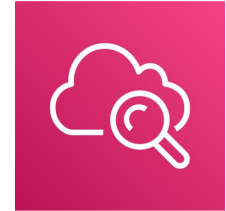


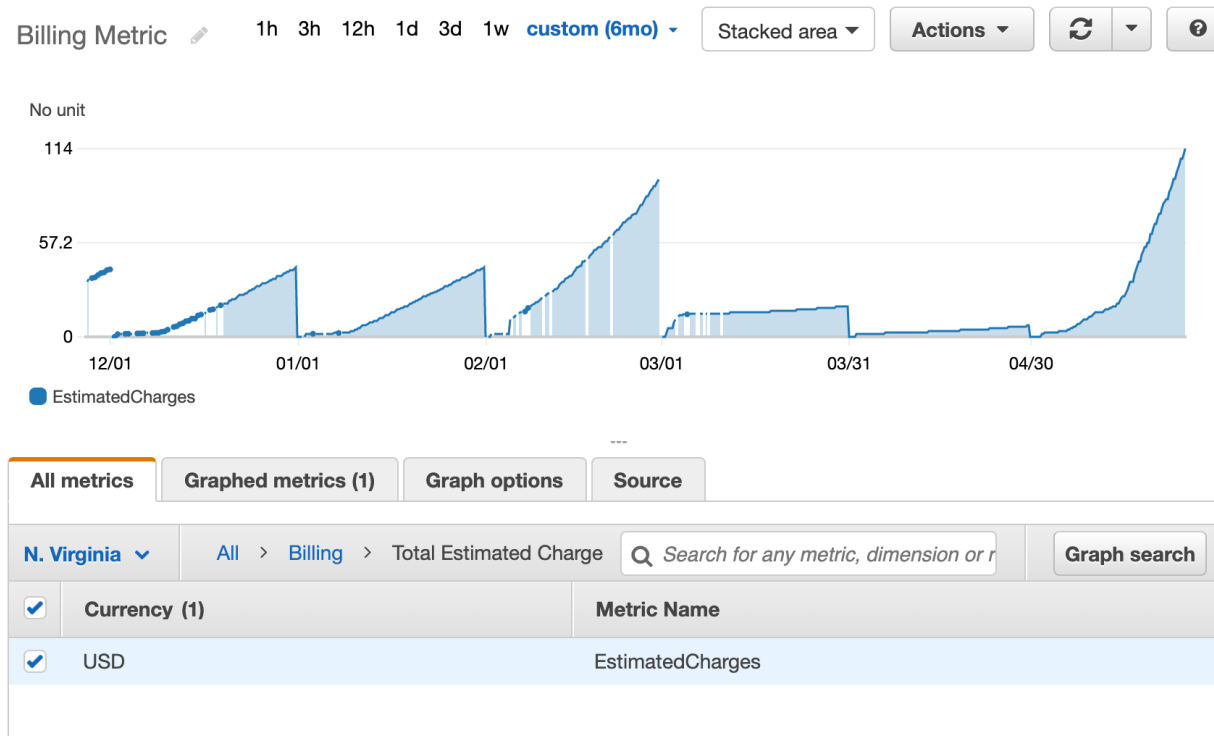
Cloud Monitoring Section

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

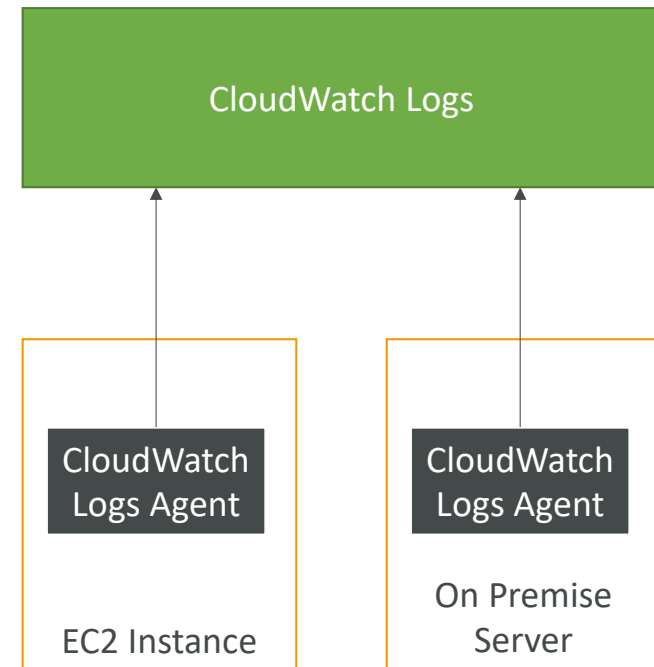
Amazon CloudWatch Logs



- 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

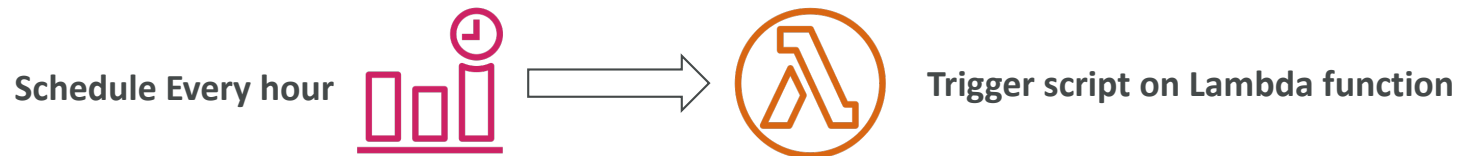
- By default, no logs from your EC2 instance will go to CloudWatch
- You need to run a CloudWatch agent on EC2 to push the log files you want
- Make sure IAM permissions are correct
- The CloudWatch log agent can be setup on-premises too



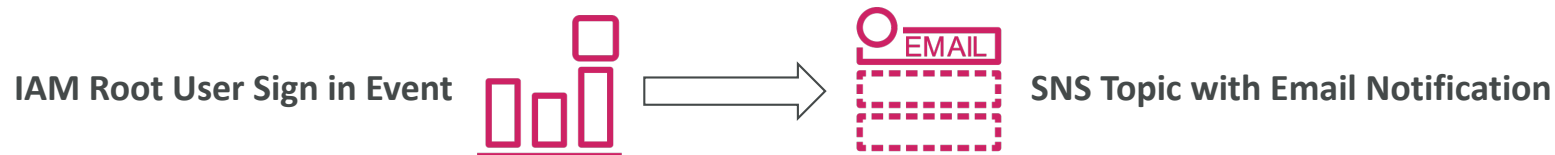
Amazon EventBridge (formerly CloudWatch Events)



- Schedule: Cron jobs (scheduled scripts)

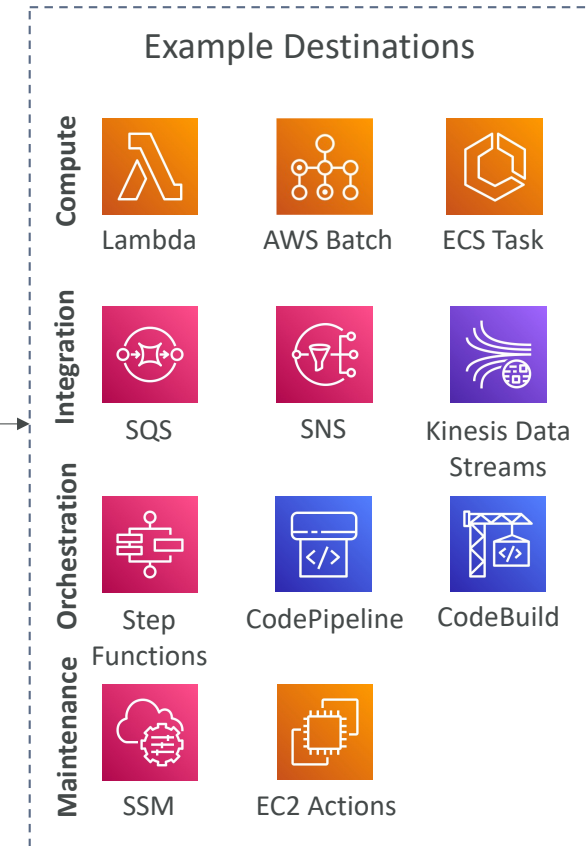
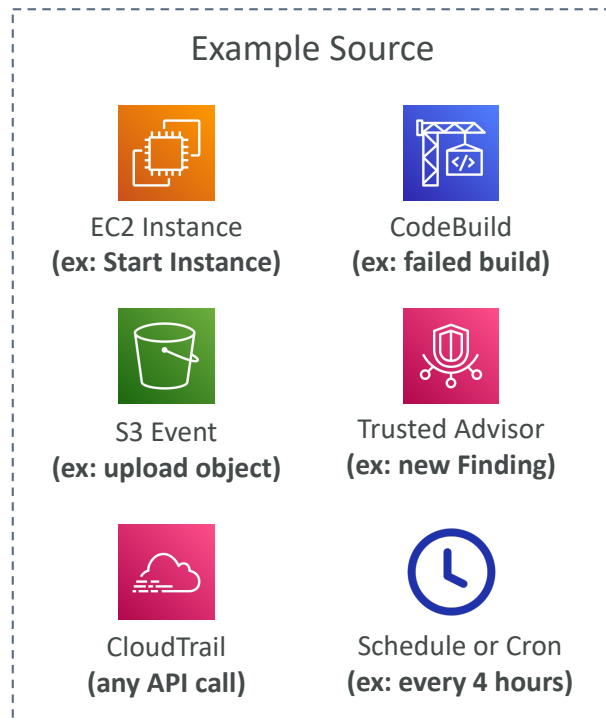


- Event Pattern: Event rules to react to a service doing something

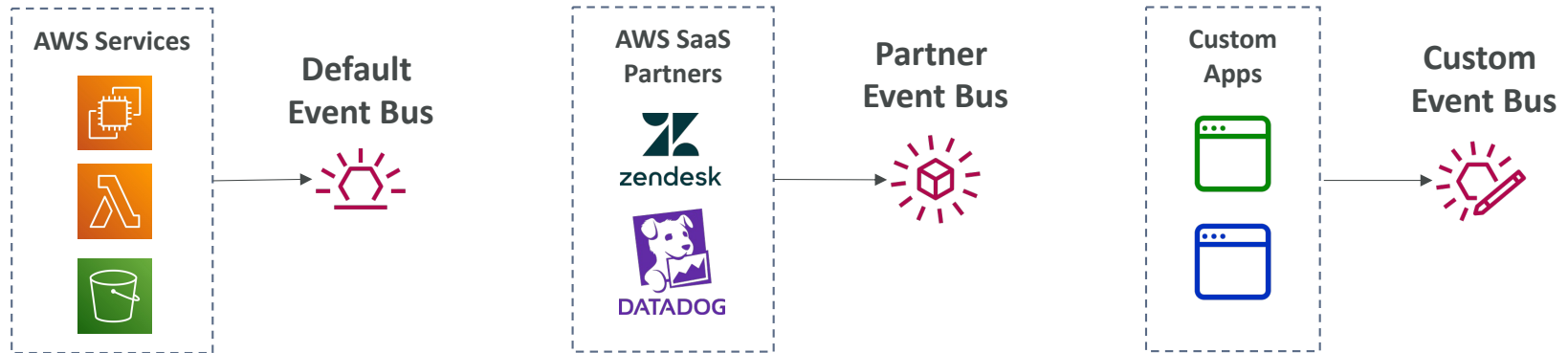


- Trigger Lambda functions, send SQS/SNS messages...

Amazon EventBridge Rules

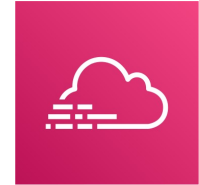


Amazon EventBridge



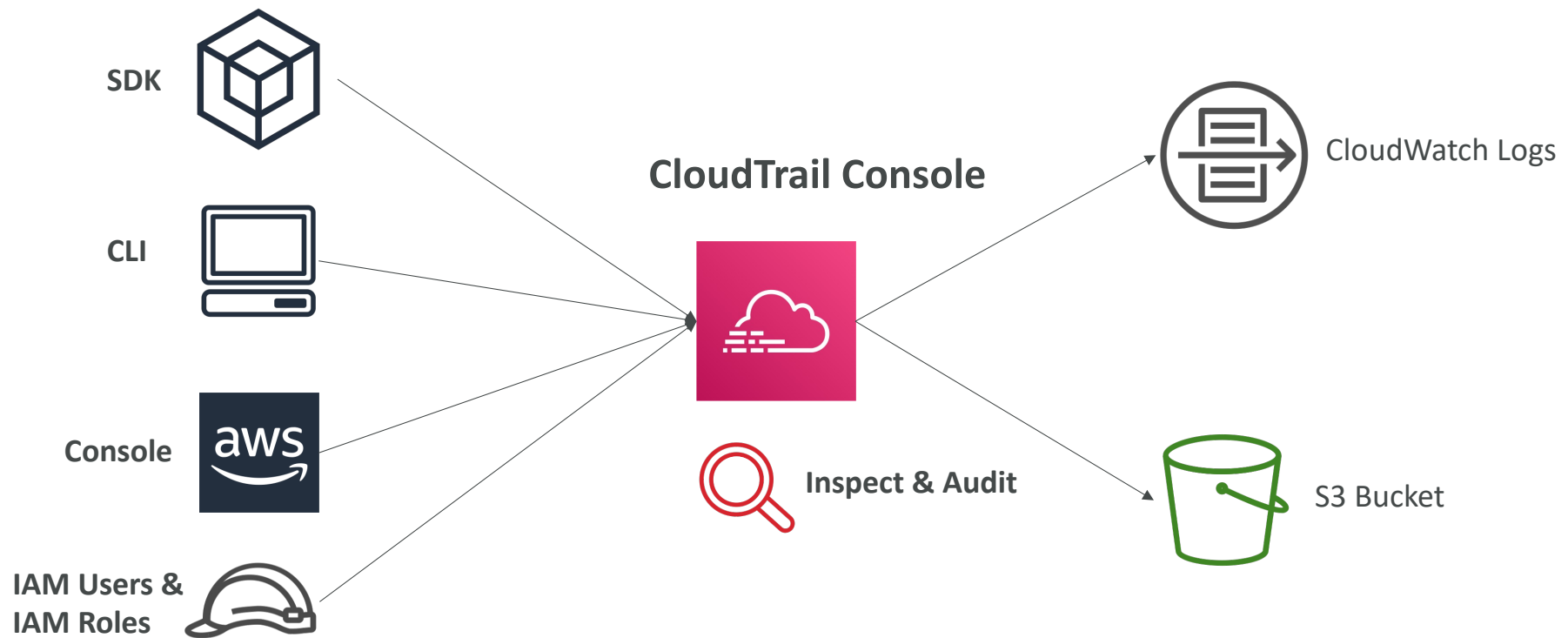
- **Schema Registry:** model event schema
- You can **archive events** (all/filter) sent to an event bus (indefinitely or set period)
- Ability to **replay archived events**

AWS CloudTrail

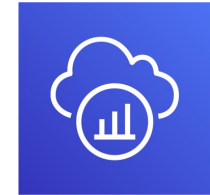


- Provides governance, compliance and audit for your AWS Account
- CloudTrail is enabled by default!
- Get an history of events / API calls made within your AWS Account by:
 - Console
 - SDK
 - CLI
 - AWS Services
- Can put logs from CloudTrail into CloudWatch Logs or S3
- A trail can be applied to All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

CloudTrail Diagram



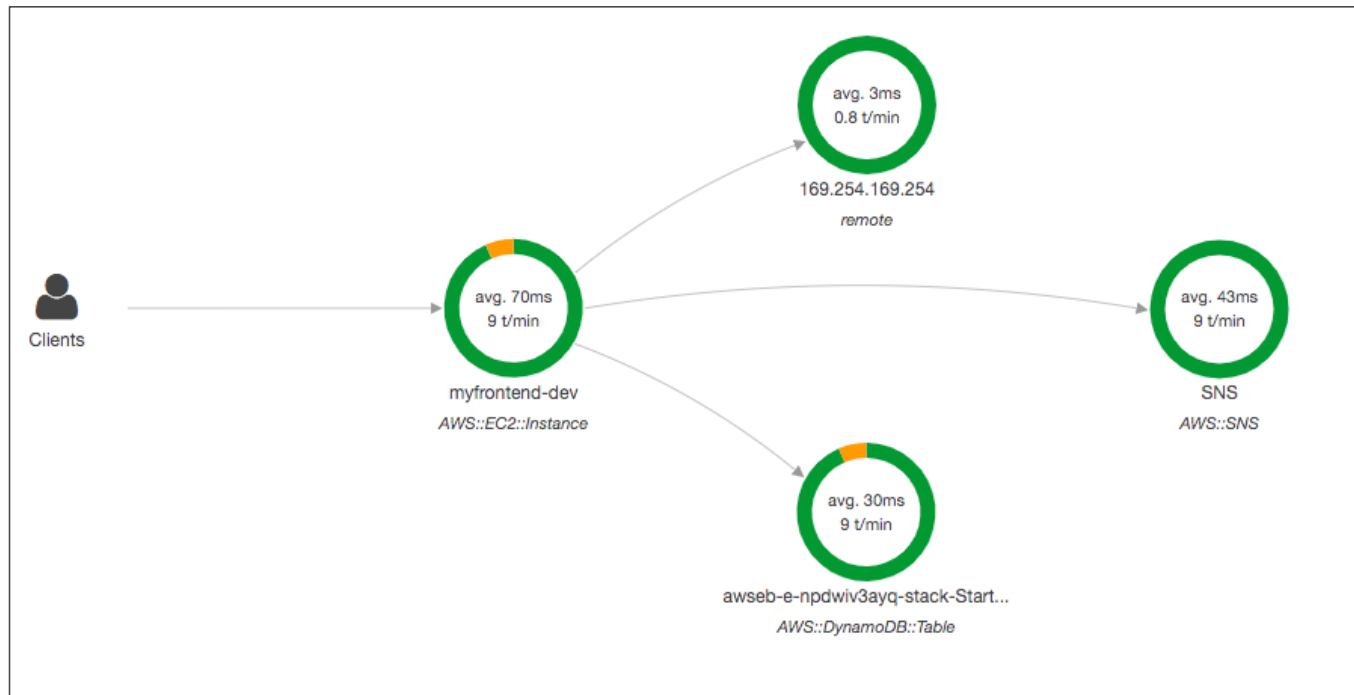
AWS X-Ray



- 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!

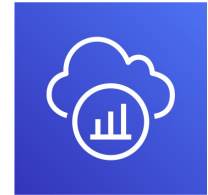
AWS X-Ray

Visual analysis of our applications



AWS X-Ray advantages

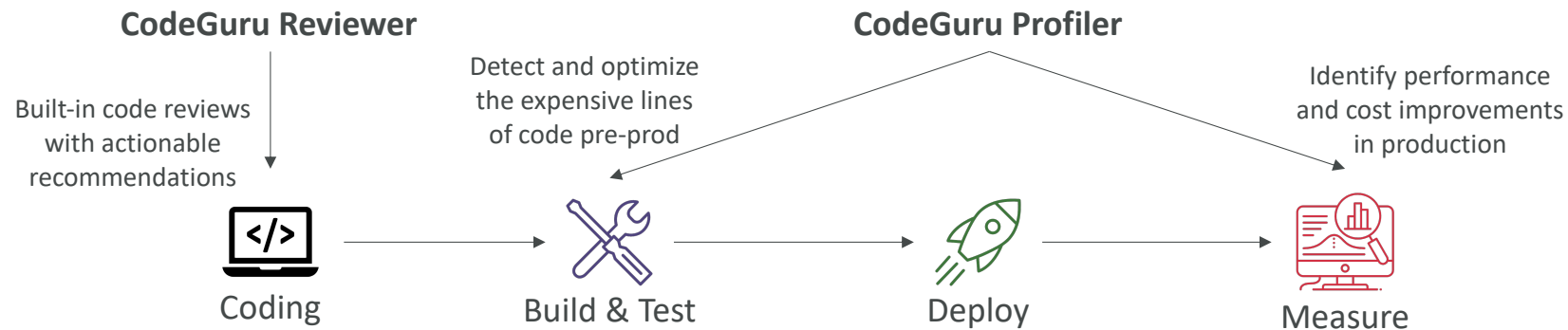
- Troubleshooting performance (bottlenecks)
- Understand dependencies in a microservice architecture
- Pinpoint service issues
- Review request behavior
- Find errors and exceptions
- Are we meeting time SLA?
- Where I am throttled?
- Identify users that are impacted



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

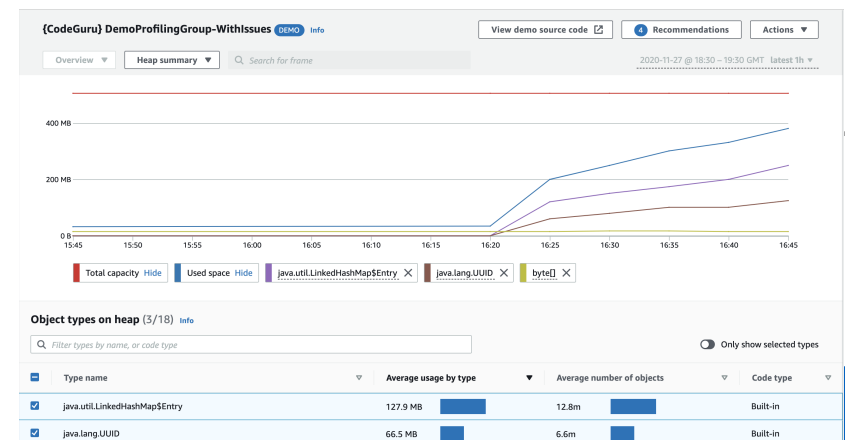
- Identify critical issues, security vulnerabilities, and hard-to-find bugs
- Example: common coding best practices, resource leaks, security detection, input validation
- Uses Machine Learning and automated reasoning
- Hard-learned lessons across millions of code reviews on 1000s of open-source and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

The screenshot shows the Amazon CodeGuru Reviewer interface for a repository analysis. The top section, titled 'RepositoryAnalysis-amazon-codeguru-reviewer-sample-app-master-mw2tsa56o0000000', displays the 'Details' of the review. The status is 'Completed', and the recommendations count is 4. The interface also shows the provider (GitHub), repository (amazon-codeguru-reviewer-sample-app), and branch name (master). Below the details, the 'Recommendations (4)' section is visible, showing a search bar and a list of recommendations. The first recommendation is for 'EventHandler.java Line: 79', stating that the code appears to be waiting for a resource before it runs. The second recommendation is for 'EventHandler.java Line: 100', stating that the code might not produce accurate results if the operation returns paginated results instead of all results. The third recommendation is also for 'EventHandler.java Line: 100', stating that the code uses an outdated API. Each recommendation includes a 'Was this helpful?' feedback section with thumbs up and down icons.

<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/>

The screenshot shows the AWS Service Health Dashboard for North America. It includes a header with the AWS logo and 'SERVICE HEALTH DASHBOARD'. Below the header, there's a link to 'Amazon Web Services » Service Health Dashboard' and a button to 'Open the Personal Health Dashboard'. The main section is titled 'Current Status - May 26, 2020 PDT' and contains a paragraph explaining the dashboard's purpose. Below this, there's a table with tabs for different regions: North America, South America, Europe, Africa, Asia Pacific, and Middle East. The 'North America' tab is selected, showing a table with columns for 'Recent Events', 'Details', and 'RSS'. The table lists various services and their status, all of which are 'operating normally'.

Recent Events	Details	RSS
✓ No recent events.		
Remaining Services		
✓ Alexa for Business (N. Virginia)	Service is operating normally	RSS
✓ Amazon API Gateway (Montreal)	Service is operating normally	RSS
✓ Amazon API Gateway (N. California)	Service is operating normally	RSS
✓ Amazon API Gateway (N. Virginia)	Service is operating normally	RSS
✓ Amazon API Gateway (Ohio)	Service is operating normally	RSS
✓ Amazon API Gateway (Oregon)	Service is operating normally	RSS
✓ Amazon AppStream 2.0 (N. Virginia)	Service is operating normally	RSS
✓ Amazon AppStream 2.0 (Oregon)	Service is operating normally	RSS
✓ Amazon Athena (Montreal)	Service is operating normally	RSS

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



Alerts	
Open issues	0
Scheduled changes	0
Other notifications	1
View all alerts	

Event log

Add filter							
	Event	Status	Region/AZ ⓘ	Start time	Last update time	Affected resources	Event category
<input type="radio"/>	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
<input type="radio"/>	CodeBuild operational notification	-	-	May 21, 2020 at 11:20:00 PM U...	May 21, 2020 at 11:35:26 PM U...	1 entity	Notification
<input type="radio"/>	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
<input type="radio"/>	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
<input type="radio"/>	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
<input type="radio"/>	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
<input type="radio"/>	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