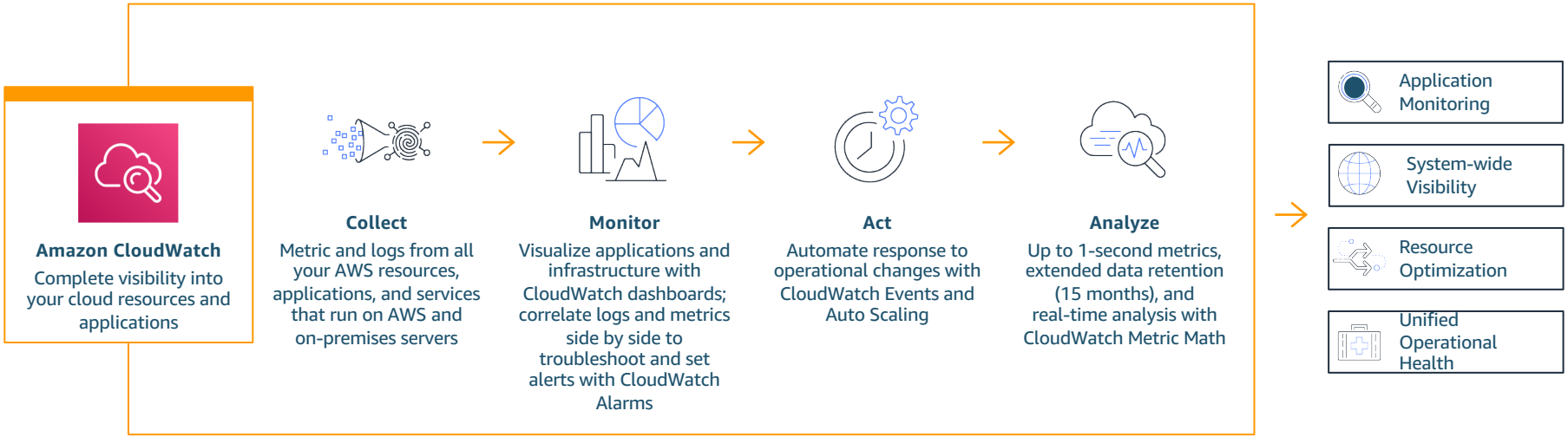
Solutions Architect Professional

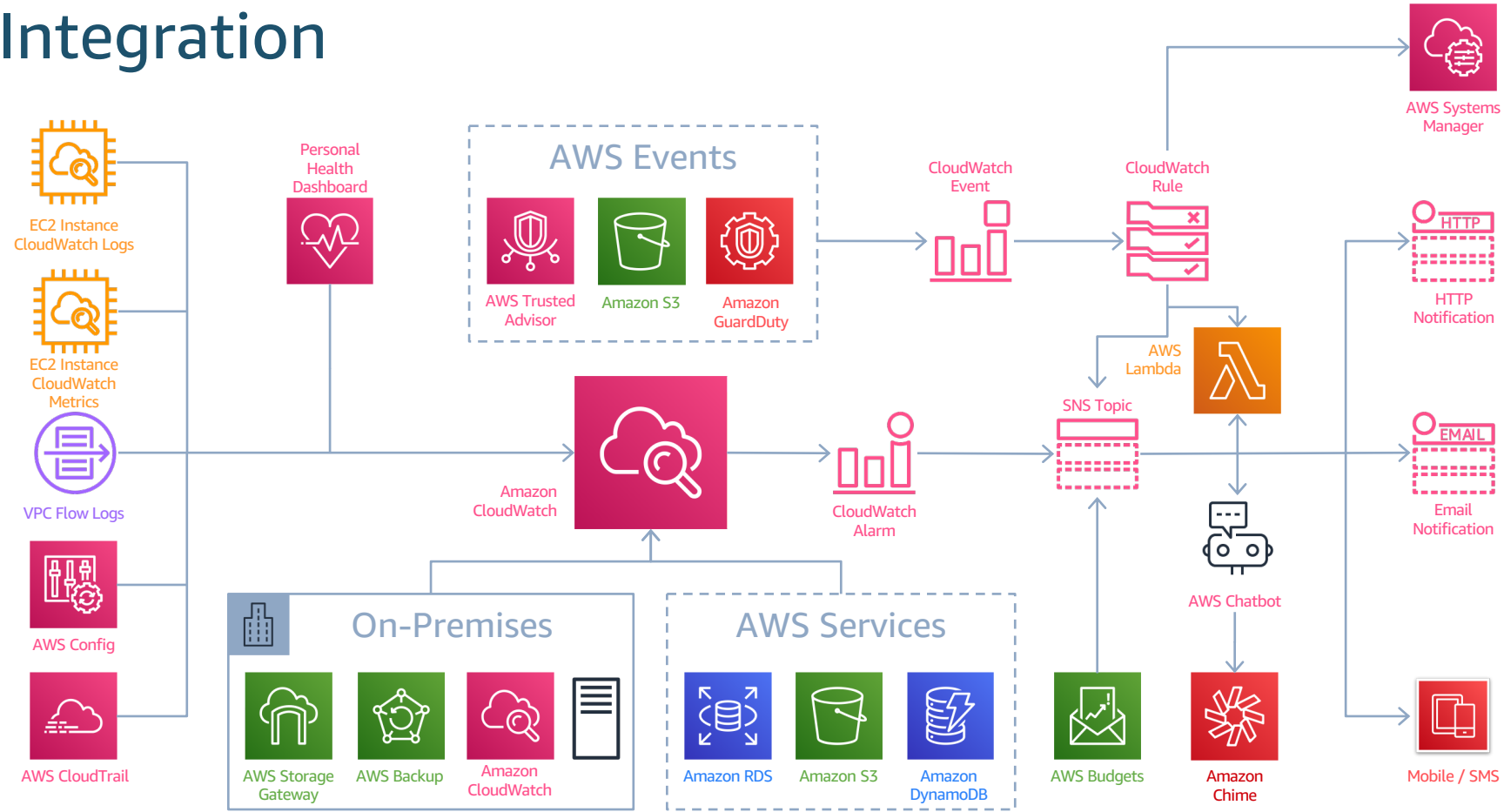
Deployment and Operations

CloudWatch

How it works


Amazon CloudWatch
Complete visibility into your cloud resources and applications
Collect
Metric and logs from all your AWS resources, applications, and services that run on AWS and on-premises servers
Monitor
Visualize applications and infrastructure with CloudWatch dashboards; correlate logs and metrics side by side to troubleshoot and set alerts with CloudWatch Alarms
Act
Automate response to operational changes with CloudWatch Events and Auto Scaling
Analyze
Up to 1-second metrics, extended data retention (15 months), and real-time analysis with CloudWatch Metric Math
Application Monitoring
System-wide Visibility
Resource Optimization
Unified Operational Health

Integration



Collect

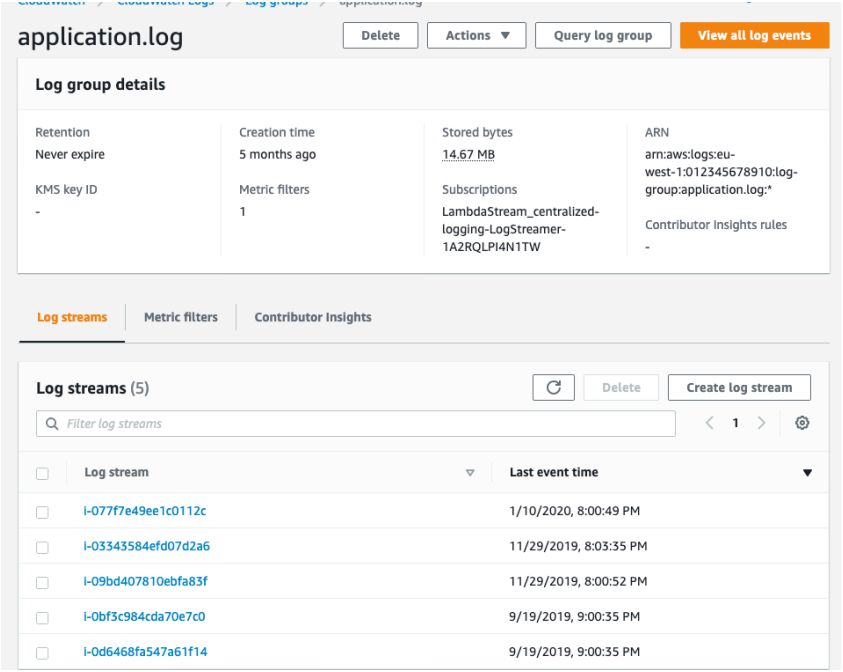
Easily collect and store logs

The Amazon CloudWatch Logs service allows you to collect and store logs from your resources, applications, and services in near real-time.

Collect logs from:

- Amazon EC2 instances
- On-premises servers
- VPC Flow Logs
- AWS CloudTrail
- AWS Lambda
- Other AWS Services

Log data can be stored and accessed indefinitely in highly durable, low-cost storage so you don't have to worry about filling up hard drives.

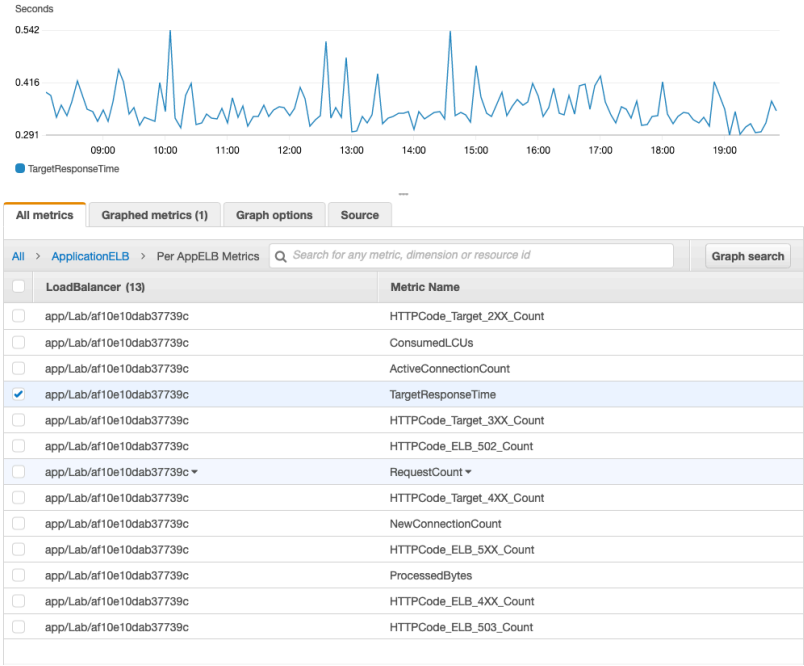


Built-in metrics

Collecting metrics is time consuming. Amazon CloudWatch allows you to collect default metrics from more than 70 AWS services, such as:

- Amazon EC2
- Amazon DynamoDB
- Amazon S3
- Amazon ECS
- AWS Lambda
- Amazon API Gateway

No action is required on your part. For example, EC2 instances automatically publish CPU utilization, data transfer, and disk usage metrics to help you understand changes in state.



Built-in metrics

Service	Namespace	Service	Namespace	Service	Namespace
Amazon API Gateway	AWS/ApiGateway	Amazon ElastiCache for Memcached	AWS/ElastiCache	Amazon Neptune	AWS/Neptune
AppStream 2.0	AWS/AppStream	Amazon ElastiCache for Redis	AWS/ElastiCache	AWS OpsWorks	AWS/OpsWorks
AWS AppSync	AWS/AppSync	Amazon Elasticsearch Service	AWS/ES	Amazon Polly	AWS/Polly
Amazon Athena	AWS/Athena	Amazon EMR	AWS/ElasticMapReduce	Amazon QLDB	AWS/QLDB
AWS Billing and Cost Management	AWS/Billing	AWS Elemental MediaConnect	AWS/MediaConnect	Amazon Redshift	AWS/Redshift
ACM Private CA	AWS/ACMPrivateCA	AWS Elemental MediaConvert	AWS/MediaConvert	Amazon Relational Database Service	AWS/RDS
AWS Chatbot	AWS/Chatbot	AWS Elemental MediaPackage	AWS/MediaPackage	AWS RoboMaker	AWS/Robomaker
Amazon CloudFront	AWS/CloudFront	AWS Elemental MediaStore	AWS/MediaStore	Amazon Route 53	AWS/Route53
AWS CloudHSM	AWS/CloudHSM	AWS Elemental MediaTailor	AWS/MediaTailor	Amazon SageMaker	AWS/SageMaker
Amazon CloudSearch	AWS/CloudSearch	Amazon EventBridge	AWS/Events	AWS SDK Metrics for Enterprise Support	AWS/SDKMetrics
Amazon CloudWatch Logs	AWS/Logs	Amazon FSx for Lustre	AWS/FSx	AWS Service Catalog	AWS/ServiceCatalog
AWS CodeBuild	AWS/CodeBuild	Amazon FSx for Windows File Server	AWS/FSx	AWS Shield Advanced	AWS/DDoSProtection
Amazon Cognito	AWS/Cognito	Amazon GameLift	AWS/GameLift	Amazon Simple Email Service	AWS/SES
Amazon Connect	AWS/Connect	AWS Glue	AWS/Glue	Amazon Simple Notification Service	AWS/SNS
AWS DataSync	AWS/DataSync	AWS Ground Station	AWS/GroundStation	Amazon Simple Queue Service	AWS/SQS
AWS Database Migration Service	AWS/DMS	Amazon Inspector	AWS/Inspector	Amazon Simple Storage Service	AWS/S3
AWS Direct Connect	AWS/DX	AWS IoT	AWS/IoT	Amazon Simple Workflow Service	AWS/SWF
Amazon DocumentDB	AWS/DocDB	AWS IoT Analytics	AWS/IoTAnalytics	AWS Step Functions	AWS/States
Amazon DynamoDB	AWS/DynamoDB	AWS IoT SiteWise	AWS/IoTSiteWise	AWS Storage Gateway	AWS/StorageGateway
Amazon EC2	AWS/EC2	AWS IoT Things Graph	AWS/ThingsGraph	AWS Systems Manager Run Command	AWS/SSM-RunCommand
Amazon EC2 Spot Fleet	AWS/EC2Spot	AWS Key Management Service	AWS/KMS	Amazon Textract	AWS/Textract
Amazon EC2 Auto Scaling	AWS/AutoScaling	Amazon Keyspaces (for Apache Cassandra)	AWS/Cassandra	AWS Transfer for SFTP	AWS/Transfer
AWS Elastic Beanstalk	AWS/ElasticBeanstalk	Amazon Kinesis Data Analytics	AWS/KinesisAnalytics	Amazon Translate	AWS/Translate
Amazon Elastic Block Store	AWS/EBS	Amazon Kinesis Data Firehose	AWS/Firehose	AWS Trusted Advisor	AWS/TrustedAdvisor
Amazon Elastic Container Service	AWS/ECS	Amazon Kinesis Data Streams	AWS/Kinesis	Amazon VPC	AWS/NATGateway
Amazon Elastic File System	AWS/EFS	Amazon Kinesis Video Streams	AWS/KinesisVideo	Amazon VPC	AWS/TransitGateway
Amazon Elastic Inference	AWS/ElasticInference	AWS Lambda	AWS/Lambda	Amazon VPC	AWS/VPN
Elastic Load Balancing	AWS/ApplicationELB	Amazon Lex	AWS/Lex	AWS WAF	WAF
Elastic Load Balancing	AWS/ELB	Amazon Machine Learning	AWS/ML	Amazon WorkMail	AWS/WorkMail
Elastic Load Balancing	AWS/NetworkELB	Amazon Managed Streaming for Apache Kafka	AWS/Kafka	Amazon WorkSpaces	AWS/WorkSpaces
Amazon Elastic Transcoder	AWS/ElasticTranscoder	Amazon MQ	AWS/AmazonMQ		

AWS Services That Publish CloudWatch Metrics:

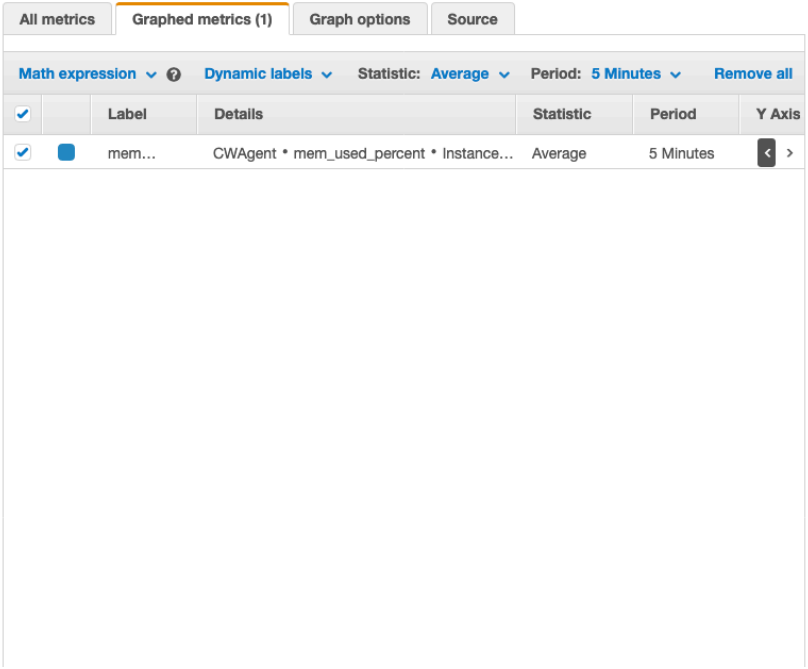
https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/aws-services-cloudwatch-metrics.html

aws

Custom metrics

Collect custom metrics from your own applications to monitor operational performance, troubleshoot issues, and spot trends. User activity is an example of a custom metric you can collect and monitor over a period of time.

- Publish metrics using the AWS CLI or an API
- Standard resolution, with a one-minute granularity
- High resolution, with a granularity of one second
- Aggregate data before you publish to CloudWatch
- StatsD and collectd support via CloudWatch Agent

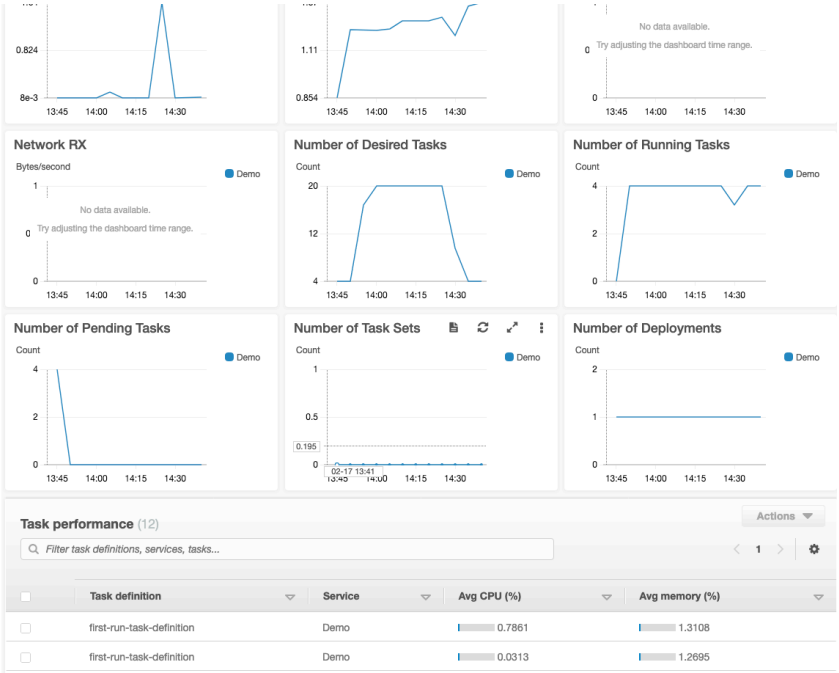


aws

Collect and aggregate container metrics and logs

Use CloudWatch Container Insights to collect, aggregate, and summarize metrics and logs from your containerized applications and microservices.

- Collects metrics from each container
  - CPU
  - Memory
  - Disk
  - Network
- Automatically generated dashboards
- Set alarms on metrics



Monitor

Unified operational view with dashboards

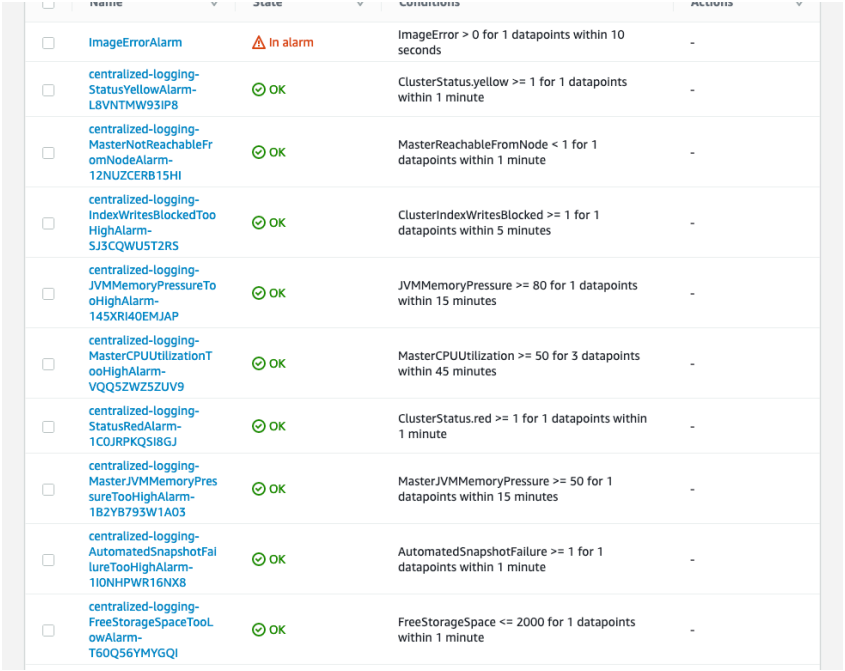
Amazon CloudWatch dashboards enable you to create re-usable graphs and visualize your cloud resources and applications in a unified view.

- A single view for selected metrics and alarms
- Multiple AWS accounts and multiple Regions.
- An operational playbook
- A common view of critical resource and application measurements that can be shared

High resolution alarms

Amazon CloudWatch alarms allow you to set a threshold on metrics and trigger an action.

- Watch a single metric or the result of a math expression
- Perform actions based on the value of metrics
  - Send a notification to an SNS topic
  - Auto Scaling action
  - EC2 Action (Stop, Terminate, Reboot or Recover)
- Add alarms to dashboards to visualize them



Name	State	Conditions	Actions
ImageErrorAlarm	In alarm	ImageError > 0 for 1 datapoints within 10 seconds	-
centralized-logging-StatusYellowAlarm-L8VNTMW93IP8	OK	ClusterStatus.yellow >= 1 for 1 datapoints within 1 minute	-
centralized-logging-MasterNotReachableFromNodeAlarm-12NUZCERB15HI	OK	MasterReachableFromNode < 1 for 1 datapoints within 1 minute	-
centralized-logging-IndexWritesBlockedTooHighAlarm-SJ3CQWU5T2RS	OK	ClusterIndexWritesBlocked >= 1 for 1 datapoints within 5 minutes	-
centralized-logging-JVMMemoryPressureTooHighAlarm-145XRI40EMJAP	OK	JVMMemoryPressure >= 80 for 1 datapoints within 15 minutes	-
centralized-logging-MasterCPUUtilizationTooHighAlarm-VQQ5ZWZ5ZUV9	OK	MasterCPUUtilization >= 50 for 3 datapoints within 45 minutes	-
centralized-logging-StatusRedAlarm-1C0JRPKQSI8GJ	OK	ClusterStatus.red >= 1 for 1 datapoints within 1 minute	-
centralized-logging-MasterJVMMemoryPressureTooHighAlarm-1B2YB793W1A03	OK	MasterJVMMemoryPressure >= 50 for 1 datapoints within 15 minutes	-
centralized-logging-AutomatedSnapshotFailureTooHighAlarm-1I0NHPWR16NX8	OK	AutomatedSnapshotFailure >= 1 for 1 datapoints within 1 minute	-
centralized-logging-FreeStorageSpaceTooLowAlarm-T60Q56YMYGQI	OK	FreeStorageSpace <= 2000 for 1 datapoints within 1 minute	-

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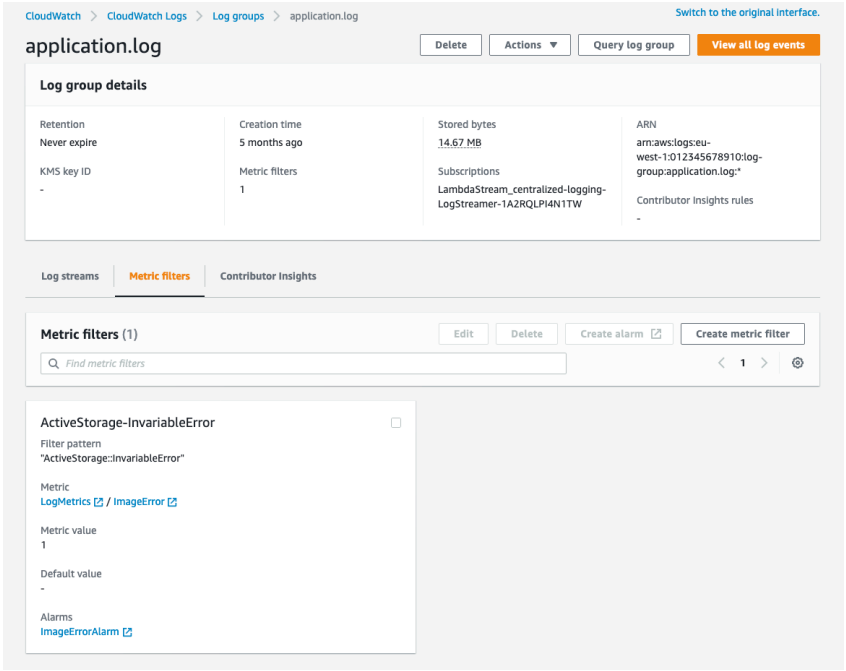
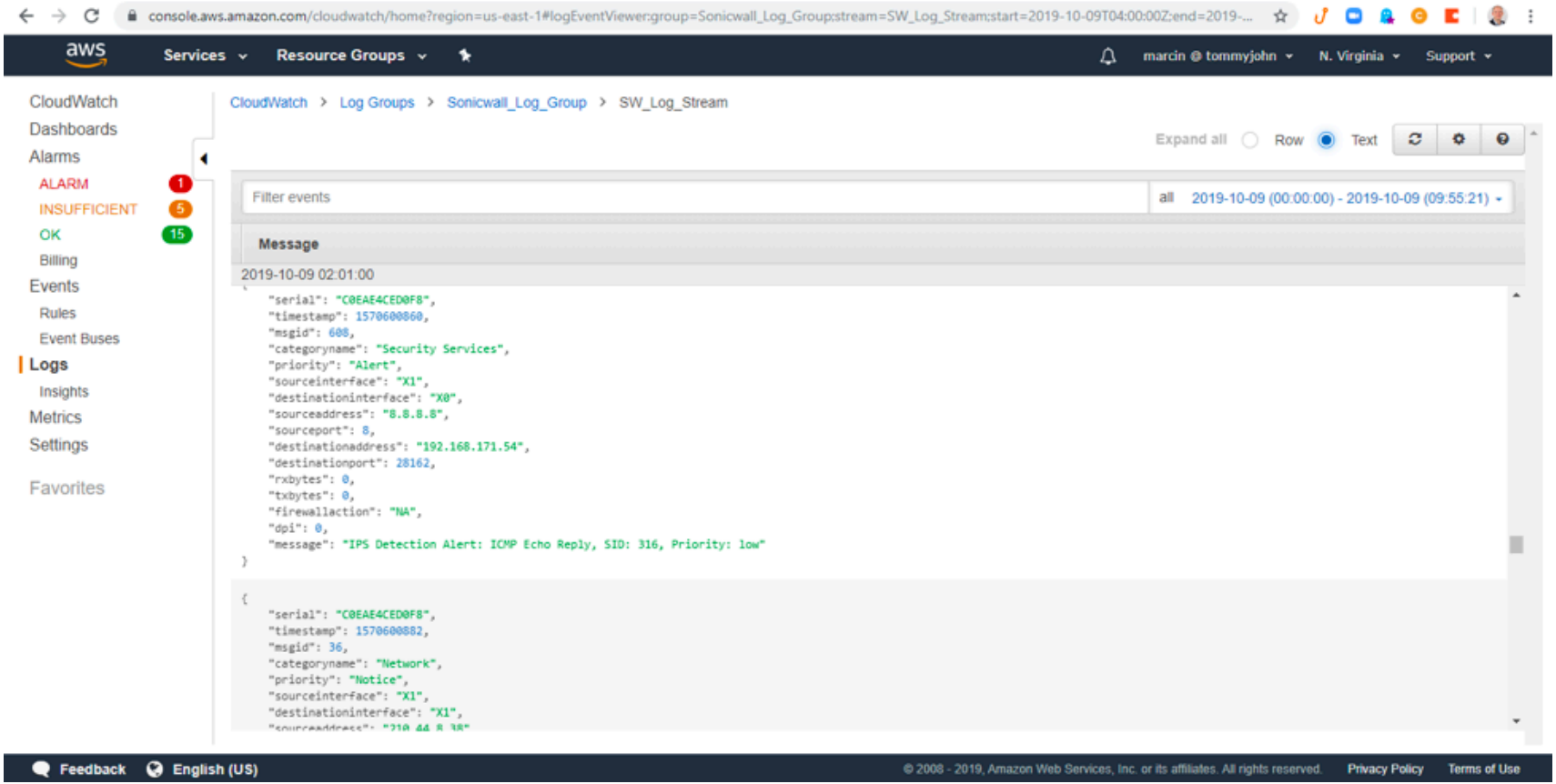
Logs and metrics correlation

Amazon CloudWatch also makes it easy to correlate metrics and logs.

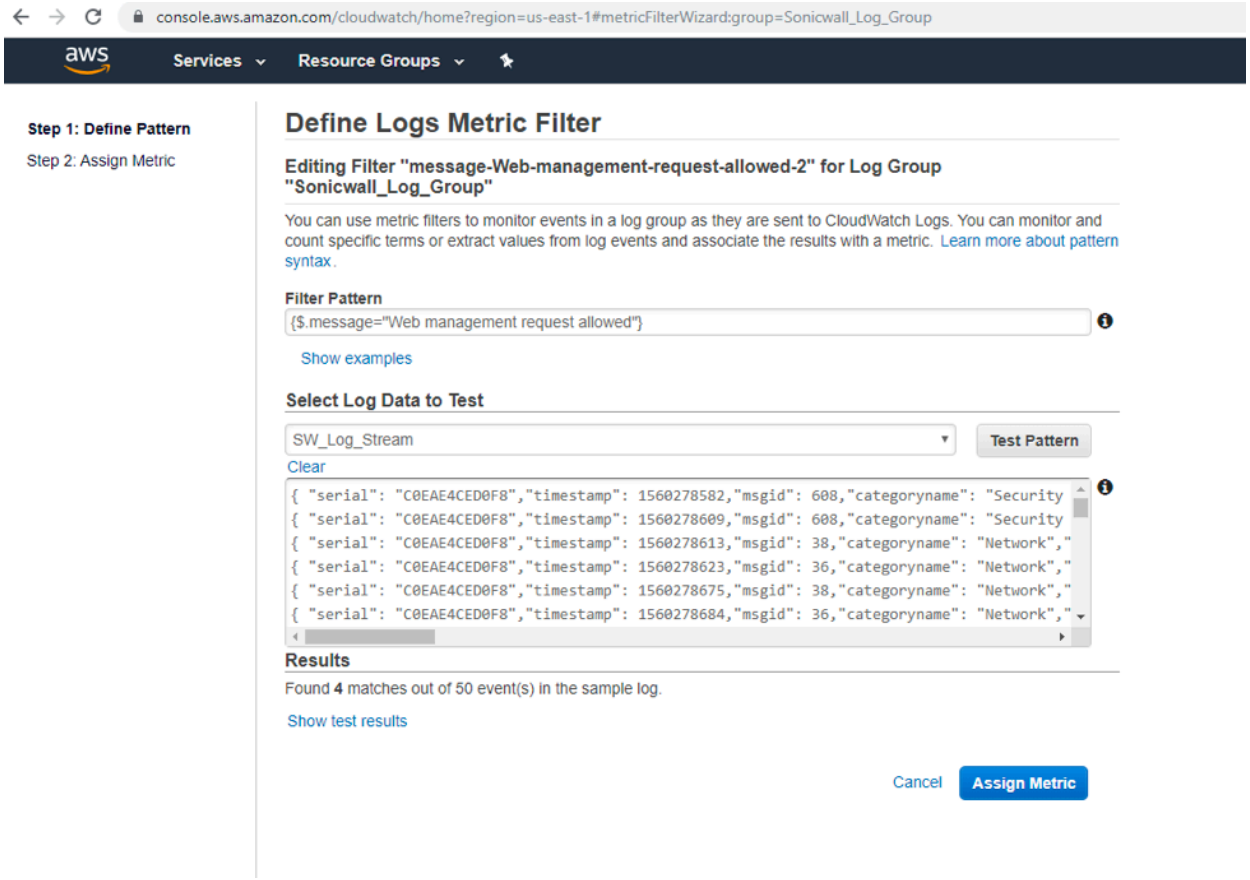
- Manage logs and metrics in a single platform
- Use metric filters to convert logs to metrics



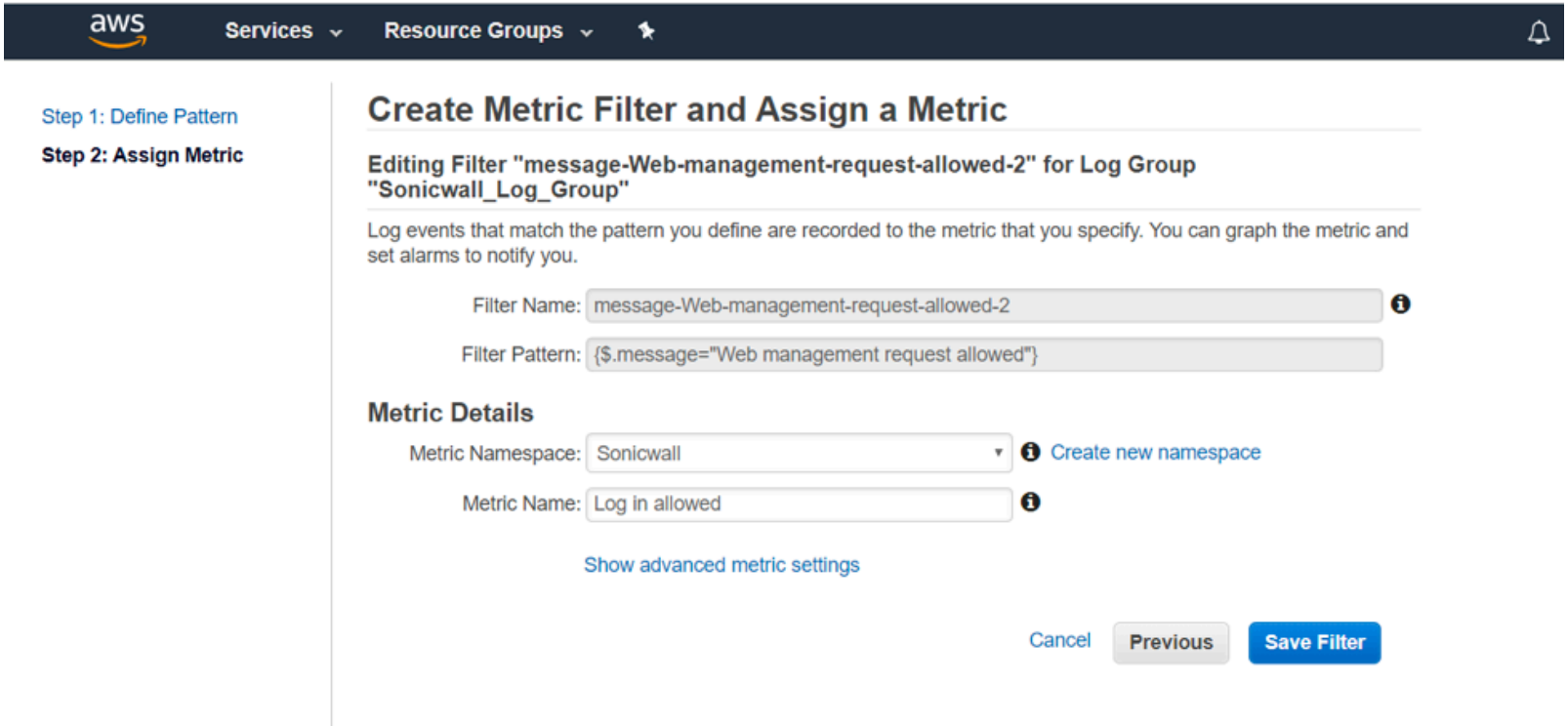
CloudWatch Metrics Example



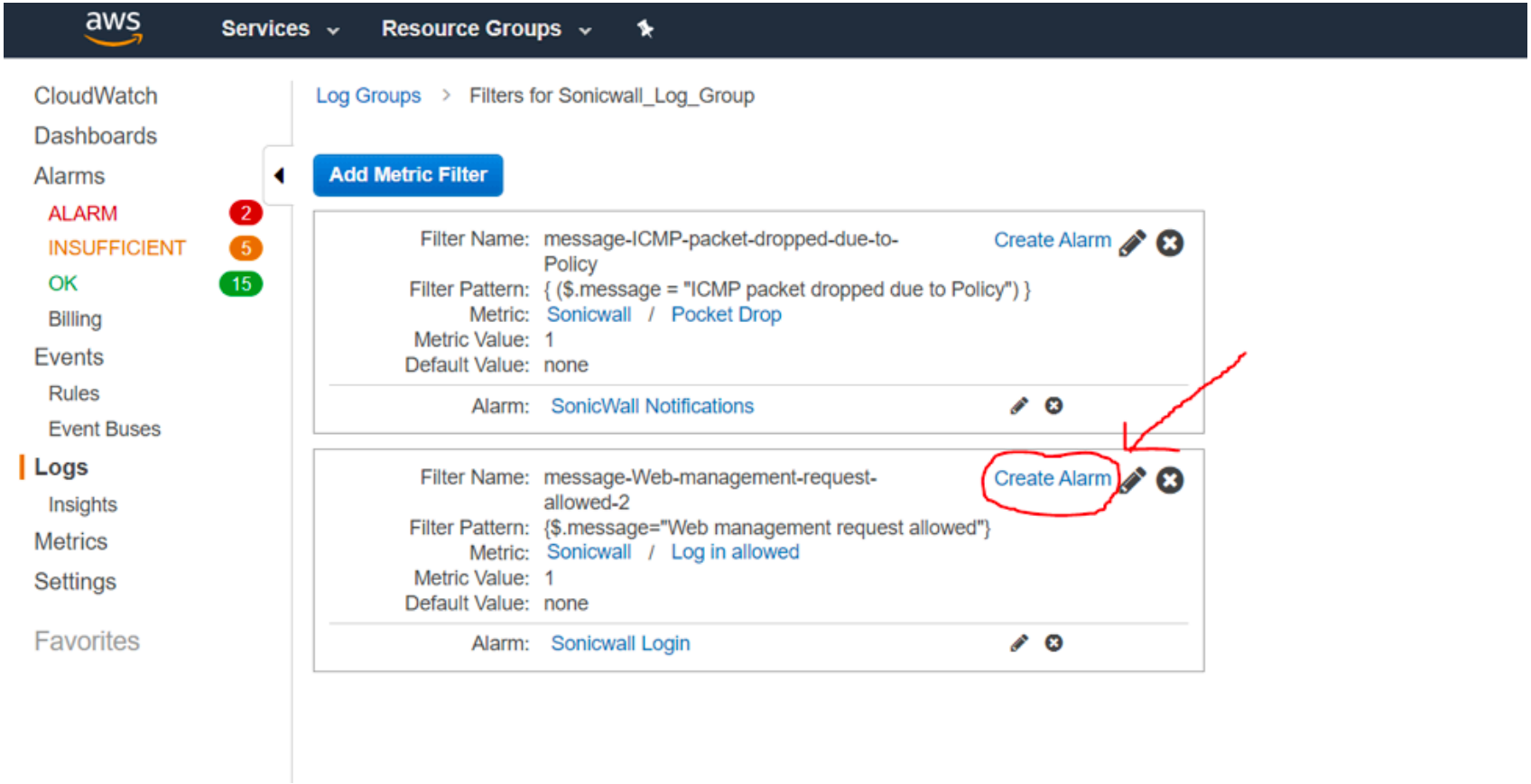
CloudWatch Metrics Example



CloudWatch Metrics Example



CloudWatch Metrics Example



CloudWatch Metrics Example

CloudWatch Metrics Example

ALARM: "Sonicwall Login" in US East (N. Virginia)
1 message

AWS Notifications <no-reply@sns.amazonaws.com> Wed, Oct 9, 2019 at 3:16 PM
To: marcin+alerts@tommyjohn.com

You are receiving this email because your Amazon CloudWatch Alarm "Sonicwall Login" in the US East (N. Virginia) region has entered the ALARM state, because "Threshold Crossed: 1 out of the last 1 datapoints [14.0 (09/10/19 18:16:00)] was greater than or equal to the threshold (1.0) (minimum 1 datapoint for OK -> ALARM transition)." at "Wednesday 09 October, 2019 19:16:19 UTC".

View this alarm in the AWS Management Console:
https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1#s=Alarms&alarm=Sonicwall%20Login

Alarm Details:
- Name: Sonicwall Login
- Description: Someone login in to the sonicwall
- State Change: INSUFFICIENT_DATA -> ALARM
- Reason for State Change: Threshold Crossed: 1 out of the last 1 datapoints [14.0 (09/10/19 18:16:00)] was greater than or equal to the threshold (1.0) (minimum 1 datapoint for OK -> ALARM transition).
- Timestamp: Wednesday 09 October, 2019 19:16:19 UTC
- AWS Account: 353588062513

Threshold:
- The alarm is in the ALARM state when the metric is GreaterThanOrEqualToThreshold 1.0 for 3600 seconds.

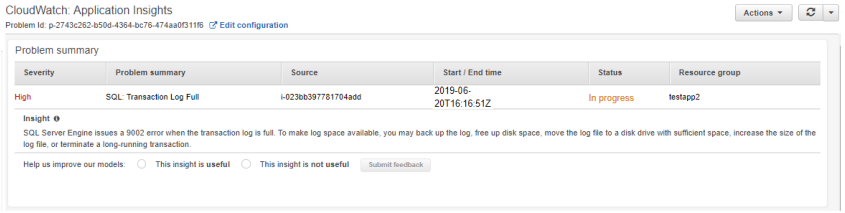
Monitored Metric:
- MetricNamespace: Sonicwall
- MetricName: Log in allowed
- Dimensions:
- Period: 3600 seconds
- Statistic: Sum
- Unit: not specified
- TreatMissingData: missing

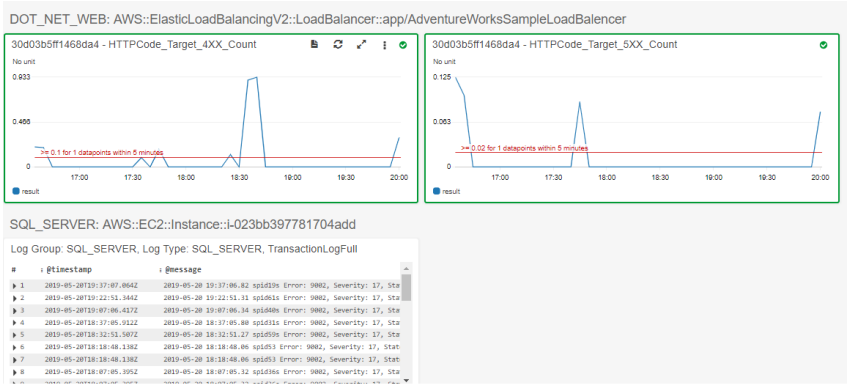
State Change Actions:
- OK:
- ALARM: [arn:aws:sns:us-east-1:353588062513:Sonicwall-Alerts]

Application Insights for .NET and SQL Server applications

Easily monitor .NET and SQL Server applications, so you can get visibility into the health of such applications.

- Automatic Set Up of Monitors for Application Resources
- Problem Detection and Notification
- Automatic dashboards
- Insights that point to potential root causes

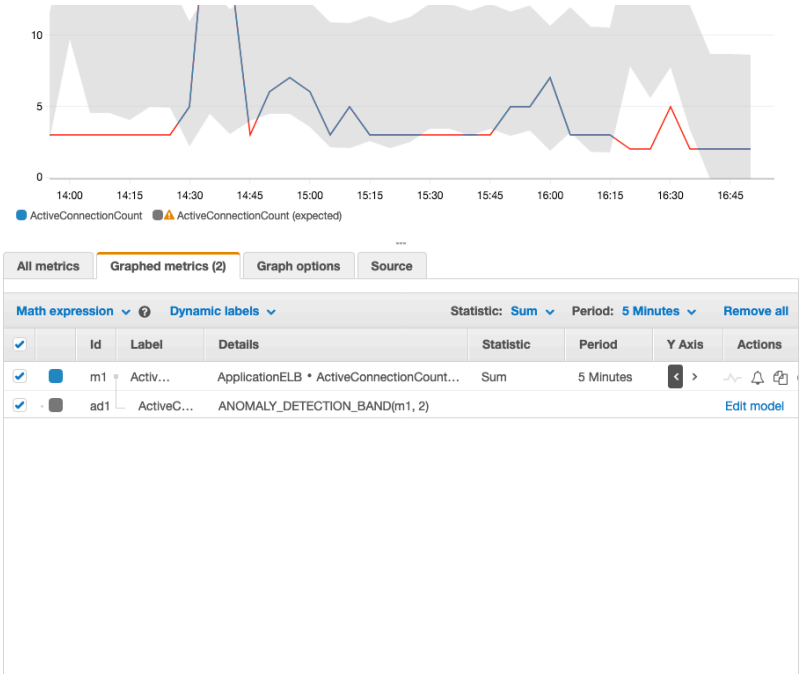




Anomaly Detection

When you enable anomaly detection for a metric, CloudWatch applies machine learning algorithms to the metric's past data to create a model of the metric's expected values.

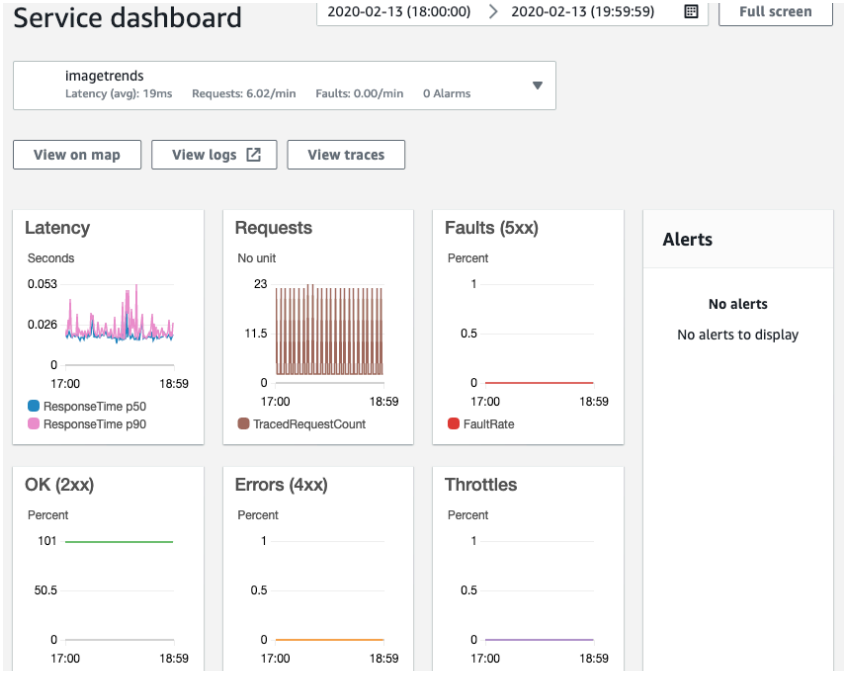
- Create alarms that auto-adjust thresholds based on natural metric patterns
- Alarm when the metric value is above or below the band, or both
- Visualize metrics with anomaly detection bands on dashboards



ServiceLens

You can use Amazon CloudWatch ServiceLens to visualize and analyze the health, performance, and availability of your applications in a single place.

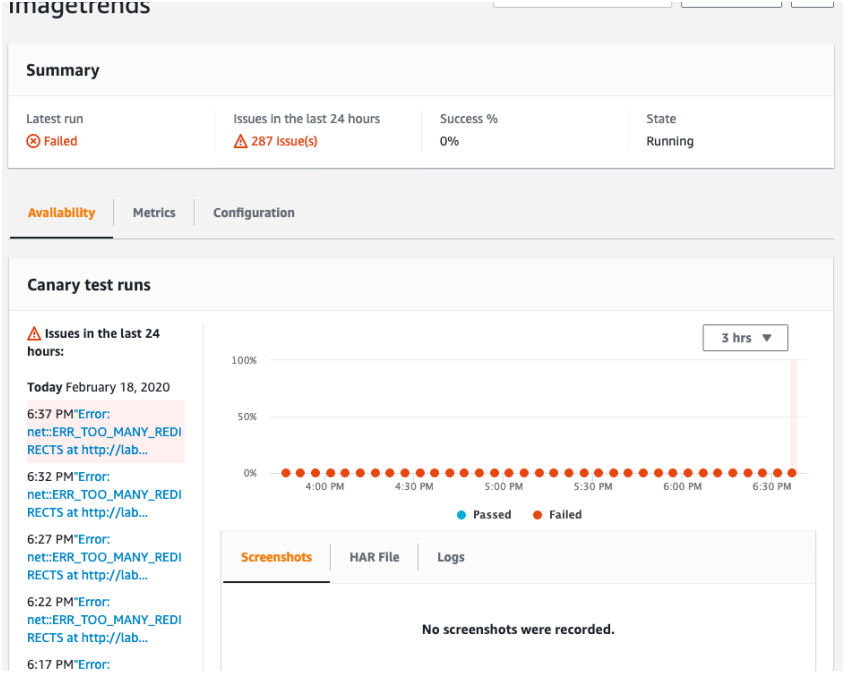
- Integrates CloudWatch with AWS X-Ray to provide an end-to-end view of your application
- A service map displays your service endpoints and resources as “nodes” and highlights the traffic, latency, and errors for each node and its connections
- You can choose a node to see detailed insights about the correlated metrics, logs, and traces associated with that part of the service



Synthetics

Run tests on your endpoints every minute, 24x7, and alerts you as soon as your application endpoints don't behave as expected.

- View of your customers' experiences
- Configurable scripts
- Run once
- Run on a schedule
- Check availability and latency
- Store load time data
- Store screenshots

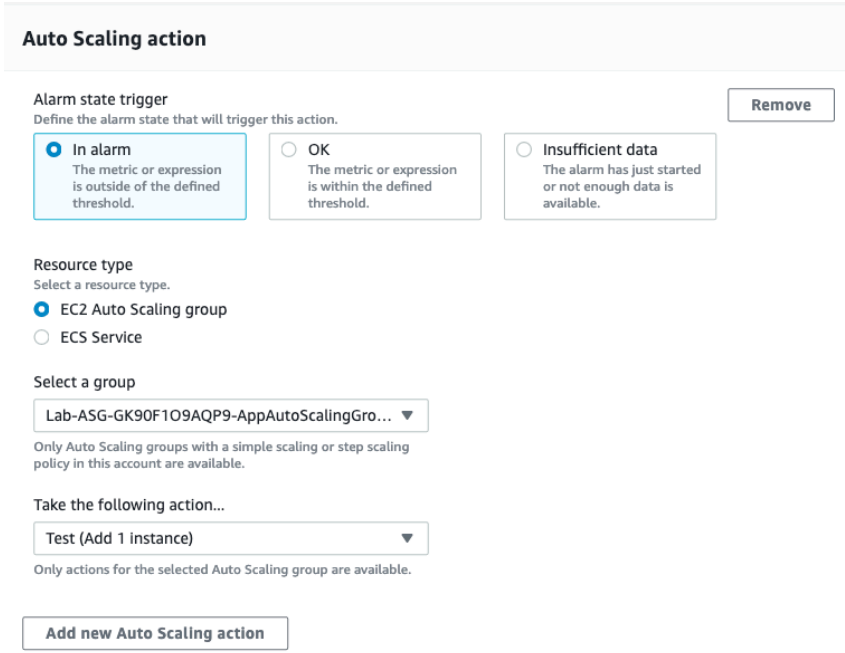


Act

Auto Scaling

Auto Scaling helps you automate capacity and resource planning.

- Set a threshold to alarm on a key metric and trigger an automated Auto Scaling action
- For example, you could set up an Auto Scaling workflow based on queue depth
- Configure policies to scale in or scale out
- Allows you to set 1 scaling policy and trigger with multiple alarms



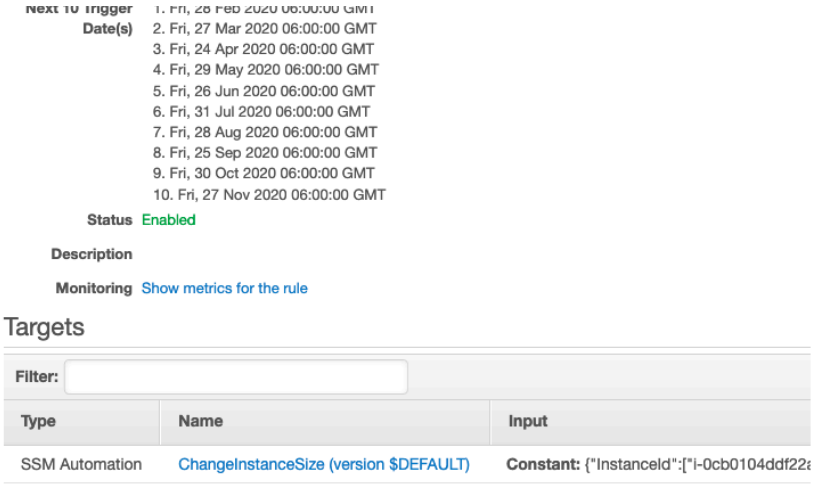
Automate response to changes with CloudWatch Events

CloudWatch Events provides a near real-time stream of system events that describe changes to your AWS resources.

- Respond quickly
- Take corrective action

Write rules to indicate which events are of interest to your application and what automated actions to take when a rule matches an event.

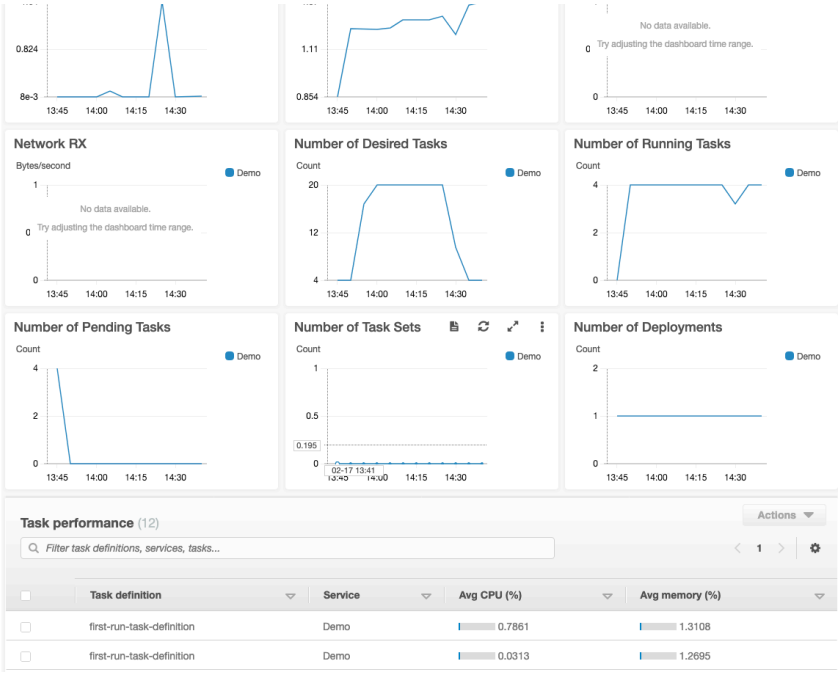
- Invoke a Lambda Function
- Notify an SNS Topic
- Create an Ops Item in Systems Manager



Alarm and automate actions on EKS, ECS, and k8s clusters

For Amazon EKS and k8s clusters, Container Insights allows you to alarm on compute metrics to trigger auto scaling policies on your Amazon EC2 Auto Scaling group and provides you the ability to stop, terminate, reboot, and recover any Amazon EC2 instance.

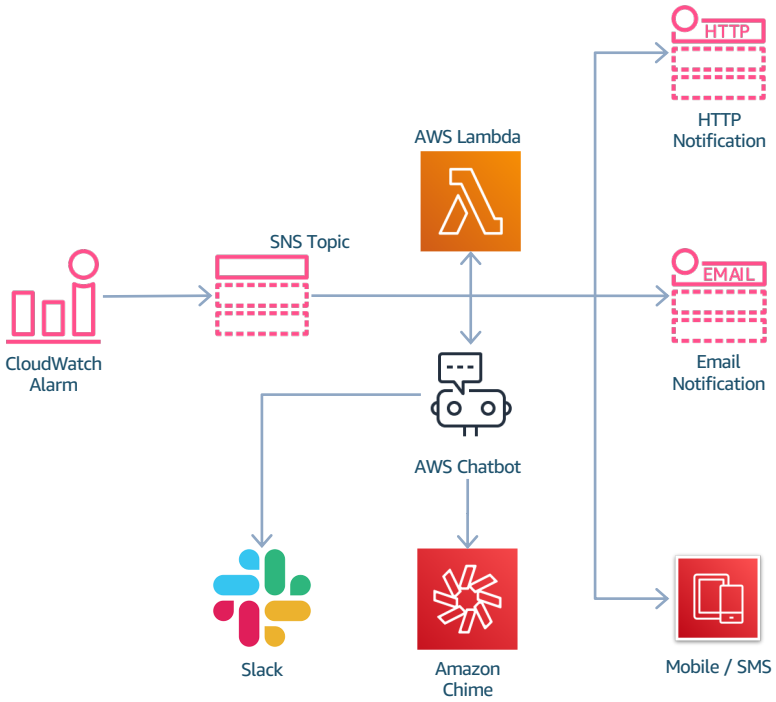
For Amazon ECS clusters, compute metrics from your tasks and services can be used for Service Auto Scaling.



Automation

CloudWatch Alarms can send a notification to SNS, from there, you can trigger a Lambda function or push a message to Slack or Amazon Chime via AWS Chatbot. This allows you to do almost anything, including:

- Trigger a Systems Manager Automation
- Resize an instance
- Send a message to Chime or Slack
  - Respond with CLI commands
- Invoke disaster recovery
- Update security groups
- Automate deployments
- Instigate backups and snapshots
- Responding to security events

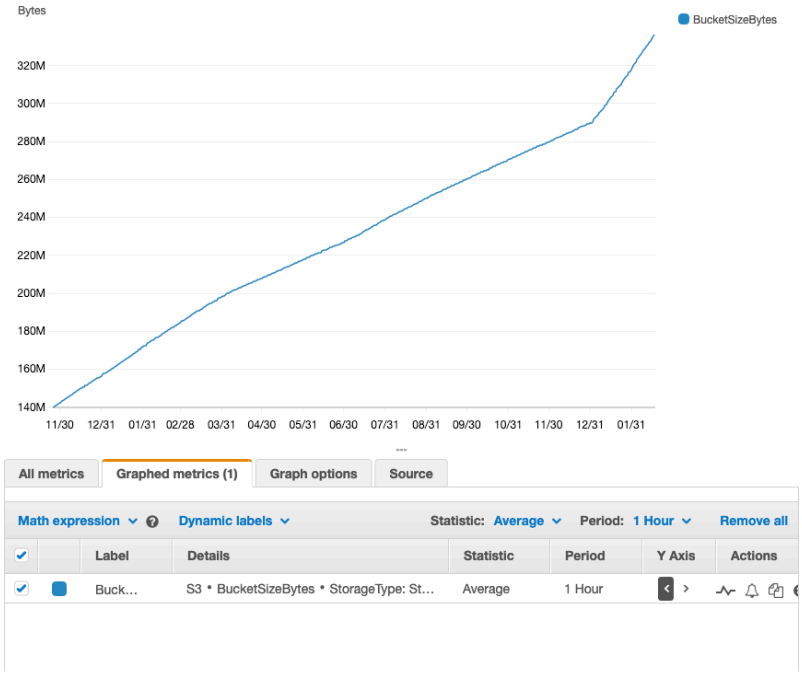


Analyze

Granular data and extended retention

Amazon CloudWatch allows you to monitor trends and seasonality with 15 months of metric data (storage and retention).

- Historical analysis to fine-tune resource utilization
- Collect metrics with a granularity of 1 second
- Granular real-time data enables better visualization
- Spot and monitor trends to optimize applications



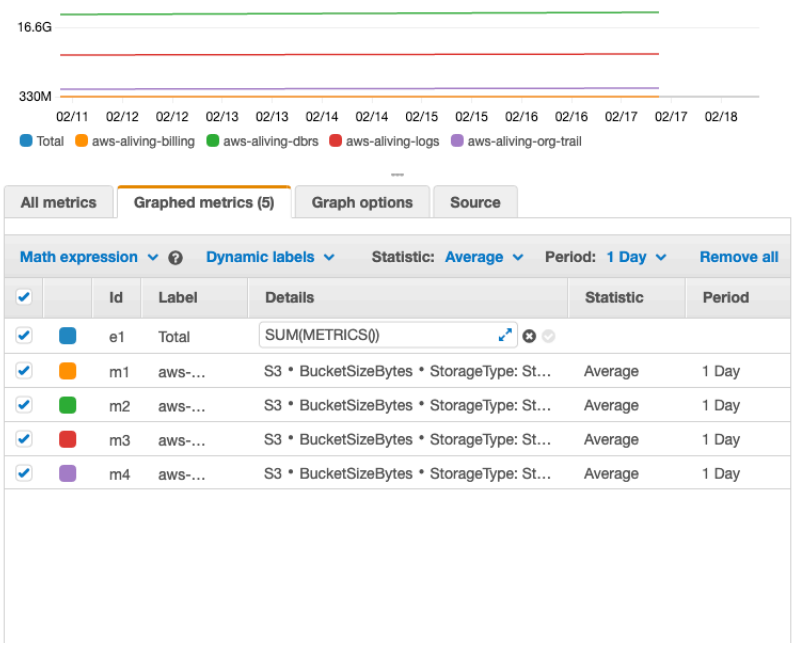
Custom operations on metrics

Metric Math enables you to perform calculations across multiple metrics for real-time analysis.

- Visualize computed metrics in the Console
- Add them to CloudWatch dashboards
- Retrieve them using the GetMetricData API action

Metric Math supports arithmetic operations such as +, -, /, *, and mathematical functions such as Sum, Average, Min, Max, and Standard Deviation.

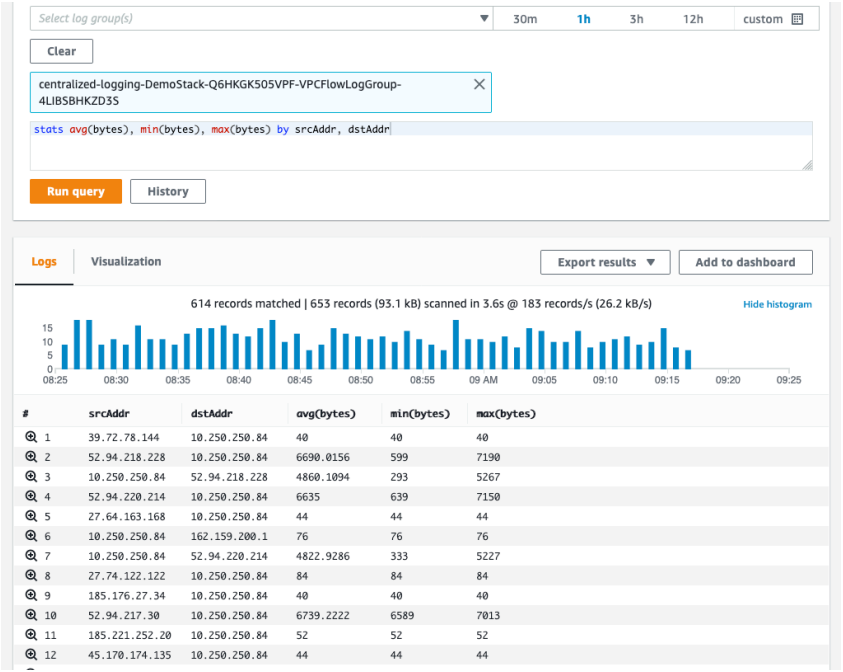
Using AWS Lambda metrics as an example, you could divide the Errors metric by the Invocations metric to get an error rate.



Log analytics

CloudWatch Logs Insights enables you to drive actionable intelligence from your logs to address operational issues without needing to provision servers or manage software.

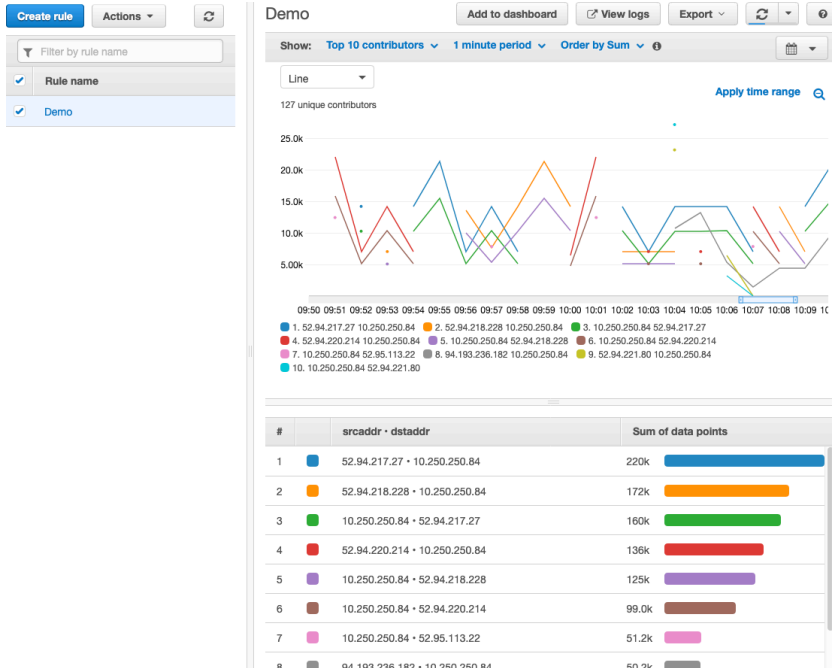
- You can instantly begin writing queries with aggregations, filters, and regular expressions
- In addition, you can:
  - Visualize timeseries data
  - Drill down into individual log events
  - Export query results to CloudWatch Dashboards
- You only pay for the queries you run



Contributor Insights

Analyzes time-series data to provide a view of the top contributors influencing system performance.

- Runs continuously without needing user intervention
- Understand who or what is impacting your system
- Evaluate patterns in structured log events
- Display on CloudWatch dashboards
- Add to CloudWatch alarms



CloudTrail

CloudTrail

- By default, CloudTrail is configured to store 90 days of event history
- Logs API calls (ie. Console, CLI, API, SDK)
- You can view entries in the Event History
- A Trail is how you configure CloudTrail to deliver to S3
    - Can be for a single region or multiple regions

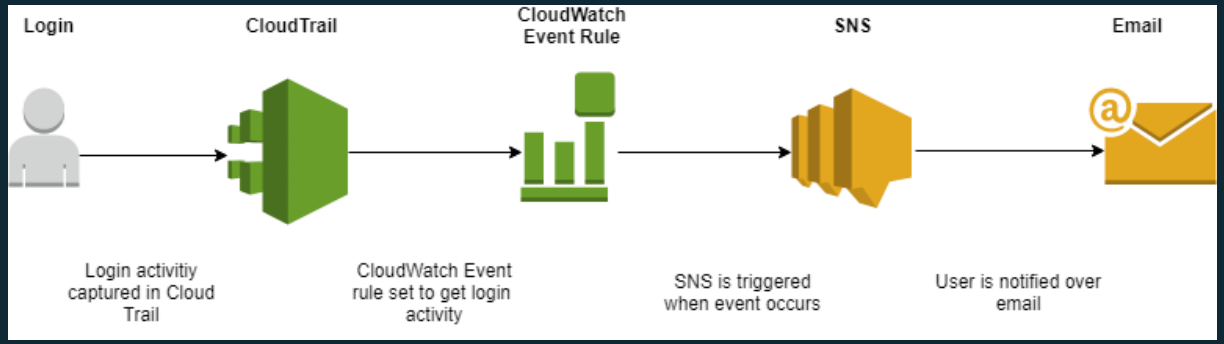
CloudTrail – Configuration options

- Management Events – Control plane events:
  - User login events
  - Configuring Security
  - Setting up logging
- Data Events
  - Object-level events in S3 (GetObject, PutObject)
  - Function-level events in Lambda (Invocation API functions)
- Encryption
  - Encrypted in S3 server-side by default, can be changed to KMS.
- Organizations
  - Can create Trail for an Organization
  - Inherits to sub-accounts

CloudTrail – CloudWatch Logs integration

- You can configure CloudTrail to deliver logs to CloudWatch Logs
- In an Organization, each account would have its own Log Stream

- You can create Metric Filters from CloudTrail Logs



Systems Manager

AWS Systems Manager Capabilities


Resource Groups


Patch Manager


State Manager


Run Command


Automation


Maintenance Window


Inventory


Parameter Store

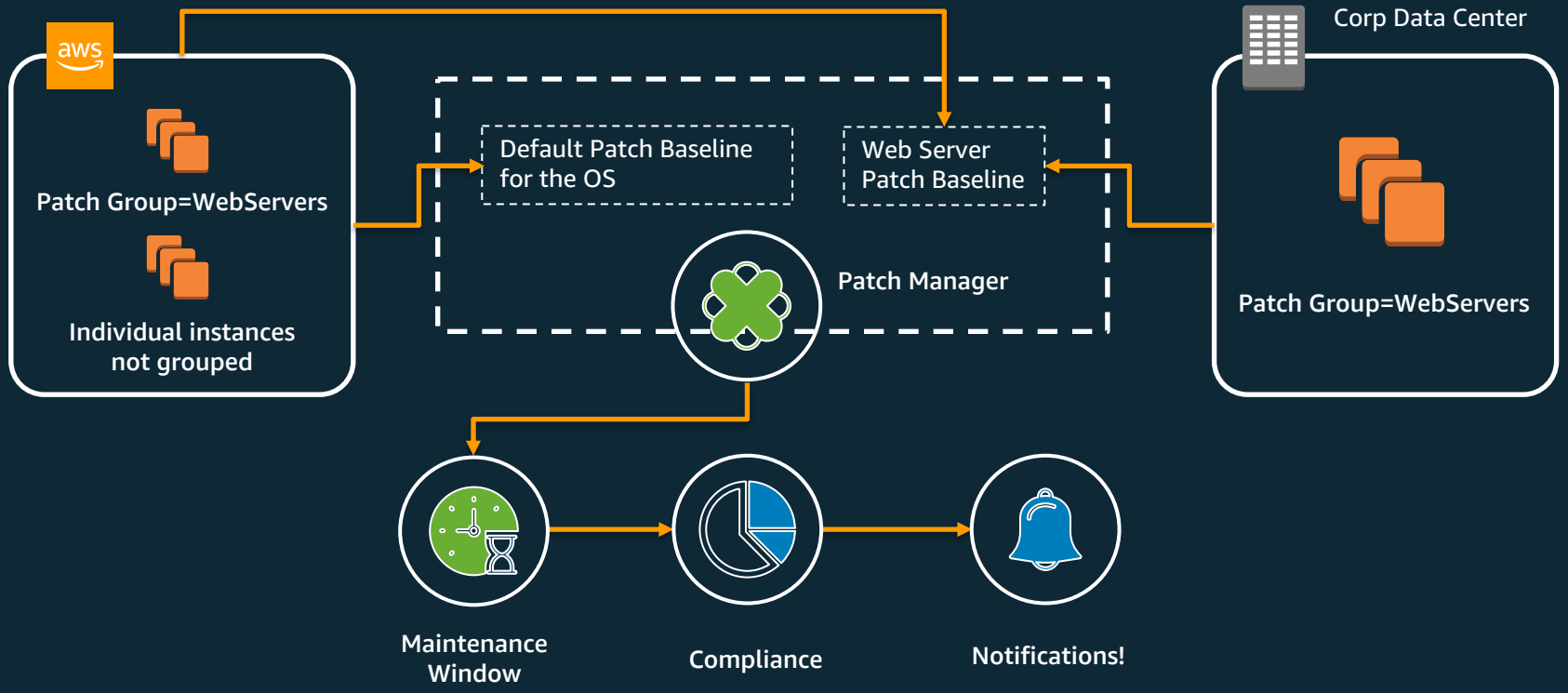

Session Manager


Distributor

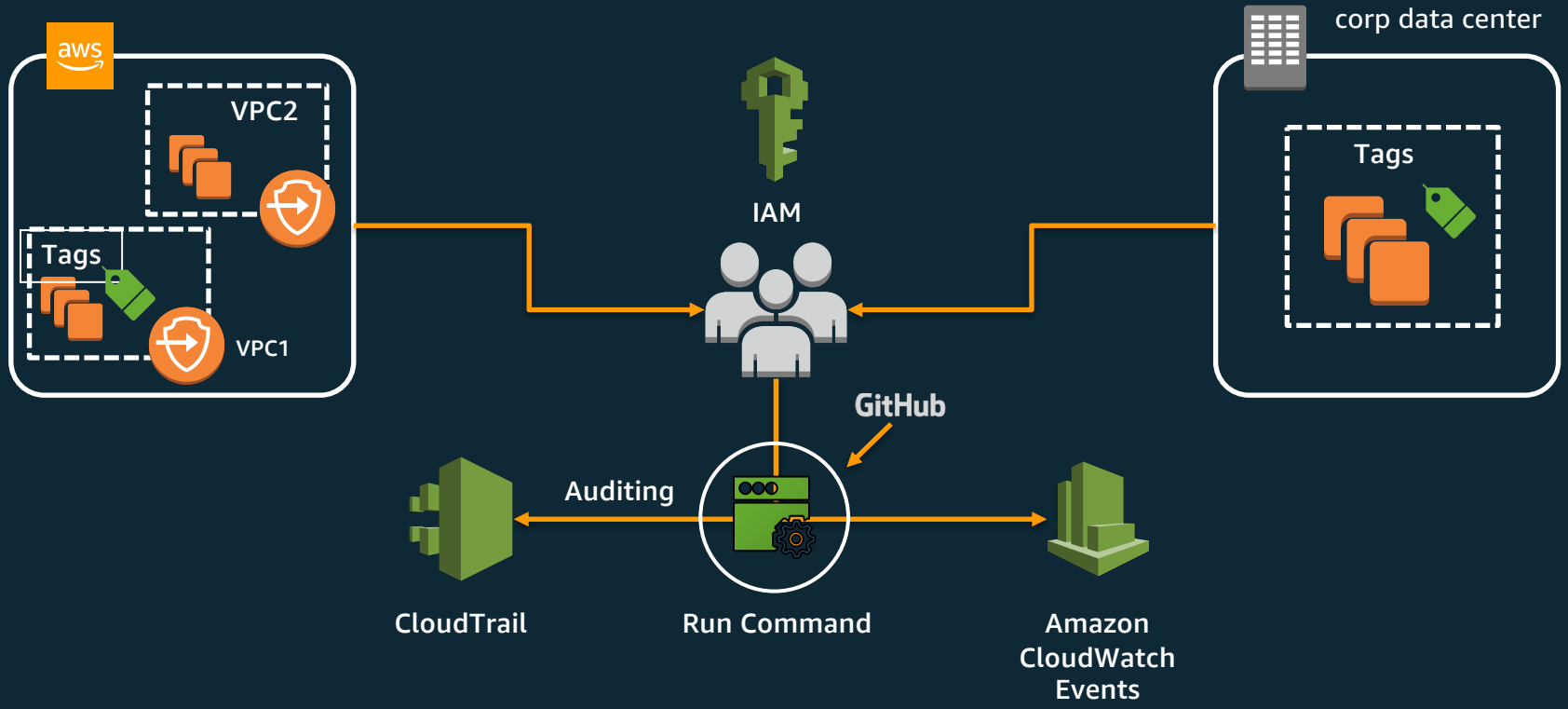

OpsCenter

aws

Compliance with Patch Manager



Safe and Secure Operations



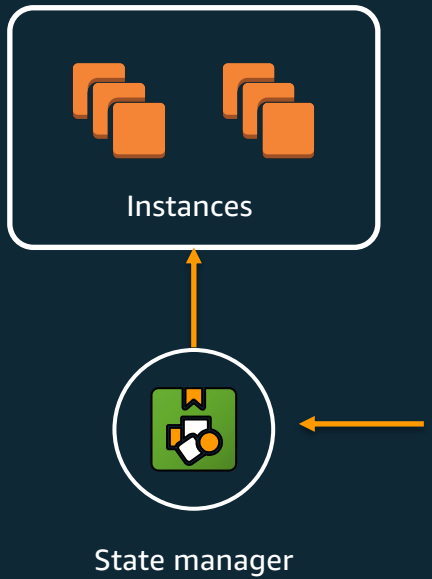
Systems Manager State Manager

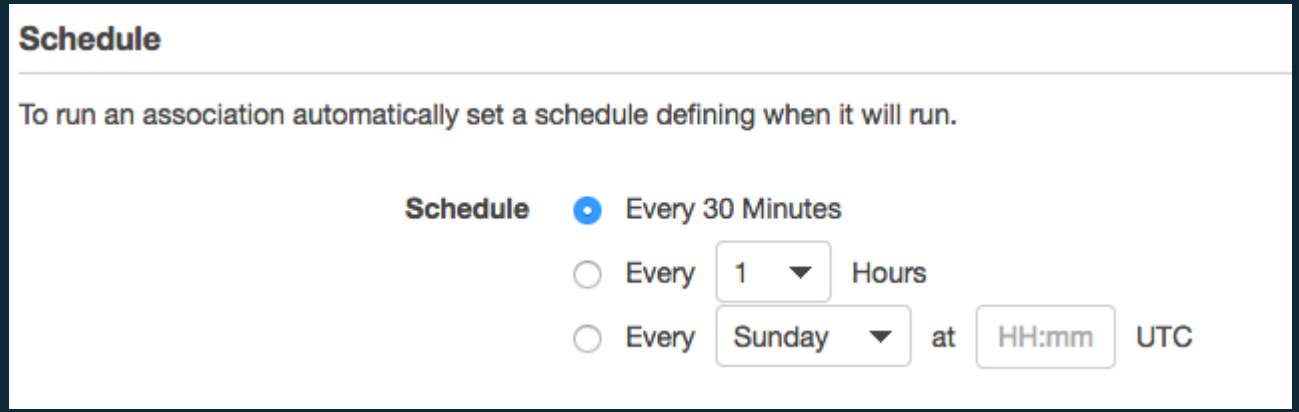
Automates the process of keeping your Amazon EC2 and hybrid infrastructure in a state that you define.

One of the use case I found out of AWS System Manager State Manager is to run the command on a scheduled basis(eg: SnapShot Creation)

Manage Configuration Drift with State Manager

State Manager automates the process of keeping your Amazon EC2 and hybrid infrastructure in a state that you define.

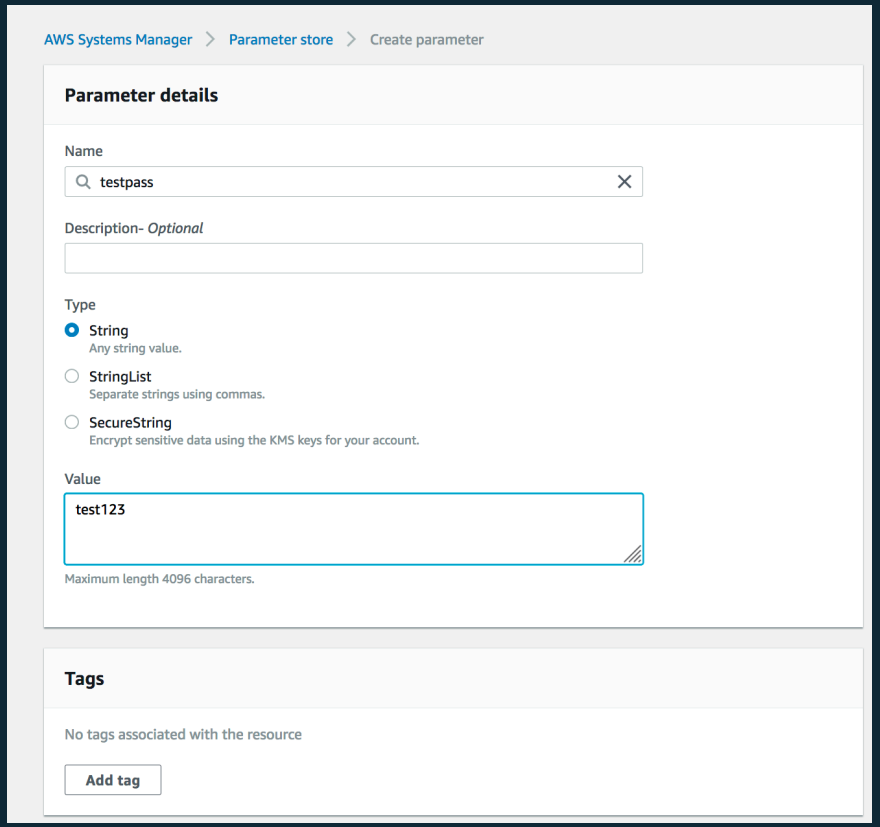




Systems Manager Parameter Store

- Provides secure, hierarchical storage for configuration data management and secrets management. We can store data such as,
    - passwords
    - database strings
    - license codes
- Which we can then be programmatically accessed via the SSM API.
- Free

Creating a parameter from the Console



Retrieving a parameter from the CLI

```
$ aws ssm get-parameters --names "testpass”

{
"InvalidParameters": [],
"Parameters": [
    {
    "Name": "testpass",
    "LastModifiedDate": 1552923749.085,
    "Value": "test123",
    "Version": 1,
    "Type": "String",
    "ARN": "arn:aws:ssm:us-west-2:XXXXXXX:parameter/testpass”
    }
]
}
```


aws

Parameter Store SecureString

- Any sensitive data that needs to be stored and referenced in a secure manner. If you have data that you don't want users to alter or reference in plain text, such as passwords or license keys, create those parameters using the SecureString datatype.
- Recommend using SecureString parameters for the following scenarios.
    - You want to use data/parameters across AWS services without exposing the values as plain text in commands, functions, agent logs, or AWS CloudTrail logs.
    - You want to control who has access to sensitive data.
    - You want to be able to audit when sensitive data is accessed (AWS CloudTrail).
    - You want to encrypt your sensitive data and you want to bring your own encryption keys to manage access.

CloudFormation

CloudFormation

Expect questions about CloudFormation on the test

Understand:

- Stack Updates
- Stack Sets – create stacks in multiple accounts
- Nested Stack – stacks created by other stacks (reusable patterns, standardization)
- Drift Detection – detects whether a stack's actual configuration differs from the expected configuration.
- Custom Resources

aws

CloudFormation for Disaster Recovery

CloudFormation (Infrastructure as code) can be used as part of a DR strategy to spin up resources quickly in the event of a disaster.

- Create infrastructure when needed
- Scale up pilot light resources

Homework – Scheduled your Exam!

- Work with your Training contact (Kala Srikanth) to request voucher
- Note that certifications are currently available in online-proctored mode.
    - Quite place, reliable device, webcam, reliable internet
- Be aware of ESL +30min accommodations
    - https://www.certmetrics.com/amazon/candidate/exam_scheduling.aspx