AWS re:Invent

SEC306

Automated forensic artifact collection on AWS with Goldman Sachs

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Agenda

Learning objectives

Problem space

Goldman Sachs’s solution

Additional resources

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Learning objectives

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Q3 Tech Talk recap

1

Leverage AWS Security Hub

to centralize findings and automate security checks

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2

Enrich findings and tune detections

to provide contextual data and account for varied configurations

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3

Trigger remediation actions

to quickly and consistently resolve security events

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Problem space

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Why is threat detection so difficult?

Large, varied datasets

High rate of false-positives

Limited resources

Goldman Sachs's solution

AWS Security Finding Format (ASFF)

Enrichment and filtering

Automated detection and response

Set the scene

EXAMPLE GUARDDUTY FINDING

UnauthorizedAccess:EC2/TorRelay

Finding ID: 0cb9b1ec82915cf247f759d34b2adce5

EC2 instance i-99999999 is communicating with IP address 198.51.100.0 on the Tor Anonymizing Proxy network. Learn More

Severity HIGH	**Region** us-east-1
Count 1	**Account ID** [redacted]
Resource ID i-99999999	**Created at** 11-30-2020 16:33:53
Updated at 11-30-2020 16:33:53	

Resource affected

Resource role TARGET	**Resource type** Instance
Instance ID i-99999999	**Port** 39677
Port name Unknown	**Instance type** m3.xlarge
Outpost ARN arn:aws:outposts:us-west-2:1234567…	**Instance state** running
Availability zone us-east-1a	**Image ID** ami-99999999
Image description Prod Tomcat Server	**Launch time** 08-01-2016 21:05:06

Set the scene

EXAMPLE INSPECTOR FINDING

Finding for assessment target 'Assessment-Target-All-Instances-All-Rules' and template 'Assessment-Template-Default-All-Rules'

ARN	[illegible]
Run name	Run - Assessment-Template-Default-All-Rules
Target name	Assessment-Target-All-Instances-All-Rules
Template name	Assessment-Template-Default-All-Rules
Start	Today at 5:33 PM (GMT-5) (an hour ago)
End	Today at 6:35 PM (GMT-5) (17 minutes ago)
Status	Analysis complete
Rules package	CIS Operating System Security Configuration Benchmarks-1.0
AWS agent ID	i-99999999
Finding	Instance i-99999999 is not compliant with rule 1.6.1.2 Ensure the SELinux state is enforcing, 1.0.0 CIS Amazon Linux 2 Benchmark. Applicable profiles: Level 2.
Severity	High
Description	Description Set SELinux to enable when the system is booted. Rationale SELinux must be enabled at boot time in to ensure that the controls it provides are in effect at all times.
Recommendation	Edit the /etc/selinux/config file to set the SELINUX parameter: SELINUX=enforcing

Show Details

What happens next?

- How does SOC analyst get notified about and access this finding?
- What is the purpose of the AWS account?
- What other API calls happened around the time of the event?
- Is the EC2 instance communicating with a known-bad IP address?
- Has someone made a change to the EC2 instance or any of its related resources?

Sky Watch

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Sky Watch – 1,000-foot view

AWS Security Hub finding

ORIGINAL FINDING

EC2 instance i-99999999 is communicate with IP address 198.51.100.0 on the Tor Anonymizing Proxy network

HIGH

EC2 instance i-99999999 is communicate with IP address 198.51.100.0 on the Tor Anonymizing Proxy network

Workflow status

New

RECORD STATE

ACTIVE

Set by the finding provider

AWS account ID

Severity (original)

8

Severity (normalized)

75

Created at

2020-11-30T16:33:53.870Z

Updated at

2020-11-30T16:33:53.870Z

Product name

GuardDuty

Severity label

HIGH

Company name

Amazon

Source URL

https://us-east-1.console.aws.amazon.com/guardduty/home?region=us-east-1#/findings?macros=current&fId=0cb9b1ec82915cf247f759d34b2adce5

Instance i-99999999 is not compliant with rule 1.6.1.2 Ensure the SELinux state is enforcing, 1.0.0 CIS Amazon Linux 2 Benchmark. Applicable profiles: Level 2.

HIGH

Description Set SELinux to enable when the system is booted. Rationale SELinux must be enabled at boot time in to ensure that the controls it provides are in effect at all times.

Workflow status

New

RECORD STATE

ACTIVE

Set by the finding provider

AWS account ID

Severity (normalized)

70

Created at

2020-11-29T22:33:14.901Z

Updated at

2020-11-29T23:35:14.901Z

Product name

Inspector

Severity label

HIGH

Company name

Amazon

Enrichment and auto remediation architecture

AWS Security Hub finding

ENRICHED FINDING


```
"USERDEFINEDFIELDS": {
  "Business_Unit": "Web Server Architecture",
  "Account_Name": "Prod Tomcat Account",
  "Account_Type": "Prod",
  "VPC_Flow_Location": "s3://vpcflow-
  bucket/0cb9b1ec82915cf247f759d34b2adce5",
  "Contextual_CloudTrail_Location": "s3://contextual-cloudtrail-
  bucket/0cb9b1ec82915cf247f759d34b2adce5",
  "Enriched_IP_City": "Moscow",
  "Enriched_IP_Country": "Russia",
  "Enriched_IP_ASN": "AS60804"
}
```

AWS CloudTrail and Amazon VPC Flow evidence

Contextual evidence from CloudTrail

Timestamp	UserIdentity.ARN	Event name	Error code
2020-11-27T14:30:35	arn:aws:iam::XXXXXXXXXXXX:role/TomcatServerRole	ListBuckets	AccessDenied
2020-11-27T14:30:37	arn:aws:iam::XXXXXXXXXXXX:role/TomcatServerRole	DescribeInstances	
2020-11-27T14:30:41	arn:aws:iam::XXXXXXXXXXXX:role/TomcatServerRole	RunInstances	AccessDenied

Contextual evidence from VPC Flow

Timestamp	Instance ID	Port	Packet source address	Packet destination address	Action
2020-11-30T16:33:53	i-99999999	443	198.51.100.0	192.168.1.45	ALLOW
2020-11-30T16:30:55	i-99999999	2057	192.168.1.45	198.51.100.0	ALLOW
2020-11-30T16:31:01	i-99999999	9001	198.51.100.0	192.168.1.45	ALLOW

Are we done?

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Digital forensic evidence

Disk forensic evidence

What

Point in time copy of all volumes attached to compromised instance

Why

- When and how did the malware get installed on the instance?
- How many times has the malware been run on the instance?
- How was the malware configured to run? (e.g., scheduled task or on boot)
- Were any other suspicious files (e.g., other malware, worms, or large encrypted archives) created on the instance?

Memory forensic evidence

What

Point in time copy of memory (RAM) associated with compromised instance

Why

- What process is running the malware?
- What network connections has been established?
- What parent process executed the malware?
- What evasion techniques (if any) have been employed by the malware?

Sky Collect

Monitored account
Security account
CloudTrail Logs
VPC Flow Logs
DNS Logs
Contextual data
Amazon GuardDuty
AWS Security Hub (member)
AWS Security Hub (master)
Amazon CloudWatch Events
Compromised EC2 instance
AWS Systems Manager
IAM role
AWS Step Functions
Attached EBS volumes
Encrypted snapshots
Shared snapshots
Created EBS volumes
Collector VM instance
Amazon S3 evidence bucket

Benefits of Sky Watch

Near real-time response

Cost-effective, serverless workflows

Scalable, auditable and event driven

Metrics on Sky Watch and Sky Collect

12 hours → 70 seconds

Mean detection to remediation time

63%

Average monthly cost savings

80 minutes → 11 minutes*

Disk evidence collection time savings

Summary

- Discussed challenges of aggregating multiple, disparate sources across a large number of accounts
- Reviewed Sky Watch and Sky Collect solutions built by Goldman Sachs
- Demonstrated cost and time savings achieved using Sky Watch / Sky Collect solutions

Appendices

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Resources

APPENDIX A

AWS Q3 Tech Talk: Disk and Memory Evidence Collection

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SEC301 – Automating threat detection and response in AWS

SEC318 – DIY guide to runbooks, incident reports, and incident response

AWS re:Invent 2020

SEC301 – Security investigations with Amazon Detective

SEC307 – Use Amazon GuardDuty and AWS Security Hub to secure multiple accounts

SEC313 – A security operator's guide to practical AWS CloudTrail analysis

And many more!

Pro tips

APPENDIX B

- Consider deploying in phases
  1) **Native integrations** – Security Hub has many useful native integrations with services (e.g., GuardDuty, Macie, and Inspector); integrations are enabled by default on initial Security Hub configuration
  2) **Custom Integrations** – For services that do not yet support native Security Hub integration, bespoke solutions must be created to import findings as custom findings
  3) **Enrichments** – Leverage UserDefinedFields and BatchUpdateFindings API to provide and store contextual enrichment data in the finding
- Evaluate business impact before turning on auto remediations
- Design to be fault tolerant, enable monitoring, and establish SLAs to minimize downtime – anything could fail at any time

CloudTrail detection architecture

APPENDIX C

1. Subset of Org CloudTrail logs is forwarded to Kinesis Data Stream via CloudWatch Log Subscription Filter

2. Kinesis Data Stream acts as trigger for Dispatcher Lambda

3. Dispatcher Lambda triggers Detection Lambdas based on event source and API call

4. Detection Lambdas evaluate API call and import true positives into Security Hub

Config detection architecture

APPENDIX D

1. Config evaluates resource for compliance change

2. Compliance change notification forwarded to Security account Event Bridge as CloudWatch Event

3. CloudWatch Event Rule picks up event and triggers Integration Lambda

4. Integration Lambda extracts relevant fields and imports finding into Security Hub

Thank you!

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