorageClass": "STANDARD",
            "Owner": {
                "DisplayName": "firehose+2test",
                "ID": "EXAMPLE27fd05889c665d2636218451970ef79400e3d2aecca3adb1930042e0"
            }
        }
    ]
}
```

You can then retrieve a specific object from the bucket by entering the following command. Replace the value of `key` with the value you found in the previous command.

```
aws s3api get-object --bucket 'amzn-s3-demo-bucket' --key '2021/02/02/08/my-delivery-
stream-1-2021-02-02-08-55-24-5e6dc317-071b-45ba-a9d3-4805ba39c2ba' testfile.gz
```

The data in the Amazon S3 object is compressed with the gzip format. You can examine the raw data from the command line using one of the following commands:

Linux:

```
zcat testfile.gz
```

macOS:

```
zcat <testfile.gz
```

Modifying destination membership at runtime

You might encounter situations where you have to add or remove log senders from a destination that you own. You can use the **PutDestinationPolicy** action on your destination with new access policy. In the following example, a previously added account **111111111111** is stopped from sending any more log data, and account **333333333333** is enabled.

1. Fetch the policy that is currently associated with the destination **testDestination** and make a note of the **AccessPolicy**:

```
aws logs describe-destinations \
    --destination-name-prefix "testFirehoseDestination"

{
    "destinations": [
        {
            "destinationName": "testFirehoseDestination",
            "targetArn": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream",
            "roleArn": "arn:aws:iam:: 222222222222:role/CWLtoKinesisFirehoseRole",
            "accessPolicy": "{\n  \"Version\" : \"2012-10-17\",\n  \"Statement
\" : [\n    {\n      \"Sid\" : \"\",\n      \"Effect\" : \"Allow\",\n
 \"Principal\" : {\n        \"AWS\" : \"111111111111 \"\n      },\n      \"Action
\" : \"logs:PutSubscriptionFilter\",\n      \"Resource\" : \"arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination\"\n    }\n  ]\n}\n\n",
            "arn": "arn:aws:logs:us-east-1:
 222222222222:destination:testFirehoseDestination",
```

```
            "creationTime": 1612256124430
        }
    ]
}
```

2. Update the policy to reflect that account **111111111111** is stopped, and that account **333333333333** is enabled. Put this policy in the **~/NewAccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "333333333333 "
      },
      "Action" : "logs:PutSubscriptionFilter",
      "Resource" : "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"
    }
  ]
}
```

3. Use the following command to associate the policy defined in the **NewAccessPolicy.json** file with the destination:

```
aws logs put-destination-policy \
    --destination-name "testFirehoseDestination" \

    --access-policy file://~/NewAccessPolicy.json
```

This eventually disables the log events from account ID **111111111111**. Log events from account ID **333333333333** start flowing to the destination as soon as the owner of account **333333333333** creates a subscription filter.

Cross-account cross-Region account-level subscriptions using Kinesis Data Streams

When you create a cross-account subscription, you can specify a single account or an organization to be the sender. If you specify an organization, then this procedure enables all accounts in the organization to send logs to the receiver account.

To share log data across accounts, you need to establish a log data sender and receiver:

- **Log data sender**—gets the destination information from the recipient and lets CloudWatch Logs know that it's ready to send its log events to the specified destination. In the procedures in the rest of this section, the log data sender is shown with a fictional Amazon account number of 111111111111.

  If you're going to have multiple accounts in one organization send logs to one recipient account, you can create a policy that grants all accounts in the organization the permission to send logs to the recipient account. You still have to set up separate subscription filters for each sender account.
- **Log data recipient**—sets up a destination that encapsulates a Kinesis Data Streams stream and lets CloudWatch Logs know that the recipient wants to receive log data. The recipient then shares the information about this destination with the sender. In the procedures in the rest of this section, the log data recipient is shown with a fictional Amazon account number of 999999999999.

To start receiving log events from cross-account users, the log data recipient first creates a CloudWatch Logs destination. Each destination consists of the following key elements:

Destination name

The name of the destination you want to create.

Target ARN

The Amazon Resource Name (ARN) of the Amazon resource that you want to use as the destination of the subscription feed.

Role ARN

An Amazon Identity and Access Management (IAM) role that grants CloudWatch Logs the necessary permissions to put data into the chosen stream.

Access policy

An IAM policy document (in JSON format, written using IAM policy grammar) that governs the set of users that are allowed to write to your destination.

> **Note**
>
> The log group and the destination must be in the same Amazon Region. However, the Amazon resource that the destination points to can be located in a different Region. In the examples in the following sections, all Region-specific resources are created in US East (N. Virginia).

Topics

Setting up a new cross-account subscription

Follow the steps in these sections to set up a new cross-account log subscription.

Topics

Step 1: Create a destination

> **Important**
>
> All steps in this procedure are to be done in the log data recipient account.

For this example, the log data recipient account has an Amazon account ID of 999999999999, while the log data sender Amazon account ID is 111111111111.

This example creates a destination using a Kinesis Data Streams stream called RecipientStream, and a role that enables CloudWatch Logs to write data to it.

When the destination is created, CloudWatch Logs sends a test message to the destination on the recipient account's behalf. When the subscription filter is active later, CloudWatch Logs sends log events to the destination on the source account's behalf.

To create a destination

1. In the recipient account, create a destination stream in Kinesis Data Streams. At a command prompt, type:

```
aws kinesis create-stream --stream-name "RecipientStream" --shard-count 1
```

2. Wait until the stream becomes active. You can use the **aws kinesis describe-stream** command to check the **StreamDescription.StreamStatus** property. In addition, take note of the **StreamDescription.StreamARN** value because you will pass it to CloudWatch Logs later:

```
aws kinesis describe-stream --stream-name "RecipientStream"
{
  "StreamDescription": {
    "StreamStatus": "ACTIVE",
    "StreamName": "RecipientStream",
    "StreamARN": "arn:aws:kinesis:us-east-1:999999999999:stream/RecipientStream",
    "Shards": [
      {
        "ShardId": "shardId-000000000000",
        "HashKeyRange": {
          "EndingHashKey": "340282366920938463463374607431768EXAMPLE",
          "StartingHashKey": "0"
        },
        "SequenceNumberRange": {
          "StartingSequenceNumber":
 "49551135218688818456679503831981458784591352702 18EXAMPLE"
        }
      }
    ]
  }
}
```

It might take a minute or two for your stream to show up in the active state.

3. Create the IAM role that grants CloudWatch Logs the permission to put data into your stream. First, you'll need to create a trust policy in a file **~/TrustPolicyForCWL.json**. Use a text editor to create this policy file, do not use the IAM console.

   This policy includes a `aws:SourceArn` global condition context key that specifies the `sourceAccountId` to help prevent the confused deputy security problem. If you don't yet know the source account ID in the first call, we recommend that you put the destination ARN in the source ARN field. In the subsequent calls, you should set the source ARN to be the actual source ARN that you gathered from the first call. For more information, see Confused deputy prevention.

   ```
   {
       "Statement": {
           "Effect": "Allow",
           "Principal": {
               "Service": "logs.amazonaws.com"
           },
           "Condition": {
               "StringLike": {
                   "aws:SourceArn": [
                       "arn:aws:logs:region:sourceAccountId:*",
                       "arn:aws:logs:region:recipientAccountId:*"
                   ]
               }
           },
           "Action": "sts:AssumeRole"
       }
   }
   ```

4. Use the **aws iam create-role** command to create the IAM role, specifying the trust policy file. Take note of the returned Role.Arn value because it will also be passed to CloudWatch Logs later:

   ```
   aws iam create-role \
   --role-name CWLtoKinesisRole \
   --assume-role-policy-document file://~/TrustPolicyForCWL.json

   {
       "Role": {
   ```

```
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": [
                            "arn:aws:logs:region:sourceAccountId:*",
                            "arn:aws:logs:region:recipientAccountId:*"
                        ]
                    }
                },
                "Principal": {
                    "Service": "logs.amazonaws.com"
                }
            }
        },
        "RoleId": "AAOIIAH450GAB4HC5F431",
        "CreateDate": "2023-05-29T13:46:29.431Z",
        "RoleName": "CWLtoKinesisRole",
        "Path": "/",
        "Arn": "arn:aws:iam::999999999999:role/CWLtoKinesisRole"
    }
}
```

5. Create a permissions policy to define which actions CloudWatch Logs can perform on your account. First, use a text editor to create a permissions policy in a file **~/PermissionsForCWL.json**:

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:region:999999999999:stream/RecipientStream"
    }
  ]
}
```

6. Associate the permissions policy with the role by using the **aws iam put-role-policy** command:

```
aws iam put-role-policy \
    --role-name CWLtoKinesisRole \
```

```
    --policy-name Permissions-Policy-For-CWL \
    --policy-document file://~/PermissionsForCWL.json
```

7. After the stream is in the active state and you have created the IAM role, you can create the CloudWatch Logs destination.

   a. This step doesn't associate an access policy with your destination and is only the first step out of two that completes a destination creation. Make a note of the **DestinationArn** that is returned in the payload:

```
aws logs put-destination \
    --destination-name "testDestination" \
    --target-arn "arn:aws:kinesis:region:999999999999:stream/RecipientStream" \
    --role-arn "arn:aws:iam::999999999999:role/CWLtoKinesisRole"

{
  "DestinationName" : "testDestination",
  "RoleArn" : "arn:aws:iam::999999999999:role/CWLtoKinesisRole",
  "DestinationArn" : "arn:aws:logs:us-
east-1:999999999999:destination:testDestination",
  "TargetArn" : "arn:aws:kinesis:us-east-1:999999999999:stream/RecipientStream"
}
```

   b. After step 7a is complete, in the log data recipient account, associate an access policy with the destination. This policy must specify the **logs:PutSubscriptionFilter** action and grants permission to the sender account to access the destination.

      The policy grants permission to the Amazon account that sends logs. You can specify just this one account in the policy, or if the sender account is a member of an organization, the policy can specify the organization ID of the organization. This way, you can create just one policy to allow multiple accounts in one organization to send logs to this destination account.

      Use a text editor to create a file named `~/AccessPolicy.json` with one of the following policy statements.

      This first example policy allows all accounts in the organization that have an ID of `o-1234567890` to send logs to the recipient account.

```
{
    "Version" : "2012-10-17",
```

```
    "Statement" : [
        {
            "Sid" : "",
            "Effect" : "Allow",
            "Principal" : "*",
            "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
            "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination",
            "Condition": {
               "StringEquals" : {
                   "aws:PrincipalOrgID" : ["o-1234567890"]
                }
            }
        }
    ]
}
```

This next example allows just the log data sender account (111111111111) to send logs to the log data recipient account.

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "111111111111"
      },
      "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
      "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination"
    }
  ]
}
```

c. Attach the policy you created in the previous step to the destination.

```
aws logs put-destination-policy \
    --destination-name "testDestination" \
    --access-policy file://~/AccessPolicy.json
```

This access policy enables users in the Amazon Account with ID 111111111111 to call **PutSubscriptionFilter** against the destination with ARN arn:aws:logs:*region*:999999999999:destination:testDestination. Any other user's attempt to call PutSubscriptionFilter against this destination will be rejected.

To validate a user's privileges against an access policy, see Using Policy Validator in the *IAM User Guide*.

When you have finished, if you're using Amazon Organizations for your cross-account permissions, follow the steps in Step 2: (Only if using an organization) Create an IAM role. If you're granting permissions directly to the other account instead of using Organizations, you can skip that step and proceed to Step 3: Create an account-level subscription filter policy.

Step 2: (Only if using an organization) Create an IAM role

In the previous section, if you created the destination by using an access policy that grants permissions to the organization that account 111111111111 is in, instead of granting permissions directly to account 111111111111, then follow the steps in this section. Otherwise, you can skip to Step 3: Create an account-level subscription filter policy.

The steps in this section create an IAM role, which CloudWatch can assume and validate whether the sender account has permission to create a subscription filter against the recipient destination.

Perform the steps in this section in the sender account. The role must exist in the sender account, and you specify the ARN of this role in the subscription filter. In this example, the sender account is 111111111111.

To create the IAM role necessary for cross-account log subscriptions using Amazon Organizations

1. Create the following trust policy in a file `./TrustPolicyForCWLSubscriptionFilter.json`. Use a text editor to create this policy file; do not use the IAM console.

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.amazonaws.com" },
    "Action": "sts:AssumeRole"
```

```
  }
}
```

2. Create the IAM role that uses this policy. Take note of the `Arn` value that is returned by the command, you will need it later in this procedure. In this example, we use `CWLtoSubscriptionFilterRole` for the name of the role we're creating.

```
aws iam create-role \
     --role-name CWLtoSubscriptionFilterRole \
     --assume-role-policy-document file://~/
TrustPolicyForCWLSubscriptionFilter.json
```

3. Create a permissions policy to define the actions that CloudWatch Logs can perform on your account.

   a. First, use a text editor to create the following permissions policy in a file named `~/PermissionsForCWLSubscriptionFilter.json`.

```
{
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "logs:PutLogEvents",
            "Resource": "arn:aws:logs:region:111111111111:log-
group:LogGroupOnWhichSubscriptionFilterIsCreated:*"
        }
    ]
}
```

   b. Enter the following command to associate the permissions policy you just created with the role that you created in step 2.

```
aws iam put-role-policy
    --role-name CWLtoSubscriptionFilterRole
    --policy-name Permissions-Policy-For-CWL-Subscription-filter
    --policy-document file://~/PermissionsForCWLSubscriptionFilter.json
```

When you have finished, you can proceed to Step 3: Create an account-level subscription filter policy.

Step 3: Create an account-level subscription filter policy

After you create a destination, the log data recipient account can share the destination ARN (arn:aws:logs:us-east-1:999999999999:destination:testDestination) with other Amazon accounts so that they can send log events to the same destination. These other sending accounts users then create a subscription filter on their respective log groups against this destination. The subscription filter immediately starts the flow of real-time log data from the chosen log group to the specified destination.

> **Note**
>
> If you are granting permissions for the subscription filter to an entire organization, you will need to use the ARN of the IAM role that you created in Step 2: (Only if using an organization) Create an IAM role.

In the following example, an account-level subscription filter policy is created in a sending account. the filter is associated with the sender account 111111111111 so that every log event matching the filter and selection criteria is delivered to the destination you previously created. That destination encapsulates a stream called "RecipientStream".

The `selection-criteria` field is optional, but is important for excluding log groups that can cause an infinite log recursion from a subscription filter. For more information about this issue and determining which log groups to exclude, see Log recursion prevention. Currently, NOT IN is the only supported operator for `selection-criteria`.

```
aws logs put-account-policy \
    --policy-name "CrossAccountStreamsExamplePolicy" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document
 '{"DestinationArn":"arn:aws:logs:region:999999999999:destination:testDestination",
 "FilterPattern": "", "Distribution": "Random"}' \
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

The sender account's log groups and the destination must be in the same Amazon Region. However, the destination can point to an Amazon resource such as a Kinesis Data Streams stream that is located in a different Region.

Validate the flow of log events

After you create the account-level subscription filter policy, CloudWatch Logs forwards all the incoming log events that match the filter pattern and selection criteria to the stream that is encapsulated within the destination stream called "**RecipientStream**". The destination owner can verify that this is happening by using the **aws kinesis get-shard-iterator** command to grab a Kinesis Data Streams shard, and using the **aws kinesis get-records** command to fetch some Kinesis Data Streams records:

```
aws kinesis get-shard-iterator \
      --stream-name RecipientStream \
      --shard-id shardId-000000000000 \
      --shard-iterator-type TRIM_HORIZON

{
    "ShardIterator":
    "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL+wev
+e2P4djJg4L9wmXKvQYoE+rMUiFq+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f
+OIK8zM5My8ID+g6rMo7UKWeI4+IWiKEXAMPLE"
}

aws kinesis get-records \
      --limit 10 \
      --shard-iterator
      "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL+wev
+e2P4djJg4L9wmXKvQYoE+rMUiFq+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f
+OIK8zM5My8ID+g6rMo7UKWeI4+IWiKEXAMPLE"
```

> **Note**
>
> You might need to rerun the `get-records` command a few times before Kinesis Data Streams starts to return data.

You should see a response with an array of Kinesis Data Streams records. The data attribute in the Kinesis Data Streams record is compressed in gzip format and then base64 encoded. You can examine the raw data from the command line using the following Unix command:

```
echo -n "<Content of Data>" | base64 -d | zcat
```

The base64 decoded and decompressed data is formatted as JSON with the following structure:

```
{
    "owner": "111111111111",
    "logGroup": "CloudTrail/logs",
    "logStream": "111111111111_CloudTrail/logs_us-east-1",
    "subscriptionFilters": [
        "RecipientStream"
    ],
    "messageType": "DATA_MESSAGE",
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424 29EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type\":\"Root
\"}"
        }
    ]
}
```

The key elements in the data structure are the following:

messageType

Data messages will use the "DATA_MESSAGE" type. Sometimes CloudWatch Logs might emit Kinesis Data Streams records with a "CONTROL_MESSAGE" type, mainly for checking if the destination is reachable.

owner

The Amazon Account ID of the originating log data.

logGroup

The log group name of the originating log data.

logStream

The log stream name of the originating log data.

subscriptionFilters

The list of subscription filter names that matched with the originating log data.

logEvents

The actual log data, represented as an array of log event records. The "id" property is a unique identifier for every log event.

policyLevel

The level at which the policy was enforced. "ACCOUNT_LEVEL_POLICY" is the `policyLevel` for an account-level subscription filter policy.

Modify destination membership at runtime

You might encounter situations where you have to add or remove membership of some users from a destination that you own. You can use the `put-destination-policy` command on your destination with a new access policy. In the following example, a previously added account **111111111111** is stopped from sending any more log data, and account **222222222222** is enabled.

1. Fetch the policy that is currently associated with the destination **testDestination** and make a note of the **AccessPolicy**:

```
aws logs describe-destinations \
    --destination-name-prefix "testDestination"

{
 "Destinations": [
   {
```

```
    "DestinationName": "testDestination",
    "RoleArn": "arn:aws:iam::999999999999:role/CWLtoKinesisRole",
    "DestinationArn":
 "arn:aws:logs:region:999999999999:destination:testDestination",
    "TargetArn": "arn:aws:kinesis:region:999999999999:stream/RecipientStream",
    "AccessPolicy": "{\"Version\": \"2012-10-17\", \"Statement\":
 [{\"Sid\": \"\", \"Effect\": \"Allow\", \"Principal\": {\"AWS\":
 \"111111111111\"}, \"Action\": \"logs:PutSubscriptionFilter\", \"Resource\":
 \"arn:aws:logs:region:999999999999:destination:testDestination\"}] }"
  }
 ]
}
```

2. Update the policy to reflect that account **111111111111** is stopped, and that account **222222222222** is enabled. Put this policy in the **~/NewAccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "222222222222"
      },
      "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
      "Resource" : "arn:aws:logs:region:999999999999:destination:testDestination"
    }
  ]
}
```

3. Call **PutDestinationPolicy** to associate the policy defined in the **NewAccessPolicy.json** file with the destination:

```
aws logs put-destination-policy \
--destination-name "testDestination" \
--access-policy file://~/NewAccessPolicy.json
```

This will eventually disable the log events from account ID **111111111111**. Log events from account ID **222222222222** start flowing to the destination as soon as the owner of account **222222222222** creates a subscription filter.

Updating an existing cross-account subscription

If you currently have a cross-account logs subscription where the destination account grants permissions only to specific sender accounts, and you want to update this subscription so that the destination account grants access to all accounts in an organization, follow the steps in this section.

Topics

Step 1: Update the subscription filters

> **Note**
>
> This step is needed only for cross-account subscriptions for logs that are created by the services listed in Enable logging from Amazon services. If you are not working with logs created by one of these log groups, you can skip to Step 2: Update the existing destination access policy.

In certain cases, you must update the subscription filters in all the sender accounts that are sending logs to the destination account. The update adds an IAM role, which CloudWatch can assume and validate that the sender account has permission to send logs to the recipient account.

Follow the steps in this section for every sender account that you want to update to use organization ID for the cross-account subscription permissions.

In the examples in this section, two accounts, 111111111111 and 222222222222 already have subscription filters created to send logs to account 999999999999. The existing subscription filter values are as follows:

```
## Existing Subscription Filter parameter values
{
    "DestinationArn": "arn:aws:logs:region:999999999999:destination:testDestination",
    "FilterPattern": "{$.userIdentity.type = Root}",
    "Distribution": "Random"
}
```

If you need to find the current subscription filter parameter values, enter the following command.

```
aws logs describe-account-policies \
--policy-type "SUBSCRIPTION_FILTER_POLICY" \
--policy-name "CrossAccountStreamsExamplePolicy"
```

To update a subscription filter to start using organization IDs for cross-account log permissions

1. Create the following trust policy in a file ~/TrustPolicyForCWL.json. Use a text editor to create this policy file; do not use the IAM console.

   ```
   {
     "Statement": {
       "Effect": "Allow",
       "Principal": { "Service": "logs.amazonaws.com" },
       "Action": "sts:AssumeRole"
     }
   }
   ```

2. Create the IAM role that uses this policy. Take note of the Arn value of the Arn value that is returned by the command, you will need it later in this procedure. In this example, we use CWLtoSubscriptionFilterRole for the name of the role we're creating.

   ```
   aws iam create-role
       \ --role-name CWLtoSubscriptionFilterRole
       \ --assume-role-policy-document file://~/TrustPolicyForCWL.json
   ```

3. Create a permissions policy to define the actions that CloudWatch Logs can perform on your account.

   a. First, use a text editor to create the following permissions policy in a file named / PermissionsForCWLSubscriptionFilter.json.

      ```
      {
          "Statement": [
              {
                  "Effect": "Allow",
                  "Action": "logs:PutLogEvents",
                  "Resource": "arn:aws:logs:region:111111111111:log-
      group:LogGroupOnWhichSubscriptionFilterIsCreated:*"
              }
          ]
      }
      ```

b. Enter the following command to associate the permissions policy you just created with the role that you created in step 2.

```
aws iam put-role-policy
    --role-name CWLtoSubscriptionFilterRole
    --policy-name Permissions-Policy-For-CWL-Subscription-filter
    --policy-document file://~/PermissionsForCWLSubscriptionFilter.json
```

4. Enter the following command to update the subscription filter policy.

```
aws logs put-account-policy \
    --policy-name "CrossAccountStreamsExamplePolicy" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document
 '{"DestinationArn":"arn:aws:logs:region:999999999999:destination:testDestination",
 "FilterPattern": "{$.userIdentity.type = Root}", "Distribution": "Random"}' \
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

Step 2: Update the existing destination access policy

After you have updated the subscription filters in all of the sender accounts, you can update the destination access policy in the recipient account.

In the following examples, the recipient account is 999999999999 and the destination is named `testDestination`.

The update enables all accounts that are part of the organization with ID `o-1234567890` to send logs to the recipient account. Only the accounts that have subscription filters created will actually send logs to the recipient account.

To update the destination access policy in the recipient account to start using an organization ID for permissions

1. In the recipient account, use a text editor to create a `~/AccessPolicy.json` file with the following contents.

```
{
"Version" : "2012-10-17",
```

```
    "Statement" : [
        {
"Sid" : "",
            "Effect" : "Allow",
            "Principal" : "*",
            "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
            "Resource" :
 "arn:aws:logs:region:999999999999:destination:testDestination",
            "Condition": {
"StringEquals" : {
"aws:PrincipalOrgID" : ["o-1234567890"]
                }
            }
        }
    ]
}
```

2. Enter the following command to attach the policy that you just created to the existing destination. To update a destination to use an access policy with an organization ID instead of an access policy that lists specific Amazon account IDs, include the `force` parameter.

> **Warning**
>
> If you are working with logs sent by an Amazon service listed in Enable logging from Amazon services, then before doing this step, you must have first updated the subscription filters in all the sender accounts as explained in Step 1: Update the subscription filters.

```
aws logs put-destination-policy
    \ --destination-name "testDestination"
    \ --access-policy file://~/AccessPolicy.json
    \ --force
```

Cross-account cross-Region account-level subscriptions using Firehose

To share log data across accounts, you need to establish a log data sender and receiver:

- **Log data sender**—gets the destination information from the recipient and lets CloudWatch Logs know that it is ready to send its log events to the specified destination. In the procedures in the

rest of this section, the log data sender is shown with a fictional Amazon account number of 111111111111.

- **Log data recipient**—sets up a destination that encapsulates a Kinesis Data Streams stream and lets CloudWatch Logs know that the recipient wants to receive log data. The recipient then shares the information about this destination with the sender. In the procedures in the rest of this section, the log data recipient is shown with a fictional Amazon account number of 222222222222.

The example in this section uses a Firehose delivery stream with Amazon S3 storage. You can also set up Firehose delivery streams with different settings. For more information, see Creating a Firehose Delivery Stream.

> **Note**
>
> The log group and the destination must be in the same Amazon Region. However, the Amazon resource that the destination points to can be located in a different Region.

> **Note**
>
> Firehose subscription filter for a ***same account*** and ***cross-Region*** delivery stream is supported.

Topics

Step 1: Create a Firehose delivery stream

> **Important**
>
> Before you complete the following steps, you must use an access policy, so Firehose can access your Amazon S3 bucket. For more information, see Controlling Access in the *Amazon Data Firehose Developer Guide*.
> All of the steps in this section (Step 1) must be done in the log data recipient account.
> US East (N. Virginia) is used in the following sample commands. Replace this Region with the correct Region for your deployment.

To create a Firehose delivery stream to be used as the destination

1. Create an Amazon S3 bucket:

```
aws s3api create-bucket --bucket amzn-s3-demo-bucket --create-bucket-configuration
 LocationConstraint=us-east-1
```

2. Create the IAM role that grants Firehose permission to put data into the bucket.

   a. First, use a text editor to create a trust policy in a file `~/TrustPolicyForFirehose.json`.

```
{ "Statement": { "Effect": "Allow", "Principal": { "Service":
 "firehose.amazonaws.com" }, "Action": "sts:AssumeRole", "Condition":
 { "StringEquals": { "sts:ExternalId":"222222222222" } } } }
```

   b. Create the IAM role, specifying the trust policy file that you just made.

```
aws iam create-role \
    --role-name FirehosetoS3Role \
    --assume-role-policy-document file://~/TrustPolicyForFirehose.json
```

   c. The output of this command will look similar to the following. Make a note of the role name and the role ARN.

```
{
    "Role": {
        "Path": "/",
        "RoleName": "FirehosetoS3Role",
```

```
        "RoleId": "AROAR3BXASEKW7K635M53",
        "Arn": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
        "CreateDate": "2021-02-02T07:53:10+00:00",
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Effect": "Allow",
                "Principal": {
                    "Service": "firehose.amazonaws.com"
                },
                "Action": "sts:AssumeRole",
                "Condition": {
                    "StringEquals": {
                        "sts:ExternalId": "222222222222"
                    }
                }
            }
        }
    }
}
```

3. Create a permissions policy to define the actions that Firehose can perform in your account.

   a. First, use a text editor to create the following permissions policy in a file named ~/PermissionsForFirehose.json. Depending on your use case, you might need to add more permissions to this file.

```
{
    "Statement": [{
        "Effect": "Allow",
        "Action": [
            "s3:PutObject",
            "s3:PutObjectAcl",
            "s3:ListBucket"
        ],
        "Resource": [
            "arn:aws:s3:::amzn-s3-demo-bucket",
            "arn:aws:s3:::amzn-s3-demo-bucket/*"
        ]
    }]
}
```

   b. Enter the following command to associate the permissions policy that you just created with the IAM role.

```
aws iam put-role-policy --role-name FirehosetoS3Role --policy-name
 Permissions-Policy-For-Firehose-To-S3 --policy-document file://~/
PermissionsForFirehose.json
```

4. Enter the following command to create the Firehose delivery stream. Replace *my-role-arn* and *amzn-s3-demo-bucket2-arn* with the correct values for your deployment.

```
aws firehose create-delivery-stream \
   --delivery-stream-name 'my-delivery-stream' \
   --s3-destination-configuration \
  '{"RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role", "BucketARN":
 "arn:aws:s3:::amzn-s3-demo-bucket"}'
```

The output should look similar to the following:

```
{
    "DeliveryStreamARN": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream"
}
```

Step 2: Create a destination

> **Important**
>
> All steps in this procedure are to be done in the log data recipient account.

When the destination is created, CloudWatch Logs sends a test message to the destination on the recipient account's behalf. When the subscription filter is active later, CloudWatch Logs sends log events to the destination on the source account's behalf.

To create a destination

1. Wait until the Firehose stream that you created in Step 1: Create a Firehose delivery stream becomes active. You can use the following command to check the **StreamDescription.StreamStatus** property.

```
aws firehose describe-delivery-stream --delivery-stream-name "my-delivery-stream"
```

In addition, take note of the **DeliveryStreamDescription.DeliveryStreamARN** value, because you will need to use it in a later step. Sample output of this command:

```
{
    "DeliveryStreamDescription": {
        "DeliveryStreamName": "my-delivery-stream",
        "DeliveryStreamARN": "arn:aws:firehose:us-
east-1:222222222222:deliverystream/my-delivery-stream",
        "DeliveryStreamStatus": "ACTIVE",
        "DeliveryStreamEncryptionConfiguration": {
            "Status": "DISABLED"
        },
        "DeliveryStreamType": "DirectPut",
        "VersionId": "1",
        "CreateTimestamp": "2021-02-01T23:59:15.567000-08:00",
        "Destinations": [
            {
                "DestinationId": "destinationId-000000000001",
                "S3DestinationDescription": {
                    "RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket",
                    "BufferingHints": {
                        "SizeInMBs": 5,
                        "IntervalInSeconds": 300
                    },
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "CloudWatchLoggingOptions": {
                        "Enabled": false
                    }
                },
                "ExtendedS3DestinationDescription": {
                    "RoleARN": "arn:aws:iam::222222222222:role/FirehosetoS3Role",
                    "BucketARN": "arn:aws:s3:::amzn-s3-demo-bucket",
                    "BufferingHints": {
                        "SizeInMBs": 5,
                        "IntervalInSeconds": 300
                    },
                    "CompressionFormat": "UNCOMPRESSED",
                    "EncryptionConfiguration": {
```

```
                        "NoEncryptionConfig": "NoEncryption"
                    },
                    "CloudWatchLoggingOptions": {
                        "Enabled": false
                    },
                    "S3BackupMode": "Disabled"
                }
            }
        ],
        "HasMoreDestinations": false
    }
}
```

It might take a minute or two for your delivery stream to show up in the active state.

2. When the delivery stream is active, create the IAM role that will grant CloudWatch Logs the permission to put data into your Firehose stream. First, you'll need to create a trust policy in a file **~/TrustPolicyForCWL.json**. Use a text editor to create this policy. For more information about CloudWatch Logs endpoints, see Amazon CloudWatch Logs endpoints and quotas.

   This policy includes a `aws:SourceArn` global condition context key that specifies the `sourceAccountId` to help prevent the confused deputy security problem. If you don't yet know the source account ID in the first call, we recommend that you put the destination ARN in the source ARN field. In the subsequent calls, you should set the source ARN to be the actual source ARN that you gathered from the first call. For more information, see Confused deputy prevention.

```
{
    "Statement": {
        "Effect": "Allow",
        "Principal": {
            "Service": "logs.amazonaws.com"
        },
        "Action": "sts:AssumeRole",
        "Condition": {
            "StringLike": {
                "aws:SourceArn": [
                    "arn:aws:logs:region:sourceAccountId:*",
                    "arn:aws:logs:region:recipientAccountId:*"
                ]
            }
        }
```

```
     }
}
```

3. Use the **aws iam create-role** command to create the IAM role, specifying the trust policy file that you just created.

```
aws iam create-role \
      --role-name CWLtoKinesisFirehoseRole \
      --assume-role-policy-document file://~/TrustPolicyForCWL.json
```

The following is a sample output. Take note of the returned `Role.Arn` value, because you will need to use it in a later step.

```
{
    "Role": {
        "Path": "/",
        "RoleName": "CWLtoKinesisFirehoseRole",
        "RoleId": "AROAR3BXASEKYJYWF243H",
        "Arn": "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole",
        "CreateDate": "2023-02-02T08:10:43+00:00",
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.amazonaws.com"
                },
                "Action": "sts:AssumeRole",
                "Condition": {
                    "StringLike": {
                        "aws:SourceArn": [
                            "arn:aws:logs:region:sourceAccountId:*",
                            "arn:aws:logs:region:recipientAccountId:*"
                        ]
                    }
                }
            }
        }
    }
}
```

4. Create a permissions policy to define which actions CloudWatch Logs can perform on your account. First, use a text editor to create a permissions policy in a file **~/PermissionsForCWL.json**:

```
{
    "Statement":[
      {
        "Effect":"Allow",
        "Action":["firehose:*"],
        "Resource":["arn:aws:firehose:region:222222222222:*"]
      }
    ]
}
```

5. Associate the permissions policy with the role by entering the following command:

```
aws iam put-role-policy --role-name CWLtoKinesisFirehoseRole --policy-name
 Permissions-Policy-For-CWL --policy-document file://~/PermissionsForCWL.json
```

6. After the Firehose delivery stream is in the active state and you have created the IAM role, you can create the CloudWatch Logs destination.

   a. This step will not associate an access policy with your destination and is only the first step out of two that completes a destination creation. Make a note of the ARN of the new destination that is returned in the payload, because you will use this as the `destination.arn` in a later step.

```
aws logs put-destination \

    --destination-name "testFirehoseDestination" \
    --target-arn "arn:aws:firehose:us-east-1:222222222222:deliverystream/my-
delivery-stream" \
    --role-arn "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole"

{
    "destination": {
        "destinationName": "testFirehoseDestination",
        "targetArn": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream",
        "roleArn": "arn:aws:iam::222222222222:role/CWLtoKinesisFirehoseRole",
        "arn": "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"}
```

```
}
```

b. After the previous step is complete, in the log data recipient account (222222222222), associate an access policy with the destination. This policy enables the log data sender account (111111111111) to access the destination in just the log data recipient account (222222222222). You can use a text editor to put this policy in the ~/AccessPolicy.json file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "111111111111"
      },
      "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
      "Resource" : "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"
    }
  ]
}
```

c. This creates a policy that defines who has write access to the destination. This policy must specify the logs:PutSubscriptionFilter and logs:PutAccountPolicy actions to access the destination. Cross-account users will use the PutSubscriptionFilter and PutAccountPolicy actions to send log events to the destination.

```
aws logs put-destination-policy \
    --destination-name "testFirehoseDestination" \
    --access-policy file://~/AccessPolicy.json
```

Step 3: Create an account-level subscription filter policy

Switch to the sending account, which is 111111111111 in this example. You will now create the account-level subscription filter policy in the sending account. In this example, the filter causes every log event containing the string ERROR in all but two log groups to be delivered to the destination you previously created.

```
aws logs put-account-policy \
    --policy-name "CrossAccountFirehoseExamplePolicy" \
    --policy-type "SUBSCRIPTION_FILTER_POLICY" \
    --policy-document '{"DestinationArn":"arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination", "FilterPattern":
 "{$.userIdentity.type = AssumedRole}", "Distribution": "Random"}' \
    --selection-criteria 'LogGroupName NOT IN ["LogGroupToExclude1",
 "LogGroupToExclude2"]' \
    --scope "ALL"
```

The sending account's log groups and the destination must be in the same Amazon Region. However, the destination can point to an Amazon resource such as a Firehose stream that is located in a different Region.

Validating the flow of log events

After you create the subscription filter, CloudWatch Logs forwards all the incoming log events that match the filter pattern and selection criteria to the Firehose delivery stream. The data starts appearing in your Amazon S3 bucket based on the time buffer interval that is set on the Firehose delivery stream. Once enough time has passed, you can verify your data by checking the Amazon S3 bucket. To check the bucket, enter the following command:

```
aws s3api list-objects --bucket 'amzn-s3-demo-bucket'
```

The output of that command will be similar to the following:

```
{
    "Contents": [
        {
            "Key": "2021/02/02/08/my-delivery-
stream-1-2021-02-02-08-55-24-5e6dc317-071b-45ba-a9d3-4805ba39c2ba",
            "LastModified": "2023-02-02T09:00:26+00:00",
            "ETag": "\"EXAMPLEa817fb88fc770b81c8f990d\"",
            "Size": 198,
            "StorageClass": "STANDARD",
            "Owner": {
                "DisplayName": "firehose+2test",
                "ID": "EXAMPLE27fd05889c665d2636218451970ef79400e3d2aecca3adb1930042e0"
            }
        }
    ]
```

```
}
```

You can then retrieve a specific object from the bucket by entering the following command. Replace the value of `key` with the value you found in the previous command.

```
aws s3api get-object --bucket 'amzn-s3-demo-bucket' --key '2021/02/02/08/my-delivery-
stream-1-2021-02-02-08-55-24-5e6dc317-071b-45ba-a9d3-4805ba39c2ba' testfile.gz
```

The data in the Amazon S3 object is compressed with the gzip format. You can examine the raw data from the command line using one of the following commands:

Linux:

```
zcat testfile.gz
```

macOS:

```
zcat <testfile.gz
```

Modifying destination membership at runtime

You might encounter situations where you have to add or remove log senders from a destination that you own. You can use the **PutDestinationPolicy** and `PutAccountPolicy` actions on your destination with the new access policy. In the following example, a previously added account **111111111111** is stopped from sending any more log data, and account **333333333333** is enabled.

1. Fetch the policy that is currently associated with the destination **testDestination** and make a note of the **AccessPolicy**:

   ```
   aws logs describe-destinations \
       --destination-name-prefix "testFirehoseDestination"
   ```

   The returned data might look like this.

   ```
   {
       "destinations": [
           {
   ```

```
            "destinationName": "testFirehoseDestination",
            "targetArn": "arn:aws:firehose:us-east-1:222222222222:deliverystream/
my-delivery-stream",
            "roleArn": "arn:aws:iam:: 222222222222:role/CWLtoKinesisFirehoseRole",
            "accessPolicy": "{\n  \"Version\" : \"2012-10-17\",\n  \"Statement
\" : [\n    {\n      \"Sid\" : \"\",\n      \"Effect\" : \"Allow\",\n
 \"Principal\" : {\n        \"AWS\" : \"111111111111 \"\n      },\n      \"Action
\" : \"logs:PutSubscriptionFilter\",\n      \"Resource\" : \"arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination\"\n    }\n  ]\n}\n\n",
            "arn": "arn:aws:logs:us-east-1:
 222222222222:destination:testFirehoseDestination",
            "creationTime": 1612256124430
        }
    ]
}
```

2. Update the policy to reflect that account **111111111111** is stopped, and that account **333333333333** is enabled. Put this policy in the **~/NewAccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "333333333333 "
      },
      "Action" : ["logs:PutSubscriptionFilter","logs:PutAccountPolicy"],
      "Resource" : "arn:aws:logs:us-
east-1:222222222222:destination:testFirehoseDestination"
    }
  ]
}
```

3. Use the following command to associate the policy defined in the **NewAccessPolicy.json** file with the destination:

```
aws logs put-destination-policy \
    --destination-name "testFirehoseDestination" \

    --access-policy file://~/NewAccessPolicy.json
```

This eventually disables the log events from account ID **111111111111**. Log events from account ID **333333333333** start flowing to the destination as soon as the owner of account **333333333333** creates a subscription filter.

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 Amazon, 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, Amazon 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`, `aws:SourceAccount`, `aws:SourceOrgID`, and `aws:SourceOrgPaths` global condition context keys in resource policies to limit the permissions that gives another service to the resource. Use `aws:SourceArn` to associate only one resource with cross-service access. Use `aws:SourceAccount` to let any resource in that account be associated with the cross-service use. Use `aws:SourceOrgID` to allow any resource from any account within an organization be associated with the cross-service use. Use `aws:SourceOrgPaths` to associate any resource from accounts within an Amazon Organizations path with the cross-service use. For more information about using and understanding paths, see Understand the Amazon Organizations entity path.

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 wildcard characters (*) for the unknown portions of the ARN. For example, `arn:aws-cn:`*`servicename`*`:*:`*`123456789012`*`:*`.

If the `aws:SourceArn` value does not contain the account ID, such as an Amazon S3 bucket ARN, you must use both `aws:SourceAccount` and `aws:SourceArn` to limit permissions.

To protect against the confused deputy problem at scale, use the `aws:SourceOrgID` or `aws:SourceOrgPaths` global condition context key with the organization ID or organization path of the resource in your resource-based policies. Policies that include the `aws:SourceOrgID` or

`aws:SourceOrgPaths` key will automatically include the correct accounts and you don't have to manually update the policies when you add, remove, or move accounts in your organization.

The policies documented for granting access to CloudWatch Logs to write data to Kinesis Data Streams and Firehose in Step 1: Create a destination and Step 2: Create a destination show how you can use the aws:SourceArn global condition context key to help prevent the confused deputy problem.

Log recursion prevention

There is a risk of causing an infinite log recursion with subscription filters that can lead to a large increase in ingestion billing in both CloudWatch Logs and your destination, if not prevented. This can occur when a subscription filter is associated with a log group that receives log events as a result of your subscription delivery workflow. The logs ingested into the log group will be delivered to the destination, causing the log group to ingest more logs which will then be forwarded again to the destination, creating a recursion loop.

For example, consider a subscription filter with the destination as Firehose, which delivers log events to Amazon S3. Additionally, there is also a Lambda function that processes new events delivered to Amazon S3 and produces some logs itself. If the subscription filter is applied to the Lambda function's log group, then the log events produced by the function will get forwarded to Firehose and Amazon S3 at the destination, which will then invoke the function again, causing more logs to be produced and forwarded to Firehose and Amazon S3, causing another invocation of the function and so on. This will occur in an infinite loop, leading to an unexpected billing increase on log ingestion, Firehose, and Amazon S3.

If the Lambda function is attached to a VPC with flow logs enabled for CloudWatch Logs, then the VPC's log group can cause a log recursion as well.

We recommend that you don't apply subscription filters to log groups that are a part of your subscription delivery workflow. For account-level subscription filters, use the `selectionCriteria` parameter in the `PutAccountPolicy` API to exclude these log groups from the policy.

When excluding log groups, consider the following Amazon services that produce logs and may be a part of your subscription delivery workflows:

- Amazon EC2 with Fargate
- Lambda

- Amazon Step Functions
- Amazon VPC flow logs that are enabled for CloudWatch Logs

> **Note**
>
> Log events produced by a Lambda destination's log group will not be forwarded back to the Lambda function for an account-level subscription filter policy. In this case, excluding the destination Lambda function's log group using `selectionCriteria` is not required for account subscription policies.

Filter pattern syntax for metric filters, subscription filters, filter log events, and Live Tail

> **Note**
>
> For information about how to query your log groups with the Amazon CloudWatch Logs Insights query language, see CloudWatch Logs Insights language query syntax.

With CloudWatch Logs, you can use metric filters to transform log data into actionable metrics, subscription filters to route log events to other Amazon services, filter log events to search for log events, and Live Tail to interactively view your logs in real-time as they are ingested.

Filter patterns make up the syntax that metric filters, subscription filters, log events, and Live Tail use to match terms in log events. Terms can be words, exact phrases, or numeric values. Regular expressions (regex) can be used to create standalone filter patterns, or can be incorporated with JSON and space-delimited filter patterns.

Create filter patterns with the terms that you want to match. Filter patterns only return the log events that contain the terms you define. You can test filter patterns in the CloudWatch console.

Topics

Supported regular expressions (regex) syntax

Supported regex syntax

When using regex to search and filter log data, you must surround your expressions with %.

Filter patterns with regex can only include the following:

- Alphanumeric characters – An alphanumeric character is a character that is either a letter (from A to Z or a to z) or a digit (from 0 to 9).
- Supported symbol characters – These include: ':', '_', '#', '=', '@','/', ';', ',', and '-'. For example, `%something!%` would be rejected since '!' is not supported.
- Supported operators – These include: '^', '$', '?', '[', ']', '{', '}', '|', '\', '*', '+', and '.'.

The (and) operators are not supported. You cannot use parentheses to define a subpattern.

Multi-byte characters are not supported.

> **Note**
>
> **Quotas**
> There is a maximum of 5 filter patterns containing regex for each log group when creating metric filters or subscription filters.
> There is a limit of 2 regex for each filter pattern when creating a delimited or JSON filter pattern for metric filters and subscription filters or when filtering log events or Live Tail.

Usage of supported operators

- ^: Anchors the match to the beginning of a string. For example, `%^[hc]at%` matches "hat" and "cat", but only at the beginning of a string.
- $: Anchors the match to the end of a string. For example, `%[hc]at$%` matches "hat" and "cat", but only at the end of a string.
- ?: Matches zero or more instances of the preceding term. For example, `%colou?r%` can match both "color" and "colour".
- `[]`: Defines a character class. Matches the character list or character range contained within the brackets. For example, `%[abc]%` matches "a", "b", or "c"; `%[a-z]%` matches any lowercase letter from "a" to "z"; and `%[abcx-z]%`matches "a", "b", "c", "x", "y", or "z".
- `{m, n}`: Matches the preceding term at least *m* and not more than *n* times. For example, `%a{3,5}%` matches only "aaa", "aaaa", and "aaaaa".

> **Note**
>
> Either *m* or *n* can be omitted if you chose not to define a minimum or maximum.

- `|`: Boolean "Or", which matches the term on either side of the vertical bar. For example:
  - `%gra|ey%` can match "gray" or "grey"
  - `%^starting|^initializing|^shutting down%` can match match "starting ...", or "initializing ...", or "shutting down", but won't match "skipping initializing ..."
  - `%abcc|ab[^c]$` can match match "abcc ..." and "aba ..." but won't match "aac ..."
- `\`: Escape character, which allows you to use the literal meaning of an operator instead of its special meaning. For example, `%\[.\]%` matches any single character surrounded by "[" and "]" since the brackets are escaped, such as "[a]", "[b]", "[7]", "[@]", "[]]", and "[ ]".

  > **Note**
  >
  > `%10\.10\.0\.1%` is the correct way to create a regex to match the IP address 10.10.0.1.

- `*`: Matches zero or more instances of the preceding term. For example, `%ab*c%` can match "ac", "abc", and "abbbc"; `%ab[0-9]*%` can match "ab", "ab0", and "ab129".
- `+`: Matches one or more instances of the preceding term. For example, `%ab+c%` can match "abc", "abbc", and "abbbc", but not "ac".
- `.`: Matches any single character. For example, `%.at%` matches any three character string ending with "at", including "hat", "cat", "bat", "4at", "#at" and " at" (starting with a space).

  > **Note**
  >
  > When creating a regex to match IP addresses, it is important to escape the `.` operator. For example, `%10.10.0.1%` can match "10010,051" which might not be the actual intended purpose of the expression.

- `\d`, `\D`: Matches a digit/non-digit character. For example, `%\d%` is equivalent to `%[0-9]%` and `%\D%` is equivalent to `%[^0-9]%`.

  > **Note**
  >
  > The uppercase operator denotes the inverse of its lowercase counterpart.

- `\s`, `\S`: Matches a whitespace character/non-whitespace character.

> **Note**
>
> The uppercase operator denotes the inverse of its lowercase counterpart. Whitespace characters include the tab (\t), space( ), and newline (\n) characters.

- \w, \W: Matches an alphanumeric character/non-alphanumeric character. For example, %\w% is equivalent to %[a-zA-Z_0-9]% and %\W% is equivalent to %[^a-zA-Z_0-9]%.

> **Note**
>
> The uppercase operator denotes the inverse of its lowercase counterpart.

- \xhh: Matches the ASCII mapping for a two-digit hexadecimal character. \x is the escape sequence which indicates that the following characters represent the hexadecimal value for ASCII. hh specifies the two hexadecimal digits (0-9 and A-F) which point to a character in the ASCII table.

> **Note**
>
> You can use \xhh to match symbol characters that are not supported by the filter pattern. For example, %\x3A% matches :; and %\x28% matches (.

Using filter patterns to match terms with a regular expression (regex)

Match terms using regex

You can match terms in your log events using a regex pattern surrounded with % (percentage signs before and after the regex pattern). The following code snippet shows an example of a filter pattern that returns all log events consisting of the **AUTHORIZED** keyword.

For a list of supported regular expressions, see Supported regular expressions.

```
%AUTHORIZED%
```

This filter pattern returns log event messages, such as the following:

- `[ERROR 401] UNAUTHORIZED REQUEST`
- `[SUCCESS 200] AUTHORIZED REQUEST`

Using filter patterns to match terms in unstructured log events

Match terms in unstructured log events

The following examples contain code snippets that show how you can use filter patterns to match terms in unstructured log events.

> **Note**
>
> Filter patterns are case sensitive. Enclose exact phrases and terms that include non-alphanumeric characters in double quotation marks ("").

Example: Match a single term

The following code snippet shows an example of a single-term filter pattern that returns all log events where messages contain the word ***ERROR***.

```
ERROR
```

This filter pattern matches log event messages, such as the following:

- `[ERROR 400] BAD REQUEST`
- `[ERROR 401] UNAUTHORIZED REQUEST`
- `[ERROR 419] MISSING ARGUMENTS`
- `[ERROR 420] INVALID ARGUMENTS`

Example: Match multiple terms

The following code snippet shows an example of a multiple-term filter pattern that returns all log events where messages contain the words ***ERROR*** and ***ARGUMENTS***.

```
ERROR ARGUMENTS
```

The filter returns log event messages, such as the following:

- `[ERROR 419] MISSING ARGUMENTS`
- `[ERROR 420] INVALID ARGUMENTS`

This filter pattern doesn't return the following log event messages because they don't contain both of the terms specified in the filter pattern.

- `[ERROR 400] BAD REQUEST`
- `[ERROR 401] UNAUTHORIZED REQUEST`

Example: Match optional terms

You can use pattern matching to create filter patterns that return log events containing optional terms. Place a question mark ("?") before the terms that you want to match. The following code snippet shows an example of a filter pattern that returns all log events where messages contain the word ***ERROR*** or the word ***ARGUMENTS***.

```
?ERROR ?ARGUMENTS
```

This filter pattern matches log event messages, such as the following:

- `[ERROR 400] BAD REQUEST`
- `[ERROR 401] UNAUTHORIZED REQUEST`
- `[ERROR 419] MISSING ARGUMENTS`
- `[ERROR 420] INVALID ARGUMENTS`

Note

You cant' combine the question mark ("?") with other filter patterns, such as include and exclude terms. If you combine "?" with other filter patterns, all question mark terms will be ignored.
For example, the following filter pattern matches all events containing the word REQUEST, but the question mark ("?") filter terms are ignored and have no effect.

```
?ERROR ?ARGUMENTS REQUEST
```

Log event matches

- `[INFO] REQUEST FAILED`
- `[WARN] UNAUTHORIZED REQUEST`
- `[ERROR] 400 BAD REQUEST`

Example: Match exact phrases

The following code snippet shows an example of a filter pattern that returns log events where messages contain the exact phrase ***INTERNAL SERVER ERROR***.

```
"INTERNAL SERVER ERROR"
```

This filter pattern returns the following log event message:

- `[ERROR 500] INTERNAL SERVER ERROR`

Example: Include and exclude terms

You can create filter patterns that return log events where messages include some terms and exclude other terms. Place a minus symbol (**"-"**) before the terms that you want to exclude. The following code snippet shows an example of a filter pattern that returns log events where messages include the term ***ERROR*** and exclude the term ***ARGUMENTS***.

```
ERROR -ARGUMENTS
```

This filter pattern returns log event messages, such as the following:

- `[ERROR 400] BAD REQUEST`
- `[ERROR 401] UNAUTHORIZED REQUEST`

This filter pattern doesn't return the following log event messages because they contain the word ***ARGUMENTS***.

- `[ERROR 419] MISSING ARGUMENTS`
- `[ERROR 420] INVALID ARGUMENTS`

Example: Match everything

You can match everything in your log events with double quotation marks. The following code snippet shows an example of a filter pattern that returns all log events.

```
" "
```

Using filter patterns to match terms in JSON log events

Writing filter patterns for JSON log events

The following describes how to write the syntax for filter patterns that match JSON terms containing strings and numeric values.

Writing filter patterns that match strings

You can create filter patterns to match strings in JSON log events. The following code snippet shows an example of the syntax for string-based filter pattern.

```
{ PropertySelector EqualityOperator String }
```

Enclose filter patterns in curly braces ("{}"). String-based filter patterns must contain the following parts:

- **Property selector**

  Set off property selectors with a dollar sign followed by a period ("$."). Property selectors are alphanumeric strings that support hyphen ("-") and underscore ("_") characters. Strings don't support scientific notation. Property selectors point to value nodes in JSON log events. Value nodes can be strings or numbers. Place arrays after property selectors. The elements in arrays follow a zero-based numbering system, meaning that the first element in the array is element 0, the second element is element 1, and so on. Enclose elements in brackets ("[]"). If a property selector points to an array or object, the filter pattern won't match the log format. If the JSON property contains a period (" . "), then the bracket notation may be used to select that property.

  > **Note**
  >
  > **Wildcard selector**
  > You can use the JSON wildcard to select any array element or any JSON object field.
  > **Quotas**
  > You can only use up to one wildcard selector in a property selector.

- **Equality operator**

  Set off equality operators with one of the following symbols: equal ("=") or not equal ("!="). Equality operators return a Boolean value (true or false).

- **String**

  You can enclose strings in double quotation marks (""). Strings that contain types other than alphanumeric characters and the underscore symbol must be placed in double quotation marks. Use the asterisk ("*") as a wild card to match text.

> **Note**
>
> You can use any conditional regular expression when creating filter patterns to match terms in JSON log events. For a list of supported regular expressions, see Supported regular expressions.

The following code snippet contains an example of a filter pattern showing how you can format a filter pattern to match a JSON term with a string.

```
{ $.eventType = "UpdateTrail" }
```

Writing filter patterns that match numeric values

You can create filter patterns to match numeric values in JSON log events. The following code snippet shows an example of the syntax for filter patterns that match numeric values.

```
{ PropertySelector NumericOperator Number }
```

Enclose filter patterns in curly braces ("{}"). Filter patterns that match numeric values must have the following parts:

- **Property selector**

  Set off property selectors with a dollar sign followed by a period ("$."). Property selectors are alphanumeric strings that support hyphen ("-") and underscore ("_") characters. Strings don't support scientific notation. Property selectors point to value nodes in JSON log events. Value nodes can be strings or numbers. Place arrays after property selectors. The elements in arrays follow a zero-based numbering system, meaning that the first element in the array is element 0, the second element is element 1, and so on. Enclose elements in brackets ("[]"). If a property selector points to an array or object, the filter pattern won't match the log format. If the JSON property contains a period (" . "), then the bracket notation may be used to select that property.

> **Note**
>
> **Wildcard selector**
> You can use the JSON wildcard to select any array element or any JSON object field.
> **Quotas**
> You can only use up to one wildcard selector in a property selector.

- **Numeric operator**

  Set off numeric operators with one of the following symbols: greater than (">"), less than ("<"), equal ("="), not equal ("!="), greater than or equal to (">="), or less than or equal to ("<=").

- **Number**

  You can use integers that contain plus ("+") or minus ("-") symbols and follow scientific notation. Use the asterisk ("*") as a wild card to match numbers.

The following code snippet contains examples showing how you can format filter patterns to match JSON terms with numeric values.

```
// Filter pattern with greater than symbol
{ $.bandwidth > 75 }
// Filter pattern with less than symbol
{ $.latency < 50 }
// Filter pattern with greater than or equal to symbol
{ $.refreshRate >= 60 }
// Filter pattern with less than or equal to symbol
{ $.responseTime <= 5 }
// Filter pattern with equal sign
{ $.errorCode = 400}
// Filter pattern with not equal sign
{ $.errorCode != 500 }
// Filter pattern with scientific notation and plus symbol
{ $.number[0] = 1e-3 }
// Filter pattern with scientific notation and minus symbol
{ $.number[0] != 1e+3 }
```

Match terms in JSON log events using simple expressions

The following examples contain code snippets that show how filter patterns can match terms in a JSON log event.

> **Note**
>
> If you test an example filter pattern with the example JSON log event, you must enter the example JSON log on a single line.

JSON log event

```
{
      "eventType": "UpdateTrail",
      "sourceIPAddress": "111.111.111.111",
      "arrayKey": [
            "value",
            "another value"
      ],
      "objectList": [
           {
             "name": "a",
             "id": 1
           },
           {
             "name": "b",
             "id": 2
           }
      ],
      "SomeObject": null,
      "cluster.name": "c"
}
```

Example: Filter pattern that matches string values

This filter pattern matches the string `"UpdateTrail"` in the property `"eventType"`.

```
{ $.eventType = "UpdateTrail" }
```

Example: Filter pattern that matches string values (IP address)

This filter pattern contains a wild card and matches the property "sourceIPAddress" because it doesn't contain a number with the prefix "123.123.".

```
{ $.sourceIPAddress != 123.123.* }
```

Example: Filter pattern that matches a specific array element with a string value

This filter pattern matches the element "value" in the array "arrayKey".

```
{ $.arrayKey[0] = "value" }
```

Example: Filter pattern that matches a string using regex

This filter pattern matches the string "Trail" in the property "eventType".

```
{ $.eventType = %Trail% }
```

Example: Filter pattern that uses a wildcard to match values of any element in the array using regex

The filter pattern contain regex which matches the element "value" in the array "arrayKey".

```
{ $.arrayKey[*] = %val.{2}% }
```

Example: Filter pattern that uses a wildcard to match values of any element with a specific prefix and subnet using regex (IP address)

This filter pattern contains regex which matches the element "111.111.111.111" in the property "sourceIPAddress".

```
{ $.* = %111\.111\.111\.1[0-9]{1,2}% }
```

> **Note**
>
> **Quotas**
>
> You can only use up to one wildcard selector in a property selector.

Example: Filter pattern that matches a JSON property with a period (.) in the key

```
{ $.['cluster.name'] = "c" }
```

Example: Filter pattern that matches JSON logs using IS

You can create filter patterns that match fields in JSON logs with the `IS` variable. The `IS` variable can match fields that contain the values `NULL`, `TRUE`, or `FALSE`. The following filter pattern returns JSON logs where the value of `SomeObject` is `NULL`.

```
{ $.SomeObject IS NULL }
```

Example: Filter pattern that matches JSON logs using NOT EXISTS

You can create filter patterns with the `NOT EXISTS` variable to return JSON logs that don't contain specific fields in the log data. The following filter pattern uses `NOT EXISTS` to return JSON logs that don't contain the field `SomeOtherObject`.

```
{ $.SomeOtherObject NOT EXISTS }
```

> **Note**
>
> The variables `IS NOT` and `EXISTS` currently aren't supported.

Match terms in JSON objects using compound expressions

You can use the logical operators AND ("&&") and OR ("||") in filter patterns to create compound expressions that match log events where two or more conditions are true. Compound expressions support the use of parentheses ("()") and the following standard order of operations: () > && > ||. The following examples contain code snippets that show how you can use filter patterns with compound expressions to match terms in a JSON object.

JSON object

```
{
    "user": {
        "id": 1,
        "email": "John.Stiles@example.com"
    },
    "users": [
        {
         "id": 2,
         "email": "John.Doe@example.com"
        },
        {
         "id": 3,
         "email": "Jane.Doe@example.com"
        }
    ],
    "actions": [
        "GET",
        "PUT",
        "DELETE"
    ],
    "coordinates": [
        [0, 1, 2],
        [4, 5, 6],
        [7, 8, 9]
    ]
}
```

Example: Expression that matches using AND (&&)

This filter pattern contains a compound expression that matches `"id"` in `"user"` with a numeric value of 1 and `"email"` in the first element of the `"users"` array with the string `"John.Doe@example.com"`.

```
{ ($.user.id = 1) && ($.users[0].email = "John.Doe@example.com") }
```

Example: Expression that matches using OR (||)

This filter pattern contains a compound expression that matches `"email"` in `"user"` with the string `"John.Stiles@example.com"`.

```
{ $.user.email = "John.Stiles@example.com" || $.coordinates[0][1] = "nonmatch" &&
 $.actions[2] = "nonmatch" }
```

Example: Expression that doesn't match using AND (&&)

This filter pattern contains a compound expression that doesn't find a match because the expression doesn't match the third action in `"actions"`.

```
{ ($.user.email = "John.Stiles@example.com" || $.coordinates[0][1] = "nonmatch") &&
 $.actions[2] = "nonmatch" }
```

Note

Quotas

You can only use up to one wildcard selector in a property selector, and up to three wildcard selectors in a filter pattern with compound expressions.

Example: Expression that doesn't match using OR (||)

This filter pattern contains a compound expression that doesn't find a match because the expression doesn't match the first property in `"users"` or the third action in `"actions"`.

```
{ ($.user.id = 2 && $.users[0].email = "nonmatch") || $.actions[2] = "GET" }
```

Using filter patterns to match terms in space-delimited log events

Writing filter patterns for space-delimited log events

You can create filter patterns to match terms in space-delimited log events. The following provides an example space-delimited log event and describes how to write the syntax for filter patterns that match terms in the space-delimited log event.

> **Note**
>
> You can use any conditional regular expression when creating filter patterns to match terms in space-delimited log events. For a list of supported regular expressions, see Supported regular expressions.

Example: Space-delimited log event

The following code snippet shows a space-delimited log event that contains seven fields: `ip`, `user`, `username`, `timestamp`, `request`, `status_code`, and `bytes`.

```
127.0.0.1 Prod frank [10/Oct/2000:13:25:15 -0700] "GET /index.html HTTP/1.0" 404
 1534
```

> **Note**
>
> Characters between brackets ("[]") and double quotation marks ("") are considered single fields.

Writing filter patterns that match terms in a space-delimited log event

To create a filter pattern that matches terms in a space-delimited log event, enclose the filter pattern in brackets ("[]"), and specify fields with names that are separated by commas (","). The following filter pattern parses seven fields.

```
[ip=%127\.0\.0\.[1-9]%, user, username, timestamp, request =*.html*, status_code =
 4*, bytes]
```

You can use numeric operators (>, <, =, !=, >=, or <=) and the asterisk (*) as a wild card or regex to give your filter pattern conditions. In the example filter pattern, `ip` uses regex that matches IP address range 127.0.0.1 - 127.0.0.9, `request` contains a wildcard that states it must extract a value with `.html`, and `status_code` contains a wildcard that states it must extract a value beginning with `4`.

If you don't know the number of fields that you're parsing in a space-delimited log event, you can use ellipsis (...) to reference any unnamed field. Elipsis can reference as many fields as needed. The following example shows a filter pattern with ellipsis that represent the first four unnamed fields shown in the previous example filter pattern.

```
[..., request =*.html*, status_code = 4*, bytes]
```

You also can use the logical operators AND (&&) and OR (||) to create compound expressions. The following filter pattern contains a compound expression that states the value of `status_code` must be `404` or `410`.

```
[ip, user, username, timestamp, request =*.html*, status_code = 404 || status_code =
 410, bytes]
```

Match terms in space-delimited log events using pattern matching

You can use pattern matching to create space-delimited filter patterns that match terms in a specific order. Specify the order of your terms with indicators. Use **w1** to represent your first term and **w2** and so on to represent the order of your subsequent terms. Place commas (",") between your terms. The following examples contain code snippets that show how you can use pattern matching with space-delimited filter patterns.

> **Note**
>
> You can use any conditional regular expression when creating filter patterns to match terms in space-delimited log events. For a list of supported regular expressions, see Supported regular expressions.

Space-delimited log event

```
INFO 09/25/2014 12:00:00 GET /service/resource/67 1200
INFO 09/25/2014 12:00:01 POST /service/resource/67/part/111 1310
WARNING 09/25/2014 12:00:02 Invalid user request
ERROR 09/25/2014 12:00:02 Failed to process request
```

Example: Match terms in order

The following space-delimited filter pattern returns log events where the first word in the log events is ***ERROR***.

```
[w1=ERROR, w2]
```

> **Note**
>
> When you create space-delimited filter patterns that use pattern matching, you must include a blank indicator after you specify the order of your terms. For example, if you create a filter pattern that returns log events where the first word is ***ERROR***, include a blank **w2** indicator after the **w1** term.

Example: Match terms with AND (&&) and OR (||)

You can use the logical operators AND ("&&") and OR ("||") to create space-delimited filter patterns that contain conditions. The following filter pattern returns log events where the first word in the events is ***ERROR*** or ***WARNING***.

```
[w1=ERROR || w1=WARNING, w2]
```

Example: Exclude terms from matches

You can create space-delimited filter patterns that return log events excluding one or more terms. Place a not equal symbol ("!=") before the term or terms that you want to exclude. The following code snippet shows an example of a filter pattern that returns log events where the first words aren't ***ERROR*** and ***WARNING***.

```
[w1!=ERROR && w1!=WARNING, w2]
```

Example: Match the top level item in a resource URI

The following code snippet shows an example of a filter pattern that matches the top level item in a resource URI using regex.

```
[logLevel, date, time, method, url=%/service/resource/[0-9]+$%, response_time]
```

Example: Match the child level item in a resource URI

The following code snippet shows an example of a filter pattern that matches the child level item in a resource URI using regex.

```
[logLevel, date, time, method, url=%/service/resource/[0-9]+/part/[0-9]+$%,
 response_time]
```

Enable logging from Amazon services

While many services publish logs only to CloudWatch Logs, some Amazon services can publish logs directly to Amazon Simple Storage Service or Amazon Data Firehose. If your main requirement for logs is storage or processing in one of these services, you can easily have the service that produces the logs send them directly to Amazon S3 or Firehose without additional setup.

Even when logs are published directly to Amazon S3 or Firehose, charges apply. For more information, see *Vended Logs* on the **Logs** tab at Amazon CloudWatch Pricing.

Some Amazon services use a common infrastructure to send their logs. To enable logging from these services, you must be logged in as a user that has certain permissions. Additionally, you must grant permissions to Amazon to enable the logs to be sent.

For services that require these permissions, there are two versions of the permissions needed. The services that require these extra permissions are noted as **Supported [V1 Permissions]** and **Supported [V2 Permissions]** in the table. For information about these required permissions, see the sections after the table.

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon API Gateway access logs	Vended logs	Supported [V1 Permissions]		
Amazon AppSync logs	Custom logs	Supported		
Amazon Aurora MySQL logs	Custom logs	Supported		
Amazon Bedrock Knowledge bases logging	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Chime media quality metric logs and SIP message logs	Vended logs	Supported [V1 Permissions]		
CloudFront: access logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon CloudHSM audit logs	Custom logs	Supported		
CloudWatch Evidently evaluation event logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	
CloudWatch Internet Monitor logs	Vended logs		Supported [V1 Permissions]	
CloudTrail logs	Custom logs	Supported		
Amazon CodeBuild logs	Custom logs	Supported		
Amazon CodeWhisperer event logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Cognito logs	Vended logs	Supported [V1 Permissions]		
Amazon Connect logs	Custom logs	Supported		
Amazon DataSync logs	Custom logs	Supported		
Amazon ElastiCache (Redis OSS) logs	Vended logs	Supported [V1 Permissions]		Supported [V1 Permissions]
Amazon Elastic Beanstalk logs	Custom logs	Supported		
Amazon Elastic Container Service logs	Custom logs	Supported		
Amazon Elastic Kubernetes Service control plane logs	Vended logs	Supported		
AWS Elemental MediaPackage access logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
AWS Elemental MediaTailor logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Entity Resolution logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon EventBridge Pipes logging	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Fargate logs	Custom logs	Supported		
Amazon Fault Injection Service experiment logs	Vended logs		Supported [V1 Permissions]	
Amazon FinSpace	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Global Accelerator flow logs	Vended logs		Supported [V1 Permissions]	
Amazon Glue job logs	Custom logs	Supported		
IAM Identity Center error logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Interactive Video Service chat logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon IoT logs	Custom logs	Supported		
Amazon IoT FleetWise logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Lambda logs	Vended logs	Supported	Supported	Supported
Amazon Macie logs	Custom logs	Supported		
Amazon SES logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon Mainframe Modernization	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Managed Service for Prometheus logs	Vended logs	Supported [V1 Permissions]		

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon MSK broker logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon MSK Connect logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon MQ general and audit logs	Custom logs	Supported		
Amazon Network Firewall logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Network Load Balancer access logs	Vended logs		Supported [V1 Permissions]	
OpenSearch logs	Custom logs	Supported		
Amazon OpenSearch Service ingestion logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon OpsWorks logs	Custom logs	Supported		

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon PCS logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon Relational Database ServicePostgreSQL logs	Custom logs	Supported		
Amazon Q Business conversation logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon RoboMaker logs	Custom logs	Supported		
Amazon Route 53 public DNS query logs	Vended logs	Supported		
Amazon Route 53 resolver query logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	
Amazon SageMaker AI events	Vended logs	Supported [V1 Permissions]		
Amazon SageMaker AI worker events	Vended logs	Supported [V1 Permissions]		

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Site-to_Site VPN logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Simple Email Service logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon Simple Notification Service logs	Custom logs	Supported		
Amazon Simple Notification Service data protection policy logs	Custom logs	Supported		
EC2 Spot Instance data feed files	Vended logs		Supported [V1 Permissions]	
Amazon Step Functions Express Workflow and Standard Workflow logs	Vended logs	Supported [V1 Permissions]		
Storage Gateway audit logs and health logs	Vended logs	Supported [V1 Permissions]		
Amazon Transfer Family logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]

Log source	Log type	CloudWatch Logs	Amazon S3	Firehose
Amazon Verified Access logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon Virtual Private Cloud flow logs	Vended logs	Supported	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon VPC Lattice access logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported [V1 Permissions]
Amazon VPC Route Server	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]
Amazon WAF logs	Vended logs	Supported [V1 Permissions]	Supported [V1 Permissions]	Supported
Amazon WorkMail audit logs	Vended logs	Supported [V2 Permissions]	Supported [V2 Permissions]	Supported [V2 Permissions]

Logging that requires additional permissions [V1]

Some Amazon services use a common infrastructure to send their logs to CloudWatch Logs, Amazon S3, or Firehose. To enable the Amazon services listed in the following table to send their logs to these destinations, you must be logged in as a user that has certain permissions.

Additionally, permissions must be granted to Amazon to enable the logs to be sent. Amazon can automatically create those permissions when the logs are set up, or you can create them yourself first before you set up the logging. For cross-account delivery, you must manually create the permission policies yourself.

If you choose to have Amazon automatically set up the necessary permissions and resource policies when you or someone in your organization first sets up the sending of logs, then the user who is setting up the sending of logs must have certain permissions, as explained later in this section. Alternatively, you can create the resource policies yourself, and then the users who set up the sending of logs do not need as many permissions.

The following table summarizes which types of logs and which log destinations that the information in this section applies to.

The following sections provide more details for each of these destinations.

Logs sent to CloudWatch Logs

> **Important**
>
> When you set up the log types in the following list to be sent to CloudWatch Logs, Amazon creates or changes the resource policies associated with the log group receiving the logs, if needed. Continue reading this section to see the details.

This section applies when the types of logs listed in the table in the preceding section are sent to CloudWatch Logs:

User permissions

To be able to set up sending any of these types of logs to CloudWatch Logs for the first time, you must be logged into an account with the following permissions.

- `logs:CreateLogDelivery`
- `logs:PutResourcePolicy`
- `logs:DescribeResourcePolicies`
- `logs:DescribeLogGroups`

> **Note**
>
> When you specify the `logs:DescribeLogGroups`, `logs:DescribeResourcePolicies`, or `logs:PutResourcePolicy` permission, be sure to set the ARN of its `Resource` line to use a `*` wildcard, instead of specifying only a single log group name. For example, `"Resource": "arn:aws:logs:us-east-1:111122223333:log-group:*"`

If any of these types of logs is already being sent to a log group in CloudWatch Logs, then to set up the sending of another one of these types of logs to that same log group, you only need the `logs:CreateLogDelivery` permission.

Log group resource policy

The log group where the logs are being sent must have a resource policy that includes certain permissions. If the log group currently does not have a resource policy, and the user setting up the logging has the `logs:PutResourcePolicy`, `logs:DescribeResourcePolicies`, and `logs:DescribeLogGroups` permissions for the log group, then Amazon automatically creates the following policy for it when you begin sending the logs to CloudWatch Logs.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSLogDeliveryWrite20150319",
      "Effect": "Allow",
      "Principal": {
        "Service": [
          "delivery.logs.amazonaws.com"
        ]
      },
      "Action": [
        "logs:CreateLogStream",
```

```
        "logs:PutLogEvents"
      ],
      "Resource": [
        "arn:aws:logs:us-east-1:0123456789:log-group:my-log-group:log-stream:*"
      ],
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": ["0123456789"]
        },
        "ArnLike": {
          "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:*"]
        }
      }
    }
  ]
}
```

If the log group does have a resource policy but that policy doesn't contain the statement shown in the previous policy, and the user setting up the logging has the `logs:PutResourcePolicy`, `logs:DescribeResourcePolicies`, and `logs:DescribeLogGroups` permissions for the log group, that statement is appended to the log group's resource policy.

Logs sent to Amazon S3

When you set logs to be sent to Amazon S3, Amazon creates or changes the resource policies associated with the S3 bucket that is receiving the logs, if needed.

Logs published directly to Amazon S3 are published to an existing bucket that you specify. One or more log files are created every five minutes in the specified bucket.

When you deliver logs for the first time to an Amazon S3 bucket, the service that delivers logs records the owner of the bucket to ensure that the logs are delivered only to a bucket belonging to this account. As a result, to change the Amazon S3 bucket owner, you must re-create or update the log subscription in the originating service.

> **Note**
>
> CloudFront uses a different permissions model than the other services that send vended logs to S3. For more information, see Permissions required to configure standard logging and to access your log files.

Additionally, if you use the same S3 bucket for CloudFront access logs and another log source, enabling ACL on the bucket for CloudFront also grants permission to all other log sources that use this bucket.

Important

If you're sending logs to an Amazon S3 bucket and the bucket policy contains a `NotAction` or `NotPrincipal` element, adding log delivery permissions to the bucket automatically and creating a log subscription will fail. To create a log subscription successfully, you need to manually add the log delivery permissions to the bucket policy, then create the log subscription. For more information, see the instructions in this section.

If the bucket has server-side encryption using a customer managed Amazon KMS key, you must also add the key policy for your customer managed key. For more information, see Amazon S3.

If the destination bucket has SSE-KMS and a Bucket Key enabled, the attached customer managed KMS key policy no longer works as expected for all requests. For more information, see Reducing the cost of SSE-KMS with Amazon S3 Bucket Keys.

If you're using vended logs and S3 encryption with a customer managed Amazon KMS key, you must use a fully qualified Amazon KMS key ARN instead of a key ID when you configure the bucket. For more information, see put-bucket-encryption.

User permissions

To be able to set up sending any of these types of logs to Amazon S3 for the first time, you must be logged into an account with the following permissions.

- `logs:CreateLogDelivery`
- `S3:GetBucketPolicy`
- `S3:PutBucketPolicy`

If any of these types of logs is already being sent to an Amazon S3 bucket, then to set up the sending of another one of these types of logs to the same bucket you only need to have the `logs:CreateLogDelivery` permission.

S3 bucket resource policy

The S3 bucket where the logs are being sent must have a resource policy that includes certain permissions. If the bucket currently does not have a resource policy and the user setting up the logging has the `S3:GetBucketPolicy` and `S3:PutBucketPolicy` permissions for the bucket, then Amazon automatically creates the following policy for it when you begin sending the logs to Amazon S3.

```
{
    "Version": "2012-10-17",
    "Id": "AWSLogDeliveryWrite20150319",
    "Statement": [
        {
            "Sid": "AWSLogDeliveryAclCheck",
            "Effect": "Allow",
            "Principal": {
                "Service": "delivery.logs.amazonaws.com"
                },
            "Action": "s3:GetBucketAcl",
            "Resource": "arn:aws:s3:::amzn-s3-demo-bucket",
            "Condition": {
                "StringEquals": {
                "aws:SourceAccount": ["0123456789"]
                },
                "ArnLike": {
                "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:*"]
                }
            }
        },
        {
            "Sid": "AWSLogDeliveryWrite",
            "Effect": "Allow",
            "Principal": {
                "Service": "delivery.logs.amazonaws.com"
            },
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::amzn-s3-demo-bucket/AWSLogs/account-ID/*",
            "Condition": {
                "StringEquals": {
                    "s3:x-amz-acl": "bucket-owner-full-control",
                    "aws:SourceAccount": ["0123456789"]
                },
                "ArnLike": {
                    "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:*"]
                }
```

```
            }
        }
    ]
}
```

In the previous policy, for `aws:SourceAccount`, specify the list of account IDS for which logs are being delivered to this bucket. For `aws:SourceArn`, specify the list of ARNs of the resource that generates the logs, in the form `arn:aws:logs:`*`source-region`*`:`*`source-account-id`*`:*`.

If the bucket has a resource policy but that policy doesn't contain the statement shown in the previous policy, and the user setting up the logging has the `S3:GetBucketPolicy` and `S3:PutBucketPolicy` permissions for the bucket, that statement is appended to the bucket's resource policy.

> **Note**
>
> In some cases, you may see `AccessDenied` errors in Amazon CloudTrail if the `s3:ListBucket` permission has not been granted to `delivery.logs.amazonaws.com`. To avoid these errors in your CloudTrail logs, you must grant the `s3:ListBucket` permission to `delivery.logs.amazonaws.com` and you must include the `Condition` parameters shown with the `s3:GetBucketAcl` permission set in the preceding bucket policy. To make this simpler, instead of creating a new `Statement`, you can directly update the `AWSLogDeliveryAclCheck` to be `“Action”: [“s3:GetBucketAcl”, “s3:ListBucket”]`

Amazon S3 bucket server-side encryption

You can protect the data in your Amazon S3 bucket by enabling either server-side Encryption with Amazon S3-managed keys (SSE-S3) or server-side encryption with a Amazon KMS key stored in Amazon Key Management Service (SSE-KMS). For more information, see Protecting data using server-side encryption.

If you choose SSE-S3, no additional configuration is required. Amazon S3 handles the encryption key.

> **Warning**
>
> If you choose SSE-KMS, you must use a customer managed key, because using an Amazon managed key is not supported for this scenario. If you set up encryption using an Amazon managed key, the logs will be delivered in an unreadable format.

When you use a customer managed Amazon KMS key, you can specify the Amazon Resource Name (ARN) of the customer managed key when you enable bucket encryption. You must add the following to the key policy for your customer managed key (not to the bucket policy for your S3 bucket), so that the log delivery account can write to your S3 bucket.

If you choose SSE-KMS, you must use a customer managed key, because using an Amazon managed key is not supported for this scenario. When you use a customer managed Amazon KMS key, you can specify the Amazon Resource Name (ARN) of the customer managed key when you enable bucket encryption. You must add the following to the key policy for your customer managed key (not to the bucket policy for your S3 bucket), so that the log delivery account can write to your S3 bucket.

```
{
    "Sid": "Allow Logs Delivery to use the key",
    "Effect": "Allow",
    "Principal": {
        "Service": [ "delivery.logs.amazonaws.com" ]
    },
    "Action": [
        "kms:Encrypt",
        "kms:Decrypt",
        "kms:ReEncrypt*",
        "kms:GenerateDataKey*",
        "kms:DescribeKey"
    ],
    "Resource": "*",
    "Condition": {
        "StringEquals": {
            "aws:SourceAccount": ["0123456789"]
        },
        "ArnLike": {
            "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:*"]
        }
        }
```

```
}
```

For `aws:SourceAccount`, specify the list of account IDS for which logs are being delivered to this bucket. For `aws:SourceArn`, specify the list of ARNs of the resource that generates the logs, in the form `arn:aws:logs:`*`source-region`*`:`*`source-account-id`*`:*`.

Logs sent to Firehose

This section applies when the types of logs listed in the table in the preceding section are sent to Firehose:

User permissions

To be able to set up sending any of these types of logs to Firehose for the first time, you must be logged into an account with the following permissions.

- `logs:CreateLogDelivery`
- `firehose:TagDeliveryStream`
- `iam:CreateServiceLinkedRole`

If any of these types of logs is already being sent to Firehose, then to set up the sending of another one of these types of logs to Firehose you need to have only the `logs:CreateLogDelivery` and `firehose:TagDeliveryStream` permissions.

IAM roles used for permissions

Because Firehose does not use resource policies, Amazon uses IAM roles when setting up these logs to be sent to Firehose. Amazon creates a service-linked role named **AWSServiceRoleForLogDelivery**. This service-linked role includes the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "firehose:PutRecord",
                "firehose:PutRecordBatch",
                "firehose:ListTagsForDeliveryStream"
            ],
```

```
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:ResourceTag/LogDeliveryEnabled": "true"
                }
            },
            "Effect": "Allow"
        }
    ]
}
```

This service-linked role grants permission for all Firehose delivery streams that have the `LogDeliveryEnabled` tag set to `true`. Amazon gives this tag to the destination delivery stream when you set up the logging.

This service-linked role also has a trust policy that allows the `delivery.logs.amazonaws.com` service principal to assume the needed service-linked role. That trust policy is as follows:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "delivery.logs.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
```

Logging that requires additional permissions [V2]

Some Amazon services use a new method to send their logs. This is a flexible method that enables you to set up log delivery from these services to one or more of the following destinations: CloudWatch Logs, Amazon S3, or Firehose.

A working log delivery consists of three elements:

- A `DeliverySource`, which is a logical object that represents the resource(s) that actually send the logs.

- A `DeliveryDestination`, which is a logical object that represents the actual delivery destination.
- A `Delivery`, which connects a delivery source to delivery destination

To configure logs delivery between a supported Amazon service and a destination, you must do the following:

- Create a delivery source with PutDeliverySource.
- Create a delivery destination with PutDeliveryDestination.
- If you are delivering logs cross-account, you must use PutDeliveryDestinationPolicy in the destination account to assign an IAM policy to the destination. This policy authorizes creating a delivery from the delivery source in account A to the delivery destination in account B. For cross-account delivery, you must manually create the permission policies yourself.
- Create a delivery by pairing exactly one delivery source and one delivery destination, by using CreateDelivery.

The following sections provide the details of the permissions you need to have when you are signed in to set up log delivery to each type of destination, using the V2 process. These permissions can be granted to an IAM role that you are signed in with.

Important

It is your responsibility to remove log delivery resources after deleting the log-generating resource. To do so, follow these steps.

1. Delete the `Delivery` by using the DeleteDelivery operation.
2. Delete the `DeliverySource` by using the DeleteDeliverySource operation.
3. If the `DeliveryDestination` associated with the `DeliverySource` that you just deleted is used only for this specific `DeliverySource`, then you can remove it by using the DeleteDeliveryDestinations operation.

Contents

- Amazon S3 bucket server-side encryption
- Logs sent to Firehose
- Service-specific permissions
- Console-specific permissions

Logs sent to CloudWatch Logs

User permissions

To enable sending logs to CloudWatch Logs, you must be signed in with the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ReadWriteAccessForLogDeliveryActions",
            "Effect": "Allow",
            "Action": [
                "logs:GetDelivery",
                "logs:GetDeliverySource",
                "logs:PutDeliveryDestination",
                "logs:GetDeliveryDestinationPolicy",
                "logs:DeleteDeliverySource",
                "logs:PutDeliveryDestinationPolicy",
                "logs:CreateDelivery",
                "logs:GetDeliveryDestination",
                "logs:PutDeliverySource",
                "logs:DeleteDeliveryDestination",
                "logs:DeleteDeliveryDestinationPolicy",
                "logs:DeleteDelivery",
                "logs:UpdateDeliveryConfiguration"
            ],
            "Resource": [
                "arn:aws:logs:region:account-id:delivery:*",
                "arn:aws:logs:region:account-id:delivery-source:*",
                "arn:aws:logs:region:account-id:delivery-destination:*"
            ]
        },
        {
            "Sid": "ListAccessForLogDeliveryActions",
            "Effect": "Allow",
```

```
            "Action": [
                "logs:DescribeDeliveryDestinations",
                "logs:DescribeDeliverySources",
                "logs:DescribeDeliveries",
                "logs:DescribeConfigurationTemplates"
            ],
            "Resource": "*"
        },
        {
            "Sid": "AllowUpdatesToResourcePolicyCWL",
            "Effect": "Allow",
            "Action": [
                "logs:PutResourcePolicy",
                "logs:DescribeResourcePolicies",
                "logs:DescribeLogGroups"
            ],
            "Resource": [
                "arn:aws:logs:region:account-id:*"
            ]
        }
    ]
}
```

Log group resource policy

The log group where the logs are being sent must have a resource policy that includes certain permissions. If the log group currently does not have a resource policy, and the user setting up the logging has the `logs:PutResourcePolicy`, `logs:DescribeResourcePolicies`, and `logs:DescribeLogGroups` permissions for the log group, then Amazon automatically creates the following policy for it when you begin sending the logs to CloudWatch Logs.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AWSLogDeliveryWrite20150319",
      "Effect": "Allow",
      "Principal": {
        "Service": [
          "delivery.logs.amazonaws.com"
        ]
      },
      "Action": [
```

```
        "logs:CreateLogStream",
        "logs:PutLogEvents"
      ],
      "Resource": [
        "arn:aws:logs:us-east-1:0123456789:log-group:my-log-group:log-stream:*"
      ],
      "Condition": {
        "StringEquals": {
          "aws:SourceAccount": ["0123456789"]
        },
        "ArnLike": {
          "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:*"]
        }
      }
    }
  ]
}
```

Logs sent to Amazon S3

User permissions

To enable sending logs to Amazon S3, you must be signed in with the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ReadWriteAccessForLogDeliveryActions",
            "Effect": "Allow",
            "Action": [
                "logs:GetDelivery",
                "logs:GetDeliverySource",
                "logs:PutDeliveryDestination",
                "logs:GetDeliveryDestinationPolicy",
                "logs:DeleteDeliverySource",
                "logs:PutDeliveryDestinationPolicy",
                "logs:CreateDelivery",
                "logs:GetDeliveryDestination",
                "logs:PutDeliverySource",
                "logs:DeleteDeliveryDestination",
                "logs:DeleteDeliveryDestinationPolicy",
                "logs:DeleteDelivery",
```

```
                "logs:UpdateDeliveryConfiguration"
            ],
            "Resource": [
                "arn:aws:logs:region:account-id:delivery:*",
                "arn:aws:logs:region:account-id:delivery-source:*",
                "arn:aws:logs:region:account-id:delivery-destination:*"
            ]
        },
        {
            "Sid": "ListAccessForLogDeliveryActions",
            "Effect": "Allow",
            "Action": [
                "logs:DescribeDeliveryDestinations",
                "logs:DescribeDeliverySources",
                "logs:DescribeDeliveries",
                "logs:DescribeConfigurationTemplates"
            ],
            "Resource": "*"
        },
        {
            "Sid": "AllowUpdatesToResourcePolicyS3",
            "Effect": "Allow",
            "Action": [
                "s3:PutBucketPolicy",
                "s3:GetBucketPolicy"
            ],
            "Resource": "arn:aws:s3:::bucket-name"
        }
    ]
}
```

The S3 bucket where the logs are being sent must have a resource policy that includes certain permissions. If the bucket currently does not have a resource policy and the user setting up the logging has the `S3:GetBucketPolicy` and `S3:PutBucketPolicy` permissions for the bucket, then Amazon automatically creates the following policy for it when you begin sending the logs to Amazon S3.

```
{
    "Version": "2012-10-17",
    "Id": "AWSLogDeliveryWrite20150319",
    "Statement": [
        {
            "Sid": "AWSLogDeliveryWrite",
```

```
            "Effect": "Allow",
            "Principal": {
                "Service": "delivery.logs.amazonaws.com"
            },
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::amzn-s3-demo-bucket/AWSLogs/account-ID/*",
            "Condition": {
                "StringEquals": {
                    "s3:x-amz-acl": "bucket-owner-full-control",
                    "aws:SourceAccount": ["0123456789"]
                },
                "ArnLike": {
                    "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:delivery-
source:*"]
                }
            }
        }
    ]
}
```

In the previous policy, for `aws:SourceAccount`, specify the list of account IDS for which logs are being delivered to this bucket. For `aws:SourceArn`, specify the list of ARNs of the resource that generates the logs, in the form `arn:aws:logs:`*`source-region`*`:`*`source-account-id`*`:*`.

If the bucket has a resource policy but that policy doesn't contain the statement shown in the previous policy, and the user setting up the logging has the `S3:GetBucketPolicy` and `S3:PutBucketPolicy` permissions for the bucket, that statement is appended to the bucket's resource policy.

Note

In some cases, you may see `AccessDenied` errors in Amazon CloudTrail if the `s3:ListBucket` permission has not been granted to `delivery.logs.amazonaws.com`. To avoid these errors in your CloudTrail logs, you must grant the `s3:ListBucket` permission to `delivery.logs.amazonaws.com` and you must include the `Condition` parameters shown with the `s3:GetBucketAcl` permission set in the preceding bucket policy. To make this simpler, instead of creating a new `Statement`, you can directly update the `AWSLogDeliveryAclCheck` to be `“Action”: [“s3:GetBucketAcl”, “s3:ListBucket”]`

Amazon S3 bucket server-side encryption

You can protect the data in your Amazon S3 bucket by enabling either server-side Encryption with Amazon S3-managed keys (SSE-S3) or server-side encryption with a Amazon KMS key stored in Amazon Key Management Service (SSE-KMS). For more information, see Protecting data using server-side encryption.

If you choose SSE-S3, no additional configuration is required. Amazon S3 handles the encryption key.

> **Warning**
>
> If you choose SSE-KMS, you must use a customer managed key, because using an Amazon managed key is not supported for this scenario. If you set up encryption using an Amazon managed key, the logs will be delivered in an unreadable format.

When you use a customer managed Amazon KMS key, you can specify the Amazon Resource Name (ARN) of the customer managed key when you enable bucket encryption. You must add the following to the key policy for your customer managed key (not to the bucket policy for your S3 bucket), so that the log delivery account can write to your S3 bucket.

If you choose SSE-KMS, you must use a customer managed key, because using an Amazon managed key is not supported for this scenario. When you use a customer managed Amazon KMS key, you can specify the Amazon Resource Name (ARN) of the customer managed key when you enable bucket encryption. You must add the following to the key policy for your customer managed key (not to the bucket policy for your S3 bucket), so that the log delivery account can write to your S3 bucket.

```
{
    "Sid": "Allow Logs Delivery to use the key",
    "Effect": "Allow",
    "Principal": {
        "Service": [ "delivery.logs.amazonaws.com" ]
    },
    "Action": [
        "kms:Encrypt",
        "kms:Decrypt",
        "kms:ReEncrypt*",
        "kms:GenerateDataKey*",
```

```
            "kms:DescribeKey"
        ],
        "Resource": "*",
        "Condition": {
            "StringEquals": {
                "aws:SourceAccount": ["0123456789"]
            },
            "ArnLike": {
                "aws:SourceArn": ["arn:aws:logs:us-east-1:0123456789:delivery-source:*"]
            }
            }
}
```

For `aws:SourceAccount`, specify the list of account IDS for which logs are being delivered to this bucket. For `aws:SourceArn`, specify the list of ARNs of the resource that generates the logs, in the form `arn:aws:logs:`*`source-region`*`:`*`source-account-id`*`:*`.

Logs sent to Firehose

User permissions

To enable sending logs to Firehose, you must be signed in with the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ReadWriteAccessForLogDeliveryActions",
            "Effect": "Allow",
            "Action": [
                "logs:GetDelivery",
                "logs:GetDeliverySource",
                "logs:PutDeliveryDestination",
                "logs:GetDeliveryDestinationPolicy",
                "logs:DeleteDeliverySource",
                "logs:PutDeliveryDestinationPolicy",
                "logs:CreateDelivery",
                "logs:GetDeliveryDestination",
                "logs:PutDeliverySource",
                "logs:DeleteDeliveryDestination",
                "logs:DeleteDeliveryDestinationPolicy",
                "logs:DeleteDelivery",
```

```
                "logs:UpdateDeliveryConfiguration"
            ],
            "Resource": [
                "arn:aws:logs:region:account-id:delivery:*",
                "arn:aws:logs:region:account-id:delivery-source:*",
                "arn:aws:logs:region:account-id:delivery-destination:*"
            ]
        },
        {
            "Sid": "ListAccessForLogDeliveryActions",
            "Effect": "Allow",
            "Action": [
                "logs:DescribeDeliveryDestinations",
                "logs:DescribeDeliverySources",
                "logs:DescribeDeliveries",
                "logs:DescribeConfigurationTemplates"
            ],
            "Resource": "*"
        },
        {
            "Sid": "AllowUpdatesToResourcePolicyFH",
            "Effect": "Allow",
            "Action": [
                "firehose:TagDeliveryStream"
            ],
            "Resource": [
                "arn:aws:firehose:region:account-id:deliverystream/*"
            ]
        },
        {
            "Sid": "CreateServiceLinkedRole",
            "Effect": "Allow",
            "Action": [
                "iam:CreateServiceLinkedRole"
            ],
            "Resource": "arn:aws:iam::account-id:role/aws-service-role/
delivery.logs.amazonaws.com/AWSServiceRoleForLogDelivery"
        }
    ]
}
```

IAM roles used for resource permissions

Because Firehose does not use resource policies, Amazon uses IAM roles when setting up these logs to be sent to Firehose. Amazon creates a service-linked role named **AWSServiceRoleForLogDelivery**. This service-linked role includes the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "firehose:PutRecord",
                "firehose:PutRecordBatch",
                "firehose:ListTagsForDeliveryStream"
            ],
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "aws:ResourceTag/LogDeliveryEnabled": "true"
                }
            },
            "Effect": "Allow"
        }
    ]
}
```

This service-linked role grants permission for all Firehose delivery streams that have the `LogDeliveryEnabled` tag set to `true`. Amazon gives this tag to the destination delivery stream when you set up the logging.

This service-linked role also has a trust policy that allows the `delivery.logs.amazonaws.com` service principal to assume the needed service-linked role. That trust policy is as follows:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "delivery.logs.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
```

```
}
```

Service-specific permissions

In addition to the destination-specific permissions listed in the previous sections, some services require explicit authorization that customers are allowed to send logs from their resources, as an additional layer of security. It authorizes the `AllowVendedLogDeliveryForResource` action for resources that vend logs within that service. For these services, use the following policy and replace *`service`* and *`resource-type`* with the appropriate values. For the service-specific values for these fields, see those services' documentation page for vended logs.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "ServiceLevelAccessForLogDelivery",
            "Effect": "Allow",
            "Action": [
                "service:AllowVendedLogDeliveryForResource"
            ],
            "Resource": "arn:aws:service:region:account-id:resource-type/*"
        }
    ]
}
```

Console-specific permissions

In addition to the permissions listed in the previous sections, if you are setting up log delivery using the console instead of the APIs, you also need the following additional permissions:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowLogDeliveryActionsConsoleCWL",
            "Effect": "Allow",
            "Action": [
                "logs:DescribeLogGroups",
                "logs:CreateLogGroups"
            ],
            "Resource": [
```

```
                "arn:aws:logs:us-east-1:111122223333:log-group:*"
            ]
        },
        {
            "Sid": "AllowLogDeliveryActionsConsoleS3",
            "Effect": "Allow",
            "Action": [
                "s3:ListAllMyBuckets",
                "s3:ListBucket",
                "s3:GetBucketLocation"
            ],
            "Resource": [
                "arn:aws:s3:::*"
            ]
        },
        {
            "Sid": "AllowLogDeliveryActionsConsoleFH",
            "Effect": "Allow",
            "Action": [
                "firehose:ListDeliveryStreams",
                "firehose:DescribeDeliveryStream"
            ],
            "Resource": [
                "*"
            ]
        }
    ]
}
```

Cross-account delivery example

In this example, two accounts are involved. The account with the log-generating resource is Account A, ID: *AAAAAAAAAAAA*, and the account with the log-consuming resource is Account B, ID: *BBBBBBBBBBBB*.

Account A wants to deliver logs from the Amazon Bedrock knowledge base in their account with the ARN arn:aws:bedrock:*region*:*AAAAAAAAAAAA*:knowledge-base/*XXXXXXXXXX*.

For this example, account A needs the following permissions:

```
{
"Version": "2012-10-17",
```

```
    "Statement": [
        {
            "Sid": "AllowVendedLogDeliveryForKnowledgeBase",
            "Effect": "Allow",
            "Action": [
                "bedrock:AllowVendedLogDeliveryForResource"
            ],
            "Resource": "arn:aws:bedrock:region:AAAAAAAAAAAA:knowledge-base/XXXXXXXXXX"
        },
        {
            "Sid": "CreateLogDeliveryPermissions",
            "Effect": "Allow",
            "Action": [
                "logs:PutDeliverySource",
                "logs:CreateDelivery"
            ],
            "Resource": [
                "arn:aws:logs:region:AAAAAAAAAAAA:delivery-source:*",
                "arn:aws:logs:region:AAAAAAAAAAAA:delivery:*",
                "arn:aws:logs:region:BBBBBBBBBBBB:delivery-destination:*"
            ]
        }
    ]
}
```

Create delivery source

To begin, account A creates a delivery source with their bedrock knowledge base:

```
aws logs put-delivery-source --name my-delivery-source --log-type APPLICATION_LOGS --
resource-arn arn:aws:bedrock:region:AAAAAAAAAAAA:knowledge-base/XXXXXXXXXX
```

Next, account B must create the delivery destination using one of the flows below:

- Configure delivery to an Amazon S3 bucket
- Configure delivery to a Firehose stream

Configure delivery to an Amazon S3 bucket

Account B wants to receive the logs into their S3 bucket with the ARN arn:aws:s3:::amzn-s3-demo-bucket For this example, account B will need the following permissions:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "PutLogDestinationPermissions",
            "Effect": "Allow",
            "Action": [
                "logs:PutDeliveryDestination",
                "logs:PutDeliveryDestinationPolicy"
            ],
            "Resource": "arn:aws:logs:region:BBBBBBBBBBBB:delivery-destination:*"
        }
    ]
}
```

The bucket will need the following permissions in its bucket policy:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AWSLogsDeliveryWrite",
            "Effect": "Allow",
            "Principal": {
                "Service": "delivery.logs.amazonaws.com"
            },
            "Action": [
                "s3:PutObject"
            ],
            "Resource": "arn:aws:s3:::amzn-s3-demo-bucket/AWSLogs/AAAAAAAAAAAA/*",
            "Condition": {
                "StringEquals": {
                    "s3:x-amz-acl": "bucket-owner-full-control",
                    "aws:SourceAccount": ["AAAAAAAAAAAA"]
                },
                "ArnLike": {
                    "aws:SourceArn": ["arn:aws:logs:region:AAAAAAAAAAAA:delivery-
source:my-delivery-source"]
                }
            }
        }
    ]
```

```
}
```

If the bucket is encrypted with SSE-KMS, ensure the Amazon KMS key policy has the appropriate permissions. For example, if the KMS key is `arn:aws:kms:region:BBBBBBBBBBBB:key/X`, use the following:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowLogsGenerateDataKey",
            "Effect": "Allow",
            "Principal": {
                "Service": "delivery.logs.amazonaws.com"
            }
            "Action": [
                "kms:GenerateDataKey"
            ],
            "Resource": "arn:aws:kms:region:BBBBBBBBBBBB:key/X",
            "Condition": {
                "StringEquals": {
                    "aws:SourceAccount": ["AAAAAAAAAAAA"]
                },
                "ArnLike": {
                    "aws:SourceArn": ["arn:aws:logs:region:AAAAAAAAAAAA:delivery-
source:my-delivery-source"]
                }
            }
        }
    ]
}
```

Account B can then create a delivery destination with the S3 bucket as the destination resource:

```
aws logs put-delivery-destination --name my-s3-delivery-destination --delivery-
destination-configuration "destinationResourceArn=arn:aws:s3:::amzn-s3-demo-bucket"
```

Next, Account B creates a delivery destination policy on their newly created delivery destination, which will give permission for Account A to create a log delivery. The policy that will be added to the newly created delivery destination is the following:

```
{
```

```
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowCreateDelivery",
            "Effect": "Allow",
            "Principal": {
                "AWS": "AAAAAAAAAAAA"
            },
            "Action": [
                "logs:CreateDelivery"
            ],
            "Resource": "arn:aws:logs:region:BBBBBBBBBBB:delivery-destination:my-s3-
delivery-destination"
        }
    ]
}
```

This policy will be saved in Account B's computer as `destination-policy-s3.json` To attach this resource, Account B will run the following command:

```
aws logs put-delivery-destination-policy --delivery-destination-name my-s3-delivery-
destination --delivery-destination-policy file://destination-policy-s3.json
```

Lastly, Account A creates the delivery, which links the delivery source in Account A to the delivery destination in Account B.

```
aws logs create-delivery --delivery-source-name my-delivery-source --delivery-
destination-arn arn:aws:logs:region:BBBBBBBBBBB:delivery-destination:my-s3-delivery-
destination
```

Configure delivery to a Firehose stream

In this example, Account B wants to receive logs into their Firehose stream. The Firehose stream has the following ARN and is configured to use the DirectPut delivery stream type:

`arn:aws:firehose:region:BBBBBBBBBBB:deliverystream/X`

For this example, Account B needs the following permissions:

```
{
    "Version": "2012-10-17",
```

```
    "Statement": [
        {
            "Sid": "AllowFirehoseCreateSLR",
            "Effect": "Allow",
            "Action": [
                "iam:CreateServiceLinkedRole"
            ],
            "Resource": "arn:aws:iam::BBBBBBBBBBBB:role/aws-service-role/
delivery.logs.amazonaws.com/AWSServiceRoleForLogDelivery",
        },
        {
            "Sid": "AllowFirehoseTagging",
            "Effect": "Allow",
            "Action": [
                "firehose:TagDeliveryStream"
            ],
            "Resource": "arn:aws:firehose:region:BBBBBBBBBBBB:deliverystream/X"
        },
        {
            "Sid": "AllowFirehoseDeliveryDestination",
            "Effect": "Allow",
            "Action": [
                "logs:PutDeliveryDestination",
                "logs:PutDeliveryDestinationPolicy"
            ],
            "Resource": "arn:aws:logs:region:BBBBBBBBBBBB:delivery-destination:*"
        }
    ]
}
```

The Firehose stream must have the tag `LogDeliveryEnabled` set to `true`.

Account B will then create a delivery destination with the Firehose stream as the destination resource:

```
aws logs put-delivery-destination --name my-fh-delivery-destination --delivery-
destination-configuration
 "destinationResourceArn=arn:aws:firehose:region:BBBBBBBBBBBB:deliverystream/X"
```

Next, Account B creates a delivery destination policy on their newly created delivery destination, which will give permission for Account A to create a log delivery. The policy to be added to the newly created delivery destination is the following:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowCreateDelivery",
            "Effect": "Allow",
            "Principal": {
                "AWS": "AAAAAAAAAAAA"
            },
            "Action": [
                "logs:CreateDelivery"
            ],
            "Resource": "arn:aws:logs:region:BBBBBBBBBBBB:delivery-destination:my-fh-
delivery-destination"
        }
    ]
}
```

This policy will be saved in Account B's computer as `destination-policy-fh.json` To attach this resource, Account B runs the following command:

```
aws logs put-delivery-destination-policy --delivery-destination-name my-fh-delivery-
destination --delivery-destination-policy file://destination-policy-fh.json
```

Lastly, Account A creates the delivery, which links the delivery source in Account A to the delivery destination in Account B.

```
aws logs create-delivery --delivery-source-name my-delivery-source --delivery-
destination-arn arn:aws:logs:region:BBBBBBBBBBBB:delivery-destination:my-fh-delivery-
destination
```

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 Amazon, 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, Amazon 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, aws:SourceAccount, aws:SourceOrgID, and aws:SourceOrgPaths global condition context keys in resource policies to limit the permissions that CloudWatch Logs gives another service to the resource. Use aws:SourceArn to associate only one resource with cross-service access. Use aws:SourceAccount to let any resource in that account be associated with the cross-service use. Use aws:SourceOrgID to allow any resource from any account within an organization be associated with the cross-service use. Use aws:SourceOrgPaths to associate any resource from accounts within an Amazon Organizations path with the cross-service use. For more information about using and understanding paths, see Understand the Amazon Organizations entity path.

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 wildcard characters (*) for the unknown portions of the ARN. For example, arn:aws-cn:*servicename*:*:*123456789012*:*.

If the aws:SourceArn value does not contain the account ID, such as an Amazon S3 bucket ARN, you must use both aws:SourceAccount and aws:SourceArn to limit permissions.

To protect against the confused deputy problem at scale, use the aws:SourceOrgID or aws:SourceOrgPaths global condition context key with the organization ID or organization path of the resource in your resource-based policies. Policies that include the aws:SourceOrgID or aws:SourceOrgPaths key will automatically include the correct accounts and you don't have to manually update the policies when you add, remove, or move accounts in your organization.

The policies in the previous sections of this page show how you can use the aws:SourceArn and aws:SourceAccount global condition context keys to prevent the confused deputy problem.

CloudWatch Logs updates to Amazon managed policies

View details about updates to Amazon managed policies for CloudWatch Logs since this service began tracking these changes. For automatic alerts about changes to this page, subscribe to the RSS feed on the CloudWatch Logs Document history page.

Change	Description	Date
AWSServiceRoleForLogDelivery service-linked role policy – Update to an existing policy	CloudWatch Logs changed the permissions in the IAM policy associated with the **AWSServiceRoleForLogDelivery** service-linked role. The following change was made: • The `firehose:ResourceTag/LogDeliveryEnabled": "true"` condition key was changed to `aws:ResourceTag/LogDeliveryEnabled": "true"` .	July 15, 2021
CloudWatch Logs started tracking changes	CloudWatch Logs started tracking changes for its Amazon managed policies.	June 10, 2021

Exporting log data to Amazon S3

This chapter provides you with information, so you can export log data from your log groups to an Amazon S3 bucket for custom processing and analysis, or to load onto other systems. You can export to a bucket in the same account or a different account.

You can do the following:

- Export log data to S3 buckets that are encrypted by SSE-KMS in Amazon Key Management Service (Amazon KMS)
- Export log data to S3 buckets that have S3 Object Lock enabled with a retention period

> **Note**
>
> Export to Amazon S3 is supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

We recommend that you don't regularly export to Amazon S3 as a way to continuously archive your logs. For that use case, we instead recommend that you use subscriptions. For more information about subscriptions, see Real-time processing of log data with subscriptions.

To begin the export process, you must create an S3 bucket to store the exported log data. You can store the exported files in your S3 bucket and define Amazon S3 lifecycle rules to archive or delete exported files automatically.

You can export to S3 buckets that are encrypted with AES-256 or with SSE-KMS. Exporting to buckets encrypted with DSSE-KMS is not supported.

You can export logs from multiple log groups or multiple time ranges to the same S3 bucket. To separate log data for each export task, you can specify a prefix that will be used as the Amazon S3 key prefix for all exported objects.

> **Note**
>
> Time-based sorting on chunks of log data inside an exported file is not guaranteed. You can sort the exported log field data by using Linux utilities. For example, the following utility command sorts the events in all `.gz` files in a single folder.

```
find . -exec zcat {} + | sed -r 's/^[0-9]+/\x0&/' | sort -z
```

The following utility command sorts .gz files from multiple subfolders.

```
find ./*/ -type f -exec zcat {} + | sed -r 's/^[0-9]+/\x0&/' | sort -z
```

Additionally, you can use another `stdout` command to pipe the sorted output to another file to save it.

Log data can take up to 12 hours to become available for export. Export tasks time out after 24 hours. If your export tasks are timing out, reduce the time range when you create the export task.

For near real-time analysis of log data, see Analyzing log data with CloudWatch Logs Insights or Real-time processing of log data with subscriptions instead.

Contents

Concepts

Before you begin, become familiar with the following export concepts:

log group name

The name of the log group associated with an export task. The log data in this log group will be exported to the specified S3 bucket.

from (timestamp)

A required timestamp expressed as the number of milliseconds since Jan 1, 1970 00:00:00 UTC. All log events in the log group that were ingested on or after this time will be exported.

to (timestamp)

A required timestamp expressed as the number of milliseconds since Jan 1, 1970 00:00:00 UTC. All log events in the log group that were ingested before this time will be exported.

destination bucket

The name of the S3 bucket associated with an export task. This bucket is used to export the log data from the specified log group.

destination prefix

An optional attribute that is used as the Amazon S3 key prefix for all exported objects. This helps create a folder-like organization in your bucket.

Export log data to Amazon S3 using the console

In the following examples, you use the Amazon CloudWatch console to export all data from an Amazon CloudWatch Logs log group named `my-log-group` to an Amazon S3 bucket named `my-exported-logs`.

Exporting log data to S3 buckets that are encrypted by SSE-KMS is supported. Exporting to buckets encrypted with DSSE-KMS is not supported.

The details of how you set up the export depends on whether the Amazon S3 bucket that you want to export to is in the same account as your logs that are being exported, or in a different account.

Topics

Same-account export

If the Amazon S3 bucket is in the same account as the logs that are being exported, use the instructions in this section.

Topics

- Step 3: Set permissions on an S3 bucket
- (Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS
- Step 5: Create an export task

Step 1: Create an Amazon S3 bucket

We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, you can skip to step 2.

> **Note**
>
> The S3 bucket must reside in the same Region as the log data to export. CloudWatch Logs doesn't support exporting data to S3 buckets in a different Region.

To create an S3 bucket

1. Open the Amazon S3 console at https://console.amazonaws.cn/s3/.
2. If necessary, change the Region. From the navigation bar, choose the Region where your CloudWatch Logs reside.
3. Choose **Create Bucket**.
4. For **Bucket Name**, enter a name for the bucket.
5. For **Region**, select the Region where your CloudWatch Logs data resides.
6. Choose **Create**.

Step 2: Set up access permissions

To create the export task in step 5, you'll need to be signed on with the `AmazonS3ReadOnlyAccess` IAM role and with the following permissions:

- `logs:CreateExportTask`
- `logs:CancelExportTask`
- `logs:DescribeExportTasks`
- `logs:DescribeLogStreams`
- `logs:DescribeLogGroups`

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.
- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.
  - (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) in the *IAM User Guide*.

Step 3: Set permissions on an S3 bucket

By default, all S3 buckets and objects are private. Only the resource owner, the Amazon Web Services account that created the bucket, can access the bucket and any objects that it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

When you set the policy, we recommend that you include a randomly generated string as the prefix for the bucket, so that only intended log streams are exported to the bucket.

> **Important**
>
> To make exports to S3 buckets more secure, we now require you to specify the list of source accounts that are allowed to export log data to your S3 bucket.
> In the following example, the list of account IDs in the `aws:SourceAccount` key would be the accounts from which a user can export log data to your S3 bucket. The `aws:SourceArn` key would be the resource for which the action is being taken. You may restrict this to a specific log group, or use a wildcard as shown in this example.
> We recommend that you also include the account ID of the account where the S3 bucket is created, to allow export within the same account.

To set permissions on an Amazon S3 bucket

1. In the Amazon S3 console, choose the bucket that you created in step 1.
2. Choose **Permissions**, **Bucket policy**.

3. In the **Bucket Policy Editor**, add the following policy. Change `my-exported-logs` to the name of your S3 bucket. Be sure to specify the correct Region endpoint, such as `us-west-1`, for **Principal**.

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
          "Action": "s3:GetBucketAcl",
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs",
          "Principal": { "Service": "logs.Region.amazonaws.com" },
          "Condition": {
            "StringEquals": {
                "aws:SourceAccount": [
                    "AccountId1",
                    "AccountId2",
                    ...
                ]
            },
            "ArnLike": {
                    "aws:SourceArn": [
                        "arn:aws:logs:Region:AccountId1:log-group:*",
                        "arn:aws:logs:Region:AccountId2:log-group:*",
                        ...
                     ]
            }
          }
      },
      {
          "Action": "s3:PutObject" ,
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs/*",
          "Principal": { "Service": "logs.Region.amazonaws.com" },
          "Condition": {
            "StringEquals": {
                "s3:x-amz-acl": "bucket-owner-full-control",
                "aws:SourceAccount": [
                    "AccountId1",
                    "AccountId2",
                    ...
                ]
            },
```

```
            "ArnLike": {
                    "aws:SourceArn": [
                        "arn:aws:logs:Region:AccountId1:log-group:*",
                        "arn:aws:logs:Region:AccountId2:log-group:*",
                        ...
                    ]
            }
          }
      }
    ]
}
```

4. Choose **Save** to set the policy that you just added as the access policy on your bucket. This policy enables CloudWatch Logs to export log data to your S3 bucket. The bucket owner has full permissions on all of the exported objects.

> **Warning**
>
> If the existing bucket already has one or more policies attached to it, add the statements for CloudWatch Logs access to that policy or policies. We recommend that you evaluate the resulting set of permissions to be sure that they're appropriate for the users who will access the bucket.

(Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS

This step is necessary only if you are exporting to an S3 bucket that uses server-side encryption with Amazon KMS keys. This encryption is known as SSE-KMS.

To export to a bucket encrypted with SSE-KMS

1. Open the Amazon KMS console at https://console.amazonaws.cn/kms.
2. To change the Amazon Web Services Region, use the Region selector in the upper-right corner of the page.
3. In the left navigation bar, choose **Customer managed keys**.

   Choose **Create Key**.
4. For **Key type**, choose **Symmetric**.
5. For **Key usage**, choose **Encrypt and decrypt** and then choose **Next**.

6. Under **Add labels**, enter an alias for the key and optionally add a description or tags. Then choose **Next**.
7. Under **Key administrators**, select who can administer this key, and then choose **Next**.
8. Under **Define key usage permissions**, make no changes and choose **Next**.
9. Review the settings and choose **Finish**.
10. Back at the **Customer managed keys** page, choose the name of the key that you just created.
11. Choose the **Key policy** tab and choose **Switch to policy view**.
12. In the **Key policy** section, choose **Edit**.
13. Add the following statement to the key policy statement list. When you do, replace *Region* with the Region of your logs and replace *account-ARN* with the ARN of the account that owns the KMS key.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow CWL Service Principal usage",
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.Region.amazonaws.com"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "account-ARN"
            },
            "Action": [
                "kms:GetKeyPolicy*",
                "kms:PutKeyPolicy*",
                "kms:DescribeKey*",
                "kms:CreateAlias*",
                "kms:ScheduleKeyDeletion*",
                "kms:Decrypt"
```

```
            ],
            "Resource": "*"
        }
    ]
}
```

14. Choose **Save changes**.
15. Open the Amazon S3 console at https://console.amazonaws.cn/s3/.
16. Find the bucket that you created in Step 1: Create an S3 bucket and choose the bucket name.
17. Choose the **Properties** tab. Then, under **Default Encryption**, choose **Edit**.
18. Under **Server-side Encryption**, choose **Enable**.
19. Under **Encryption type**, choose **Amazon Key Management Service key (SSE-KMS)**.
20. Choose **Choose from your Amazon KMS keys** and find the key that you created.
21. For **Bucket key**, choose **Enable**.
22. Choose **Save changes**.

Step 5: Create an export task

In this step, you create the export task for exporting logs from a log group.

To export data to Amazon S3 using the CloudWatch console

1. Sign in with sufficient permissions as documented in Step 2: Set up access permissions.
2. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
3. In the navigation pane, choose **Log groups**.
4. On the **Log Groups** screen, choose the name of the log group.
5. Choose **Actions**, **Export data to Amazon S3**.
6. On the **Export data to Amazon S3** screen, under **Define data export**, set the time range for the data to export using **From** and **To**.
7. If your log group has multiple log streams, you can provide a log stream prefix to limit the log group data to a specific stream. Choose **Advanced**, and then for **Stream prefix**, enter the log stream prefix.
8. Under **Choose S3 bucket**, choose the account associated with the S3 bucket.
9. For **S3 bucket name**, choose an S3 bucket.

10. For **S3 Bucket prefix**, enter the randomly generated string that you specified in the bucket policy.
11. Choose **Export** to export your log data to Amazon S3.
12. To view the status of the log data that you exported to Amazon S3, choose **Actions** and then **View all exports to Amazon S3**.

Cross-account export

If the Amazon S3 bucket is in a different account than the logs that are being exported, use the instructions in this section.

Topics

Step 1: Create an Amazon S3 bucket

We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, you can skip to step 2.

> **Note**
>
> The S3 bucket must reside in the same Region as the log data to export. CloudWatch Logs doesn't support exporting data to S3 buckets in a different Region.

To create an S3 bucket

1. Open the Amazon S3 console at https://console.amazonaws.cn/s3/.
2. If necessary, change the Region. From the navigation bar, choose the Region where your CloudWatch Logs reside.
3. Choose **Create Bucket**.

4. For **Bucket Name**, enter a name for the bucket.
5. For **Region**, select the Region where your CloudWatch Logs data resides.
6. Choose **Create**.

Step 2: Set up access permissions

First, you must create a new IAM policy to enable CloudWatch Logs to have the `s3:PutObject` permission for the destination Amazon S3 bucket in the destination account.

The policy that you create depends on whether the destination bucket uses Amazon KMS encryption.

To create an IAM policy to export logs to an Amazon S3 bucket

1. Open the IAM console at https://console.amazonaws.cn/iam/.
2. In the navigation pane on the left, choose **Policies**.
3. Choose **Create policy**.
4. In the **Policy editor** section, choose **JSON**.
5. If the destination bucket does not use Amazon KMS encryption, paste the following policy into the editor.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::my-exported-logs/*"
        }
    ]
}
```

If the destination bucket does use Amazon KMS encryption, paste the following policy into the editor.

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
```

```
      "Effect": "Allow",
      "Action": "s3:PutObject",
      "Resource": "arn:aws:s3:::my-exported-logs/*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "kms:GenerateDataKey",
        "kms:Decrypt"
      ],
      "Resource": "ARN_OF_KMS_KEY"
    }
  ]
}
```

6. Choose **Next**.
7. Enter a policy name. You will use this name to attach the policy to your IAM role.
8. Choose **Create policy** to save the new policy.

To create the export task in step 5, you'll need to be signed on with the `AmazonS3ReadOnlyAccess` IAM role. You must also be signed on with the IAM policy that you just created, and also with the following permissions:

- `logs:CreateExportTask`
- `logs:CancelExportTask`
- `logs:DescribeExportTasks`
- `logs:DescribeLogStreams`
- `logs:DescribeLogGroups`

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.
- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.

- (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) in the *IAM User Guide*.

Step 3: Set permissions on an S3 bucket

By default, all S3 buckets and objects are private. Only the resource owner, the Amazon Web Services account that created the bucket, can access the bucket and any objects that it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

When you set the policy, we recommend that you include a randomly generated string as the prefix for the bucket, so that only intended log streams are exported to the bucket.

> **Important**
>
> To make exports to S3 buckets more secure, we now require you to specify the list of source accounts that are allowed to export log data to your S3 bucket.
> In the following example, the list of account IDs in the `aws:SourceAccount` key would be the accounts from which a user can export log data to your S3 bucket. The `aws:SourceArn` key would be the resource for which the action is being taken. You may restrict this to a specific log group, or use a wildcard as shown in this example.
> We recommend that you also include the account ID of the account where the S3 bucket is created, to allow export within the same account.

To set permissions on an Amazon S3 bucket

1. In the Amazon S3 console, choose the bucket that you created in step 1.
2. Choose **Permissions**, **Bucket policy**.
3. In the **Bucket Policy Editor**, add the following policy. Change `my-exported-logs` to the name of your S3 bucket. Be sure to specify the correct Region endpoint, such as `us-west-1`, for **Principal**.

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
          "Action": "s3:GetBucketAcl",
```

```
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::my-exported-logs",
            "Principal": { "Service": "logs.Region.amazonaws.com" },
            "Condition": {
              "StringEquals": {
                  "aws:SourceAccount": [
                      "AccountId1",
                      "AccountId2",
                      ...
                  ]
              },
              "ArnLike": {
                      "aws:SourceArn": [
                          "arn:aws:logs:Region:AccountId1:log-group:*",
                          "arn:aws:logs:Region:AccountId2:log-group:*",
                          ...
                       ]
              }
            }
        },
        {
            "Action": "s3:PutObject" ,
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::my-exported-logs/*",
            "Principal": { "Service": "logs.Region.amazonaws.com" },
            "Condition": {
              "StringEquals": {
                  "s3:x-amz-acl": "bucket-owner-full-control",
                  "aws:SourceAccount": [
                      "AccountId1",
                      "AccountId2",
                      ...
                  ]
              },
              "ArnLike": {
                      "aws:SourceArn": [
                          "arn:aws:logs:Region:AccountId1:log-group:*",
                          "arn:aws:logs:Region:AccountId2:log-group:*",
                          ...
                      ]
              }
            }
        },
        {
```

```
            "Effect": "Allow",
            "Principal": {
              "AWS": "arn:aws:iam::create_export_task_caller_account:role/role_name"
            },
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::my-exported-logs/*",
            "Condition": {
              "StringEquals": {
                  "s3:x-amz-acl": "bucket-owner-full-control"
              }
            }
        }
    ]
}
```

4. Choose **Save** to set the policy that you just added as the access policy on your bucket. This policy enables CloudWatch Logs to export log data to your S3 bucket. The bucket owner has full permissions on all of the exported objects.

> **Warning**
>
> If the existing bucket already has one or more policies attached to it, add the statements for CloudWatch Logs access to that policy or policies. We recommend that you evaluate the resulting set of permissions to be sure that they're appropriate for the users who will access the bucket.

(Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS

This step is necessary only if you are exporting to an S3 bucket that uses server-side encryption with Amazon KMS keys. This encryption is known as SSE-KMS.

To export to a bucket encrypted with SSE-KMS

1. Open the Amazon KMS console at https://console.amazonaws.cn/kms.
2. To change the Amazon Web Services Region, use the Region selector in the upper-right corner of the page.
3. In the left navigation bar, choose **Customer managed keys**.

   Choose **Create Key**.

4. For **Key type**, choose **Symmetric**.
5. For **Key usage**, choose **Encrypt and decrypt** and then choose **Next**.
6. Under **Add labels**, enter an alias for the key and optionally add a description or tags. Then choose **Next**.
7. Under **Key administrators**, select who can administer this key, and then choose **Next**.
8. Under **Define key usage permissions**, make no changes and choose **Next**.
9. Review the settings and choose **Finish**.
10. Back at the **Customer managed keys** page, choose the name of the key that you just created.
11. Choose the **Key policy** tab and choose **Switch to policy view**.
12. In the **Key policy** section, choose **Edit**.
13. Add the following statement to the key policy statement list. When you do, replace *Region* with the Region of your logs and replace *account-ARN* with the ARN of the account that owns the KMS key.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow CWL Service Principal usage",
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.Region.amazonaws.com"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "account-ARN"
            },
            "Action": [
                "kms:GetKeyPolicy*",
                "kms:PutKeyPolicy*",
                "kms:DescribeKey*",
```

```
                "kms:CreateAlias*",
                "kms:ScheduleKeyDeletion*",
                "kms:Decrypt"
            ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM Role Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS":
 "arn:aws:iam::create_export_task_caller_account:role/role_name"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "ARN_OF_KMS_KEY"
        }
    ]
}
```

14. Choose **Save changes**.
15. Open the Amazon S3 console at https://console.amazonaws.cn/s3/.
16. Find the bucket that you created in Step 1: Create an S3 bucket and choose the bucket name.
17. Choose the **Properties** tab. Then, under **Default Encryption**, choose **Edit**.
18. Under **Server-side Encryption**, choose **Enable**.
19. Under **Encryption type**, choose **Amazon Key Management Service key (SSE-KMS)**.
20. Choose **Choose from your Amazon KMS keys** and find the key that you created.
21. For **Bucket key**, choose **Enable**.
22. Choose **Save changes**.

Step 5: Create an export task

In this step, you create the export task for exporting logs from a log group.

To export data to Amazon S3 using the CloudWatch console

1. Sign in with sufficient permissions as documented in Step 2: Set up access permissions.

2. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
3. In the navigation pane, choose **Log groups**.
4. On the **Log Groups** screen, choose the name of the log group.
5. Choose **Actions**, **Export data to Amazon S3**.
6. On the **Export data to Amazon S3** screen, under **Define data export**, set the time range for the data to export using **From** and **To**.
7. If your log group has multiple log streams, you can provide a log stream prefix to limit the log group data to a specific stream. Choose **Advanced**, and then for **Stream prefix**, enter the log stream prefix.
8. Under **Choose S3 bucket**, choose the account associated with the S3 bucket.
9. For **S3 bucket name**, choose an S3 bucket.
10. For **S3 Bucket prefix**, enter the randomly generated string that you specified in the bucket policy.
11. Choose **Export** to export your log data to Amazon S3.
12. To view the status of the log data that you exported to Amazon S3, choose **Actions** and then **View all exports to Amazon S3**.

Export log data to Amazon S3 using the Amazon CLI

In the following example, you use an export task to export all data from a CloudWatch Logs log group named `my-log-group` to an Amazon S3 bucket named `my-exported-logs`. This example assumes that you have already created a log group called `my-log-group`.

Exporting log data to S3 buckets that are encrypted by Amazon KMS is supported. Exporting to buckets encrypted with DSSE-KMS is not supported.

The details of how you set up the export depends on whether the Amazon S3 bucket that you want to export to is in the same account as your logs that are being exported, or in a different account.

Topics

- Same-account export
- Cross-account export

Same-account export

If the Amazon S3 bucket is in the same account as the logs that are being exported, use the instructions in this section.

Topics

Step 1: Create an S3 bucket

We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, you can skip to step 2.

> **Note**
>
> The S3 bucket must reside in the same Region as the log data to export. CloudWatch Logs doesn't support exporting data to S3 buckets in a different Region.

To create an S3 bucket using the Amazon CLI

At a command prompt, run the following create-bucket command, where `LocationConstraint` is the Region where you are exporting log data.

```
aws s3api create-bucket --bucket my-exported-logs --create-bucket-configuration
 LocationConstraint=us-west-2
```

The following is example output.

```
{
    "Location": "/my-exported-logs"
}
```

Step 2: Set up access permissions

To create the export task in step 5, you'll need to be signed on with the `AmazonS3ReadOnlyAccess` IAM role and with the following permissions:

- `logs:CreateExportTask`
- `logs:CancelExportTask`
- `logs:DescribeExportTasks`
- `logs:DescribeLogStreams`
- `logs:DescribeLogGroups`

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.
- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.
  - (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) in the *IAM User Guide*.

Step 3: Set permissions on an S3 bucket

By default, all S3 buckets and objects are private. Only the resource owner, the account that created the bucket, can access the bucket and any objects that it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

Important

To make exports to S3 buckets more secure, we now require you to specify the list of source accounts that are allowed to export log data to your S3 bucket.
In the following example, the list of account IDs in the `aws:SourceAccount` key would be the accounts from which a user can export log data to your S3 bucket. The

`aws:SourceArn` key would be the resource for which the action is being taken. You may restrict this to a specific log group, or use a wildcard as shown in this example.
We recommend that you also include the account ID of the account where the S3 bucket is created, to allow export within the same account.

To set permissions on an S3 bucket

1. Create a file named `policy.json` and add the following access policy, changing `my-exported-logs` to the name of your S3 bucket and `Principal` to the endpoint of the Region where you are exporting log data, such as `us-west-1`. Use a text editor to create this policy file. Don't use the IAM console.

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
          "Action": "s3:GetBucketAcl",
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs",
          "Principal": { "Service": "logs.Region.amazonaws.com" },
          "Condition": {
            "StringEquals": {
                "aws:SourceAccount": [
                    "AccountId1",
                    "AccountId2",
                    ...
                ]
            },
            "ArnLike": {
                    "aws:SourceArn": [
                        "arn:aws:logs:Region:AccountId1:log-group:*",
                        "arn:aws:logs:Region:AccountId2:log-group:*",
                        ...
                     ]
            }
          }
      },
      {
          "Action": "s3:PutObject" ,
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs/*",
```

```
            "Principal": { "Service": "logs.Region.amazonaws.com" },
            "Condition": {
              "StringEquals": {
                  "s3:x-amz-acl": "bucket-owner-full-control",
                  "aws:SourceAccount": [
                      "AccountId1",
                      "AccountId2",
                      ...
                  ]
              },
              "ArnLike": {
                      "aws:SourceArn": [
                          "arn:aws:logs:Region:AccountId1:log-group:*",
                          "arn:aws:logs:Region:AccountId2:log-group:*",
                          ...
                      ]
              }
            }
        }
    ]
}
```

2. Set the policy that you just added as the access policy on your bucket by using the put-bucket-policy command. This policy enables CloudWatch Logs to export log data to your S3 bucket. The bucket owner will have full permissions on all of the exported objects.

```
aws s3api put-bucket-policy --bucket my-exported-logs --policy file://policy.json
```

> **Warning**
>
> If the existing bucket already has one or more policies attached to it, add the statements for CloudWatch Logs access to that policy or policies. We recommend that you evaluate the resulting set of permissions to be sure that they're appropriate for the users who will access the bucket.

(Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS

This step is necessary only if you are exporting to an S3 bucket that uses server-side encryption with Amazon KMS keys. This encryption is known as SSE-KMS.

To export to a bucket encrypted with SSE-KMS

1. Use a text editor to create a file named `key_policy.json` and add the following access policy. When you add the policy, make the following changes:

   - Replace *Region* with the Region of your logs.
   - Replace *account-ARN* with the ARN of the account that owns the KMS key.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow CWL Service Principal usage",
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.Region.amazonaws.com"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "account-ARN"
            },
            "Action": [
                "kms:GetKeyPolicy*",
                "kms:PutKeyPolicy*",
                "kms:DescribeKey*",
                "kms:CreateAlias*",
                "kms:ScheduleKeyDeletion*",
                "kms:Decrypt"
            ],
            "Resource": "*"
        }
    ]
}
```

2. Enter the following command:

```
aws kms create-key --policy file://key_policy.json
```

The following is example output from this command:

```
{
    "KeyMetadata": {
        "AWSAccountId": "account_id",
        "KeyId": "key_id",
        "Arn": "arn:aws:kms:us-east-2:account_id:key/key_id",
        "CreationDate": "time",
        "Enabled": true,
        "Description": "",
        "KeyUsage": "ENCRYPT_DECRYPT",
        "KeyState": "Enabled",
        "Origin": "AWS_KMS",
        "KeyManager": "CUSTOMER",
        "CustomerMasterKeySpec": "SYMMETRIC_DEFAULT",
        "KeySpec": "SYMMETRIC_DEFAULT",
        "EncryptionAlgorithms": [
            "SYMMETRIC_DEFAULT"
        ],
        "MultiRegion": false
    }
```

3. Use a text editor to create a file called `bucketencryption.json` with the following contents.

```
{
  "Rules": [
    {
      "ApplyServerSideEncryptionByDefault": {
        "SSEAlgorithm": "aws:kms",
        "KMSMasterKeyID": "{KMS Key ARN}"
      },
      "BucketKeyEnabled": true
    }
  ]
}
```

4. Enter the following command, replacing *bucket-name* with the name of the bucket that you are exporting logs to.

```
aws s3api put-bucket-encryption --bucket bucket-name --server-side-encryption-
configuration file://bucketencryption.json
```

If the command doesn't return an error, the process is successful.

Step 5: Create an export task

Use the following command to create the export task. After you create it, the export task might take anywhere from a few seconds to a few hours, depending on the size of the data to export.

To export data to Amazon S3 using the Amazon CLI

1. Sign in with sufficient permissions as documented in Step 2: Set up access permissions.
2. At a command prompt, use the following create-export-task command to create the export task.

```
aws logs create-export-task --profile CWLExportUser --task-name "my-log-
group-09-10-2015" --log-group-name "my-log-group" --from 1441490400000 --
to 1441494000000 --destination "my-exported-logs" --destination-prefix "export-
task-output"
```

The following is example output.

```
{
    "taskId": "cda45419-90ea-4db5-9833-aade86253e66"
}
```

Cross-account export

If the Amazon S3 bucket is in a different account than the logs that are being exported, use the instructions in this section.

Topics

- Step 1: Create an S3 bucket

- Step 2: Set up access permissions
- Step 3: Set permissions on an S3 bucket
- (Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS
- Step 5: Create an export task

Step 1: Create an S3 bucket

We recommend that you use a bucket that was created specifically for CloudWatch Logs. However, if you want to use an existing bucket, you can skip to step 2.

> **Note**
>
> The S3 bucket must reside in the same Region as the log data to export. CloudWatch Logs doesn't support exporting data to S3 buckets in a different Region.

To create an S3 bucket using the Amazon CLI

At a command prompt, run the following create-bucket command, where `LocationConstraint` is the Region where you are exporting log data.

```
aws s3api create-bucket --bucket my-exported-logs --create-bucket-configuration
 LocationConstraint=us-west-2
```

The following is example output.

```
{
    "Location": "/my-exported-logs"
}
```

Step 2: Set up access permissions

First, you must create a new IAM policy to enable CloudWatch Logs to have the `s3:PutObject` permission for the destination Amazon S3 bucket.

To create the export task in step 5, you'll need to be signed on with the `AmazonS3ReadOnlyAccess` IAM role and with certain other permissions. You can create a policy that contains some of these other necessary permissions.

The policy that you create depends on whether the destination bucket uses Amazon KMS encryption. If it does not use Amazon KMS encryption, create a policy with the following contents.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::my-exported-logs/*"
        }
    ]
}
```

If the destination bucket uses Amazon KMS encryption, create a policy with the following contents.

```
{
    "Version": "2012-10-17",
    "Statement": [{
            "Effect": "Allow",
            "Action": "s3:PutObject",
            "Resource": "arn:aws:s3:::my-exported-logs/*"
        },
        {
            "Effect": "Allow",
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "ARN_OF_KMS_KEY"
        }
    ]
}
```

To create the export task in step 5, you must be signed on with the `AmazonS3ReadOnlyAccess` IAM role, the IAM policy that you just created, and also with the following permissions:

- `logs:CreateExportTask`
- `logs:CancelExportTask`
- `logs:DescribeExportTasks`
- `logs:DescribeLogStreams`

- `logs:DescribeLogGroups`

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.
- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.
  - (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) in the *IAM User Guide*.

Step 3: Set permissions on an S3 bucket

By default, all S3 buckets and objects are private. Only the resource owner, the account that created the bucket, can access the bucket and any objects that it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

> **Important**
>
> To make exports to S3 buckets more secure, we now require you to specify the list of source accounts that are allowed to export log data to your S3 bucket.
> In the following example, the list of account IDs in the `aws:SourceAccount` key would be the accounts from which a user can export log data to your S3 bucket. The `aws:SourceArn` key would be the resource for which the action is being taken. You may restrict this to a specific log group, or use a wildcard as shown in this example.
> We recommend that you also include the account ID of the account where the S3 bucket is created, to allow export within the same account.

To set permissions on an S3 bucket

1. Create a file named `policy.json` and add the following access policy, changing `my-exported-logs` to the name of your S3 bucket and `Principal` to the endpoint of the

Region where you are exporting log data, such as `us-west-1`. Use a text editor to create this policy file. Don't use the IAM console.

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
          "Action": "s3:GetBucketAcl",
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs",
          "Principal": { "Service": "logs.Region.amazonaws.com" },
          "Condition": {
            "StringEquals": {
                "aws:SourceAccount": [
                    "AccountId1",
                    "AccountId2",
                    ...
                ]
            },
            "ArnLike": {
                    "aws:SourceArn": [
                        "arn:aws:logs:Region:AccountId1:log-group:*",
                        "arn:aws:logs:Region:AccountId2:log-group:*",
                        ...
                     ]
            }
          }
      },
      {
          "Action": "s3:PutObject" ,
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs/*",
          "Principal": { "Service": "logs.Region.amazonaws.com" },
          "Condition": {
            "StringEquals": {
                "s3:x-amz-acl": "bucket-owner-full-control",
                "aws:SourceAccount": [
                    "AccountId1",
                    "AccountId2",
                    ...
                ]
            },
```

```
            "ArnLike": {
                    "aws:SourceArn": [
                        "arn:aws:logs:Region:AccountId1:log-group:*",
                        "arn:aws:logs:Region:AccountId2:log-group:*",
                        ...
                    ]
            }
          }
      },
      {
          "Effect": "Allow",
          "Principal": {
            "AWS": "arn:aws:iam::create_export_task_caller_account:role/role_name"
          },
          "Action": "s3:PutObject",
          "Resource": "arn:aws:s3:::my-exported-logs/*",
          "Condition": {
            "StringEquals": {
                "s3:x-amz-acl": "bucket-owner-full-control"
            }
          }
       }
    ]
}
```

2. Set the policy that you just added as the access policy on your bucket by using the put-bucket-policy command. This policy enables CloudWatch Logs to export log data to your S3 bucket. The bucket owner will have full permissions on all of the exported objects.

```
aws s3api put-bucket-policy --bucket my-exported-logs --policy file://policy.json
```

> **Warning**
>
> If the existing bucket already has one or more policies attached to it, add the statements for CloudWatch Logs access to that policy or policies. We recommend that you evaluate the resulting set of permissions to be sure that they're appropriate for the users who will access the bucket.

(Optional) Step 4: Exporting to a bucket encrypted with SSE-KMS

This step is necessary only if you are exporting to an S3 bucket that uses server-side encryption with Amazon KMS keys. This encryption is known as SSE-KMS.

To export to a bucket encrypted with SSE-KMS

1. Use a text editor to create a file named `key_policy.json` and add the following access policy. When you add the policy, make the following changes:

   - Replace *`Region`* with the Region of your logs.
   - Replace *`account-ARN`* with the ARN of the account that owns the KMS key.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "Allow CWL Service Principal usage",
            "Effect": "Allow",
            "Principal": {
                "Service": "logs.Region.amazonaws.com"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM User Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS": "account-ARN"
            },
            "Action": [
                "kms:GetKeyPolicy*",
                "kms:PutKeyPolicy*",
                "kms:DescribeKey*",
                "kms:CreateAlias*",
                "kms:ScheduleKeyDeletion*",
                "kms:Decrypt"
            ],
```

```
            "Resource": "*"
        },
        {
            "Sid": "Enable IAM Role Permissions",
            "Effect": "Allow",
            "Principal": {
                "AWS":
 "arn:aws:iam::create_export_task_caller_account:role/role_name"
            },
            "Action": [
                "kms:GenerateDataKey",
                "kms:Decrypt"
            ],
            "Resource": "ARN_OF_KMS_KEY"
        }
    ]
}
```

2. Enter the following command:

```
aws kms create-key --policy file://key_policy.json
```

The following is example output from this command:

```
{
    "KeyMetadata": {
        "AWSAccountId": "account_id",
        "KeyId": "key_id",
        "Arn": "arn:aws:kms:us-east-2:account_id:key/key_id",
        "CreationDate": "time",
        "Enabled": true,
        "Description": "",
        "KeyUsage": "ENCRYPT_DECRYPT",
        "KeyState": "Enabled",
        "Origin": "AWS_KMS",
        "KeyManager": "CUSTOMER",
        "CustomerMasterKeySpec": "SYMMETRIC_DEFAULT",
        "KeySpec": "SYMMETRIC_DEFAULT",
        "EncryptionAlgorithms": [
            "SYMMETRIC_DEFAULT"
        ],
        "MultiRegion": false
```

```
    }
```

3. Use a text editor to create a file called `bucketencryption.json` with the following contents.

```
{
  "Rules": [
    {
      "ApplyServerSideEncryptionByDefault": {
        "SSEAlgorithm": "aws:kms",
        "KMSMasterKeyID": "{KMS Key ARN}"
      },
      "BucketKeyEnabled": true
    }
  ]
}
```

4. Enter the following command, replacing *bucket-name* with the name of the bucket that you are exporting logs to.

```
aws s3api put-bucket-encryption --bucket bucket-name --server-side-encryption-
configuration file://bucketencryption.json
```

If the command doesn't return an error, the process is successful.

Step 5: Create an export task

Use the following command to create the export task. After you create it, the export task might take anywhere from a few seconds to a few hours, depending on the size of the data to export.

To export data to Amazon S3 using the Amazon CLI

1. Sign in with sufficient permissions as documented in Step 2: Set up access permissions.
2. At a command prompt, use the following create-export-task command to create the export task.

```
aws logs create-export-task --profile CWLExportUser --task-name "my-log-
group-09-10-2015" --log-group-name "my-log-group" --from 1441490400000 --
to 1441494000000 --destination "my-exported-logs" --destination-prefix "export-
task-output"
```

The following is example output.

```
{
    "taskId": "cda45419-90ea-4db5-9833-aade86253e66"
}
```

Describe export tasks

After you create an export task, you can get the current status of the task.

To describe export tasks using the Amazon CLI

At a command prompt, use the following describe-export-tasks command.

```
aws logs --profile CWLExportUser describe-export-tasks --task-id
 "cda45419-90ea-4db5-9833-aade86253e66"
```

The following is example output.

```
{
   "exportTasks": [
   {
      "destination": "my-exported-logs",
      "destinationPrefix": "export-task-output",
      "executionInfo": {
         "creationTime": 1441495400000
      },
      "from": 1441490400000,
      "logGroupName": "my-log-group",
      "status": {
         "code": "RUNNING",
         "message": "Started Successfully"
      },
      "taskId": "cda45419-90ea-4db5-9833-aade86253e66",
      "taskName": "my-log-group-09-10-2015",
      "tTo": 1441494000000
   }]
}
```

You can use the `describe-export-tasks` command in three different ways:

- **Without any filters** – Lists all of your export tasks, in reverse order of creation.
- **Filter on task ID** – Lists the export task, if one exists, with the specified ID.
- **Filter on task status** – Lists the export tasks with the specified status.

For example, use the following command to filter on the `FAILED` status.

```
aws logs --profile CWLExportUser describe-export-tasks --status-code "FAILED"
```

The following is example output.

```
{
   "exportTasks": [
   {
      "destination": "my-exported-logs",
      "destinationPrefix": "export-task-output",
      "executionInfo": {
         "completionTime": 1441498600000
         "creationTime": 1441495400000
      },
      "from": 1441490400000,
      "logGroupName": "my-log-group",
      "status": {
         "code": "FAILED",
         "message": "FAILED"
      },
      "taskId": "cda45419-90ea-4db5-9833-aade86253e66",
      "taskName": "my-log-group-09-10-2015",
      "to": 1441494000000
   }]
}
```

Cancel an export task

You can cancel an export task if it's in a `PENDING` or `RUNNING` state.

To cancel an export task using the Amazon CLI

At a command prompt, use the following cancel-export-task command:

```
aws logs --profile CWLExportUser cancel-export-task --task-id "cda45419-90ea-4db5-9833-aade86253e66"
```

You can use the describe-export-tasks command to verify that the task was canceled successfully.

Streaming CloudWatch Logs data to Amazon OpenSearch Service

You can configure a log group in Amazon CloudWatch Logs, so you can stream data to your Amazon OpenSearch Service cluster in near real-time. For more information, see Real-time processing of log data with subscriptions.

> **Note**
>
> Streaming to OpenSearch Service is supported only for log groups in the Standard log class. For more information about log classes, see Log classes.

Depending on the amount of log data that's streamed, consider setting a function-level concurrency limit. For more information, see Lambda function scaling.

> **Note**
>
> Because streaming large amounts of CloudWatch Logs data to OpenSearch Service might result in high usage charges, we recommend that you create a budget in the Amazon Billing and Cost Management console. For more information, see Managing your costs with Amazon Budgets.

This section describes the prerequisites you must complete before subscribing a log group to OpenSearch Service. It also describes how to subscribe a log group to OpenSearch Service.

Prerequisites

Before you begin, create an OpenSearch Service domain. The domain can have either public access or VPC access, but you can't then modify the type of access after the domain is created. You might want to review your OpenSearch Service domain settings later, and modify your cluster configuration based on the amount of data your cluster will be processing. For instructions to create a domain, see Creating OpenSearch Service domains.

For more information about OpenSearch Service, see the Amazon OpenSearch Service Developer Guide.

Subscribe a log group to OpenSearch Service

You can use the CloudWatch console to subscribe a log group to OpenSearch Service.

To subscribe a log group to OpenSearch Service

1. Open the CloudWatch console at https://console.amazonaws.cn/cloudwatch/.
2. In the navigation pane, choose **Log groups**.
3. Select the name of the log group.
4. Choose **Actions**, **Subscription filters**, **Create Amazon OpenSearch Service subscription filter**.
5. Choose whether you want to stream to a cluster in this account or another account.
   - If you chose this account, select the domain you created in the previous step.
   - If you chose another account, provide the domain ARN and endpoint.
6. For **Lambda IAM Execution Role**, choose the IAM role that Lambda should use when executing calls to OpenSearch.

   The IAM role you choose must fulfill these requirements:

   - It must have `lambda.amazonaws.com` in the trust relationship.
   - It must include the following policy:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "es:*"
            ],
            "Effect": "Allow",
            "Resource": "arn:aws:es:region:account-id:domain/target-domain-name/
*"
        }
    ]
}
```

   - If the target OpenSearch Service domain uses VPC access, the role must have the **AWSLambdaVPCAccessExecutionRole** policy attached. This Amazon-managed policy

grants Lambda access to the customer's VPC, enabling Lambda to write to the OpenSearch endpoint in the VPC.

7. For **Log format**, choose a log format.
8. For **Subscription filter pattern**, type the terms or pattern to find in your log events. This ensures that you send only the data you're interested in to your OpenSearch cluster. For more information, see Creating metrics from log events using filters.
9. (Optional) For **Select log data to test**, select a log stream and then choose **Test pattern** to verify that your search filter is returning the results you expect.
10. Choose **Start streaming**.

Code examples for CloudWatch Logs using Amazon SDKs

The following code examples show how to use CloudWatch Logs with an Amazon software development kit (SDK).

Actions are code excerpts from larger programs and must be run in context. While actions show you how to call individual service functions, you can see actions in context in their related scenarios.

Scenarios are code examples that show you how to accomplish specific tasks by calling multiple functions within a service or combined with other Amazon Web Services services.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Code examples

- Use scheduled events to invoke a Lambda function

Basic examples for CloudWatch Logs using Amazon SDKs

The following code examples show how to use the basics of Amazon CloudWatch Logs with Amazon SDKs.

Examples

- Actions for CloudWatch Logs using Amazon SDKs
  - Use AssociateKmsKey with an Amazon SDK
  - Use CancelExportTask with an Amazon SDK
  - Use CreateExportTask with an Amazon SDK
  - Use CreateLogGroup with an Amazon SDK or CLI
  - Use CreateLogStream with an Amazon SDK or CLI
  - Use DeleteLogGroup with an Amazon SDK or CLI
  - Use DeleteSubscriptionFilter with an Amazon SDK
  - Use DescribeExportTasks with an Amazon SDK
  - Use DescribeLogGroups with an Amazon SDK or CLI
  - Use DescribeSubscriptionFilters with an Amazon SDK
  - Use GetQueryResults with an Amazon SDK
  - Use PutSubscriptionFilter with an Amazon SDK
  - Use StartLiveTail with an Amazon SDK
  - Use StartQuery with an Amazon SDK

Actions for CloudWatch Logs using Amazon SDKs

The following code examples demonstrate how to perform individual CloudWatch Logs actions with Amazon SDKs. Each example includes a link to GitHub, where you can find instructions for setting up and running the code.

These excerpts call the CloudWatch Logs API and are code excerpts from larger programs that must be run in context. You can see actions in context in Scenarios for CloudWatch Logs using Amazon SDKs .

The following examples include only the most commonly used actions. For a complete list, see the Amazon CloudWatch Logs API Reference.

Examples

- Use AssociateKmsKey with an Amazon SDK
- Use CancelExportTask with an Amazon SDK
- Use CreateExportTask with an Amazon SDK
- Use CreateLogGroup with an Amazon SDK or CLI
- Use CreateLogStream with an Amazon SDK or CLI
- Use DeleteLogGroup with an Amazon SDK or CLI
- Use DeleteSubscriptionFilter with an Amazon SDK
- Use DescribeExportTasks with an Amazon SDK
- Use DescribeLogGroups with an Amazon SDK or CLI
- Use DescribeSubscriptionFilters with an Amazon SDK
- Use GetQueryResults with an Amazon SDK
- Use PutSubscriptionFilter with an Amazon SDK
- Use StartLiveTail with an Amazon SDK
- Use StartQuery with an Amazon SDK

Use `AssociateKmsKey` with an Amazon SDK

The following code example shows how to use `AssociateKmsKey`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
```

```
    using Amazon.CloudWatchLogs;
    using Amazon.CloudWatchLogs.Model;

    /// <summary>
    /// Shows how to associate an AWS Key Management Service (AWS KMS) key with
    /// an Amazon CloudWatch Logs log group.
    /// </summary>
    public class AssociateKmsKey
    {
        public static async Task Main()
        {
            // This client object will be associated with the same AWS Region
            // as the default user on this system. If you need to use a
            // different AWS Region, pass it as a parameter to the client
            // constructor.
            var client = new AmazonCloudWatchLogsClient();

            string kmsKeyId = "arn:aws:kms:us-west-2:<account-
number>:key/7c9eccc2-38cb-4c4f-9db3-766ee8dd3ad4";
            string groupName = "cloudwatchlogs-example-loggroup";

            var request = new AssociateKmsKeyRequest
            {
                KmsKeyId = kmsKeyId,
                LogGroupName = groupName,
            };

            var response = await client.AssociateKmsKeyAsync(request);

            if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
            {
                Console.WriteLine($"Successfully associated KMS key ID:
 {kmsKeyId} with log group: {groupName}.");
            }
            else
            {
                Console.WriteLine("Could not make the association between:
 {kmsKeyId} and {groupName}.");
            }
        }
    }
```

- For API details, see AssociateKmsKey in *Amazon SDK for .NET API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `CancelExportTask` with an Amazon SDK

The following code example shows how to use `CancelExportTask`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
using Amazon.CloudWatchLogs;
using Amazon.CloudWatchLogs.Model;

/// <summary>
/// Shows how to cancel an Amazon CloudWatch Logs export task.
/// </summary>
public class CancelExportTask
{
    public static async Task Main()
    {
        // This client object will be associated with the same AWS Region
        // as the default user on this system. If you need to use a
        // different AWS Region, pass it as a parameter to the client
        // constructor.
        var client = new AmazonCloudWatchLogsClient();
        string taskId = "exampleTaskId";

        var request = new CancelExportTaskRequest
        {
```

```
                TaskId = taskId,
            };

            var response = await client.CancelExportTaskAsync(request);

            if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
            {
                Console.WriteLine($"{taskId} successfully canceled.");
            }
            else
            {
                Console.WriteLine($"{taskId} could not be canceled.");
            }
        }
    }
```

- For API details, see CancelExportTask in *Amazon SDK for .NET API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `CreateExportTask` with an Amazon SDK

The following code example shows how to use `CreateExportTask`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
using Amazon.CloudWatchLogs;
```

```
   using Amazon.CloudWatchLogs.Model;

   /// <summary>
   /// Shows how to create an Export Task to export the contents of the Amazon
   /// CloudWatch Logs to the specified Amazon Simple Storage Service (Amazon
S3)
   /// bucket.
   /// </summary>
   public class CreateExportTask
   {
       public static async Task Main()
       {
           // This client object will be associated with the same AWS Region
           // as the default user on this system. If you need to use a
           // different AWS Region, pass it as a parameter to the client
           // constructor.
           var client = new AmazonCloudWatchLogsClient();
           string taskName = "export-task-example";
           string logGroupName = "cloudwatchlogs-example-loggroup";
           string destination = "amzn-s3-demo-bucket";
           var fromTime = 1437584472382;
           var toTime = 1437584472833;

           var request = new CreateExportTaskRequest
           {
               From = fromTime,
               To = toTime,
               TaskName = taskName,
               LogGroupName = logGroupName,
               Destination = destination,
           };

           var response = await client.CreateExportTaskAsync(request);

           if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
           {
               Console.WriteLine($"The task, {taskName} with ID: " +
                                 $"{response.TaskId} has been created
successfully.");
           }
       }
   }
```

- For API details, see CreateExportTask in *Amazon SDK for .NET API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `CreateLogGroup` with an Amazon SDK or CLI

The following code examples show how to use `CreateLogGroup`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
using Amazon.CloudWatchLogs;
using Amazon.CloudWatchLogs.Model;

/// <summary>
/// Shows how to create an Amazon CloudWatch Logs log group.
/// </summary>
public class CreateLogGroup
{
    public static async Task Main()
    {
        // This client object will be associated with the same AWS Region
        // as the default user on this system. If you need to use a
        // different AWS Region, pass it as a parameter to the client
        // constructor.
        var client = new AmazonCloudWatchLogsClient();

        string logGroupName = "cloudwatchlogs-example-loggroup";
```

```
            var request = new CreateLogGroupRequest
            {
                LogGroupName = logGroupName,
            };

            var response = await client.CreateLogGroupAsync(request);

            if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
            {
                Console.WriteLine($"Successfully create log group with ID:
{logGroupName}.");
            }
            else
            {
                Console.WriteLine("Could not create log group.");
            }
        }
    }
```

- For API details, see CreateLogGroup in *Amazon SDK for .NET API Reference*.

CLI

Amazon CLI

The following command creates a log group named `my-logs`:

```
aws logs create-log-group --log-group-name my-logs
```

- For API details, see CreateLogGroup in *Amazon CLI Command Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import { CreateLogGroupCommand } from "@aws-sdk/client-cloudwatch-logs";
import { client } from "../libs/client.js";

const run = async () => {
  const command = new CreateLogGroupCommand({
    // The name of the log group.
    logGroupName: process.env.CLOUDWATCH_LOGS_LOG_GROUP,
  });

  try {
    return await client.send(command);
  } catch (err) {
    console.error(err);
  }
};

export default run();
```

- For API details, see CreateLogGroup in *Amazon SDK for JavaScript API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `CreateLogStream` with an Amazon SDK or CLI

The following code examples show how to use `CreateLogStream`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
using Amazon.CloudWatchLogs;
using Amazon.CloudWatchLogs.Model;

/// <summary>
/// Shows how to create an Amazon CloudWatch Logs stream for a CloudWatch
/// log group.
/// </summary>
public class CreateLogStream
{
    public static async Task Main()
    {
        // This client object will be associated with the same AWS Region
        // as the default user on this system. If you need to use a
        // different AWS Region, pass it as a parameter to the client
        // constructor.
        var client = new AmazonCloudWatchLogsClient();
        string logGroupName = "cloudwatchlogs-example-loggroup";
        string logStreamName = "cloudwatchlogs-example-logstream";

        var request = new CreateLogStreamRequest
        {
            LogGroupName = logGroupName,
            LogStreamName = logStreamName,
        };

        var response = await client.CreateLogStreamAsync(request);

        if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
        {
```

```
                Console.WriteLine($"{logStreamName} successfully created for
{logGroupName}.");
            }
            else
            {
                Console.WriteLine("Could not create stream.");
            }
        }
    }
```

- For API details, see CreateLogStream in *Amazon SDK for .NET API Reference*.

CLI

Amazon CLI

The following command creates a log stream named `20150601` in the log group `my-logs`:

```
aws logs create-log-stream --log-group-name my-logs --log-stream-name 20150601
```

- For API details, see CreateLogStream in *Amazon CLI Command Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `DeleteLogGroup` with an Amazon SDK or CLI

The following code examples show how to use `DeleteLogGroup`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
    using System;
    using System.Threading.Tasks;
    using Amazon.CloudWatchLogs;
    using Amazon.CloudWatchLogs.Model;

    /// <summary>
    /// Uses the Amazon CloudWatch Logs Service to delete an existing
    /// CloudWatch Logs log group.
    /// </summary>
    public class DeleteLogGroup
    {
        public static async Task Main()
        {
            var client = new AmazonCloudWatchLogsClient();
            string logGroupName = "cloudwatchlogs-example-loggroup";

            var request = new DeleteLogGroupRequest
            {
                LogGroupName = logGroupName,
            };

            var response = await client.DeleteLogGroupAsync(request);

            if (response.HttpStatusCode == System.Net.HttpStatusCode.OK)
            {
                Console.WriteLine($"Successfully deleted CloudWatch log group,
{logGroupName}.");
            }
        }
    }
```

- For API details, see DeleteLogGroup in *Amazon SDK for .NET API Reference*.

CLI

Amazon CLI

The following command deletes a log group named `my-logs`:

```
aws logs delete-log-group --log-group-name my-logs
```

- For API details, see DeleteLogGroup in *Amazon CLI Command Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import { DeleteLogGroupCommand } from "@aws-sdk/client-cloudwatch-logs";
import { client } from "../libs/client.js";

const run = async () => {
  const command = new DeleteLogGroupCommand({
    // The name of the log group.
    logGroupName: process.env.CLOUDWATCH_LOGS_LOG_GROUP,
  });

  try {
    return await client.send(command);
  } catch (err) {
    console.error(err);
  }
};

export default run();
```

- For API details, see DeleteLogGroup in *Amazon SDK for JavaScript API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `DeleteSubscriptionFilter` with an Amazon SDK

The following code examples show how to use `DeleteSubscriptionFilter`.

C++

SDK for C++

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

Include the required files.

```
#include <aws/core/Aws.h>
#include <aws/core/utils/Outcome.h>
#include <aws/logs/CloudWatchLogsClient.h>
#include <aws/logs/model/DeleteSubscriptionFilterRequest.h>
#include <iostream>
```

Delete the subscription filter.

```
        Aws::CloudWatchLogs::CloudWatchLogsClient cwl;
        Aws::CloudWatchLogs::Model::DeleteSubscriptionFilterRequest request;
        request.SetFilterName(filter_name);
        request.SetLogGroupName(log_group);

        auto outcome = cwl.DeleteSubscriptionFilter(request);
        if (!outcome.IsSuccess()) {
            std::cout << "Failed to delete CloudWatch log subscription filter "
                << filter_name << ": " << outcome.GetError().GetMessage() <<
                std::endl;
        } else {
            std::cout << "Successfully deleted CloudWatch logs subscription " <<
                "filter " << filter_name << std::endl;
        }
```

- For API details, see DeleteSubscriptionFilter in *Amazon SDK for C++ API Reference*.

Java

SDK for Java 2.x

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import software.amazon.awssdk.services.cloudwatch.model.CloudWatchException;
import software.amazon.awssdk.services.cloudwatchlogs.CloudWatchLogsClient;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.DeleteSubscriptionFilterRequest;

/**
 * Before running this Java V2 code example, set up your development
 * environment, including your credentials.
 *
 * For more information, see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-
started.html
 */
public class DeleteSubscriptionFilter {
    public static void main(String[] args) {
        final String usage = """

                Usage:
                  <filter> <logGroup>

                Where:
                  filter - The name of the subscription filter (for example,
 MyFilter).
                  logGroup - The name of the log group. (for example, testgroup).
                """;

        if (args.length != 2) {
            System.out.println(usage);
            System.exit(1);
        }
```

```
        String filter = args[0];
        String logGroup = args[1];
        CloudWatchLogsClient logs = CloudWatchLogsClient.builder()
                .build();

        deleteSubFilter(logs, filter, logGroup);
        logs.close();
    }

    public static void deleteSubFilter(CloudWatchLogsClient logs, String filter,
 String logGroup) {
        try {
            DeleteSubscriptionFilterRequest request =
 DeleteSubscriptionFilterRequest.builder()
                    .filterName(filter)
                    .logGroupName(logGroup)
                    .build();

            logs.deleteSubscriptionFilter(request);
            System.out.printf("Successfully deleted CloudWatch logs subscription
 filter %s", filter);

        } catch (CloudWatchException e) {
            System.err.println(e.awsErrorDetails().errorMessage());
            System.exit(1);
        }
    }
}
```

- For API details, see DeleteSubscriptionFilter in *Amazon SDK for Java 2.x API Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import { DeleteSubscriptionFilterCommand } from "@aws-sdk/client-cloudwatch-
logs";
import { client } from "../libs/client.js";

const run = async () => {
  const command = new DeleteSubscriptionFilterCommand({
    // The name of the filter.
    filterName: process.env.CLOUDWATCH_LOGS_FILTER_NAME,
    // The name of the log group.
    logGroupName: process.env.CLOUDWATCH_LOGS_LOG_GROUP,
  });

  try {
    return await client.send(command);
  } catch (err) {
    console.error(err);
  }
};

export default run();
```

- For API details, see DeleteSubscriptionFilter in *Amazon SDK for JavaScript API Reference*.

SDK for JavaScript (v2)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
// Load the AWS SDK for Node.js
var AWS = require("aws-sdk");
// Set the region
AWS.config.update({ region: "REGION" });

// Create the CloudWatchLogs service object
var cwl = new AWS.CloudWatchLogs({ apiVersion: "2014-03-28" });

var params = {
  filterName: "FILTER",
```

```
  logGroupName: "LOG_GROUP",
};

cwl.deleteSubscriptionFilter(params, function (err, data) {
  if (err) {
    console.log("Error", err);
  } else {
    console.log("Success", data);
  }
});
```

- For more information, see Amazon SDK for JavaScript Developer Guide.
- For API details, see DeleteSubscriptionFilter in *Amazon SDK for JavaScript API Reference*.

Kotlin

SDK for Kotlin

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
suspend fun deleteSubFilter(
    filter: String?,
    logGroup: String?,
) {
    val request =
        DeleteSubscriptionFilterRequest {
            filterName = filter
            logGroupName = logGroup
        }

    CloudWatchLogsClient { region = "us-west-2" }.use { logs ->
        logs.deleteSubscriptionFilter(request)
        println("Successfully deleted CloudWatch logs subscription filter named
 $filter")
    }
}
```

- For API details, see DeleteSubscriptionFilter in *Amazon SDK for Kotlin API reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `DescribeExportTasks` with an Amazon SDK

The following code example shows how to use `DescribeExportTasks`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
using System;
using System.Threading.Tasks;
using Amazon.CloudWatchLogs;
using Amazon.CloudWatchLogs.Model;

/// <summary>
/// Shows how to retrieve a list of information about Amazon CloudWatch
/// Logs export tasks.
/// </summary>
public class DescribeExportTasks
{
    public static async Task Main()
    {
        // This client object will be associated with the same AWS Region
        // as the default user on this system. If you need to use a
        // different AWS Region, pass it as a parameter to the client
        // constructor.
        var client = new AmazonCloudWatchLogsClient();
```

```
            var request = new DescribeExportTasksRequest
            {
                Limit = 5,
            };

            var response = new DescribeExportTasksResponse();

            do
            {
                response = await client.DescribeExportTasksAsync(request);
                response.ExportTasks.ForEach(t =>
                {
                    Console.WriteLine($"{t.TaskName} with ID: {t.TaskId} has
status: {t.Status}");
                });
            }
            while (response.NextToken is not null);
        }
    }
```

- For API details, see DescribeExportTasks in *Amazon SDK for .NET API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `DescribeLogGroups` with an Amazon SDK or CLI

The following code examples show how to use `DescribeLogGroups`.

.NET

Amazon SDK for .NET

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
    using System;
    using System.Threading.Tasks;
    using Amazon.CloudWatchLogs;
    using Amazon.CloudWatchLogs.Model;

    /// <summary>
    /// Retrieves information about existing Amazon CloudWatch Logs log groups
    /// and displays the information on the console.
    /// </summary>
    public class DescribeLogGroups
    {
        public static async Task Main()
        {
            // Creates a CloudWatch Logs client using the default
            // user. If you need to work with resources in another
            // AWS Region than the one defined for the default user,
            // pass the AWS Region as a parameter to the client constructor.
            var client = new AmazonCloudWatchLogsClient();

            bool done = false;
            string newToken = null;

            var request = new DescribeLogGroupsRequest
            {
                Limit = 5,
            };

            DescribeLogGroupsResponse response;

            do
            {
                if (newToken is not null)
                {
                    request.NextToken = newToken;
                }

                response = await client.DescribeLogGroupsAsync(request);

                response.LogGroups.ForEach(lg =>
                {
                    Console.WriteLine($"{lg.LogGroupName} is associated with the
key: {lg.KmsKeyId}.");
```

```
                    Console.WriteLine($"Created on:
{lg.CreationTime.Date.Date}");
                    Console.WriteLine($"Date for this group will be stored for:
{lg.RetentionInDays} days.\n");
                });

                if (response.NextToken is null)
                {
                    done = true;
                }
                else
                {
                    newToken = response.NextToken;
                }
            }
            while (!done);
        }
    }
```

- For API details, see DescribeLogGroups in *Amazon SDK for .NET API Reference*.

CLI

Amazon CLI

The following command describes a log group named `my-logs`:

```
aws logs describe-log-groups --log-group-name-prefix my-logs
```

Output:

```
{
    "logGroups": [
        {
            "storedBytes": 0,
            "metricFilterCount": 0,
            "creationTime": 1433189500783,
            "logGroupName": "my-logs",
            "retentionInDays": 5,
            "arn": "arn:aws:logs:us-west-2:0123456789012:log-group:my-logs:*"
```

```
        }
    ]
}
```

- For API details, see DescribeLogGroups in *Amazon CLI Command Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import {
  paginateDescribeLogGroups,
  CloudWatchLogsClient,
} from "@aws-sdk/client-cloudwatch-logs";

const client = new CloudWatchLogsClient({});

export const main = async () => {
  const paginatedLogGroups = paginateDescribeLogGroups({ client }, {});
  const logGroups = [];

  for await (const page of paginatedLogGroups) {
    if (page.logGroups?.every((lg) => !!lg)) {
      logGroups.push(...page.logGroups);
    }
  }

  console.log(logGroups);
  return logGroups;
};
```

- For API details, see DescribeLogGroups in *Amazon SDK for JavaScript API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `DescribeSubscriptionFilters` with an Amazon SDK

The following code examples show how to use `DescribeSubscriptionFilters`.

C++

SDK for C++

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

Include the required files.

```
#include <aws/core/Aws.h>
#include <aws/core/utils/Outcome.h>
#include <aws/logs/CloudWatchLogsClient.h>
#include <aws/logs/model/DescribeSubscriptionFiltersRequest.h>
#include <aws/logs/model/DescribeSubscriptionFiltersResult.h>
#include <iostream>
#include <iomanip>
```

List the subscription filters.

```
        Aws::CloudWatchLogs::CloudWatchLogsClient cwl;
        Aws::CloudWatchLogs::Model::DescribeSubscriptionFiltersRequest request;
        request.SetLogGroupName(log_group);
        request.SetLimit(1);

        bool done = false;
        bool header = false;
        while (!done) {
            auto outcome = cwl.DescribeSubscriptionFilters(
                    request);
            if (!outcome.IsSuccess()) {
```

```
                std::cout << "Failed to describe CloudWatch subscription filters
"
                    << "for log group " << log_group << ": " <<
                    outcome.GetError().GetMessage() << std::endl;
                break;
            }

            if (!header) {
                std::cout << std::left << std::setw(32) << "Name" <<
                    std::setw(64) << "FilterPattern" << std::setw(64) <<
                    "DestinationArn" << std::endl;
                header = true;
            }

            const auto &filters = outcome.GetResult().GetSubscriptionFilters();
            for (const auto &filter : filters) {
                std::cout << std::left << std::setw(32) <<
                    filter.GetFilterName() << std::setw(64) <<
                    filter.GetFilterPattern() << std::setw(64) <<
                    filter.GetDestinationArn() << std::endl;
            }

            const auto &next_token = outcome.GetResult().GetNextToken();
            request.SetNextToken(next_token);
            done = next_token.empty();
        }
```

- For API details, see DescribeSubscriptionFilters in *Amazon SDK for C++ API Reference*.

Java

SDK for Java 2.x

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import software.amazon.awssdk.auth.credentials.ProfileCredentialsProvider;
import software.amazon.awssdk.services.cloudwatch.model.CloudWatchException;
```

```
import software.amazon.awssdk.services.cloudwatchlogs.CloudWatchLogsClient;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.DescribeSubscriptionFiltersRequest;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.DescribeSubscriptionFiltersResponse
import software.amazon.awssdk.services.cloudwatchlogs.model.SubscriptionFilter;

/**
 * Before running this Java V2 code example, set up your development
 * environment, including your credentials.
 *
 * For more information, see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-
started.html
 */
public class DescribeSubscriptionFilters {
    public static void main(String[] args) {

        final String usage = """

                Usage:
                  <logGroup>

                Where:
                  logGroup - A log group name (for example, myloggroup).
                """;

        if (args.length != 1) {
            System.out.println(usage);
            System.exit(1);
        }

        String logGroup = args[0];
        CloudWatchLogsClient logs = CloudWatchLogsClient.builder()
                .credentialsProvider(ProfileCredentialsProvider.create())
                .build();

        describeFilters(logs, logGroup);
        logs.close();
    }

    public static void describeFilters(CloudWatchLogsClient logs, String
 logGroup) {
```

```
        try {
            boolean done = false;
            String newToken = null;

            while (!done) {
                DescribeSubscriptionFiltersResponse response;
                if (newToken == null) {
                    DescribeSubscriptionFiltersRequest request =
DescribeSubscriptionFiltersRequest.builder()
                            .logGroupName(logGroup)
                            .limit(1).build();

                    response = logs.describeSubscriptionFilters(request);
                } else {
                    DescribeSubscriptionFiltersRequest request =
DescribeSubscriptionFiltersRequest.builder()
                            .nextToken(newToken)
                            .logGroupName(logGroup)
                            .limit(1).build();
                    response = logs.describeSubscriptionFilters(request);
                }

                for (SubscriptionFilter filter : response.subscriptionFilters())
{
                    System.out.printf("Retrieved filter with name %s, " +
"pattern %s " + "and destination arn %s",
                            filter.filterName(),
                            filter.filterPattern(),
                            filter.destinationArn());
                }

                if (response.nextToken() == null) {
                    done = true;
                } else {
                    newToken = response.nextToken();
                }
            }

        } catch (CloudWatchException e) {
            System.err.println(e.awsErrorDetails().errorMessage());
            System.exit(1);
        }
        System.out.printf("Done");
    }
```

```
}
```

- For API details, see DescribeSubscriptionFilters in *Amazon SDK for Java 2.x API Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import { DescribeSubscriptionFiltersCommand } from "@aws-sdk/client-cloudwatch-
logs";
import { client } from "../libs/client.js";

const run = async () => {
  // This will return a list of all subscription filters in your account
  // matching the log group name.
  const command = new DescribeSubscriptionFiltersCommand({
    logGroupName: process.env.CLOUDWATCH_LOGS_LOG_GROUP,
    limit: 1,
  });

  try {
    return await client.send(command);
  } catch (err) {
    console.error(err);
  }
};

export default run();
```

- For API details, see DescribeSubscriptionFilters in *Amazon SDK for JavaScript API Reference*.

SDK for JavaScript (v2)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
// Load the AWS SDK for Node.js
var AWS = require("aws-sdk");
// Set the region
AWS.config.update({ region: "REGION" });

// Create the CloudWatchLogs service object
var cwl = new AWS.CloudWatchLogs({ apiVersion: "2014-03-28" });

var params = {
  logGroupName: "GROUP_NAME",
  limit: 5,
};

cwl.describeSubscriptionFilters(params, function (err, data) {
  if (err) {
    console.log("Error", err);
  } else {
    console.log("Success", data.subscriptionFilters);
  }
});
```

- For more information, see Amazon SDK for JavaScript Developer Guide.
- For API details, see DescribeSubscriptionFilters in *Amazon SDK for JavaScript API Reference*.

Kotlin

SDK for Kotlin

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
suspend fun describeFilters(logGroup: String) {
    val request =
        DescribeSubscriptionFiltersRequest {
            logGroupName = logGroup
            limit = 1
        }

    CloudWatchLogsClient { region = "us-west-2" }.use { cwlClient ->
        val response = cwlClient.describeSubscriptionFilters(request)
        response.subscriptionFilters?.forEach { filter ->
            println("Retrieved filter with name  ${filter.filterName} pattern
 ${filter.filterPattern} and destination ${filter.destinationArn}")
        }
    }
}
```

- For API details, see DescribeSubscriptionFilters in *Amazon SDK for Kotlin API reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `GetQueryResults` with an Amazon SDK

The following code examples show how to use `GetQueryResults`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- Run a large query

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
/**
 * Simple wrapper for the GetQueryResultsCommand.
 * @param {string} queryId
 */
_getQueryResults(queryId) {
  return this.client.send(new GetQueryResultsCommand({ queryId }));
}
```

- For API details, see GetQueryResults in *Amazon SDK for JavaScript API Reference*.

Python

SDK for Python (Boto3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
    def _wait_for_query_results(self, client, query_id):
        """
        Waits for the query to complete and retrieves the results.

        :param query_id: The ID of the initiated query.
        :type query_id: str
        :return: A list containing the results of the query.
        :rtype: list
        """
```

```
        while True:
            time.sleep(1)
            results = client.get_query_results(queryId=query_id)
            if results["status"] in [
                "Complete",
                "Failed",
                "Cancelled",
                "Timeout",
                "Unknown",
            ]:
                return results.get("results", [])
```

- For API details, see GetQueryResults in *Amazon SDK for Python (Boto3) API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `PutSubscriptionFilter` with an Amazon SDK

The following code examples show how to use `PutSubscriptionFilter`.

C++

SDK for C++

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

Include the required files.

```
#include <aws/core/Aws.h>
#include <aws/logs/CloudWatchLogsClient.h>
#include <aws/logs/model/PutSubscriptionFilterRequest.h>
#include <aws/core/utils/Outcome.h>
#include <iostream>
```

Create the subscription filter.

```
        Aws::CloudWatchLogs::CloudWatchLogsClient cwl;
        Aws::CloudWatchLogs::Model::PutSubscriptionFilterRequest request;
        request.SetFilterName(filter_name);
        request.SetFilterPattern(filter_pattern);
        request.SetLogGroupName(log_group);
        request.SetDestinationArn(dest_arn);
        auto outcome = cwl.PutSubscriptionFilter(request);
        if (!outcome.IsSuccess())
        {
            std::cout << "Failed to create CloudWatch logs subscription filter "
                << filter_name << ": " << outcome.GetError().GetMessage() <<
                std::endl;
        }
        else
        {
            std::cout << "Successfully created CloudWatch logs subscription " <<
                "filter " << filter_name << std::endl;
        }
```

- For API details, see PutSubscriptionFilter in *Amazon SDK for C++ API Reference*.

Java

SDK for Java 2.x

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import software.amazon.awssdk.regions.Region;
import software.amazon.awssdk.services.cloudwatchlogs.CloudWatchLogsClient;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.CloudWatchLogsException;
```

```
import
 software.amazon.awssdk.services.cloudwatchlogs.model.PutSubscriptionFilterRequest;

/**
 * Before running this code example, you need to grant permission to CloudWatch
 * Logs the right to execute your Lambda function.
 * To perform this task, you can use this CLI command:
 *
 * aws lambda add-permission --function-name "lamda1" --statement-id "lamda1"
 * --principal "logs.us-west-2.amazonaws.com" --action "lambda:InvokeFunction"
 * --source-arn "arn:aws:logs:us-west-2:111111111111:log-group:testgroup:*"
 * --source-account "111111111111"
 *
 * Make sure you replace the function name with your function name and replace
 * '111111111111' with your account details.
 * For more information, see "Subscription Filters with AWS Lambda" in the
 * Amazon CloudWatch Logs Guide.
 *
 *
 * Also, before running this Java V2 code example,set up your development
 * environment,including your credentials.
 *
 * For more information,see the following documentation topic:
 *
 * https://docs.aws.amazon.com/sdk-for-java/latest/developer-guide/get-
started.html
 *
 */

public class PutSubscriptionFilter {
    public static void main(String[] args) {
        final String usage = """

                Usage:
                  <filter> <pattern> <logGroup> <functionArn>\s

                Where:
                  filter - A filter name (for example, myfilter).
                  pattern - A filter pattern (for example, ERROR).
                  logGroup - A log group name (testgroup).
                  functionArn - An AWS Lambda function ARN (for example,
 arn:aws:lambda:us-west-2:111111111111:function:lambda1) .
                """;
```

```
        if (args.length != 4) {
            System.out.println(usage);
            System.exit(1);
        }

        String filter = args[0];
        String pattern = args[1];
        String logGroup = args[2];
        String functionArn = args[3];
        Region region = Region.US_WEST_2;
        CloudWatchLogsClient cwl = CloudWatchLogsClient.builder()
                .region(region)
                .build();

        putSubFilters(cwl, filter, pattern, logGroup, functionArn);
        cwl.close();
    }

    public static void putSubFilters(CloudWatchLogsClient cwl,
            String filter,
            String pattern,
            String logGroup,
            String functionArn) {

        try {
            PutSubscriptionFilterRequest request =
PutSubscriptionFilterRequest.builder()
                    .filterName(filter)
                    .filterPattern(pattern)
                    .logGroupName(logGroup)
                    .destinationArn(functionArn)
                    .build();

            cwl.putSubscriptionFilter(request);
            System.out.printf(
                    "Successfully created CloudWatch logs subscription filter
%s",
                    filter);

        } catch (CloudWatchLogsException e) {
            System.err.println(e.awsErrorDetails().errorMessage());
            System.exit(1);
        }
    }
```

```
}
```

- For API details, see PutSubscriptionFilter in *Amazon SDK for Java 2.x API Reference*.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
import { PutSubscriptionFilterCommand } from "@aws-sdk/client-cloudwatch-logs";
import { client } from "../libs/client.js";

const run = async () => {
  const command = new PutSubscriptionFilterCommand({
    // An ARN of a same-account Kinesis stream, Kinesis Firehose
    // delivery stream, or Lambda function.
    // https://docs.aws.amazon.com/AmazonCloudWatch/latest/logs/
SubscriptionFilters.html
    destinationArn: process.env.CLOUDWATCH_LOGS_DESTINATION_ARN,

    // A name for the filter.
    filterName: process.env.CLOUDWATCH_LOGS_FILTER_NAME,

    // A filter pattern for subscribing to a filtered stream of log events.
    // https://docs.aws.amazon.com/AmazonCloudWatch/latest/logs/
FilterAndPatternSyntax.html
    filterPattern: process.env.CLOUDWATCH_LOGS_FILTER_PATTERN,

    // The name of the log group. Messages in this group matching the filter
 pattern
    // will be sent to the destination ARN.
    logGroupName: process.env.CLOUDWATCH_LOGS_LOG_GROUP,
  });

  try {
    return await client.send(command);
```

```
  } catch (err) {
    console.error(err);
  }
};

export default run();
```

- For API details, see PutSubscriptionFilter in *Amazon SDK for JavaScript API Reference*.

SDK for JavaScript (v2)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
// Load the AWS SDK for Node.js
var AWS = require("aws-sdk");
// Set the region
AWS.config.update({ region: "REGION" });

// Create the CloudWatchLogs service object
var cwl = new AWS.CloudWatchLogs({ apiVersion: "2014-03-28" });

var params = {
  destinationArn: "LAMBDA_FUNCTION_ARN",
  filterName: "FILTER_NAME",
  filterPattern: "ERROR",
  logGroupName: "LOG_GROUP",
};

cwl.putSubscriptionFilter(params, function (err, data) {
  if (err) {
    console.log("Error", err);
  } else {
    console.log("Success", data);
  }
});
```

- For more information, see Amazon SDK for JavaScript Developer Guide.

- For API details, see PutSubscriptionFilter in *Amazon SDK for JavaScript API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `StartLiveTail` with an Amazon SDK

The following code examples show how to use `StartLiveTail`.

.NET

Amazon SDK for .NET

Include the required files.

```
using Amazon;
using Amazon.CloudWatchLogs;
using Amazon.CloudWatchLogs.Model;
```

Start the Live Tail session.

```
            var client = new AmazonCloudWatchLogsClient();
            var request = new StartLiveTailRequest
            {
                LogGroupIdentifiers = logGroupIdentifiers,
                LogStreamNames = logStreamNames,
                LogEventFilterPattern = filterPattern,
            };

            var response = await client.StartLiveTailAsync(request);

            // Catch if request fails
            if (response.HttpStatusCode != System.Net.HttpStatusCode.OK)
            {
                Console.WriteLine("Failed to start live tail session");
                return;
            }
```

You can handle the events from the Live Tail session in two ways:

```
            /* Method 1
            * 1). Asynchronously loop through the event stream
            * 2). Set a timer to dispose the stream and stop the Live Tail
session at the end.
            */
            var eventStream = response.ResponseStream;
            var task = Task.Run(() =>
            {
                foreach (var item in eventStream)
                {
                    if (item is LiveTailSessionUpdate liveTailSessionUpdate)
                    {
                        foreach (var sessionResult in
liveTailSessionUpdate.SessionResults)
                        {
                            Console.WriteLine("Message : {0}",
sessionResult.Message);
                        }
                    }
                    if (item is LiveTailSessionStart)
                    {
                        Console.WriteLine("Live Tail session started");
                    }
                    // On-stream exceptions are processed here
                    if (item is CloudWatchLogsEventStreamException)
                    {
                        Console.WriteLine($"ERROR: {item}");
                    }
                }
            });
            // Close the stream to stop the session after a timeout
            if (!task.Wait(TimeSpan.FromSeconds(10))){
                eventStream.Dispose();
                Console.WriteLine("End of line");
            }
```

```
            /* Method 2
            * 1). Add event handlers to each event variable
            * 2). Start processing the stream and wait for a timeout using
AutoResetEvent
            */
            AutoResetEvent endEvent = new AutoResetEvent(false);
```

```
            var eventStream = response.ResponseStream;
            using (eventStream) // automatically disposes the stream to stop the
 session after execution finishes
            {
                eventStream.SessionStartReceived += (sender, e) =>
                {
                    Console.WriteLine("LiveTail session started");
                };
                eventStream.SessionUpdateReceived += (sender, e) =>
                {
                    foreach (LiveTailSessionLogEvent logEvent in
 e.EventStreamEvent.SessionResults){
                        Console.WriteLine("Message: {0}", logEvent.Message);
                    }
                };
                // On-stream exceptions are captured here
                eventStream.ExceptionReceived += (sender, e) =>
                {
                    Console.WriteLine($"ERROR:
 {e.EventStreamException.Message}");
                };

                eventStream.StartProcessing();
                // Stream events for this amount of time.
                endEvent.WaitOne(TimeSpan.FromSeconds(10));
                Console.WriteLine("End of line");
            }
```

- For API details, see StartLiveTail in *Amazon SDK for .NET API Reference*.

Go

SDK for Go V2

Include the required files.

```
import (
 "context"
 "log"
 "time"

 "github.com/aws/aws-sdk-go-v2/config"
```

```
 "github.com/aws/aws-sdk-go-v2/service/cloudwatchlogs"
 "github.com/aws/aws-sdk-go-v2/service/cloudwatchlogs/types"
)
```

Handle the events from the Live Tail session.

```
func handleEventStreamAsync(stream *cloudwatchlogs.StartLiveTailEventStream) {
 eventsChan := stream.Events()
 for {
  event := <-eventsChan
  switch e := event.(type) {
  case *types.StartLiveTailResponseStreamMemberSessionStart:
   log.Println("Received SessionStart event")
  case *types.StartLiveTailResponseStreamMemberSessionUpdate:
   for _, logEvent := range e.Value.SessionResults {
    log.Println(*logEvent.Message)
   }
  default:
   // Handle on-stream exceptions
   if err := stream.Err(); err != nil {
    log.Fatalf("Error occured during streaming: %v", err)
   } else if event == nil {
    log.Println("Stream is Closed")
    return
   } else {
    log.Fatalf("Unknown event type: %T", e)
   }
  }
 }
}
```

Start the Live Tail session.

```
 cfg, err := config.LoadDefaultConfig(context.TODO())
 if err != nil {
  panic("configuration error, " + err.Error())
 }
 client := cloudwatchlogs.NewFromConfig(cfg)

 request := &cloudwatchlogs.StartLiveTailInput{
  LogGroupIdentifiers:   logGroupIdentifiers,
```

```
 LogStreamNames:        logStreamNames,
 LogEventFilterPattern: logEventFilterPattern,
}

response, err := client.StartLiveTail(context.TODO(), request)
// Handle pre-stream Exceptions
if err != nil {
 log.Fatalf("Failed to start streaming: %v", err)
}

// Start a Goroutine to handle events over stream
stream := response.GetStream()
go handleEventStreamAsync(stream)
```

Stop the Live Tail session after a period of time has elapsed.

```
// Close the stream (which ends the session) after a timeout
time.Sleep(10 * time.Second)
stream.Close()
log.Println("Event stream closed")
```

- For API details, see StartLiveTail in *Amazon SDK for Go API Reference*.

Java

SDK for Java 2.x

Include the required files.

```
import io.reactivex.FlowableSubscriber;
import io.reactivex.annotations.NonNull;
import org.reactivestreams.Subscription;
import software.amazon.awssdk.auth.credentials.ProfileCredentialsProvider;
import software.amazon.awssdk.services.cloudwatchlogs.CloudWatchLogsAsyncClient;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.LiveTailSessionLogEvent;
import software.amazon.awssdk.services.cloudwatchlogs.model.LiveTailSessionStart;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.LiveTailSessionUpdate;
import software.amazon.awssdk.services.cloudwatchlogs.model.StartLiveTailRequest;
```

```
import
 software.amazon.awssdk.services.cloudwatchlogs.model.StartLiveTailResponseHandler;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.CloudWatchLogsException;
import
 software.amazon.awssdk.services.cloudwatchlogs.model.StartLiveTailResponseStream;

import java.util.Date;
import java.util.List;
import java.util.concurrent.atomic.AtomicReference;
```

Handle the events from the Live Tail session.

```
   private static StartLiveTailResponseHandler
 getStartLiveTailResponseStreamHandler(
           AtomicReference<Subscription> subscriptionAtomicReference) {
       return StartLiveTailResponseHandler.builder()
           .onResponse(r -> System.out.println("Received initial response"))
           .onError(throwable -> {
               CloudWatchLogsException e = (CloudWatchLogsException)
 throwable.getCause();
               System.err.println(e.awsErrorDetails().errorMessage());
               System.exit(1);
           })
           .subscriber(() -> new FlowableSubscriber<>() {
               @Override
               public void onSubscribe(@NonNull Subscription s) {
                   subscriptionAtomicReference.set(s);
                   s.request(Long.MAX_VALUE);
               }

               @Override
               public void onNext(StartLiveTailResponseStream event) {
                   if (event instanceof LiveTailSessionStart) {
                       LiveTailSessionStart sessionStart =
 (LiveTailSessionStart) event;
                       System.out.println(sessionStart);
                   } else if (event instanceof LiveTailSessionUpdate) {
                       LiveTailSessionUpdate sessionUpdate =
 (LiveTailSessionUpdate) event;
                       List<LiveTailSessionLogEvent> logEvents =
 sessionUpdate.sessionResults();
```

```
                        logEvents.forEach(e -> {
                            long timestamp = e.timestamp();
                            Date date = new Date(timestamp);
                            System.out.println("[" + date + "] " + e.message());
                        });
                    } else {
                        throw CloudWatchLogsException.builder().message("Unknown
event type").build();
                    }
                }

                @Override
                public void onError(Throwable throwable) {
                    System.out.println(throwable.getMessage());
                    System.exit(1);
                }

                @Override
                public void onComplete() {
                    System.out.println("Completed Streaming Session");
                }
            })
            .build();
    }
```

Start the Live Tail session.

```
        CloudWatchLogsAsyncClient cloudWatchLogsAsyncClient =
                CloudWatchLogsAsyncClient.builder()
                    .credentialsProvider(ProfileCredentialsProvider.create())
                    .build();

        StartLiveTailRequest request =
                StartLiveTailRequest.builder()
                    .logGroupIdentifiers(logGroupIdentifiers)
                    .logStreamNames(logStreamNames)
                    .logEventFilterPattern(logEventFilterPattern)
                    .build();

        /* Create a reference to store the subscription */
        final AtomicReference<Subscription> subscriptionAtomicReference = new
AtomicReference<>(null);
```

```
        cloudWatchLogsAsyncClient.startLiveTail(request,
 getStartLiveTailResponseStreamHandler(subscriptionAtomicReference));
```

Stop the Live Tail session after a period of time has elapsed.

```
        /* Set a timeout for the session and cancel the subscription. This will:
         * 1). Close the stream
         * 2). Stop the Live Tail session
         */
        try {
            Thread.sleep(10000);
        } catch (InterruptedException e) {
            throw new RuntimeException(e);
        }
        if (subscriptionAtomicReference.get() != null) {
            subscriptionAtomicReference.get().cancel();
            System.out.println("Subscription to stream closed");
        }
```

- For API details, see StartLiveTail in *Amazon SDK for Java 2.x API Reference*.

JavaScript

SDK for JavaScript (v3)

Include the required files.

```
import { CloudWatchLogsClient, StartLiveTailCommand } from "@aws-sdk/client-
cloudwatch-logs";
```

Handle the events from the Live Tail session.

```
async function handleResponseAsync(response) {
    try {
      for await (const event of response.responseStream) {
        if (event.sessionStart !== undefined) {
          console.log(event.sessionStart);
```

```
        } else if (event.sessionUpdate !== undefined) {
          for (const logEvent of event.sessionUpdate.sessionResults) {
            const timestamp = logEvent.timestamp;
            const date = new Date(timestamp);
            console.log("[" + date + "] " + logEvent.message);
          }
        } else {
            console.error("Unknown event type");
        }
      }
    } catch (err) {
        // On-stream exceptions are captured here
        console.error(err)
    }
}
```

Start the Live Tail session.

```
    const client = new CloudWatchLogsClient();

    const command = new StartLiveTailCommand({
        logGroupIdentifiers: logGroupIdentifiers,
        logStreamNames: logStreamNames,
        logEventFilterPattern: filterPattern
    });
    try{
        const response = await client.send(command);
        handleResponseAsync(response);
    } catch (err){
        // Pre-stream exceptions are captured here
        console.log(err);
    }
```

Stop the Live Tail session after a period of time has elapsed.

```
    /* Set a timeout to close the client. This will stop the Live Tail session.
 */
    setTimeout(function() {
        console.log("Client timeout");
        client.destroy();
      }, 10000);
```

- For API details, see StartLiveTail in *Amazon SDK for JavaScript API Reference*.

Kotlin

SDK for Kotlin

Include the required files.

```
import aws.sdk.kotlin.services.cloudwatchlogs.CloudWatchLogsClient
import aws.sdk.kotlin.services.cloudwatchlogs.model.StartLiveTailRequest
import aws.sdk.kotlin.services.cloudwatchlogs.model.StartLiveTailResponseStream
import kotlinx.coroutines.flow.takeWhile
```

Start the Live Tail session.

```
    val client = CloudWatchLogsClient.fromEnvironment()

    val request = StartLiveTailRequest {
        logGroupIdentifiers = logGroupIdentifiersVal
        logStreamNames = logStreamNamesVal
        logEventFilterPattern = logEventFilterPatternVal
    }

    val startTime = System.currentTimeMillis()

    try {
        client.startLiveTail(request) { response ->
            val stream = response.responseStream
            if (stream != null) {
                /* Set a timeout to unsubcribe from the flow. This will:
                * 1). Close the stream
                * 2). Stop the Live Tail session
                */
                stream.takeWhile { System.currentTimeMillis() - startTime <
10000 }.collect { value ->
                    if (value is StartLiveTailResponseStream.SessionStart) {
                        println(value.asSessionStart())
                    } else if (value is
StartLiveTailResponseStream.SessionUpdate) {
```

```
                    for (e in value.asSessionUpdate().sessionResults!!) {
                        println(e)
                    }
                } else {
                    throw IllegalArgumentException("Unknown event type")
                }
            }
        } else {
            throw IllegalArgumentException("No response stream")
        }
    }
} catch (e: Exception) {
    println("Exception occurred during StartLiveTail: $e")
    System.exit(1)
}
```

- For API details, see StartLiveTail in *Amazon SDK for Kotlin API reference*.

Python

SDK for Python (Boto3)

Include the required files.

```
import boto3
import time
from datetime import datetime
```

Start the Live Tail session.

```
    # Initialize the client
    client = boto3.client('logs')

    start_time = time.time()

    try:
        response = client.start_live_tail(
            logGroupIdentifiers=log_group_identifiers,
            logStreamNames=log_streams,
            logEventFilterPattern=filter_pattern
```

```
        )
        event_stream = response['responseStream']
        # Handle the events streamed back in the response
        for event in event_stream:
            # Set a timeout to close the stream.
            # This will end the Live Tail session.
            if (time.time() - start_time >= 10):
                event_stream.close()
                break
            # Handle when session is started
            if 'sessionStart' in event:
                session_start_event = event['sessionStart']
                print(session_start_event)
            # Handle when log event is given in a session update
            elif 'sessionUpdate' in event:
                log_events = event['sessionUpdate']['sessionResults']
                for log_event in log_events:
                    print('[{date}]
{log}'.format(date=datetime.fromtimestamp(log_event['timestamp']/1000),log=log_event['me
            else:
                # On-stream exceptions are captured here
                raise RuntimeError(str(event))
    except Exception as e:
        print(e)
```

- For API details, see StartLiveTail in *Amazon SDK for Python (Boto3) API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use `StartQuery` with an Amazon SDK

The following code examples show how to use `StartQuery`.

Action examples are code excerpts from larger programs and must be run in context. You can see this action in context in the following code example:

- Run a large query

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
/**
 * Wrapper for the StartQueryCommand. Uses a static query string
 * for consistency.
 * @param {[Date, Date]} dateRange
 * @param {number} maxLogs
 * @returns {Promise<{ queryId: string }>}
 */
async _startQuery([startDate, endDate], maxLogs = 10000) {
  try {
    return await this.client.send(
      new StartQueryCommand({
        logGroupNames: this.logGroupNames,
        queryString: "fields @timestamp, @message | sort @timestamp asc",
        startTime: startDate.valueOf(),
        endTime: endDate.valueOf(),
        limit: maxLogs,
      }),
    );
  } catch (err) {
    /** @type {string} */
    const message = err.message;
    if (message.startsWith("Query's end date and time")) {
      // This error indicates that the query's start or end date occur
      // before the log group was created.
      throw new DateOutOfBoundsError(message);
    }

    throw err;
  }
}
```

- For API details, see StartQuery in *Amazon SDK for JavaScript API Reference*.

Python

SDK for Python (Boto3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

```
    def perform_query(self, date_range):
        """
        Performs the actual CloudWatch log query.

        :param date_range: A tuple representing the start and end datetime for
the query.
        :type date_range: tuple
        :return: A list containing the query results.
        :rtype: list
        """
        client = boto3.client("logs")
        try:
            try:
                start_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[0])
                )
                end_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[1])
                )
                response = client.start_query(
                    logGroupName=self.log_group,
                    startTime=start_time,
                    endTime=end_time,
                    queryString=self.query_string,
                    limit=self.limit,
                )
                query_id = response["queryId"]
            except client.exceptions.ResourceNotFoundException as e:
```

```
                raise DateOutOfBoundsError(f"Resource not found: {e}")
            while True:
                time.sleep(1)
                results = client.get_query_results(queryId=query_id)
                if results["status"] in [
                    "Complete",
                    "Failed",
                    "Cancelled",
                    "Timeout",
                    "Unknown",
                ]:
                    return results.get("results", [])
        except DateOutOfBoundsError:
            return []

    def _initiate_query(self, client, date_range, max_logs):
        """
        Initiates the CloudWatch logs query.

        :param date_range: A tuple representing the start and end datetime for
the query.
        :type date_range: tuple
        :param max_logs: The maximum number of logs to retrieve.
        :type max_logs: int
        :return: The query ID as a string.
        :rtype: str
        """
        try:
            start_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[0])
            )
            end_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[1])
            )
            response = client.start_query(
                logGroupName=self.log_group,
                startTime=start_time,
                endTime=end_time,
                queryString=self.query_string,
                limit=max_logs,
            )
            return response["queryId"]
```

```
        except client.exceptions.ResourceNotFoundException as e:
            raise DateOutOfBoundsError(f"Resource not found: {e}")
```

- For API details, see StartQuery in *Amazon SDK for Python (Boto3) API Reference*.

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Scenarios for CloudWatch Logs using Amazon SDKs

The following code examples show you how to implement common scenarios in CloudWatch Logs with Amazon SDKs. These scenarios show you how to accomplish specific tasks by calling multiple functions within CloudWatch Logs or combined with other Amazon Web Services services. Each scenario includes a link to the complete source code, where you can find instructions on how to set up and run the code.

Scenarios target an intermediate level of experience to help you understand service actions in context.

Examples

- Use CloudWatch Logs to run a large query
- Use scheduled events to invoke a Lambda function

Use CloudWatch Logs to run a large query

The following code examples show how to use CloudWatch Logs to query more than 10,000 records.

JavaScript

SDK for JavaScript (v3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

This is the entry point.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0
import { CloudWatchLogsClient } from "@aws-sdk/client-cloudwatch-logs";
import { CloudWatchQuery } from "./cloud-watch-query.js";

console.log("Starting a recursive query...");

if (!process.env.QUERY_START_DATE || !process.env.QUERY_END_DATE) {
  throw new Error(
    "QUERY_START_DATE and QUERY_END_DATE environment variables are required.",
  );
}

const cloudWatchQuery = new CloudWatchQuery(new CloudWatchLogsClient({}), {
  logGroupNames: ["/workflows/cloudwatch-logs/large-query"],
  dateRange: [
    new Date(Number.parseInt(process.env.QUERY_START_DATE)),
    new Date(Number.parseInt(process.env.QUERY_END_DATE)),
  ],
});

await cloudWatchQuery.run();

console.log(
  `Queries finished in ${cloudWatchQuery.secondsElapsed} seconds.\nTotal logs
 found: ${cloudWatchQuery.results.length}`,
);
```

This is a class that splits queries into multiple steps if necessary.

```
// Copyright Amazon.com, Inc. or its affiliates. All Rights Reserved.
// SPDX-License-Identifier: Apache-2.0
import {
  StartQueryCommand,
  GetQueryResultsCommand,
} from "@aws-sdk/client-cloudwatch-logs";
import { splitDateRange } from "@aws-doc-sdk-examples/lib/utils/util-date.js";
import { retry } from "@aws-doc-sdk-examples/lib/utils/util-timers.js";

class DateOutOfBoundsError extends Error {}

export class CloudWatchQuery {
  /**
   * Run a query for all CloudWatch Logs within a certain date range.
   * CloudWatch logs return a max of 10,000 results. This class
   * performs a binary search across all of the logs in the provided
   * date range if a query returns the maximum number of results.
   *
   * @param {import('@aws-sdk/client-cloudwatch-logs').CloudWatchLogsClient}
 client
   * @param {{ logGroupNames: string[], dateRange: [Date, Date], queryConfig:
 { limit: number } }} config
   */
  constructor(client, { logGroupNames, dateRange, queryConfig }) {
    this.client = client;
    /**
     * All log groups are queried.
     */
    this.logGroupNames = logGroupNames;

    /**
     * The inclusive date range that is queried.
     */
    this.dateRange = dateRange;

    /**
     * CloudWatch Logs never returns more than 10,000 logs.
     */
    this.limit = queryConfig?.limit ?? 10000;

    /**
     * @type {import("@aws-sdk/client-cloudwatch-logs").ResultField[][]}
     */
```

```
    this.results = [];
  }

  /**
   * Run the query.
   */
  async run() {
    this.secondsElapsed = 0;
    const start = new Date();
    this.results = await this._largeQuery(this.dateRange);
    const end = new Date();
    this.secondsElapsed = (end - start) / 1000;
    return this.results;
  }

  /**
   * Recursively query for logs.
   * @param {[Date, Date]} dateRange
   * @returns {Promise<import("@aws-sdk/client-cloudwatch-logs").ResultField[]
[]>}
   */
  async _largeQuery(dateRange) {
    const logs = await this._query(dateRange, this.limit);

    console.log(
      `Query date range: ${dateRange
        .map((d) => d.toISOString())
        .join(" to ")}. Found ${logs.length} logs.`,
    );

    if (logs.length < this.limit) {
      return logs;
    }

    const lastLogDate = this._getLastLogDate(logs);
    const offsetLastLogDate = new Date(lastLogDate);
    offsetLastLogDate.setMilliseconds(lastLogDate.getMilliseconds() + 1);
    const subDateRange = [offsetLastLogDate, dateRange[1]];
    const [r1, r2] = splitDateRange(subDateRange);
    const results = await Promise.all([
      this._largeQuery(r1),
      this._largeQuery(r2),
    ]);
    return [logs, ...results].flat();
```

```
}

/**
 * Find the most recent log in a list of logs.
 * @param {import("@aws-sdk/client-cloudwatch-logs").ResultField[][]} logs
 */
_getLastLogDate(logs) {
  const timestamps = logs
    .map(
      (log) =>
        log.find((fieldMeta) => fieldMeta.field === "@timestamp")?.value,
    )
    .filter((t) => !!t)
    .map((t) => `${t}Z`)
    .sort();

  if (!timestamps.length) {
    throw new Error("No timestamp found in logs.");
  }

  return new Date(timestamps[timestamps.length - 1]);
}

/**
 * Simple wrapper for the GetQueryResultsCommand.
 * @param {string} queryId
 */
_getQueryResults(queryId) {
  return this.client.send(new GetQueryResultsCommand({ queryId }));
}

/**
 * Starts a query and waits for it to complete.
 * @param {[Date, Date]} dateRange
 * @param {number} maxLogs
 */
async _query(dateRange, maxLogs) {
  try {
    const { queryId } = await this._startQuery(dateRange, maxLogs);
    const { results } = await this._waitUntilQueryDone(queryId);
    return results ?? [];
  } catch (err) {
    /**
     * This error is thrown when StartQuery returns an error indicating
```

```
       * that the query's start or end date occur before the log group was
       * created.
       */
      if (err instanceof DateOutOfBoundsError) {
        return [];
      }
      throw err;
    }
  }

  /**
   * Wrapper for the StartQueryCommand. Uses a static query string
   * for consistency.
   * @param {[Date, Date]} dateRange
   * @param {number} maxLogs
   * @returns {Promise<{ queryId: string }>}
   */
  async _startQuery([startDate, endDate], maxLogs = 10000) {
    try {
      return await this.client.send(
        new StartQueryCommand({
          logGroupNames: this.logGroupNames,
          queryString: "fields @timestamp, @message | sort @timestamp asc",
          startTime: startDate.valueOf(),
          endTime: endDate.valueOf(),
          limit: maxLogs,
        }),
      );
    } catch (err) {
      /** @type {string} */
      const message = err.message;
      if (message.startsWith("Query's end date and time")) {
        // This error indicates that the query's start or end date occur
        // before the log group was created.
        throw new DateOutOfBoundsError(message);
      }

      throw err;
    }
  }

  /**
   * Call GetQueryResultsCommand until the query is done.
   * @param {string} queryId
```

```
   */
  _waitUntilQueryDone(queryId) {
    const getResults = async () => {
      const results = await this._getQueryResults(queryId);
      const queryDone = [
        "Complete",
        "Failed",
        "Cancelled",
        "Timeout",
        "Unknown",
      ].includes(results.status);

      return { queryDone, results };
    };

    return retry(
      { intervalInMs: 1000, maxRetries: 60, quiet: true },
      async () => {
        const { queryDone, results } = await getResults();
        if (!queryDone) {
          throw new Error("Query not done.");
        }

        return results;
      },
    );
  }
}
```

- For API details, see the following topics in *Amazon SDK for JavaScript API Reference*.
  - GetQueryResults
  - StartQuery

Python

SDK for Python (Boto3)

> **Note**
>
> There's more on GitHub. Find the complete example and learn how to set up and run in the Amazon Code Examples Repository.

This file invokes an example module for managing CloudWatch queries exceeding 10,000 results.

```
import logging
import os
import sys

import boto3
from botocore.config import Config

from cloudwatch_query import CloudWatchQuery
from date_utilities import DateUtilities

# Configure logging at the module level.
logging.basicConfig(
    level=logging.INFO,
    format="%(asctime)s - %(levelname)s - %(filename)s:%(lineno)d - %(message)s",
)

DEFAULT_QUERY_LOG_GROUP = "/workflows/cloudwatch-logs/large-query"


class CloudWatchLogsQueryRunner:
    def __init__(self):
        """
        Initializes the CloudWatchLogsQueryRunner class by setting up date
 utilities
        and creating a CloudWatch Logs client with retry configuration.
        """
        self.date_utilities = DateUtilities()
        self.cloudwatch_logs_client = self.create_cloudwatch_logs_client()
```

```
   def create_cloudwatch_logs_client(self):
       """
       Creates and returns a CloudWatch Logs client with a specified retry
configuration.

       :return: A CloudWatch Logs client instance.
       :rtype: boto3.client
       """
       try:
           return boto3.client("logs", config=Config(retries={"max_attempts":
10}))
       except Exception as e:
           logging.error(f"Failed to create CloudWatch Logs client: {e}")
           sys.exit(1)

   def fetch_environment_variables(self):
       """
       Fetches and validates required environment variables for query start and
end dates.
       Fetches the environment variable for log group, returning the default
value if it
       does not exist.

       :return: Tuple of query start date and end date as integers and the log
group.
       :rtype: tuple
       :raises SystemExit: If required environment variables are missing or
invalid.
       """
       try:
           query_start_date = int(os.environ["QUERY_START_DATE"])
           query_end_date = int(os.environ["QUERY_END_DATE"])
       except KeyError:
           logging.error(
               "Both QUERY_START_DATE and QUERY_END_DATE environment variables
are required."
           )
           sys.exit(1)
       except ValueError as e:
           logging.error(f"Error parsing date environment variables: {e}")
           sys.exit(1)

       try:
           log_group = os.environ["QUERY_LOG_GROUP"]
```

```
        except KeyError:
            logging.warning("No QUERY_LOG_GROUP environment variable, using
 default value")
            log_group = DEFAULT_QUERY_LOG_GROUP

        return query_start_date, query_end_date, log_group

    def convert_dates_to_iso8601(self, start_date, end_date):
        """
        Converts UNIX timestamp dates to ISO 8601 format using DateUtilities.

        :param start_date: The start date in UNIX timestamp.
        :type start_date: int
        :param end_date: The end date in UNIX timestamp.
        :type end_date: int
        :return: Start and end dates in ISO 8601 format.
        :rtype: tuple
        """
        start_date_iso8601 =
 self.date_utilities.convert_unix_timestamp_to_iso8601(
            start_date
        )
        end_date_iso8601 = self.date_utilities.convert_unix_timestamp_to_iso8601(
            end_date
        )
        return start_date_iso8601, end_date_iso8601

    def execute_query(
        self,
        start_date_iso8601,
        end_date_iso8601,
        log_group="/workflows/cloudwatch-logs/large-query",
        query="fields @timestamp, @message | sort @timestamp asc"
    ):
        """
        Creates a CloudWatchQuery instance and executes the query with provided
 date range.

        :param start_date_iso8601: The start date in ISO 8601 format.
        :type start_date_iso8601: str
        :param end_date_iso8601: The end date in ISO 8601 format.
        :type end_date_iso8601: str
        :param log_group: Log group to search: "/workflows/cloudwatch-logs/large-
query"
```

```
        :type log_group: str
        :param query: Query string to pass to the CloudWatchQuery instance
        :type query: str
        """
        cloudwatch_query = CloudWatchQuery(
            log_group=log_group,
            query_string=query
        )
        cloudwatch_query.query_logs((start_date_iso8601, end_date_iso8601))
        logging.info("Query executed successfully.")
        logging.info(
            f"Queries completed in {cloudwatch_query.query_duration} seconds.
 Total logs found: {len(cloudwatch_query.query_results)}"
        )


def main():
    """
    Main function to start a recursive CloudWatch logs query.
    Fetches required environment variables, converts dates, and executes the
 query.
    """
    logging.info("Starting a recursive CloudWatch logs query...")
    runner = CloudWatchLogsQueryRunner()
    query_start_date, query_end_date, log_group =
 runner.fetch_environment_variables()
    start_date_iso8601 = DateUtilities.convert_unix_timestamp_to_iso8601(
        query_start_date
    )
    end_date_iso8601 =
 DateUtilities.convert_unix_timestamp_to_iso8601(query_end_date)
    runner.execute_query(start_date_iso8601, end_date_iso8601,
 log_group=log_group)


if __name__ == "__main__":
    main()
```

This module processes CloudWatch queries exceeding 10,000 results.

```
import logging
import time
```

```
from datetime import datetime
import threading
import boto3

from date_utilities import DateUtilities

DEFAULT_QUERY = "fields @timestamp, @message | sort @timestamp asc"
DEFAULT_LOG_GROUP = "/workflows/cloudwatch-logs/large-query"

class DateOutOfBoundsError(Exception):
    """Exception raised when the date range for a query is out of bounds."""

    pass


class CloudWatchQuery:
    """
    A class to query AWS CloudWatch logs within a specified date range.

    :vartype date_range: tuple
    :ivar limit: Maximum number of log entries to return.
    :vartype limit: int
    :log_group str: Name of the log group to query
    :query_string str: query
    """

    def __init__(self, log_group: str = DEFAULT_LOG_GROUP, query_string:
 str=DEFAULT_QUERY) -> None:
        self.lock = threading.Lock()
        self.log_group = log_group
        self.query_string = query_string
        self.query_results = []
        self.query_duration = None
        self.datetime_format = "%Y-%m-%d %H:%M:%S.%f"
        self.date_utilities = DateUtilities()
        self.limit = 10000

    def query_logs(self, date_range):
        """
        Executes a CloudWatch logs query for a specified date range and
 calculates the execution time of the query.

        :return: A batch of logs retrieved from the CloudWatch logs query.
        :rtype: list
```

```
        """
        start_time = datetime.now()

        start_date, end_date = self.date_utilities.normalize_date_range_format(
            date_range, from_format="unix_timestamp", to_format="datetime"
        )

        logging.info(
            f"Original query:"
            f"\n       START:     {start_date}"
            f"\n       END:       {end_date}"
            f"\n       LOG GROUP: {self.log_group}"
        )
        self.recursive_query((start_date, end_date))
        end_time = datetime.now()
        self.query_duration = (end_time - start_time).total_seconds()

   def recursive_query(self, date_range):
        """
        Processes logs within a given date range, fetching batches of logs
recursively if necessary.

        :param date_range: The date range to fetch logs for, specified as a tuple
(start_timestamp, end_timestamp).
        :type date_range: tuple
        :return: None if the recursive fetching is continued or stops when the
final batch of logs is processed.
                 Although it doesn't explicitly return the query results, this
method accumulates all fetched logs
                 in the `self.query_results` attribute.
        :rtype: None
        """
        batch_of_logs = self.perform_query(date_range)
        # Add the batch to the accumulated logs
        with self.lock:
            self.query_results.extend(batch_of_logs)
        if len(batch_of_logs) == self.limit:
            logging.info(f"Fetched {self.limit}, checking for more...")
            most_recent_log = self.find_most_recent_log(batch_of_logs)
            most_recent_log_timestamp = next(
                item["value"]
                for item in most_recent_log
                if item["field"] == "@timestamp"
            )
```

```
            new_range = (most_recent_log_timestamp, date_range[1])
            midpoint = self.date_utilities.find_middle_time(new_range)

            first_half_thread = threading.Thread(
                target=self.recursive_query,
                args=((most_recent_log_timestamp, midpoint),),
            )
            second_half_thread = threading.Thread(
                target=self.recursive_query, args=((midpoint, date_range[1]),)
            )

            first_half_thread.start()
            second_half_thread.start()

            first_half_thread.join()
            second_half_thread.join()

    def find_most_recent_log(self, logs):
        """
        Search a list of log items and return most recent log entry.
        :param logs: A list of logs to analyze.
        :return: log
        :type :return List containing log item details
        """
        most_recent_log = None
        most_recent_date = "1970-01-01 00:00:00.000"

        for log in logs:
            for item in log:
                if item["field"] == "@timestamp":
                    logging.debug(f"Compared: {item['value']} to
{most_recent_date}")
                    if (
                        self.date_utilities.compare_dates(
                            item["value"], most_recent_date
                        )
                        == item["value"]
                    ):
                        logging.debug(f"New most recent: {item['value']}")
                        most_recent_date = item["value"]
                        most_recent_log = log
        logging.info(f"Most recent log date of batch: {most_recent_date}")
        return most_recent_log
```

```
   def perform_query(self, date_range):
       """
       Performs the actual CloudWatch log query.

       :param date_range: A tuple representing the start and end datetime for
the query.
       :type date_range: tuple
       :return: A list containing the query results.
       :rtype: list
       """
       client = boto3.client("logs")
       try:
           try:
               start_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[0])
               )
               end_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[1])
               )
               response = client.start_query(
                   logGroupName=self.log_group,
                   startTime=start_time,
                   endTime=end_time,
                   queryString=self.query_string,
                   limit=self.limit,
               )
               query_id = response["queryId"]
           except client.exceptions.ResourceNotFoundException as e:
               raise DateOutOfBoundsError(f"Resource not found: {e}")
           while True:
               time.sleep(1)
               results = client.get_query_results(queryId=query_id)
               if results["status"] in [
                   "Complete",
                   "Failed",
                   "Cancelled",
                   "Timeout",
                   "Unknown",
               ]:
                   return results.get("results", [])
       except DateOutOfBoundsError:
           return []
```

```
   def _initiate_query(self, client, date_range, max_logs):
       """
       Initiates the CloudWatch logs query.

       :param date_range: A tuple representing the start and end datetime for
the query.
       :type date_range: tuple
       :param max_logs: The maximum number of logs to retrieve.
       :type max_logs: int
       :return: The query ID as a string.
       :rtype: str
       """
       try:
           start_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[0])
           )
           end_time = round(

self.date_utilities.convert_iso8601_to_unix_timestamp(date_range[1])
           )
           response = client.start_query(
               logGroupName=self.log_group,
               startTime=start_time,
               endTime=end_time,
               queryString=self.query_string,
               limit=max_logs,
           )
           return response["queryId"]
       except client.exceptions.ResourceNotFoundException as e:
           raise DateOutOfBoundsError(f"Resource not found: {e}")


   def _wait_for_query_results(self, client, query_id):
       """
       Waits for the query to complete and retrieves the results.

       :param query_id: The ID of the initiated query.
       :type query_id: str
       :return: A list containing the results of the query.
       :rtype: list
       """
       while True:
```

```
            time.sleep(1)
            results = client.get_query_results(queryId=query_id)
            if results["status"] in [
                "Complete",
                "Failed",
                "Cancelled",
                "Timeout",
                "Unknown",
            ]:
                return results.get("results", [])
```

- For API details, see the following topics in *Amazon SDK for Python (Boto3) API Reference*.
  - GetQueryResults
  - StartQuery

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Use scheduled events to invoke a Lambda function

The following code examples show how to create an Amazon Lambda function invoked by an Amazon EventBridge scheduled event.

Java

SDK for Java 2.x

Shows how to create an Amazon EventBridge scheduled event that invokes an Amazon Lambda function. Configure EventBridge to use a cron expression to schedule when the Lambda function is invoked. In this example, you create a Lambda function by using the Lambda Java runtime API. This example invokes different Amazon services to perform a specific use case. This example demonstrates how to create an app that sends a mobile text message to your employees that congratulates them at the one year anniversary date.

For complete source code and instructions on how to set up and run, see the full example on GitHub.

Services used in this example

- CloudWatch Logs
- DynamoDB
- EventBridge
- Lambda
- Amazon SNS

JavaScript

SDK for JavaScript (v3)

Shows how to create an Amazon EventBridge scheduled event that invokes an Amazon Lambda function. Configure EventBridge to use a cron expression to schedule when the Lambda function is invoked. In this example, you create a Lambda function by using the Lambda JavaScript runtime API. This example invokes different Amazon services to perform a specific use case. This example demonstrates how to create an app that sends a mobile text message to your employees that congratulates them at the one year anniversary date.

For complete source code and instructions on how to set up and run, see the full example on GitHub.

This example is also available in the Amazon SDK for JavaScript v3 developer guide.

Services used in this example

- CloudWatch Logs
- DynamoDB
- EventBridge
- Lambda
- Amazon SNS

Python

SDK for Python (Boto3)

This example shows how to register an Amazon Lambda function as the target of a scheduled Amazon EventBridge event. The Lambda handler writes a friendly message and the full event data to Amazon CloudWatch Logs for later retrieval.

- Deploys a Lambda function.
- Creates an EventBridge scheduled event and makes the Lambda function the target.
- Grants permission to let EventBridge invoke the Lambda function.
- Prints the latest data from CloudWatch Logs to show the result of the scheduled invocations.
- Cleans up all resources created during the demo.

This example is best viewed on GitHub. For complete source code and instructions on how to set up and run, see the full example on GitHub.

Services used in this example

- CloudWatch Logs
- DynamoDB
- EventBridge
- Lambda
- Amazon SNS

For a complete list of Amazon SDK developer guides and code examples, see Using CloudWatch Logs with an Amazon SDK. This topic also includes information about getting started and details about previous SDK versions.

Security in Amazon CloudWatch Logs

Cloud security at Amazon is the highest priority. As an Amazon 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 Amazon and you. The shared responsibility model describes this as security of the cloud and security in the cloud:

- **Security of the cloud** – Amazon is responsible for protecting the infrastructure that runs Amazon services in the Amazon Cloud. Amazon 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 Amazon Compliance Programs. To learn about the compliance programs that apply to WorkSpaces, see Amazon Services in Scope by Compliance Program.
- **Security in the cloud** – Your responsibility is determined by the Amazon 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 Amazon CloudWatch Logs. It shows you how to configure Amazon CloudWatch Logs to meet your security and compliance objectives. You also learn how to use other Amazon services that help you to monitor and secure your CloudWatch Logs resources.

Contents

Data protection in Amazon CloudWatch Logs

> **Note**
>
> In addition to the following information about general data protection in Amazon, CloudWatch Logs also enables you to protect sensitive data in log events by masking it. For more information, see Help protect sensitive log data with masking.

The Amazon shared responsibility model applies to data protection in Amazon CloudWatch Logs. As described in this model, Amazon is responsible for protecting the global infrastructure that runs all of the Amazon Web Services Cloud. You are responsible for maintaining control over your content that is hosted on this infrastructure. You are also responsible for the security configuration and management tasks for the Amazon Web Services services that you use. For more information about data privacy, see the Data Privacy FAQ.

For data protection purposes, we recommend that you protect Amazon Web Services account credentials and set up individual users with Amazon IAM Identity Center or Amazon 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 Amazon resources. We require TLS 1.2 and recommend TLS 1.3.
- Set up API and user activity logging with Amazon CloudTrail. For information about using CloudTrail trails to capture Amazon activities, see Working with CloudTrail trails in the *Amazon CloudTrail User Guide*.
- Use Amazon encryption solutions, along with all default security controls within Amazon Web Services 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 140-3 validated cryptographic modules when accessing Amazon 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) 140-3.

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 CloudWatch Logs or other Amazon Web Services services using the console, API, Amazon CLI, or Amazon 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.

Encryption at rest

CloudWatch Logs protects data at rest using encryption. All log groups are encrypted. By default, the CloudWatch Logs service manages the server-side encryption and uses server-side encryption with 256-bit Advanced Encryption Standard Galois/Counter Mode (AES-GCM) to encrypt log data at rest.

If you want to manage the keys used for encrypting and decrypting your logs, use Amazon KMS keys. For more information, see Encrypt log data in CloudWatch Logs using Amazon Key Management Service.

Encryption in transit

CloudWatch Logs uses end-to-end encryption of data in transit. The CloudWatch Logs service manages the server-side encryption keys.

Identity and access management for Amazon CloudWatch Logs

Access to Amazon CloudWatch Logs requires credentials that Amazon can use to authenticate your requests. Those credentials must have permissions to access Amazon resources, such as to retrieve CloudWatch Logs data about your cloud resources. The following sections provide details on how you can use Amazon Identity and Access Management (IAM) and CloudWatch Logs to help secure your resources by controlling who can access them:

- Authentication
- Access control

Authentication

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.

- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.
  - (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) in the *IAM User Guide*.

Access control

You can have valid credentials to authenticate your requests, but unless you have permissions you cannot create or access CloudWatch Logs resources. For example, you must have permissions to create log streams, create log groups, and so on.

The following sections describe how to manage permissions for CloudWatch Logs. We recommend that you read the overview first.

- Overview of managing access permissions to your CloudWatch Logs resources
- Using identity-based policies (IAM policies) for CloudWatch Logs
- CloudWatch Logs permissions reference

Overview of managing access permissions to your CloudWatch Logs resources

To provide access, add permissions to your users, groups, or roles:

- Users managed in IAM through an identity provider:

  Create a role for identity federation. Follow the instructions in Create a role for a third-party identity provider (federation) in the *IAM User Guide*.

- IAM users:
  - Create a role that your user can assume. Follow the instructions in Create a role for an IAM user in the *IAM User Guide*.

- (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) in the *IAM User Guide*.

Topics

CloudWatch Logs resources and operations

In CloudWatch Logs the primary resources are log groups, log streams and destinations. CloudWatch Logs does not support subresources (other resources for use with the primary resource).

These resources and subresources have unique Amazon Resource Names (ARNs) associated with them as shown in the following table.

Resource type	ARN format
Log group	Both of the following are used. The second one, with the `:*` at the end, is what is returned by the `describe-log-groups` CLI command and the **DescribeLogGroups** API. arn:aws:logs:*region*:*account-id* :log-group:*log_group_name* arn:aws:logs:*region*:*account-id* :log-group:*log_group_name* :* Use the first version, without the trailing `:*`, in the following situations:

Resource type	ARN format
	• In the `logGroupIdentifier` input field in many CloudWatch Logs APIs. • In the `resourceArn` field in tagging APIs • In IAM policies, when specifying permissions for TagResource, UntagResource, and ListTagsForResource. Use the second version, with the trailing `:*`, to refer to the ARN when specifying permissions in IAM policies for all other API actions.
Log stream	arn:aws:logs:*region*:*account-id* :log-group:*log_group_name* :log-stream:*log-stream-name*
Destination	arn:aws:logs:*region*:*account-id* :destination:*destination_name*

For more information about ARNs, see ARNs in *IAM User Guide*. For information about CloudWatch Logs ARNs, see Amazon Resource Names (ARNs) in *Amazon Web Services General Reference*. For an example of a policy that covers CloudWatch Logs, see Using identity-based policies (IAM policies) for CloudWatch Logs.

CloudWatch Logs provides a set of operations to work with the CloudWatch Logs resources. For a list of available operations, see CloudWatch Logs permissions reference.

Understanding resource ownership

The Amazon account owns the resources that are created in the account, regardless of who created the resources. Specifically, the resource owner is the Amazon account of the principal entity (that

is, the root account, a user, or an IAM role) that authenticates the resource creation request. The following examples illustrate how this works:

- If you use the root account credentials of your Amazon account to create a log group, your Amazon account is the owner of the CloudWatch Logs resource.
- If you create a user in your Amazon account and grant permissions to create CloudWatch Logs resources to that user, the user can create CloudWatch Logs resources. However, your Amazon account, to which the user belongs, owns the CloudWatch Logs resources.
- If you create an IAM role in your Amazon account with permissions to create CloudWatch Logs resources, anyone who can assume the role can create CloudWatch Logs resources. Your Amazon account, to which the role belongs, owns the CloudWatch Logs resources.

Managing access to resources

A *permissions policy* describes who has access to what. The following section explains the available options for creating permissions policies.

> **Note**
>
> This section discusses using IAM in the context of CloudWatch Logs. It doesn't provide detailed information about the IAM service. For complete IAM documentation, see What is IAM? in the *IAM User Guide*. For information about IAM policy syntax and descriptions, see IAM policy reference in the *IAM User Guide*.

Policies attached to an IAM identity are referred to as identity-based policies (IAM polices) and policies attached to a resource are referred to as resource-based policies. CloudWatch Logs supports identity-based policies, and resource-based policies for destinations, which are used to enable cross account subscriptions. For more information, see Cross-account cross-Region subscriptions.

Topics

- Log group permissions and Contributor Insights
- Resource-based policies

Log group permissions and Contributor Insights

Contributor Insights is a feature of CloudWatch that enables you to analyze data from log groups and create time series that display contributor data. You can see metrics about the top-N contributors, the total number of unique contributors, and their usage. For more information, see Using Contributor Insights to Analyze High-Cardinality Data.

When you grant a user the `cloudwatch:PutInsightRule` and `cloudwatch:GetInsightRuleReport` permissions, that user can create a rule that evaluates any log group in CloudWatch Logs and then see the results. The results can contain contributor data for those log groups. Be sure to grant these permissions only to users who should be able to view this data.

Resource-based policies

CloudWatch Logs supports resource-based policies for destinations, which you can use to enable cross account subscriptions. For more information, see Step 1: Create a destination. Destinations can be created using the PutDestination API, and you can add a resource policy to the destination using the PutDestinationPolicy API. The following example allows another Amazon account with the account ID 111122223333 to subscribe their log groups to the destination `arn:aws:logs:us-east-1:123456789012:destination:testDestination`.

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "111122223333"
      },
      "Action" : "logs:PutSubscriptionFilter",
      "Resource" : "arn:aws:logs:us-east-1:123456789012:destination:testDestination"
    }
  ]
}
```

Specifying policy elements: Actions, effects, and principals

For each CloudWatch Logs resource, the service defines a set of API operations. To grant permissions for these API operations, CloudWatch Logs defines a set of actions that you can

specify in a policy. Some API operations can require permissions for more than one action in order to perform the API operation. For more information about resources and API operations, see CloudWatch Logs resources and operations and CloudWatch Logs permissions reference.

The following are the basic policy elements:

- **Resource** – You use an Amazon Resource Name (ARN) to identify the resource that the policy applies to. For more information, see CloudWatch Logs resources and operations.
- **Action** – You use action keywords to identify resource operations that you want to allow or deny. For example, the `logs.DescribeLogGroups` permission allows the user permissions to perform the `DescribeLogGroups` operation.
- **Effect** – You specify the effect, either allow or deny, when the user requests the specific action. If you don't explicitly grant access to (allow) a resource, access is implicitly denied. You can also explicitly deny access to a resource, which you might do to make sure that a user cannot access it, even if a different policy grants access.
- **Principal** – In identity-based policies (IAM policies), the user that the policy is attached to is the implicit principal. For resource-based policies, you specify the user, account, service, or other entity that you want to receive permissions (applies to resource-based policies only). CloudWatch Logs supports resource-based policies for destinations.

To learn more about IAM policy syntax and descriptions, see Amazon IAM Policy Reference in the *IAM User Guide*.

For a table showing all of the CloudWatch Logs API actions and the resources that they apply to, see CloudWatch Logs permissions reference.

Specifying conditions in a policy

When you grant permissions, you can use the access policy language to specify the conditions when a policy should take effect. For example, you might want a policy to be applied only after a specific date. For more information about specifying conditions in a policy language, see Condition in the *IAM User Guide*.

To express conditions, you use predefined condition keys. For a list of context keys supported by each Amazon service and a list of Amazon-wide policy keys, see Actions, resources, and condition keys for Amazon services and Amazon global condition context keys .

Note

You can use tags to control access to CloudWatch Logs resources, including log groups and destinations. Access to log streams is controlled at the log group level, because of the hierarchical relation between log groups and log streams. For more information about using tags to control access, see Controlling access to Amazon Web Services resources using tags.

Using identity-based policies (IAM policies) for CloudWatch Logs

This topic provides examples of identity-based policies in which an account administrator can attach permissions policies to IAM identities (that is, users, groups, and roles).

Important

We recommend that you first review the introductory topics that explain the basic concepts and options available for you to manage access to your CloudWatch Logs resources. For more information, see Overview of managing access permissions to your CloudWatch Logs resources.

This topic covers the following:

- Permissions required to use the CloudWatch console
- Amazon managed (predefined) policies for CloudWatch Logs
- Customer managed policy examples

The following is an example of a permissions policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "logs:CreateLogGroup",
        "logs:CreateLogStream",
```

```
        "logs:PutLogEvents",
        "logs:DescribeLogStreams"
    ],
      "Resource": [
        "arn:aws:logs:*:*:*"
    ]
  }
 ]
}
```

This policy has one statement that grants permissions to create log groups and log streams, to upload log events to log streams, and to list details about log streams.

The wildcard character (*) at the end of the `Resource` value means that the statement allows permission for the `logs:CreateLogGroup`, `logs:CreateLogStream`, `logs:PutLogEvents`, and `logs:DescribeLogStreams` actions on any log group. To limit this permission to a specific log group, replace the wildcard character (*) in the resource ARN with the specific log group ARN. For more information about the sections within an IAM policy statement, see IAM Policy Elements Reference in *IAM User Guide*. For a list showing all of the CloudWatch Logs actions, see CloudWatch Logs permissions reference.

Permissions required to use the CloudWatch console

For a user to work with CloudWatch Logs in the CloudWatch console, that user must have a minimum set of permissions that allows the user to describe other Amazon resources in their Amazon account. In order to use CloudWatch Logs in the CloudWatch console, you must have permissions from the following services:

- CloudWatch
- CloudWatch Logs
- OpenSearch Service
- IAM
- Kinesis
- Lambda
- Amazon S3

If you create an IAM policy that is more restrictive than the minimum required permissions, the console won't function as intended for users with that IAM policy. To ensure that those users can

still use the CloudWatch console, also attach the `CloudWatchReadOnlyAccess` managed policy to the user, as described in Amazon managed (predefined) policies for CloudWatch Logs.

You don't need to allow minimum console permissions for users that are making calls only to the Amazon CLI or the CloudWatch Logs API.

The full set of permissions required to work with the CloudWatch console for a user who is not using the console to manage log subscriptions are:

- cloudwatch:GetMetricData
- cloudwatch:ListMetrics
- logs:CancelExportTask
- logs:CreateExportTask
- logs:CreateLogGroup
- logs:CreateLogStream
- logs:DeleteLogGroup
- logs:DeleteLogStream
- logs:DeleteMetricFilter
- logs:DeleteQueryDefinition
- logs:DeleteRetentionPolicy
- logs:DeleteSubscriptionFilter
- logs:DescribeExportTasks
- logs:DescribeLogGroups
- logs:DescribeLogStreams
- logs:DescribeMetricFilters
- logs:DescribeQueryDefinitions
- logs:DescribeQueries
- logs:DescribeSubscriptionFilters
- logs:FilterLogEvents
- logs:GetLogEvents
- logs:GetLogGroupFields
- logs:GetLogRecord

- logs:GetQueryResults
- logs:PutMetricFilter
- logs:PutQueryDefinition
- logs:PutRetentionPolicy
- logs:StartQuery
- logs:StopQuery
- logs:PutSubscriptionFilter
- logs:TestMetricFilter

For a user who will also be using the console to manage log subscriptions, the following permissions are also required:

- es:DescribeElasticsearchDomain
- es:ListDomainNames
- iam:AttachRolePolicy
- iam:CreateRole
- iam:GetPolicy
- iam:GetPolicyVersion
- iam:GetRole
- iam:ListAttachedRolePolicies
- iam:ListRoles
- kinesis:DescribeStreams
- kinesis:ListStreams
- lambda:AddPermission
- lambda:CreateFunction
- lambda:GetFunctionConfiguration
- lambda:ListAliases
- lambda:ListFunctions
- lambda:ListVersionsByFunction
- lambda:RemovePermission

- s3:ListBuckets

Amazon managed (predefined) policies for CloudWatch Logs

Amazon addresses many common use cases by providing standalone IAM policies that are created and administered by Amazon. Managed policies grant necessary permissions for common use cases so you can avoid having to investigate what permissions are needed. For more information, see Amazon Managed Policies in the *IAM User Guide*.

The following Amazon managed policies, which you can attach to users and roles in your account, are specific to CloudWatch Logs:

- **CloudWatchLogsFullAccess** – Grants full access to CloudWatch Logs.
- **CloudWatchLogsReadOnlyAccess** – Grants read-only access to CloudWatch Logs.

CloudWatchLogsFullAccess

The **CloudWatchLogsFullAccess** policy grants full access to CloudWatch Logs. The policy includes the `cloudwatch:GenerateQuery` and `cloudwatch:GenerateQueryResultsSummary` permissions, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt. To see the full contents of the policy, see CloudWatchLogsFullAccess in the *Amazon Managed Policy Reference Guide*.

CloudWatchLogsReadOnlyAccess

The **CloudWatchLogsReadOnlyAccess** policy grants read-only access to CloudWatch Logs. It includes the `cloudwatch:GenerateQuery` and `cloudwatch:GenerateQueryResultsSummary` permissions, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt. To see the full contents of the policy, see CloudWatchLogsReadOnlyAccess in the *Amazon Managed Policy Reference Guide*.

CloudWatchOpenSearchDashboardsFullAccess

The **CloudWatchOpenSearchDashboardsFullAccess** policy grants access to create, manage, and delete integrations with OpenSearch Service, and to create delete and manage vended log dashboards in those integrations. For more information, see Analyze with Amazon OpenSearch Service.

To see the full contents of the policy, see CloudWatchOpenSearchDashboardsFullAccess in the *Amazon Managed Policy Reference Guide*.

CloudWatchOpenSearchDashboardAccess

The **CloudWatchOpenSearchDashboardAccess** policy grants access to view vended logs dashboards that are created with Amazon OpenSearch Service analytics. For more information, see Analyze with Amazon OpenSearch Service.

> **Important**
>
> In addition to granting this policy, to enable a role or user to be able to view vended log dashboards, you must also specify them when you create the integration with OpenSearch Service. For more information, see Step 1: Create the integration with OpenSearch Service.

To see the full contents of the policy, see CloudWatchOpenSearchDashboardAccess in the *Amazon Managed Policy Reference Guide*.

CloudWatchLogsCrossAccountSharingConfiguration

The **CloudWatchLogsCrossAccountSharingConfiguration** policy grants access to create, manage, and view Observability Access Manager links for sharing CloudWatch Logs resources between accounts. For more information, see CloudWatch cross-account observability.

To see the full contents of the policy, see CloudWatchLogsCrossAccountSharingConfiguration in the *Amazon Managed Policy Reference Guide*.

CloudWatch Logs updates to Amazon managed policies

View details about updates to Amazon managed policies for CloudWatch Logs since this service began tracking these changes. For automatic alerts about changes to this page, subscribe to the RSS feed on the CloudWatch Logs Document history page.

Change	Description	Date
CloudWatchLogsFullAccess – Update to an existing policy.		May 20, 2025

Change	Description	Date
	CloudWatch Logs added permissions to **CloudWatchLogsFullAccess**. Permissions for `cloudwatch:GenerateQueryResultsSummary` were added to allow for generation of a natural language summary of the query results.	
CloudWatchLogsReadOnlyAccess – Update to an existing policy.	CloudWatch Logs added permissions to **CloudWatchLogsReadOnlyAccess**. Permissions for `cloudwatch:GenerateQueryResultsSummary` were added to allow for generation of a natural language summary of the query results.	May 20, 2025
CloudWatchLogsFullAccess – Update to an existing policy.	CloudWatch Logs added permissions to **CloudWatchLogsFullAccess**. Permissions for Amazon OpenSearch Service and IAM were added, to enable CloudWatch Logs integration with OpenSearch Service for some features.	December 1, 2024

Change	Description	Date
CloudWatchOpenSearchDashboardsFullAccess – New IAM policy.	CloudWatch Logs added a new IAM policy, **CloudWatchOpenSearchDashboardsFullAccess**.- This policy grants access to create, manage, and delete integrations with OpenSearch Service, and to create, manage, and delete vended log dashboards in those integrations. For more information, see Analyze with Amazon OpenSearch Service.	December 1, 2024
CloudWatchOpenSearchDashboardAccess – New IAM policy.	CloudWatch Logs added a new IAM policy, **CloudWatchOpenSearchDashboardAccess**.- This policy grants access to view vended logs dashboards powered by Amazon OpenSearch Service. For more information, see Analyze with Amazon OpenSearch Service.	December 1, 2024

Change	Description	Date
CloudWatchLogsFullAccess – Update to an existing policy.	CloudWatch Logs added a permission to **CloudWatchLogsFullAccess**. The `cloudwatch:GenerateQuery` permission was added, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt.	November 27, 2023
CloudWatchLogsReadOnlyAccess – Update to an existing policy.	CloudWatch added a permission to **CloudWatchLogsReadOnlyAccess**. The `cloudwatch:GenerateQuery` permission was added, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt.	November 27, 2023

Change	Description	Date
CloudWatchLogsReadOnlyAccess – Update to an existing policy	CloudWatch Logs added permissions to **CloudWatchLogsReadOnlyAccess**. The `logs:StartLiveTail` and `logs:StopLiveTail` permissions were added so that users with this policy can use the console to start and stop CloudWatch Logs live tail sessions. For more information, see Use live tail to view logs in near real time.	June 6, 2023
CloudWatchLogsCrossAccountSharingConfiguration – New policy	CloudWatch Logs added a new policy to enable you to manage CloudWatch cross-account observability links that share CloudWatch Logs log groups. For more information, see CloudWatch cross-account observability	November 27, 2022

Change	Description	Date
CloudWatchLogsReadOnlyAccess – Update to an existing policy	CloudWatch Logs added permissions to **CloudWatchLogsReadOnlyAccess**. The `oam:ListSinks` and `oam:ListAttachedLinks` permissions were added so that users with this policy can use the console to view data shared from source accounts in CloudWatch cross-account observability.	November 27, 2022

Customer managed policy examples

You can create your own custom IAM policies to allow permissions for CloudWatch Logs actions and resources. You can attach these custom policies to the users or groups that require those permissions.

In this section, you can find example user policies that grant permissions for various CloudWatch Logs actions. These policies work when you are using the CloudWatch Logs API, Amazon SDKs, or the Amazon CLI.

Examples

- Example 1: Allow full access to CloudWatch Logs
- Example 2: Allow read-only access to CloudWatch Logs
- Example 3: Allow access to one log group

Example 1: Allow full access to CloudWatch Logs

The following policy allows a user to access all CloudWatch Logs actions.

```
{
  "Version": "2012-10-17",
```

```
  "Statement": [
    {
      "Action": [
        "logs:*"
      ],
      "Effect": "Allow",
      "Resource": "*"
    }
  ]
}
```

Example 2: Allow read-only access to CloudWatch Logs

Amazon provides a **CloudWatchLogsReadOnlyAccess** policy that enables read-only access to CloudWatch Logs data. This policy includes the following permissions.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": [
                "logs:Describe*",
                "logs:Get*",
                "logs:List*",
                "logs:StartQuery",
                "logs:StopQuery",
                "logs:TestMetricFilter",
                "logs:FilterLogEvents",
                "logs:StartLiveTail",
                "logs:StopLiveTail",
                "cloudwatch:GenerateQuery"
            ],
            "Effect": "Allow",
            "Resource": "*"
        }
    ]
}
```

Example 3: Allow access to one log group

The following policy allows a user to read and write log events in one specified log group.

Important

The `:*` at the end of the log group name in the `Resource` line is required to indicate that the policy applies to all log streams in this log group. If you omit `:*`, the policy will not be enforced.

```
{
   "Version":"2012-10-17",
   "Statement":[
      {
      "Action": [
        "logs:CreateLogStream",
        "logs:DescribeLogStreams",
        "logs:PutLogEvents",
        "logs:GetLogEvents"
      ],
      "Effect": "Allow",
      "Resource": "arn:aws:logs:us-west-2:123456789012:log-group:SampleLogGroupName:*"
      }
   ]
}
```

Use tagging and IAM policies for control at the log group level

You can grant users access to certain log groups while preventing them from accessing other log groups. To do so, tag your log groups and use IAM policies that refer to those tags. To apply tags to a log group, you need to have either the `logs:TagResource` or `logs:TagLogGroup` permission. This applies both if you are assigning tags to the log group when you create it. or assigning them later.

For more information about tagging log groups, see Tag log groups in Amazon CloudWatch Logs.

When you tag log groups, you can then grant an IAM policy to a user to allow access to only the log groups with a particular tag. For example, the following policy statement grants access to only log groups with the value of `Green` for the tag key `Team`.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
```

```
            "Action": [
                "logs:*"
            ],
            "Effect": "Allow",
            "Resource": "*",
            "Condition": {
                "StringLike": {
                    "aws:ResourceTag/Team": "Green"
                }
            }
        }
    ]
}
```

The **StopQuery** and **StopLiveTail** API operations don't interact with Amazon resources in the traditional sense. They don't return any data, put any data, or modify a resource in any way. Instead, they operate only on a given live tail session or a given CloudWatch Logs Insights query, which are not categorized as resources. As a result, when you specify the `Resource` field in IAM policies for these operations, you must set the value of the `Resource` field as `*`, as in the following example.

```
{
    "Version": "2012-10-17",
    "Statement":
        [ {
            "Effect": "Allow",
            "Action": [
                "logs:StopQuery",
                "logs:StopLiveTail"
            ],
            "Resource": "*"
            }
        ]
}
```

For more information about using IAM policy statements, see Controlling Access Using Policies in the *IAM User Guide*.

CloudWatch Logs permissions reference

When you are setting up Access control and writing permissions policies that you can attach to an IAM identity (identity-based policies), you can use the following table as a reference. The table

lists each CloudWatch Logs API operation and the corresponding actions for which you can grant permissions to perform the action. You specify the actions in the policy's `Action` field. For the `Resource` field, you can specify the ARN of a log group or log stream, or specify `*` to represent all CloudWatch Logs resources.

You can use Amazon-wide condition keys in your CloudWatch Logs policies to express conditions. For a complete list of Amazon-wide keys, see Amazon Global and IAM Condition Context Keys in the *IAM User Guide*.

> **Note**
>
> To specify an action, use the `logs:` prefix followed by the API operation name. For example: `logs:CreateLogGroup`, `logs:CreateLogStream`, or `logs:*` (for all CloudWatch Logs actions).

CloudWatch Logs API operations and required permissions for actions

CloudWatch Logs API operations	Required permissions (API actions)
CancelExportTask	`logs:CancelExportTask` Required to cancel a pending or running export task.
CreateExportTask	`logs:CreateExportTask` Required to export data from a log group to an Amazon S3 bucket.
CreateLogGroup	`logs:CreateLogGroup` Required to create a new log group.
CreateLogStream	`logs:CreateLogStream`

CloudWatch Logs API operations	Required permissions (API actions)
	Required to create a new log stream in a log group.
DeleteDestination	`logs:DeleteDestination` Required to delete a log destination and disables any subscription filters to it.
DeleteLogGroup	`logs:DeleteLogGroup` Required to delete a log group and any associated archived log events.
DeleteLogStream	`logs:DeleteLogStream` Required to delete a log stream and any associated archived log events.
DeleteMetricFilter	`logs:DeleteMetricFilter` Required to delete a metric filter associated with a log group.
DeleteQueryDefinition	`logs:DeleteQueryDefinition` Required to delete a saved query definition in CloudWatch Logs Insights.
DeleteResourcePolicy	`logs:DeleteResourcePolicy` Required to delete a CloudWatch Logs resource policy.

CloudWatch Logs API operations	Required permissions (API actions)
DeleteRetentionPolicy	`logs:DeleteRetentionPolicy` Required to delete a log group's retention policy.
DeleteSubscriptionFilter	`logs:DeleteSubscriptionFilter` Required to delete the subscription filter associated with a log group.
DescribeDestinations	`logs:DescribeDestinations` Required to view all destinations associated with the account.
DescribeExportTasks	`logs:DescribeExportTasks` Required to view all export tasks associated with the account.
DescribeLogGroups	`logs:DescribeLogGroups` Required to view all log groups associated with the account.
DescribeLogStreams	`logs:DescribeLogStreams` Required to view all log streams associated with a log group.

CloudWatch Logs API operations	Required permissions (API actions)
DescribeMetricFilters	`logs:DescribeMetricFilters` Required to view all metrics associated with a log group.
DescribeQueryDefinitions	`logs:DescribeQueryDefinitions` Required to see the list of saved query definitions in CloudWatch Logs Insights.
DescribeQueries	`logs:DescribeQueries` Required to see the list of CloudWatch Logs Insights queries that are scheduled, executing, or have recently excecuted.
DescribeResourcePolicies	`logs:DescribeResourcePolicies` Required to view a list of CloudWatch Logs resource policies.
DescribeSubscriptionFilters	`logs:DescribeSubscriptionFilters` Required to view all subscription filters associated with a log group.
FilterLogEvents	`logs:FilterLogEvents` Required to sort log events by log group filter pattern.

CloudWatch Logs API operations	Required permissions (API actions)
GetLogEvents	`logs:GetLogEvents` Required to retrieve log events from a log stream.
GetLogGroupFields	`logs:GetLogGroupFields` Required to retrieve the list of fields that are included in the log events in a log group.
GetLogRecord	`logs:GetLogRecord` Required to retrieve the details from a single log event.
GetQueryResults	`logs:GetQueryResults` Required to retrieve the results of CloudWatch Logs Insights queries.
ListEntitiesForLogGroup (CloudWatch console-only permission)	`logs:ListEntitiesForLogGroup` Required to find the entities associated with a log group. Required to explore related logs within the CloudWatch console.
ListLogGroupsForEntity (CloudWatch console-only permission)	`logs:ListLogGroupsForEntity` Required to find the log groups associated with an entity. Required to explore related logs within the CloudWatch console.

CloudWatch Logs API operations	Required permissions (API actions)
ListTagsLogGroup	`logs:ListTagsLogGroup` Required to list the tags associated with a log group.
PutDestination	`logs:PutDestination` Required to create or update a destination log stream (such as an Kinesis stream).
PutDestinationPolicy	`logs:PutDestinationPolicy` Required to create or update an access policy associated with an existing log destination.
PutLogEvents	`logs:PutLogEvents` Required to upload a batch of log events to a log stream.
PutMetricFilter	`logs:PutMetricFilter` Required to create or update a metric filter and associate it with a log group.
PutQueryDefinition	`logs:PutQueryDefinition` Required to save a query in CloudWatch Logs Insights.

CloudWatch Logs API operations	Required permissions (API actions)
PutResourcePolicy	`logs:PutResourcePolicy` Required to create a CloudWatch Logs resource policy.
PutRetentionPolicy	`logs:PutRetentionPolicy` Required to set the number of days to keep log events (retention) in a log group.
PutSubscriptionFilter	`logs:PutSubscriptionFilter` Required to create or update a subscription filter and associate it with a log group.
StartQuery	`logs:StartQuery` Required to start CloudWatch Logs Insights queries.
StopQuery	`logs:StopQuery` Required to stop a CloudWatch Logs Insights query that is in progress.
TagLogGroup	`logs:TagLogGroup` Required to add or update log group tags.
TestMetricFilter	`logs:TestMetricFilter` Required to test a filter pattern against a sampling of log event messages.

Using service-linked roles for CloudWatch Logs

Amazon CloudWatch Logs uses Amazon Identity and Access Management (IAM) service-linked roles. A service-linked role is a unique type of IAM role that is linked directly to CloudWatch Logs. Service-linked roles are predefined by CloudWatch Logs and include all the permissions that the service requires to call other Amazon services on your behalf.

A service-linked role makes setting up CloudWatch Logs more efficient because you aren't required to manually add the necessary permissions. CloudWatch Logs defines the permissions of its service-linked roles, and unless defined otherwise, only CloudWatch Logs can assume those roles. The defined permissions include the trust policy and the permissions policy. That permissions policy cannot be attached to any other IAM entity.

For information about other services that support service-linked roles, see Amazon Services That Work with IAM. 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 CloudWatch Logs

CloudWatch Logs uses the service-linked role named **AWSServiceRoleForLogDelivery**. CloudWatch Logs uses this service-linked role to write logs directly to Firehose. For more information, see Enable logging from Amazon services.

The **AWSServiceRoleForLogDelivery** service-linked role trusts the following services to assume the role:

- `logs.amazonaws.com`

The role permissions policy allows CloudWatch Logs to complete the following actions on the specified resources:

- Action: `firehose:PutRecord` and `firehose:PutRecordBatch` on all Firehose streams that have a tag with a `LogDeliveryEnabled` key with a value of `True`. This tag is automatically attached to an Firehose stream when you create a subscription to deliver the logs to Firehose.

You must configure permissions to allow an IAM entity to create, edit, or delete a service-linked role. This entity could be a user, group, or role. For more information, see Service-Linked Role Permissions in the *IAM User Guide*.

Creating a service-linked role for CloudWatch Logs

You aren't required to manually create a service-linked role. When you set up logs to be sent directly to a Firehose stream in the Amazon Web Services Management Console, the Amazon CLI, or the Amazon API, CloudWatch Logs creates the service-linked role for you.

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 again set up logs to be sent directly to a Firehose stream, CloudWatch Logs creates the service-linked role for you again.

Editing a service-linked role for CloudWatch Logs

CloudWatch Logs does not allow you to edit **AWSServiceRoleForLogDelivery**, or any other service-linked role, after you create it. 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 CloudWatch Logs

If you no longer need to use a feature or service that requires a service-linked role, we recommend that you delete that role. That way you don't have an unused entity that is not actively monitored or maintained. However, you must clean up the resources for your service-linked role before you can manually delete it.

> **Note**
>
> If the CloudWatch Logs service is using the role when you try to delete the resources, then the deletion might fail. If that happens, wait for a few minutes and try the operation again.

To delete CloudWatch Logs resources used by the AWSServiceRoleForLogDelivery service-linked role

- Stop sending logs directly to Firehose streams.

To manually delete the service-linked role using IAM

Use the IAM console, the Amazon CLI, or the Amazon API to delete the **AWSServiceRoleForLogDelivery** service-linked role. For more information, see Deleting a Service-Linked Role

Supported Regions for CloudWatch Logs service-linked roles

CloudWatch Logs supports using service-linked roles in all of the Amazon Regions where the service is available. For more information, see CloudWatch Logs Regions and Endpoints.

Compliance validation for Amazon CloudWatch Logs

To learn whether an Amazon Web Services service is within the scope of specific compliance programs, see Amazon Web Services services in Scope by Compliance Program and choose the compliance program that you are interested in. For general information, see Amazon Web Services Compliance Programs.

You can download third-party audit reports using Amazon Artifact. For more information, see Downloading Reports in Amazon Artifact.

Your compliance responsibility when using Amazon Web Services services is determined by the sensitivity of your data, your company's compliance objectives, and applicable laws and regulations. Amazon provides the following resources to help with compliance:

- Security & Compliance – These solution implementation guides discuss architectural considerations and provide steps for deploying security and compliance features.
- Amazon Compliance Resources – This collection of workbooks and guides might apply to your industry and location.
- Evaluating Resources with Rules in the *Amazon Config Developer Guide* – The Amazon Config service assesses how well your resource configurations comply with internal practices, industry guidelines, and regulations.
- Amazon Security Hub – This Amazon Web Services service provides a comprehensive view of your security state within Amazon. Security Hub uses security controls to evaluate your Amazon 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.
- Amazon GuardDuty – This Amazon Web Services service detects potential threats to your Amazon Web Services accounts, workloads, containers, and data by monitoring your environment for suspicious and malicious activities. GuardDuty can help you address various compliance requirements, like PCI DSS, by meeting intrusion detection requirements mandated by certain compliance frameworks.

Resilience in Amazon CloudWatch Logs

The Amazon global infrastructure is built around Amazon Regions and Availability Zones. Regions provide multiple physically separated and isolated Availability Zones, which are connected through low-latency, high-throughput, and highly redundant networking. With Availability Zones, you can design and operate applications and databases that automatically fail over between zones without interruption. Availability Zones are more highly available, fault tolerant, and scalable than traditional single or multiple data center infrastructures.

For more information about Amazon Regions and Availability Zones, see Amazon Global Infrastructure.

Infrastructure security in Amazon CloudWatch Logs

As a managed service, Amazon CloudWatch Logs is protected by Amazon global network security. For information about Amazon security services and how Amazon protects infrastructure, see Amazon Cloud Security. To design your Amazon environment using the best practices for infrastructure security, see Infrastructure Protection in *Security Pillar Amazon Well-Architected Framework*.

You use Amazon published API calls to access CloudWatch Logs 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 Amazon Security Token Service (Amazon STS) to generate temporary security credentials to sign requests.

Using CloudWatch Logs with interface VPC endpoints

If you use Amazon Virtual Private Cloud (Amazon VPC) to host your Amazon resources, you can establish a private connection between your VPC and CloudWatch Logs. You can use this connection to send logs to CloudWatch Logs without sending them through the internet.

CloudWatch Logs supports IPv4 VPC endpoints in all Regions, and supports IPv6 endpoints in all Regions except Asia Pacific (Malaysia), Asia Pacific (Thailand), and Mexico (Central).

Amazon VPC is an Amazon service that you can use to launch Amazon resources in a virtual network that you define. With a VPC, you have control over your network settings, such the IP address range, subnets, route tables, and network gateways. To connect your VPC to CloudWatch Logs, you define an *interface VPC endpoint* for CloudWatch Logs. This type of endpoint enables you to connect your VPC to Amazon services. The endpoint provides reliable, scalable connectivity to CloudWatch Logs 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 Amazon PrivateLink, an Amazon technology that enables private communication between Amazon services using an elastic network interface with private IP addresses. For more information, see New – Amazon PrivateLink for Amazon Services.

The following steps are for users of Amazon VPC. For more information, see Getting Started in the *Amazon VPC User Guide*.

Availability

CloudWatch Logs currently supports VPC endpoints in all Amazon Regions, including the Amazon GovCloud (US) Regions.

Creating a VPC endpoint for CloudWatch Logs

To start using CloudWatch Logs with your VPC, create an interface VPC endpoint for CloudWatch Logs. The service to choose is **com.amazonaws.*Region*.logs**. You do not need to change any settings for CloudWatch Logs. For more information, see Creating an Interface Endpoint in the *Amazon VPC User Guide*.

Testing the connection between your VPC and CloudWatch Logs

After you create the endpoint, you can test the connection.

To test the connection between your VPC and your CloudWatch Logs endpoint

1. Connect to an Amazon EC2 instance that resides in your VPC. For information about connecting, see Connect to Your Linux Instance or Connecting to Your Windows Instance in the Amazon EC2 documentation.

2. From the instance, use the Amazon CLI to create a log entry in one of your existing log groups.

   First, create a JSON file with a log event. The timestamp must be specified as the number of milliseconds after Jan 1, 1970 00:00:00 UTC.

   ```
   [
     {
       "timestamp": 1533854071310,
       "message": "VPC Connection Test"
     }
   ]
   ```

   Then, use the `put-log-events` command to create the log entry:

   ```
   aws logs put-log-events --log-group-name LogGroupName --log-stream-
   name LogStreamName --log-events file://JSONFileName
   ```

   If the response to the command includes `nextSequenceToken`, the command has succeeded and your VPC endpoint is working.

Controlling access to your CloudWatch Logs VPC endpoint

A VPC endpoint policy is an IAM resource policy that you attach to an endpoint when you create or modify the endpoint. If you don't attach a policy when you create an endpoint, we attach a default policy for you that allows full access to the service. An endpoint policy doesn't override or replace IAM policies or service-specific policies. It's a separate policy for controlling access from the endpoint to the specified service.

Endpoint policies must be written in JSON format.

For more information, see Controlling Access to Services with VPC Endpoints in the *Amazon VPC User Guide*.

The following is an example of an endpoint policy for CloudWatch Logs. This policy enables users connecting to CloudWatch Logs through the VPC to create log streams and send logs to CloudWatch Logs, and prevents them from performing other CloudWatch Logs actions.

```
{
  "Statement": [
```

```
    {
      "Sid": "PutOnly",
      "Principal": "*",
      "Action": [
        "logs:CreateLogStream",
        "logs:PutLogEvents"
      ],
      "Effect": "Allow",
      "Resource": "*"
    }
  ]
}
```

To modify the VPC endpoint policy for CloudWatch Logs

1. Open the Amazon VPC console at https://console.amazonaws.cn/vpc/.
2. In the navigation pane, choose **Endpoints**.
3. If you have not already created the endpoint for CloudWatch Logs, choose **Create Endpoint**. Then select **com.amazonaws.*Region*.logs** and choose **Create endpoint**.
4. Select the **com.amazonaws.*Region*.logs** endpoint, and choose the **Policy** tab in the lower half of the screen.
5. Choose **Edit Policy** and make the changes to the policy.

Support for VPC context keys

CloudWatch Logs supports the `aws:SourceVpc` and `aws:SourceVpce` context keys that can limit access to specific VPCs or specific VPC endpoints. These keys work only when the user is using VPC endpoints. For more information, see Keys Available for Some Services in the *IAM User Guide*.

Logging CloudWatch Logs API and console operations in Amazon CloudTrail

Amazon CloudWatch Logs is integrated with Amazon CloudTrail, a service that provides a record of actions taken by a user, role, or an Amazon Web Services service. CloudTrail captures API calls for CloudWatch Logs as events. The calls captured include calls from the CloudWatch Logs console and code calls to the CloudWatch Logs API operations. Using the information collected by CloudTrail, you can determine the request that was made to CloudWatch Logs, the IP address from which the request was made, when it was made, and additional details.

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root user or user credentials.
- Whether the request was made on behalf of an IAM Identity Center user.
- Whether the request was made with temporary security credentials for a role or federated user.
- Whether the request was made by another Amazon Web Services service.

CloudTrail is active in your Amazon Web Services account when you create the account and you automatically have access to the CloudTrail **Event history**. The CloudTrail **Event history** provides a viewable, searchable, downloadable, and immutable record of the past 90 days of recorded management events in an Amazon Web Services Region. For more information, see Working with CloudTrail Event history in the *Amazon CloudTrail User Guide*. There are no CloudTrail charges for viewing the **Event history**.

For an ongoing record of events in your Amazon Web Services account past 90 days, create a trail or a CloudTrail Lake event data store.

CloudTrail trails

A *trail* enables CloudTrail to deliver log files to an Amazon S3 bucket. All trails created using the Amazon Web Services Management Console are multi-Region. You can create a single-Region or a multi-Region trail by using the Amazon CLI. Creating a multi-Region trail is recommended because you capture activity in all Amazon Web Services Regions in your account. If you create a single-Region trail, you can view only the events logged in the trail's Amazon Web Services

Region. For more information about trails, see Creating a trail for your Amazon Web Services account and Creating a trail for an organization in the *Amazon CloudTrail User Guide*.

You can deliver one copy of your ongoing management events to your Amazon S3 bucket at no charge from CloudTrail by creating a trail, however, there are Amazon S3 storage charges. For more information about CloudTrail pricing, see Amazon CloudTrail Pricing. For information about Amazon S3 pricing, see Amazon S3 Pricing.

CloudTrail Lake event data stores

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. The selectors that you apply to an event data store control which events persist and are available for you to query. For more information about CloudTrail Lake, see Working with Amazon CloudTrail Lake in the *Amazon CloudTrail User Guide*.

CloudTrail Lake event data stores and queries incur costs. When you create an event data store, you choose the pricing option you want to use for the event data store. The pricing option determines the cost for ingesting and storing events, and the default and maximum retention period for the event data store. For more information about CloudTrail pricing, see Amazon CloudTrail Pricing.

CloudWatch Logs supports logging the following actions as events in CloudTrail log files:

- CancelExportTask
- CreateExportTask
- CreateLogGroup
- CreateLogStream
- DeleteDestination
- DeleteLogGroup
- DeleteLogStream
- DeleteMetricFilter
- DeleteRetentionPolicy
- DeleteSubscriptionFilter

- PutDestination
- PutDestinationPolicy
- PutMetricFilter
- PutResourcePolicy
- PutRetentionPolicy
- PutSubscriptionFilter
- StartQuery
- StopQuery
- TestMetricFilter

Only request elements are logged in CloudTrail for these CloudWatch Logs API actions:

- DescribeDestinations
- DescribeExportTasks
- DescribeLogGroups
- DescribeLogStreams
- DescribeMetricFilters
- DescribeQueries
- DescribeResourcePolicies
- DescribeSubscriptionFilters
- FilterLogEvents
- GetLogEvents
- GetLogGroupFields
- GetLogRecord
- GetQueryResults

Every event or log entry contains information about who generated the request. The identity information helps you determine the following:

- Whether the request was made with root or IAM user credentials.
- Whether the request was made with temporary security credentials for a role or federated user.
- Whether the request was made by another Amazon service.

For more information, see the CloudTrail userIdentity Element.

Query generation information in CloudTrail

CloudTrail logging for Query generator console events is also supported. Query generator is currently supported for CloudWatch Logs Insights and CloudWatch Metric Insights. In these CloudTrail events, the `eventSource` is `monitoring.amazonaws.com`.

The following example shows a CloudTrail log entry that demonstrates the **GenerateQuery** action in CloudWatch Logs Insights.


```
{
    "eventVersion": "1.09",
    "userIdentity": {
        "type": "AssumedRole",
        "principalId": "EX_PRINCIPAL_ID",
        "arn": "arn:aws:iam::123456789012:assumed-role/role_name",
        "accountId": "123456789012",
        "accessKeyId": "AKIAIOSFODNN7EXAMPLE",
        "sessionContext": {
            "sessionIssuer": {
                "type": "Role",
                "principalId": "EX_PRINCIPAL_ID",
                "arn": "arn:aws:iam::111222333444:role/Administrator",
                "accountId": "123456789012",
                "userName": "SAMPLE_NAME"
            },
            "attributes": {
                "creationDate": "2020-04-08T21:43:24Z",
                "mfaAuthenticated": "false"
            }
        }
    },
    "eventTime": "2020-04-08T23:06:30Z",
    "eventSource": "monitoring.amazonaws.com",
    "eventName": "GenerateQuery",
    "awsRegion": "us-east-1",
    "sourceIPAddress": "127.0.0.1",
    "userAgent": "exampleUserAgent",
    "requestParameters": {
        "query_ask": "***",
        "query_type": "LogsInsights",
```

```
        "logs_insights": {
            "fields": "***",
            "log_group_names": ["yourloggroup"]
        },
        "include_description": true
    },
    "responseElements": null,
    "requestID": "2f56318c-cfbd-4b60-9d93-1234567890",
    "eventID": "52723fd9-4a54-478c-ac55-1234567890",
    "readOnly": true,
    "eventType": "AwsApiCall",
    "managementEvent": true,
    "recipientAccountId": "111122223333",
    "eventCategory": "Management"
}
```

Understanding log file entries

A trail is a configuration that enables delivery of events as log files to an Amazon S3 bucket that you specify. CloudTrail log files contain one or more log entries. An event represents a single request from any source and includes information about the requested action, the date and time of the action, request parameters, and so on. CloudTrail log files aren't an ordered stack trace of the public API calls, so they don't appear in any specific order.

The following log file entry shows that a user called the CloudWatch Logs **CreateExportTask** action.

```
{
        "eventVersion": "1.03",
        "userIdentity": {
            "type": "IAMUser",
            "principalId": "EX_PRINCIPAL_ID",
            "arn": "arn:aws:iam::123456789012:user/someuser",
            "accountId": "123456789012",
            "accessKeyId": "AKIAIOSFODNN7EXAMPLE",
            "userName": "someuser"
        },
        "eventTime": "2016-02-08T06:35:14Z",
        "eventSource": "logs.amazonaws.com",
        "eventName": "CreateExportTask",
        "awsRegion": "us-east-1",
        "sourceIPAddress": "127.0.0.1",
```

```
        "userAgent": "aws-sdk-ruby2/2.0.0.rc4 ruby/1.9.3 x86_64-linux Seahorse/0.1.0",
        "requestParameters": {
            "destination": "yourdestination",
            "logGroupName": "yourloggroup",
            "to": 123456789012,
            "from": 0,
            "taskName": "yourtask"
        },
        "responseElements": {
            "taskId": "15e5e534-9548-44ab-a221-64d9d2b27b9b"
        },
        "requestID": "1cd74c1c-ce2e-12e6-99a9-8dbb26bd06c9",
        "eventID": "fd072859-bd7c-4865-9e76-8e364e89307c",
        "eventType": "AwsApiCall",
        "apiVersion": "20140328",
        "recipientAccountId": "123456789012"
}
```

CloudWatch Logs agent reference

> **Important**
>
> This section is a reference for those using the deprecated CloudWatch Logs agent. If you're using Instance Metadata Service Version 2 (IMDSv2), you must use the new unified CloudWatch agent. However, even if you're not using IMDSv2, we strongly recommend using the newer unified CloudWatch agent instead of the deprecated CloudWatch Logs agent. For information about the newer unified CloudWatch agent, see Collecting metrics and logs from Amazon EC2 instance and on-premises servers with the CloudWatch agent. For information about migrating from the deprecated CloudWatch Logs agent to the unified agent, Create the CloudWatch agent configuration file with the wizard.

The CloudWatch Logs agent provides an automated way to send log data to CloudWatch Logs from Amazon EC2 instances. The agent includes the following components:

- A plug-in to the Amazon CLI that pushes log data to CloudWatch Logs.
- A script (daemon) that initiates the process to push data to CloudWatch Logs.
- A cron job that ensures that the daemon is always running.

Agent configuration file

The CloudWatch Logs agent configuration file describes information needed by the CloudWatch Logs agent. The agent configuration file's [general] section defines common configurations that apply to all log streams. The [logstream] section defines the information necessary to send a local file to a remote log stream. You can have more than one [logstream] section, but each must have a unique name within the configuration file, e.g., [logstream1], [logstream2], and so on. The [logstream] value along with the first line of data in the log file, define the log file's identity.

```
[general]
state_file = value
logging_config_file = value
use_gzip_http_content_encoding = [true | false]

[logstream1]
log_group_name = value
```

```
log_stream_name = value
datetime_format = value
time_zone = [LOCAL|UTC]
file = value
file_fingerprint_lines = integer | integer-integer
multi_line_start_pattern = regex | {datetime_format}
initial_position = [start_of_file | end_of_file]
encoding = [ascii|utf_8|..]
buffer_duration = integer
batch_count = integer
batch_size = integer

[logstream2]
...
```

state_file

Specifies where the state file is stored.

logging_config_file

(Optional) Specifies the location of the agent logging config file. If you do not specify an agent logging config file here, the default file awslogs.conf is used. The default file location is `/var/awslogs/etc/awslogs.conf` if you installed the agent with a script, and is `/etc/awslogs/awslogs.conf` if you installed the agent with rpm. The file is in Python configuration file format (https://docs.python.org/2/library/logging.config.html#logging-config-fileformat). Loggers with the following names can be customized.

```
cwlogs.push
cwlogs.push.reader
cwlogs.push.publisher
cwlogs.push.event
cwlogs.push.batch
cwlogs.push.stream
cwlogs.push.watcher
```

The sample below changes the level of reader and publisher to WARNING while the default value is INFO.

```
[loggers]
keys=root,cwlogs,reader,publisher
```

```
[handlers]
keys=consoleHandler

[formatters]
keys=simpleFormatter

[logger_root]
level=INFO
handlers=consoleHandler

[logger_cwlogs]
level=INFO
handlers=consoleHandler
qualname=cwlogs.push
propagate=0

[logger_reader]
level=WARNING
handlers=consoleHandler
qualname=cwlogs.push.reader
propagate=0

[logger_publisher]
level=WARNING
handlers=consoleHandler
qualname=cwlogs.push.publisher
propagate=0

[handler_consoleHandler]
class=logging.StreamHandler
level=INFO
formatter=simpleFormatter
args=(sys.stderr,)

[formatter_simpleFormatter]
format=%(asctime)s - %(name)s - %(levelname)s - %(process)d - %(threadName)s -
 %(message)s
```

use_gzip_http_content_encoding

When set to true (default), enables gzip http content encoding to send compressed payloads to CloudWatch Logs. This decreases CPU usage, lowers NetworkOut, and decreases put latency. To

disable this feature, add **use_gzip_http_content_encoding = false** to the **[general]** section of the CloudWatch Logs agent configuration file, and then restart the agent.

> **Note**
>
> This setting is only available in awscli-cwlogs version 1.3.3 and later.

log_group_name

Specifies the destination log group. A log group is created automatically if it doesn't already exist. Log group names can be between 1 and 512 characters long. Allowed characters include a-z, A-Z, 0-9, '_' (underscore), '-' (hyphen), '/' (forward slash), and '.' (period).

log_stream_name

Specifies the destination log stream. You can use a literal string or predefined variables ({instance_id}, {hostname}, {ip_address}), or combination of both to define a log stream name. A log stream is created automatically if it doesn't already exist.

datetime_format

Specifies how the timestamp is extracted from logs. The timestamp is used for retrieving log events and generating metrics. The current time is used for each log event if the **datetime_format** isn't provided. If the provided **datetime_format** value is invalid for a given log message, the timestamp from the last log event with a successfully parsed timestamp is used. If no previous log events exist, the current time is used.

The common datetime_format codes are listed below. You can also use any datetime_format codes supported by Python, datetime.strptime(). The timezone offset (%z) is also supported even though it's not supported until python 3.2, [+-]HHMM without colon(:). For more information, see strftime() and strptime() Behavior.

%y: Year without century as a zero-padded decimal number. 00, 01, ..., 99

%Y: Year with century as a decimal number.1970, 1988, 2001, 2013

%b: Month as locale's abbreviated name. Jan, Feb, ..., Dec (en_US);

%B: Month as locale's full name. January, February, ..., December (en_US);

%m: Month as a zero-padded decimal number. 01, 02, ..., 12

%d: Day of the month as a zero-padded decimal number. 01, 02, ..., 31

%H: Hour (24-hour clock) as a zero-padded decimal number. 00, 01, ..., 23

%I: Hour (12-hour clock) as a zero-padded decimal number. 01, 02, ..., 12

%p: Locale's equivalent of either AM or PM.

%M: Minute as a zero-padded decimal number. 00, 01, ..., 59

%S: Second as a zero-padded decimal number. 00, 01, ..., 59

%f: Microsecond as a decimal number, zero-padded on the left. 000000, ..., 999999

%z: UTC offset in the form +HHMM or -HHMM. +0000, -0400, +1030

Example formats:

```
Syslog: '%b %d %H:%M:%S', e.g. Jan 23 20:59:29

Log4j: '%d %b %Y %H:%M:%S', e.g. 24 Jan 2014 05:00:00

ISO8601: '%Y-%m-%dT%H:%M:%S%z', e.g. 2014-02-20T05:20:20+0000
```

time_zone

Specifies the time zone of log event timestamp. The two supported values are UTC and LOCAL. The default is LOCAL, which is used if time zone can't be inferred based on **datetime_format**.

file

Specifies log files that you want to push to CloudWatch Logs. File can point to a specific file or multiple files (using wildcards such as /var/log/system.log*). Only the latest file is pushed to CloudWatch Logs based on file modification time. We recommend that you use wildcards to specify a series of files of the same type, such as access_log.2014-06-01-01, access_log.2014-06-01-02, and so on, but not multiple kinds of files, such as access_log_80 and access_log_443. To specify multiple kinds of files, add another log stream entry to the configuration file so each kind of log file goes to a different log stream. Zipped files are not supported.

file_fingerprint_lines

Specifies the range of lines for identifying a file. The valid values are one number or two dash delimited numbers, such as '1', '2-5'. The default value is '1' so the first line is used to calculate

fingerprint. Fingerprint lines are not sent to CloudWatch Logs unless all the specified lines are available.

multi_line_start_pattern

Specifies the pattern for identifying the start of a log message. A log message is made of a line that matches the pattern and any following lines that don't match the pattern. The valid values are regular expression or {datetime_format}. When using {datetime_format}, the datetime_format option should be specified. The default value is '^[^\s]' so any line that begins with non-whitespace character closes the previous log message and starts a new log message.

initial_position

Specifies where to start to read data (start_of_file or end_of_file). The default is start_of_file. It's only used if there is no state persisted for that log stream.

encoding

Specifies the encoding of the log file so that the file can be read correctly. The default is utf_8. Encodings supported by Python codecs.decode() can be used here.

> ⚠ **Warning**
>
> Specifying an incorrect encoding might cause data loss because characters that cannot be decoded are replaced with some other character.

Below are some common encodings:

```
ascii, big5, big5hkscs, cp037, cp424, cp437, cp500, cp720, cp737,
cp775, cp850, cp852, cp855, cp856, cp857, cp858, cp860, cp861, cp862,
cp863, cp864, cp865, cp866, cp869, cp874, cp875, cp932, cp949, cp950,
cp1006, cp1026, cp1140, cp1250, cp1251, cp1252, cp1253, cp1254, cp1255,
cp1256, cp1257, cp1258, euc_jp, euc_jis_2004, euc_jisx0213, euc_kr,
gb2312, gbk, gb18030, hz, iso2022_jp, iso2022_jp_1, iso2022_jp_2,
iso2022_jp_2004, iso2022_jp_3, iso2022_jp_ext, iso2022_kr, latin_1,
iso8859_2, iso8859_3, iso8859_4, iso8859_5, iso8859_6, iso8859_7,
iso8859_8, iso8859_9, iso8859_10, iso8859_13, iso8859_14, iso8859_15,
iso8859_16, johab, koi8_r, koi8_u, mac_cyrillic, mac_greek, mac_iceland,
mac_latin2, mac_roman, mac_turkish, ptcp154, shift_jis, shift_jis_2004,
```

```
shift_jisx0213, utf_32, utf_32_be, utf_32_le, utf_16, utf_16_be,
utf_16_le, utf_7, utf_8, utf_8_sig
```

buffer_duration

Specifies the time duration for the batching of log events. The minimum value is 5000ms and default value is 5000ms.

batch_count

Specifies the max number of log events in a batch, up to 10000. The default value is 10000.

batch_size

Specifies the max size of log events in a batch, in bytes, up to 1048576 bytes. The default value is 1048576 bytes. This size is calculated as the sum of all event messages in UTF-8, plus 26 bytes for each log event.

Using the CloudWatch Logs agent with HTTP proxies

You can use the CloudWatch Logs agent with HTTP proxies.

> **Note**
>
> HTTP proxies are supported in awslogs-agent-setup.py version 1.3.8 or later.

To use the CloudWatch Logs agent with HTTP proxies

1. Do one of the following:

   a. For a new installation of the CloudWatch Logs agent, run the following commands:

   ```
   curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-
   setup.py -O
   ```

   ```
   sudo python awslogs-agent-setup.py --region us-east-1 --http-proxy http://your/
   proxy --https-proxy http://your/proxy --no-proxy 169.254.169.254
   ```

In order to maintain access to the Amazon EC2 metadata service on EC2 instances, use **--no-proxy 169.254.169.254** (recommended). For more information, see Instance Metadata and User Data in the *Amazon EC2 User Guide*.

In the values for `http-proxy` and `https-proxy`, you specify the entire URL.

b. For an existing installation of the CloudWatch Logs agent, edit /var/awslogs/etc/proxy.conf, and add your proxies:

```
HTTP_PROXY=
HTTPS_PROXY=
NO_PROXY=
```

2. Restart the agent for the changes to take effect:

```
sudo service awslogs restart
```

If you are using Amazon Linux 2, use the following command to restart the agent:

```
sudo service awslogsd restart
```

Compartmentalizing CloudWatch Logs agent configuration files

If you're using awslogs-agent-setup.py version 1.3.8 or later with awscli-cwlogs 1.3.3 or later, you can import different stream configurations for various components independently of one another by creating additional configuration files in the **/var/awslogs/etc/config/** directory. When the CloudWatch Logs agent starts, it includes any stream configurations in these additional configuration files. Configuration properties in the [general] section must be defined in the main configuration file (/var/awslogs/etc/awslogs.conf) and are ignored in any additional configuration files found in /var/awslogs/etc/config/.

If you don't have a **/var/awslogs/etc/config/** directory because you installed the agent with rpm, you can use the **/etc/awslogs/config/** directory instead.

Restart the agent for the changes to take effect:

```
sudo service awslogs restart
```

If you are using Amazon Linux 2, use the following command to restart the agent:

```
sudo service awslogsd restart
```

CloudWatch Logs agent FAQ

What kinds of file rotations are supported?

The following file rotation mechanisms are supported:

- Renaming existing log files with a numerical suffix, then re-creating the original empty log file. For example, /var/log/syslog.log is renamed /var/log/syslog.log.1. If /var/log/syslog.log.1 already exists from a previous rotation, it is renamed /var/log/syslog.log.2.
- Truncating the original log file in place after creating a copy. For example, /var/log/syslog.log is copied to /var/log/syslog.log.1 and /var/log/syslog.log is truncated. There might be data loss for this case, so be careful about using this file rotation mechanism.
- Creating a new file with a common pattern as the old one. For example, /var/log/syslog.log.2014-01-01 remains and /var/log/syslog.log.2014-01-02 is created.

The fingerprint (source ID) of the file is calculated by hashing the log stream key and the first line of file content. To override this behavior, the **file_fingerprint_lines** option can be used. When file rotation happens, the new file is supposed to have new content and the old file is not supposed to have content appended; the agent pushes the new file after it finishes reading the old file.

How can I determine which version of agent am I using?

If you used a setup script to install the CloudWatch Logs agent, you can use **/var/awslogs/bin/awslogs-version.sh** to check what version of the agent you are using. It prints out the version of the agent and its major dependencies. If you used yum to install the CloudWatch Logs agent, you can use **"yum info awslogs"** and **"yum info aws-cli-plugin-cloudwatch-logs"** to check the version of the CloudWatch Logs agent and plugin.

How are log entries converted to log events?

Log events contain two properties: the timestamp of when the event occurred, and the raw log message. By default, any line that begins with non-whitespace character closes the previous log message if there is one, and starts a new log message. To override this behavior, the **multi_line_start_pattern** can be used and any line that matches the pattern starts a new log message. The pattern could be any regex or '{datetime_format}'. For example, if the

first line of every log message contains a timestamp like '2014-01-02T13:13:01Z', then the **multi_line_start_pattern** can be set to '\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2}Z'. To simplify the configuration, the '{datetime_format}' variable can be used if the **datetime_format option** is specified. For the same example, if **datetime_format** is set to '%Y-%m-%dT%H:%M:%S%z', then multi_line_start_pattern could be simply '{datetime_format}'.

The current time is used for each log event if the **datetime_format** isn't provided. If the provided **datetime_format** is invalid for a given log message, the timestamp from the last log event with a successfully parsed timestamp is used. If no previous log events exist, the current time is used. A warning message is logged when a log event falls back to the current time or time of previous log event.

Timestamps are used for retrieving log events and generating metrics, so if you specify the wrong format, log events could become non-retrievable and generate wrong metrics.

How are log events batched?

A batch becomes full and is published when any of the following conditions are met:

1. The **buffer_duration** amount of time has passed since the first log event was added.
2. Less than **batch_size** of log events have been accumulated but adding the new log event exceeds the **batch_size**.
3. The number of log events has reached **batch_count**.
4. Log events from the batch don't span more than 24 hours, but adding the new log event exceeds the 24 hours constraint.

What would cause log entries, log events, or batches to be skipped or truncated?

To follow the constraint of the `PutLogEvents` operation, the following issues could cause a log event or batch to be skipped.

> **Note**
>
> The CloudWatch Logs agent writes a warning to its log when data is skipped.

1. If the size of a log event exceeds 256 KB, the log event is skipped completely.
2. If the timestamp of log event is more than 2 hours in future, the log event is skipped.
3. If the timestamp of log event is more than 14 days in past, the log event is skipped.
4. If any log event is older than the retention period of log group, the whole batch is skipped.

5. If the batch of log events in a single `PutLogEvents` request spans more than 24 hours, the `PutLogEvents` operation fails.

Does stopping the agent cause data loss/duplicates?

Not as long as the state file is available and no file rotation has happened since the last run. The CloudWatch Logs agent can start from where it stopped and continue pushing the log data.

Can I point different log files from the same or different hosts to the same log stream?

Configuring multiple log sources to send data to a single log stream is not supported.

What API calls does the agent make (or what actions should I add to my IAM policy)?

The CloudWatch Logs agent requires the `CreateLogGroup`, `CreateLogStream`, `DescribeLogStreams`, and `PutLogEvents` operations. If you're using the latest agent, `DescribeLogStreams` is not needed. See the sample IAM policy below.

```
{
"Version": "2012-10-17",
"Statement": [
  {
    "Effect": "Allow",
    "Action": [
      "logs:CreateLogGroup",
      "logs:CreateLogStream",
      "logs:PutLogEvents",
      "logs:DescribeLogStreams"
    ],
    "Resource": [
      "arn:aws-cn:logs:*:*:*"
    ]
  }
 ]
}
```

I don't want the CloudWatch Logs agent to create either log groups or log streams automatically. How can I prevent the agent from recreating both log groups and log streams?

In your IAM policy, you can restrict the agent to only the following operations: `DescribeLogStreams`, `PutLogEvents`.

Before you revoke the `CreateLogGroup` and `CreateLogStream` permissions from the agent, be sure to create both the log groups and log streams that you want the agent to use. The logs

agent cannot create log streams in a log group that you have created unless it has both the `CreateLogGroup` and `CreateLogStream` permissions.

What logs should I look at when troubleshooting?

The agent installation log is at `/var/log/awslogs-agent-setup.log` and the agent log is at `/var/log/awslogs.log`.

Monitoring with CloudWatch metrics

You can use the tables in this section to review the metrics that Amazon CloudWatch Logs sends to Amazon CloudWatch every minute.

CloudWatch Logs metrics

The AWS/Logs namespace includes the following metrics.

Metric	Description
CallCount	The number of specified API operations performed in your account. CallCount is a CloudWatch Logs service usage metric. For more information, see CloudWatch Logs service usage metrics. Valid Dimensions: Class, Resource, Service, Type Valid Statistic: Sum Units: None
DeliveryErrors	The number of log events for which CloudWatch Logs received an error when forwarding data to the subscription destination. If the destination service returns a retryable error such as a throttling exception or a retryable service exception (HTTP 5xx for example), CloudWatch Logs continues to retry delivery for up to 24 hours. CloudWatch Logs does not try to re-deliver if the error is a non-retryable error, such as AccessDeniedException or ResourceNotFoundException . Valid Dimensions: LogGroupName, DestinationType, FilterName, PolicyLevel Valid Statistic: Sum Units: None
DeliveryThrottling	The number of log events for which CloudWatch Logs was throttled when forwarding data to the subscription destination.

Metric	Description
	If the destination service returns a retryable error such as a throttling exception or a retryable service exception (HTTP 5xx for example), CloudWatch Logs continues to retry delivery for up to 24 hours. CloudWatch Logs does not try to re-deliver if the error is a non-retryable error, such as `AccessDeniedException` or `ResourceNotFoundException`. Valid Dimensions: LogGroupName, DestinationType, FilterName, PolicyLevel Valid Statistic: Sum Units: None
`EMFParsingErrors`	The number of parsing errors encountered while processing embedded metric format logs. Such errors happen when logs are identified as embedded metric format but do not follow the correct format. For more information about the embedded metric format, see Specification: Embedded metric format. Valid Dimensions: `LogGroupName` Valid Statistic: Sum Units: None

Metric	Description
EMFValidationErrors	The number of validation errors encountered while processing embedded metric format logs. These errors occur when metric definitions within embedded metric format logs do not adhere to the embedded metric format and MetricDatum specifications. For information about the CloudWatch embedded metric format, see Specification: Embedded metric format. For information about the data type MetricDatum , see MetricDatum in the *Amazon CloudWatch API Reference*. **Note** Certain validation errors can lead to multiple metrics within an EMF log not being published. For example, all metrics set with an invalid namespace will be dropped. Valid Dimensions: LogGroupName Valid Statistic: Sum Units: None
ErrorCount	The number of API operations performed in your account that resulted in errors. ErrorCount is a CloudWatch Logs service usage metric. For more information, see CloudWatch Logs service usage metrics. Valid Dimensions: Class, Resource, Service, Type Valid Statistic: Sum Units: None

Metric	Description
ForwardedBytes	The volume of log events in compressed bytes forwarded to the subscription destination. Valid Dimensions: LogGroupName, DestinationType, FilterName Valid Statistic: Sum Units: Bytes
ForwardedLogEvents	The number of log events forwarded to the subscription destination. Valid Dimensions: LogGroupName, DestinationType, FilterName, PolicyLevel Valid Statistic: Sum Units: None
IncomingBytes	The volume of log events in uncompressed bytes uploaded to CloudWatch Logs. When used with the LogGroupName dimension, this is the volume of log events in uncompressed bytes uploaded to the log group. Valid Dimensions: LogGroupName Valid Statistic: Sum Units: Bytes
IncomingLogEvents	The number of log events uploaded to CloudWatch Logs. When used with the LogGroupName dimension, this is the number of log events uploaded to the log group. Valid Dimensions: LogGroupName Valid Statistic: Sum Units: None

Metric	Description
`LogEvents WithFindings`	The number of log events that matched a data string that you are auditing using the CloudWatch Logs data protection feature. For more information, see Help protect sensitive log data with masking. Valid Dimensions: None Valid Statistic: Sum Units: None
`ThrottleCount`	The number of API operations performed in your account that were throttled because of usage quotas. `ThrottleCount` is a CloudWatch Logs service usage metric. For more information, see CloudWatch Logs service usage metrics. Valid Dimensions: Class, Resource, Service, Type Valid Statistic: Sum Units: None

Dimensions for CloudWatch Logs metrics

The dimensions that you can use with most CloudWatch Logs metrics are listed in the following table.

Dimension	Description
`LogGroupName`	The name of the CloudWatch Logs log group for which to display metrics.
`DestinationType`	The subscription destination for the CloudWatch Logs data, which can be Amazon Lambda, Amazon Kinesis Data Streams, or Amazon Data Firehose.

Dimension	Description
FilterName	The name of the subscription filter that is forwarding data from the log group to the destination. The subscription filter name is automatically converted by CloudWatch to ASCII and any unsupported characters get replaced with a question mark (?).

Subscription filter metric dimensions

The dimensions for metrics related to account-level subscription filters are listed in the following table.

Dimension	Description
PolicyLevel	The level where the policy applies. Currently, the only valid value for this dimension is AccountPolicy
DestinationType	The subscription destination for the CloudWatch Logs data, which can be Amazon Lambda, Amazon Kinesis Data Streams, or Amazon Data Firehose.
FilterName	The name of the subscription filter that is forwarding data from the log group to the destination. The subscription filter name is automatically converted by CloudWatch to ASCII and any unsupported characters get replaced with a question mark (?).

Log transformer metrics and dimensions

CloudWatch Logs publishes the following log transformer metrics to CloudWatch in the AWS/Logs namespace.

Metric	Description
`TransformationErrors`	The number of errors encountered while transforming log events with the specified transformer. Unit: None Valid statistic: Sum
`TransformedBytes`	The volume of the output of transformed log events, in uncompressed bytes. Unit: Bytes Valid statistic: Sum
`TransformedLogEvents`	The number of transformed log events. Unit: None Valid statistic: Sum

The following dimensions are used by transformer metrics.

Dimension	Description
`LogGroupname`	This dimension is used only for log-group-level transformers.
`PolicyLevel`	This dimension is used only for account-level transformers. Currently the only valid value for this dimension is `AccountPolicy`

CloudWatch Logs service usage metrics

CloudWatch Logs sends metrics to CloudWatch that track the usage of CloudWatch Logs API operations. These metrics correspond to Amazon service quotas. Tracking these metrics can help you proactively manage your quotas. For more information, see Service Quotas Integration and Usage Metrics.

For example, you could track the `ThrottleCount` metric or set an alarm on that metric. If the value of this metric rises, you should consider requesting a quota increase for the API operation that is getting throttled. For more information about CloudWatch Logs service quotas, see CloudWatch Logs quotas.

CloudWatch Logs publishes service quota usage metrics every minute in both the `AWS/Usage` and `AWS/Logs` namespaces.

The following table lists the service usage metrics published by CloudWatch Logs. These metrics do not have a specified unit. The most useful statistic for these metrics is `SUM`, which represents the total operation count for the 1-minute period.

Each of these metrics is published with values for all of the `Service`, `Class`, `Type`, and `Resource` dimensions. They are also published with a single dimension called `Account Metrics`. Use the `Account Metrics` dimension to see the sum of metrics for all API operations in your account. Use the other dimensions and specify the name of an API operation for the `Resource` dimension to find the metrics for that particular API.

Metrics

Metric	Description
`CallCount`	The number of specified operations performed in your account. `CallCount` is published in both the `AWS/Usage` and `AWS/Logs` namespaces.
`ErrorCount`	The number of API operations performed in your account that resulted in errors. `ErrorCount` is published in only the `AWS/Logs`.
`ThrottleCount`	The number of API operations performed in your account that were throttled because of usage quotas. `ThrottleCount` is published in only the `AWS/Logs`.

Dimensions

Dimension	Description
`Account metrics`	Use this dimension to get a sum of the metric across all of the CloudWatch Logs APIs. If you want to see the metrics for one particular API, use the other dimensions listed in this table and specify the API name as the value of `Resource`.
`Service`	The name of the Amazon service containing the resource. For CloudWatch Logs usage metrics, the value for this dimension is `Logs`.
`Class`	The class of resource being tracked. CloudWatch Logs API usage metrics use this dimension with a value of `None`.
`Type`	The type of resource being tracked. Currently, when the `Service` dimension is `Logs`, the only valid value for `Type` is `API`.
`Resource`	The name of the API operation. Valid values include all of the API operation names that are listed in Actions. For example, `PutLogEvents`

CloudWatch Logs quotas

You can use the table in this section to review the default service quotas, also referred to as limits, for an Amazon account in Amazon CloudWatch Logs. Most of the service quotas, but not all, are listed under the Amazon CloudWatch Logs namespace in the Service Quotas console.

> **Note**
>
> If you want to request a quota increase for any of these quotas, see the procedure in this section.

Resource	Default quota
Account-level policies	One account-level subscription filter policy per Region per account. One account-level data protection policy per Region per account. 20 account-level field index policies per account. The log group name prefixes that they apply to can't overlap. These quotas can't be changed.
Anomaly detectors	500 anomaly detectors per account. You can request a quota increase.
Batch size	The maximum batch size is 1,048,576 bytes. This size is calculated as the sum of all event messages in UTF-8, plus 26 bytes for each log event. This quota can't be changed.
Data archiving	Up to 5 GB of data archiving for free. This quota can't be changed.

Resource	Default quota
CreateLogGroup	10 transactions per second (TPS/account/Region), after which transactions are throttled. You can request a quota increase.
CreateLogStream	50 transactions per second (TPS/account/Region), after which transactions are throttled. You can request a quota increase.
Custom data identifiers	Each data protection policy can include up to 10 custom data identifiers. You can request a quota increase. Each regular expression that defines a custom data identifier can include up to 200 characters. This quota can't be changed.
DeleteLogGroup	10 transactions per second (TPS/account/Region), after which transactions are throttled. You can request a quota increase.
DeleteLogStream	15 transactions per second (TPS/account/Region), after which transactions are throttled. You can request a quota increase.
DescribeLogGroups	10 transactions per second (TPS/account/Region). You can request a quota increase.
DescribeLogStreams	25 transactions per second (TPS/account/Region). You can request a quota increase.
Discovered log fields	CloudWatch Logs Insights can discover a maximum of 1000 log event fields in a log group. This quota can't be changed. For more information, see Supported logs and discovered fields.

Resource	Default quota
Extracted log fields in JSON logs	CloudWatch Logs Insights can extract a maximum of 200 log event fields from a JSON log. This quota can't be changed. For more information, see Supported logs and discovered fields.
Export task	One active (running or pending) export task at a time, per account. This quota can't be changed.
Field indexes	As many as 20 indexed fields per policy. This quota can't be changed.
FilterLogEvents	25 requests per second in US East (N. Virginia). 5 requests per second in the following Regions: • Asia Pacific (Jakarta) • Asia Pacific (Osaka) • Europe (Frankfurt) • Canada West (Calgary) • Israel (Tel Aviv) 10 requests per second in other Regions. This quota can't be changed.

Resource	Default quota
GetLogEvents	30 requests per second in Europe (Paris). 10 requests per second in the following Regions: • US West (Oregon) • Asia Pacific (Jakarta) • Asia Pacific (Osaka) • Canada West (Calgary) • Europe (Ireland) • Europe (Frankfurt) • Israel (Tel Aviv) 25 requests per second in all other Regions. This quota can't be changed. We recommend subscriptions if you are continuously processing new data. If you need historical data, we recommend exporting your data to Amazon S3.
Incoming data	Up to 5 GB of incoming data for free. This quota can't be changed.
Live Tail concurrent sessions.	15 concurrent sessions. You can request a quota increase.
Live Tail: log groups searched in one session.	Maximum of 10 log groups scanned in one Live Tail session. This quota can't be changed.
Log event size	1 MB (maximum). This quota can't be changed.
Log groups	1,000,000 log groups per account per Region. You can request a quota increase. There is no quota on the number of log streams that can belong to one log group.

Resource	Default quota
Metrics filters	100 per log group. This quota can't be changed.
Embedded metric format metrics	100 metrics per log event and 30 dimensions per metric. For more information about the embedded metric for mat, see Specification: Embedded Metric Format in the Amazon CloudWatch User Guide.
PutLogEvents	5 requests per second per log stream. Additional requests are throttled. This quota can't be changed. The maximum batch size of a PutLogEvents request is 1MB. 800 transactions per second per account per Region. You can request a quota increase.
Query execution timeout	Queries in CloudWatch Logs Insights time out after 60 minutes. This time limit can't be changed.
Queried log groups	A maximum of 50 log groups can be queried in a single CloudWatch Logs Insights query, when you specify log groups individually. This quota can't be changed. If you use log group criteria to choose log groups based on their name prefixes, or select to query "all log groups", you can query up to 10,000 log groups in a single query.

Resource	Default quota
Query concurrency	For Standard class log groups, a maximum of 30 concurrent CloudWatch Logs Insights queries, including queries that have been added to dashboards. This maximum of 30 applies to the total number of concurrent queries, no matter the query language used. Only 15 of these concurrent queries can be in OpenSearch Service PPL and/or OpenSearch Service SQL. For Infrequent Access class log groups, a maximum of 5 concurrent CloudWatch Logs Insights queries, including queries that have been added to dashboards. These quotas can't be changed.
Queries generated from natural language	As many as five concurrent natural-language generated query requests.
Query availability	Queries constructed in the console are available for 30 days, via the **History** command. This availability period can't be changed. Query definitions created by using PutQueryDefinition do not expire.
Query results availability	Results from a query are retrievable for 7 days. This availability time can't be changed.
Query results displayed in console	Up to to 10,000 rows of query results are displayed on the console.

Resource	Default quota
Regular expressions	Up to 5 filter patterns containing regular expressions for each log group when creating metric filters or subscript ion filters. This quota can't be changed. Up to 2 regular expressions for each filter pattern, when creating a delimited or JSON filter pattern for metric filters and subscription filters or when filtering log events.
Resource policies	Up to 10 CloudWatch Logs resource policies per Region per account. This quota can't be changed.
Saved queries	You can save as many as 1000 CloudWatch Logs Insights queries, per Region per account. This quota can't be changed.
Subscription filters	2 per log group. This quota can't be changed.
Transformers	A log transformer can have a maximum of 5 parser-ty pe processors. It can have a maximum of 20 processors overall. Each log group can have only one log-group level transformer. Each account can have as many as 20 account-level transformers. None of these transformers can apply to identical or overlapping log group prefixes. None of these quotas can be changed.

Managing your CloudWatch Logs service quotas

CloudWatch Logs has integrated with Service Quotas, an Amazon service that enables you to view and manage your quotas from a central location. For more information, see What Is Service Quotas? in the *Service Quotas User Guide*.

Service Quotas makes it easy to look up the value of your CloudWatch Logs service quotas.

Amazon Web Services Management Console

To view CloudWatch Logs service quotas using the console

1. Open the Service Quotas console at https://console.amazonaws.cn/servicequotas/.
2. In the navigation pane, choose **Amazon services**.
3. From the **Amazon services** list, search for and select **Amazon CloudWatch Logs**.

   In the **Service quotas** list, you can see the service quota name, applied value (if it is available), Amazon default quota, and whether the quota value is adjustable.
4. To view additional information about a service quota, such as the description, choose the quota name.
5. (Optional) To request a quota increase, select the quota that you want to increase, select **Request quota increase**, enter or select the required information, and select **Request**.

To work more with service quotas using the console see the Service Quotas User Guide. To request a quota increase, see Requesting a quota increase in the *Service Quotas User Guide*.

Amazon CLI

To view CloudWatch Logs service quotas using the Amazon CLI

Run the following command to view the default CloudWatch Logs quotas.

```
aws service-quotas list-aws-default-service-quotas \
    --query 'Quotas[*].
{Adjustable:Adjustable,Name:QuotaName,Value:Value,Code:QuotaCode}' \
    --service-code logs \
    --output table
```

To work more with service quotas using the Amazon CLI, see the Service Quotas Amazon CLI Command Reference. To request a quota increase, see the `request-service-quota-increase` command in the Amazon CLI Command Reference.

Document history

The following table describes important changes in each release of the CloudWatch Logs User Guide, beginning in June 2018. For notification about updates to this documentation, you can subscribe to an RSS feed.

Change	Description	Date
CloudWatch Logs Insights adds support for Amazon VPC Route Server logs	CloudWatch Logs Insights adds support for Amazon VPC Route Server logs. For more information, see Enable logging from Amazon services. The new log source for Amazon VPC Route Server, `EVENT_LOGS` is documented in PutDeliverySource	June 12, 2025
CloudWatch Logs Insights adds support for Amazon PCS logs	CloudWatch Logs Insights adds support for Amazon PCS logs. For more information, see Enable logging from Amazon services. The new log sources for Amazon PCS, `PCS_SCHEDULER_LOGS` and `PCS_JOBCOMP_LOGS` are documented in PutDeliverySource	June 12, 2025
CloudWatch Logs Insights adds support for Amazon Entity Resolution logs	CloudWatch Logs Insights adds support for Amazon Entity Resolution logs. For more information, see Enable logging from Amazon services. The new log source for Amazon Entity Resolution, `WORKFLOW_LOGS` is	May 22, 2025

	documented in PutDeliverySource	
CloudWatch Logs managed policy updates to support natural language summaries	Permissions for `cloudwatch:GenerateQueryResultsSummary` were added to **CloudWatchLogsFullAccess** and **CloudWatchLogsReadOnlyAccess** allow for generation of a natural language summary of the query results. To see the contents of the policies, see CloudWatchLogsFullAccess and CloudWatchLogsReadOnlyAccessin the *Amazon Managed Policy Reference Guide*.	May 20, 2025
CloudWatch Logs Insights adds support for generating natural language summaries from CloudWatch Logs Insights query results	Added support for natural language summaries in CloudWatch Logs Insights. This feature generates human-readable summaries of query results, currently available in US East (N. Virginia). For more information, see Generate natural language summaries from CloudWatch Logs Insights query results.	May 20, 2025

CloudWatchOpenSearchDashboardAccess and **CloudWatchOpenSearchDashboardsFullAccess** are new IAM policies	CloudWatch Logs added two new IAM policies, **CloudWatchOpenSearchDashboardsFullAccess** and **CloudWatchOpenSearchDashboardAccess**. **CloudWatchOpenSearchDashboardsFullAccess** grants permission to create and manage integrations with OpenSearch Service. **CloudWatchOpenSearchDashboardAccess** grants access to view vended logs dashboards that are created in these integrations. For more information, see Vended log dashboards powered by Amazon OpenSearch Service.	December 1, 2024
CloudWatchLogsFullAccess policy updated	CloudWatch Logs added permissions for Amazon OpenSearch Service and IAM to the **CloudWatchLogsFullAccess** policy, to enable CloudWatch Logs integration with OpenSearch Service for some features.	December 1, 2024
CloudWatch Logs Insights adds new structure types to the query sytnax	CloudWatch Logs Insights adds the `unnest` command and two JSON functions, which enable you to operate JSON strings as maps and lists. For more information, see Structure types.	November 21, 2024

CloudWatch Logs supports log transformation during log ingestion	You can create log transformers which can modify log events at the time of ingestion, helping you normalize your logs in different formats and from different sources into consistent and context-rich formats. For more information, see Transform logs during ingestion.	November 20, 2024
CloudWatch Logs Insights adds field indexing	CloudWatch Logs Insights has added support for field indexing of logs. When you then use a field index in a CloudWatch Logs Insights query, the query attempts to skip processing log events that are known to not include the indexed field For more information, see Create field indexes to improve query performance and reduce scan volume.	November 20, 2024
CloudWatch Logs Insights support for natural language query generation is generally available	CloudWatch Logs Insights supports natural language to generate and update queries. For more information, see Use natural language to generate and update CloudWatch Logs Insights queries.	June 20, 2024

CloudWatchLogsReadOnlyAccess policy updated	CloudWatch Logs added the `cloudwatch:GenerateQuery` permission to **CloudWatchLogsReadOnlyAccess**, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt.	November 26, 2023
CloudWatchLogsFullAccess policy updated	CloudWatch Logs added the `cloudwatch:GenerateQuery` permission to **CloudWatchLogsFullAccess**, so that users with this policy can generate a CloudWatch Logs Insights query string from a natural language prompt.	November 26, 2023
CloudWatch Logs adds log pattern analysis	CloudWatch Logs now scans for patterns in log events every time you perform a CloudWatch Logs Insights query. For more information, see Pattern analysis.	November 26, 2023
CloudWatch Logs adds log anomaly detection	You can create a log anomaly detector for a log group. The anomaly detector scans the log events ingested into the log group and finds anomalies in the log data. For more information, see Log anomaly detection.	November 26, 2023

CloudWatch Logs adds compare feature	You can now use CloudWatch Logs Insights to compare changes in your log events over time. . For more information, see Compare (diff) with previous time ranges.	November 26, 2023
CloudWatch Logs adds a new log class	CloudWatch Logs supports two classes of log groups so that you can have a cost-effective option for logs that you access infrequently, and you also have a full-featured option for logs that require real-time monitoring or other features. For more information, see Log classes.	November 26, 2023
CloudWatch Logs Insights supports natural language query generation	CloudWatch Logs Insights supports natural language to generate and update queries. For more information, see Use natural language to generate and update CloudWatch Logs Insights queries.	November 26, 2023
CloudWatch Logs adds regular expression filter pattern syntax support for Live Tail	You can now further customize your search and match operations to meet your needs with flexible regular expressions within Live Tail filter patterns. For more information, see Filter pattern syntax in the *Amazon CloudWatch Logs User Guide*.	November 13, 2023

CloudWatch Logs adds regular expression filter pattern syntax support for metric filters, subscription filters, and filter log events	You can now further customize your search and match operations to meet your needs with flexible regular expressions within filter patterns. For more information, see Filter pattern syntax in the *Amazon CloudWatch Logs User Guide*.	September 5, 2023
CloudWatch Logs Insights adds a pattern command	You can now use **pattern** in your CloudWatch Logs Insights queries to automatic ally cluster your log data into patterns. A pattern is shared text structure that recurs among your log fields. For more information, see pattern in the *Amazon CloudWatch Logs User Guide*.	July 17, 2023
CloudWatch Logs Insights adds a dedup command	You can now use **dedup** in your CloudWatch Logs Insights queries to remove duplicate results based on specific values in fields that you specify. For more information, see dedup in the *Amazon CloudWatch Logs User Guide*.	June 20, 2023

Account-level data protection policies	You can now set data protection policies at the account level. These account-level policies can audit and mask sensitive informati on in log events in all log groups in the account. For more information, see Help protect sensitive log data with masking in the *Amazon CloudWatch Logs User Guide*.	June 8, 2023
Live Tail feature added	CloudWatch Logs added Live Tail ability, so you can scan logs as they are ingested to help with troubleshooting. You can optionally filter the displayed stream of log events based on specified terms, and also highlight log events that have specified terms. For more information, see Use live tail to view logs in near real time.	June 6, 2023

CloudWatchLogsReadOnlyAccess policy updated	CloudWatch Logs added permissions to **CloudWatchLogsReadOnlyAccess**. The `logs:StartLiveTail` and `logs:StopLiveTail` permissions were added so that users with this policy can use the console to start and stop CloudWatch Logs live tail sessions. For more information, see Use live tail to view logs in near real time.	June 6, 2023
CloudWatch Logs Insights released	You can use CloudWatch Logs Insights to interactively search and analyze your log data. For more information see Analyze Log Data with CloudWatch Logs Insights in the *Amazon CloudWatch Logs User Guide*	November 27, 2018
Support for Amazon VPC endpoints	You can now establish a private connection between your VPC and CloudWatch Logs. For more information, see Using CloudWatch Logs with Interface VPC Endpoints in the *Amazon CloudWatch Logs User Guide*.	June 28, 2018

The following table describes the important changes to the Amazon CloudWatch Logs User's Guide.

Change	Description	Release date
Interface VPC endpoints	In some Regions, you can use an interface VPC endpoint to keep traffic between your Amazon VPC and CloudWatch Logs from leaving the Amazon network. For more information see Using CloudWatch Logs with interface VPC endpoints.	March 7, 2018
Route 53 DNS query logs	You can use CloudWatch Logs to store logs about the DNS queries received by Route 53. For more information see What is Amazon CloudWatch Logs? or Logging DNS Queries in the Amazon Route 53 Developer Guide.	September 7, 2017
Tag log groups	You can use tags to categorize your log groups. For more information, see Tag log groups in Amazon CloudWatch Logs.	December 13, 2016
Console improvements	You can navigate from metrics graphs to the associated log groups. For more information, see Pivot from metrics to logs.	November 7, 2016
Console usability improvements	Improved the experience to make it easier to search, filter, and troubleshoot. For example, you can now filter your log data to a date and time range. For more information, see View log data sent to CloudWatch Logs.	August 29, 2016
Added Amazon CloudTrai l support for Amazon CloudWatch Logs and new CloudWatch Logs metrics	Added Amazon CloudTrail support for CloudWatc h Logs. For more information, see Logging CloudWatch Logs API and console operations in Amazon CloudTrail.	March 10, 2016

Change	Description	Release date
Added support for CloudWatch Logs export to Amazon S3	Added support for exporting CloudWatch Logs data to Amazon S3. For more information, see Exporting log data to Amazon S3.	December 7, 2015
Added support for Amazon CloudTrail logged events in Amazon CloudWatch Logs	You can create alarms in CloudWatch and receive notifications of particular API activity as captured by CloudTrail and use the notification to perform troubleshooting.	November 10, 2014
Added support for Amazon CloudWatch Logs	You can use Amazon CloudWatch Logs to monitor, store, and access your system, applicati on, and custom log files from Amazon Elastic Compute Cloud (Amazon EC2) instances or other sources. You can then retrieve the associated log data from CloudWatch Logs using the Amazon CloudWatch console, the CloudWatch Logs commands in the Amazon CLI, or the CloudWatc h Logs SDK. For more information, see What is Amazon CloudWatch Logs?.	July 10, 2014

Amazon Glossary

For the latest Amazon terminology, see the Amazon glossary in the *Amazon Web Services Glossary Reference*.