

SANS DFIR

ENTERPRISE
CLOUD FORENSICS
&
INCIDENT RESPONSE
P O S T E R

DFPS_FOR509_v1.1_10-22

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CLOUD TERMINOLOGY

Service	AWS	Azure	GCP
Virtual Machine	EC2 Instance	Virtual Machine	Compute Engine
Serverless	Lambda	Functions	Cloud Functions
VM Disk Storage	EBS(Elastic Block Store)	Managed Disks	Persistent Disks
Object Storage	S3 (Simple Storage Service)	Blob Storage	Cloud Storage
Network File Storage	EFS (Elastic File System)	File Storage	File Store
Virtual Networking	VPC	VNet	Cloud Virtual Network
Logging	CloudWatch & CloudTrail	Log Analytics	Log Explorer
Message Queuing	SQS (Simple Queue Service)	Event Hub	Cloud Pub/Sub

SIGNIFICANT LOG SOURCES

Microsoft 365

Unified Audit Log

- Every Microsoft workload, user and admin activity
- Accessed via Purview compliance portal, PowerShell or API

Azure

Log Types

- Tenant logs (on by default)
- Subscription logs (on by default)
- Resource logs (off by default) – NSG Flow logs included here
- Operating system logs (off by default)
- Application logs (off by default)

Access Methods

- View them directly on the Azure portal.
- Store them in a Log Analytics workspace.
- Send them to a storage account for archival or export.
- Send them to a SIEM by using an event hub or Graph API.

Tenant

Subscriptions

Resource

Operating System

Application

insights-logs-auditlogs

insights-logs-signinlogs

insights-logs-managedidentitysigninlogs

insights-logs-noninteractiveuserssigninlogs

insights-logs-serviceprincipalsigninlogs

insights-activity-logs

insights-logs-networksecuritygroupflowevent

insights-logs-storage-read

WADWindowsEventLogsTable

LinuxSyslogVer2vo

wad-iis-logfiles

AWS

Log Types

- CloudTrail – Tenant audit logs
- CloudTrail Insights – API usage outside of baselines
- CloudWatch Logs – Forwarded logs from applications and endpoints
- GuardDuty – Anomaly detection within CloudTrail
- VPC flow logs – NetFlow logs from your VPCs
- S3 Server access – Logs from web-based storage access
- Route 53 – DNS Resolver Logs
- Load Balancer Logs

Access Methods

- View them in the AWS console
- Store them in S3 and search with Athena
- Analyze them with AWS Detective
- Ship them with Event Hub to your SIEM

GCP

Log Types

- Admin Activity Logs
- System Event Logs
- Enterprise Group Audit Logs
- Login Audit Logs
- Access Transparency Logs
- Policy Denied Audit Logs
- Bucket Logs

**You get 400 days of free logs under the Required bucket*

GWS

Log Types

- Admin log events
- Drive log events
- Gmail log events
- OAuth log events
- Rules log events
- Takeout log events
- User log events

SOFF-ELK FOR CLOUD LOGS

Microsoft 365

Unified audit log

– either exported from the portal or PowerShell, must be CSV formatted

Parser:

/usr/local/sof-elk/configfiles/6701-office365.conf

Logstash folder:

/logstash/office365

Azure

Tenant, subscription and resource logs

– exported from storage account in JSON format

Parser:

/usr/local/sof-elk/configfiles/6801-azure.conf

Logstash folder:

/logstash/azure

Preprocessing commands:

- Processing Azure PT1H files:

```
$ find . -type f -name PT1H.json -exec cat {} + | tee output.json
```

AWS

CloudTrail logs

Parser:

/usr/local/sof-elk/configfiles/6901-aws.conf

Logstash folder:

/logstash/aws

Preprocessing commands:

- ```
$ aws-cloudtrail2sof-elk.py -r ./path/to/log -w /logstash/aws/cloudtrail.json
```

GCP

Google Logging exports

Parser:

/usr/local/sof-elk/configfiles/6950-gcp.conf

Logstash folder:

/logstash/gcp

Google Workspace

Google Workspace audit logs exported via API in JSON format – email tracking logs exported to CSV from the admin portal

Parser:

/usr/local/sof-elk/configfiles/6951-gws.conf

Logstash folder:

/logstash/gws

Flow Logs

VPC flow logs from AWS or GCP, NSG flow logs from Azure

Logstash folder:

/logstash/nfarch

Preprocessing commands:

- AWS: 

```
$ aws-vpcflow2sof-elk.sh -r /path/to/aws/flow/log -w /logstash/nfarch/aws_flow_log.txt
```
- Azure: 

```
$ azure-vpcflow2sof-elk.py -r /path/to/azure/flow/log -w /logstash/nfarch/azure_flow_log.txt
```

DEFAULT LOG RETENTION CONFIGURATION

|                | AWS            | Azure          | GCP            |
|----------------|----------------|----------------|----------------|
| Authentication | 90 days        | 30 days        | 400 days       |
| User Accounts  | 90 days        | 30 days        | 400 days       |
| Resources      | 90 days        | 30 days        | 400 days       |
| Storage        | Off by default | Off by default | Off by default |
| Flow Logs      | Off by default | Off by default | Off by default |
| Firewall Logs  | Off by default | Off by default | Off by default |

SANS DFIR CURRICULUM

@SANSForensics dfir.to/DFIRCast dfir.to/LinkedIn

OPERATING SYSTEM & DEVICE IN-DEPTH

FOR308

Digital Forensics Essentials

FOR498

Battlefield Forensics & Data Acquisition GBFA

FOR500

Windows Forensic Analysis GCCE

FOR518

Mac and iOS Forensic Analysis In-Depth Response

FOR585

Smartphone Forensic Analysis In-Depth GASF

INCIDENT RESPONSE & THREAT HUNTING

FOR508

Advanced Incident Response, Threat Hunting & Digital Forensics GCFA

FOR509

Enterprise Cloud Forensics & Incident Response

FOR528

Ransomware for Incident Responders

FOR572

Advanced Network Forensics: Threat Hunting, Analysis & Incident Response GNFA

FOR578

Cyber Threat Intelligence GCTI

FOR608

Enterprise-Class Incident Response & Threat Hunting

FOR610

REM: Malware Analysis Tools & Techniques GREM

FOR710

Reverse-Engineering Malware: Advanced Code Analysis

SEC504

Hacker Tools, Techniques & Incident Handling GCIH

SANS TRAINING

FOR509: Enterprise Cloud Forensics and Incident Response

The world is changing and so is the data we need to conduct our investigations. Cloud platforms change how data is stored and accessed. They remove the examiner's ability to directly access systems and use classical data extraction methods. Unfortunately, many examiners are still trying to force old methods for on-premise examination onto cloud-hosted platforms. Rather than resisting change, examiners must learn to embrace the new opportunities presented to them in the form of new evidence sources. FOR509: Enterprise Cloud Forensics and Incident Response addresses today's need to bring examiners up to speed with the rapidly changing world of enterprise cloud environments by uncovering the new evidence sources that only exist in the Cloud.





# Threat Hunting in the Cloud

## Events of Interest

| Scenario                            | Log Source                        |                            |                    |                  |      |
|-------------------------------------|-----------------------------------|----------------------------|--------------------|------------------|------|
|                                     | AWS                               | Azure                      | GCP                | GWS              | M365 |
| Impossible Travel                   | CloudTrail                        | Signin Logs                | Login Audit Logs   | Audit Report     | UAL  |
| Console Access via Service Accounts | CloudTrail                        | SPN Signin Logs            | Policy Denied Logs | NA               | UAL  |
| Publicly Exposed Keys               | CloudTrail                        | Activity Logs              | System Event Logs  | OAuth Log Events | UAL  |
| Storage Canaries                    | CloudTrail/<br>Server Access Logs | Storage Logs               | Storage Logs       | Drive Log Events | UAL  |
| Lateral Movement                    | CloudTrail                        | Activity Logs              | System Event Logs  | User Log Events  | UAL  |
| Password Sprays                     | CloudTrail                        | Signin Logs                | Login Audit Logs   | User Log Events  | UAL  |
| Cloud Tenant Enumeration            | CloudTrail                        | Activity Logs<br>(Limited) | System Event Logs  | Service Logs     | UAL  |

## API Calls That Return Creds for AWS

|                                                   |                                                      |
|---------------------------------------------------|------------------------------------------------------|
| iam:CreateServiceSpecificCredential               | sts:GetFederationToken                               |
| iam:ResetServiceSpecificCredential                | sts:GetSessionToken                                  |
| iam:UpdateAccessKey                               | chime:CreateApiKey                                   |
| lightsail:GetInstanceAccessDetails                | codepipeline:PollForJobs                             |
| lightsail:GetRelationalDatabaseMasterUserPassword | cognito-identity:GetOpenIdToken                      |
| rds-db:connect                                    | cognito-identity: GetOpenIdTokenForDeveloperIdentity |
| redshift:GetClusterCredentials                    | cognito-identity: GetCredentialsForIdentity          |
| sso:GetRoleCredentials                            | connect:GetFederationToken                           |
| mediapackage:RotateChannelCredentials             | connect:GetFederationTokens                          |
| mediapackage:RotateIngestEndpointCredentials      | ecr:GetAuthorizationToken                            |
| sts:AssumeRole                                    | gamelift:RequestUploadCredentials                    |
| sts:AssumeRoleWithSaml                            | iam:CreateAccessKey                                  |
| sts:AssumeRoleWithWebIdentity                     | iam:CreateLoginProfile                               |

# CLI Cheat Sheet

## PowerShell – Connecting to Microsoft 365

```
| PS> Install-Module -Name ExchangeOnlineManagement
| PS> Import-Module ExchangeOnlineManagement; Get-Module ExchangeOnlineManagement
| PS> Connect-ExchangeOnline -UserPrincipalName <UPN> -ShowProgress $true
```

## PowerShell – Connecting to Azure

```
| PS> Install-Module -Name Az -AllowClobber
| PS> Import-Module Az; Get-Module Az
| PS> Connect-AzAccount
```

## Download Cloudtrail Logs

```
| $ aws s3 cp s3://<name of log bucket>/AWSLogs . --recursive
```

## gcloud Log Collection

```
| $ gcloud logging buckets list
| $ gcloud logging read 'timestamp<="2021-02-28T00:00:00Z" AND timestamp>="2020-01-25T00:00:00Z"' --format="json" > all_gcp_logs.json
```

## Azure Snapshot Download

```
| azcopy cp "<snapshot URL>" "c:\temp\snapshot.vhd" --check-md5 nocheck
```

## AWS Snapshot Download via Coldsnap

```
| coldsnap --region <region> download <snapshot id> image.dd
```

## AWS Snapshot Creation and Mounting via AWS CLI

```
| aws ec2 create-snapshot --volume-id <volumeid> --description "Making a snapshot"
| aws ec2 create-volume --availability-zone <zone where your DFIR AMI is running> --snapshot-id <snapshot-id>
| aws ec2 attach-volume --volume-id <volume id returned from prior command> --instance-id <your DFIR EC2 instance> --device </dev/sdX>
```

# Resources

- FOR509 GitHub: <https://for509.com/github>
- CrowdStrike CRT: <https://for509.com/crowdstrike crt>
- Tesorion CERT UAL Extractor: <https://for509.com/tcert-ual>
- Invictus IR M365 Extractor: <https://for509.com/invictus-ual>

# Enterprise Cloud Forensics & Incident Response