



IAM The One Who Knocks

Igal Gofman, Noam Dahan

Igal Gofman

@IgalGofman

- Head of Research, Ermetic
- Microsoft MSTIC
- Microsoft security research
- Active Directory expert

Noam Dahan

@NoamDahan

- Cloud security researcher
- Love/hate relationship with embedded devices
- Offensive background

Why are we here?

IAM best practices



- AWS - Apply least-privilege permissions
- AWS - Use IAM Access Analyzer to generate least-privilege policies based on access activity
- AWS - Regularly review and remove unused users, roles, permissions, policies, and credentials
- AWS - Use conditions in IAM policies to further restrict access



- GCP - Basic roles include thousands of permissions across all Google Cloud services. In production environments, do not grant basic roles unless there is no alternative. Instead, grant the most limited predefined roles or custom roles that meet your needs.
- GCP - Treat each component of your application as a separate trust boundary.
- GCP - Grant roles at the smallest scope needed.



- Azure - Treat identity as the primary security perimeter
- Azure - Use role-based access control
- Azure - Lower exposure of privileged accounts

<https://docs.aws.amazon.com/IAM/latest/UserGuide/best-practices.html>

<https://cloud.google.com/iam/docs/using-iam-securely>

<https://docs.microsoft.com/en-us/azure/security/fundamentals/identity-management-best-practices>

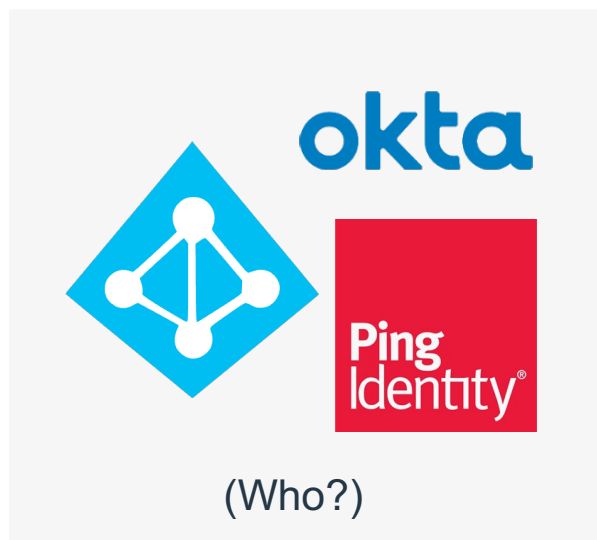
Agenda

- IAM Crash Course
- Cloud IAM weak spots (permissions landscape)
- Things are not always what they seem
- Defense & Monitoring techniques
- Demo

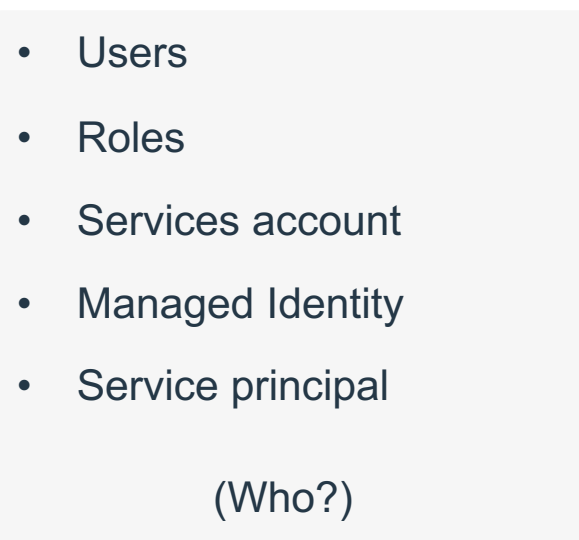


IAM Crash Course

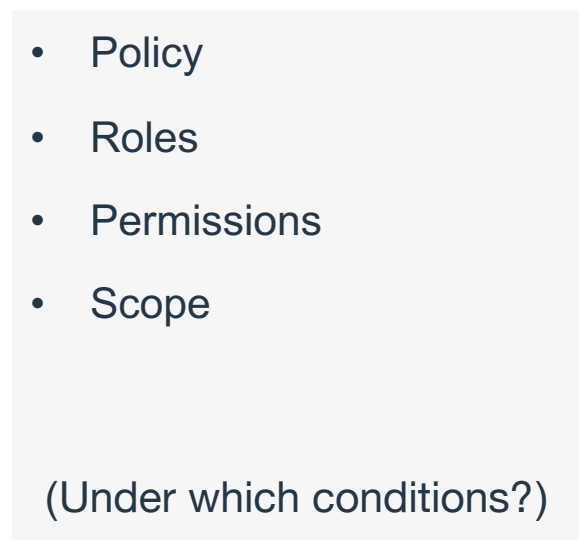
Federation Services

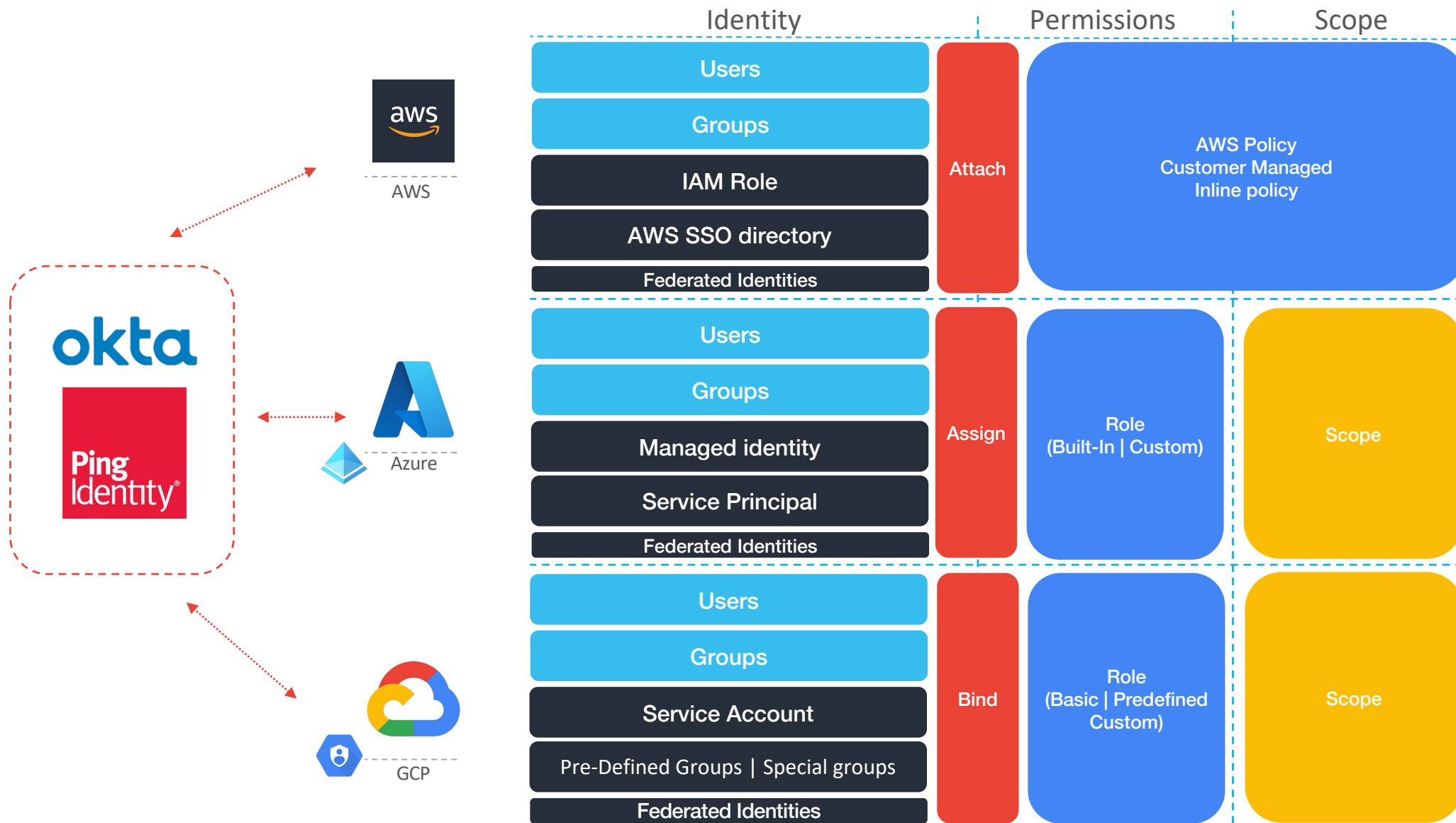


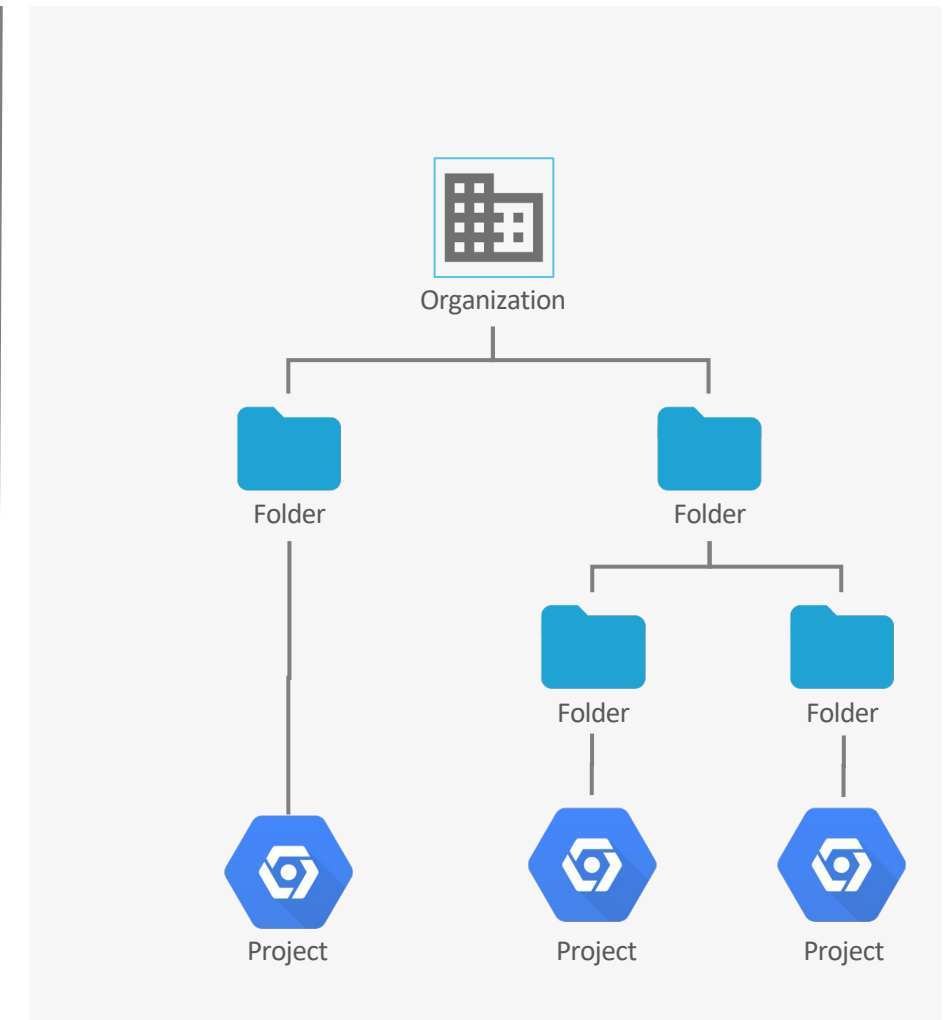
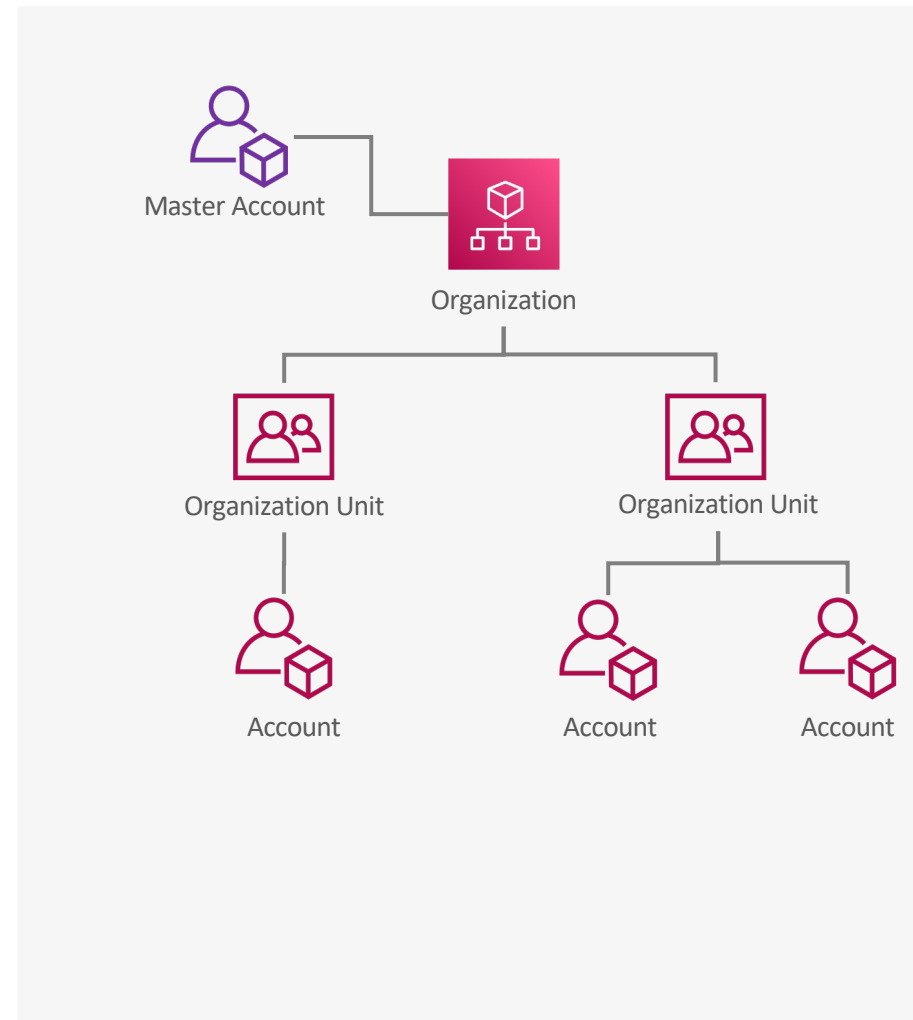
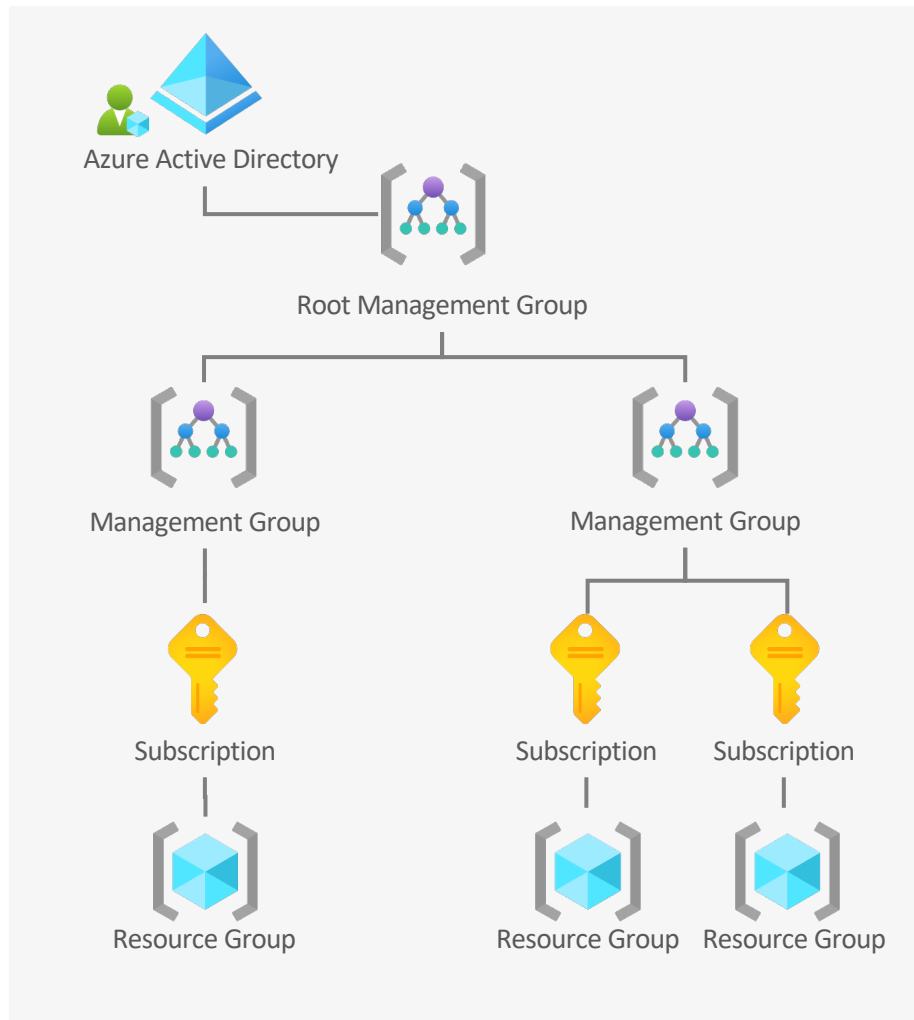
Security Context



Access policy









Cloud IAM weak spot

Cloud IAM weak spot

- Non-human Identities
- Assignment of new permissions
- Code Execution | Task | Template 🧑🏻‍🚀
- Grants and Delegation
- New credentials | secrets
- Encryption & Cryptographic key management
- Organizational policies

Cloud IAM weak spot

Non-human Identities



AWS

Role attachment



Azure

Managed Identities



GCP

Service account

Permissions Landscape

Assignment | Code Execution | Grants and Delegation | New credentials

Assignment

- Azure - Microsoft.Authorization/roleAssignments/write
- Azure - Microsoft.Authorization/roleDefinitions/write
- GCP - iam.roles.update
- GCP - orgpolicy.policy.set
- GCP - resourcemanager.projects.setIamPolicy
- AWS - lambda:AddPermission
- AWS - iam:AttachUserPolicy
- AWS - iam:AttachGroupPolicy
- AWS - iam:AttachRolePolicy

Grants and Delegation

- GCP - iam.serviceAccounts.implicitDelegation
- GCP - deploymentmanager.deployments.create
- GCP - iam.serviceAccounts.actAs
- AWS - iam:PassRole
- Azure - Microsoft.ManagedIdentity/userAssignedIdentities/*/assign/action

Code Execution

- AWS - lambda:CreateFunction
- AWS - lambda:InvokeFunction
- AWS - lambda:UpdateFunctionConfiguration
- AWS - cloudformation:CreateStack
- GCP - cloudscheduler.jobs.create
- GCP - cloudbuild.builds.create
- GCP - cloudfunctions.functions.create
- GCP - cloudfunctions.functions.update
- GCP - run.services.create

New Credentials

- AWS - iam:CreateLoginProfile
- AWS - iam:UpdateLoginProfile
- AWS - iam:CreateAccessKey
- GCP - iam.serviceAccountKeys.create
- GCP - iam.serviceAccounts.signJwt
- GCP - serviceusage.apiKeys.create
- GCP - iam.serviceAccounts.getAccessToken



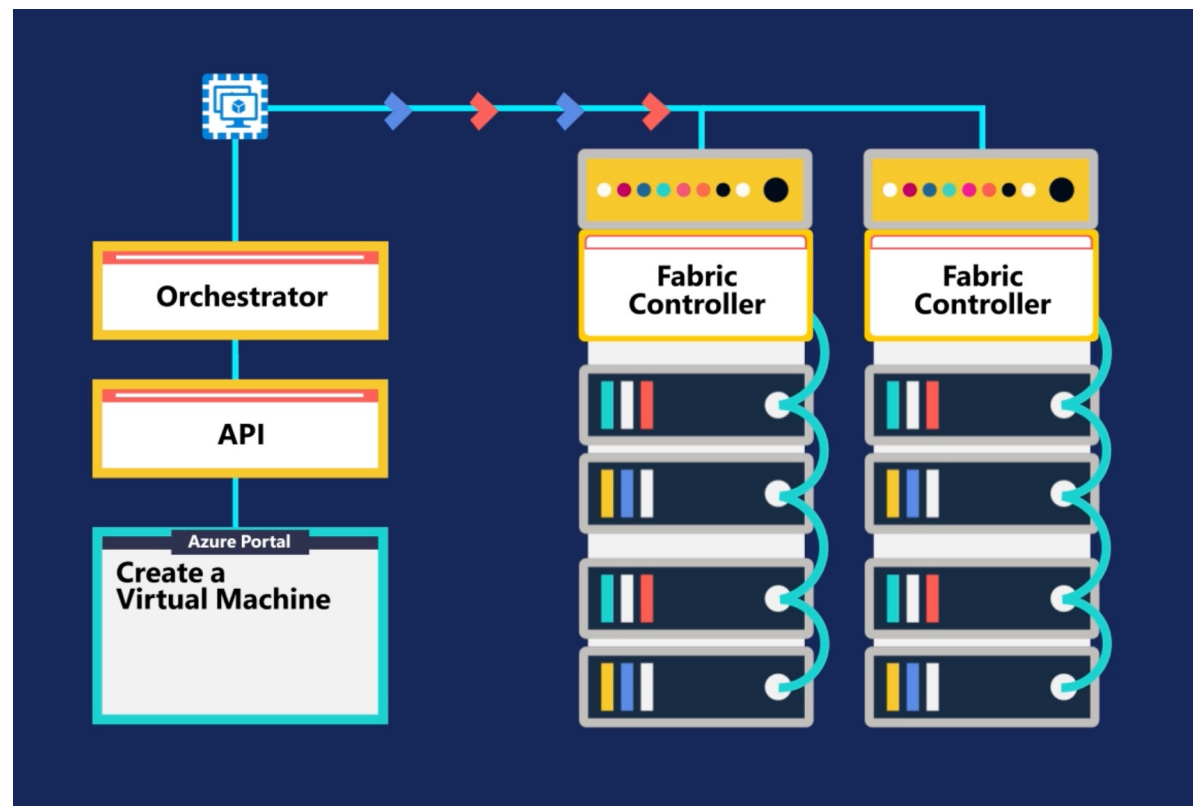
Things are not always what they seem

Lesson #1: Beware of non-human identities

- How cloud providers handle non-human credentials (Certificates)
- How cloud consumers handle non-human credentials (Short-lived tokens)
- The Instance metadata, local addresses, and environment variables
- Beware of hybrid Instance metadata

Lesson #1: Beware of non-human identities

- The **Fabric Controller (FC)** is a distributed program that manages the hardware and applications in a cluster internally used by Azure.



```
PS C:\Windows\system32> route print
-----
Interface List
 0...{00 0d 3a 9e ed 35}...{Microsoft Hyper-V Network Adapter}
 1...{...}...{Software Loopback Interface 1}
-----
IPv4 Route Table
-----
Active Routes:
Network Destination  Netmask          Gateway           Interface  Metric
0.0.0.0              0.0.0.0          10.0.0.1          10.0.0.4   5
10.0.0.0             255.255.255.0    10.0.0.4          10.0.0.4   261
10.0.0.255          255.255.255.255  10.0.0.4          10.0.0.4   261
127.0.0.0           255.0.0.0        10.0.0.1          127.0.0.1  331
127.0.0.1           255.255.255.255  10.0.0.1          127.0.0.1  331
127.255.255.255    255.255.255.255  10.0.0.1          127.0.0.1  331
169.254.160.254    255.255.255.255  10.0.0.1          10.0.0.4   6
224.0.0.0           240.0.0.0        10.0.0.1          127.0.0.1  331
224.0.0.0           240.0.0.0        10.0.0.4          10.0.0.4   6
255.255.255.255    255.255.255.255  10.0.0.1          127.0.0.1  331
255.255.255.255    255.255.255.255  10.0.0.4          10.0.0.4   261
-----
Persistent Routes:
None
-----
IPv6 Route Table
-----
Active Routes:
If Metric Network Destination  Gateway
1 331 ::1/128 On-Link
6 261 fe80::/64 On-Link
6 261 fe80::30d3:10ba:e29a:858d/128 On-Link
1 331 ff00::/8 On-Link
6 261 ff00::/8 On-Link
-----
Persistent Routes:
None
PS C:\Windows\system32>
```

```
PS C:\Windows\system32> curl http://168.63.129.16/?Comp=Versions
StatusCode      : 200
StatusDescription : OK
Content         : <?xml version="1.0" encoding="utf-8"?>
                 <Versions>
                 <Preferred>
                 <Version>2015-04-05</Version>
                 </Preferred>
                 <Supported>
                 <Version>2015-04-05</Version>
                 <Version>2012-11-30</Version...
RawContent      : HTTP/1.1 200 OK
                 Content-Length: 510
                 Content-Type: text/xml; charset=utf-8
                 Date: Sun, 24 Jul 2022 13:30:55 GMT
                 Server: Microsoft-IIS/10.0
                 <?xml version="1.0" encoding="utf-8"?>
                 <P...
Forms           : {}
Headers         : [[Content-Length, 510], [Content-Type, text/xml; charset=utf-8], [Date, Sun, 24 Jul 2022 13:30:55 GMT], [Server, Microsoft-IIS/10.0]]
Images          : {}
InputFields     : {}
Links           : {}
ParsedHtml      : System.__ComObject
RawContentLength : 510
PS C:\Windows\system32>
```


Lesson #2: Study implementation details

- Serverless code – Are AWS lambda and GCP functions the same?
- Versioning and revision
- Who can access my function code?
- Privilege escalation

Lesson #3: Defaults are a hacker's best friend

- Why do we need default policies?
- Can we rely on custom policies? (Limitations)
- Service providers best practices?

Lesson #3: Defaults are a hacker's best friend

- **AWS**
- Inherently broad permissions
- “Temporary fix” that becomes permanent
- **Look for:** ReadOnlyAccess, CloudTrailReadOnlyAccess, PassRole, Network modifiers, Permission modifiers, AssumeRole escalations

Lesson #3: Defaults are a hacker's best friend

- **Azure**
- Built-in roles... but oh so many of them
- Custom role limits
- Inherited permissions
- **Look for:** Read permissions, Assignment permissions (self-assignment)

Lesson #3: Defaults are a hacker's best friend

- **GCP**
- Inherited permissions by scope
- Legacy roles have strong and broad permissions (Viewer)
- Legacy mechanism: Access Scopes



Practical Practices for Defenders

Clay or Marble

- Two approaches
- Bottom-up or Top-Down
- Clay is hard → have to know exactly what you need
- Marble is hard → have to prove a negative
- Most people choose Marble, and then never cut down permissions

Limit the effect of mistakes

- AWS Account/GCP Project/Azure resource group **separation per workload**
- Avoid permanent credentials when possible
- Secure human identities

Log more, audit better

- Log whatever you can
- Use audit to build a stronger security policy
- **Challenges:** opaque APIs and distributed logging

Limits of logging

- The unlogged and the un-loggable:
- **Azure** read actions, distributed logging
- **AWS** cross-account actions & failures, passive recon, some data actions, session name manipulation, CloudTrail manipulation



DEMO



Takeaways

Questions?