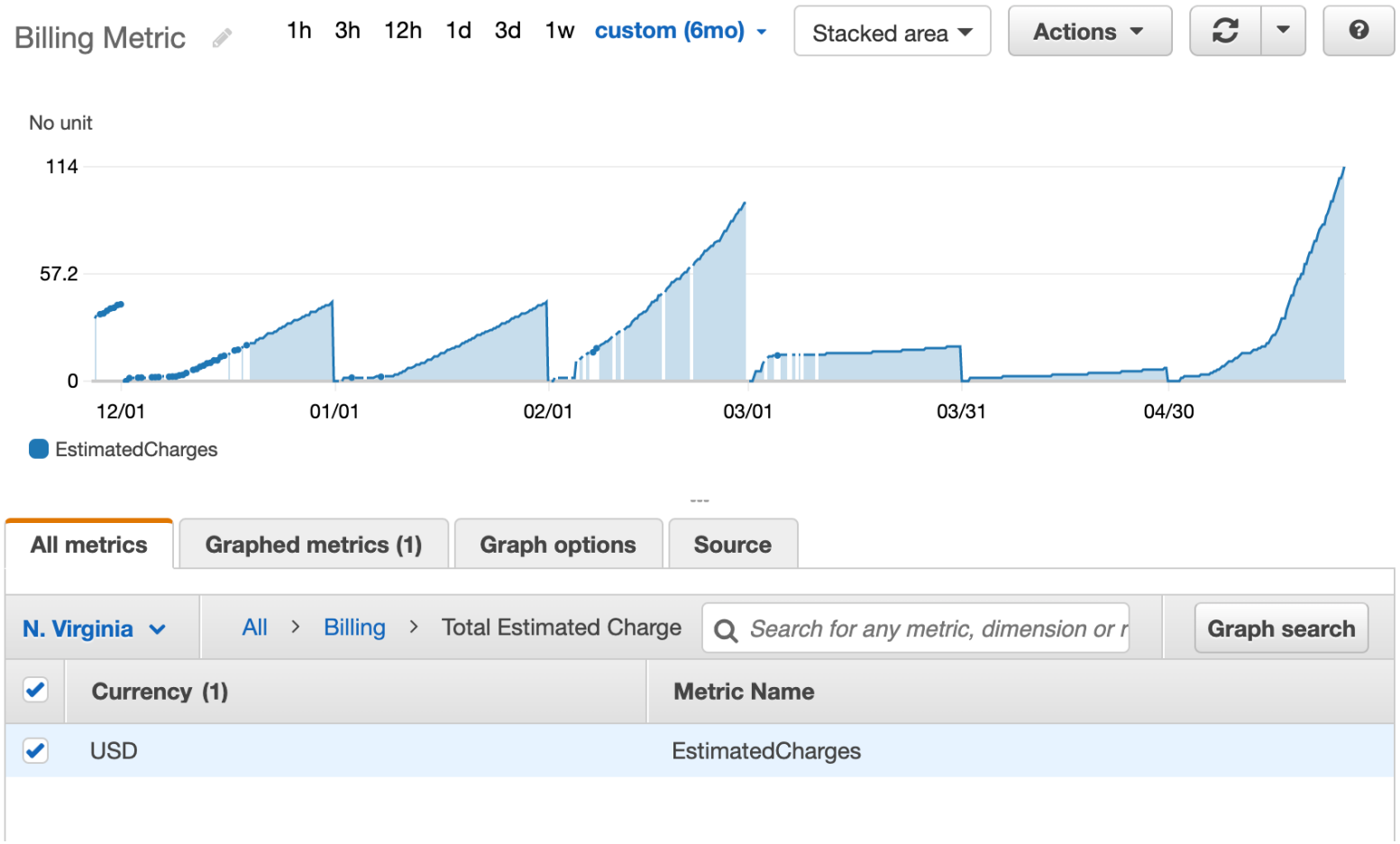
Cloud Monitoring Section

Amazon CloudWatch Metrics

- CloudWatch provides metrics for *every* services in AWS
- **Metric** is a variable to monitor (CPUUtilization, NetworkIn…)
- Metrics have **timestamps**
- Can create **CloudWatch dashboards** of metrics

Example: CloudWatch Billing metric (us-east-1)



Important Metrics

- **EC2 instances:** CPU Utilization, Status Checks, Network (not RAM)
  - Default metrics every 5 minutes
  - Option for Detailed Monitoring ($$$): metrics every 1 minute
- **EBS volumes:** Disk Read/Writes
- **S3 buckets:** BucketSizeBytes, NumberOfObjects, AllRequests
- **Billing:** Total Estimated Charge (only in us-east-1)
- **Service Limits:** how much you've been using a service API
- **Custom metrics:** push your own metrics

Amazon CloudWatch Alarms

- Alarms are used to trigger notifications for any metric
- Alarms actions…
  - **Auto Scaling:** increase or decrease EC2 instances "desired" count
  - **EC2 Actions:** stop, terminate, reboot or **recover an EC2 instance**
  - **SNS notifications:** send a notification into an SNS topic
- Various options (sampling, %, max, min, etc…)
- Can choose the period on which to evaluate an alarm
- Example: create **a billing alarm** on the CloudWatch Billing metric
- Alarm States: OK. INSUFFICIENT_DATA, ALARM

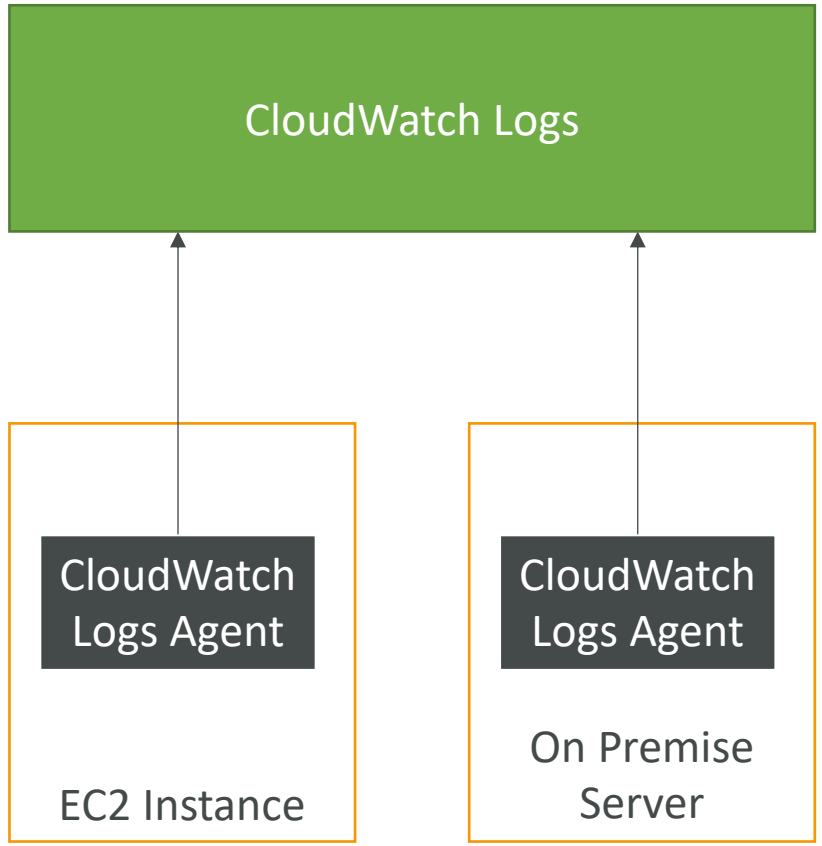
Amazon CloudWatch Logs

- CloudWatch Logs can collect log from:
  - Elastic Beanstalk: collection of logs from application
  - ECS: collection from containers
  - AWS Lambda: collection from function logs
  - CloudTrail based on filter
  - **CloudWatch log agents: on EC2 machines or on-premises servers**
  - Route53: Log DNS queries

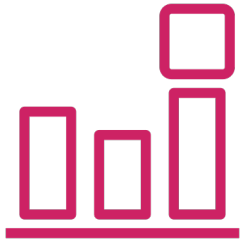
- Enables **real-time monitoring** of logs
- Adjustable CloudWatch Logs retention

CloudWatch Logs for EC2

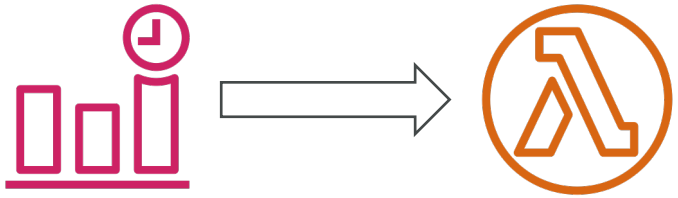
- By default, no logs from your EC2 instance will go to CloudWatch
- You need to run a CloudWatch agent on EC2 to push the log files you want
- Make sure IAM permissions are correct
- The CloudWatch log agent can be setup on-premises too



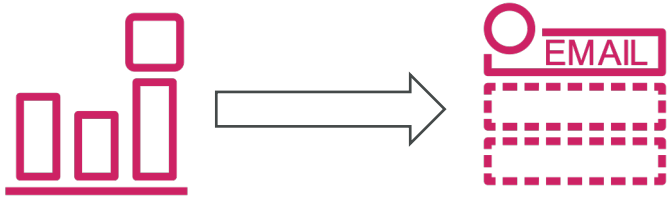
Amazon CloudWatch Events



- Schedule: Cron jobs (scheduled scripts)

Schedule Every hour  **Trigger script on Lambda function**

- Event Pattern: Event rules to react to a service doing something

IAM Root User Sign in Event  **SNS Topic with Email Notification**

- Trigger Lambda functions, send SQS/SNS messages…

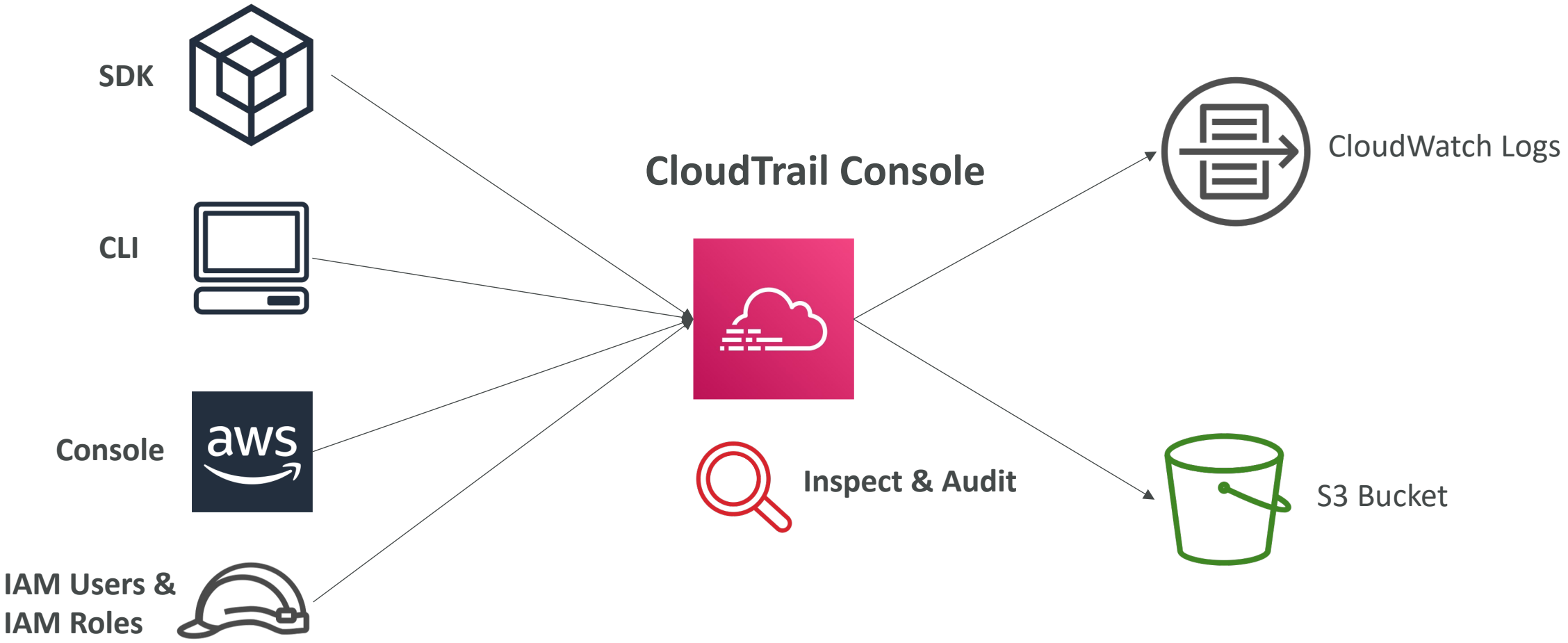
Amazon EventBridge

- EventBridge is the next evolution of CloudWatch Events
- **Default event bus:** generated by AWS services (CloudWatch Events)
- **Partner event bus:** receive events from SaaS service or applications (Zendesk, DataDog, Segment, Auth0…)
- **Custom Event buses:** for your own applications
- **Schema Registry**: model event schema
- EventBridge has a different name to mark the new capabilities
- The CloudWatch Events name will be replaced with EventBridge

AWS CloudTrail

- Provides governance, compliance and audit for your AWS Account
- CloudTrail is enabled by default!
- Get an history of events / API calls made within your AWS Account by:
  - Console
  - SDK
  - CLI
  - AWS Services
- Can put logs from CloudTrail into CloudWatch Logs or S3
- A trail can be applied to All Regions (default) or a single Region.
- If a resource is deleted in AWS, investigate CloudTrail first!

CloudTrail Diagram



CloudTrail Events

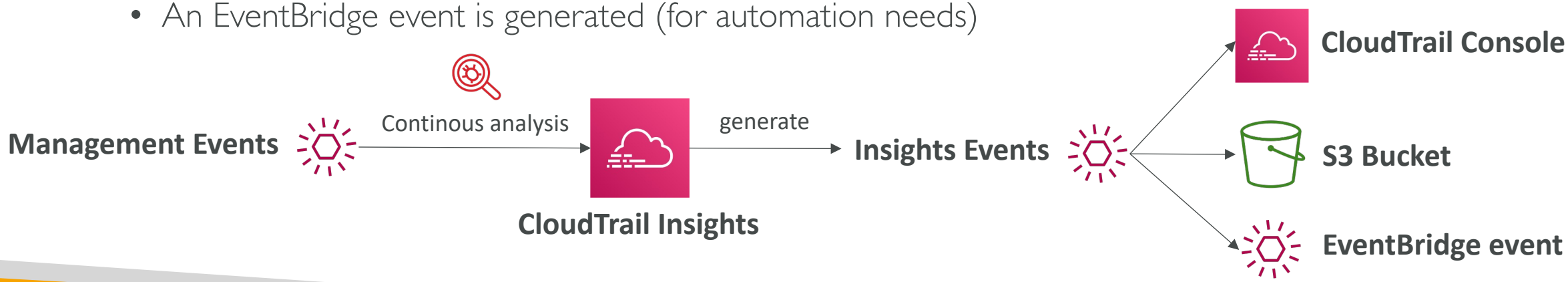
- Management Events:
  - Operations that are performed on resources in your AWS account
  - Examples:
    - Configuring security (IAM `AttachRolePolicy`)
    - Configuring rules for routing data (Amazon EC2 `CreateSubnet`)
    - Setting up logging (AWS CloudTrail `CreateTrail`)
  - By default, trails are configured to log management events.
  - Can separate **Read Events** (that don't modify resources) from **Write Events** (that may modify resources)

- Data Events:
  - By default, data events are not logged (because high volume operations)
  - Amazon S3 object-level activity (ex: `GetObject`, `DeleteObject`, `PutObject`): can separate Read and Write Events
  - AWS Lambda function execution activity (the `Invoke` API)

- CloudTrail Insights Events:
  - See next slide ☺

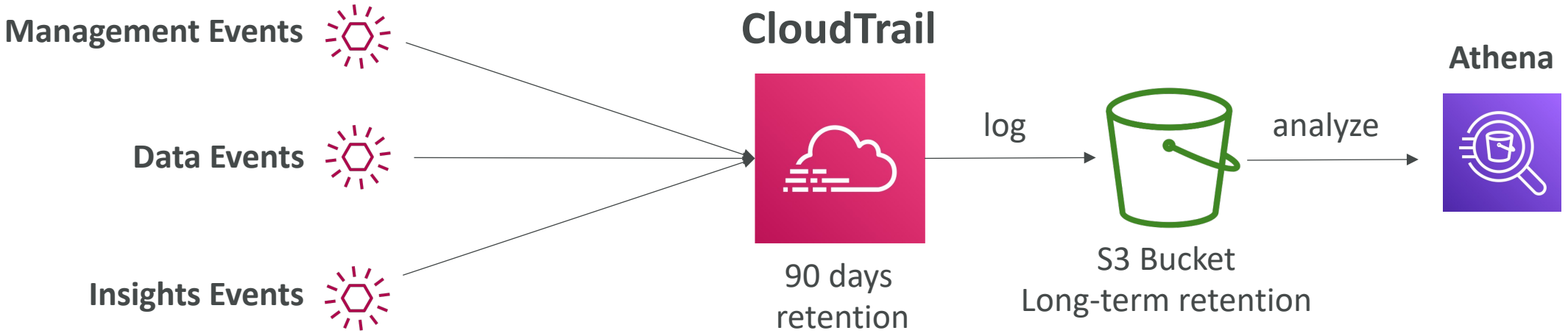
CloudTrail Insights

- Enable **CloudTrail Insights to detect unusual activity** in your account:
  - inaccurate resource provisioning
  - hitting service limits
  - Bursts of AWS IAM actions
  - Gaps in periodic maintenance activity
- CloudTrail Insights analyzes normal management events to create a baseline
- And then **continuously analyzes write events to detect unusual patterns**
  - Anomalies appear in the CloudTrail console
  - Event is sent to Amazon S3
  - An EventBridge event is generated (for automation needs)



CloudTrail Events Retention

- Events are stored for 90 days in CloudTrail
- To keep events beyond this period, log them to S3 and use Athena

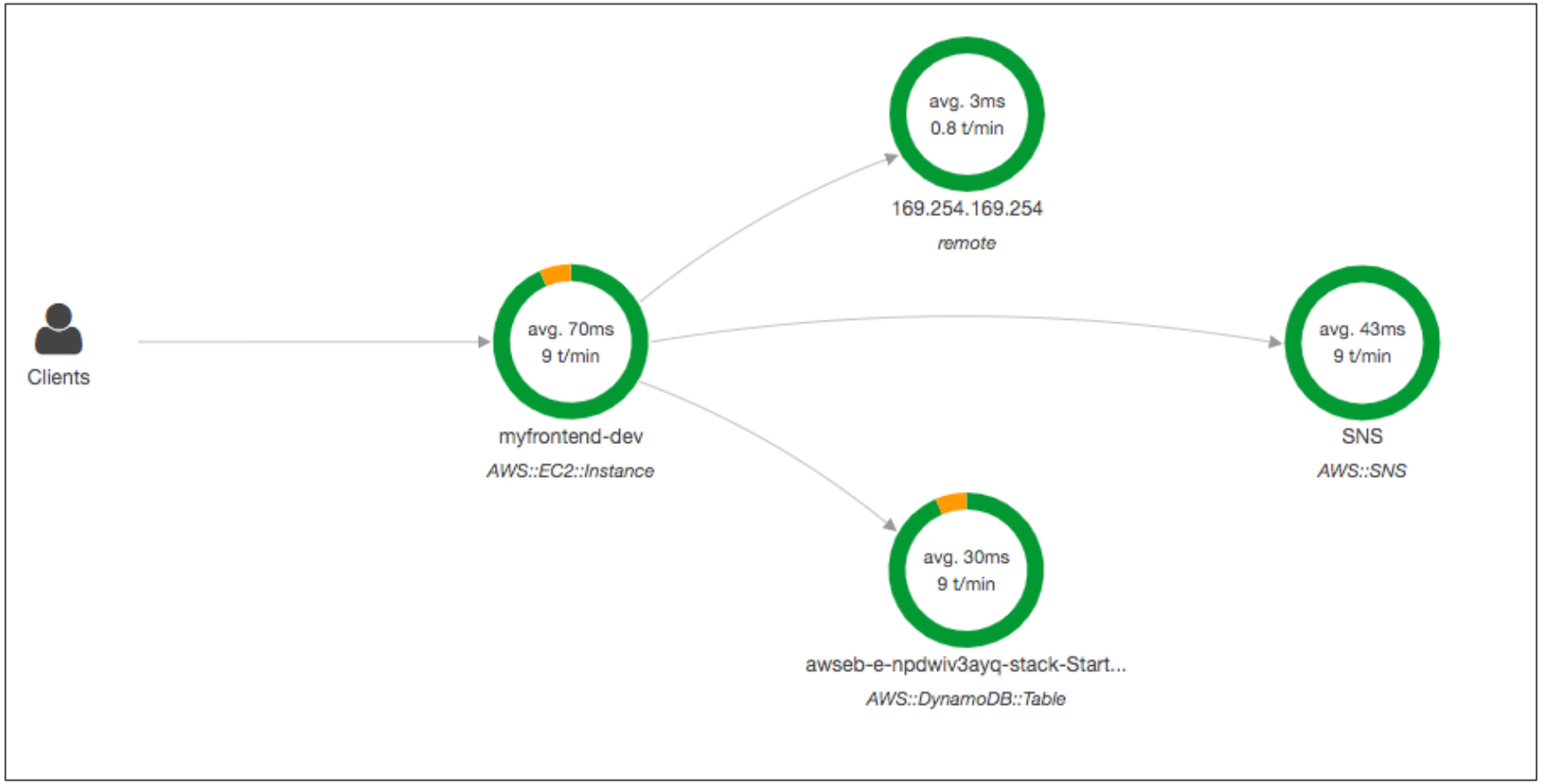


AWS X-Ray

- Debugging in Production, the good old way:
  - Test locally
  - Add log statements everywhere
  - Re-deploy in production
- Log formats differ across applications and log analysis is hard.
- Debugging: one big monolith "easy", distributed services "hard"
- No common views of your entire architecture

- Enter… AWS X-Ray!

AWS X-Ray
Visual analysis of our applications

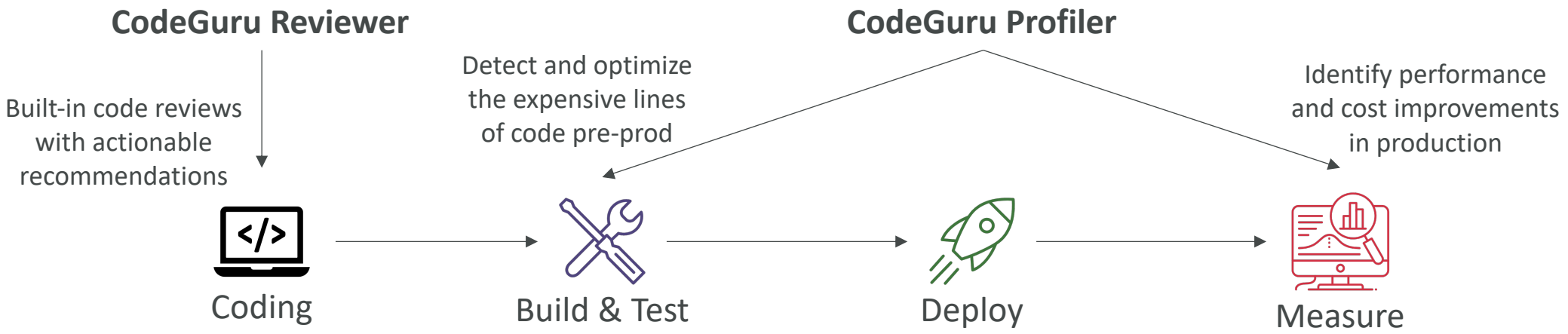


AWS X-Ray advantages

- Troubleshooting performance (bottlenecks)
- Understand dependencies in a microservice architecture
- Pinpoint service issues
- Review request behavior
- Find errors and exceptions
- Are we meeting time SLA?
- Where I am throttled?
- Identify users that are impacted

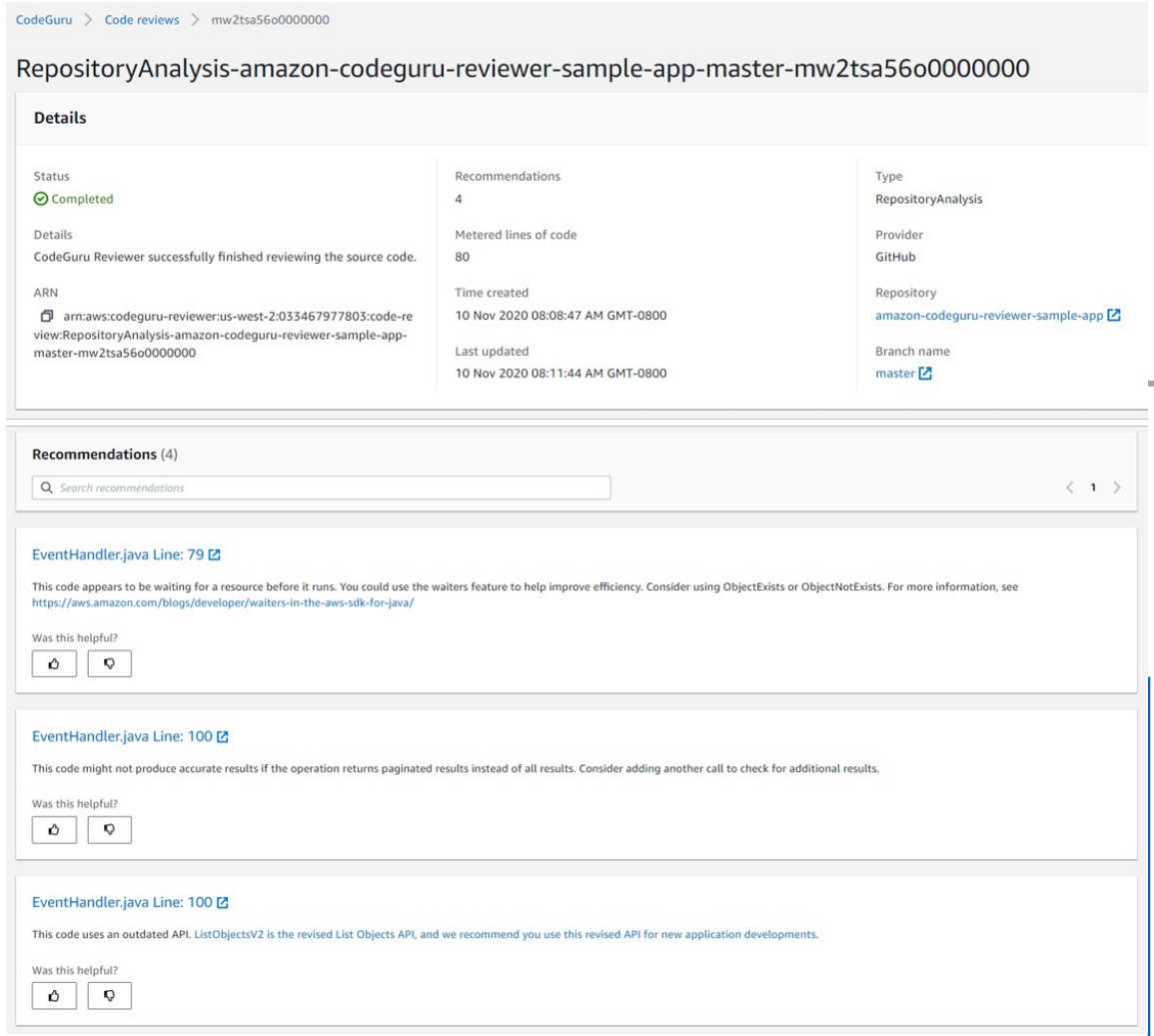
Amazon CodeGuru

- An ML-powered service for **automated code reviews** and **application performance recommendations**
- Provides two functionalities
  - **CodeGuru Reviewer:** automated code reviews for static code analysis (development)
  - **CodeGuru Profiler:** visibility/recommendations about application performance during runtime (production)



Amazon CodeGuru Reviewer

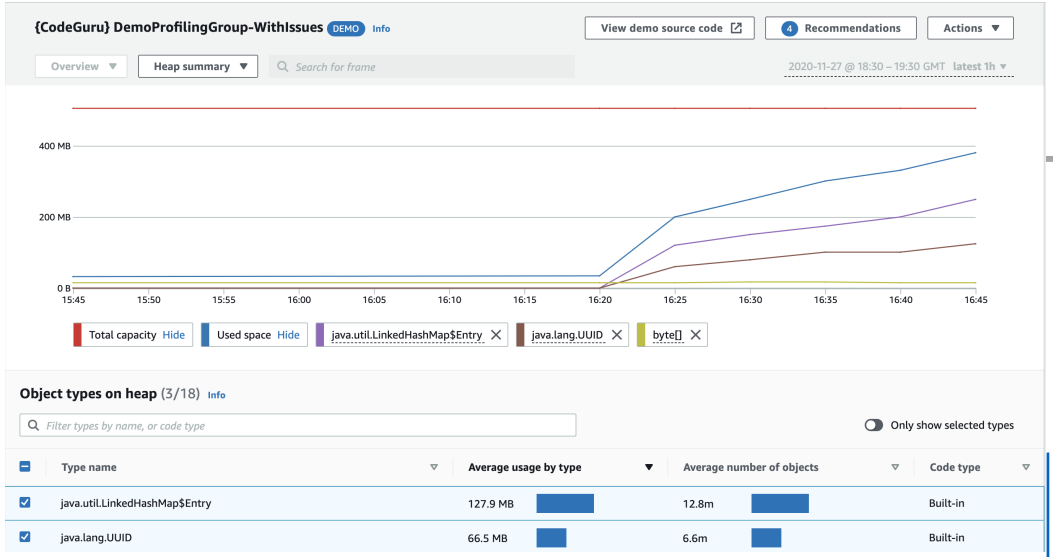
- Identify critical issues, security vulnerabilities, and hard-to-find bugs
- Example: common coding best practices, resource leaks, security detection, input validation
- Uses Machine Learning and automated reasoning
- Hard-learned lessons across millions of code reviews on 1000s of open-source and Amazon repositories
- Supports Java and Python
- Integrates with GitHub, Bitbucket, and AWS CodeCommit



https://aws.amazon.com/codeguru/features/

Amazon CodeGuru Profiler

- Helps understand the runtime behavior of your application
- Example: identify if your application is consuming excessive CPU capacity on a logging routine
- Features:
  - Identify and remove code inefficiencies
  - Improve application performance (e.g., reduce CPU utilization)
  - Decrease compute costs
  - Provides heap summary (identify which objects using up memory)
  - Anomaly Detection
- Support applications running on AWS or on-premise
- Minimal overhead on application

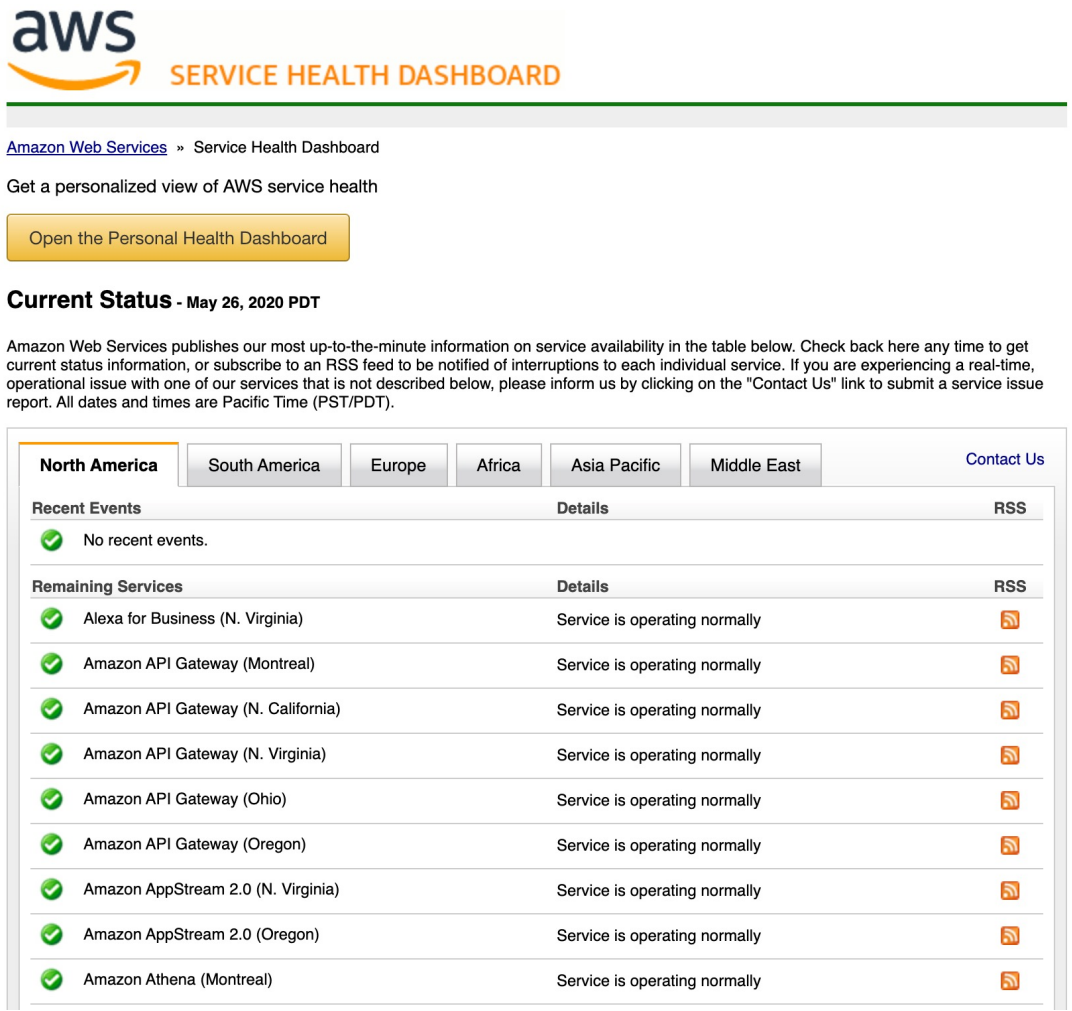


https://aws.amazon.com/codeguru/features/

AWS Status - Service Health Dashboard

- Shows all regions, all services health
- Shows historical information for each day
- Has an RSS feed you can subscribe to

- https://status.aws.amazon.com/

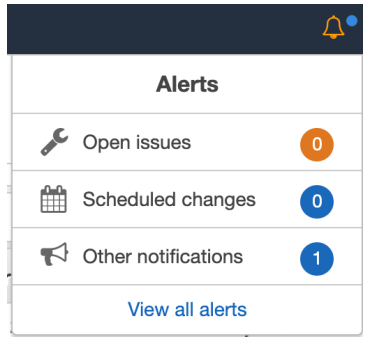


AWS Personal Health Dashboard

- AWS Personal Health Dashboard provides **alerts and remediation guidance** when AWS is experiencing **events that may impact you.**
- While the Service Health Dashboard displays the general status of AWS services, Personal Health Dashboard gives you a **personalized view into the performance and availability of the AWS services underlying your AWS resources.**
- The dashboard displays **relevant and timely information** to help you manage events in progress and provides **proactive notification** to help you plan for **scheduled activities.**

AWS Personal Health Dashboard

- Global service https://phd.aws.amazon.com/
- Shows how AWS outages directly impact you & your AWS resources
- Alert, remediation, proactive, scheduled activities



Event log

Add filter

Event	Status	Region/AZ	Start time	Last update time	Affected resources	Event category
ElasticContainerRegistry operational issue	Closed	us-west-2	May 22, 2020 at 11:48:49 PM U...	May 22, 2020 at 11:49:31 PM U...	-	Issue
CodeBuild operational notification	-	-	May 21, 2020 at 11:20:00 PM U...	May 21, 2020 at 11:35:26 PM U...	1 entity	Notification
ElasticsearchService operational issue	Closed	us-east-1	May 21, 2020 at 3:44:30 PM UT...	May 21, 2020 at 4:38:20 PM UT...	-	Issue
Batch operational issue	Closed	us-west-1	May 10, 2020 at 3:38:49 AM UT...	May 10, 2020 at 5:55:46 AM UT...	-	Issue
ElasticContainerService operational issue	Closed	us-west-1	May 10, 2020 at 3:31:30 AM UT...	May 10, 2020 at 5:52:25 AM UT...	-	Issue
CloudFormation operational issue	Closed	us-west-2	April 30, 2020 at 9:47:10 PM UT...	April 30, 2020 at 11:11:31 PM U...	-	Issue
CloudFront operational issue	Closed	-	April 21, 2020 at 11:57:30 PM U...	April 22, 2020 at 12:28:15 AM U...	-	Issue

Monitoring Summary

- CloudWatch:
  - Metrics: monitor the performance of AWS services and billing metrics
  - Alarms: automate notification, perform EC2 action, notify to SNS based on metric
  - Logs: collect log files from EC2 instances, servers, Lambda functions…
  - Events (or EventBridge): react to events in AWS, or trigger a rule on a schedule
- CloudTrail: audit API calls made within your AWS account
- CloudTrail Insights: automated analysis of your CloudTrail Events
- X-Ray: trace requests made through your distributed applications
- Service Health Dashboard: status of all AWS services across all regions
- Personal Health Dashboard: AWS events that impact your infrastructure
- Amazon CodeGuru: automated code reviews and application performance recommendations