

Logging Services

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CloudTrail - logs all **API calls** (SDK, CLI) between **AWS services** (who can we blame)

Who created this bucket?

Who spun up that expensive EC2 instance?

Who launched this SageMaker Notebook?

- Detect developer misconfiguration
- Detect malicious actors
- Automate responses



CloudWatch is a collection of multiple services

- CloudWatch **Logs** A centralized place to store your cloud services log data or application logs.
- CloudWatch **Metrics** Represents a time-ordered set of data points. A variable to monitor
- CloudWatch **Events (EventBridge)** trigger an event based on a condition eg. ever hour take snapshot of server
- CloudWatch **Alarms** triggers notifications based on metrics
- CloudWatch **Dashboard** create visualizations based on metrics



AWS X-Ray is a **distributed tracing system**. You can use it to pinpoint issues with your microservices.

See how data moves from one app to another, how long it took to move, and if it failed to move forward.

AWS CloudTrail

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AWS CloudTrail is a service that enables governance, compliance, operational auditing, and risk auditing of your AWS account.

AWS CloudTrail is used to monitor API calls and Actions made on an AWS account.

Easily identify which users and accounts made the call to AWS eg.

- **Where** — Source IP Address
- **When** — EventTime
- **Who** — User, UserAgent
- **What** — Region, Resource, Action

```
1 {"Records": [{
2   "eventVersion": "1.0",
3   "userIdentity": {
4     "type": "IAMUser",
5     "principalId": "EX_PRINCIPAL_ID",
6     "arn": "arn:aws:iam::123456789012:user/Worf",
7     "accountId": "123456789012",
8     "accessKeyId": "EXAMPLE_KEY_ID",
9     "userName": "Worf"
10  },
11  "eventTime": "2014-03-24T21:11:59Z",
12  "eventSource": "iam.amazonaws.com",
13  "eventName": "CreateUser",
14  "awsRegion": "us-east-1",
15  "sourceIPAddress": "127.0.0.1",
16  "userAgent": "aws-cli/1.3.2 Python/2.7.5 Windows/10",
17  "requestParameters": {"userName": "LaForge"},
18  "responseElements": {"user": {
19    "createDate": "Mar 24, 2014 9:11:59 PM",
20    "userName": "LaForge",
21    "arn": "arn:aws:iam::123456789012:user/LaForge",
22    "path": "/",
23    "userId": "EXAMPLEUSERID"
24  }}
25 ]}]}
```


AWS CloudTrail

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CloudTrail is already logging by default and will collect logs for **last 90 days** via **Event History**

If you need more than 90 days you need to create a **Trail**

Trails are output to S3 and do not have GUI like Event History. To analyze a Trail you'd have to use **Amazon Athena**.



CloudTrail

Dashboard

Event history

Trails

Learn more

Pricing

Documentation

Forums

FAQs

Event history

Your event history contains the activities taken by people, groups, or AWS services in [supported services](#). It filters out read-only events. You can change or remove that filter, or apply other filters.

You can view the last 90 days of events. Choose an event to view more information about it. To view a console trail and then go to your Amazon S3 bucket or CloudWatch Logs. [Learn more](#)

Can't find what you're looking for? [Run advanced queries in Amazon Athena](#)


Filter: Read only false Time range: Select time range

	Event time	User name	Event name
▶	2019-09-01, 09:33:07 PM	i-014d0d0e482491e69	UpdateInstanceInformation
▶	2019-09-01, 09:30:07 PM	i-08ece9e263d3edfbc	UpdateInstanceInformation
▶	2019-09-01, 09:28:07 PM	i-0984241e0f6a0f9ca	UpdateInstanceInformation
▶	2019-09-01, 09:25:07 PM	i-07a9e824ebb4d5f2b	UpdateInstanceInformation
▶	2019-09-01, 09:23:34 PM	exampro-events	CreateLogStream
▶	2019-09-01, 09:23:07 PM	i-014d0d0e482491e69	UpdateInstanceInformation
▶	2019-09-01, 09:20:07 PM	i-0f5f9d47f3c1cfe6d	UpdateInstanceInformation
▶	2019-09-01, 09:18:07 PM	i-08ece9e263d3edfbc	UpdateInstanceInformation
▶	2019-09-01, 09:15:07 PM	i-07a9e824ebb4d5f2b	UpdateInstanceInformation
▶	2019-09-01, 09:13:51 PM	exampro-metrics	CreateLogStream

CloudWatch Alarms

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A CloudWatch Alarm monitors a **CloudWatch Metric** based on a **defined threshold**.

<input type="checkbox"/>	Name	State	Last state update	Conditions	Actions
<input type="checkbox"/>	Network_In	 In alarm	2020-07-20 13:01:35	NetworkIn > 300 for 1 datapoints within 5 minutes	No actions

When alarm breaches (goes outside the defined threshold) than it changes **state**.

When it changes state we can define what **action it should trigger**.

Metric Alarm States

- **OK** The metric or expression is **within** the defined threshold
- **ALARM** The metric or expression is **outside** of the defined threshold
- **INSUFFICIENT_DATA**
 - The alarm has **just started**
 - the metric is **not available**
 - **Not enough data** is available

Notification

Alarm state trigger
Define the alarm state that will trigger this action.

☒ **In alarm**
The metric or expression is outside of the defined threshold.

☐ **OK**
The metric or expression is within the defined threshold.

☐ **Insufficient data**
The alarm has just started or not enough data is available.

Select an SNS topic
Define the SNS (Simple Notification Service) topic that will receive the notification.

☒ Select an existing SNS topic

☐ Create new topic

☐ Use topic ARN

Add notification

Auto Scaling action

Add Auto Scaling action

EC2 action

This action is only available for EC2 Per-Instance Metrics.

Add EC2 action

- Notification
- Auto Scaling Group
- EC2 Action

CloudWatch Alarms – Anatomy of an Alarm

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Threshold Condition

Defines when a datapoint is breached

Threshold type

☒ Static
Use a value as a threshold

Whenever NetworkIn is...
Define the alarm condition.

☐ Greater
> threshold

☐ Greater or Equal
≥ threshold

than...
Define the threshold value.

100000

Must be a number

Evaluation Periods

number of previous periods

Data point

Represents the metric's measurement at a given period

Period

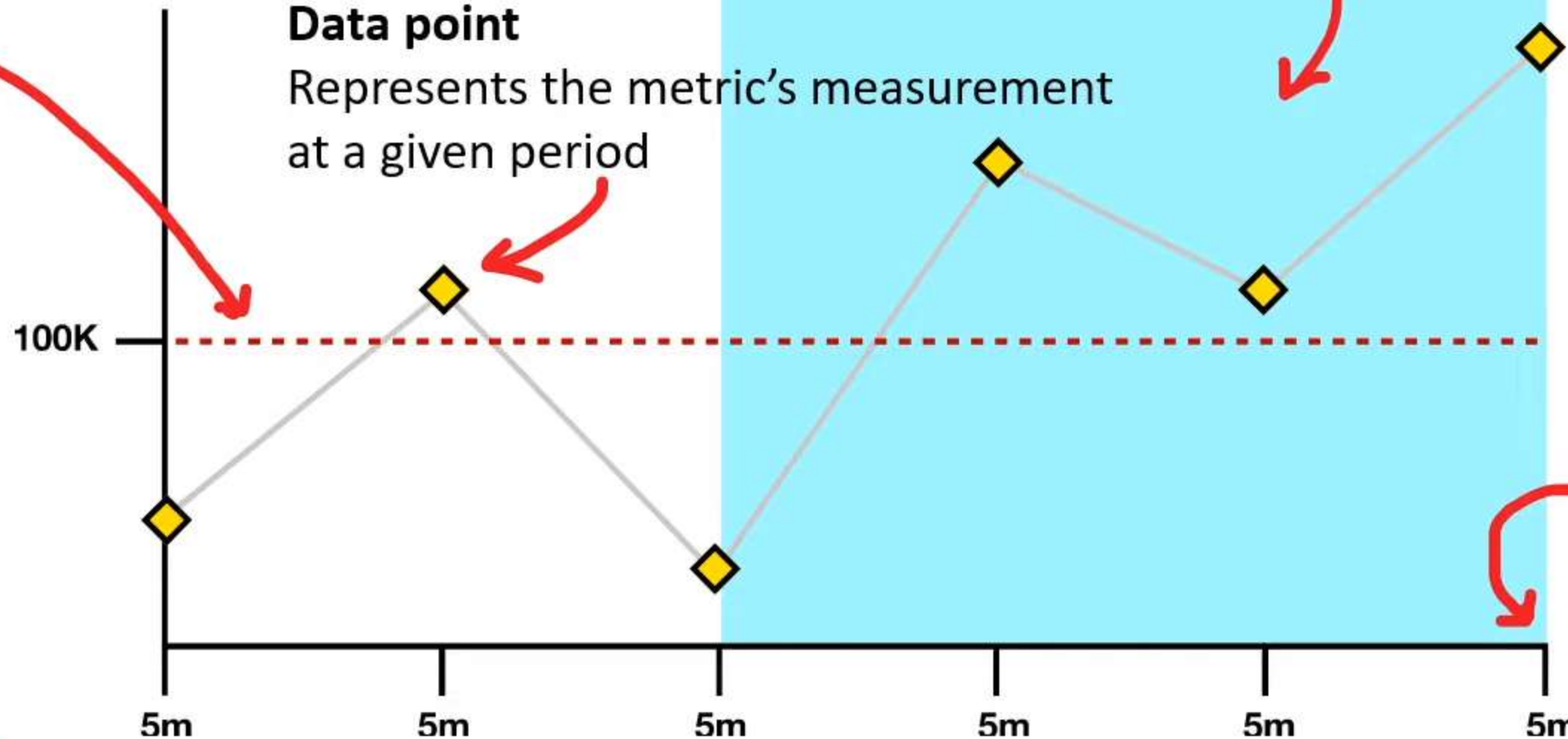
How often it checks to evaluate the Alarm

Period

5 minutes

Metric

The actual data we are measuring



NetworkIn

The volume of incoming network traffic, measured in Bytes. When using 5min monitoring divide by 300 to get Bytes/second

Datapoints to alarm

1 data point is breached in an evaluation period going back 4 periods.
This is what triggers the alarm

Datapoints to alarm
Define the number of datapoints within the evaluation period that must be breaching to cause the alarm to go to ALARM state.

1 out of 4



CloudWatch Logs – Log Streams

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Log Streams

A log stream represents a **sequence of events** from a **application or instance being monitored**.

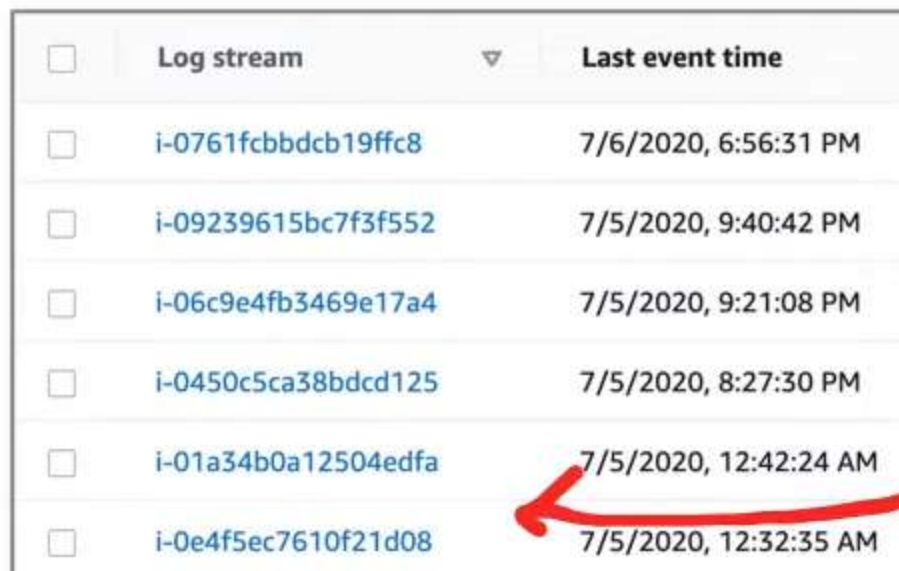


You can create Log Streams manually but generally this is automatically done by the service you are using

Here is a Log Group for a **Lambda function**
You can see here the Log Streams are named after the **running instance**. Lambdas frequently run on new instances so the stream streams contain timestamps

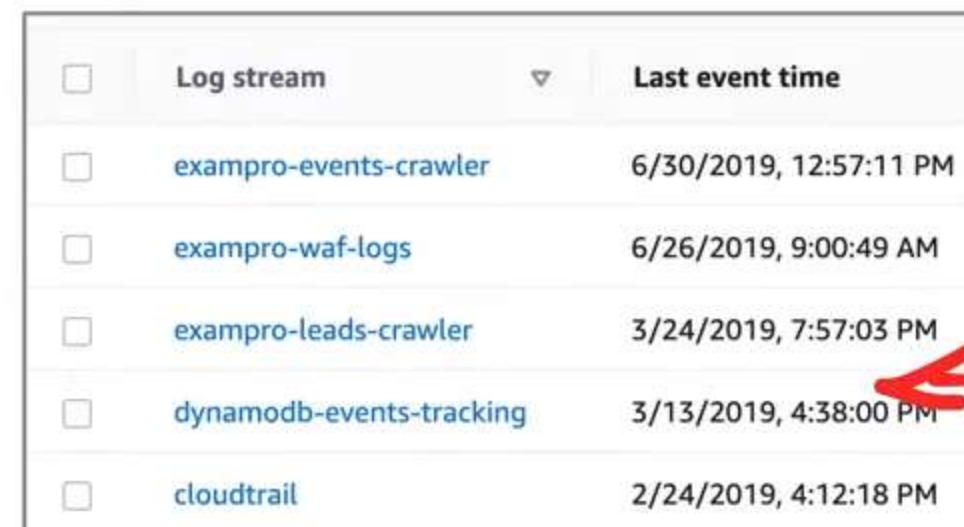


<input type="checkbox"/>	Log stream	Last event time
<input type="checkbox"/>	2020/07/06/[\$LATEST]ebca38579fac4842b531b260d5c35e0e	7/6/2020, 7:41:24 PM
<input checked="" type="checkbox"/>	2020/07/06/[\$LATEST]7679ba0f37b14a3da994cd243963ca60	7/6/2020, 6:14:42 PM
<input type="checkbox"/>	2020/07/06/[\$LATEST]bb7edeb95cb345b48dd151a79367a5d6	7/6/2020, 3:52:56 PM
<input type="checkbox"/>	2020/07/06/[\$LATEST]e1544efd95a4492585b9c8d27ddaea4b	7/6/2020, 1:30:09 PM
<input type="checkbox"/>	2020/07/06/[\$LATEST]86a8ec4dcff746628effaeb82b41e1cc	7/6/2020, 12:28:00 PM
<input type="checkbox"/>	2020/07/06/[\$LATEST]a06263c73f8242e5a0e35b366b3bbdf9	7/6/2020, 10:08:43 AM



<input type="checkbox"/>	Log stream	Last event time
<input type="checkbox"/>	i-0761fcbdbdc19ffc8	7/6/2020, 6:56:31 PM
<input type="checkbox"/>	i-09239615bc7f3f552	7/5/2020, 9:40:42 PM
<input type="checkbox"/>	i-06c9e4fb3469e17a4	7/5/2020, 9:21:08 PM
<input type="checkbox"/>	i-0450c5ca38bdcd125	7/5/2020, 8:27:30 PM
<input type="checkbox"/>	i-01a34b0a12504edfa	7/5/2020, 12:42:24 AM
<input type="checkbox"/>	i-0e4f5ec7610f21d08	7/5/2020, 12:32:35 AM

Here is a Log Group for an **application logs running on EC2** You can see here the Log Streams are named after the **running instance's Instance ID**



<input type="checkbox"/>	Log stream	Last event time
<input type="checkbox"/>	exampro-events-crawler	6/30/2019, 12:57:11 PM
<input type="checkbox"/>	exampro-waf-logs	6/26/2019, 9:00:49 AM
<input type="checkbox"/>	exampro-leads-crawler	3/24/2019, 7:57:03 PM
<input type="checkbox"/>	dynamodb-events-tracking	3/13/2019, 4:38:00 PM
<input type="checkbox"/>	cloudtrail	2/24/2019, 4:12:18 PM

Here is a Log Group for **AWS Glue**. You can see here the Log Streams are named after the **Glue Jobs**.

CloudWatch Logs – Log Events

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Log Events



Represents a single event in a log file. Log events can be seen within a Log Stream.

▶	2020-07-06T20:12:18.079-04:00	START RequestId: e4b5bd10-5d88-4d7b-870c-daf793159b88 Version: \$LATEST
▶	2020-07-06T20:12:18.082-04:00	{"records_size":1}
▶	2020-07-06T20:12:18.093-04:00	{"failed_put_count":0}
▶	2020-07-06T20:12:18.127-04:00	END RequestId: e4b5bd10-5d88-4d7b-870c-daf793159b88
▶	2020-07-06T20:12:18.127-04:00	REPORT RequestId: e4b5bd10-5d88-4d7b-870c-daf793159b88 Duration: 45.32 ms Billed Duration: 100 ms Memory Size: 128

You can use filter events to filter Out logs based on simple or Pattern matching syntax:

Log events



<input type="text" value="D"/>	<input type="button" value="Clear"/>	<input type="button" value="1m"/>	<input type="button" value="30m"/>	<input type="button" value="1h"/>	<input type="button" value="12h"/>	<input type="button" value="custom"/>		
▶	Timestamp	Message						
▶	2020-07-05T21:39:26.857-04:00	D, [2020-07-06T01:39:26.596187 #3979] DEBUG -- : [1m [35m (0.4ms)						
▶	2020-07-05T21:39:26.857-04:00	D, [2020-07-06T01:39:26.614381 #3979] DEBUG -- : [1m [35m (1.5ms)						
▶	2020-07-05T21:39:26.857-04:00	D, [2020-07-06T01:39:26.621670 #3979] DEBUG -- : [1m [36mActiveRec						
▶	2020-07-05T21:39:26.857-04:00	D, [2020-07-06T01:39:26.626819 #3979] DEBUG -- : [1m [35m (0.4ms)						
▶	2020-07-05T21:39:26.857-04:00	D, [2020-07-06T01:39:26.627990 #3979] DEBUG -- : [1m [35m (0.4ms)						

CloudWatch Logs – Log Insights

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CloudWatch Logs Insights enables you to **interactively search and analyze your CloudWatch log data** and has the following advantages:

- more robust filtering than using the simple Filter events in a Log Stream
- Less burdensome than having to export logs to S3 and analyze them via Athena.

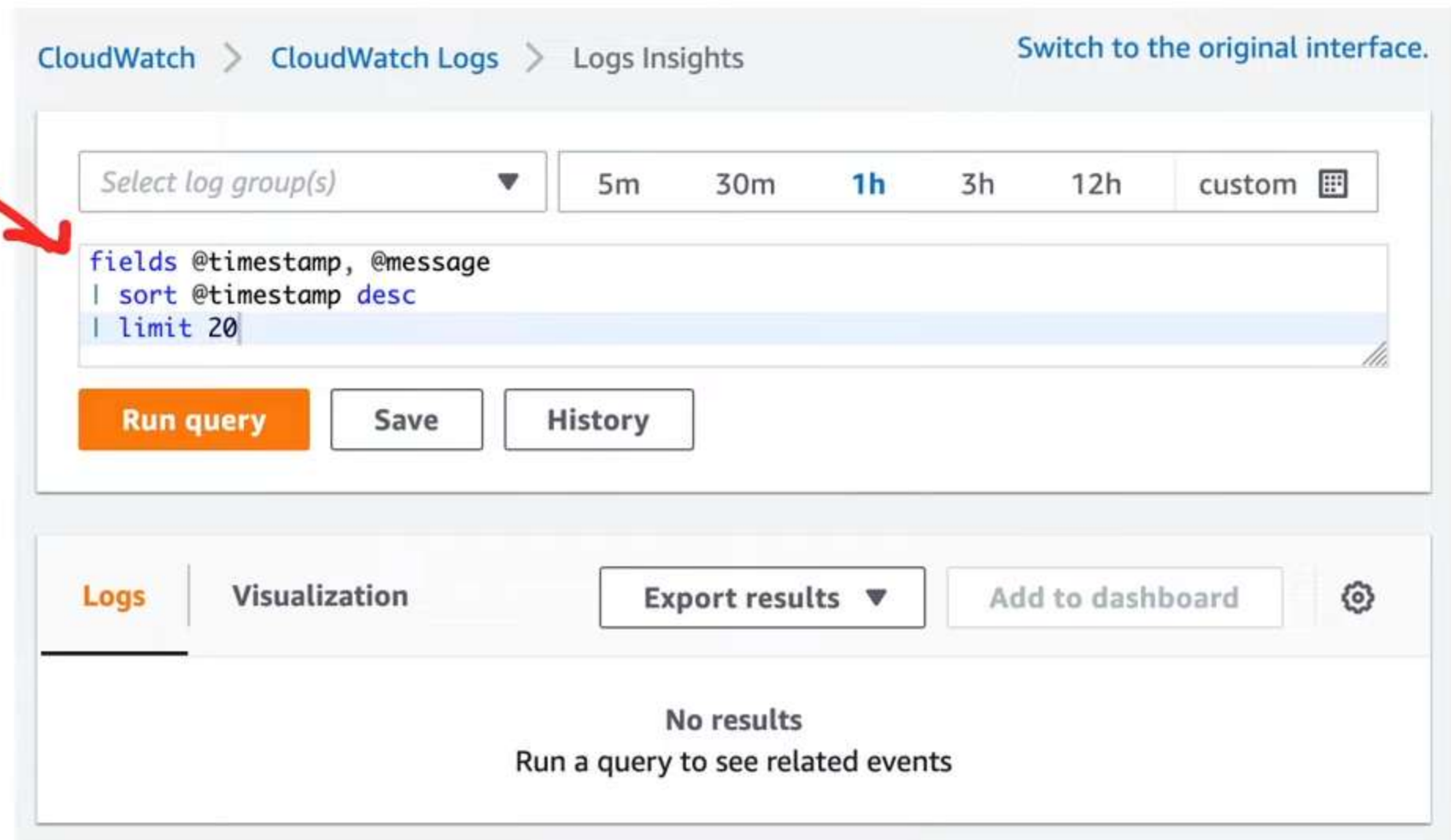
CloudWatch Logs Insights supports all types of logs.

CloudWatch Logs Insights is commonly used via the console to do ad-hoc queries against logs groups.

CloudWatch Insights has its own language called:

- CloudWatch Logs Insights **Query Syntax**

```
filter action="REJECT"  
| stats count(*) as numRejections by srcAddr  
| sort numRejections desc  
| limit 20
```



CloudWatch > CloudWatch Logs > Logs Insights [Switch to the original interface.](#)

Select log group(s) 5m 30m **1h** 3h 12h custom

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

Run query Save History

Logs Visualization Export results Add to dashboard

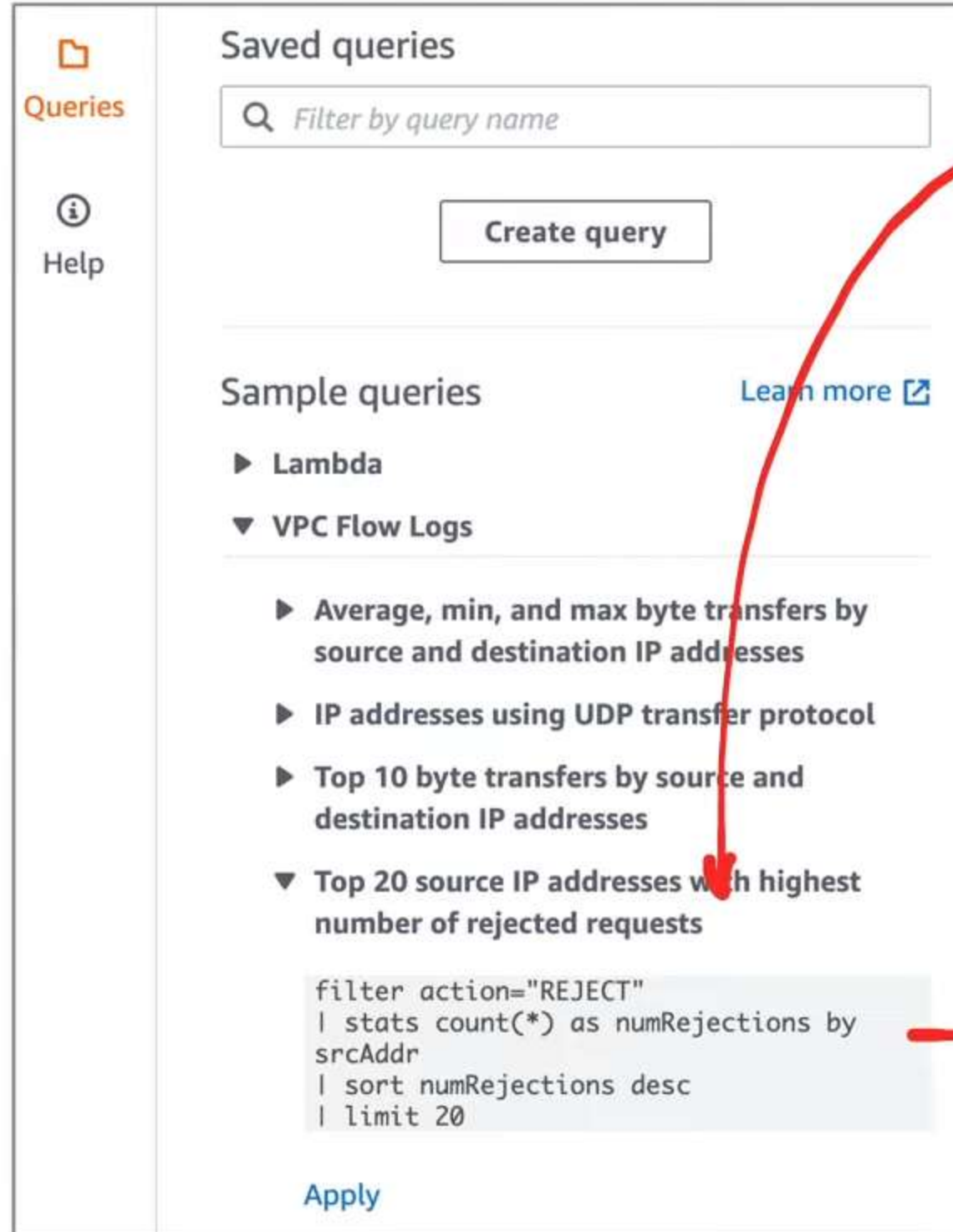
No results
Run a query to see related events

- A single request can query up to **20 log groups**.
- Queries **time out after 15 minutes**, if they have not completed.
- Query results are **available for 7 days**.

CloudWatch Logs – Log Insights

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AWS provides sample queries that can get you started for common tasks, And to ease learning the Query Syntax. A good example is filtering VPC Flow Logs.



Queries

Help

Saved queries

Filter by query name

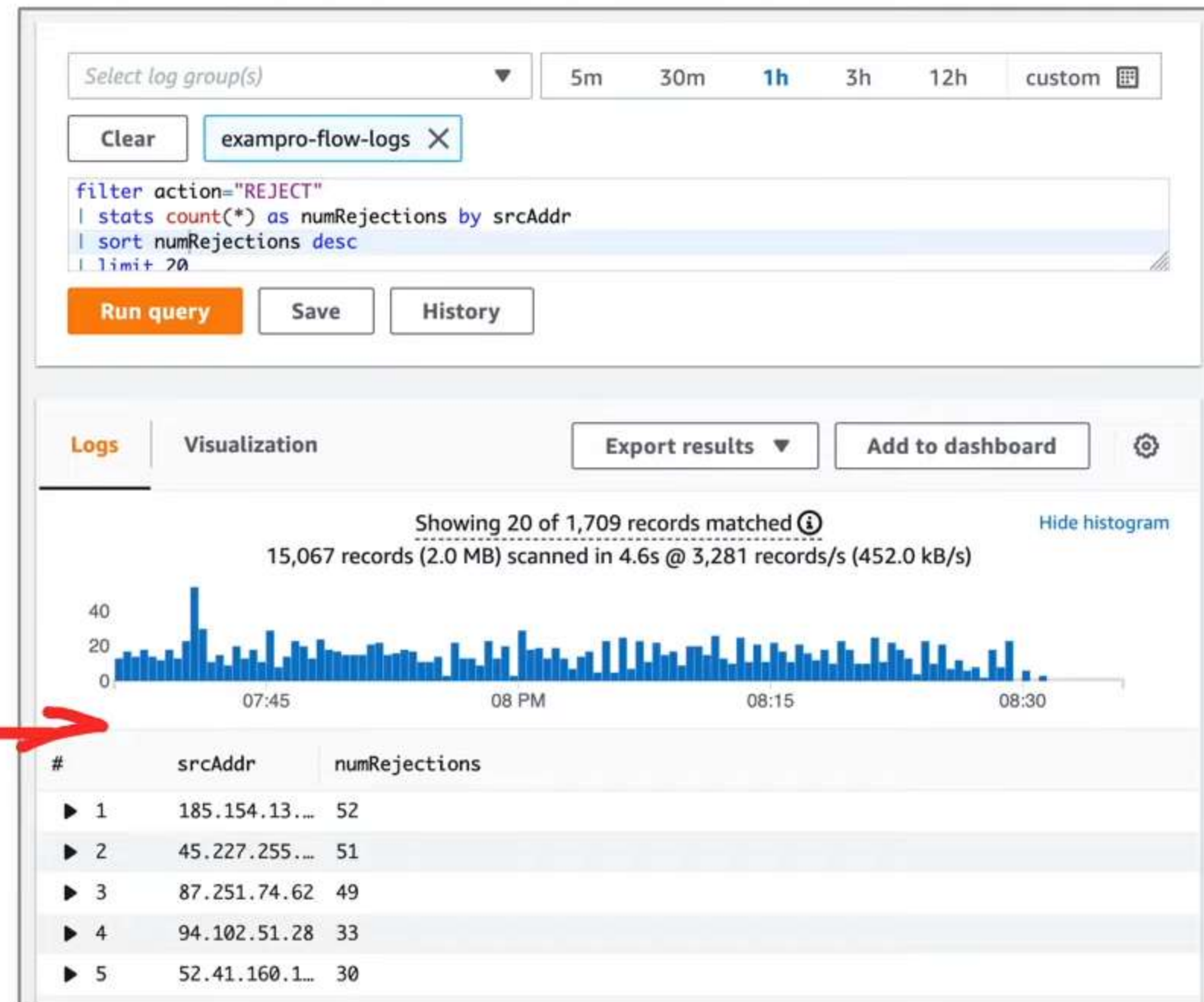
Create query

Sample queries [Learn more](#)

- Lambda
- ▼ VPC Flow Logs
 - Average, min, and max byte transfers by source and destination IP addresses
 - IP addresses using UDP transfer protocol
 - Top 10 byte transfers by source and destination IP addresses
 - ▼ Top 20 source IP addresses with highest number of rejected requests

```
filter action="REJECT"
| stats count(*) as numRejections by srcAddr
| sort numRejections desc
| limit 20
```

Apply



Select log group(s)

5m 30m 1h 3h 12h custom

Clear exampro-flow-logs

```
filter action="REJECT"
| stats count(*) as numRejections by srcAddr
| sort numRejections desc
| limit 20
```

Run query Save History

Logs Visualization

Export results Add to dashboard

Showing 20 of 1,709 records matched ⓘ

15,067 records (2.0 MB) scanned in 4.6s @ 3,281 records/s (452.0 kB/s)

Hide histogram

#	srcAddr	numRejections
► 1	185.154.13...	52
► 2	45.227.255...	51
► 3	87.251.74.62	49
► 4	94.102.51.28	33
► 5	52.41.160.1...	30

You can create and save your own queries to make future repetitive tasks easier.

CloudWatch Metrics

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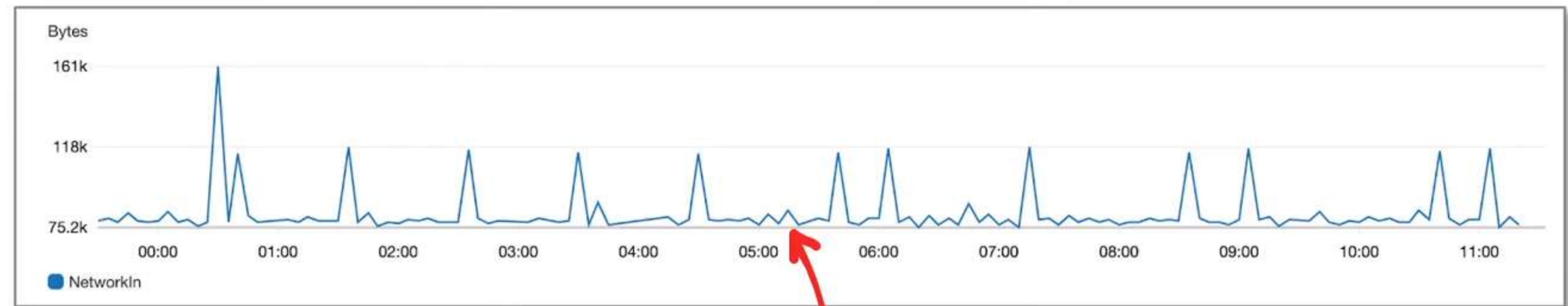
A CloudWatch Metric represents a **time-ordered set of data points**
Its a **variable** that is **monitored over time**.

CloudWatch comes with many **predefined** metrics that are generally name spaced by AWS Service.



EC2 Per-Instance Metrics

- CPUUtilization
- DiskReadOps
- DiskWriteOps
- DiskReadBytes
- DiskWriteBytes
- **NetworkIn**
- NetworkOut
- NetworkPacketsIn
- NetworkPacketsOut



AWS Namespaces		
ApiGateway 21 Metrics	ApplicationELB 75 Metrics	Billing 104 Metrics
CloudFront 30 Metrics	CodeBuild 28 Metrics	DynamoDB 98 Metrics
EBS 216 Metrics	EC2 640 Metrics	Events 9 Metrics