

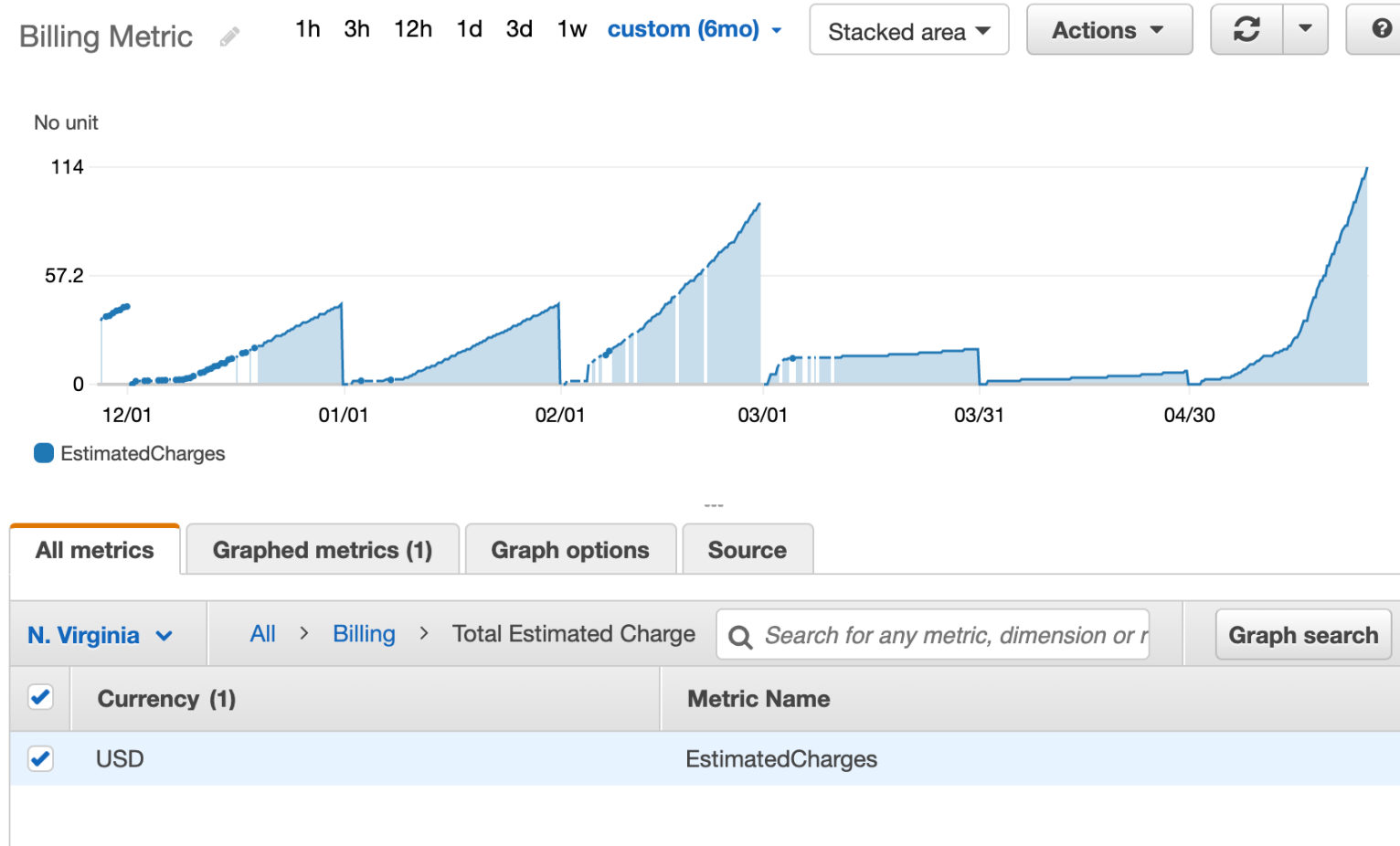
Cloud Monitoring Section

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

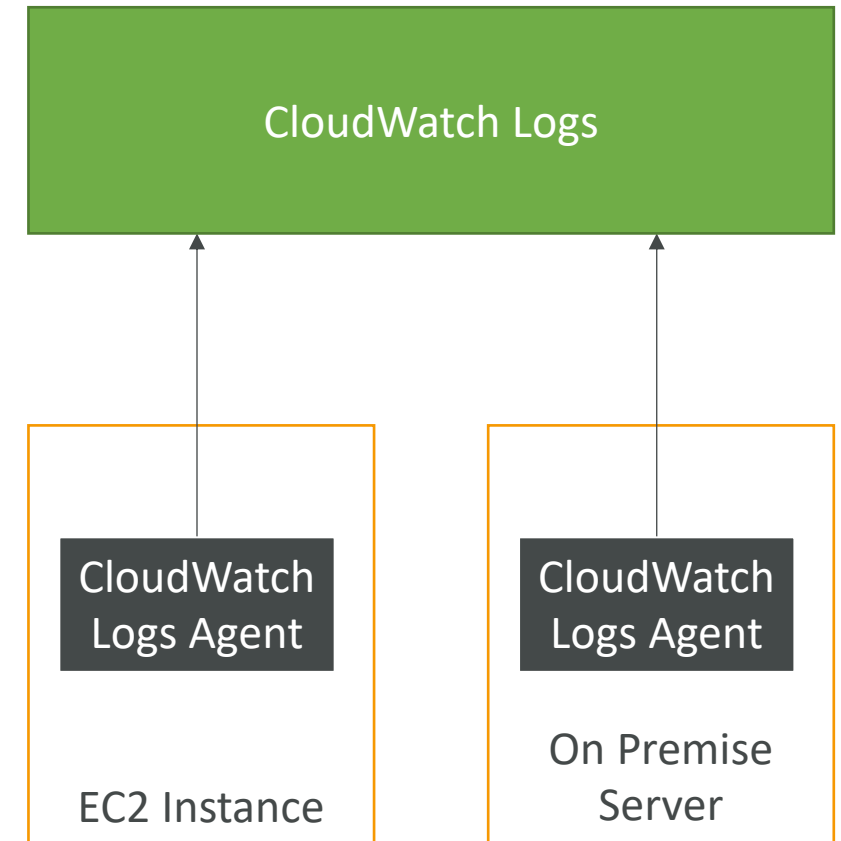


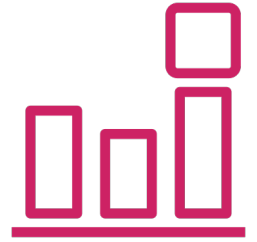
Amazon CloudWatch Logs

- 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

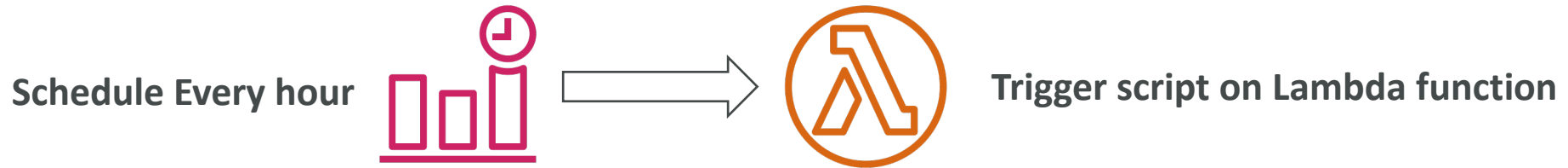
- By default, no logs from your EC2 instance will go to CloudWatch
- You need to run a CloudWatch agent on EC2 to push the log files you want
- Make sure IAM permissions are correct
- The CloudWatch log agent can be setup on-premises too



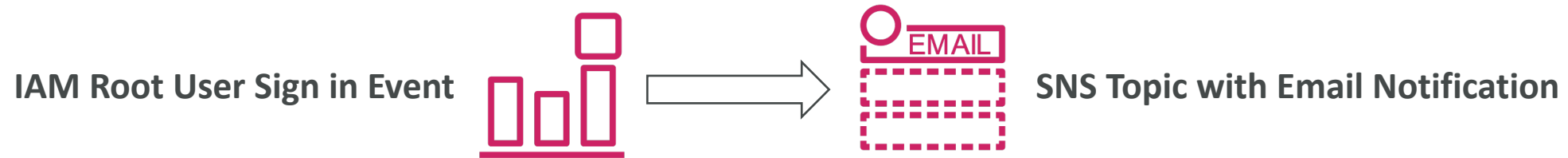


Amazon CloudWatch Events

- Schedule: Cron jobs (scheduled scripts)



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

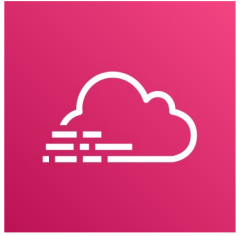


- Trigger Lambda functions, send SQS/SNS messages...



Amazon EventBridge

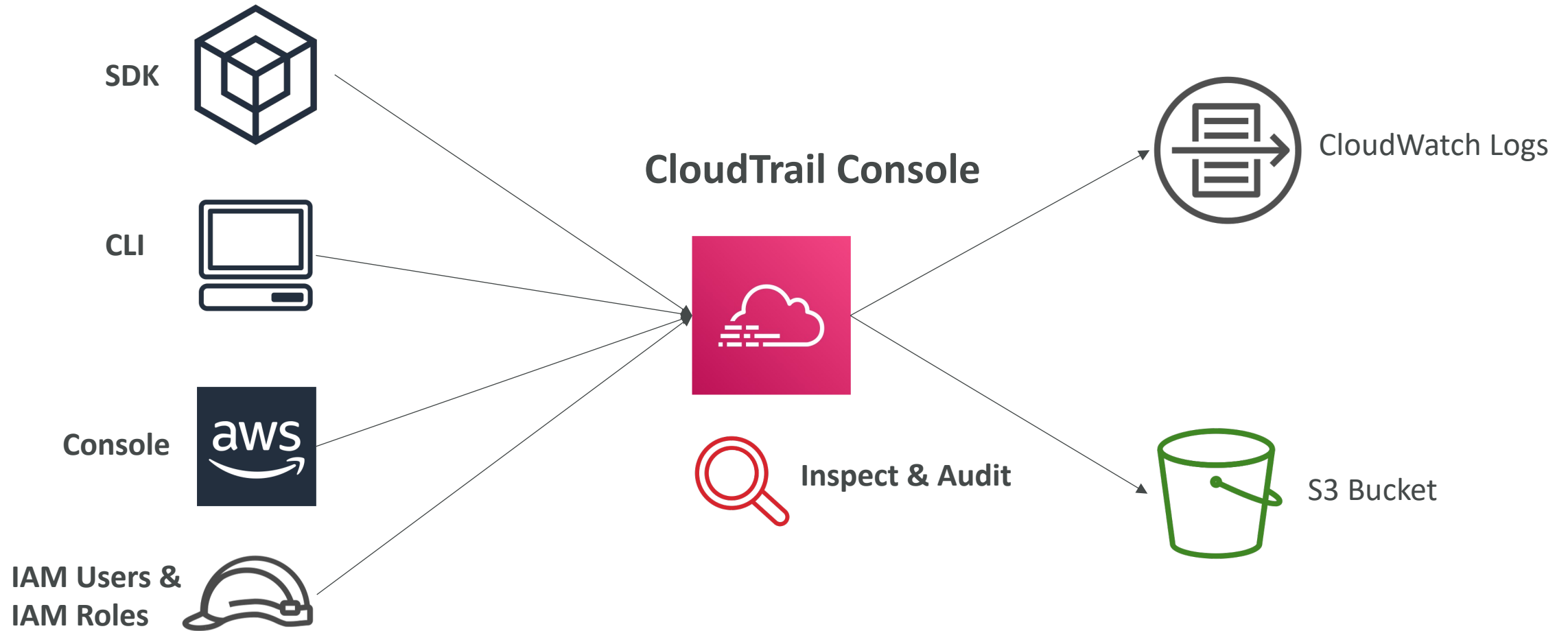
- EventBridge is the next evolution of CloudWatch Events
- **Default event bus:** generated by AWS services (CloudWatch Events)
- **Partner event bus:** receive events from SaaS service or applications (Zendesk, DataDog, Segment, Auth0...)
- **Custom Event buses:** for your own applications
- **Schema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



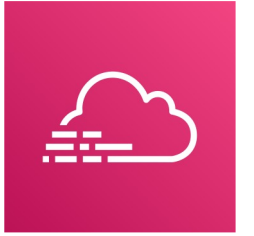
AWS CloudTrail

- 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

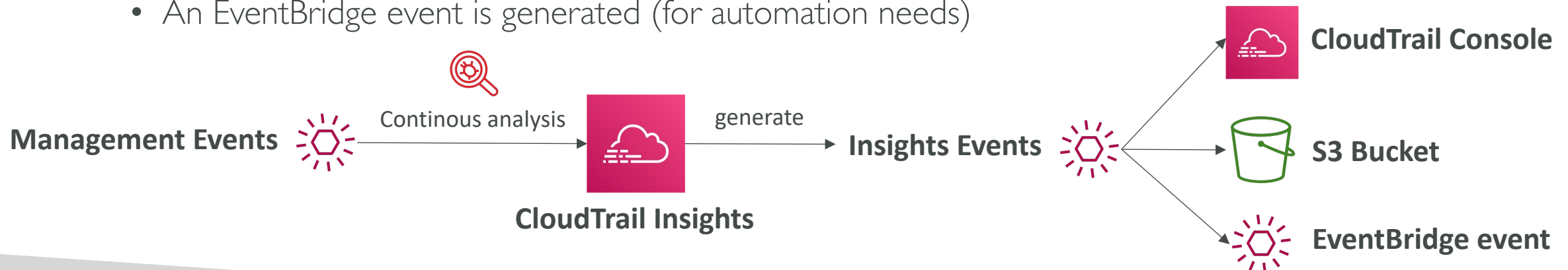


- **Management Events:**
 - Operations that are performed on resources in your AWS account
 - Examples:
 - Configuring security (IAM **AttachRolePolicy**)
 - Configuring rules for routing data (Amazon EC2 **CreateSubnet**)
 - Setting up logging (AWS CloudTrail **CreateTrail**)
 - **By default, trails 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

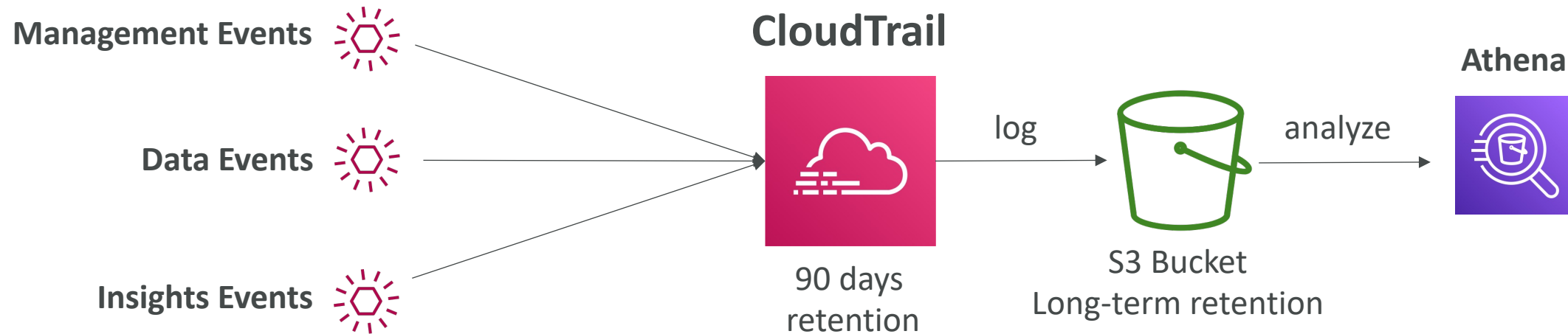


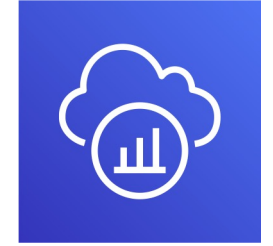
- Enable **CloudTrail Insights** to **detect unusual activity** in your account:
 - inaccurate resource provisioning
 - hitting service limits
 - Bursts of AWS IAM actions
 - Gaps in periodic maintenance activity
- CloudTrail Insights analyzes normal management events to create a baseline
- And then **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





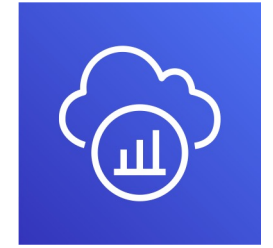
AWS X-Ray

- 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





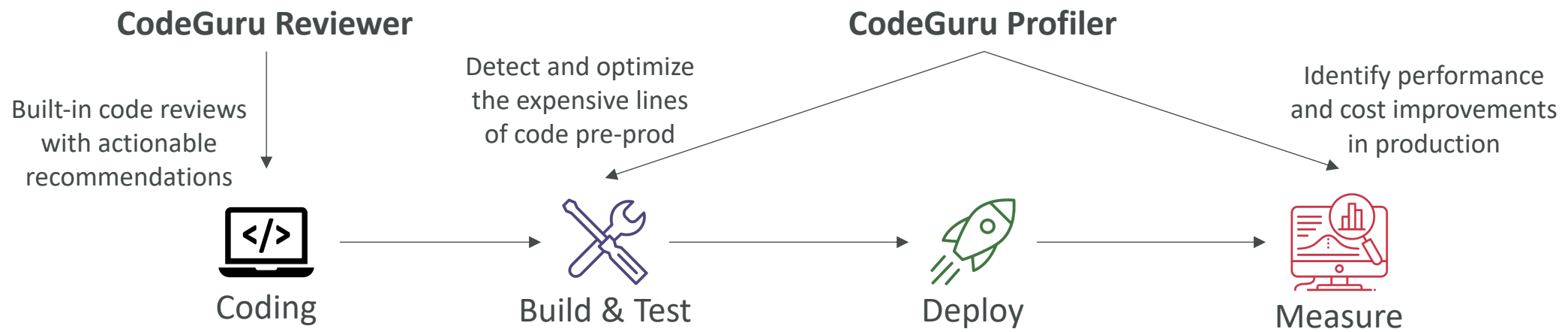
AWS X-Ray advantages

- 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

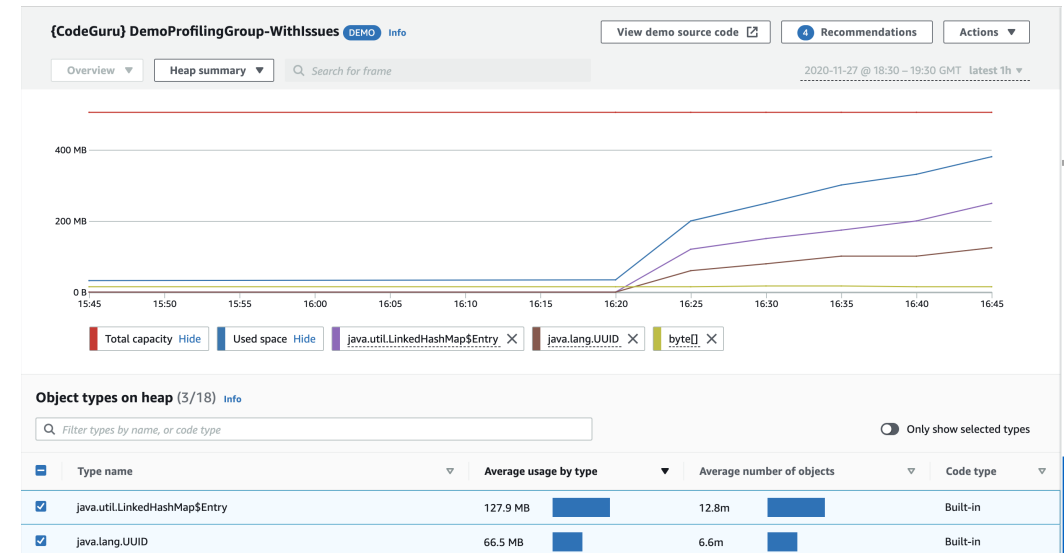
- Identify critical issues, security vulnerabilities, and hard-to-find bugs
- Example: common coding best practices, resource leaks, security detection, input validation
- Uses Machine Learning and automated reasoning
- Hard-learned lessons across millions of code reviews on 1000s of open-source and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

The screenshot displays the Amazon CodeGuru Reviewer console for a repository analysis. The breadcrumb navigation shows 'CodeGuru > Code reviews > mw2tsa56o000000'. The main title is 'RepositoryAnalysis-amazon-codeguru-reviewer-sample-app-master-mw2tsa56o000000'. Below this, a 'Details' section provides information about the analysis: Status is 'Completed' (green checkmark), Recommendations are 4, Metered lines of code are 80, Type is 'RepositoryAnalysis', Provider is 'GitHub', Repository is 'amazon-codeguru-reviewer-sample-app', and Branch name is 'master'. The 'Details' section also includes a description: 'CodeGuru Reviewer successfully finished reviewing the source code.' and an ARN: 'arn:aws:codeguru-reviewer:us-west-2:033467977803:code-review:RepositoryAnalysis-amazon-codeguru-reviewer-sample-app-master-mw2tsa56o000000'. The 'Recommendations (4)' section shows three recommendations for 'EventHandler.java'. The first recommendation is at line 79, stating 'This code appears to be waiting for a resource before it runs. You could use the waiters feature to help improve efficiency. Consider using ObjectExists or ObjectNotExists. For more information, see https://aws.amazon.com/blogs/developer/waiters-in-the-aws-sdk-for-java/'. The second recommendation is at line 100, stating 'This code might not produce accurate results if the operation returns paginated results instead of all results. Consider adding another call to check for additional results.' The third recommendation is also at line 100, stating 'This code uses an outdated API. ListObjectsV2 is the revised List Objects API, and we recommend you use this revised API for new application developments.' Each recommendation includes a 'Was this helpful?' 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/>



[Amazon Web Services](#) » Service Health Dashboard

Get a personalized view of AWS service health

[Open the Personal Health Dashboard](#)

Current Status - May 26, 2020 PDT

Amazon Web Services publishes our most up-to-the-minute information on service availability in the table below. Check back here any time to get current status information, or subscribe to an RSS feed to be notified of interruptions to each individual service. If you are experiencing a real-time, operational issue with one of our services that is not described below, please inform us by clicking on the "Contact Us" link to submit a service issue report. All dates and times are Pacific Time (PST/PDT).

North America			South America	Europe	Africa	Asia Pacific	Middle East	Contact Us
Recent Events		Details	RSS					
✓ No recent events.								
Remaining Services		Details	RSS					
✓	Alexa for Business (N. Virginia)	Service is operating normally						
✓	Amazon API Gateway (Montreal)	Service is operating normally						
✓	Amazon API Gateway (N. California)	Service is operating normally						
✓	Amazon API Gateway (N. Virginia)	Service is operating normally						
✓	Amazon API Gateway (Ohio)	Service is operating normally						
✓	Amazon API Gateway (Oregon)	Service is operating normally						
✓	Amazon AppStream 2.0 (N. Virginia)	Service is operating normally						
✓	Amazon AppStream 2.0 (Oregon)	Service is operating normally						
✓	Amazon Athena (Montreal)	Service is operating normally						



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

	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