Amazon CloudWatch Logs

User Guide

Amazon CloudWatch Logs: User Guide

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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, AWS CloudTrail, and other sources. You can then retrieve the associated log data from CloudWatch Logs.

Features

- **Monitor Logs from Amazon EC2 Instances in Real-time**—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 (p. 7).
- **Monitor AWS 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 *AWS CloudTrail User Guide*.
- **Archive Log Data**—You can use CloudWatch Logs to store your log data in highly durable storage. You can change the log retention setting so that any log events older than this setting are automatically deleted. 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.

Related AWS Services

The following services are used in conjunction with CloudWatch Logs:

- **AWS 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 AWS Management Console, command line interface (CLI), and other services. When CloudTrail logging is turned on, CloudWatch will write log files into the Amazon S3 bucket that you specified when you configured CloudTrail. 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 AWS CloudTrail, see What is AWS CloudTrail? in the *AWS CloudTrail User Guide*. For an example of the type of data that CloudWatch writes into CloudTrail log files, see Logging Amazon CloudWatch Logs API Calls in AWS CloudTrail (p. 78).

- **AWS Identity and Access Management (IAM)** is a web service that helps you securely control access to AWS resources for your users. Use IAM to control who can use your AWS 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 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 Streams? in the *Amazon Kinesis Streams Developer Guide*.
- **AWS 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 AWS Lambda? in the *AWS Lambda Developer Guide*.

Pricing

When you sign up for AWS, you can get started with CloudWatch Logs for free using the AWS 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, see Amazon CloudWatch Pricing.

Amazon CloudWatch Logs Concepts

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

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. In addition, AWS may delete empty log streams that are over 2 months old.

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, a typical log group organization for a fleet of Apache web servers could be the following: `MyWebsite.com/Apache/access_log`, or `MyWebsite.com/Apache/error_log`.

Metric Filters

Metric filters can be used to express how the service would 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.

CloudWatch Logs Limits

CloudWatch Logs has the following limits:

Resource	Default Limit
Batch size	1 MB (maximum). This limit cannot be changed.
CreateLogGroup	500 log groups/account/region. If you exceed your log group limit, you get a `ResourceLimitExceeded` exception. You can request a limit increase.
Data archiving	Up to 5 GB of data archiving for free. This limit cannot be changed.
DescribeLogStreams	5 transactions per second (TPS/account/region). If you experience frequent throttling, you can request a limit increase.
Event size	256 KB (maximum). This limit cannot be changed.
Export task	One active (running or pending) export task at a time, per account. This limit cannot be changed.
FilterLogEvents	5 transactions per second (TPS)/account/region. This limit can be changed only in special circumstances. If you experience frequent throttling, contact AWS Support. For instructions, see AWS Service Limits.
GetLogEvents	10 requests/second/account/region. We recommend subscriptions if you are continuously processing new data. If you need historical data, we recommend exporting your data to Amazon S3. This limit can be changed only in special circumstances. If you experience frequent throttling, contact AWS Support. For instructions, see AWS Service Limits.
Incoming data	Up to 5 GB of incoming data for free. This limit cannot be changed.
Log groups	500/AWS account (maximum). You can request a limit increase.

Resource	Default Limit
Metrics filters	100/log group. This limit cannot be changed.
PutLogEvents	5 requests/second/log stream. This limit cannot be changed. The maximum batch size of a PutLogEvents request is 1MB. 1500 transactions/second/account/region. You can request a limit increase.
Subscription filters	1/log group. This limit cannot be changed.

Getting Set Up

To use Amazon CloudWatch Logs you need an AWS account. Your AWS 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 AWS Command Line Interface (AWS CLI).

Sign Up for Amazon Web Services (AWS)

When you create an AWS account, we automatically sign up your account for all AWS services. You pay only for the services that you use.

If you have an AWS account already, skip to the next step. If you don't have an AWS account, use the following procedure to create one.

To sign up for an AWS account

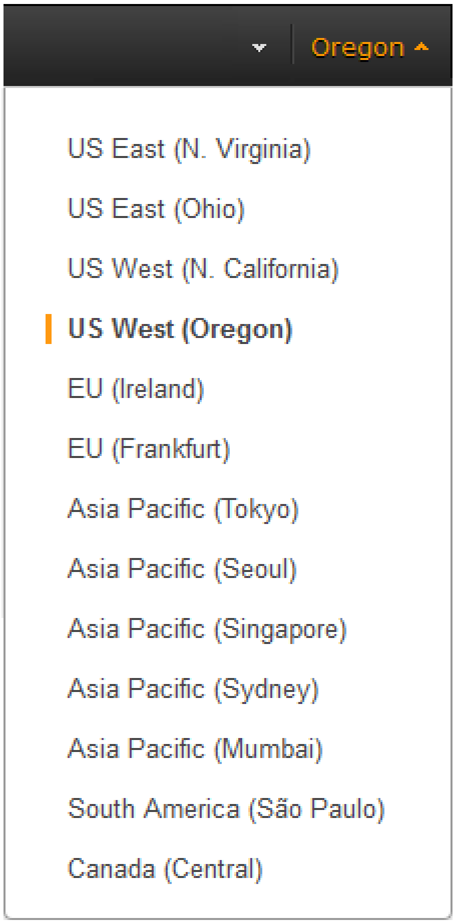
1. Open http://aws.amazon.com/, and then choose **Create an AWS Account**.
2. Follow the online instructions.

   Part of the sign-up procedure involves receiving a phone call and entering a PIN using the phone keypad.

Sign in to the Amazon CloudWatch Console

To sign in to the Amazon CloudWatch console

1. Sign in to the AWS Management Console and open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. If necessary, change the region. From the navigation bar, choose the region where you have your AWS resources.



3. In the navigation pane, choose **Logs**.

Set Up the Command Line Interface

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

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

Getting Started with CloudWatch Logs

You can publish log data from Amazon EC2 instances running Linux or Windows Server, and logged events from AWS CloudTrail. CloudWatch Logs can consume logs from resources in any region, but you can only view the log data in the CloudWatch console in the regions where CloudWatch Logs is supported. For more information, see Regions and Endpoints in the *Amazon Web Services General Reference*.

To get started with CloudWatch Logs on an EC2 instance running Microsoft Windows, see Sending Performance Counters to CloudWatch and Logs to CloudWatch Logs in the *Amazon EC2 User Guide for Windows Instances*.

To get started with CloudWatch Logs and logged events in CloudTrail, see Sending CloudTrail Events to CloudWatch Logs in the *AWS CloudTrail User Guide*.

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CloudWatch Logs Agent Prerequisites

The CloudWatch Logs agent requires Python version 2.6, 2.7, 3.0, or 3.3, and any of the following versions of Linux:

- Amazon Linux version 2014.03.02 or later
- Ubuntu Server version 12.04, or 14.04
- 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 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, the agent confirms that it has started and it stays running until you disable it.

In addition to the agent, you can also publish log data using the AWS CLI, CloudWatch Logs SDK, or the CloudWatch Logs API. The AWS 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'll need to use your IAM credentials for the next steps because you cannot assign an IAM role to an existing instance; you can only specify a role when you launch a new instance.

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

To configure your IAM role or user for CloudWatch Logs

1. Open the Identity and Access Management (IAM) console at https://console.aws.amazon.com/iam/.
2. In the navigation pane, choose **Roles**, and then for **Role Name**, select an IAM role.
3. On the **Permissions** tab, under **Inline Policies**, choose **Create Role Policy**.
4. On the **Set Permissions** page, choose **Custom Policy**, **Select**.

   For more information about creating custom policies, see IAM Policies for Amazon EC2 in the *Amazon EC2 User Guide for Linux Instances*.
5. On the **Review Policy** page, for **Policy Name**, type a name for the policy.
6. 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:logs:*:*:*"
    ]
    }
  ]
}
```

7. Choose **Apply 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 AWS without having to manually reinstall the CloudWatch Logs agent.

> **Caution**
> 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 Linux Instances*.

   If you have trouble connecting, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide for Linux Instances*.
2. Update your Amazon Linux instance to pick up the latest changes in the package repositories.

```
[ec2-user ~]$ sudo yum update -y
```

3. Install the `awslogs` package.

```
[ec2-user ~]$ sudo yum install -y awslogs
```

4. Edit the `/etc/awslogs/awscli.conf` file and in the `[default]` section, specify the region in which to view log data and add your credentials.

```
region = us-east-1
aws_access_key_id = <YOUR ACCESS KEY>
aws_secret_access_key = <YOUR SECRET KEY>
```

> **Note**
> Adding your credentials here is optional if your instance was launched using an IAM role or user with the appropriate permissions to use CloudWatch Logs.

5. 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 (p. 81).
6. Start the `awslogs` service.

```
[ec2-user ~]$ sudo service awslogs start
```

```
Starting awslogs:                                          [  OK  ]
```

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.

   ```
   [ec2-user ~]$ sudo chkconfig awslogs on
   ```

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.

   To view your logs, see View Log Data Sent to CloudWatch Logs (p. 20).

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 Linux Instances*.

   If you have trouble connecting, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide for Linux Instances*.
2. Run the CloudWatch Logs agent installer. On the instance, open a command prompt, type the following commands, and then follow the prompts.

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

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

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

   Note
   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.

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

Item	Description
AWS access key ID	Press Enter if using an IAM role. Otherwise, enter your AWS access key ID.
AWS secret access key	Press Enter if using an IAM role. Otherwise, enter your AWS secret access key.
Default region name	Press Enter. The default is us-east-1. You can set this to 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.
Default output format	Leave blank and press Enter.

Item	Description
Path of log file to upload	The location of the file that contains the log data you want 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 timestamp within the specified log file. Choose custom to specify your own format.
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 if you want to configure 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 (p. 81).

> **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.

   To view your logs, see View Log Data Sent to CloudWatch Logs (p. 20).

4. Optional. If you later need to edit your credentials, in the `/var/awslogs/etc/aws.conf` file and in the `[default]` section, specify the region where you want to view log data and add your credentials.

```
region = <REGION>
aws_access_key_id = <YOUR ACCESS KEY>
aws_secret_access_key = <YOUR SECRET KEY>
```

> **Note**
> Adding your credentials here is optional if your instance was launched using an IAM role or user with the appropriate permissions to use CloudWatch Logs.

Quick Start: Install and Configure the CloudWatch Logs Agent on an EC2 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. You can launch a new EC2 instance and enable logs by performing the following steps.

To launch a new instance and enable CloudWatch Logs

1. Create an agent configuration file that describes all your log groups and log streams.

Sample agent configuration file for Amazon Linux

```
[general]
state_file = /var/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
```

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
```

The agent configuration file describes the log files to monitor and the target log groups and log streams to upload it 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 (p. 81).

Save it as a text file (for example, awslogs.cfg) either on the AMI's filesystem, in a publicly accessible http/https location, or an Amazon S3 location (for example, s3://myawsbucket/my-config-file). For more information about assigning permissions to an Amazon S3 bucket, see Specifying Resources in a Policy in the *Amazon Simple Storage Service Developer Guide*.

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

2. Open the Identity and Access Management (IAM) console at https://console.aws.amazon.com/iam/.
3. In the navigation pane, choose **Policies**, **Create Policy**.
4. 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 for Linux Instances*.
5. On the **Review Policy** page, for **Policy Name**, type a name for the policy.
6. 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:logs:*:*:*"
            ]
        },
        {
            "Effect": "Allow",
            "Action": [
                "s3:GetObject"
            ],
            "Resource": [
                "arn:aws:s3:::myawsbucket/*"
            ]
        }
    ]
}
```

7. Choose **Create Policy**.
8. In the navigation pane, choose **Roles**, **Create New Role**.
9. On the **Set Role Name** page, enter a name for the role and choose **Next Step**.
10. On the **Select Role Type** page, choose **Select** next to **Amazon EC2**.
11. On the **Attach Policy** page, in the table header (next to **Filter** and **Search**), choose **Policy Type**, **Customer Managed Policies**.
12. For **Customer Managed Policies**, select the IAM policy that you created above and choose **Next Step**.
13. If you're satisfied with the role, choose **Create Role**.

    For more information about IAM users and policies, see IAM Users and Groups and Managing IAM Policies in the *IAM User Guide*.
14. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
15. If necessary, change the region. From the navigation bar, select the region that meets your needs. For more information, see Regions and Endpoints in the *Amazon Web Services General Reference*.
16. Choose **Launch Instance**.

    For more information, see Launching an Instance in *Amazon EC2 User Guide for Linux Instances*.
17. 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**.

    Note

    Make sure that cloud-init (http://cloudinit.readthedocs.org/en/latest/index.html) is installed on your Amazon Machine Image (AMI). Amazon Linux, Ubuntu, and RHEL instances already include cloud-init, but CentOS and other AMIs in the AWS Marketplace may not.
18. On the **Step 3: Configure Instance Details** page, for **IAM role**, select the IAM role that you created above.
19. Under **Advanced Details**, for **User data**, paste in the script and update the **-c** option with the location of the 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://myawsbucket/my-config-file
```

> **Note**
> 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.

20. Make any other changes to the instance, review your launch settings, and then choose **Launch**.
21. 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.

    To view your logs, see View Log Data Sent to CloudWatch Logs (p. 20).

Quick Start: Install the CloudWatch Logs Agent Using AWS OpsWorks and Chef

You can install the CloudWatch Logs agent and create log streams using AWS 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. If you want to monitor multiple log files, you need to extend the recipes to create multiple log groups and log streams.

Topics

Step 1: Create Custom Recipes

Create a repository to store your recipes. AWS 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 *AWS 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.

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 (p. 81).

```
[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 AWS OpsWorks Stack

1. Open the AWS OpsWorks console at https://console.aws.amazon.com/opsworks/.
2. On the **OpsWorks Dashboard**, choose **Add stack** to create an AWS 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 AWS OpsWorks instances, you need to extend the IAM role used by your instances.

1. Open the Identity and Access Management (IAM) console at https://console.aws.amazon.com/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 for Linux Instances*.
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: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 AWS OpsWorks stack. You can find the one used by your stack in the stack settings (the default is `aws-opsworks-ec2-role`).

   Tip
   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 IAM 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 AWS OpsWorks console at https://console.aws.amazon.com/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*, which correspond to AWS OpsWorks lifecycle events. AWS 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**.

   AWS 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 AWS OpsWorks console at https://console.aws.amazon.com/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.

   AWS 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.

To view your logs, see View Log Data Sent to CloudWatch Logs (p. 20).

Quick Start: Use AWS CloudFormation to Send Log Data to CloudWatch Logs

AWS CloudFormation enables you to describe your AWS resources in JSON format. With AWS CloudFormation, you can describe and then quickly and consistently provision log groups and metric filters in CloudWatch Logs. You can also use AWS CloudFormation to install and configure the CloudWatch Logs agent on EC2 instances. For example, if you have multiple Apache web servers on EC2 instances, you can write a single AWS CloudFormation template that defines the web server logs and the information from those logs that you want to monitor. You can then reuse the template for all of your Apache web servers. For more information, see the AWS CloudFormation User Guide.

For more information about CloudWatch resources in AWS CloudFormation, see the AWS::Logs::LogGroup and AWS::Logs::MetricFilter in the *AWS CloudFormation User Guide*.

Example

The following template snippet creates a log group and metric filter. The log group retains log events for 7 days. The metric filter counts the number of 404 occurrences. It sends a metric value of 1 each time the status code field equals 404.

```
"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"
            }
        ]
    }
}
```

For a stack named `MyStack`, the example creates a log group named "`MyStack-LogGroup-`*unique-hash*" and a metric filter named "`MetricFilter-`*unique-hash*. For a complete sample template that includes an EC2 instance and CloudWatch alarms, see Amazon CloudWatch Logs Sample in the *AWS CloudFormation User Guide*.

Report the CloudWatch Logs Agent's 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 Linux Instances*.

   If you have trouble connecting, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide for Linux Instances*
2. At a command prompt, type the following command:

   ```
   sudo service awslogs 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 Linux Instances*.

   If you have trouble connecting, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide for Linux Instances*.
2. At a command prompt, type the following command:

   ```
   sudo service awslogs 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 Linux Instances*.

   If you have trouble connecting, see Troubleshooting Connecting to Your Instance in the *Amazon EC2 User Guide for Linux Instances*.
2. At a command prompt, type the following command:

```
sudo service awslogs stop
```

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 you want to view.

To view log data

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. For **Log Groups**, choose the log group to view the streams.
4. For **Log Streams**, choose the log stream name to view the log data.
5. To change how the log data is displayed, do one of the following:
   - To expand all log events, above the list of log events, choose **Expand all**.
   - To expand all log events and view them as plain text, above the list of log events, choose **Text**.
   - To filter the log events, type the desired search filter in the search field. For more information, see Searching and Filtering Log Data (p. 21).
   - To view log data for a specified date and time range, above the list of log events, choose **custom**. You can choose **Absolute** to specify a date and time range or **Relative** to choose a predefined number of minutes, hours, days, or weeks. You can also switch between **UTC** and **Local timezone**.

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 automatically deleted. You can change the log retention for each log group at any time.

To change the logs retention setting

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. For **Expire Events After**, choose the retention setting to change.
4. In the **Edit Retention** dialog box, for **Retention**, choose a log retention value, and then choose **Ok**.

Searching and Filtering Log Data

After the CloudWatch Logs agent begins publishing log data to Amazon CloudWatch, you can begin searching and filtering the log data 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 CloudWatch metrics that you can graph or set an alarm on.

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

Concepts

Each metric 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. 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
What to publish to the metric. 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 the published value will be the value in the log event.

Filter and Pattern Syntax

You use metric filters to search for and match terms, phrases, or values in your log events. When a metric filter finds one of the terms, phrases, or values in your log events, it counts each occurrence in a CloudWatch metric. For example, you can create a metric filter to search for and count the occurrence of the word *ERROR* in your log events. Metric filters can also extract values from space-delimited log events, such as the latency of web requests. You can also use conditional operators and wildcards to create exact matches. Before you create a metric filter, you can test your search patterns in the CloudWatch console. The following sections explain the metric filter syntax in more detail.

Matching Terms in Log Events

To search for a term in your log events, use the term as your metric filter pattern. You can specify multiple terms in a metric filter pattern, but all terms must appear in a log event for there to be a match. Metric filters are case sensitive.

Metric filter terms that include characters other than alphanumeric or underscore must be placed inside double quotes ("").

To exclude a term, use a minus sign (-) before the term.

Example 1: Single term

The filter pattern "ERROR" matches log event messages that contain this term, such as the following:

- [ERROR] A fatal exception has occurred
- Exiting with ERRORCODE: -1

Example 2: Include a term and exclude a term

In the previous example, if you change the filter pattern to "ERROR -Exiting", the log event message "Exiting with ERRORCODE: -1" would be excluded.

Example 3: Multiple terms

The filter pattern "ERROR Exception" matches log event messages that contain both terms, such as the following:

- [ERROR] Caught IllegalArgumentException
- [ERROR] Unhandled Exception

The filter pattern "Failed to process the request" matches log event messages that contain all terms, such as the following:

- [WARN] Failed to process the request
- [ERROR] Unable to continue: Failed to process the request

Matching Terms in JSON Log Events

You can extract values from JSON log events. To extract values from JSON log events, you need to create a string-based metric filter. Strings containing scientific notation are not supported. The items in the JSON log event data must exactly match the metric filter. You might want to create metric filters in JSON log events to indicate the following:

- A certain event occurs. For example eventName is "UpdateTrail".
- The IP is outside a known subnet. For example, sourceIPAddress is not in some known subnet range.
- A combination of two or more other conditions are true. For example, the eventName is "UpdateTrail" and the recipientAccountId is 123456789012.

Using Metric Filters to Extract Values from Space-Delimited Log Events

You can use metric filters to extract values from space-delimited log events. The characters between a pair of square brackets [] or two double quotes ("") are treated as a single field. For example:

```
127.0.0.1 - frank [10/Oct/2000:13:25:15 -0700] "GET /apache_pb.gif HTTP/1.0"
 200 1534
127.0.0.1 - frank [10/Oct/2000:13:35:22 -0700] "GET /apache_pb.gif HTTP/1.0"
 500 5324
127.0.0.1 - frank [10/Oct/2000:13:50:35 -0700] "GET /apache_pb.gif HTTP/1.0"
 200 4355
```

To specify a metric filter pattern that parses space-delimited events, the metric filter pattern has to specify the fields with a name, separated by commas, with the entire pattern enclosed in square brackets. For example: [ip, user, username, timestamp, request, status_code, bytes].

In cases where you don't know the number of fields, you can use shorthand notification using an ellipsis (…). For example:

```
[..., status_code, bytes]
[ip, user, ..., status_code, bytes]
[ip, user, ...]
```

You can also add conditions to your fields so that only log events that match all conditions would match the filters. For example:

```
[ip, user, username, timestamp, request, status_code, bytes > 1000]
[ip, user, username, timestamp, request, status_code = 200, bytes]
[ip, user, username, timestamp, request, status_code = 4*, bytes]
[ip, user, username, timestamp, request = *html*, status_code = 4*, bytes]
```

CloudWatch Logs supports both string and numeric conditional fields. For string fields, you can use = or != operators with an asterisk (*).

For numeric fields, you can use the >, <, >=, <=, =, and != operators.

If you are using a space-delimited filter, extracted fields map to the names of the space-delimited fields (as expressed in the filter) to the value of each of these fields. If you are not using a space-delimited filter, this will be empty.

Example Filter:

```
[..., request=*.html*, status_code=4*,]
```

Example log event for the filter:

```
127.0.0.1 - frank [10/Oct/2000:13:25:15 -0700] \"GET /index.html HTTP/1.0\"
 404 1534
```

Extracted fields for the log event and filter pattern:

```
{
   "$status_code": "400",
   "$request": "GET /products/index.html HTTP/1.0",
   "$7": "1534",
   "$4": "10/Oct/2000:13:25:15 -0700",
   "$3": "frank",
   "$2": "-",
   "$1": "127.0.0.1"
}
```

Using Metric Filters to Extract Values from JSON Log Events

You can use metric filters to extract values from JSON log events. The metric filter syntax for JSON log events uses the following format:

```
{ SELECTOR EQUALITY_OPERATOR STRING }
```

The metric filter must be enclosed in curly braces { }, to indicate this is a JSON expression. The metric filter is contains the following parts:

SELECTOR
Specifies what JSON property to check. Property selectors always start with dollar sign ($), which signifies the root of the JSON. Property selectors are alphanumeric strings that also support '-' and '_' characters. Array elements are denoted with [NUMBER] syntax, and must follow a property. Examples are: $.eventId, $.users[0], $.users[0].id, $.requestParameters.instanceId.

EQUALITY_OPERATOR
Can be either = or !=.

STRING
A string with or without quotes. You can use the asterisk '*' wildcard character to match any text at, before, or after a search term. For example, ***Event** will match **PutEvent** and **GetEvent**. **Event*** will match **EventId** and **EventName**. **Ev*ent** will only match the actual string **Ev*ent**. Strings that consist entirely of alphanumeric characters do not need to be quoted. Strings that have unicode and other characters such as ‘@,‘ ‘$,' ‘\,' etc. must be enclosed in double quotes to be valid.

Metric Filter Examples

The following is a JSON example:

```
{
  "eventType": "UpdateTrail",
  "sourceIPAddress": "111.111.111.111",
  "arrayKey": [
        "value",
        "another value"
  ],
  "objectList": [
       {
         "name": "a",
         "id": 1
       },
       {
         "name": "b",
         "id": 2
       }
  ],
  "SomeObject": null,
  "ThisFlag": true
}
```

The following filters would match:

```
{ $.eventType = "UpdateTrail" }
```

Filter on the event type being UpdateTrail.

```
{ $.sourceIPAddress != 123.123.* }
```

Filter on the IP address being outside the subnet 123.123 prefix.

```
{ $.arrayKey[0] = "value" }
```

Filter on the first entry in arrayKey being "value". If arrayKey is not an array this will be false.

```
{ $.objectList[1].id = 2 }
```

Filter on the second entry in objectList having a property called id = 2. If objectList is not an array this will be false. If the items in objectList are not objects or do not have an id property, this will be false.

```
{ $.SomeObject IS NULL }
```

Filter on SomeObject being set to null. This will only be true is the specified object is set to null.

```
{ $.SomeOtherObject NOT EXISTS }
```

Filter on SomeOtherObject being non-existent. This will only be true if specified object does not exist in log data.

```
{ $.ThisFlag IS TRUE }
```

Filters on ThisFlag being TRUE. This also works for boolean filters which check for FALSE value.

Compound Conditions

You can combine multiple conditions into a compound expression using OR (||) and AND (&&). Parenthesis are allowed and the syntax follows standard order of operations () > && > ||.

```
{
    "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]
    ]
}
```

Examples

```
{ ($.user.id = 1) && ($.users[0].email = "John.Doe@example.com") }
```

Matches the JSON above.

```
{ ($.user.id = 2 && $.users[0].email = "nonmatch") || $.actions[2] = "GET" }
```

Doesn't match the JSON above.

```
{ $.user.email = "John.Stiles@example.com" || $.coordinates[0][1] = nonmatch
 && $.actions[2] = nomatch }
```

Matches the JSON above.

```
{ ($.user.email = "John.Stiles@example.com" || $.coordinates[0][1] =
 nonmatch) && $.actions[2] = nomatch }
```

Doesn't match the JSON above.

Special Considerations

The SELECTOR must point to a value node (string or number) in the JSON. If it points to an array or object, the filter will not be applied because the log format doesn't match the filter. For example, both {$.users = 1} and {$.users != 1} will fail to match a log event where users is an array:

```
{
  "users": [1, 2, 3]
}
```

Numeric Comparisons

The metric filter syntax supports precise matching on numeric comparisons. The following numeric comparisons are supported: <, >, >=, <=, =, !=

Numeric filters have a syntax of

```
{ SELECTOR NUMERIC_OPERATOR NUMBER }
```

The metric filter must be enclosed in curly braces { }, to indicate this is a JSON expression. The metric filter is contains the following parts:

SELECTOR
: Specifies what JSON property to check. Property selectors always start with dollar sign ($), which signifies the root of the JSON. Property selectors are alphanumeric strings that also support '-' and '_' characters. Array elements are denoted with [NUMBER] syntax, and must follow a property. Examples are: $.latency, $.numbers[0], $.errorCode, $.processes[4].averageRuntime.

NUMERIC_OPERATOR
: Can be one of the following: =, !=, <, >, <=, or >=.

NUMBER
: An integer with an optional + or - sign, a decimal with an optional + or - sign, or a number in scientific notation, which is an integer or a decimal with an optional + or - sign, followed by 'e', followed by an integer with an optional + or - sign.

Examples:

```
{ $.latency >= 500 }
{ $.numbers[0] < 10e3 }
{ $.numbers[0] < 10e-3 }
{ $.processes[4].averageRuntime <= 55.5 }
{ $.errorCode = 400 }
{ $.errorCode != 500 }
{ $.latency > +1000 }
```

Metric Filter Value Extraction

You can publish numeric values found in JSON events as metric values to CloudWatch. The following procedure shows how to publish a metric with the latency found in the JSON request `metricFilter: { $.latency = * } metricValue: $.latency`.

To publish a metric with the latency in a JSON request

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, for **Filter Pattern**, type **`{ $.latency = * }`**, and then choose **Assign Metric**.
5. On the **Create Metric Filter and Assign a Metric** screen, choose **Show advanced metric settings**.
6. For **Metric Name**, type **myMetric**.
7. For **Metric Value**, enter **`$.latency`**, and then choose **Create Filter**.

The following log event would publish a value of 50 to the metric **myMetric** following filter creation.

```
{
"latency": 50,
"requestType": "GET"
}
```

Creating Metric Filters

The following examples show how to create metric filters.

Examples

- Example: Count Log Events (p. 28)
- Example: Count Occurrences of a Term (p. 29)
- Example: Count HTTP 404 Codes (p. 30)
- Example: Count HTTP 4xx Codes (p. 31)
- Example: Extract Fields from an Apache Log (p. 32)

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.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, leave **Filter Pattern** blank.
5. Choose **Assign Metric**, and then on the **Create Metric Filter and Assign a Metric** screen, for **Filter Name**, type **`MyAppAccessCount`**.
6. Under **Metric Details**, for **Metric Namespace**, type **`MyNameSpace`**.
7. For **Metric Name**, type **`MyAppAccessEventCount`**, and then choose **Create Filter**.

To create a metric filter using the AWS CLI

At a command prompt, run the following command:

```
aws logs put-metric-filter \
  --log-group-name MyApp/access.log \
  --filter-name MyAppAccessCount \
  --filter-pattern "" \
  --metric-transformations \
  metricName=EventCount,metricNamespace=MyNamespace,metricValue=1
```

You can test this new policy by posting any event data. You should see two data points published to the metric EventCount.

To post event data using the AWS 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 no data points are published. When graphing this data in the CloudWatch console, be sure to use the sum statistic.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, for **Filter Pattern**, type **`Error`**.

   Note
   All entries in **Filter Pattern** are case-sensitive.
5. To test your filter pattern, for **Select Log Data to Test**, select the log group to test the metric filter against, and then choose **Test Pattern**.
6. Under **Results**, CloudWatch Logs displays a message showing how many occurrences of the filter pattern were found in the log file.

   To see detailed results, choose **Show test results**.
7. Choose **Assign Metric**, and then on the **Create Metric Filter and Assign a Metric** screen, for **Filter Name**, type **`MyAppErrorCount`**.
8. Under **Metric Details**, for **Metric Namespace**, type **MyNameSpace**.
9. For **Metric Name**, type **ErrorCount**, and then choose **Create Filter**.

To create a metric filter using the AWS 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=EventCount,metricNamespace=MyNamespace,metricValue=1
```

You can test this new policy by posting events containing the word "Error" in the message.

To post events using the AWS 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.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, for **Filter Pattern**, type **`[IP, UserInfo, User, Timestamp, RequestInfo, StatusCode=404, Bytes]`**.
5. To test your filter pattern, for **Select Log Data to Test**, select the log group to test the metric filter against, and then choose **Test Pattern**.
6. Under **Results**, CloudWatch Logs displays a message showing how many occurrences of the filter pattern were found in the log file.

   To see detailed results, choose **Show test results**.
7. Choose **Assign Metric**, and then on the **Create Metric Filter and Assign a Metric** screen, for **Filter Name**, type **HTTP404Errors**.
8. Under **Metric Details**, for **Metric Namespace**, type **`MyNameSpace`**.
9. For **Metric Name**, type **`ApacheNotFoundErrorCount`**, and then choose **Create Filter**.

To create a metric filter using the AWS 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-monitoring-policies** 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 (p. 30) example.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, for **Filter Pattern**, type **`[ip, id, user, timestamp, request, status_code=4*, size]`**.
5. To test your filter pattern, for **Select Log Data to Test**, select the log group to test the metric filter against, and then choose **Test Pattern**.
6. Under **Results**, CloudWatch Logs displays a message showing how many occurrences of the filter pattern were found in the log file.

   To see detailed results, click **Show test results**.
7. Choose **Assign Metric**, and then on the **Create Metric Filter and Assign a Metric** screen, for **Filter Name**, type **`HTTP4xxErrors`**.
8. Under **Metric Details**, for **Metric Namespace**, type **`MyNameSpace`**.
9. For **Metric Name**, type **HTTP4xxErrors**, and then choose **Create Filter**.

To create a metric filter using the AWS 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
```

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

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 extraction rule matches the seven fields of the log event. The metric value is the value of the seventh matched token. You can see the reference to the token as "$7" in the `metricValue` field of the extraction rule.

To create a metric filter using the CloudWatch console

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, select a log group, and then choose **Create Metric Filter**.
4. On the **Define Logs Metric Filter** screen, for **Filter Pattern**, type **`[ip, id, user, timestamp, request, status_code, size]`**.
5. To test your filter pattern, for **Select Log Data to Test**, select the log group to test the metric filter against, and then choose **Test Pattern**.
6. Under **Results**, CloudWatch Logs displays a message showing how many occurrences of the filter pattern were found in the log file.

   To see detailed results, click **Show test results**.
7. Choose **Assign Metric**, and then on the **Create Metric Filter and Assign a Metric** screen, for **Filter Name**, type **size**.
8. Under **Metric Details**, for **Metric Namespace**, type **`MyNameSpace`**.
9. For **Metric Name**, type **`BytesTransferred`**
10. For **Metric Value**, type **`$size`**, and then choose **Create Filter**.

    If the **Metric Value** field isn't visible, choose **Show advanced metric settings**.

To create a metric filter using the AWS 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=4*, size]' \
--metric-transformations \
metricName=BytesTransferred,metricNamespace=MyNamespace,metricValue=$size
```

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.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
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 AWS 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.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. In the contents pane, in the **Metric Filter** column, choose the metric filter.
4. On the **Logs Metric Filters** screen, in the metric filter, choose **Delete Filter**.
5. When prompted for confirmation, choose **Yes, Delete**.

To delete a metric filter using the AWS CLI

At a command prompt, run the following command:

```
aws logs delete-metric-filter --log-group-name MyApp/access.log \
--filter-name MyFilterName
```

Search Log Data Using Filter Patterns

You can search your log data using the Filter and Pattern Syntax (p. 22). You can search all the log streams within a log group, or search a subset of this data. 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.

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.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
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. For **Filter**, type the metric filter syntax to use and then press Enter.

To search all log entries for a time range using the console

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. For **Log Groups**, choose the name of the log group containing the log stream to search.
4. Choose **Search Events**.
5. For **Filter**, type the metric filter syntax to use, select the date and time range, and then press Enter.

Search Log Entries Using the AWS CLI

You can search for log entries that meet a specified criteria using the AWS CLI.

To search log entries using the AWS 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 group.

```
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 AWS 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 2016-10-31T00:00:00] [--end-
time 2016-11-07T00:00:00] [--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.aws.amazon.com/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.aws.amazon.com/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:

- 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 limit your search to only those 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.

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 or AWS Lambda for custom processing, analysis, or loading to other systems. To begin subscribing to log events, create the receiving source, such as an Amazon Kinesis 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 AWS resource, as well as information about where to send matching log events to.

Contents

Concepts

Each subscription filter is made up of the following key elements:

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 would be delivered to the chosen Amazon Kinesis stream if the filter pattern matches with the log events.

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 AWS resource. For more information about the filter pattern syntax, see Filter and Pattern Syntax (p. 22).

destination arn
The Amazon Resource Name (ARN) of the Amazon Kinesis 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 Amazon Kinesis stream. 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.

Using CloudWatch Logs Subscription Filters

You can use a subscription filter with Amazon Kinesis, Lambda, or Firehose.

Examples

Example 1: Subscription Filters with Amazon Kinesis

The following example associates a subscription filter with a log group containing AWS CloudTrail events to have every logged activity made by "Root" AWS credentials delivered to an Amazon Kinesis stream called "RootAccess." For more information about how to send AWS CloudTrail events to CloudWatch Logs, see Sending CloudTrail Events to CloudWatch Logs in the *AWS CloudTrail User Guide*.

To create a subscription filter for Amazon Kinesis

1. Create a destination Amazon Kinesis stream using the following command:

```
 aws kinesis create-stream --stream-name "RootAccess" --shard-count 1
```

2. Wait until the Amazon Kinesis stream becomes Active (this might take a minue or two). You can use the following Amazon Kinesis 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":

 "49551135218688818456679503831981458784591352702181572610"
                }
            }
        ]
    }
}
```

3. Create the IAM role that will grant CloudWatch Logs permission to put data into your Amazon Kinesis stream. First, you'll need to create a trust policy in a file (for example, `~/TrustPolicyForCWL.json`):

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.us-east-1.amazonaws.com" },
    "Action": "sts:AssumeRole"
  }
}
```

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.json
```

```
{
    "Role": {
        "AssumeRolePolicyDocument": {
            "Statement": {
                "Action": "sts:AssumeRole",
                "Effect": "Allow",
                "Principal": {
                    "Service": "logs.us-east-1.amazonaws.com"
                }
            }
        },
        "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.json`):

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:us-east-1:123456789012:stream/
RootAccess"
    },
    {
      "Effect": "Allow",
      "Action": "iam:PassRole",
      "Resource": "arn:aws:iam::123456789012:role/CWLtoKinesisRole"
    }
  ]
}
```

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.json
   ```

7. After the Amazon Kinesis 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 Kinesis stream:

   ```
   aws logs put-subscription-filter \
       --log-group-name "CloudTrail" \
       --filter-name "RootAccess" \
       --filter-pattern "{$.userIdentity.type = Root}" \
       --destination-arn "arn:aws:kinesis:us-east-1:123456789012: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 Amazon Kinesis stream. You can verify that this is happening by grabbing an Amazon Kinesis shard iterator and using the Amazon Kinesis get-records command to fetch some Amazon Kinesis 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 Amazon Kinesis starts to return data.

   You should expect to see a response with an array of records. The **Data** attribute in an Amazon Kinesis 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": "123456789012",
    "logGroup": "CloudTrail",
    "logStream": "123456789012_CloudTrail_us-east-1",
    "subscriptionFilters": [
        "RootAccess"
    ],
    "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 AWS 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 Amazon Kinesis 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 AWS Lambda

In this example, you'll create a CloudWatch Logs subscription filter that sends log data to your AWS Lambda function.

To create a subscription filter for Lambda

1. Create the AWS 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 *AWS 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 = new Buffer(input.awslogs.data, 'base64');
    zlib.gunzip(payload, function(e, result) {
        if (e) {
            context.fail(e);
        } else {
            result = JSON.parse(result.toString('ascii'));
            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 file://file-path/helloWorld.zip \
    --role lambda-execution-role-arn \
    --handler helloWorld.handler \
    --runtime nodejs
```

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.us-east-1.amazonaws.com" \
    --action "lambda:InvokeFunction" \
    --source-arn "arn:aws:logs:us-east-1:123456789123: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:us-
east-1:123456789123: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": [
        "RootAccess"
    ],
    "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 AWS 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 Kinesis 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 Kinesis Firehose delivery system. Data sent from CloudWatch Logs to Amazon Kinesis Firehose is already compressed with gzip level 6 compression, so you do not need to use compression within your Firehose delivery stream.

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 my-bucket --create-bucket-configuration
    LocationConstraint=us-east-1
   ```

   The following is example output:

   ```
   {
       "Location": "/my-bucket"
   }
   ```

2. Create the IAM role that will grant Amazon Kinesis Firehose permission to put data into your Amazon S3 bucket.

   For more information, see Controlling Access with Amazon Kinesis Firehose in the *Amazon Kinesis Firehose Developer Guide*.

   First, create a trust policy in a file `~/TrustPolicyForFirehose.json` as follows, replacing *account-id* with your AWS account ID:

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "firehose.amazonaws.com" },
    "Action": "sts:AssumeRole",
    "Condition": { "StringEquals": { "sts:ExternalId":"account-id" } }
  }
  }
```

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": "logs.us-east-1.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, you'll 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:::my-bucket",
          "arn:aws:s3:::my-bucket/*" ]
    }
  ]
}
```

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:::my-bucket'

```

   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:::my-bucket",
                    "BufferingHints": {
                        "IntervalInSeconds": 300,
                        "SizeInMBs": 5
                    }
                }
            }
        ]
    }
    }
```

8. Create the IAM role that will grant CloudWatch Logs permission to put data into your Firehose delivery stream. First, you'll create a trust policy in a file `~/TrustPolicyForCWL.json`:

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.us-east-1.amazonaws.com" },
    "Action": "sts:AssumeRole"
  }
  }
```

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.us-east-1.amazonaws.com"
                }
            }
        },
        "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, you'll create a permissions policy file (for example, `~/PermissionsForCWL.json`):

```
{
    "Statement":[
      {
        "Effect":"Allow",
        "Action":["firehose:*"],
        "Resource":["arn:aws:firehose:us-east-1:123456789012:*"]
      },
      {
        "Effect":"Allow",
        "Action":["iam:PassRole"],
        "Resource":["arn:aws:iam::123456789012:role/
CWLtoKinesisFirehoseRole"]
      }
    ]
}
```

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 Kinesis 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 Kinesis Firehose delivery stream:

```
aws logs put-subscription-filter \
    --log-group-name "CloudTrail" \
    --filter-name "RootAccess" \
    --filter-pattern "{$.userIdentity.type = Root}" \
    --destination-arn "arn:aws:firehose:us-
east-1:123456789012: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 Kinesis Firehose delivery stream. Your data will start appearing in your Amazon S3 based on the time buffer interval set on your Amazon Kinesis Firehose delivery stream. Once enough time has passed, you can verify your data by checking your Amazon S3 Bucket.

```
aws s3api list-objects --bucket 'my-bucket' --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 'my-bucket' --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
```

Cross-Account Log Data Sharing with Subscriptions

You can collaborate with an owner of a different AWS account and receive their log events on your AWS resources, such as an Amazon Kinesis stream (this is known as cross-account data sharing). For example, this log event data can be read from a centralized Amazon Kinesis 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 Amazon Kinesis to attach the data to their existing security analytic systems.

> **Note**
> Cross-account subscriptions using AWS Lambda is not supported.

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.
- **Log data recipient**—sets up a destination that encapsulates an Amazon Kinesis stream and lets CloudWatch Logs know that the recipient wants to receive log data. The recipient then shares the information about his destination with the sender.

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 AWS resource that you want to use as the destination of the subscription feed.

Role ARN

An AWS Identity and Access Management (IAM) role that grants CloudWatch Logs the necessary permissions to put data into the chosen Amazon Kinesis 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.

Topics

Create a Destination

The following example creates a destination using an Amazon Kinesis stream called RootAccess, and a role that enables CloudWatch Logs to write data to it. Lambda cross-account processing is similar, except you create a Lambda function and use the Amazon Resource Name (ARN) for that function in place of the Amazon Kinesis stream ARN.

To create a destination

1. Create a destination stream in Amazon Kinesis. At a command prompt, type:

```
aws kinesis create-stream --stream-name "RootAccess" --shard-count 1
```

2. Wait until the Amazon Kinesis 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 it will be passed to CloudWatch Logs later:

```
aws kinesis describe-stream --stream-name "RootAccess"
{
  "StreamDescription": {
    "StreamStatus": "ACTIVE",
    "StreamName": "RootAccess",
    "StreamARN": "arn:aws:kinesis:us-east-1:123456789012:stream/
RootAccess",
    "Shards": [
      {
        "ShardId": "shardId-000000000000",
        "HashKeyRange": {
          "EndingHashKey": "34028236692093846346337460743176EXAMPLE",
          "StartingHashKey": "0"
        },
        "SequenceNumberRange": {
          "StartingSequenceNumber":
 "4955113521868881845667950383198145878459135270218EXAMPLE"
        }
      }
    ]
  }
}
```

It might take a minute or two for your stream to show up in the active state.

3. Create the IAM role that will grant CloudWatch Logs the permission to put data into your Amazon Kinesis stream. First, you'll need to create a trust policy in a file **~/TrustPolicyForCWL.json**:

```
{
  "Statement": {
    "Effect": "Allow",
    "Principal": { "Service": "logs.us-east-1.amazonaws.com" },
    "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 that 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",
                "Principal": {
                    "Service": "logs.us-east-1.amazonaws.com"
                }
            }
        },
        "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 which actions CloudWatch Logs can perform on your account. First, you'll create a permissions policy in a file **~/PermissionsForCWL.json**:

```
{
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "kinesis:PutRecord",
      "Resource": "arn:aws:kinesis:us-east-1:123456789012:stream/
RootAccess"
    },
    {
      "Effect": "Allow",
      "Action": "iam:PassRole",
      "Resource": "arn:aws:iam::123456789012:role/CWLtoKinesisRole"
    }
  ]
}
```

6. Associate the permissions policy with the role 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 Amazon Kinesis 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 **DestinationArn** that is returned in the payload:

   ```
   aws logs put-destination \
       --destination-name "testDestination" \
       --target-arn "arn:aws:kinesis:us-east-1:123456789012:stream/
   RootAccess" \
       --role-arn "arn:aws:iam::123456789012:role/CWLtoKinesisRole"

   {
     "DestinationName" : "testDestination",
     "RoleArn" : "arn:aws:iam::123456789012:role/CWLtoKinesisRole",
     "DestinationArn" : "arn:aws:logs:us-
   east-1:123456789012:destination:testDestination",
     "TargetArn" : "arn:aws:kinesis:us-east-1:123456789012:stream/
   RootAccess"
   }
   ```

   b. After step 7a is complete, associate an access policy with the destination. You can put this policy in the **~/AccessPolicy.json** file:

   ```
   {
     "Version" : "2012-10-17",
     "Statement" : [
       {
         "Sid" : "",
         "Effect" : "Allow",
         "Principal" : {
           "AWS" : "234567890123"
         },
         "Action" : "logs:PutSubscriptionFilter",
         "Resource" : "arn:aws:logs:us-
   east-1:123456789012:destination:testDestination"
       }
     ]
   }
   ```

   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 "testDestination" \
       --access-policy file://~/AccessPolicy.json
   ```

   This access policy allows the root user of the AWS Account with ID 234567890123 to call **PutSubscriptionFilter** against the destination with ARN arn:aws:logs:us-east-1:123456789012: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*.

Create a Subscription Filter

After you create a destination, you can share the destination ARN (arn:aws:logs:us-east-1:123456789012:destination:testDestination) with other cross-account users so that they can send you their log events. The cross-account 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.

In the following example, a subscription filter is associated with a log group containing AWS CloudTrail events so that every logged activity made by "Root" AWS credentials delivered to the destination you created above that encapsulates an Amazon Kinesis stream called "RootAccess". For more information about how to send AWS CloudTrail events to CloudWatch Logs, see Sending CloudTrail Events to CloudWatch Logs in the *AWS CloudTrail User Guide*.

```
aws logs put-subscription-filter \
    --log-group-name "CloudTrail" \
    --filter-name "RootAccess" \
    --filter-pattern "{$.userIdentity.type = Root}" \
    --destination-arn "arn:aws:logs:us-
east-1:123456789012:destination:testDestination"
```

Note
Unlike the subscriptions example Real-time Processing of Log Data with Subscriptions (p. 37), in this example you did not have to provide a role-arn. This is because role-arn is needed for impersonation while writing to an Amazon Kinesis stream, which has already been provided by the destination owner while creating destination.

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 Amazon Kinesis stream that is encapsulated within the destination stream called "**RootAccess**". The destination owner can verify that this is happening by using the **aws kinesis get-shard-iterator** command to grab an Amazon Kinesis shard, and using the **aws kinesis get-records** command to fetch some Amazon Kinesis 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+IWiKEXAMPLE"
}
```

```
aws kinesis get-records \
      --limit 10 \
      --shard-iterator
      "AAAAAAAAAAFGU/
kLvNggvndHq2UIFOw5PZc6F01s3e3afsSscRM70JSbjIefg2ub07nk1y6CDxYR1UoGHJNP4m4NFUetzfL
+wev+e2P4djJg4L9wmXKvQYoE+rMUiFq
+p4Cn3IgvqOb5dRA0yybNdRcdzvnC35KQANoHzzahKdRGb9v4scv+3vaq+f+OIK8zM5My8ID
+g6rMo7UKWeI4+IWiKEXAMPLE"
```

Note
You may need to rerun the get-records command a few times before Amazon Kinesis starts to return data.

You should see a response with an array of Amazon Kinesis records. The data attribute in the Amazon Kinesis record is Base64 encoded and compressed in gzip format. 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": "123456789012",
    "logGroup": "CloudTrail",
    "logStream": "123456789012_CloudTrail_us-east-1",
    "subscriptionFilters": [
        "RootAccess"
    ],
    "messageType": "DATA_MESSAGE",
    "logEvents": [
        {
            "id": "31953106606966983378809025079804211143289615424298EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type
\":\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type
\":\"Root\"}"
        },
        {
            "id": "31953106606966983378809025079804211143289615424298EXAMPLE",
            "timestamp": 1432826855000,
            "message": "{\"eventVersion\":\"1.03\",\"userIdentity\":{\"type
\":\"Root\"}"
        }
    ]
}
```

The key elements in this data structure are as follows:

owner
The AWS 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 Amazon Kinesis 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.

Modifying 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 **PutDestinationPolicy** action on your destination with new access policy. In the following example, a previously added account **234567890123** is stopped from sending any more log data, and account **345678901234** 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::123456789012:role/CWLtoKinesisRole",
     "DestinationArn": "arn:aws:logs:us-
east-1:123456789012:destination:testDestination",
     "TargetArn": "arn:aws:kinesis:us-east-1:123456789012:stream/
RootAccess",
     "AccessPolicy": "{\"Version\": \"2012-10-17\", \"Statement\":
 [{\"Sid\": \"\", \"Effect\": \"Allow\", \"Principal\": {\"AWS\":
 \"234567890123\"}, \"Action\": \"logs:PutSubscriptionFilter\", \"Resource
\": \"arn:aws:logs:us-east-1:123456789012:destination:testDestination
\"}] }"
   }
 ]
}
```

2. Update the policy to reflect that account **234567890123** is stopped, and that account **345678901234** is enabled. Put this policy in the **~/NewAccessPolicy.json** file:

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "345678901234"
      },
      "Action" : "logs:PutSubscriptionFilter",
      "Resource" : "arn:aws:logs:us-
east-1:123456789012: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 **234567890123**. Log events from account ID **345678901234** start flowing to the destination as soon as the owner of account **345678901234** creates a subscription filter using **PutSubscriptionFilter**.

Exporting Log Data to Amazon S3

You can export log data from your log groups to an Amazon S3 bucket and use this data in custom processing and analysis, or to load onto other systems.

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 Amazon S3 bucket and define Amazon S3 lifecycle rules to archive or delete exported files automatically.

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.

Log data can take up to 12 hours to become available for export. For near real-time analysis of log data, see Real-time Processing of Log Data with Subscriptions (p. 37) 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 Amazon 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 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 Amazon 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 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 example, you'll 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."

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 Amazon S3 bucket must reside in the same region as the log data to export. CloudWatch Logs does not support exporting data to Amazon S3 buckets in a different region.

To create an Amazon S3 bucket

1. Open the Amazon S3 console at https://console.aws.amazon.com/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**, type a name for the bucket.
5. For **Region**, select the region where your CloudWatch Logs data resides.
6. Choose **Create**.

Step 2: Set Permissions on an Amazon S3 Bucket

By default, all Amazon S3 buckets and objects are private. Only the resource owner, the AWS account that created the bucket, can access the bucket and any objects it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

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**, **Add bucket policy**.
3. In the **Bucket Policy Editor** dialog box, add the following policy, changing `Resource` to the name of your S3 bucket and `Principal` to the endpoint of the region where you are exporting log data.

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
          "Action": "s3:GetBucketAcl",
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs",
          "Principal": { "Service": "logs.us-west-2.amazonaws.com" }
      },
      {
          "Action": "s3:PutObject" ,
          "Effect": "Allow",
          "Resource": "arn:aws:s3:::my-exported-logs/*",
          "Condition": { "StringEquals": { "s3:x-amz-acl": "bucket-owner-
full-control" } },
          "Principal": { "Service": "logs.us-west-2.amazonaws.com" }
      }
    ]
}
```

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 Amazon S3 bucket. The bucket owner has full permissions on all of the exported objects.

   Caution
   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 are appropriate for the users who will access the bucket.

Step 3: 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. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. On the **Log Groups** screen, select the checkbox next to a log group, and then choose **Actions**, **Export data to Amazon S3**.
4. On the **Export data to Amazon S3** screen, under **Define data to export**, set the time range for the data to export using **From** and **To**.
5. 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**, type the log stream prefix.
6. Under **Choose S3 bucket**, choose the account associated with the Amazon S3 bucket.
7. For **S3 bucket name**, choose an Amazon S3 bucket.
8. To separate log data for each export task, you can specify an Amazon S3 prefix to be used as the Amazon S3 key prefix for all exported objects. Choose **Advanced**, and then for **S3 Bucket prefix**, type the bucket prefix.
9. Choose **Export data** to export your log data to Amazon S3.
10. To view the status of the log data that you exported to Amazon S3, choose **Actions**, **View all exports to Amazon S3**.

Export Log Data to Amazon S3 Using the AWS CLI

In the following example, you'll 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."

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 Amazon S3 bucket must reside in the same region as the log data to export. CloudWatch Logs does not support exporting data to Amazon S3 buckets in a different region.

To create an Amazon S3 bucket using the AWS 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 Permissions on an Amazon S3 Bucket

By default, all Amazon S3 buckets and objects are private. Only the resource owner, the AWS account that created the bucket, can access the bucket and any objects it contains. However, the resource owner can choose to grant access permissions to other resources and users by writing an access policy.

To set permissions on an Amazon S3 bucket

1. Create a file named policy.json and add the following access policy, changing `Resource` to the name of your S3 bucket and `Principal` to the endpoint of the region where you are exporting log data.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Action": "s3:GetBucketAcl",
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::my-exported-logs",
            "Principal": { "Service": "logs.us-west-2.amazonaws.com" }
        },
        {
            "Action": "s3:PutObject" ,
            "Effect": "Allow",
            "Resource": "arn:aws:s3:::my-exported-logs/*",
            "Condition": { "StringEquals": { "s3:x-amz-acl": "bucket-
owner-full-control" } },
            "Principal": { "Service": "logs.us-west-2.amazonaws.com" }
        }
    ]
}
```

2. Set the policy that you just added as the access policy on your bucket using the put-bucket-policy command. This policy enables CloudWatch Logs to export log data to your Amazon 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
   ```

   Caution
   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 are appropriate for the users who will access the bucket.

Step 3: Create an Export Task

After you create the export task for exporting logs from a log group, the export task might take anywhere from a few seconds to a few hours, depending on the size of the data to export.

To create an export task using the AWS CLI

At a command prompt, use the following create-export-task command to create the export task:

```
aws logs create-export-task --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:

```
{
    "task-id": "cda45419-90ea-4db5-9833-aade86253e66"
}
```

Step 4: Describe Export Tasks

After you create an export task, you can get the current status of the task.

To describe export tasks using the AWS CLI

At a command prompt, use the following describe-export-tasks command:

```
aws logs 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",
      "To": 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 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
   }]
}
```

Step 5: Cancel an Export Task

You can cancel an export task if it is in either the PENDING or the RUNNING state.

To cancel an export task using the AWS CLI

At a command prompt, use the following cancel-export-task command:

```
aws logs cancel-export-task --task-id "cda45419-90ea-4db5-9833-aade86253e66"
```

Note that you can use the describe-export-task command to verify that the task was canceled successfully.

Streaming CloudWatch Logs Data to Amazon Elasticsearch Service

You can configure a CloudWatch Logs log group to stream data it receives to your Amazon Elasticsearch Service (Amazon ES) cluster in near real-time through a CloudWatch Logs subscription. For more information, see Real-time Processing of Log Data with Subscriptions (p. 37).

> **Note**
> Streaming large amounts of CloudWatch Logs data to Amazon ES might result in high usage charges. We recommend that you monitor your AWS bill to help avoid higher-than-expected charges. For more information, see Monitor Your Estimated Charges Using CloudWatch.

Prerequisties

Before you begin, create an Amazon ES domain with default settings. You might want to review your Amazon ES domain settings later, and modify you cluster configuration based on the amount of data your cluster will be processing.

For more information about Amazon ES, see the Amazon Elasticsearch Service Developer Guide.

To create an Amazon ES domain

At a command prompt, use the following create-elasticsearch-domain command:

```
aws es create-elasticsearch-domain –-domain-name my-domain
```

Subscribe a Log Group to Amazon ES

You can use the CloudWatch console to subscribe a log group to Amazon ES.

To subscribe a log group to Amazon ES

1. Open the CloudWatch console at https://console.aws.amazon.com/cloudwatch/.
2. In the navigation pane, choose **Logs**.
3. Select the checkbox next to the log group.

4. Choose **Actions**, **Stream to Amazon Elasticsearch Service**.
5. On the **Start Streaming to Amazon Elasticsearch Service** screen, for **Amazon ES cluster**, choose the cluster you created in the previous step, and then choose **Next**.
6. Under **Lambda Function**, for **Lambda IAM Execution Role**, choose the IAM role that Lambda should use when executing calls to Amazon ES, and then choose **Next**.
7. On the **Configure Log Format and Filters** screen, for **Log Format**, choose a log format.
8. Under **Subscription Filter Pattern**, type the terms or pattern to find in your log events. This ensures that you send only the data you are interested in to your Amazon ES cluster. For more information, see Searching and Filtering Log Data (p. 21).
9. (Optional) Under **Select Log Data to Test**, select a log stream and then click **Test Pattern** to verify that your search filter is returning the results you expect.
10. Choose **Next**, and then on the **Review & Start Streaming to Amazon Elasticsearch Service** screen, choose **Start Streaming**.

Authentication and Access Control for Amazon CloudWatch Logs

Access to Amazon CloudWatch Logs requires credentials that AWS can use to authenticate your requests. Those credentials must have permissions to access AWS resources, such as to retrieve CloudWatch Logs data about your cloud resources. The following sections provide details on how you can use AWS Identity and Access Management (IAM) and CloudWatch Logs to help secure your resources by controlling who can access them:

- Authentication (p. 66)
- Access Control (p. 67)

Authentication

You can access AWS as any of the following types of identities:

- **AWS account root user** – When you sign up for AWS, you provide an email address and password that is associated with your AWS account. These are your *root credentials* and they provide complete access to all of your AWS resources.

  Important
  For security reasons, we recommend that you use the root credentials only to create an *administrator user*, which is an *IAM user* with full permissions to your AWS account. Then, you can use this administrator user to create other IAM users and roles with limited permissions. For more information, see IAM Best Practices and Creating an Admin User and Group in the *IAM User Guide*.
- **IAM user** – An IAM user is simply an identity within your AWS account that has specific custom permissions (for example, permissions to view metrics in CloudWatch Logs). You can use an IAM user name and password to sign in to secure AWS webpages like the AWS Management Console, AWS Discussion Forums, or the AWS Support Center.

In addition to a user name and password, you can also generate access keys for each user. You can use these keys when you access AWS services programmatically, either through one of the several SDKs or by using the AWS Command Line Interface (AWS CLI). The SDK and CLI tools use the access keys to cryptographically sign your request. If you don’t use the AWS tools, you must sign the request yourself. CloudWatch Logs supports *Signature Version 4*, a protocol for authenticating inbound API requests. For more information about authenticating requests, see Signature Version 4 Signing Process in the *AWS General Reference*.

- **IAM role** – An IAM role is another IAM identity you can create in your account that has specific permissions. It is similar to an *IAM user*, but it is not associated with a specific person. An IAM role enables you to obtain temporary access keys that can be used to access AWS services and resources. IAM roles with temporary credentials are useful in the following situations:

  - **Federated user access** – Instead of creating an IAM user, you can use preexisting user identities from AWS Directory Service, your enterprise user directory, or a web identity provider. These are known as *federated users*. AWS assigns a role to a federated user when access is requested through an identity provider. For more information about federated users, see Federated Users and Roles in the *IAM User Guide*.

  - **Cross-account access** – You can use an IAM role in your account to grant another AWS account permissions to access your account’s resources. For an example, see Tutorial: Delegate Access Across AWS Accounts Using IAM Roles in the *IAM User Guide*.

  - **AWS service access** – You can use an IAM role in your account to grant an AWS service permissions to access your account’s resources. For example, you can create a role that allows Amazon Redshift to access an Amazon S3 bucket on your behalf and then load data stored in the bucket into an Amazon Redshift cluster. For more information, see Creating a Role to Delegate Permissions to an AWS Service in the *IAM User Guide*.

  - **Applications running on Amazon EC2** – Instead of storing access keys within the EC2 instance for use by applications running on the instance and making AWS API requests, you can use an IAM role to manage temporary credentials for these applications. To assign an AWS role to an EC2 instance and make it available to all of its applications, you can create an instance profile that is attached to the instance. An instance profile contains the role and enables programs running on the EC2 instance to get temporary credentials. For more information, see Using Roles for Applications on Amazon EC2 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 (p. 68)
- Using Identity-Based Policies (IAM Policies) for CloudWatch Logs (p. 71)
- CloudWatch Logs Permissions Reference (p. 75)

Overview of Managing Access Permissions to Your CloudWatch Logs Resources

Every AWS resource is owned by an AWS account, and permissions to create or access a resource are governed by permissions policies. An account administrator can attach permissions policies to IAM identities (that is, users, groups, and roles), and some services (such as AWS Lambda) also support attaching permissions policies to resources.

> **Note**
> An *account administrator* (or administrator user) is a user with administrator privileges. For more information, see IAM Best Practices in the *IAM User Guide*.

When granting permissions, you decide who is getting the permissions, the resources they get permissions for, and the specific actions that you want to allow on those resources.

Topics

CloudWatch Logs Resources and Operations

In CloudWatch Logs the primary resources are log groups 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	arn:aws:logs:*region*:*account-id*:*log_group_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) and AWS Service Namespaces 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 (p. 71).

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 (p. 75).

Understanding Resource Ownership

The AWS account owns the resources that are created in the account, regardless of who created the resources. Specifically, the resource owner is the AWS account of the principal entity (that is, the root account, an IAM 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 AWS account to create a log group, your AWS account is the owner of the CloudWatch Logs resource.
- If you create an IAM user in your AWS account and grant permissions to create CloudWatch Logs resources to that user, the user can create CloudWatch Logs resources. However, your AWS account, to which the user belongs, owns the CloudWatch Logs resources.
- If you create an IAM role in your AWS account with permissions to create CloudWatch Logs resources, anyone who can assume the role can create CloudWatch Logs resources. Your AWS 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 AWS 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 Log Data Sharing with Subscriptions (p. 49).

Topics

Identity-Based Policies (IAM Policies)

You can attach policies to IAM identities. For example, you can do the following:

- **Attach a permissions policy to a user or a group in your account** – To grant a user permissions to view logs in the CloudWatch Logs, console you can attach a permissions policy to a user or group that the user belongs to.
- **Attach a permissions policy to a role (grant cross-account permissions)** – You can attach an identity-based permissions policy to an IAM role to grant cross-account permissions. For example, the administrator in Account A can create a role to grant cross-account permissions to another AWS account (for example, Account B) or an AWS service as follows:
  1. Account A administrator creates an IAM role and attaches a permissions policy to the role that grants permissions on resources in Account A.
  2. Account A administrator attaches a trust policy to the role identifying Account B as the principal who can assume the role.
  3. Account B administrator can then delegate permissions to assume the role to any users in Account B. Doing this allows users in Account B to create or access resources in Account A. The principal in the trust policy an also be an AWS service principal if you want to grant an AWS service permissions to assume the role.

  For more information about using IAM to delegate permissions, see Access Management in the *IAM User Guide*.

The following is an example policy that grants permissions for the `logs:PutLogEvents`, `logs:CreateLogGroup`, and `logs:CreateLogStream` actions on all resources in us-east-1. For log groups, CloudWatch Logs supports identifying specific resources using the resource ARNs (also referred to as resource-level permissions) for some of the API actions. If you want to include all log groups, you must specify the wildcard character (*).

```
{
  "Version" : "2012-10-17",
  "Statement" : [
    {
      "Sid" : "",
      "Effect" : "Allow",
      "Principal" : {
        "AWS" : "234567890123"
      },
      "Action" : [
          "logs:PutLogEvents",
          "logs:CreateLogGroup",
          "logs:CreateLogStream",
      "Resource" : "arn:aws:logs:us-east-1:*:*"
    }
  ]
}
```

For more information about using identity-based policies with CloudWatch Logs, see Using Identity-Based Policies (IAM Policies) for CloudWatch Logs (p. 71). For more information about users, groups, roles, and permissions, see Identities (Users, Groups, and Roles) in the *IAM User Guide*.

Resource-Based Policies

CloudWatch Logs supports resource-based policies for destinations, which you can use to enable cross account subscriptions. For more information, see Create a Destination (p. 50). Destinations can be created using the PutDestination API, and you can add a resource policy to the destination using the PutDestination API. The following example allows another AWS 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 (p. 68) and CloudWatch Logs Permissions Reference (p. 75).

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 (p. 68).
- **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 AWS 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 (p. 75).

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. There are no condition keys specific to CloudWatch Logs. However, there are AWS-wide condition keys that you can use as appropriate. For a complete list of AWS-wide keys, see Available Keys for Conditions in the *IAM User Guide*.

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 (p. 68).

This topic covers the following:

- Permissions Required to Use the CloudWatch Console (p. 72)
- AWS Managed (Predefined) Policies for CloudWatch Logs (p. 74)

- Customer Managed Policy Examples (p. 74)

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 (p. 75).

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 AWS resources in their AWS account. In order to use CloudWatch Logs in the CloudWatch console, you must have permissions from the following services:

- CloudWatch
- CloudWatch Logs
- Amazon ES
- IAM
- Amazon 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 AWS Managed (Predefined) Policies for CloudWatch Logs (p. 74).

You don't need to allow minimum console permissions for users that are making calls only to the AWS CLI or the CloudWatch Logs API.

The full set of permissions required to work with the CloudWatch console are listed below:

- cloudwatch:getMetricData
- cloudwatch:getMetricDataForAccounts
- 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
- logs:cancelExportTask
- logs:createExportTask
- logs:createLogGroup
- logs:createLogStream
- logs:deleteLogGroup
- logs:deleteLogStream
- logs:deleteMetricFilter
- logs:deleteRetentionPolicy
- logs:deleteSubscriptionFilter
- logs:describeExportTasks
- logs:describeLogGroups
- logs:describeLogStreams
- logs:describeMetricFilters
- logs:describeSubscriptionFilters
- logs:filterLogEvents
- logs:getLogEvents
- logs:putMetricFilter
- logs:putRetentionPolicy
- logs:putSubscriptionFilter
- logs:testMetricFilter
- s3:listBuckets

AWS Managed (Predefined) Policies for CloudWatch Logs

AWS addresses many common use cases by providing standalone IAM policies that are created and administered by AWS. Managed policies grant necessary permissions for common use cases so you can avoid having to investigate what permissions are needed. For more information, see AWS Managed Policies in the *IAM User Guide*.

The following AWS managed policies, which you can attach to users in your account, are specific to CloudWatch Logs:

- **CloudWatchLogsFullAccess** – Grants full access to CloudWatch Logs.
- **CloudWatchLogsReadOnlyAccess** – Grants read-only access to CloudWatch Logs.

> **Note**
> You can review these permissions policies by signing in to the IAM console and searching for specific policies there.

You can also create your own custom IAM policies to allow permissions for CloudWatch Logs actions and resources. You can attach these custom policies to the IAM users or groups that require those permissions.

Customer Managed Policy Examples

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, AWS SDKs, or the AWS CLI.

Examples

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

The following policy allows a user read-only access to CloudWatch Logs data.

```
{
   "Version":"2012-10-17",
   "Statement":[
      {
         "Action":[
            "logs:Describe*",
            "logs:Get*",
            "logs:TestMetricFilter",
            "logs:FilterLogEvents"
         ],
         "Effect":"Allow",
         "Resource":"*"
      }
   ]
}
```

CloudWatch Logs Permissions Reference

When you are setting up Access Control (p. 67) 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, and you specify a wildcard character (*) as the resource value in the policy's `Resource` field.

You can use AWS-wide condition keys in your CloudWatch Logs policies to express conditions. For a complete list of AWS-wide keys, see Available 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* Required to create a new log stream in a log group.
DeleteDestination	*logs:DeleteDestination*

CloudWatch Logs API Operations	Required Permissions (API Actions)
	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.
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.
DescribeMetricFilters	*logs:DescribeMetricFilters* Required to view all metrics associated with a log group.
DescribeSubscriptionFilters	*logs:DescribeSubscriptionFilters* Required to view all subscription filters associated with a log group.

CloudWatch Logs API Operations	Required Permissions (API Actions)
FilterLogEvents	*`logs:FilterLogEvents`* Required to sort log events by log group filter pattern.
GetLogEvents	*`logs:GetLogEvents`* Required to retrieve log events from a log stream.
PutDestination	*`logs:PutDestination`* Required to create or update a destination log stream (such as an Amazon 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.
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.
TestMetricFilter	*`logs:TestMetricFilter`* Required to test a filter pattern against a sampling of log event messages.

Logging Amazon CloudWatch Logs API Calls in AWS CloudTrail

AWS CloudTrail is a service that captures API calls made by or on behalf of your AWS account. This information is collected and written to CloudTrail log files that are stored in an Amazon S3 bucket that you specify. CloudTrail logs API calls whenever you use the API, the console, or the AWS CLI. Using the information collected by CloudTrail, you can determine what request was made, the source IP address the request was made from, who made the request, when it was made, and so on.

To learn more about CloudTrail, including how to configure and enable it, see the What is AWS CloudTrail in the *AWS CloudTrail User Guide*.

Contents

CloudWatch Logs Information in CloudTrail

If CloudTrail logging is turned on, calls made to API actions are captured in CloudTrail log files. Every log file entry contains information about who generated the request. For example, if a request is made to create a CloudWatch Logs log stream (`CreateLogStream`), CloudTrail logs the user identity of the person or service that made the request.

The user identity information in the log entry 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 AWS service

For more information, see the CloudTrail userIdentity Element in the *AWS CloudTrail User Guide*.

You can store your CloudTrail log files in your S3 bucket for as long as you want, but you can also define Amazon S3 lifecycle rules to archive or delete log files automatically. By default, your log files are encrypted by using Amazon S3 server-side encryption (SSE).

If you want to be notified upon CloudTrail log file delivery, you can configure CloudTrail to publish Amazon SNS notifications when new log files are delivered. For more information, see Configuring Amazon SNS Notifications for CloudTrail in the *AWS CloudTrail User Guide*.

You can also aggregate CloudTrail log files from multiple AWS regions and multiple AWS accounts into a single S3 bucket. For more information, see Receiving CloudTrail Log Files from Multiple Regions and Receiving CloudTrail Log Files from Multiple Accounts in the *AWS CloudTrail User Guide*.

When logging is turned on, the request and response elements are logged in CloudTrail for these CloudWatch Logs API actions:

- CancelExportTask
- CreateExportTask
- CreateLogGroup
- CreateLogStream
- DeleteDestination
- DeleteLogGroup
- DeleteLogStream
- DeleteMetricFilter
- DeleteRetentionPolicy
- DeleteSubscriptionFilter
- PutDestination
- PutDestinationPolicy
- PutMetricFilter
- PutRetentionPolicy
- PutSubscriptionFilter
- TestMetricFilter

Only request elements are logged in CloudTrail for these CloudWatch Logs API actions:

- DescribeDestinations
- DescribeExportTasks
- DescribeLogGroups
- DescribeLogStreams
- DescribeMetricFilters
- DescribeSubscriptionFilters

The `GetLogEvents`, `PutLogEvents`, and `FilterLogEvents` CloudWatch Logs API actions are not supported.

For more information about the CloudWatch Logs actions, see the Amazon CloudWatch Logs API Reference.

Understanding Log File Entries

CloudTrail log files contain one or more log entries. Each entry lists multiple JSON-formatted events. A log entry 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. The log entries are not an ordered stack trace of the public API calls, so they do not appear in any specific order. Log file entries for all API actions are similar to the examples below.

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

The CloudWatch Logs agent provides an automated way to send log data to CloudWatch Logs from Amazon EC2 instances. The agent is comprised of the following components:

- A plug-in to the AWS CLI that pushes log data to CloudWatch Logs.
- A script (daemon) that runs the CloudWatch Logs `aws logs push` command to send 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 **aws logs push** command. 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

Specifies where the agent logging config file is. This is optional and overrides the default logging configuration. 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 different kinds of files, such as access_log_80 and access_log_443. To specify multiple different kinds of files, add another log stream entry to the configuration file so each kind of log files goes to different log group. 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.

> **Caution**
>
> 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 1000.

batch_size
Specifies the max size of log events in a batch, in bytes, up to 1048576 bytes. The default value is 32768 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 for Linux Instances*.

   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
   ```

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/.

Restart the agent for the changes to take effect:

```
sudo service awslogs restart
```

CloudWatch Logs Agent FAQs

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:logs:*:*:*"
    ]
  }
 ]
}
```

I don't want the CloudWatch Logs agent to create log groups or log streams automatically. How can I create and delete them and prevent the agent from recreating them?

In your IAM policy, you can restrict the agent to only the following operations: `DescribeLogStreams`, `PutLogEvents`.

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`.

Document History

The following table describes the important changes to the Amazon CloudWatch Logs User's Guide.

Change	Description	Release Date
Console improvements	You can navigate from metrics graphs to the associated log groups. For more information, see Pivot from Metrics to Logs (p. 36).	7 November 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 (p. 20).	29 August 2016
Added AWS CloudTrail support for Amazon CloudWatch Logs and new CloudWatch Logs metrics	Added AWS CloudTrail support for CloudWatch Logs. For more information, see Logging Amazon CloudWatch Logs API Calls in AWS CloudTrail (p. 78).	10 March 2016
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 (p. 57).	7 December 2015
Added support for AWS 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, application, 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	July 10, 2014

Change	Description	Release Date
	AWS CLI, or the CloudWatch Logs SDK. For more information, see What is Amazon CloudWatch Logs? (p. 1).	

AWS Glossary

For the latest AWS terminology, see the AWS Glossary in the *AWS General Reference*.