

EXPERT INSIGHT

# Mastering Active Directory

Design, deploy, and protect Active Directory  
Domain Services for Windows Server 2022



**Third Edition**



**Dishan Francis**

**Packt>**

# Preface

Microsoft Active Directory is the most widely used identity management solution. It can centrally manage identities across its infrastructure. It is equipped with different role services, features, and components that help us handle identities securely and effectively according to business requirements. For the last 20 years, Microsoft has continued improving Active Directory, and Active Directory 2022 further consolidates its approach in terms of rectifying industry requirements and protecting identity infrastructures from emerging security threats. However, a technology-rich product is not simply going to make a productive, reliable, scalable, and secure identity infrastructure. It requires knowledge of Active Directory roles services, components, and features. It also requires knowledge of how to use those effectively to match different operational requirements. Only then can we plan, design, manage, and maintain a robust identity infrastructure. Over the past few years, more and more organizations have adopted cloud technologies for a variety of reasons. With the growth of the cloud footprint, organizations' identity requirements have also changed. We can no longer limit corporate identities to on-prem infrastructures. By using Microsoft Azure Active Directory, we can extend our on-prem identities to the cloud. The hybrid AD approach provides lots of benefits for modern authentication requirements. However, security-wise, it also opens up a whole new level of challenges. Therefore, the majority of new content in the third edition is related to designing the Azure AD hybrid cloud, securing a hybrid AD environment, and protecting sensitive data.

## Who this audiobook is for

If you are an Active Directory administrator, system administrator, or network professional who has basic knowledge of Active Directory and is looking to become an expert in this topic, this book is for you.

## What this audiobook covers

- *Chapter 1, Active Directory Fundamentals*, explains what Active Directory is and its capabilities. This chapter also explains the main components (physical and logical structure), object types, and role services of Active Directory. Last but not least, this chapter also covers why we need an advanced identity management solution such as Azure Active Directory.
- *Chapter 2, Active Directory Domain Services 2022*, explains what we can expect with **Active Directory Domain Services (AD DS) 2022** and how we can use the features introduced in AD DS 2016 (as there is no new **Domain Functional Level (DFL)** or **Forest Functional Level (FFL)** ) to improve your existing Active Directory environment.
- *Chapter 3, Designing an Active Directory Infrastructure*, talks about what needs to be considered in Active Directory infrastructure design. This chapter discusses how to place the AD DS logical and physical components in the AD DS environment according to best practices. It also covers the design concepts for hybrid identity.

- *Chapter 4, Active Directory Domain Name System*, explains how DNS works with AD DS. This chapter also includes information about the DNS server component, different types of DNS records, zones, DNS delegation, and DNS policies.
- *Chapter 5, Placing Operations Master Roles*, talks about the **Flexible Single Master Operations (FSMO)** roles and their responsibilities. This chapter also describes things we need to consider when placing FSMO roles in an Active Directory environment.
- *Chapter 6, Migrating to Active Directory 2022*, covers the different AD DS deployment models. This chapter also provides a step-by-step guide to migrating from an older version of AD DS to AD DS 2022.
- *Chapter 7, Managing Active Directory Objects*, discusses how to create objects, find objects, modify objects, and remove objects (small-scale and large-scale) by using built-in Active Directory management tools and PowerShell commands.
- *Chapter 8, Managing Users, Groups, and Devices*, further explores the Active Directory objects by deep diving into attributes, managed service accounts, and management of different object types. Last but not least, you will also learn how to sync custom attributes to Azure Active Directory.
- *Chapter 9, Designing the OU Structure*, teaches you how to design the **organizational unit (OU)** structure properly, using different models to suit business requirements. This chapter also describes how to create, update, and remove OUs. Furthermore, this chapter also discusses how we can delegate AD administration by using OUs.
- *Chapter 10, Managing Group Policies*, mainly discusses Group Policy objects and their capabilities. Group Policy processing in an AD environment depends on many different things. In this chapter, we will deep dive into group policy processing to understand the technology behind it. We are also going to look into the different methods we can use for group policy filtering. Last but not least, we will learn about most commonly use group policies.
- *Chapter 11, Active Directory Services – Part 01*, walks us through the more advanced Active Directory topics, such as AD **Lightweight Directory Services (LDS)**, Active Directory replication, and Active Directory sites.
- *Chapter 12, Active Directory Services – Part 02*, sees you learn about Active Directory trusts in detail. This chapter also covers topics such as Active Directory database maintenance, **Read-Only Domain Controller (RODC)**, AD DS backup, and recovery.
- *Chapter 13, Active Directory Certificate Services*, discusses the planning, deployment, and maintenance of Active Directory Certificate Services. Furthermore, we will also learn how signing, encryption, and decryption work in a **public key infrastructure (PKI)**.

- *Chapter 14, Active Directory Federation Services*, focuses on **Active Directory Federation Services (AD FS)** such as planning, designing, deployment, and maintenance. This chapter also covers new features of AD FS, such as built-in Azure MFA support. At the end you will also learn how to establish a federated connection with Azure AD.
- *Chapter 15, Active Directory Rights Management Services*, covers the **Active Directory Rights Management Service (AD RMS)** role, which we can use to protect sensitive data in a business. Data is the new oil, and the value of data keeps increasing. Therefore, protection of data is important for every business. In this chapter, we will learn how AD RMS works and how to configure it.
- *Chapter 16, Active Directory Security Best Practices*, covers the protection of the Active Directory environment. Recent attacks and studies prove that adversaries are increasingly targeting identities. So, we need to be mindful of protecting our Active Directory infrastructure at any cost. In this chapter, we will learn about different tools, services, and methods we can use to protect the Active Directory environment such as Secure LDAP, Microsoft LAPS, delegated permissions, restricted RDP, and Azure AD password protection.
- *Chapter 17, Advanced AD Management with PowerShell*, is full of PowerShell scripts that can be used to manage, secure, and audit an Active Directory environment. We will also learn about the Azure Active Directory PowerShell for Graph module, which we can use to manage, query, and update AD objects in a hybrid AD environment.
- *Chapter 18, Hybrid Identity*, discusses how we can extend our on-prem AD DS infrastructure to Azure Active Directory. Before we work on the implementation, we will deep dive into the planning process of the Azure AD hybrid setup. In this chapter, we will also learn about different Azure AD connects deployment models, Azure AD cloud sync, Secure LDAP, and replica sets.
- *Chapter 19, Active Directory Audit and Monitoring*, teaches you how to monitor your on-prem/hybrid AD DS infrastructure using different tools and methods (cloud based and on-prem). This chapter also demonstrates how to audit the health of an Active Directory environment.
- *Chapter 20, Active Directory Troubleshooting*, discusses how to troubleshoot the most common Active Directory infrastructure issues using different tools and methods. Furthermore, we will also look into the most common Azure AD Connect errors, which can have a direct impact on the health of the Azure AD hybrid environment. You can find this chapter available online at: [static.packt-cdn.com/downloads/9781801070393\\_Chapter\\_20.pdf](https://static.packt-cdn.com/downloads/9781801070393_Chapter_20.pdf)
- *Appendix A, References*, covers the *Further reading* section chapter wise. It's freely available online for our readers and here is the link: [static.packt-cdn.com/downloads/Mastering\\_Active\\_Directory\\_References.pdf](https://static.packt-cdn.com/downloads/Mastering_Active_Directory_References.pdf).



## To get the most out of this audiobook

This book is ideal for IT professionals, system engineers, and administrators who have a basic knowledge of Active Directory Domain Services. A basic knowledge of PowerShell is also required, since most of the role deployment, configuration, and management is done by using PowerShell commands and scripts.

## Download the example code files

The code bundle for the book is hosted on GitHub at [github.com/PacktPublishing/Mastering-Active-Directory-Third-Edition](https://github.com/PacktPublishing/Mastering-Active-Directory-Third-Edition). We also have other code bundles from our rich catalog of books and videos available at [github.com/PacktPublishing/](https://github.com/PacktPublishing/). Check them out!

## Download the supplementary materials

Packt audiobooks have been selected for a seamless audio experience. Some topics, however, do come with elements like images that aren't natural for this medium. We've adapted the content of the audiobooks so that you can listen to the audio without needing to refer to these visual elements unless necessary. To give you the choice between listening to just the audio and listening to the audio while referring to the visual elements, we've created a PDF that contains all the elements that cannot translate to the audio. All references to images in the audiobook can be found within this PDF. You can download the PDF from <https://github.com/PacktPublishing/Mastering-Active-Directory-Third-Edition-Audiobook>.

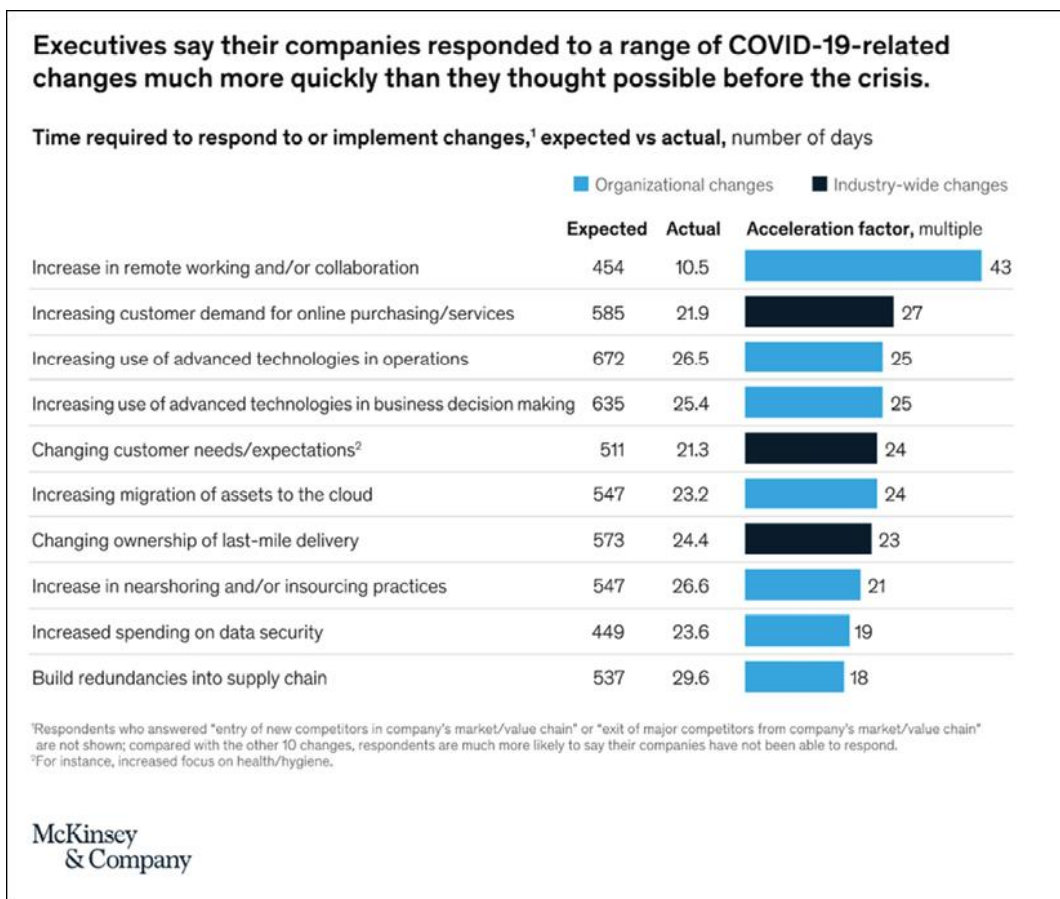
# Chapter 1

## Links

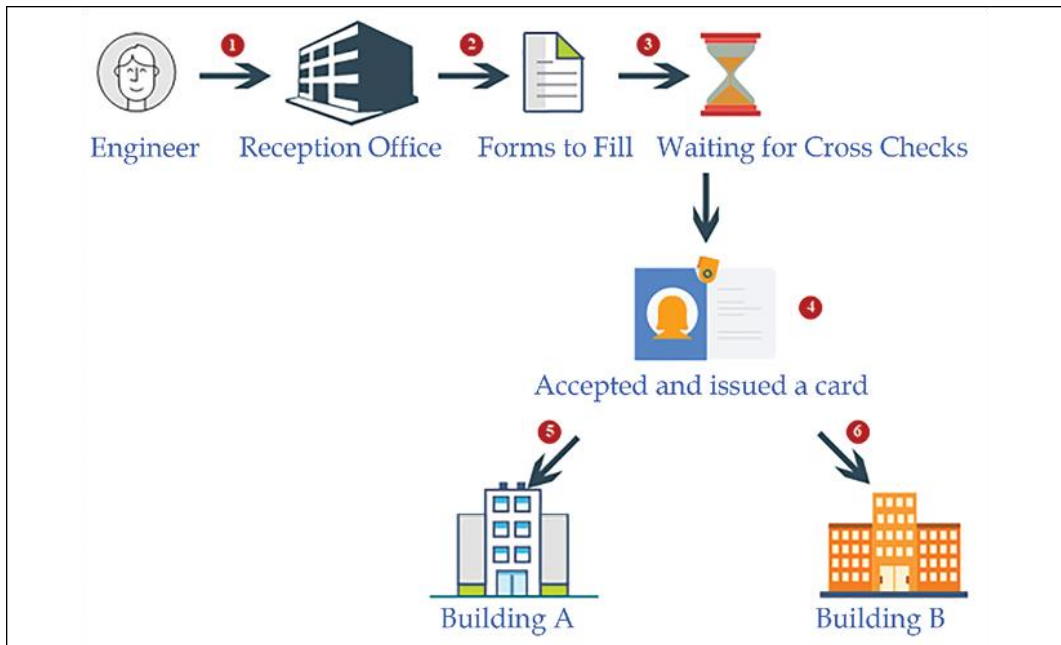
- <https://bit.ly/3CSjC08>
- <https://bit.ly/2ZSnTIK>
- <https://bit.ly/3mNckFB>
- <https://bit.ly/3whpgGV>
- <https://bit.ly/3mMxibu>
- <https://bit.ly/3BNw0qS>
- <https://bit.ly/3nZBpfQ>
- <https://bit.ly/3o3uguL>
- <https://yz.to/3CQvPCL>
- <https://bit.ly/3q6wSec>
- <https://bit.ly/3ER8lsq>
- <https://ibm.co/3wwOSif>
- <https://bit.ly/3HUQWXc>
- <https://bit.ly/3mLiJkq>
- More information about the Nobelium attack is available in the following articles, which are published by Microsoft:
  - <https://bit.ly/3wl8fvy>
  - <https://bit.ly/3BJfbDv>
  - <https://bit.ly/3bl09Dx>
- More information about WebAuthn is available at the following links:
  - <https://bit.ly/3wkLW93>
  - <https://bit.ly/3bQfamF>
- Step-by-step guide: Azure AD password-less sign-in using FIDO2 security keys:  
<https://bit.ly/3GTjHmG>
- Step-by-step guide: Enable Windows 10 password-less authentication with FIDO2 security keys (Azure AD + Microsoft Intune): <https://bit.ly/3wl8wyz>.

- <https://mck.co/3bJK14p>
- <https://bit.ly/3ENQtvz>
- <https://bit.ly/3BQImER>
- <https://bit.ly/3BQb5cK>
- <https://bit.ly/3nYq7z3>
- <https://bit.ly/3BUNA6>

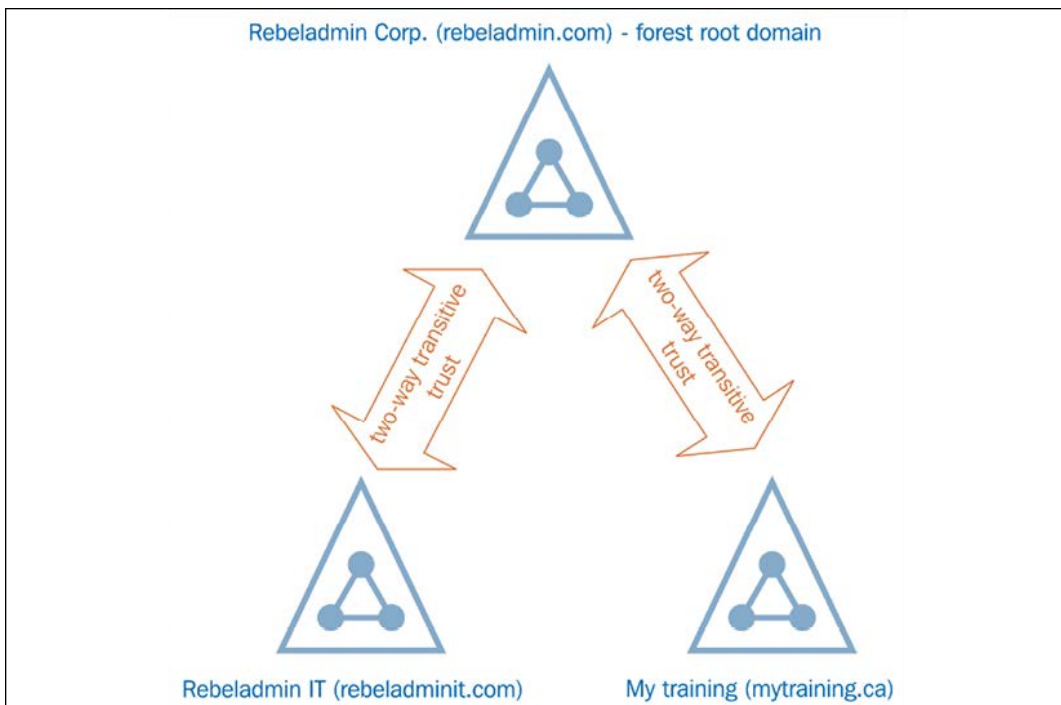
## Figures



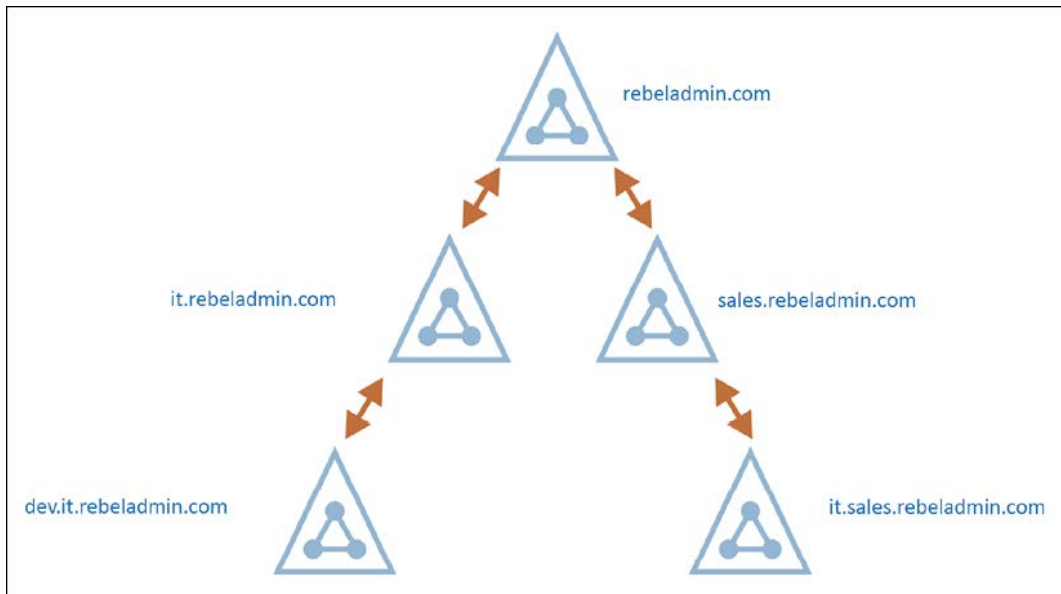
**Figure 1.1: Speed of responses to pandemic challenges. Source: <https://mck.co/2Ykj9Fd>**



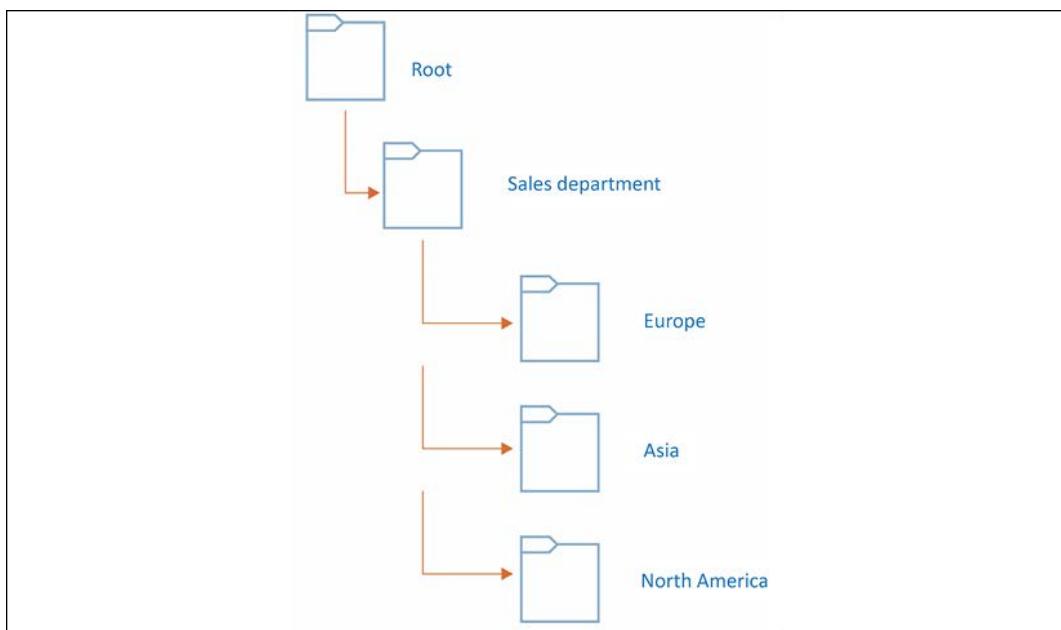
**Figure 1.2: Process of entering physical headquarters**



**Figure 1.3: Domains in the rebeladmin.com forest**



**Figure 1.4: Subdomains in a contiguous namespace**



**Figure 1.5: Organizational unit hierarchy**



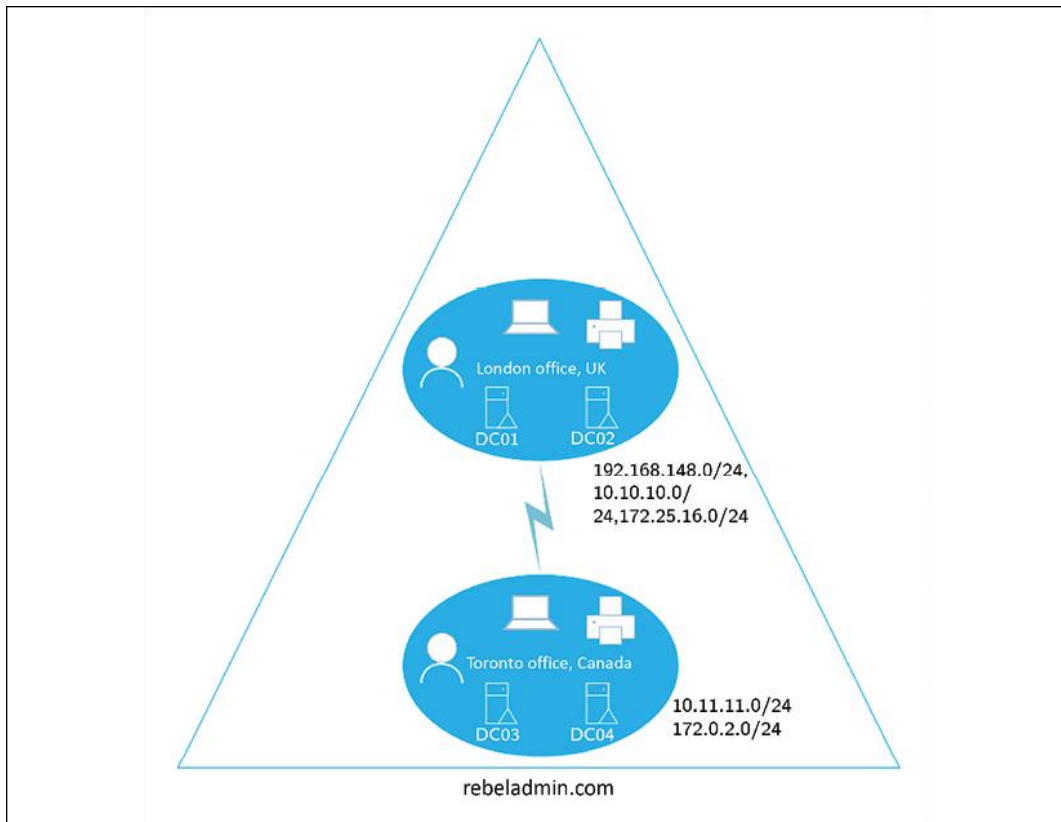


Figure 1.6: Active Directory connection

The screenshot shows two windows side-by-side: "New Object - User" and "New Object - Computer". Both windows are for creating objects in the rebeladmin.com domain.

**New Object - User:**

- Create in: rebeladmin.com/
- First name: Dishan, Initials: M
- Last name: Francis
- Full name: Dishan M. Francis
- User logon name: dfrancis@rebeladmin.com
- User logon name (pre-Windows 2000): REBELADMIN\, dfrancis

**New Object - Computer:**

- Create in: rebeladmin.com/
- Computer name: REBEL-PC-01
- Computer name (pre-Windows 2000): REBEL-PC-01
- The following user or group can join this computer to a domain.
- User or group: Default: Domain Admins (Change...)
- ☐ Assign this computer account as a pre-Windows 2000 computer

Buttons at the bottom: < Back, Next >, Cancel, OK, Cancel, Help.

Figure 1.7: Creating new objects

```

Administrator: Windows PowerShell ISE
File Edit View Tools Debug Add-ons Help

PS C:\Users\Administrator> Get-ADUser dfrancis

DistinguishedName : CN=Dishan Francis,CN=Users,DC=rebeladmin,DC=com
Enabled           : True
GivenName        : Dishan
Name             : Dishan Francis
ObjectClass      : user
ObjectGUID       : 94017e0b-d53b-4730-abf3-4c41e90de420
SamAccountName   : dfrancis
SID              : S-1-5-21-4041220333-1835452706-552999228-1106
Surname          : Francis
UserPrincipalName : dfrancis@rebeladmin.com

PS C:\Users\Administrator>
  
```

Figure 1.8: ObjectGUID and sid as they appear in PowerShell

## Tables

| Functional Level      | Domain Controller Operating System  |
|-----------------------|---|
| Windows Server 2016   | Windows Server 2022<br>Windows Server 2019<br>Windows Server 2016   |
| Windows Server 2012R2 | Windows Server 2022<br>Windows Server 2019<br>Windows Server 2016<br>Windows Server 2012 R2   |
| Windows Server 2012   | Windows Server 2022<br>Windows Server 2019<br>Windows Server 2016<br>Windows Server 2012 R2<br>Windows Server 2012  |
| Windows Server 2008R2 | Windows Server 2022<br>Windows Server 2019<br>Windows Server 2016<br>Windows Server 2012 R2<br>Windows Server 2012<br>Windows Server 2008 R2                        |
| Windows Server 2008   | Windows Server 2022<br>Windows Server 2019<br>Windows Server 2016<br>Windows Server 2012 R2<br>Windows Server 2012<br>Windows Server 2008 R2<br>Windows Server 2008 |

Table 1.1: Domain Controller operating systems for each functional level

| PowerShell cmdlets                        | Description   |
|---|---|
| Install-WindowsFeature AD-Domain-Services | This cmdlet will install the AD DS role. Please note this will only install the AD DS role on the server. This is further explained in <i>Chapter 6, Migrating to Active Directory 2022</i>   |
| Install-WindowsFeature AD FS-Federation   | This cmdlet will install the AD FS role.  |
| Install-WindowsFeature ADLDS              | This cmdlet will install AD LDS.  |
| Install-WindowsFeature ADRMS              | This cmdlet will install AD RMS. This role has two subfeatures, which are AD Rights Management Server and Identity Federation Support. If required, these individual roles can be installed using Install-WindowsFeature ADRMS, ADRMS-Server, ADRMS-Identity, or Install-WindowsFeature ADRMS - IncludeAllSubFeature. It will install all the subfeatures.  |
| Install-WindowsFeature AD-Certificate     | This cmdlet will install AD CS. This role has six subroles, which are certification authority (ADCS-Cert-Authority), Certificate Enrollment Policy Web Service (ADCS-Enroll-Web-Pol), Certificate Enrollment Web Service (ADCS-Enroll-Web-Svc), Certification Authority Web Enrollment (ADCS-Web-Enrollment), Network Device Enrollment Service (ADCS-Device-Enrollment), and Online Responder (ADCS-Online-Cert). These subfeatures can be added individually or together. |

**Table 1.2: PowerShell cmdlets to install Active Directory server roles**

# Chapter 2

## Links

- <https://bit.ly/3q4Re7E>
- <https://bit.ly/3BOPJMX>
- <https://bit.ly/3whrR3D>
- <https://bit.ly/3bMk6sO>
- <https://bit.ly/3whR6Tc>

## Figures

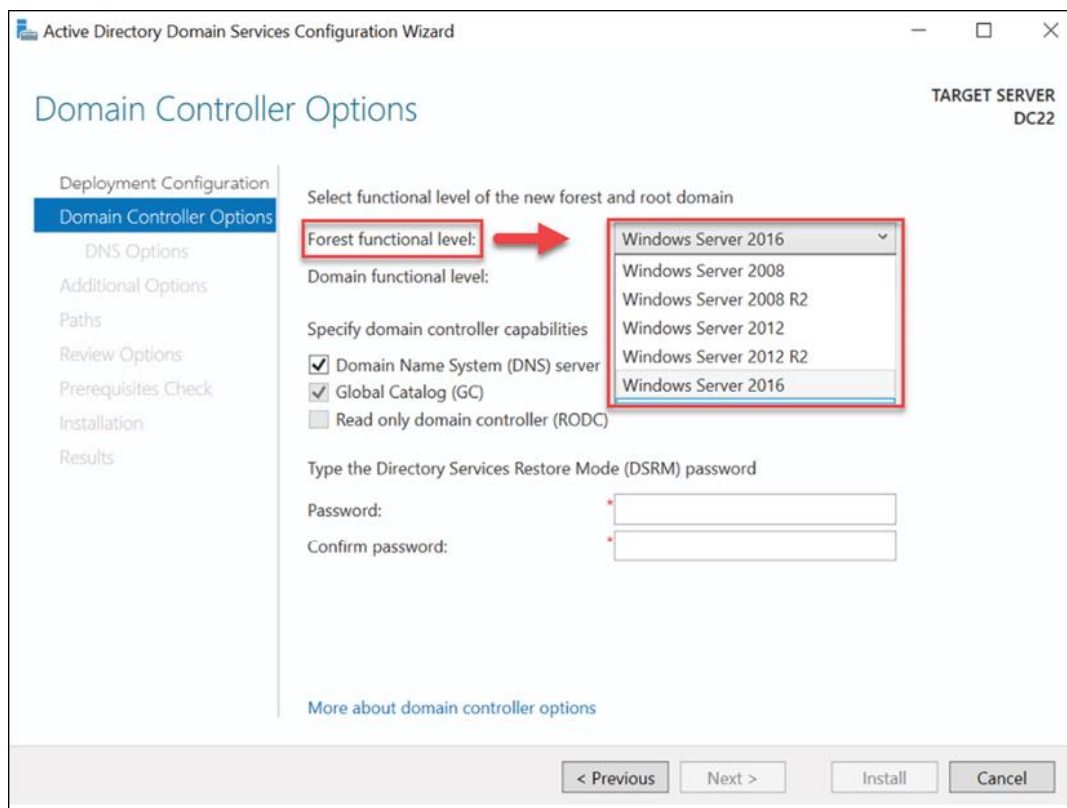


Figure 2.1: Forest functional levels for Windows Server 2019

### Web attacks blocked per month

The peak level of malicious activity took place in October, when more than 27.7 million web attacks were blocked.

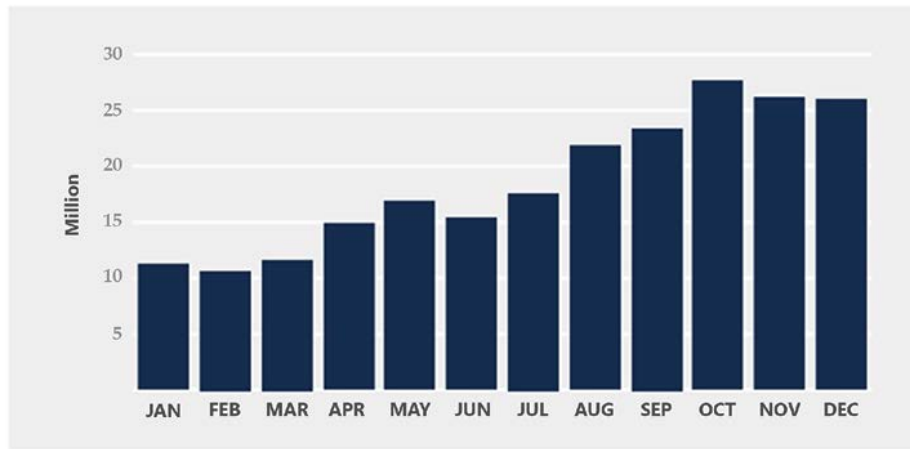


Figure 2.2: Web attacks blocked per month

### 3.1. Attack complexity

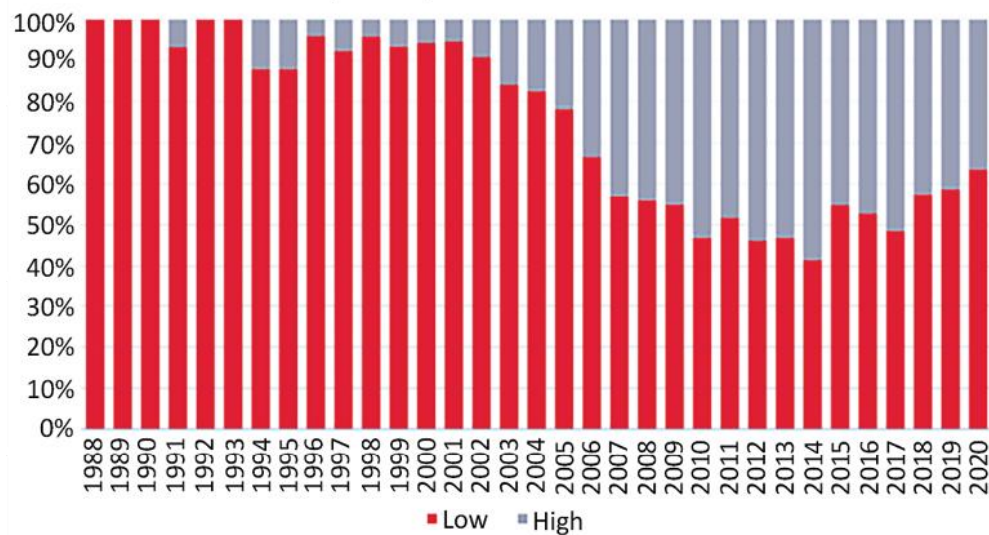


Figure 3: Percentage of low and high complexity CVEs by year: 1988-2020

Figure 2.3: Attack complexity



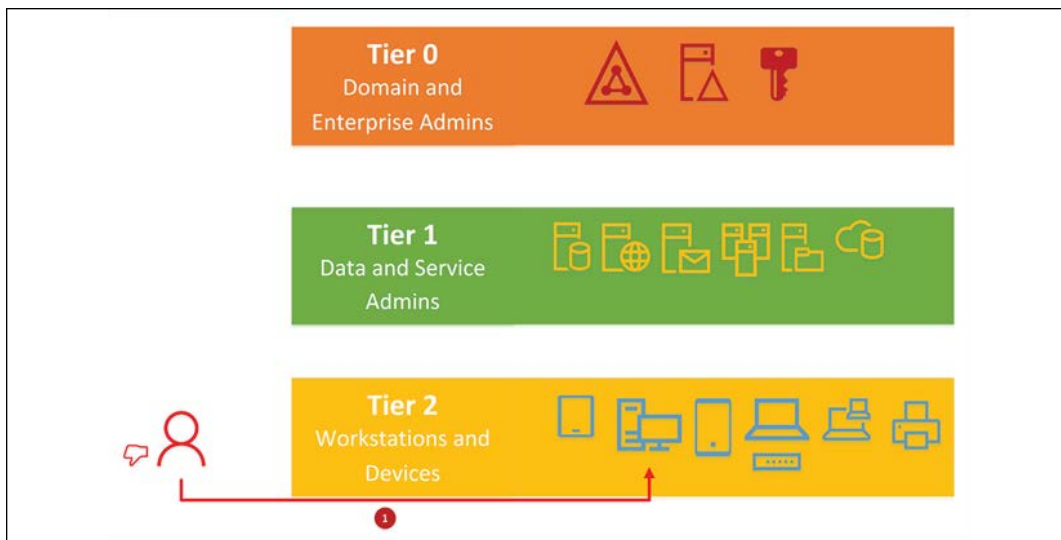


Figure 2.4: AD attack – initial breach

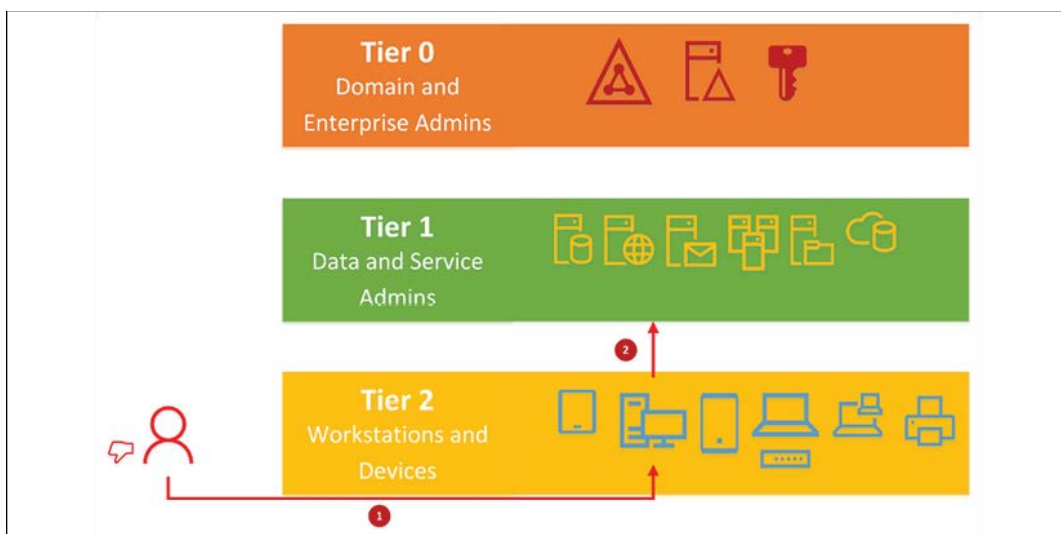
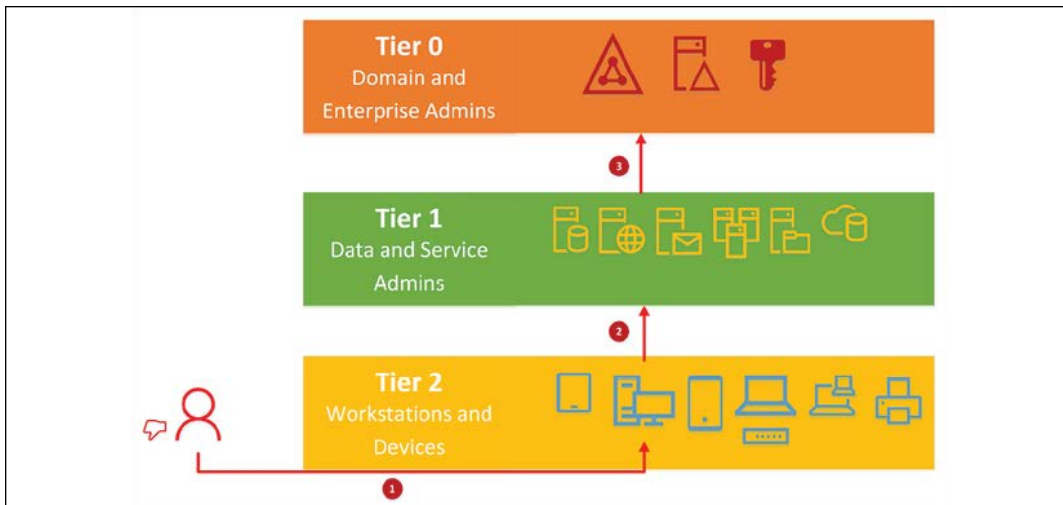
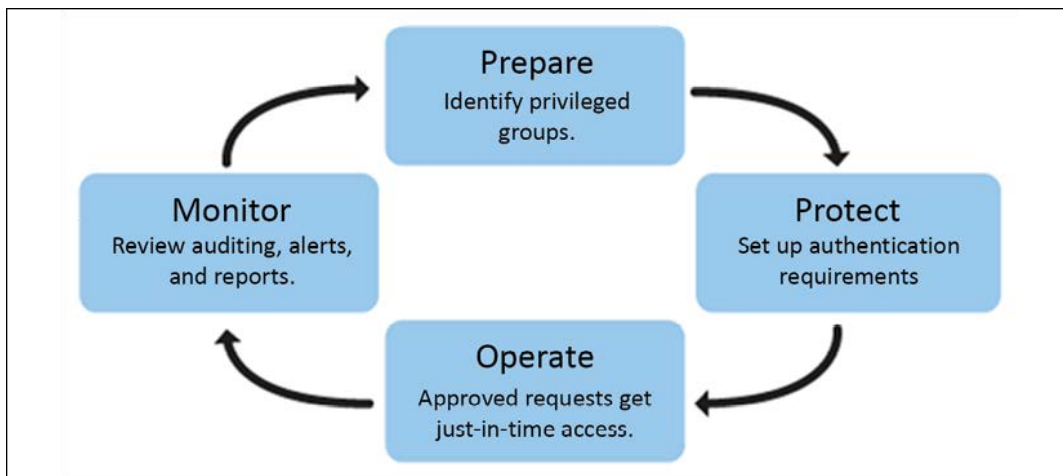


Figure 2.5: AD attack – lateral movement



**Figure 2.6: AD Attack – access to privileged accounts**



**Figure 2.7: The PAM lifecycle**

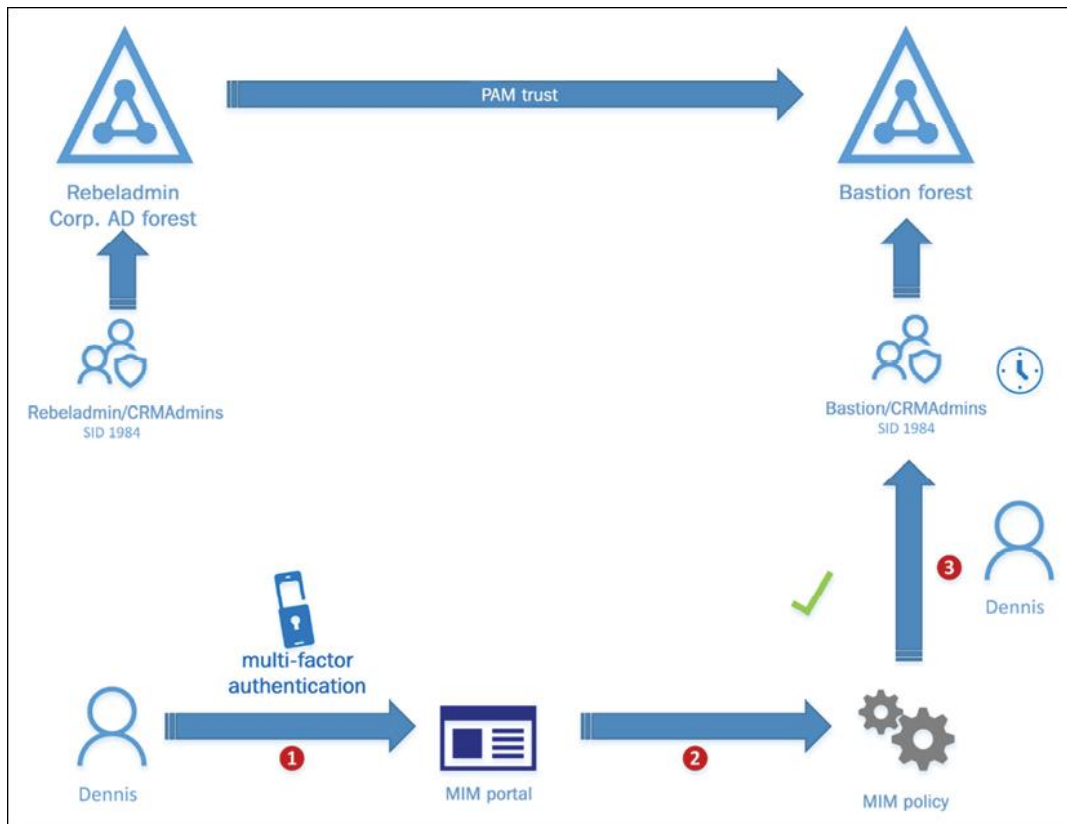


Figure 2.8: PAM in action

```
PS C:\Windows\System32> Get-ADGroupMember "Domain Admins"

distinguishedName : CN=dfrancis,CN=Users,DC=rebeladmin,DC=com
name               : dfrancis
objectClass        : user
objectGUID         : 196f45a5-d966-4063-b947-b598cd15e305
SamAccountName     : dfrancis
SID                : S-1-5-21-2368539100-1613354624-3645015003-500
```

Figure 2.9: Domain admin group membership

```

PS C:\Windows\System32> Get-ADGroup 'Domain Admins' -Property member -ShowMemberTimeToLive

DistinguishedName : CN=Domain Admins,CN=Users,DC=rebeladmin,DC=com
GroupCategory      : Security
GroupScope         : Global
member             : {<TTL=3435>,CN=Adam Curtiss,CN=Users,DC=rebeladmin,DC=com,
                    CN=df Francis,CN=Users,DC=rebeladmin,DC=com}
Name               : Domain Admins
ObjectClass        : group
ObjectGUID         : a39fe22a-9303-41e2-9560-a7889083ca1a
SamAccountName     : Domain Admins
SID                : S-1-5-21-2368539100-1613354624-3645015003-512

```

Figure 2.10: TTL for group membership

```

Administrator: PowerShell 7 (x64)
PowerShell 7.1.2
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\acurtiss> klist

Current LogonId is 0:0x2168f2

Cached Tickets: (1)

#0> Client: acurtiss @ REBELADMIN.COM
    Server: krbtgt/REBELADMIN.COM @ REBELADMIN.COM
    KerbTicket Encryption Type: AES-256-CTS-HMAC-SHA1-96
    Ticket Flags 0x40e10000 -> forwardable renewable initial pre_authent name_canonicalize
    Start Time: 2/28/2021 22:09:50 (local)
    End Time: 2/28/2021 23:01:25 (local)
    Renew Time: 2/28/2021 23:01:25 (local)
    Session Key Type: AES-256-CTS-HMAC-SHA1-96
    Cache Flags: 0x1 -> PRIMARY
    Kdc Called: DC01
PS C:\Users\acurtiss>

```

Figure 2.11: Kerberos ticket renewal time

# Chapter 3

## Figures

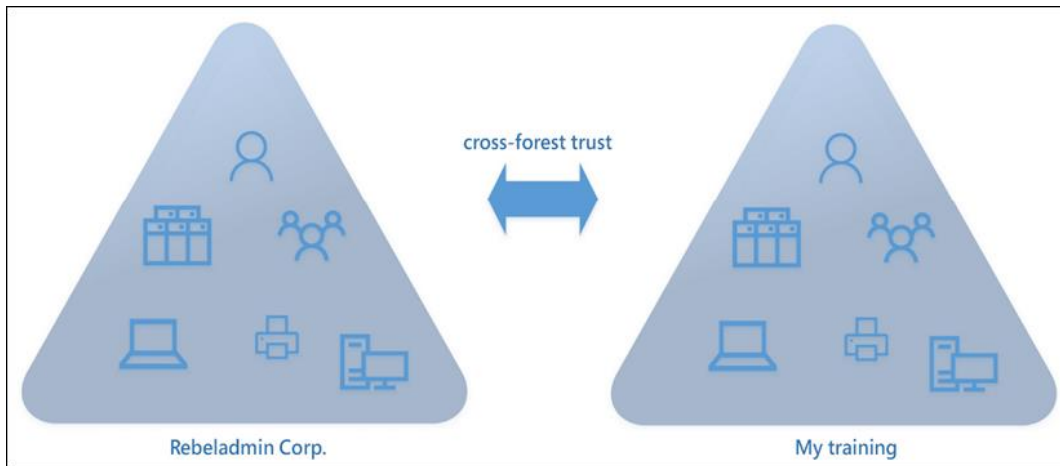


Figure 3.1: Organizational forest model example

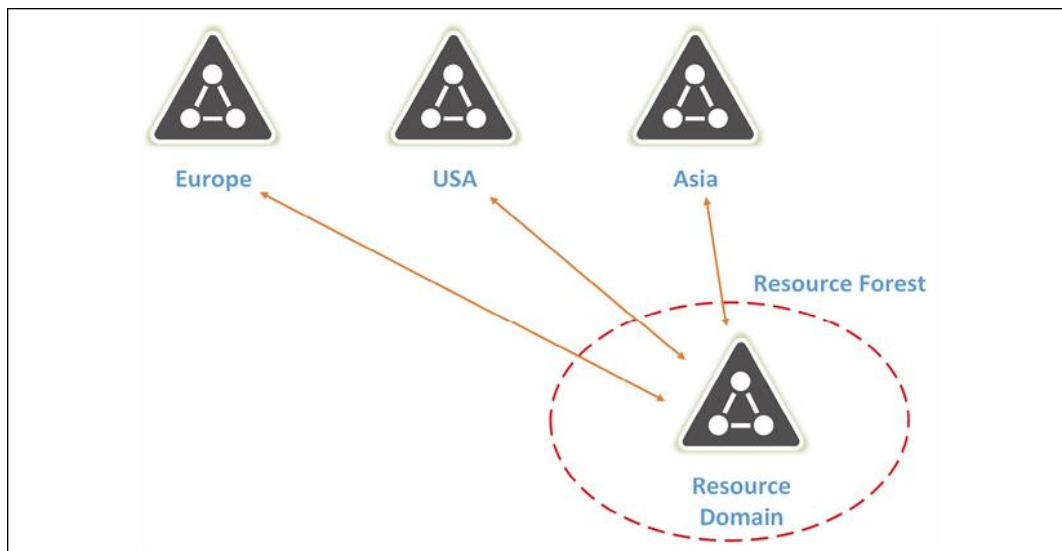
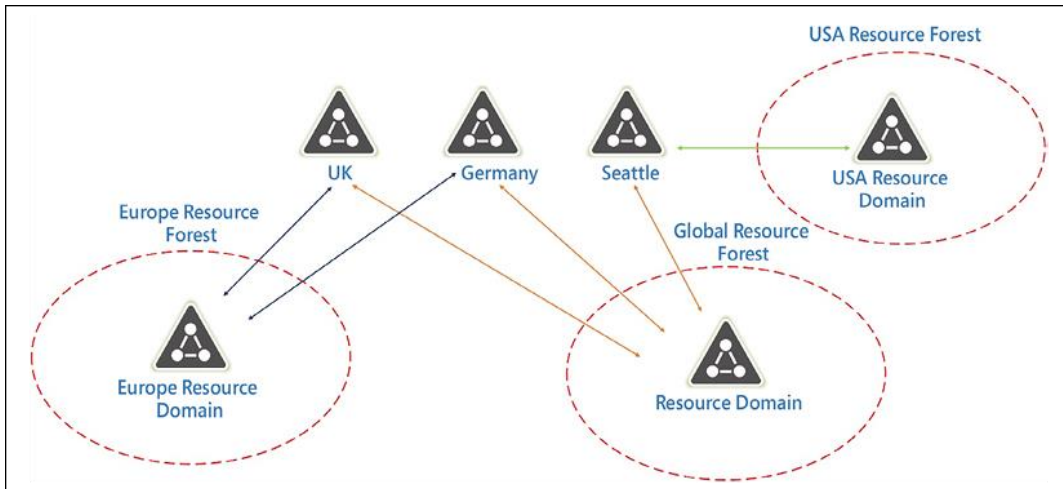
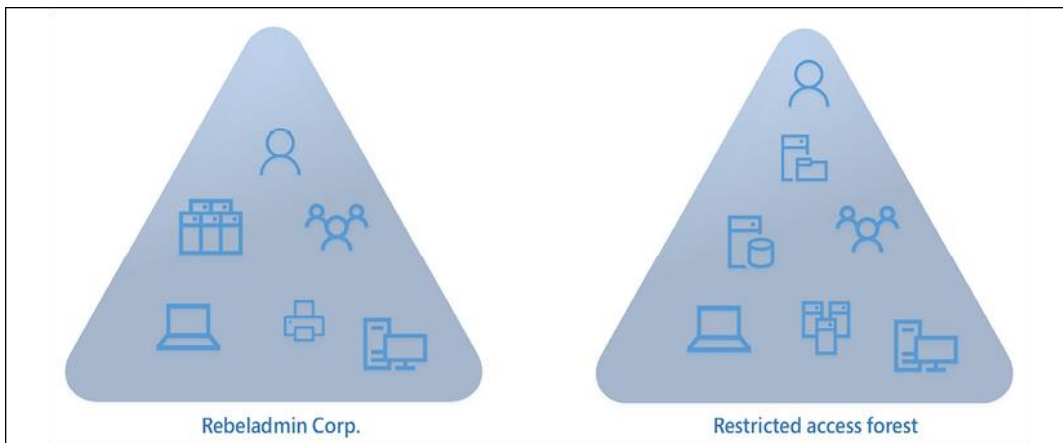


Figure 3.2: Resource forest model example 1

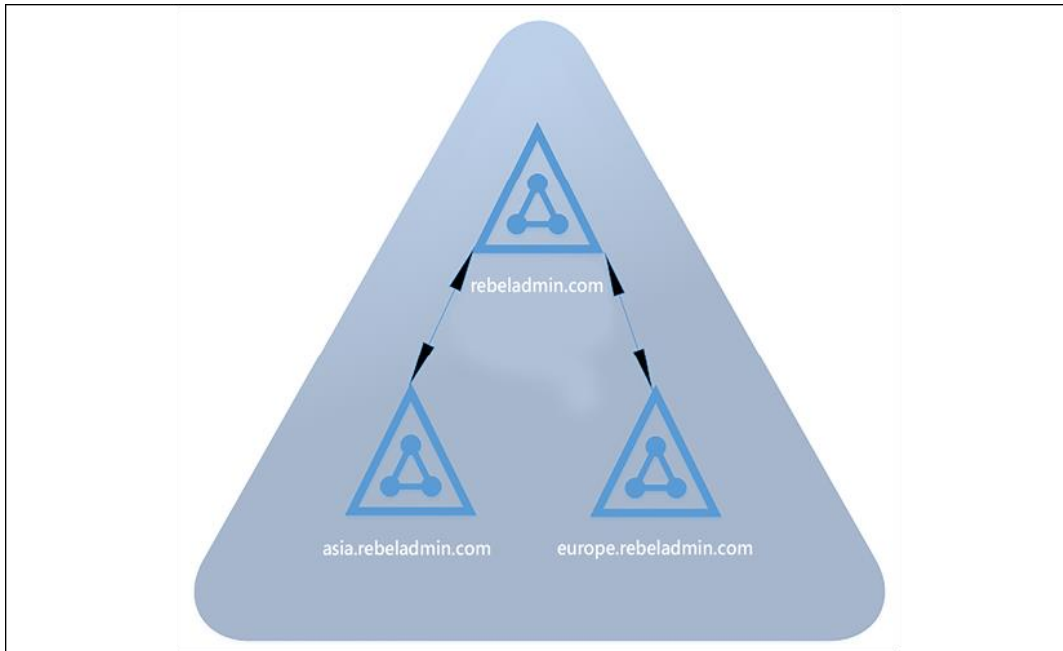




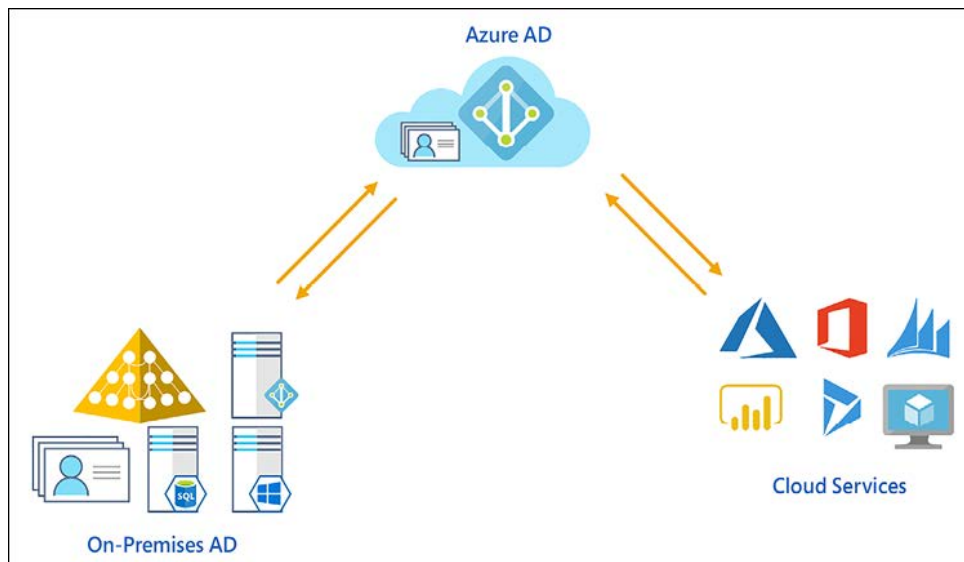
**Figure 3.3: Resource forest model example 2**



**Figure 3.4: Restricted access forest model example**



**Figure 3.5: Regional domain model example**



**Figure 3.6: Unified access experience**

## Chapter 4 Figures

```
hosts - Notepad
File Edit Format View Help
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#       102.54.94.97      rhino.acme.com      # source server
#       38.25.63.10      x.acme.com         # x client host
#
# localhost name resolution is handled within DNS itself.
#       127.0.0.1        localhost
#       ::1              localhost
```

Figure 4.1: The hosts file

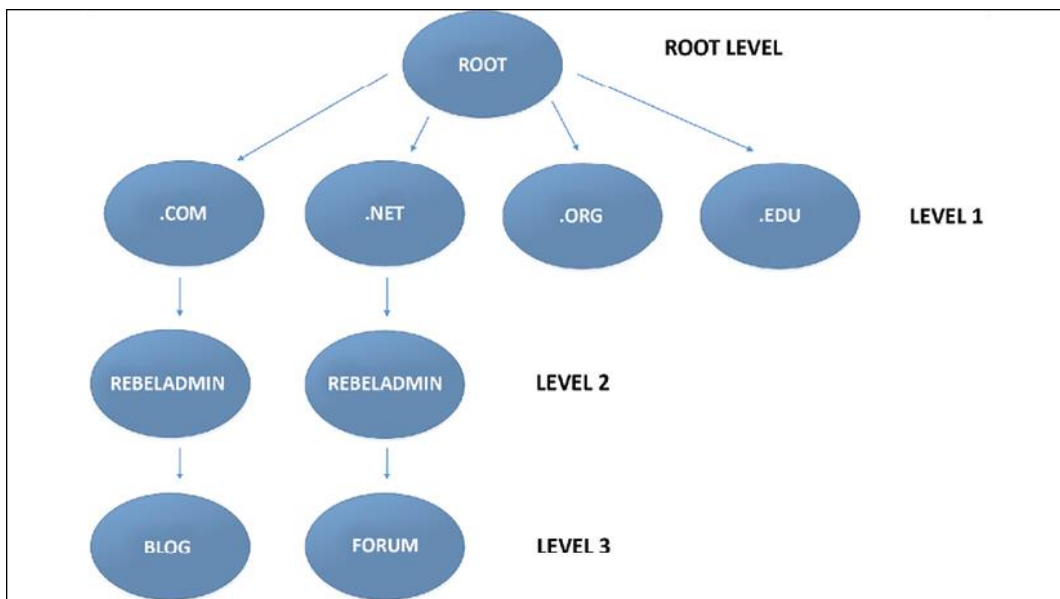


Figure 4.2: Domain naming hierarchy



Figure 4.3: Domain name example

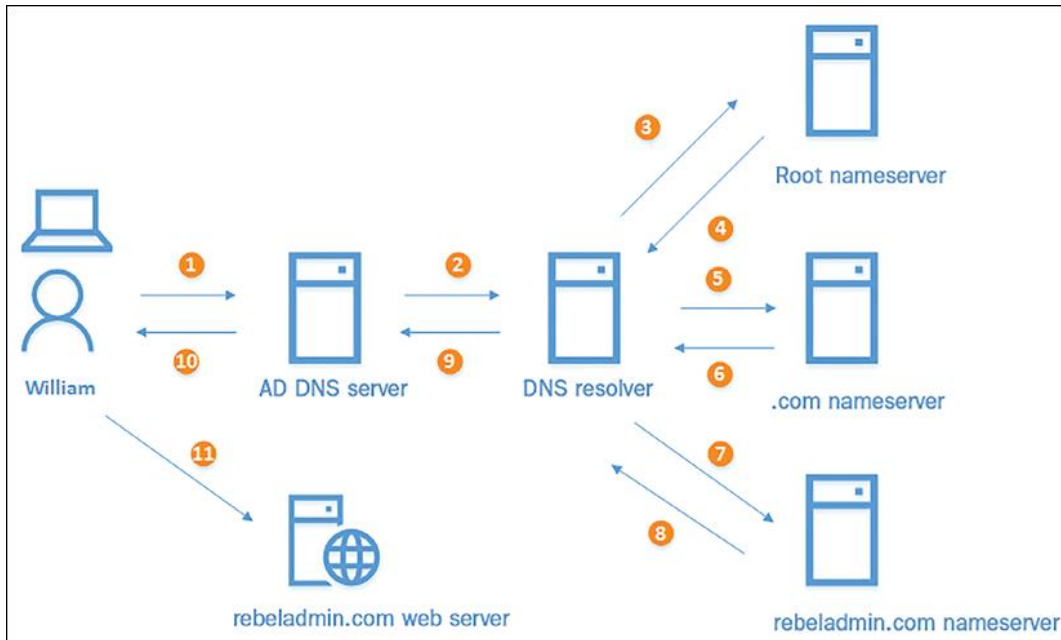


Figure 4.4: DNS query example

```
PS C:\Windows\System32> Get-DnsServerForwarder

UseRootHint      : True
Timeout(s)       : 3
EnableReordering : True
IPAddress         : 168.63.129.16
ReorderedIPAddress : 168.63.129.16

PS C:\Windows\System32> _
```

Figure 4.5: DNS forwarders

```
PS C:\Windows\System32> Get-DnsServerRootHint
```

| NameServer          | IPAddress           |
|---------------------|---------------------|
| j.root-servers.net. | 2001:503:c27::2:30  |
| b.root-servers.net. | 2001:500:200::b     |
| f.root-servers.net. | 2001:500:2f::f      |
| m.root-servers.net. | 2001:dc3::35        |
| a.root-servers.net. | 2001:503:ba3e::2:30 |
| h.root-servers.net. | 2001:500:1::53      |
| d.root-servers.net. | 2001:500:2d::d      |
| c.root-servers.net. | 2001:500:2::c       |
| k.root-servers.net. | 2001:7fd::1         |
| e.root-servers.net. | 2001:500:a8::e      |
| g.root-servers.net. | 2001:500:12::d0d    |
| i.root-servers.net. | 2001:7fe::53        |
| l.root-servers.net. | 2001:500:9f::42     |

Figure 4.6: Root DNS servers

The screenshot shows a Windows dialog box titled "\_autodiscover Properties" with a question mark icon and a close button. The "Security" tab is selected. The "Service Location (SRV)" section contains the following fields:

- Domain: rebeladmin.com
- Service: \_autodiscover
- Protocol: \_tcp
- Priority: 0
- Weight: 0
- Port number: 443
- Host offering this service: mail.rebeladmin.com.

At the bottom of the dialog are four buttons: OK, Cancel, Apply, and Help.

Figure 4.7: Sample SRV record



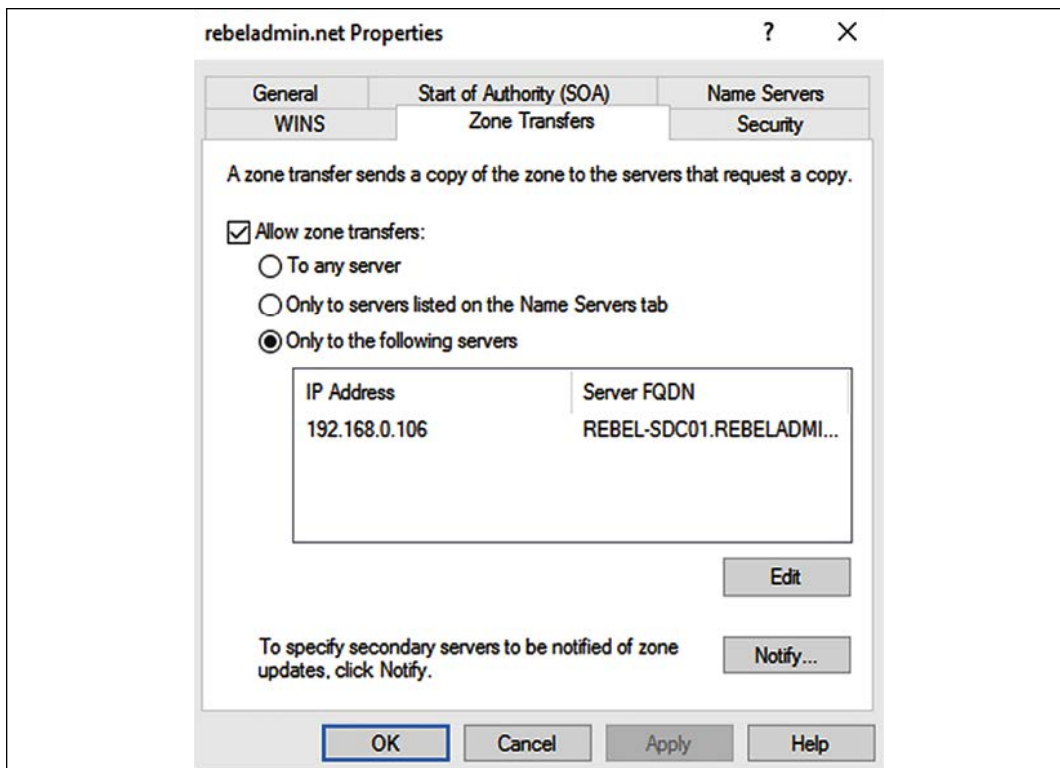


Figure 4.8: Zone transfer settings

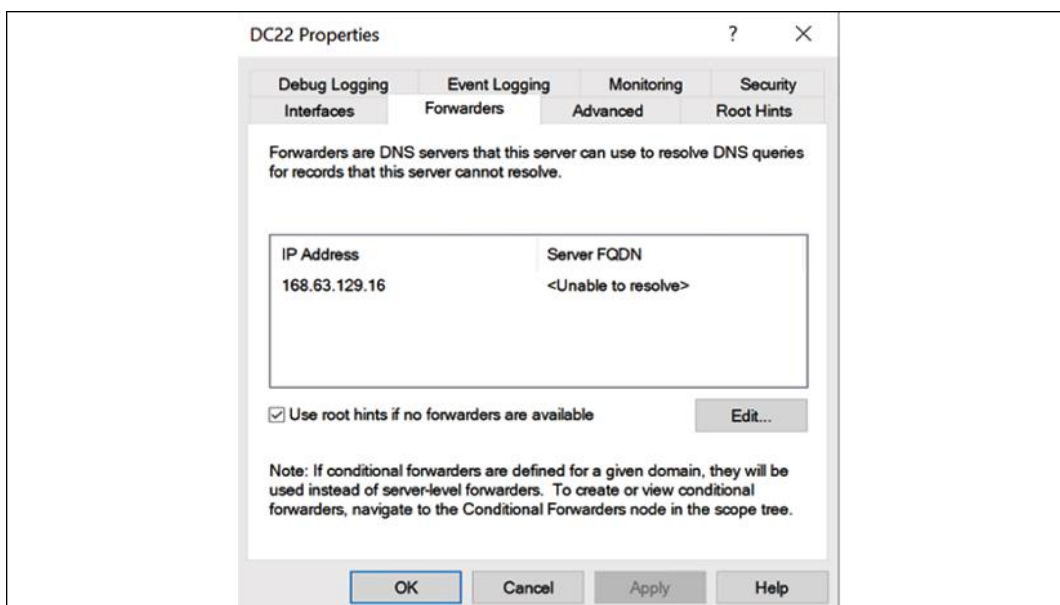


Figure 4.9: DNS forwarders

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\df Francis> nslookup portal.rebeladmin.com
Server: dc01.internal.cloudapp.net
Address: 10.0.0.4

Name: portal.rebeladmin.com
Address: 10.0.0.7

PS C:\Users\df Francis>
```

Figure 4.10: DNS query

```
PS C:\Users\df Francis> nslookup portal.rebeladmin.com
DNS request timed out.
    timeout was 2 seconds.
Server: Unknown
Address: 10.0.0.4

DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
DNS request timed out.
    timeout was 2 seconds.
*** Request to UnKnown timed-out
PS C:\Users\df Francis>
```

Figure 4.11: Failed DNS query

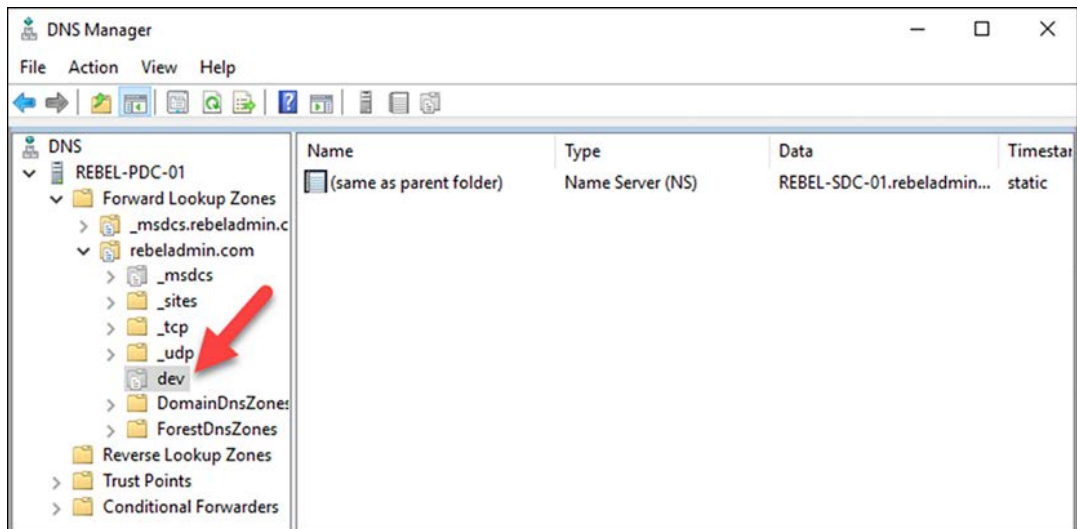


Figure 4.12: Delegated zone

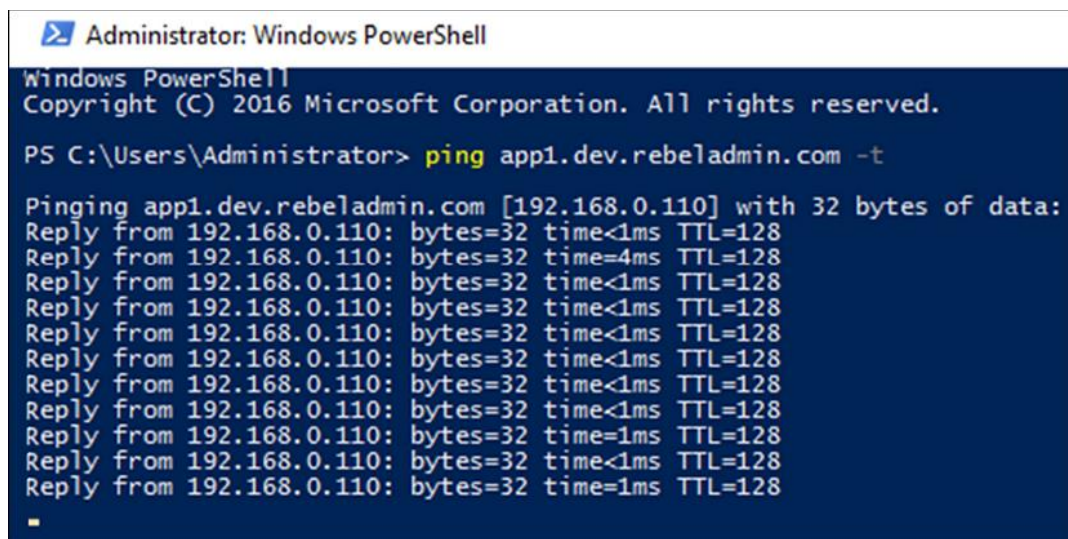


Figure 4.13: Resolve names from the delegated zone

# Chapter 5

## Figures



Figure 5.1: Time sources

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.1879]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\dfrancis>w32tm.exe /config /syncfromflags:manual /manualpeerlist:132.163.97.1,0x8 /reliable:yes /update
The command completed successfully.

C:\Users\dfrancis>w32tm.exe /config /update
The command completed successfully.

C:\Users\dfrancis>
```

Figure 5.2: Configuring the external time source

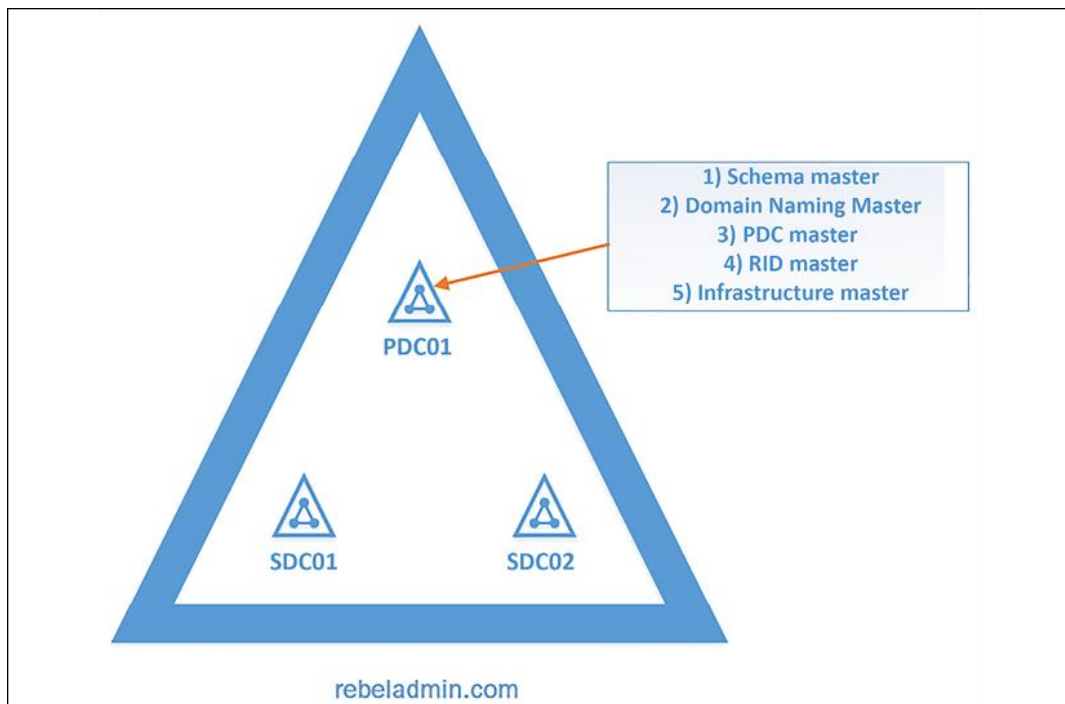


Figure 5.3: FSMO role placement example 1

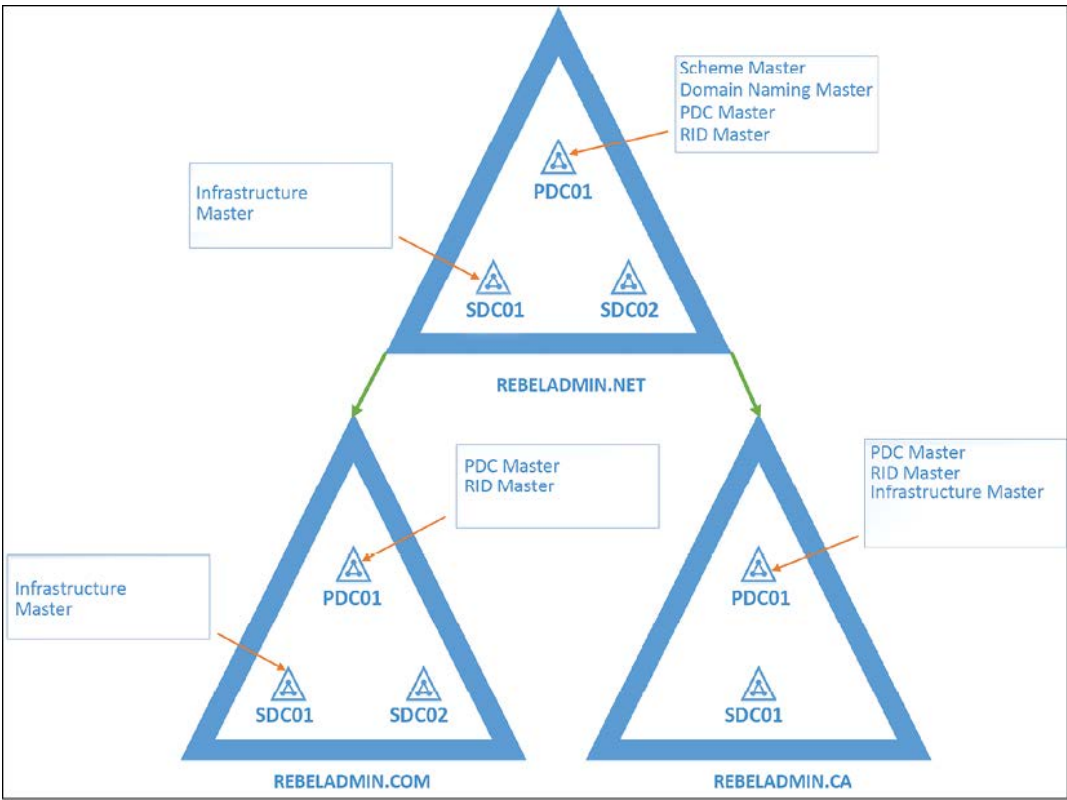


Figure 5.4: FSMO role placement example 2

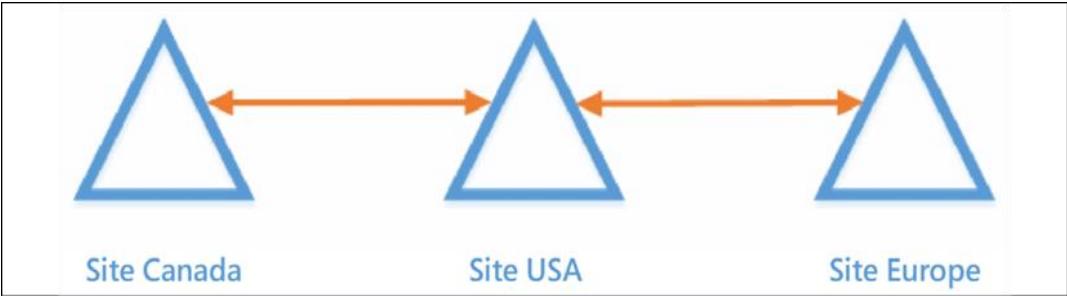


Figure 5.5: Inter-site connectivity

```

PS C:\Users\dfrancis.REBELADMIN> netdom query fsmo
Schema master                REBEL-PDC-01.rebeladmin.com
Domain naming master         REBEL-PDC-01.rebeladmin.com
PDC                          REBEL-SDC02.rebeladmin.com
RID pool manager             REBEL-SDC02.rebeladmin.com
Infrastructure master        REBEL-SDC02.rebeladmin.com
The command completed successfully.

PS C:\Users\dfrancis.REBELADMIN>

```

Figure 5.6: Migrating the selected number of FSMO roles

```

PS C:\Users\dfrancis.REBELADMIN> netdom query fsmo
Schema master                REBEL-SDC02.rebeladmin.com
Domain naming master         REBEL-SDC02.rebeladmin.com
PDC                          REBEL-SDC02.rebeladmin.com
RID pool manager             REBEL-SDC02.rebeladmin.com
Infrastructure master        REBEL-SDC02.rebeladmin.com
The command completed successfully.

```

Figure 5.7: Migrating FSMO roles

```

PS C:\Users\dfrancis>
PS C:\Users\dfrancis>
PS C:\Users\dfrancis> netdom query fsmo
Schema master                REBEL-SDC02.rebeladmin.com
Domain naming master         REBEL-SDC02.rebeladmin.com
PDC                          REBEL-SDC02.rebeladmin.com
RID pool manager             REBEL-SDC02.rebeladmin.com
Infrastructure master        REBEL-SDC02.rebeladmin.com
The command completed successfully.

PS C:\Users\dfrancis> ping REBEL-SDC02 -t

Pinging rebel-sdc02.rebeladmin.com [10.2.0.5] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.2.0.5:
    Packets: Sent = 5, Received = 0, Lost = 5 (100% loss),
Control-C

```

Figure 5.8: Domain controller ping test

```
PS C:\Program Files\PowerShell\7> netdom query fsmo
Schema master                REBEL-PDC-01.rebeladmin.com
Domain naming master         REBEL-PDC-01.rebeladmin.com
PDC                          REBEL-PDC-01.rebeladmin.com
RID pool manager             REBEL-PDC-01.rebeladmin.com
Infrastructure master         REBEL-PDC-01.rebeladmin.com
The command completed successfully.

PS C:\Program Files\PowerShell\7> █
```

**Figure 5.9: Seizing FSMO roles**

## Commands

### Command 5.1

In the Active Directory domain, the PDC role owner can be found using the following command:

```
Get-ADDomain | select PDCEmulator
```

### Command 5.2

In the Active Directory domain, the infrastructure operations master role owner can be found using the following command:

```
Get-ADDomain | select InfrastructureMaster
```



# Chapter 6

## Links

- The port requirements are available in the following document: <https://bit.ly/3HIU60i>.

## Figures

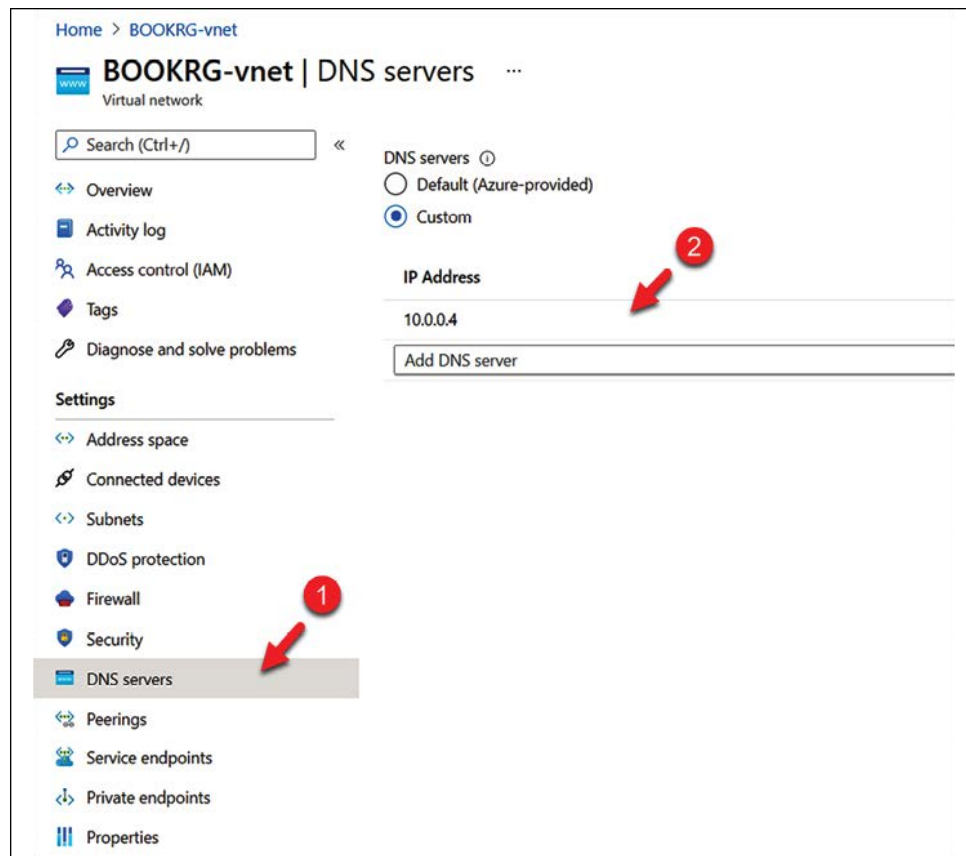


Figure 6.1: Azure Virtual Network DNS servers settings



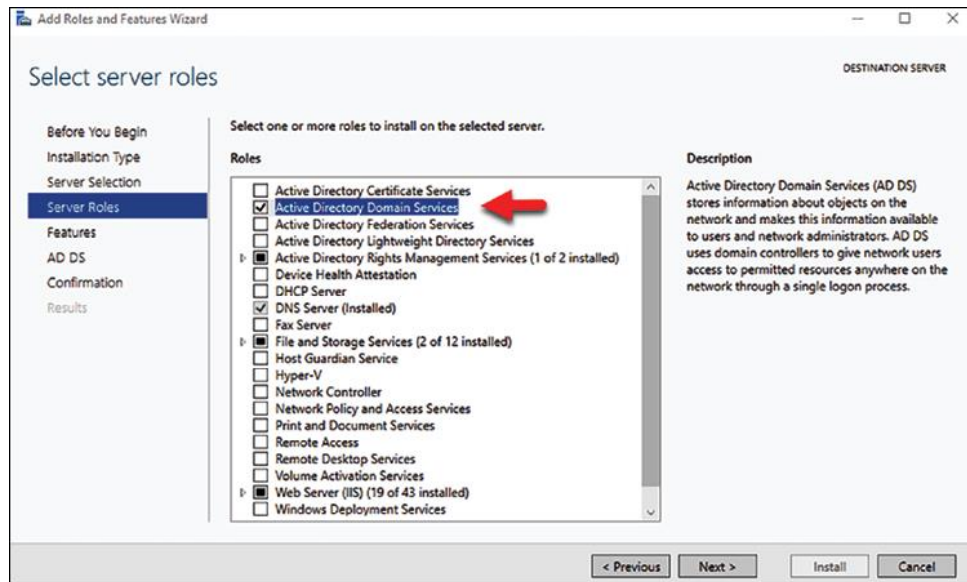


Figure 6.2: AD DS server role

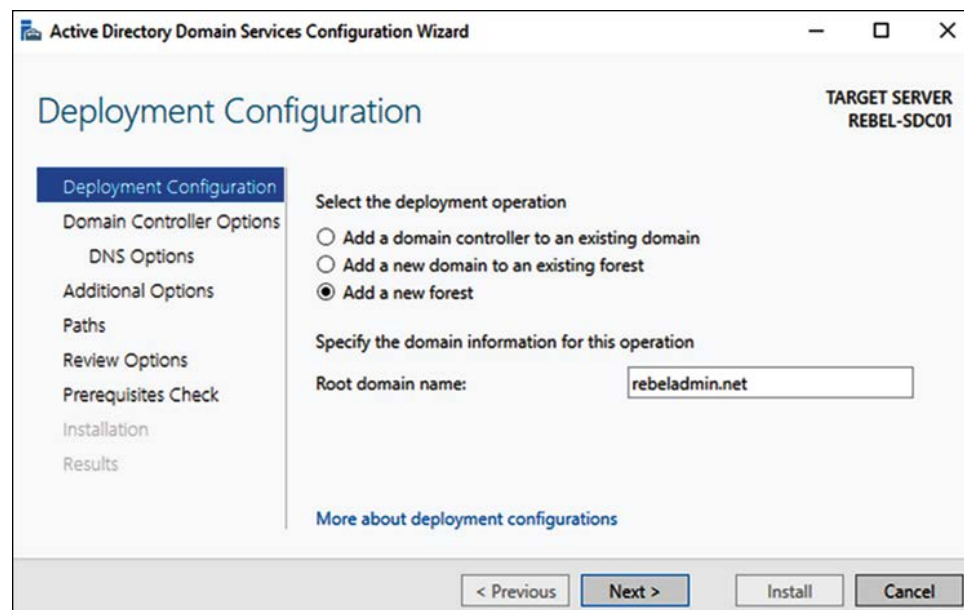


Figure 6.3: New AD forest root domain name

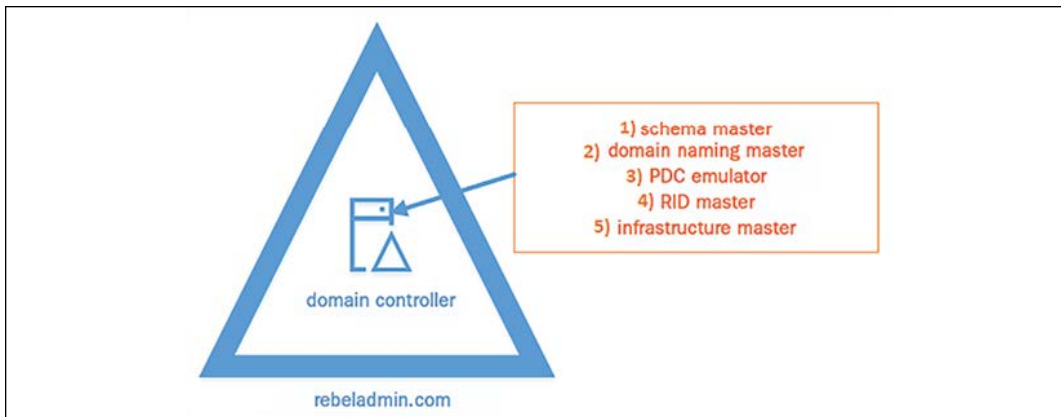


Figure 6.4: Design topology – fresh AD DS installation

```
PS C:\Windows\System32> Get-Service adws,kdc,netlogon,dns

Status  Name                DisplayName
-----
Running adws            Active Directory Web Services
Running dns           DNS Server
Running kdc           Kerberos Key Distribution Center
Running Netlogon      netlogon

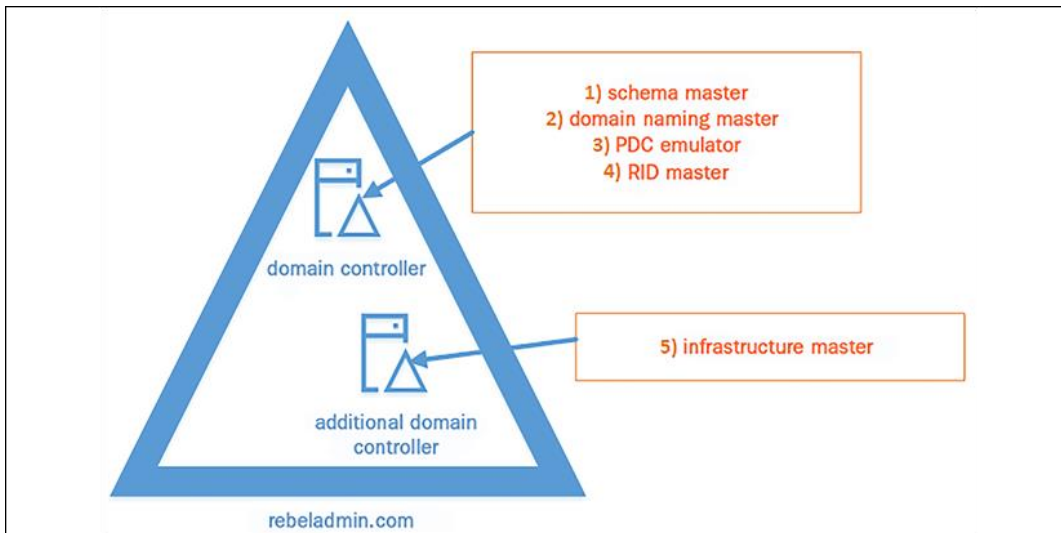
PS C:\Windows\System32> _
```

Figure 6.5: Status of AD-related services

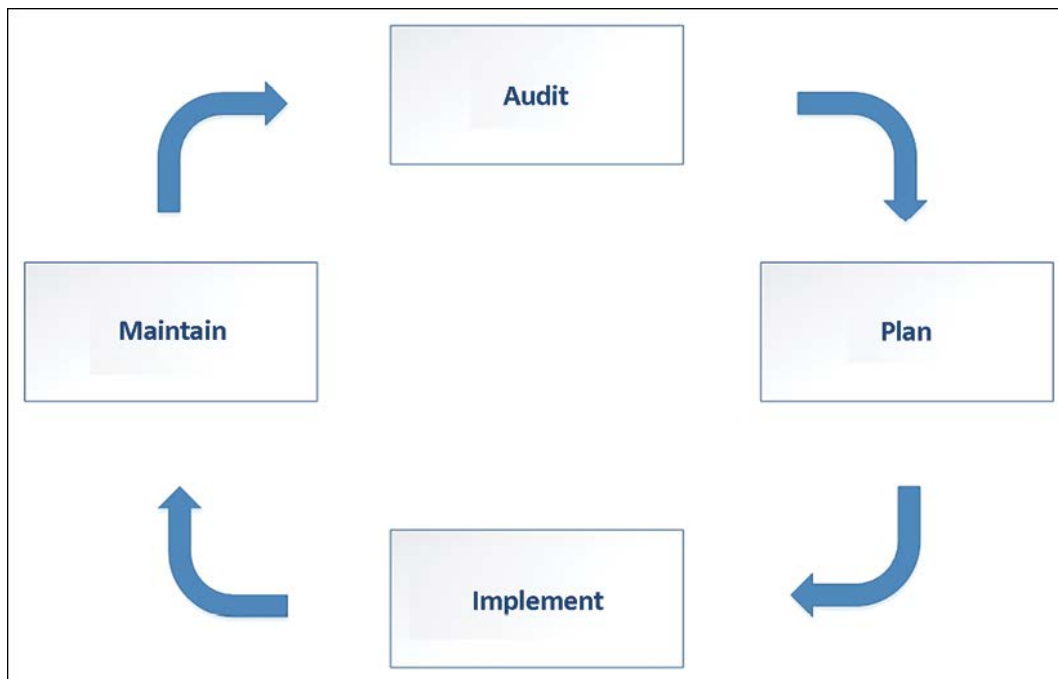
```
PS C:\Windows\System32> Get-ADDomainController

ComputerObjectDN      : CN=DC01,OU=Domain Controllers,DC=rebeladmin,DC=com
DefaultPartition      : DC=rebeladmin,DC=com
Domain                : rebeladmin.com
Enabled               : True
Forest                : rebeladmin.com
HostName              : DC01.rebeladmin.com
InvocationId           : fdb7bca0-97fb-4ca1-b720-3d69d2a27aa5
IPv4Address            : 10.0.0.4
IPv6Address            :
IsGlobalCatalog       : True
IsReadOnly             : False
LdapPort              : 389
Name                  : DC01
NTDSSettingsObjectDN  : CN=NTDS Settings,CN=DC01,CN=Servers,CN=Default-First-Site-Name,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com
OperatingSystem        : Windows Server 2019 Datacenter
OperatingSystemHotfix  :
OperatingSystemServicePack :
OperatingSystemVersion : 10.0 (17763)
OperationMasterRoles   : {SchemaMaster, DomainNamingMaster, PDCEmulator, RIDMaster...}
Partitions             : {DC=ForestDnsZones,DC=rebeladmin,DC=com, DC=DomainDnsZones,DC=rebeladmin,DC=com, CN=Schema,CN=Configuration,DC=rebeladmin,DC=com, CN=Configuration,DC=rebeladmin,DC=com...}
ServerObjectDN         : CN=DC01,CN=Servers,CN=Default-First-Site-Name,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com
ServerObjectGuid       : ccc07418-1bf3-4bed-9599-4bbbbaa8f6f5
Site                   : Default-First-Site-Name
SslPort                : 636
```

Figure 6.6: AD domain controller details



**Figure 6.7: Design topology – additional domain controller**



**Figure 6.8: AD migration life cycle**

```

PS C:\Windows\System32> Get-ItemProperty HKLM:\Software\Microsoft\Windows\CurrentVersion\Uninstall\* | select DisplayNam
e
DisplayName
-----
PuTTY release 0.74 (64-bit)
PowerShell 7-x64

```

Figure 6.9: List of software installed in a domain controller

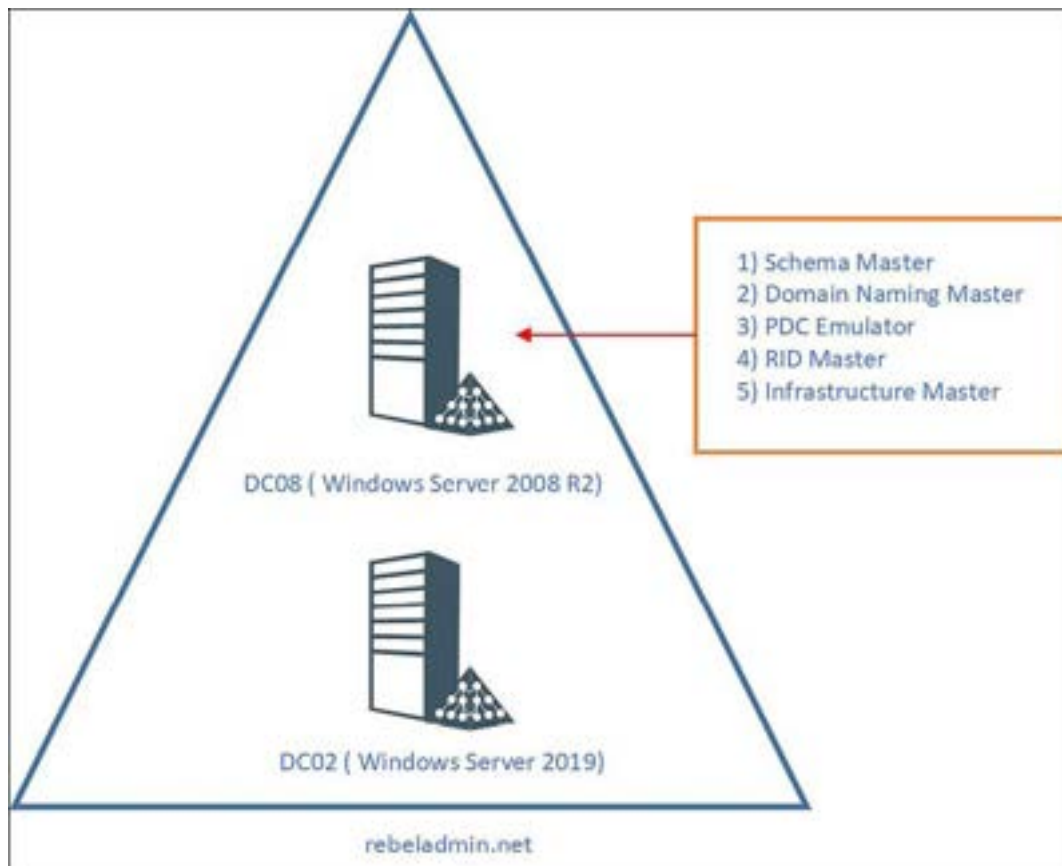


Figure 6.10: Design topology – AD DS 2008 R2 migration

```

PS C:\Users\dfrancis> dfsrnig /getmigrationstate
All Domain Controllers have migrated successfully to Global state ('Eliminated').
Migration has reached a consistent state on all Domain Controllers.
Succeeded.
PS C:\Users\dfrancis> _

```

Figure 6.11: DFSR status

```
Administrator: Windows PowerShell 7 (x64)
PowerShell 7.1.4
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\administrator.REBELADMIN> Get-ADDomain | Select-Object InfrastructureMaster, RIDMaster, PDCEmulator

InfrastructureMaster RIDMaster          PDCEmulator
-----
DC08.rebeladmin.net DC08.rebeladmin.net DC08.rebeladmin.net

PS C:\Users\administrator.REBELADMIN> Get-ADForest | Select-Object DomainNamingMaster, SchemaMaster

DomainNamingMaster SchemaMaster
-----
DC08.rebeladmin.net DC08.rebeladmin.net

PS C:\Users\administrator.REBELADMIN>
```

Figure 6.12: Current FSMO role holder

```
PS C:\Windows\System32> Move-ADDirectoryServerOperationMasterRole -Identity DC02 -OperationMasterRole SchemaMaster, DomainNamingMaster, PDCEmulator, RIDMaster, InfrastructureMaster

Move Operation Master Role
Do you want to move role 'SchemaMaster' to server 'DC02.rebeladmin.net' ?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): A
PS C:\Windows\System32>
```

Figure 6.13: Migrate FSMO roles

```
PS C:\Users\administrator.REBELADMIN> Get-ADDomain | Select-Object InfrastructureMaster, RIDMaster, PDCEmulator

InfrastructureMaster RIDMaster          PDCEmulator
-----
DC22.rebeladmin.net DC22.rebeladmin.net DC22.rebeladmin.net

PS C:\Users\administrator.REBELADMIN> Get-ADForest | Select-Object DomainNamingMaster, SchemaMaster

DomainNamingMaster SchemaMaster
-----
DC22.rebeladmin.net DC22.rebeladmin.net
```

Figure 6.14: New FSMO role holder

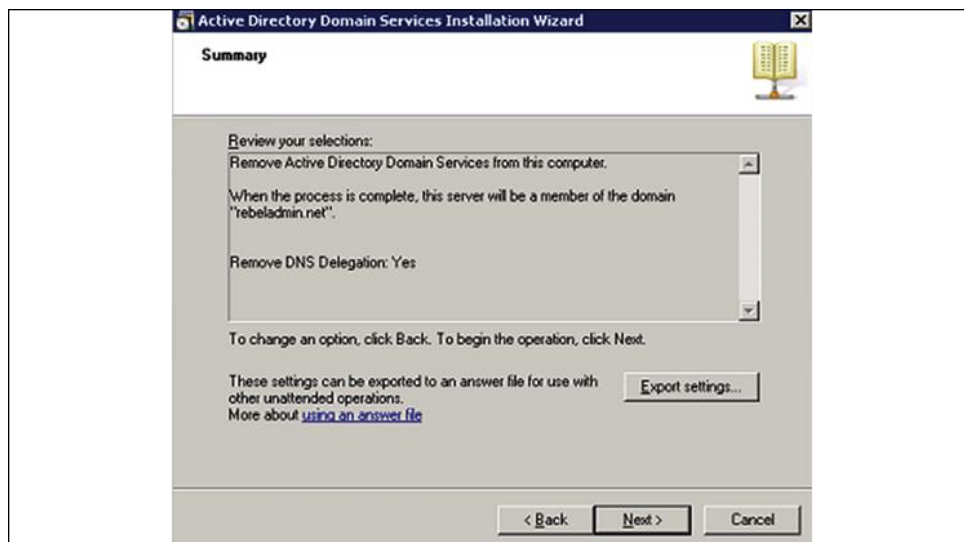


Figure 6.15: DCPromo wizard

```
PS C:\Windows\System32> Set-ADDomainMode -identity rebeladmin.net -DomainMode Windows2016Domain

Confirm
Are you sure you want to perform this action?
Performing the operation "Set" on target "DC=rebeladmin,DC=net".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): A
PS C:\Windows\System32>
```

Figure 6.16: Upgrading the domain functional level

```
PS C:\Windows\System32> Set-ADForestMode -Identity rebeladmin.net -ForestMode Windows2016Forest

Confirm
Are you sure you want to perform this action?
Performing the operation "Set" on target "CN=Partitions,CN=Configuration,DC=rebeladmin,DC=net".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): A
PS C:\Windows\System32>
```

Figure 6.17: Upgrading the forest functional level

```

PS C:\Users\administrator.REBELADMIN> Get-ADDomain | fl Name,DomainMode

Name       : rebeladmin
DomainMode : Windows2016Domain

PS C:\Users\administrator.REBELADMIN> Get-ADForest | fl Name,ForestMode

Name       : rebeladmin.net
ForestMode : Windows2016Forest

PS C:\Users\administrator.REBELADMIN>

```

**Figure 6.18: Verifying the forest and domain functional levels**

```

PS C:\Users\administrator.REBELADMIN> Get-Eventlog -LogName "Directory Service" | where {$_.eventID -eq 2009 -or $_.eventID -eq 2049} | Format-List

Index           : 586
EntryType       : Information
InstanceID     : 1073743886
Message        : The functional level of this forest has been updated.

                  New forest functional level:7

Category       : Directory Access
CategoryNumber : 8
ReplacementStrings : (7)
Source         : NTDS: General
TimeGenerated  : 02/09/2021 15:54:58
TimeWritten    : 02/09/2021 15:54:58
UserTime       : REBELADMIN\Administrator

Index           : 87
EntryType       : Information
InstanceID     : 1073743883
Message        : The functional level of this domain has been updated.

                  Domain: DC=rebeladmin,DC=net

                  New domain functional level:7

Category       : Directory Access
CategoryNumber : 8
ReplacementStrings : (DC=rebeladmin,DC=net, 7)
Source         : NTDS: General
TimeGenerated  : 02/09/2021 15:55:08
TimeWritten    : 02/09/2021 15:55:08
UserTime       : REBELADMIN\Administrator

PS C:\Users\administrator.REBELADMIN>

```

**Figure 6.19: Verifying the forest and domain functional levels – event log**

## Commands

### Command 6.1

```

Install-WindowsFeature -Name AD-Domain-Services
-IncludeManagementTools

```

### Command 6.2

```

Install-ADDSForest
-DomainName "rebeladmin.com"
-CreateDnsDelegation:$false

```

```
-DatabasePath "C:\Windows\NTDS"
-DomainMode "7"
-DomainNetbiosName "REBELADMIN"
-ForestMode "7"
-InstallDns:$true
-LogPath "C:\Windows\NTDS"
-NoRebootOnCompletion:$True
-SysvolPath "C:\Windows\SYSVOL"
-Force:$true
```

### Explanations

The following table explains the PowerShell commands and what they do:

| Cmdlet                                   | Description   |
|--|---|
| <code>Install-<br/>WindowsFeature</code> | This cmdlet allows us to install Windows roles, role services, or Windows features in a local server or remote server. It is similar to using Windows Server Manager to install them. |
| <code>Install-<br/>ADDSForest</code>     | This cmdlet allows us to set up a new AD forest.  |

The following table explains the arguments for the commands and what they do:

| Argument                                  | Description   |
|---|---|
| <code>-<br/>IncludeManagementTools</code> | This installs the management tools for the selected role service.   |
| <code>-DomainName</code>                  | This parameter defines the FQDN for the AD domain.  |
| <code>-CreateDnsDelegation</code>         | Using this parameter, we can define whether we will create a DNS delegation that references AD's integrated DNS.  |
| <code>-DatabasePath</code>                | This parameter defines the folder path for storing the AD database file (ntds.dit).   |
| <code>-DomainMode</code>                  | This parameter will specify the AD domain's functional level. In the previous example, I used mode 7, which is Windows Server 2016.                             |
| <code>-DomainNetbiosName</code>           | This defines the NetBIOS name for the forest root domain.   |
| <code>-ForestMode</code>                  | This parameter will specify the AD forest's functional level. In the previous example, I used mode 7, which is Windows Server 2016.                             |
| <code>-InstallDns</code>                  | Using this, you can specify whether a DNS role needs to be installed with the AD domain controller. For a new forest, it is required that you set it to \$true. |



|                                    |   |
|------------------------------------|---|
| <code>-LogPath</code>              | A log path can be used to specify the location that you save domain log files to.   |
| <code>-SysvolPath</code>           | This is used to define the SYSVOL folder path. The default location for it will be C:\Windows.  |
| <code>-NoRebootOnCompletion</code> | By default, the system restarts the server after domain controller configuration. Using this command can prevent an automatic system restart.                         |
| <code>-Force</code>                | This parameter will force a command to execute by ignoring the given warning. It is typical for the system to pass warnings about best practices and recommendations. |

### Command 6.3

```
Get-Service adws,kdc,netlogon,dns
```

### Command 6.4

```
Get-ADDomainController
```

### Command 6.5

```
Get-ADDomain rebeladmin.com
```

### Command 6.6

```
Get-smbshare SYSVOL
```

### Command 6.7

```
Install-WindowsFeature -Name AD-Domain-Services
                        -IncludeManagementTools
```

### Command 6.8

```
Install-ADDSDomainController
-CreateDnsDelegation:$false
-NoGlobalCatalog:$true
-InstallDns:$true
-DomainName "rebeladmin.com"
-SiteName "Default-First-Site-Name"
```

```
-ReplicationSourceDC "REBEL-SDC01.rebeladmin.com"
-DatabasePath "C:\Windows\NTDS"
-LogPath "C:\Windows\NTDS"
-NoRebootOnCompletion:$true
-SysvolPath "C:\Windows\SYSVOL"
-Force:$true
```

There are no line breaks for the preceding command. The following table contains the parameters that were used here:

| Argument                                  | Description  |
|---|--|
| <code>Install-ADDSDomainController</code> | This cmdlet will install the domain controller in the AD infrastructure.   |
| <code>-NoGlobalCatalog</code>             | If you don't want to create the domain controller as a global catalog server, this parameter can be used. By default, the system will enable the global catalog feature. |
| <code>-SiteName</code>                    | This parameter can be used to define the AD site name. The default value is Default-First-Site-Name.   |
| <code>-DomainName</code>                  | This parameter defines the FQDN for the AD domain.   |
| <code>-ReplicationSourceDC</code>         | You can use this parameter to define the AD replication source. By default, it uses any available domain controller, though you can specify one if you wish.             |

#### Command 6.9

```
Get-Service adws,kdc,netlogon,dns
```

#### Command 6.10

```
Get-ADDomainController -Filter * | Format-Table Name,
  IPv4Address, Site
```

#### Command 6.11

```
Get-ADDomainController -Discover -Service "GlobalCatalog"
```

#### Command 6.12

```
Move-ADDirectoryServerOperationMasterRole  
-Identity REBEL-SDC-02  
-OperationMasterRole InfrastructureMaster
```

#### Command 6.13

```
Get-ADDomain | Select-Object InfrastructureMaster
```

#### Command 6.14

```
Repadmin /showrepl
```

#### Command 6.15

```
Repadmin /showrepl REBEL-SDC-03
```

The `/replicate` parameter can be used to trigger a replication between the domain controllers so that you can see the results in real time:

#### Command 6.16

```
Repadmin /replicate REBEL-SDC-03.rebeladmin.com  
REBEL-PDC-01.rebeladmin.com DC=rebeladmin,DC=com
```

The preceding command will initiate replication of the rebeladmin naming context from REBEL-PDC-01 to REBEL-SDC-03.

#### Command 6.17

The following commands will initiate the full replication of all the changes from REBEL-PDC-01 to REBEL-SDC-03:

```
Repadmin /replicate REBEL-SDC-03.rebeladmin.com  
REBEL-PDC-01.rebeladmin.com DC=rebeladmin,DC=com /full
```

#### Command 6.18

The `/replsummary` parameter can be used so that you can view the summary of the replication status of all the domain controllers:

```
Repadmin /replsummary
```

The preceding command will provide a summary of all the domain controllers in the infrastructure.

#### Command 6.19

The following command will only list the domain controllers that have replication issues with other domain controllers:

```
Repadmin /replsummary /errorsonly
```

#### Command 6.20

We can check if SYSVOL replication uses DFSR by using:

```
dfsrmig /getmigrationstate
```

If the above command returns the state as eliminated, it means DFSR is already in place.

#### Command 6.21

```
Get-WindowsFeature -ComputerName DC01 | Where Installed
```

In the above command, the -ComputerName value should be replaced by the domain controller hostname.

#### Command 6.22

We should also avoid installing additional software in domain controllers (unless it is for backup or security). We can find additional software installed in a domain controller by using:

```
Get-ItemProperty  
HKLM:\Software\Microsoft\Windows\CurrentVersion\Uninstall\* | select  
DisplayName
```

#### Command 6.23

The **Dcdiag.exe** tool can be used to run predefined tests to evaluate the health of the domain controllers:

```
Dcdiag /e
```

The preceding command will test the domain controllers in the forest.

#### Command 6.24

```
Dcdiag /s:REBEL-SDC-03
```

The preceding command will run the test on the **REBEL-SDC-03** domain controller.

#### Command 6.25

Instead of running all the tests, the following command will only run a replication test on REBEL-SDC-03:

```
Dcdiag /test:replications /s:REBEL-SDC-03
```

#### Command 6.26

The following command can be used to check AD services on the local domain controller:

```
Dcdiag /test:Services
```

#### Command 6.27

The Dcdiag utility can also be used to test DNS health:

```
Dcdiag /test:DNS /DNSBasic
```

#### Command 6.28

The following command will test whether the DNS forwarders are functioning properly:

```
Dcdiag /test:DNS /DnsForwarders
```

#### Command 6.29

The following command will test the registration of DC locator records:

```
Dcdiag /test:DNS /DnsRecordRegistration
```

#### Command 6.30

We also can run a complete health report by using:

```
dcdiag /v /c /e /s:DC01 | Out-File C:\healthreport.txt
```

In the preceding command, `/v` means verbose, and it will print extended information. The `/c` argument means the system will run all tests except `DCPromo` and `RegisterInDNS`. With the `/e` argument tests will run on all servers in the enterprise. The `/s` argument is used to define the name of the domain controller to run the commands against. The output of the complete command will be written to the `C:\healthreport.txt` file. This report includes rich information about the health of the AD infrastructure.

#### Command 6.31

Before the configuration process, we need to install the AD DS role in the given server. In order to do that, we can use the following command:

```
Install-WindowsFeature -Name AD-Domain-Services  
-IncludeManagementTools
```

#### Command 6.32

Then launch the PowerShell (7.1) console and run the following commands to verify the current FSMO role holder:

```
Get-ADDomain | Select-Object InfrastructureMaster, RIDMaster,  
PDCEmulator  
Get-ADForest | Select-Object DomainNamingMaster, SchemaMaster
```

#### Command 6.33

Migrate all five FSMO roles to the new domain controller by running the following command in the **DC22** server:

```
Move-ADDirectoryServerOperationMasterRole -Identity  
DC22 -OperationMasterRole SchemaMaster,  
DomainNamingMaster, PDCEmulator, RIDMaster,  
InfrastructureMaster
```

In the preceding command, DC22 is the domain controller running Windows Server 2022.

#### Command 6.34

Once we're done, we can verify the new FSMO role holder using the following commands:

```
Get-ADDomain | Select-Object InfrastructureMaster, RIDMaster,  
PDCEmulator  
Get-ADForest | Select-Object DomainNamingMaster, SchemaMaster
```

#### Command 6.35

```
Uninstall ADDSDomainController -DemoteOperationMasterRole -  
RemoveApplicationPartition to uninstall AD DS.
```

#### Command 6.36

To change the domain functional level to Windows Server 2016, use the following command:

```
Set-ADDomainMode -identity rebeladmin.net  
-DomainMode Windows2016Domain
```

#### Command 6.37

To upgrade the forest functional level, use the following command:

```
Set-ADForestMode -Identity rebeladmin.net  
-ForestMode Windows2016Forest
```

#### Command 6.38

The following command will show the current functional level of the domain after the migration:

```
Get-ADDomain | fl Name, DomainMode
```

#### Command 6.39

The following command will show the current forest functional level of the domain after migration:

```
Get-ADForest | fl Name, ForestMode
```

#### Command 6.40

You can also use the following command to verify the forest and domain functional level updates:

```
Get-EventLog -LogName 'Directory Service' | where {$_.eventID -eq 2039  
-or $_.eventID -eq 2040} | Format-List
```

#### Command 6.41

Event ID 1458 verifies the transfer of the FSMO roles:

```
Get-EventLog -LogName 'Directory Service' | where {$_.eventID -eq  
1458} | Format-List
```

#### Command 6.42

You can use the following command to verify the list of domain controllers and make sure that the old domain controller is gone:

```
Get-ADDomainController -Filter * | Format-Table Name, IPv4Address
```

## Tables

Here, I have listed some key event IDs that will show replication problems:

| Event ID | Cause  |
|----------|--|
| 1925     | The attempt to establish a replication link for a writable directory partition failed. This can be caused by network issues, domain controller failures, or DNS issues.  |
| 1988     | The local domain controller has attempted to replicate an object from a source domain controller that isn't present on the local domain controller because it may have been deleted and already garbage-collected. Replication will not proceed for this directory partition with this partner until the situation is resolved. This happens when a domain controller is down for a long time (more than the tombstone's lifetime) before being brought back online. After this, however, it could have non-existing objects (lingering objects). They need to be cleaned to initiate replication again. |
| 2087     | AD DS could not resolve the DNS hostname of the source domain controller to an IP address, and replication failed. This will show up in the destination domain controller when it cannot resolve the DNS name for its source domain controller. If DNS lookup fails in the first place, it will also try FQDN and NetBIOS to resolve the name. It will prevent replication until it's been resolved.   |
| 2088     | AD DS could not resolve the DNS hostname of the source domain controller to an IP address, but replication succeeded. In this situation, the destination domain controller failed to resolve the source name using DNS lookup, but it was able to connect to it using the FQDN or NetBIOS name.  |
| 1311     | The replication configuration information in AD DS doesn't accurately reflect the physical topology of the network. This usually occurs due to the misconfiguration of AD site links. It may have the wrong subnets assigned to it.  |

**Table 7.1**

The following information needs to be covered in the plan:

| Data  | Description  |
|---|--|
| Overview of the existing AD DS infrastructure | Based on the data that was collected from the audit, you need to provide an overview of the existing infrastructure. This should include information about the logical and physical topology of AD.  |
| Overview of the proposed solution             | Based on the data that was collected from the audit and business requirements, we can provide a detailed design of the proposed solution. This should include data about the topology changes, new domain controller placements, FSMO role placements, new site links, IP addresses, hostnames, required hardware or VM resources, required firewall rule changes, and more. |
| Risks   | One main objective of the audit exercise is to identify the potential risks that can impact the AD DS migration. These can be due to wrong design, the bad health of the AD services, or other infrastructure or application issues.   |



|                        |  |
|------------------------|--|
|                        | The recognized risks can be categorized based on impact (for example, high, medium, and low).  |
| Risk mitigation plan   | Once the risks have been identified, we need to provide a plan to describe what action can be taken to address them. If possible, include a task list, estimated time frame, and budget in the plan.   |
| Service interruptions  | During the implementation process, there can be service interruptions. This can be due to events such as application migrations or server IP changes. In this section, make a list of these service interruptions, along with the expected time range, so that the relevant parties can be informed prior to the migration process.  |
| Recommendations        | During the audit process, you may have found things that you could do to improve AD DS performance, security, or manageability. What wasn't covered in the initial business requirements can be listed as recommendations. Note that these shouldn't have any direct impact on the AD DS migration process. If this is done, it should be listed in the proposed solution section. |
| Task list and schedule | The plan should have a detailed task list and schedule for the AD DS migration implementation process. It should also include roles and responsibilities for completing each task.   |
| Test plan              | It is also required that you have a detailed test plan in order to test the AD functions after the AD DS migration process so that you can verify its health and integrity. This must be used during the implementation process and should include evidence to prove the successful completion of each test (such as screenshots, events, reports, and more).                      |
| Recovery plan          | After a successful audit and planning process, there is a very low possibility of project failure. However, the plan still needs to provide a recovery plan that will be used in the event of a failure. It also should include a process for testing the existing DR or backup solution that will be used in the recovery, prior to starting the project.                         |

**Table 7.2**

# Chapter 7

## Figures

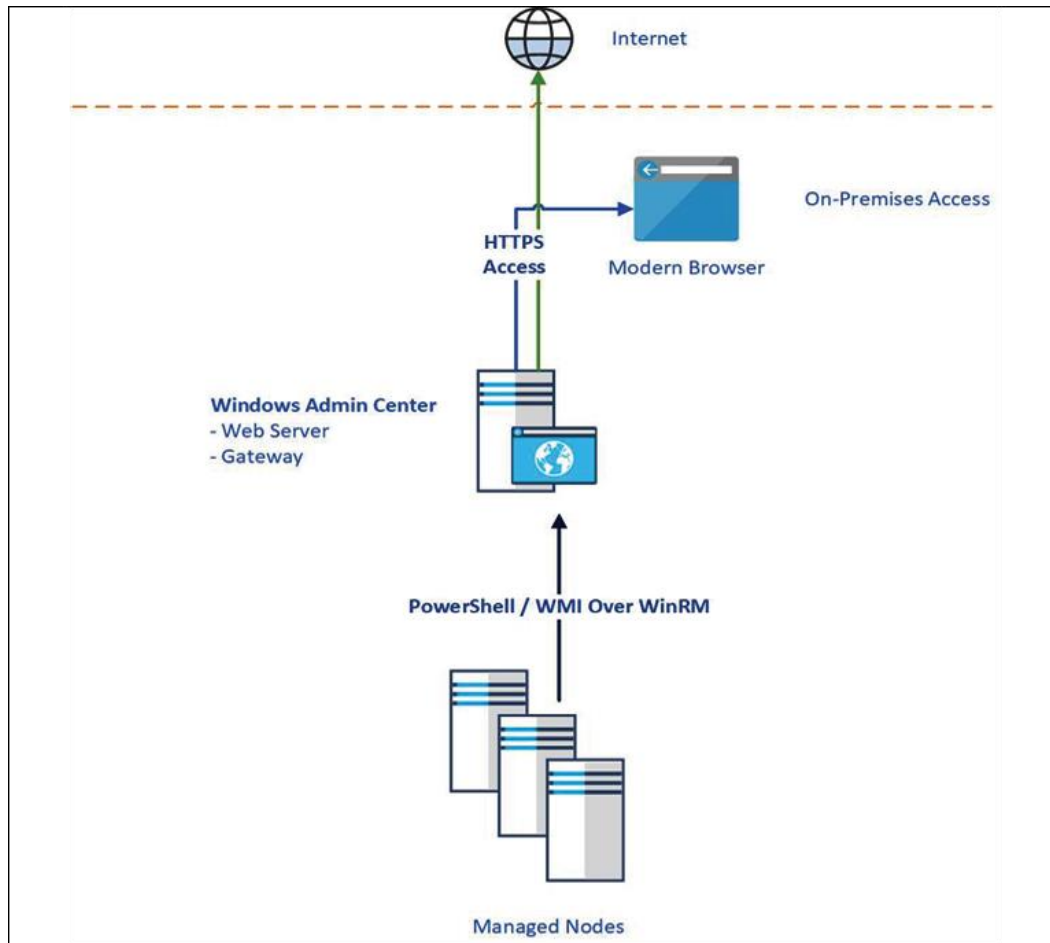


Figure 7.1: Windows Admin Center architecture

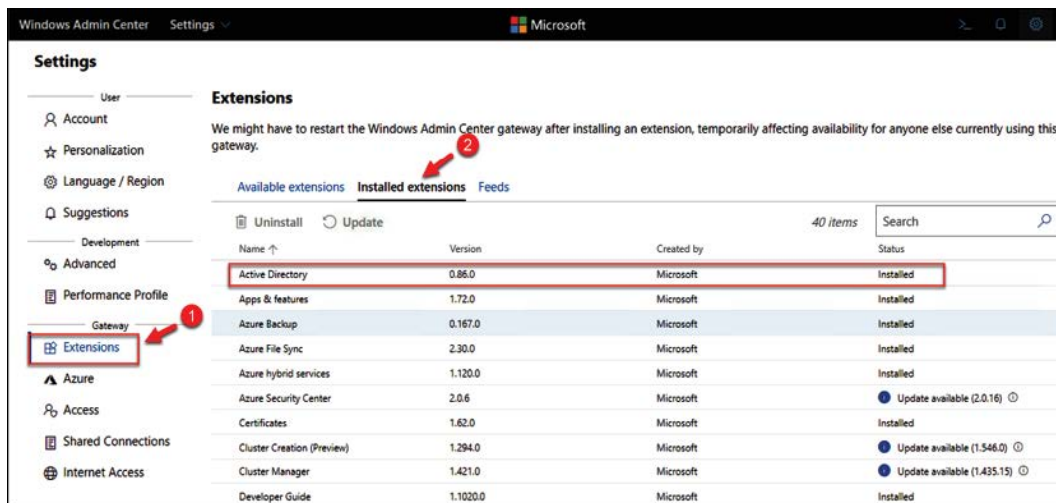


Figure 7.2: Windows Admin Center extensions

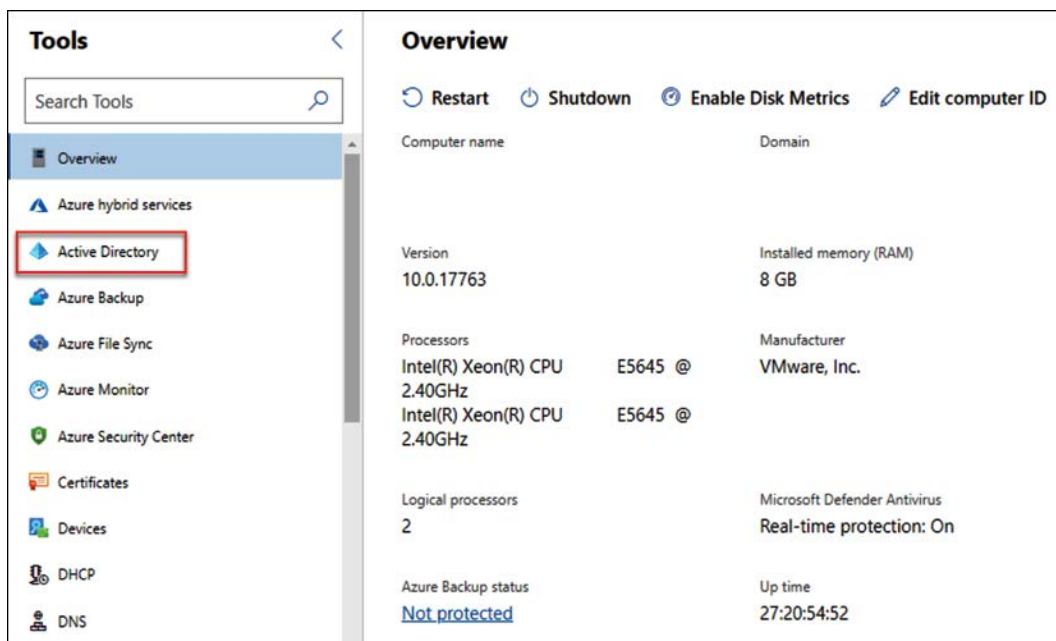


Figure 7.3: Windows Admin Center AD role management

**Active Directory Domain Services** PREVIEW ⓘ

[Overview](#) [Browse](#)

**Domain Name:**

Search

[+ Create](#) [+ Enable](#) [+ Disable](#) [Delete](#) [Reset Password](#) [Properties](#) [More](#) 2 items

| Name ↑         | Type | Description |
|----------------|------|-------------|
| Dishan Francis | user |             |

Figure 7.4: Searching AD users using Windows Admin Center

**Active Directory Domain Services > User properties: DFrancis**

[Account](#) [Membership](#)

**Name \***  **User SamsAccountName \***

**First Name**  **Last Name**

**Password**  **Confirm Password**

**User UPN Logon**

☐ Protect from Accidental Deletion  
☐ User must change password at next log on  
☐ User cannot change password  
☐ Password never expires  
☐ Microsoft Passport or smart card is required for interactive log on

Figure 7.5: Modifying a user object using Windows Admin Center

**Active Directory Domain Services** PREVIEW ⓘ

[Overview](#) [Browse](#)

**Domain Name:**

Search

[+ Create](#) [+ Enable](#) [+ Disable](#) [Delete](#) [Reset Password](#) [Properties](#) [More](#)

Figure 7.6: Disabling, deleting, or resetting the password for an object using Windows Admin Center

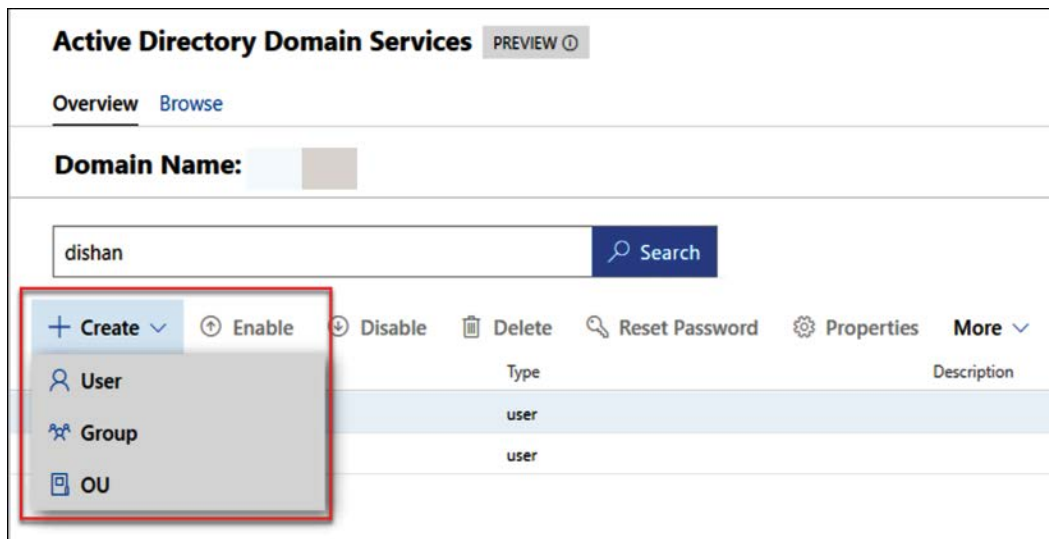


Figure 7.7: Creating an object using Windows Admin Center

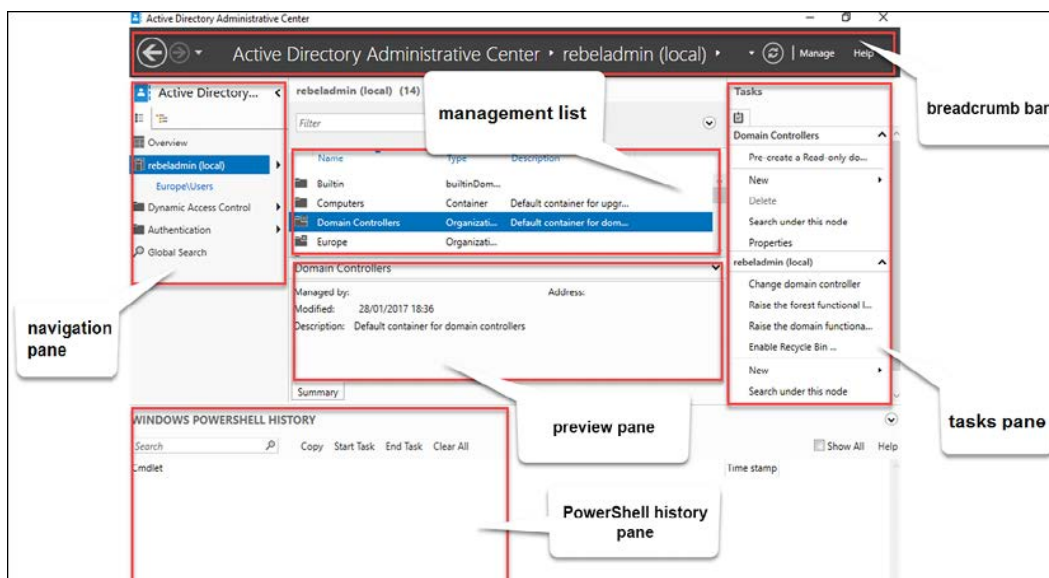


Figure 7.8: ADAC



Figure 7.9: Breadcrumb bar in ADAC

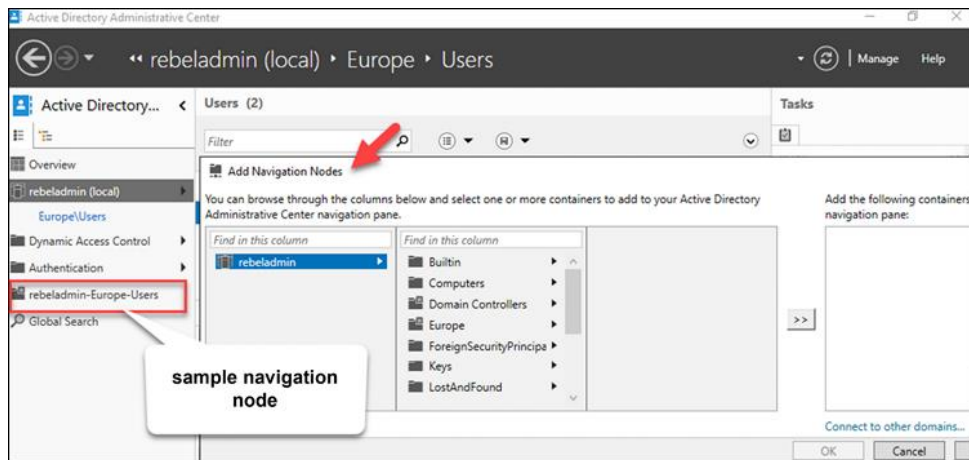


Figure 7.10: Navigation node in ADAC

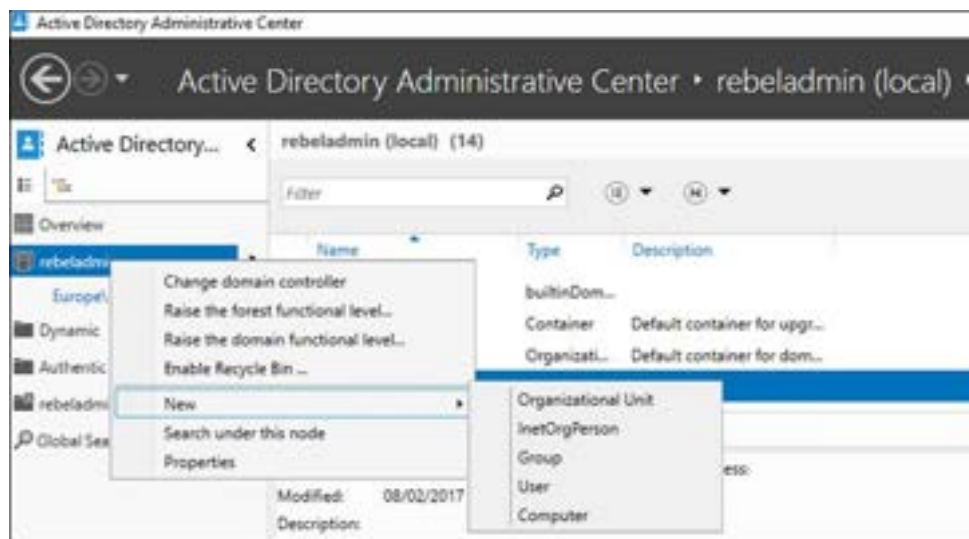


Figure 7.11: Adding objects in ADAC

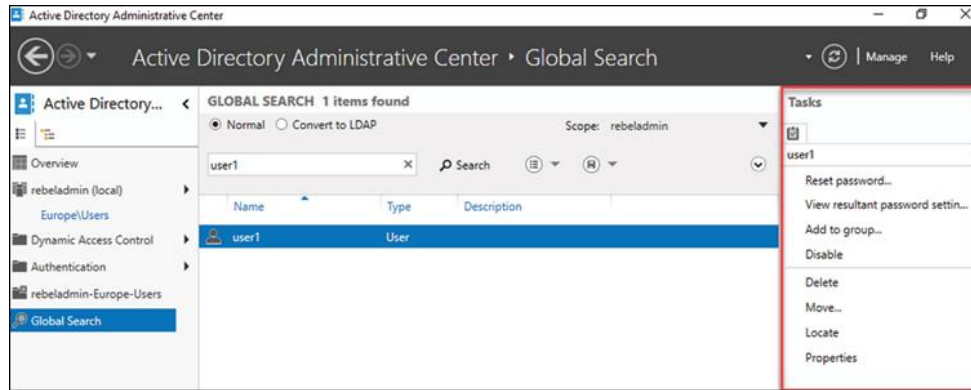


Figure 7.12: ADAC global search

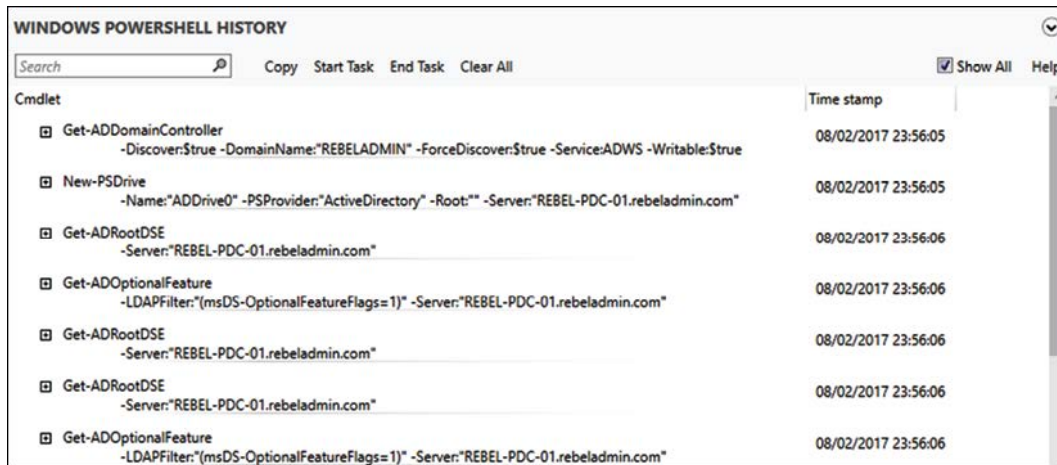



Figure 7.13: ADAC PowerShell history




Figure 7.14: Connect to other nodes

Create User: user1

Administrative Tasks  TASKS SECTIONS

**Sections**

- Account
- Organization
- Member Of
- Password Settings
- Profile
- Policy
- Silo



**Account**

First name: user1

Middle initials:

Last name:

Full name: \* user1

User UPN logon: user1 @ rebeladmin.com

User SamAccountName lo... rebeladmin \* user1

Password:

Confirm password:

Create in: OU=Asia,DC=rebeladmin,DC=com Change...

☐ Protect from accidental deletion

Log on hours... Log on to...

Account expires:

☒ Never

☐ End of

Password options:

☒ User must change password at next log on

☐ Other password options

☐ Microsoft Passport or smart card is required for interactive log on

☐ Password never expires

☐ User cannot change password

Encryption options:

Other options:

**Organization**

Display name: user1

Office:

E-mail:

Web page:

Other web pages...

Phone numbers:

Main:

Home:

Mobile:

Job title:

Department:

Company:

Manager: Edit... Clear

Direct reports:

Add... Remove

More Information

OK Cancel

Figure 7.15: Administrative tasks



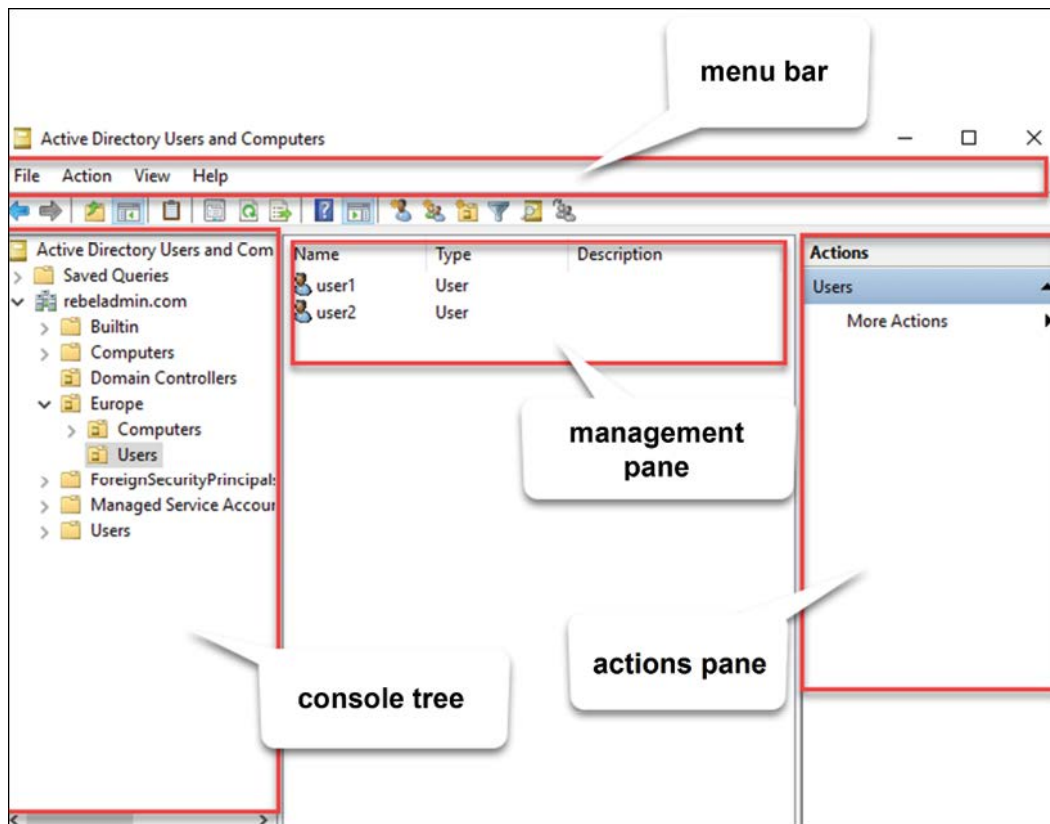


Figure 7.16: ADUC

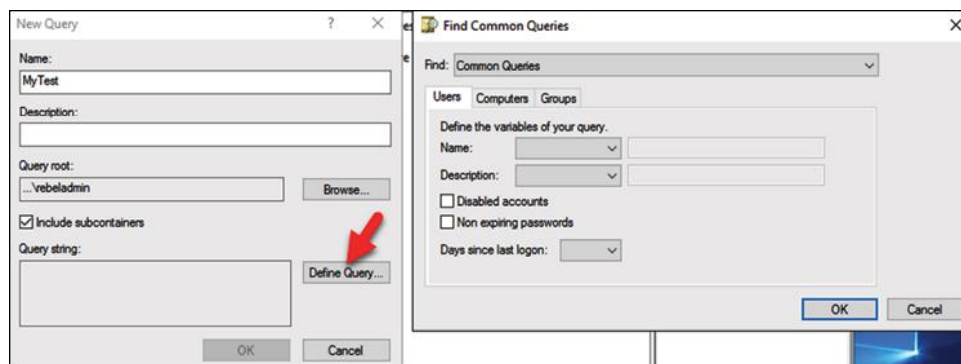


Figure 7.17: Working with queries

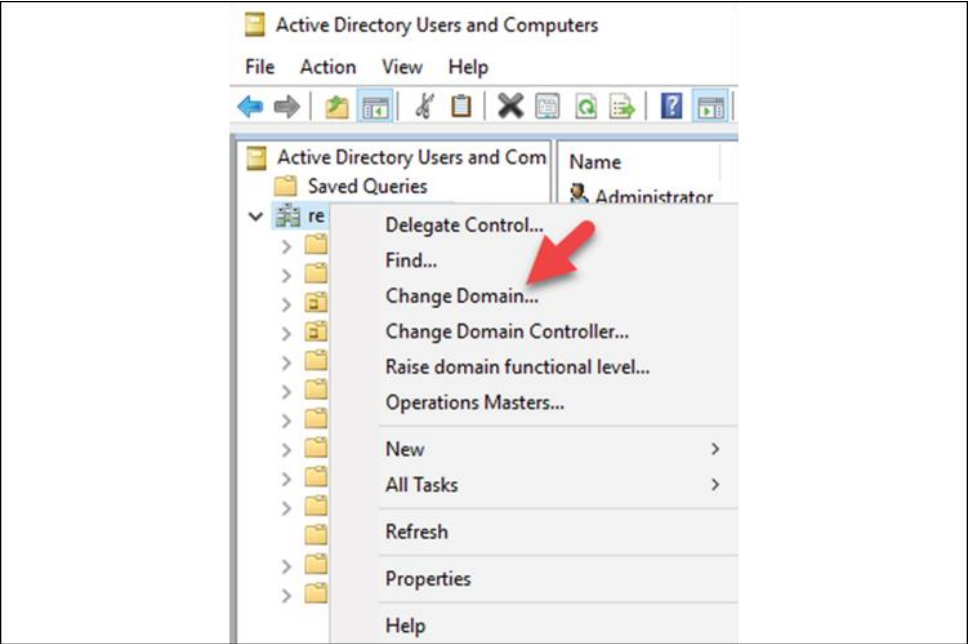


Figure 7.18: Accessing different domains

| attributes |               |           |         |                |                        |   |
|------------|---------------|-----------|---------|----------------|------------------------|---|
|            | A             | B         | C       | D              | E                      | F                                       |
| 1          | Name          | GivenName | Surname | SamAccountName | UserPrincipalName      | Path                                    |
| 2          | Test1 User1   | Test1     | User1   | tuser1         | tuser1@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 3          | Test2 User2   | Test2     | User2   | tuser2         | tuser2@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 4          | Test3 User3   | Test3     | User3   | tuser3         | tuser3@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 5          | Test4 User4   | Test4     | User4   | tuser4         | tuser4@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 6          | Test5 User5   | Test5     | User5   | tuser5         | tuser5@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 7          | Test6 User6   | Test6     | User6   | tuser6         | tuser6@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 8          | Test7 User7   | Test7     | User7   | tuser7         | tuser7@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 9          | Test8 User8   | Test8     | User8   | tuser8         | tuser8@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 10         | Test9 User9   | Test9     | User9   | tuser9         | tuser9@rebeladmin.com  | OU=Users,OU=Europe,DC=rebeladmin,DC=com |
| 11         | Test10 User10 | Test10    | User10  | tuser10        | tuser10@rebeladmin.com | OU=Users,OU=Europe,DC=rebeladmin,DC=com |

Figure 7.19: CSV file with user attribute values

Create User: TASKS SECTIONS

**\* Account**

Organization

Member Of

Password Settings

Profile

Policy

Silo

**Account**

First name:

Middle initials:

Last name:

Full name:

User UPN logon:

User SamAccountName lo...:

Password:

Confirm password:

Create in: OU=Asia,DC=rebeladmin,DC=com

☐ Protect from accidental deletion

Log on hours...  Log on to...

Account expires: ☒ Never ☐ End of

Password options:

☒ User must change password at next log on

☐ Other password options

☐ Microsoft Passport or smart card is required for interactive log on

☐ Password never expires

☐ User cannot change password

Encryption options:

Other options:

**Organization**

Display name:

Office:

E-mail:

Web page:

Other web pages...

Phone numbers:

Main:

Home:

Mobile:

Job title:

Department:

Company:

Manager:

Direct reports:

Figure 7.20: Creating a new user by using ADAC

New Object - Computer

Create in: rebeladmin.com/Computers

Computer name:

Computer name (pre-Windows 2000):

The following user or group can join this computer to a domain.

User or group:

☐ Assign this computer account as a pre-Windows 2000 computer

Figure 7.21: Creating a computer object

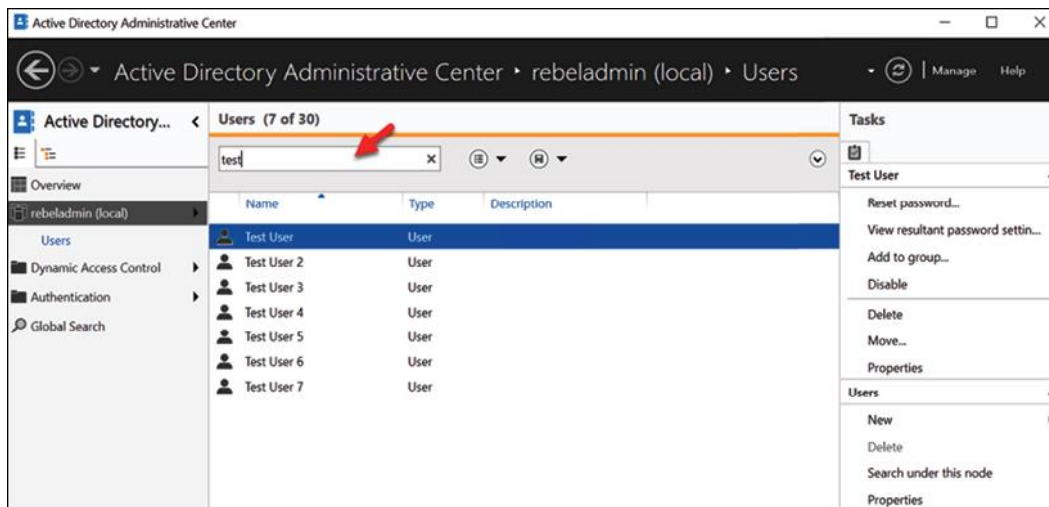


Figure 7.22: Searching for AD objects

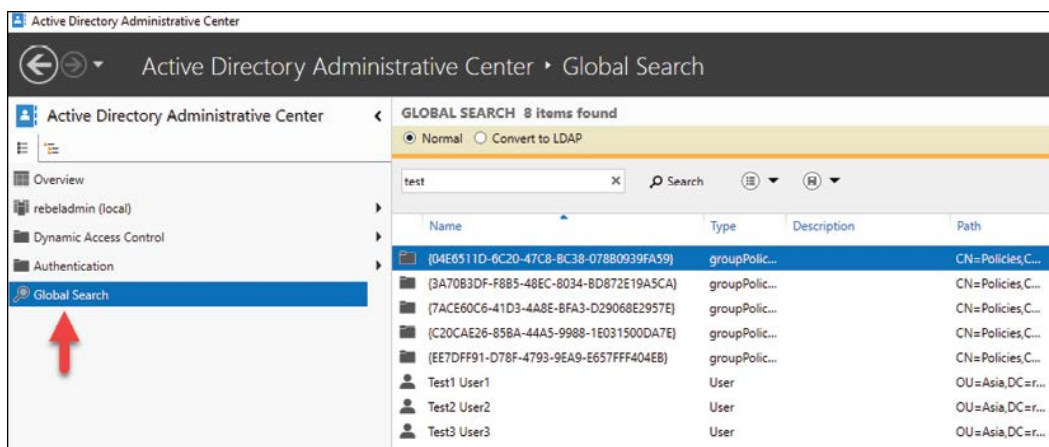


Figure 7.23: Global Search in ADAC



Figure 7.24: LDAP query-based search

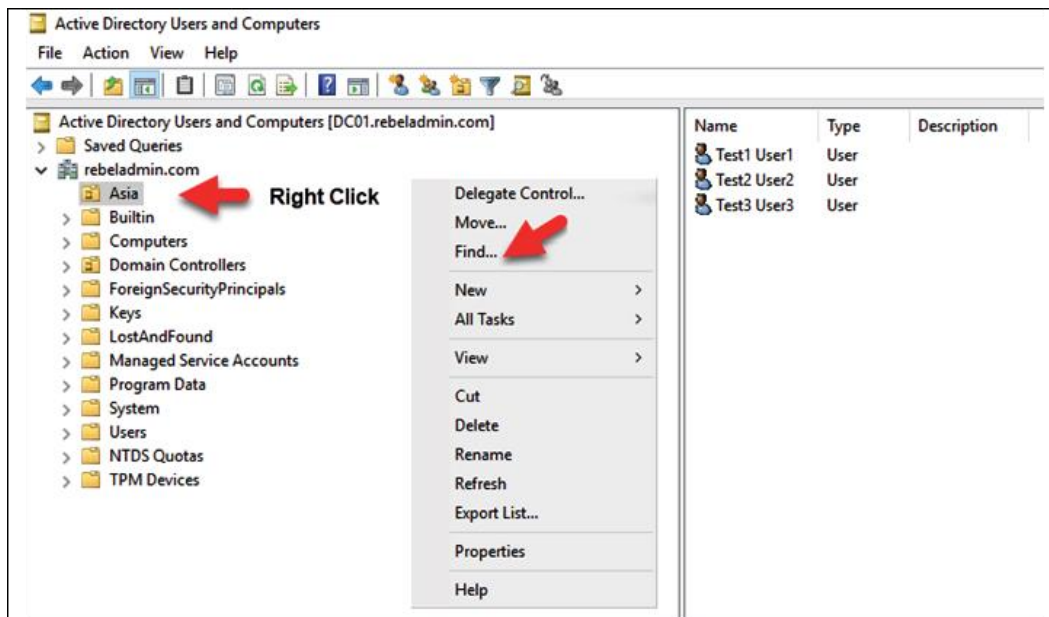


Figure 7.25: Finding objects using ADUC

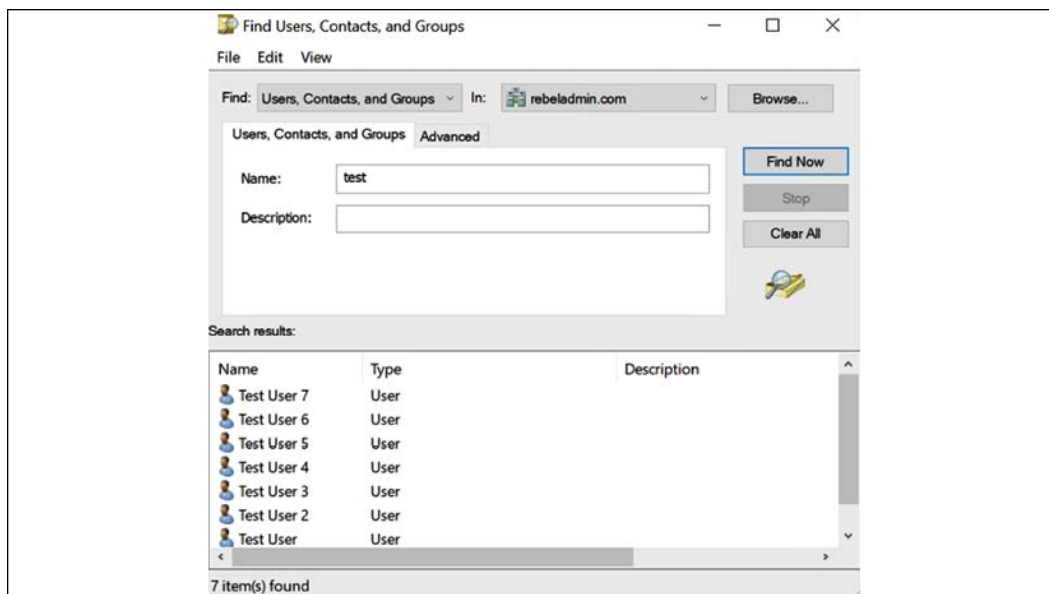


Figure 7.26: Search results

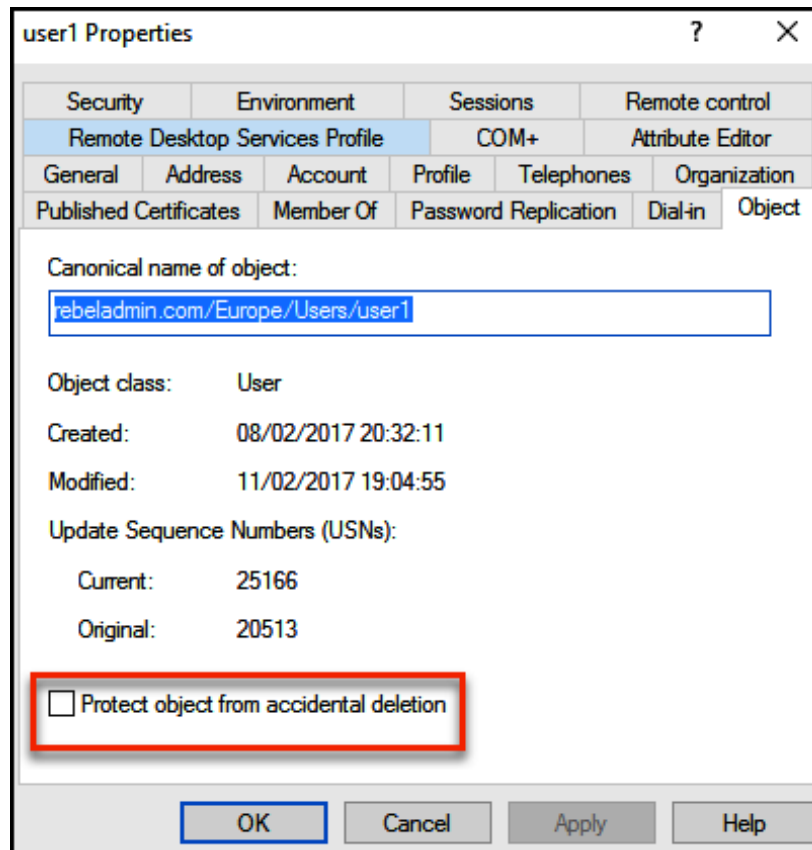


Figure 7.27: Protect object from accidental deletion



Figure 7.28: Protect object from accidental deletion – error message

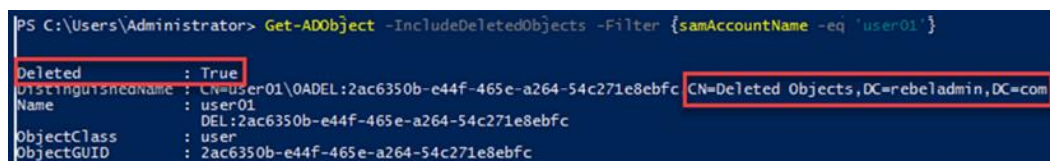


Figure 7.29: Deleted AD object

# Commands

## Command 7.1

In order to create a user object in AD, we can use the `New-ADUser` PowerShell cmdlet. You can view the full syntax of the command along with the accepted data types using the following command:

```
Get-Command New-ADUser -Syntax
```

## Command 7.2

Here is an example that can be used to create a user account:

```
New-ADUser -Name "Talib Idris" -GivenName "Talib" -Surname "Idris" -  
SamAccountName "tidris" -UserPrincipalName "tidris@rebeladmin.com" -  
Path "OU=Users,OU=Europe,DC=rebeladmin,DC=com" -AccountPassword(Read-  
Host -AsSecureString "Type Password for User") -Enabled $true
```

This command has the following parameters:

- `-Name`: This parameter defines the full name.
- `-GivenName`: This parameter defines the first name.
- `-Surname`: This parameter defines the surname.
- `-SamAccountName`: This parameter defines the username.
- `-UserPrincipalName`: This parameter defines the **User Principal Name (UPN)** for the user account.
- `-Path`: This defines the OU path. The default location is CN=Users,DC=rebeladmin,DC=com. If you do not define the -Path value, it will create the object under the default container.
- `-AccountPassword`: This will allow the user to input a password for the user, and the system will convert it into the relevant data type.
- `-Enabled`: This defines whether the user account status is enabled or disabled.

## Command 7.3

I have used data for some of the attributes via the CSV file, and some common values will be passed through the following script:

```
Import-Csv "C:\ADUsers.csv" | ForEach-Object {  
$upn = $_.SamAccountName + "@rebeladmin.com"
```

```
New-ADUser -Name $_.Name `
  -GivenName $_.GivenName `
  -Surname $_.Surname `
  -SamAccountName $_.samAccountName `
  -UserPrincipalName $upn `
  -Path $_.Path `
  -AccountPassword (ConvertTo-SecureString "Pa$$w0rd" -AsPlainText -
force) -Enabled $true
}
```

In this script, the `Import-Csv` cmdlet is used to import the CSV file that I created in the previous step. I also defined the UPN value, `-UserPrincipalName`, using `$upn = $_.SamAccountName + "@rebeladmin.com"`. At the end, I defined a common password for all of the accounts using `-AccountPassword (ConvertTo-SecureString "Toronto@1234" -AsPlainText -force)`.

#### Command 7.4

In order to create a computer object, we can use the `New-ADComputer` cmdlet. To view the complete syntax of the command, use this:

```
Get-Command New-ADComputer -Syntax
```

#### Command 7.5

The attribute you need to create a computer object is `-Name`:

```
New-ADComputer -Name "REBEL-PC-01" -SamAccountName "REBEL-PC-01" -Path
"OU=Computers,OU=Europe,DC=rebeladmin,DC=com"
```

In the preceding example, the command will create the REBEL-PC01 computer object in the OU=Computers,OU=Europe,DC=rebeladmin,DC=com OU. If you do not define the path, it will create the object under the default computer container, CN=Computers, DC=rebeladmin, DC=com.

#### Command 7.6

We can use the `Set-ADUser` cmdlet to change and add attribute values to existing AD user objects:

```
Set-ADUser tidris -OfficePhone "0912291120" -City "London"
```

In the preceding sample command, we're adding values for the `-OfficePhone` and `-City` attributes for the tidris user.

#### Command 7.7



There are occasions where you may need to change the existing value of an attribute:

```
Set-ADUser tidris -OfficePhone "0112291120"
```

In the preceding command, I'm replacing an existing value with a new one.

### Command 7.8

This will allow us to search for objects first and then push the changes:

```
Get-ADUser -Filter * -SearchBase  
'OU=Users,OU=Europe,DC=rebeladmin,DC=com' | Set-ADUser -City "London"
```

In the preceding command, we search for all of the user objects located in  
OU=Users,OU=Europe,DC=rebeladmin,DC=com and set the City value to London:

```
Get-ADUser -Filter {City -like "London"} | Set-ADUser -City "Kingston"
```

In the preceding example, I searched for all of the users in the directory who have the City value defined as London and changed it to Kingston.

### Command 7.9

Computer object values can also be added/changed using a similar method. In order to do so, we need to use the `Set-ADComputer` cmdlet:

```
Set-ADComputer REBEL-PC-01 -Description "Sales Computer"
```

The preceding command sets the Description object value of the computer named REBEL-PC-01.

### Command 7.10

This cmdlet can also be combined with a search query using the `Get-ADComputer` cmdlet:

```
Get-ADComputer -Filter {Name -like "REBEL-PC-*"} | Set-ADComputer -  
Location "M35 Building"
```

### Command 7.11

In order to remove AD user objects, we can use the `Remove-ADUser` cmdlet. We can find the complete syntax information using the following command:

```
Get-Command Remove-ADUser -Syntax
```

### Command 7.12

If it is an LDS environment, we need to define the object partition parameter too:

```
Remove-ADUser -Identity "dzhang"
```

The preceding command will remove the AD user object called `dzhang` from the directory. It will ask for confirmation before it removes the object.

### Command 7.13

This cmdlet can also be combined with the search query to find objects before removing them:

```
Get-ADUser -Filter {Name -like "Test1*"} | Remove-ADUser
```

In the preceding command, we search the entire directory for the user whose name starts with Test1 and then remove that user.

### Command 7.14

The `Remove-ADComputer` cmdlet can be used to remove computer objects from the directory:

```
Remove-ADComputer -Identity "REBEL-PC-01"
```

The preceding command will remove the REBEL-PC-01 computer object from the directory. We can also combine it with a search query:

```
Get-ADComputer -Filter * -SearchBase  
'OU=Computers,OU=Europe,DC=rebeladmin,DC=com' | Remove-ADComputer
```

In the preceding command, we search for the computer objects in the given OU and then remove the findings from the directory.

### Command 7.15

The `Get-ADUser` and `Get-ADComputer` cmdlets can also be used to retrieve specific attribute values from filtered objects:

```
Get-ADUser -Identity user1 -Properties *
```

The preceding command will list all of the attributes and values associated with user1. This helps us to find the exact attribute names and common values, which can be used for further filtering.

### Command 7.16

The following command will create a table with relevant attributes and their values:

```
Get-ADUser -Filter * -Properties Name,UserPrincipalName,Modified | ft  
Name,UserPrincipalName,Modified
```

### Command 7.17

I can see some accounts in the list that are service and administrator accounts. I only want to see the accounts in the Kingston office:

```
Get-ADUser -Filter {City -like "Kingston"} -Properties  
Name,UserPrincipalName,Modified | ft Name,UserPrincipalName,Modified
```

The preceding command filters users further based on the City value.

### Command 7.18

Now I have the list of data I need, and I'd like to export it to a CSV file for future use, like so:

```
Get-ADUser -Filter {City -like "Kingston"} -Properties  
Name,UserPrincipalName,Modified | select-object  
Name,UserPrincipalName,Modified | Export-csv -path C:\ADUserList.csv
```

This example demonstrates how a search query can be built up to gather the required information.

The `Search-ADAccount` cmdlet can also be used to search for AD objects based on the account and password status. The full syntax of the cmdlet can be retrieved using the following command:

```
Get-Command Search-ADAccount -Syntax
```

### Command 7.19

As an example, it can be used to filter accounts that are locked out:

```
Search-ADAccount -LockedOut | FT Name,UserPrincipalName
```

This command will list all of the locked-out accounts with a name and UPN.

### Command 7.20

When this option is enabled, it will not allow you to delete an object unless you disable the option. In PowerShell, this can be done using the `-ProtectedFromAccidentalDeletion $true` parameter. As an example, let's look at how we can enable this feature for a specific user account:

```
Set-ADObject -Identity 'CN=Dishan Francis,DC=rebeladmin,DC=com' -  
ProtectedFromAccidentalDeletion $true
```

In the preceding command, I am enabling the **Protect object from accidental deletion** feature for user account Dishan Francis.

### Command 7.21

The AD Recycle Bin feature requires a minimum of a Windows Server 2008 R2 domain and a forest functional level. Once this feature is enabled, it cannot be disabled. This feature can be enabled using the following command:

```
Enable-ADOptionalFeature 'Recycle Bin Feature' -Scope  
ForestOrConfigurationSet -Target rebeladmin.com
```

In the preceding command, `-Target` can be replaced with your domain name.

### Command 7.22

Once Recycle Bin Feature is enabled, we can restore objects, which are deleted using the following command:

```
Get-ADObject -filter 'isdeleted -eq $true' -includeDeletedObjects
```

The preceding command searches for objects where the `isdeleted` attribute is set to true.

### Command 7.23

Once we have found a deleted object, it can be restored using the following command:

```
Get-ADObject -Filter 'samaccountname -eq "dfrancis"' -  
IncludeDeletedObjects | Restore-ADObject
```

The preceding command restores the user object `dfrancis`.

# Chapter 8

## Figures

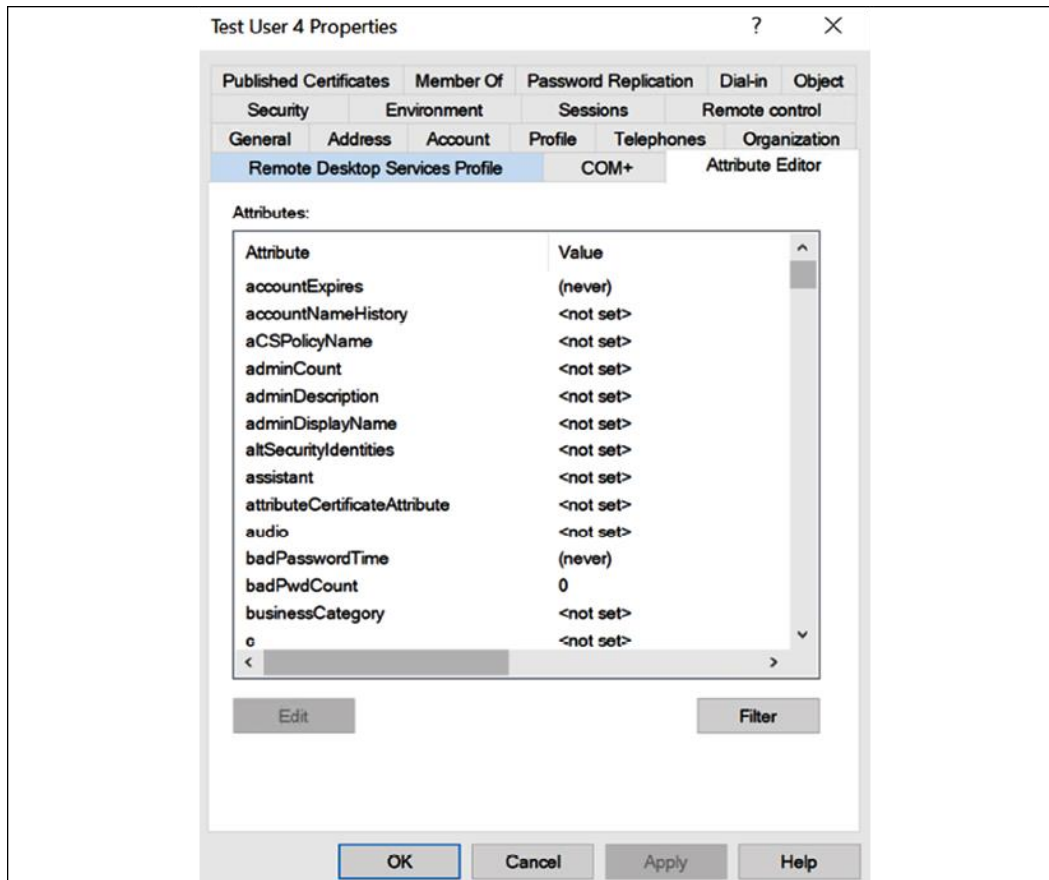


Figure 8.1: Attribute Editor

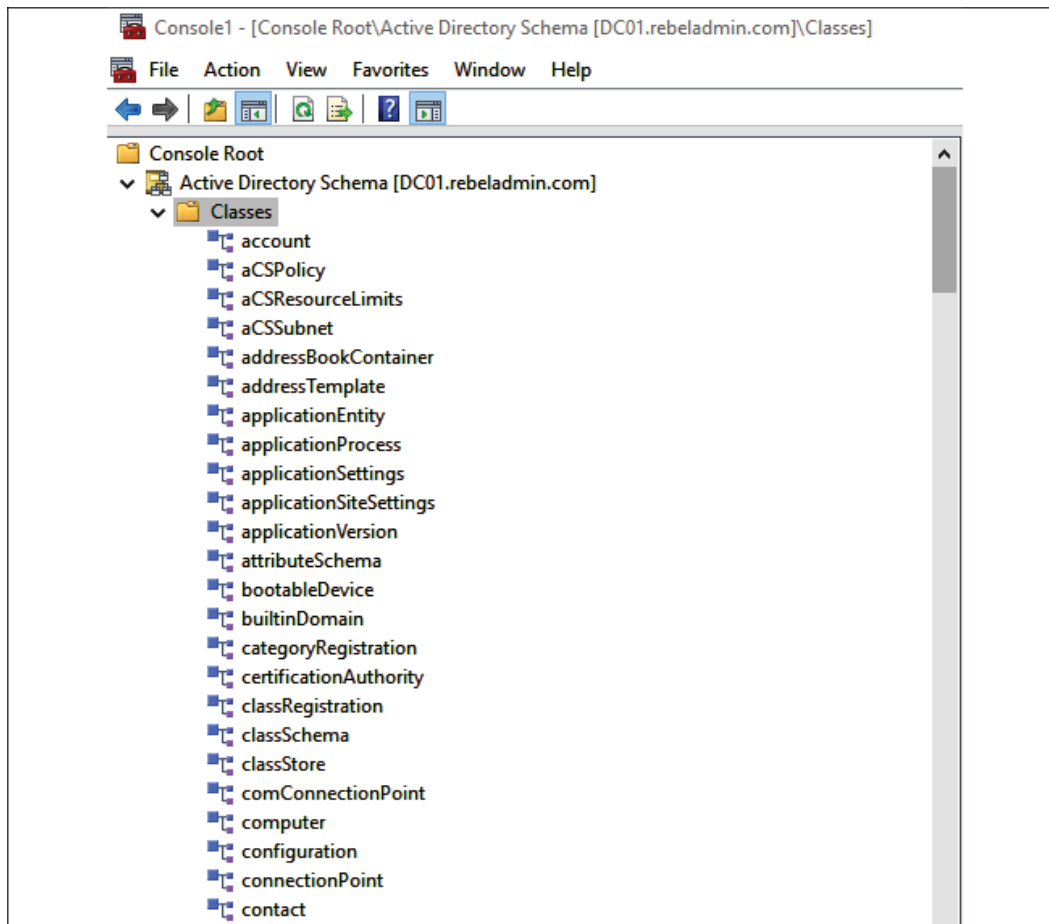


Figure 8.2: AD schema snap-in

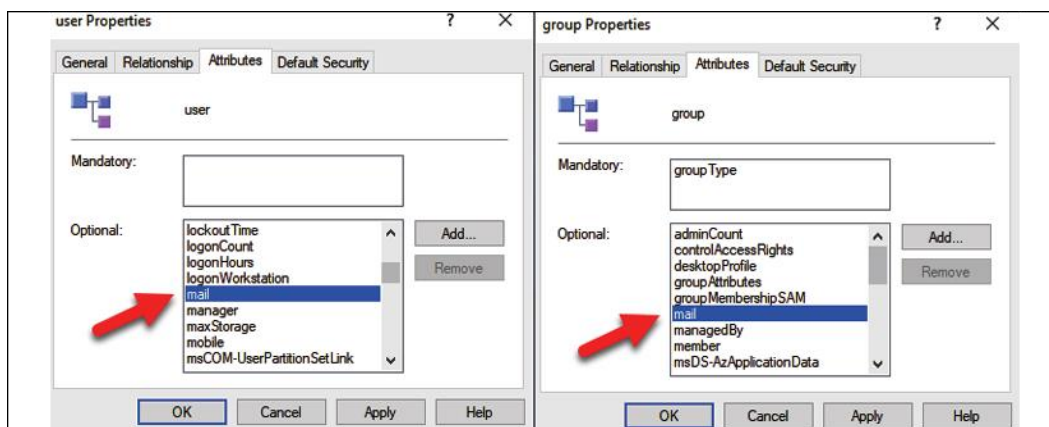


Figure 8.3: Attributes for user and group classes

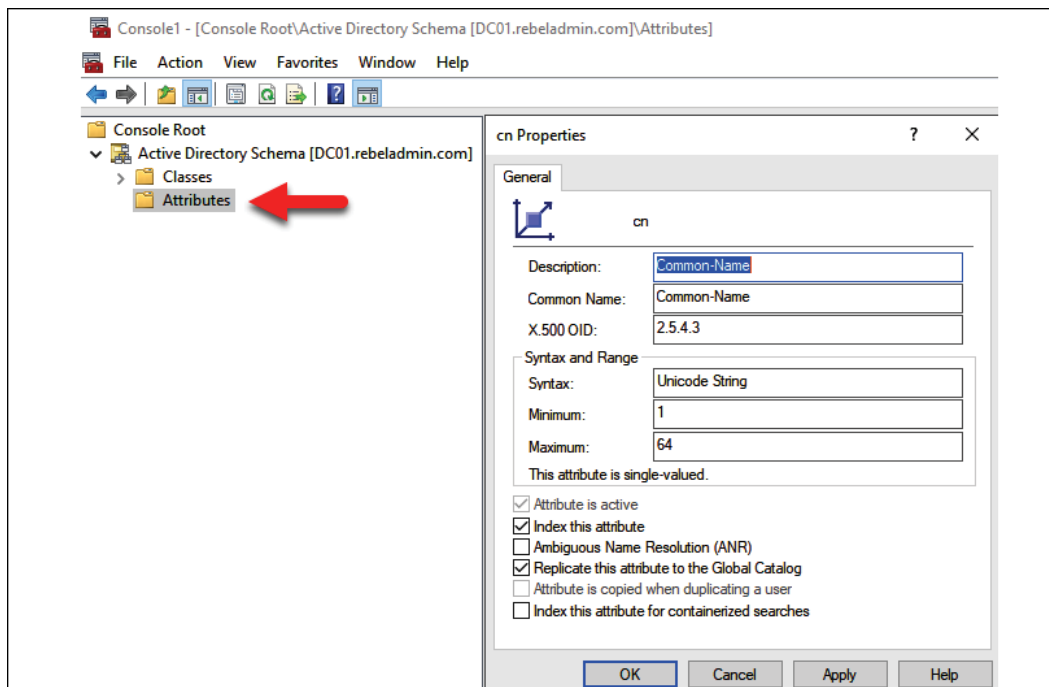


Figure 8.4: Attributes details

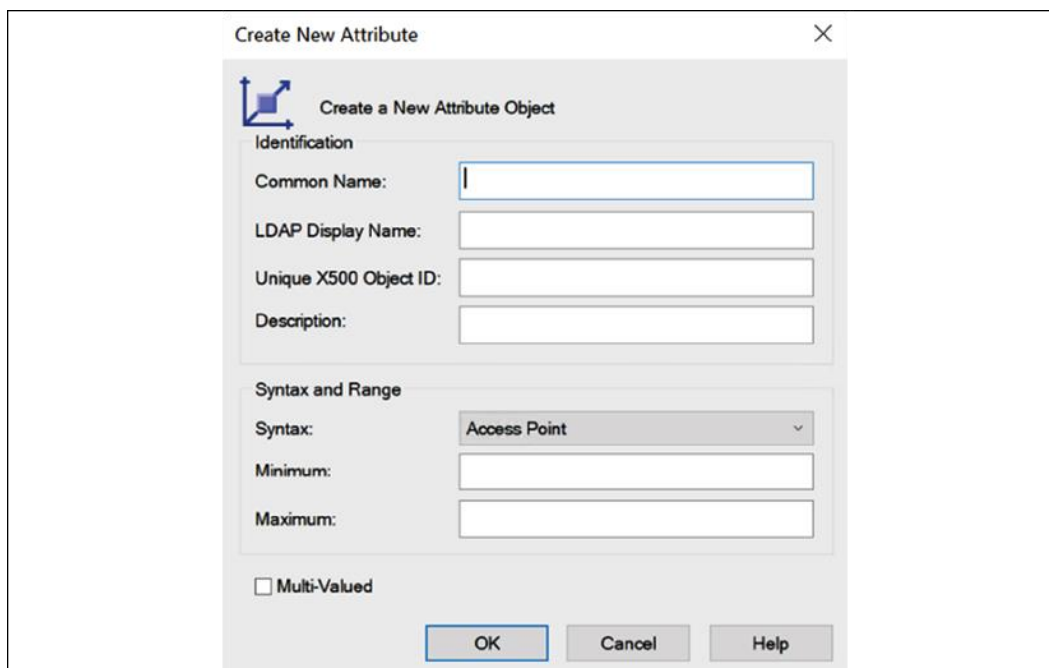


Figure 8.5: Create New Attribute

Create New Attribute

Create a New Attribute Object

Identification

Common Name: NI-Number

LDAP Display Name: nINumber

Unique X500 Object ID: 4.22631.19905.36989.10893360.16372910

Description: National Insurance Number

Syntax and Range

Syntax: Unicode String

Minimum:

Maximum:

☐ Multi-Valued

OK Cancel Help

Figure 8.6: Custom attribute properties

user Properties

General Relationship Attributes Default Security

user

Mandatory:

Optional:

accountExpires  
aCSPolicyName  
adminCount  
audio  
badPasswordTime  
badPwdCount  
businessCategory  
carLicense  
codePage

Add... Remove

Select Schema Object

Select a schema object:

netbootSCPBL  
netbootServer  
netbootSIFFFile  
netbootTools  
networkAddress  
nextLevelStore  
nextRid  
nINumber  
nisMapEntry  
nisMapName  
nisNetgroupTriple  
nonSecurityMember  
nonSecurityMemberBL  
notes  
notificationList  
nTGroupMembers  
nTMixedDomain  
ntPwdHistory  
ntSecurityDescriptor  
o  
objectCategory

OK Cancel

OK Cancel Apply Help

Figure 8.7: Custom attribute under Classes



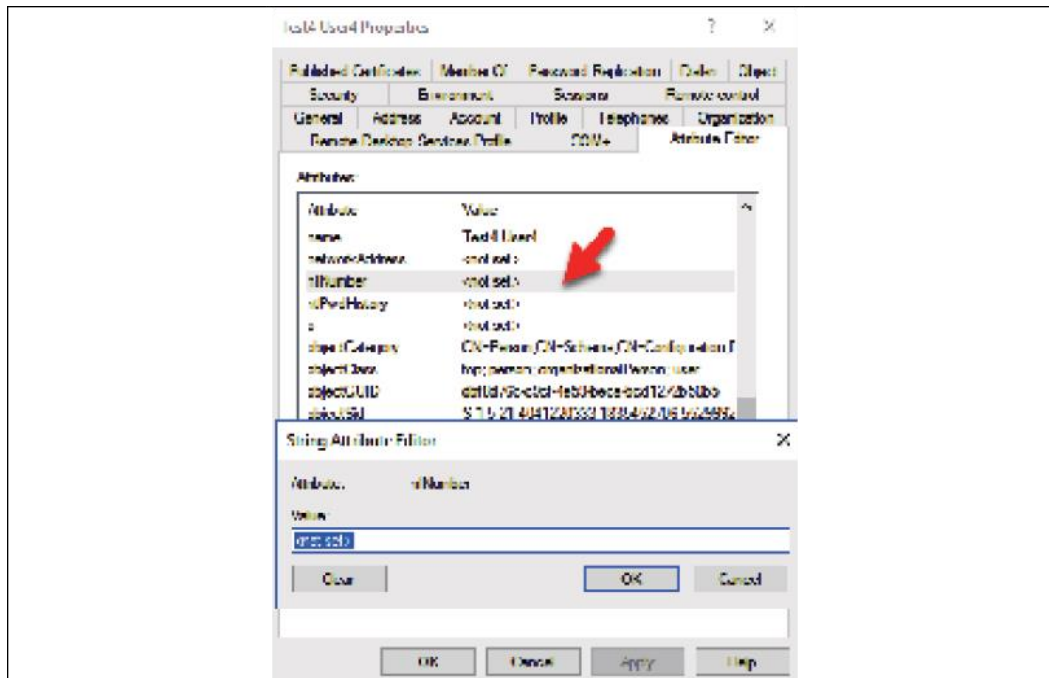


Figure 8.8: Custom attribute for user

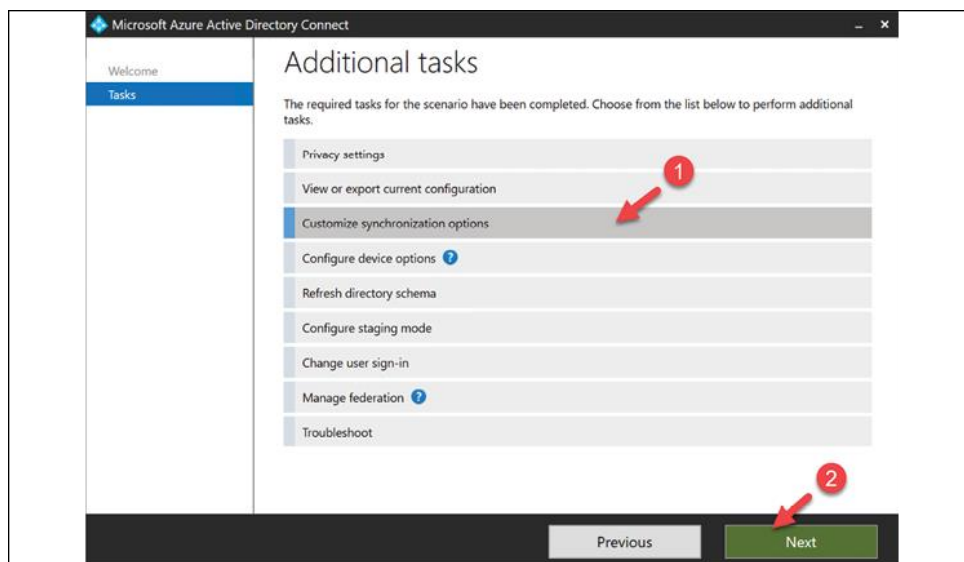


Figure 8.9: Azure AD Connect – modify synchronization options

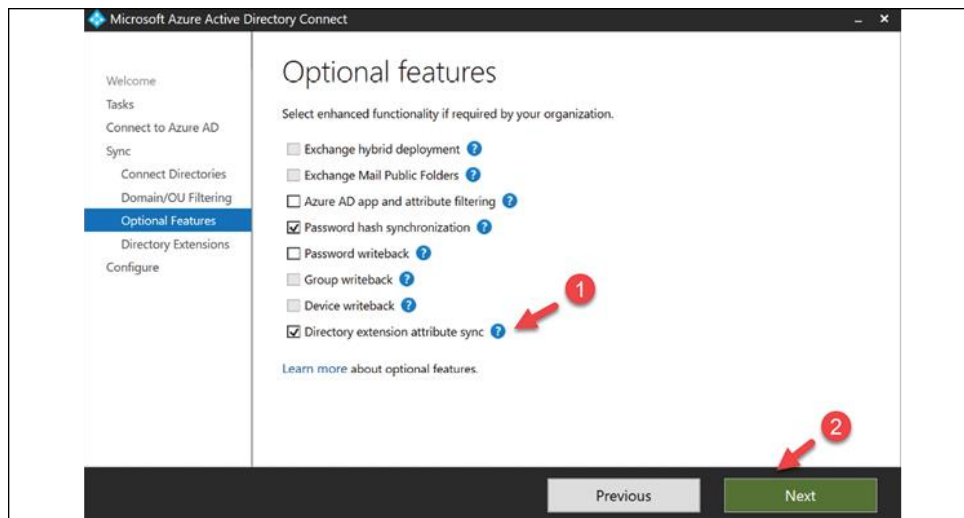


Figure 8.10: Azure AD Connect – Directory extension attribute sync

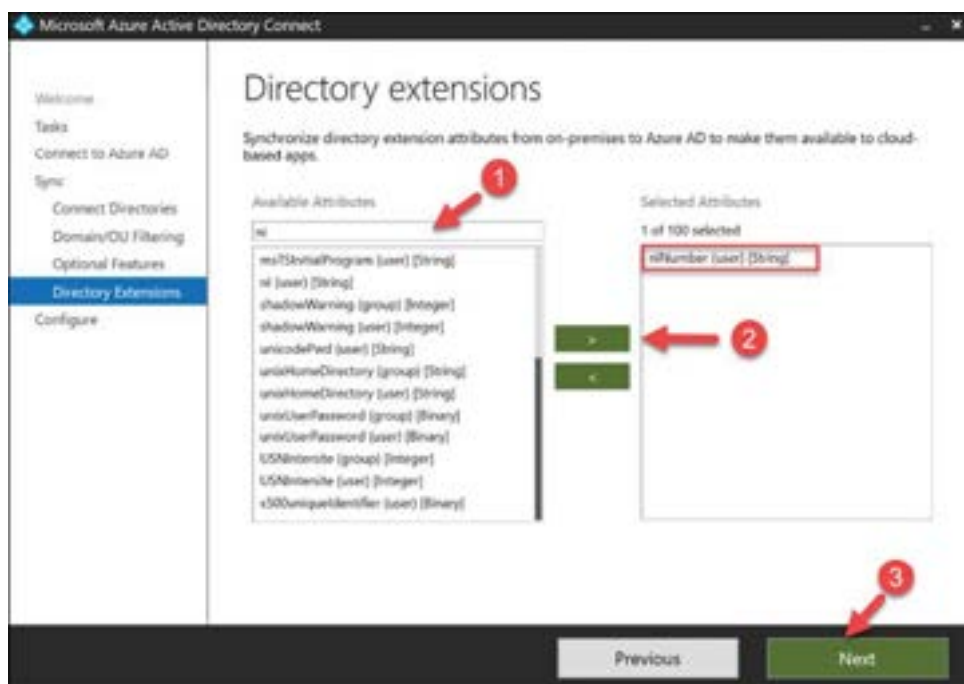


Figure 8.11: Azure AD Connect – select custom attribute

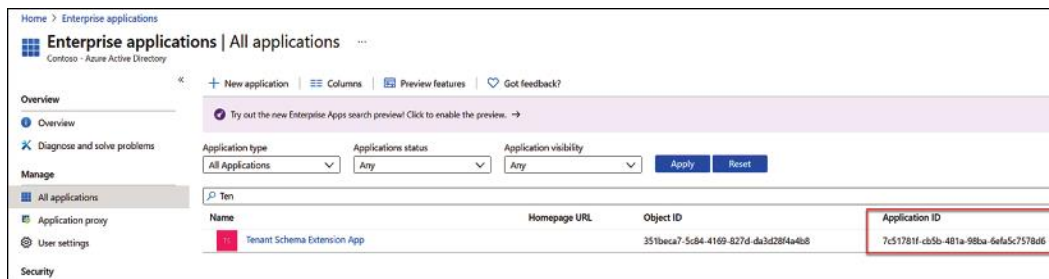


Figure 8.12: Application ID



Figure 8.13: Custom attribute value in Azure AD



Figure 8.14: Custom attribute value in Active Directory

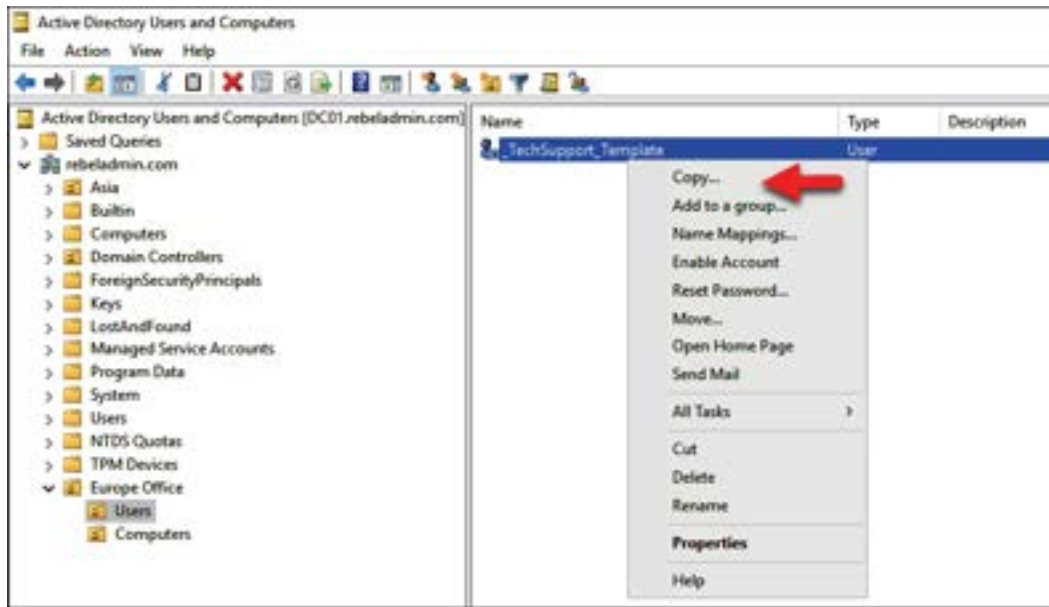


Figure 8.15: Copying a user account

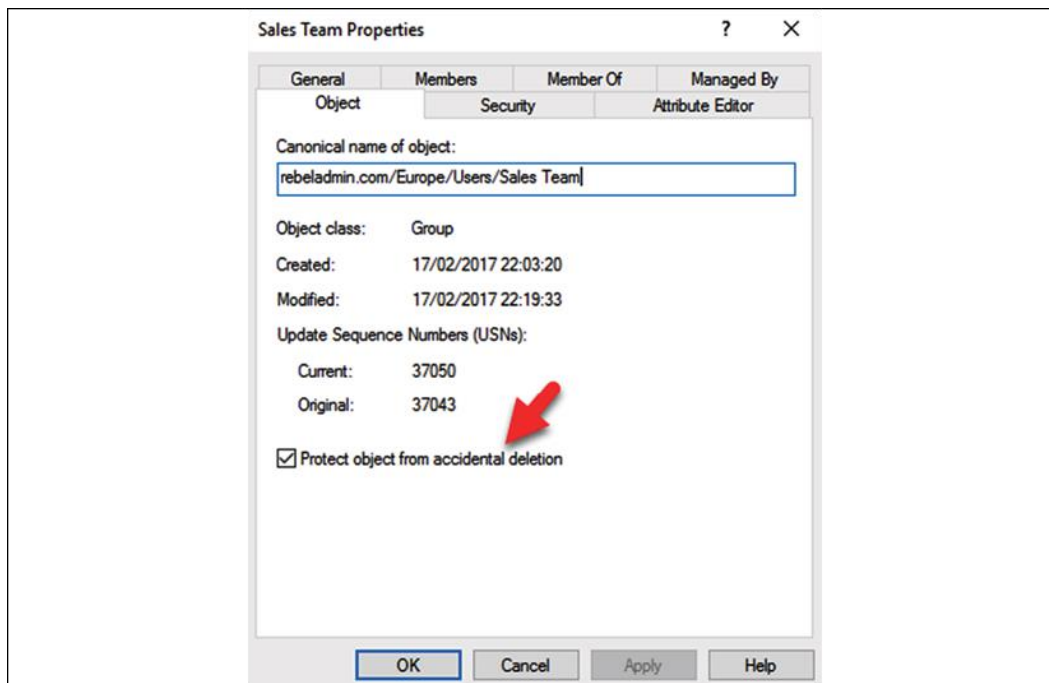


Figure 8.16: Protect object from accidental deletion

```

PS C:\Users\dfrancis> Get-ADGroup "Sales Team" -Properties DistinguishedName,Members | fl DistinguishedName,Members
DistinguishedName : CN=Sales Team,OU=Asia,DC=rebeladmin,DC=com
Members           : {CN=Test User 4,OU=Asia,DC=rebeladmin,DC=com, CN=Test User 3,OU=Asia,DC=rebeladmin,DC=com, CN=Test
                    User 2,OU=Asia,DC=rebeladmin,DC=com, CN=Test User,OU=Asia,DC=rebeladmin,DC=com}

PS C:\Users\dfrancis>

```

Figure 8.17: DN and Members values

Administrator: Windows PowerShell

```

Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\dfrancis> Set-ADGroup "Sales Team" -GroupScope Universal
PS C:\Users\dfrancis> Get-ADGroup "Sales Team"

DistinguishedName : CN=Sales Team,DC=rebeladmin,DC=com
GroupCategory     : Security
GroupScope        : Universal
Name              : Sales Team
ObjectClass       : group
ObjectGUID        : 4e0c7040-c4aa-48b5-808b-2e10c372f1fe
SamAccountName    : Sales Team
SID               : S-1-5-21-2210686053-2049469170-776893977-1601

```

A red arrow points to the 'GroupScope : Universal' property in the output.

Figure 8.18: Group scope

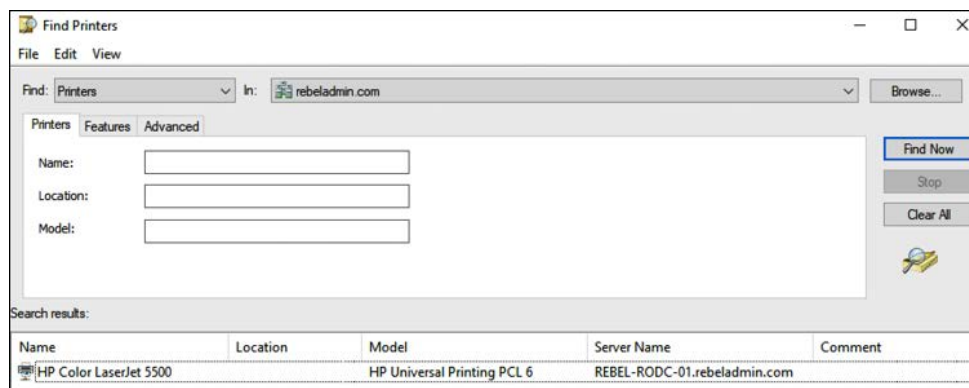


Figure 8.19: Printer object

## Links

- More information about AD schema changes for Microsoft Exchange Server can be found at <https://bit.ly/3nJ0nRL>.
- The complete list of attributes that will sync with Azure AD Connect is available at <https://bit.ly/32lpFNn>.

## Tables

In the following table, I have listed a few commonly used syntaxes:

| Syntax             | Description                                       |
|--------------------|---|
| Boolean            | True or false                                     |
| Unicode String     | A large string                                    |
| Numeric String     | String of digits                                  |
| Integer            | 32-bit numeric value                              |
| Large Integer      | 64-bit numeric value                              |
| SID                | Security identifier value                         |
| Distinguished Name | String value to uniquely identify an object in AD |

**Table 8.1**

The following table explains supported paths:

| Group scope  | Domain Local | Global   | Universal   |
|--------------|--------------|--|---|
| Domain Local | N/A          | X  | Yes (only if there are no other Domain Local groups as members) |
| Global       | X            | N/A  | Yes (only if it's not a member of other Global groups)          |
| Universal    | Yes          | Yes (only if there are no other Universal groups as members) | N/A   |

**Table 8.2**

## Commands

### Command 8.1

There is a script developed by Microsoft to generate these unique OID values:

```
#---
$Prefix="1.2.840.113556.1.8000.2554"
$GUID=[System.Guid]::NewGuid().ToString()
$Parts=@()
$Parts+= [UInt64]::Parse($guid.SubString(0,4),
```

```

"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(4,4),
"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(9,4),
"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(14,4),
"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(19,4),
"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(24,6),
"AllowHexSpecifier")
$Parts+=[UInt64]::Parse($guid.SubString(30,6),
"AllowHexSpecifier")
$OID=[String]::Format("{0}.{1}.{2}.{3}.{4}.{5}.{6}.{7}",
$prefix,$Parts[0],$Parts[1],$Parts[2],$Parts[3],$Parts[4],
$Parts[5],$Parts[6])
$oid
#---

```

## Command 8.2

Once the data has been added, we can filter out the information as required:

```
Get-ADuser "tuser4" -Properties nINumber | ft nINumber
```

## Command 8.3

To demonstrate, I am going to create a user template for Technical Department users. The command I will use is as follows:

```

New-ADUser -Name "_TechSupport_Template" -GivenName "_TechSupport" -
Surname "_Template" -SamAccountName "techtemplate" -UserPrincipalName
"techtemplate@rebeladmin.com" -Path "OU=Users,OU=Europe
Office,DC=rebeladmin,DC=com" -AccountPassword(Read-Host -
AsSecureString "Type Password for User") -Enabled $false

```

The preceding command creates a user account called `_TechSupport_Template`. It also sets the new user account as a disabled account.

## Command 8.4

I'm also going to add the account to the Technical Department security group:

```
Add-ADGroupMember "Technical Department" "techtemplate"
```

### Command 8.5

In order to create an MSA, we can use the following command. I am running this from the domain controller:

```
New-ADServiceAccount -Name "MyAcc1" -RestrictToSingleComputer
```

In the preceding command, I have created a service account called `MyAcc1` and I have restricted it to one computer.

### Command 8.6

The next step is to associate the service account with the host REBEL-SRV01 server:

```
Add-ADComputerServiceAccount -Identity REBEL-SRV01 -ServiceAccount "MyAcc1"
```

### Command 8.7

We can install it using **Remote Server Administration Tools (RSAT)**. This can be done by running the `Install-WindowsFeature RSAT-AD-Tools` command. Once it's ready, run the following command:

```
Install-ADServiceAccount -Identity "MyAcc1"
```

We can test the service account using the following command:

```
Test-ADServiceAccount "MyAcc1"
```

It returns True, which means the test was successful.

### Command 8.8

From the Active Directory server, we can verify the service account by running the following command:

```
Get-ADServiceAccount "MyAcc1"
```

### Command 8.9

In order to start the configuration process, we need to create a KDS root key. This needs to be run from the domain controller with Domain Admin or Enterprise Admin privileges:

```
Add-KdsRootKey -EffectiveImmediately
```



#### Command 8.10

We can remove the 10-hour replication time limit by using the following command:

```
Add-KdsRootKey -EffectiveTime ((get-date).addhours(-10))
```

#### Command 8.11

I have created an Active Directory group, IISFARM, and have added all my IIS servers to it. This farm will be using the new gMSA:

```
New-ADServiceAccount "Mygmsa1" -DNSHostName "web.rebeladmin.com" -  
PrincipalsAllowedToRetrieveManagedPassword "IISFARM"
```

In the preceding command, **Mygmsa1** is the service account and **web.rebeladmin.com** is the **fully qualified domain name (FQDN)** of the service.

#### Command 8.12

Once it's processed, we can verify the new account using the following command:

```
Get-ADServiceAccount "Mygmsa1"
```

#### Command 8.13

The next step is to install **Mygmsa1** on the server in the IIS farm. **Mygmsa1** needs the AD PowerShell module to run. **Mygmsa1** can be installed using RSAT:

```
Install-ADServiceAccount -Identity "Mygmsa1"
```

#### Command 8.14

Once that's executed, we can test the service account by running the following command:

```
Test-ADServiceAccount " Mygmsa1"
```

#### Command 8.15

You'll sometimes need to remove MSAs. This can be done by executing the following command:

```
Remove-ADServiceAccount -identity "Mygmsa1"
```

The preceding command will remove Mygmsa1. This applies to both types of MSAs.

#### Command 8.16

The `New-ADGroup` cmdlet can be used to add a new group to an AD environment. We can review the full syntax for the command using this:

```
Get-Command New-ADGroup -Syntax
```

#### Command 8.17

As an example, I am going to create a new security group called Sales Team:

```
New-ADGroup -Name "Sales Team" -GroupCategory Security -GroupScope  
Global -Path "OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

In the preceding command, the following is true:

- `-GroupCategory`: This defines the type of the group (security or distribution).
- `-GroupScope`: This defines the scope of the group.
- `-Path`: This defines the path for the group object. If the `-Path` option is not used, the default container will be used, Users.

#### Command 8.18

Due to the importance of the group, I want to protect this group object from accidental deletion:

```
Get-ADGroup "Sales Team" | Set-ADObject -  
ProtectedFromAccidentalDeletion:$true
```

#### Command 8.19

Now the group is ready for new members. To add new members, we can use the following:

```
Add-ADGroupMember "Sales Team" tuser3,tuser4,tuser5
```

The previous command will add the tuser3, tuser4, and tuser5 users to the group.

#### Command 8.20

If we need to remove a user from the group, we can use the following command:

```
Remove-ADGroupMember "Sales Team" tuser4
```

#### Command 8.21

We can review the group properties using the `Get-ADGroup` cmdlet:

```
Get-ADGroup "Sales Team"
```

### Command 8.22

By using the following command, we can retrieve specific values from the group:

```
Get-ADGroup "Sales Team" -Properties DistinguishedName,Members | fl  
DistinguishedName,Members
```

The preceding command will list the `DistinguishedName` and `Members` values of the Sales Team security group.

### Command 8.23

If we need to change the scope of the group, that can be done using the following command:

```
Set-ADGroup "Sales Team" -GroupScope Universal
```

### Command 8.24

A group can be removed using the `Remove-ADGroup` cmdlet:

```
Remove-ADGroup "Sales Team"
```

The preceding command will remove the Sales Team group.

### Command 8.25

To remove the accidental deletion option, we can use the `Get-ADGroup "Sales Team" | Set-ADObject -ProtectedFromAccidentalDeletion:$false` command.

### Command 8.26

In order to add this object, we can use ADAC, ADUC, or PowerShell. In PowerShell, you would use the same `New-ADUser` cmdlet:

```
New-ADUser -Name "Inet User1" -GivenName "Inet"  
-Surname "User1" -SamAccountName "inetuser1"  
-UserPrincipalName "isuer1@rebeladmin.com"  
-AccountPassword (Read-Host -AsSecureString  
"Type Password for User")  
-Enabled $true -Path "OU=Users,OU=Europe,DC=rebeladmin,DC=com"  
-Type iNetOrgPerson
```

The preceding command will add an `iNetOrgPerson` object called `Inet User1`. The only difference in the command from that of a regular Active Directory user is `-Type iNetOrgPerson`, which defines the account type as `iNetOrgPerson`.

## Command 8.27

We can convert the inetOrgPerson object to a regular Active Directory user object using the following command:

```
Set-ADUser "inetuser1" -Remove @{objectClass='inetOrgPerson'}
```

## URLs

### URL 8.1

In my demo environment, I am using the following to verify the `nINumber` attribute value:

```
https://graph.microsoft.com/v1.0/users/testuser2@M365x581675.onmicrosoft.com?$select=displayName,givenName,extension_7c51781fcb5b481a98ba6efa5c7578d6_nINumber
```

In the above, `testuser2@M365x581675.onmicrosoft.com` is the user account.

`displayName` and `givenName` are the attributes synced from the on-prem Active Directory via the default Azure AD Connect configuration.

As you can see, I have used extension `_7c51781fcb5b481a98ba6efa5c7578d6_nINumber` to define the `nINumber` attribute. In this string, `7c51781fcb5b481a98ba6efa5c7578d6` is the application ID value for the application called "Tenant Schema Extension App."

# Chapter 9

## Figures

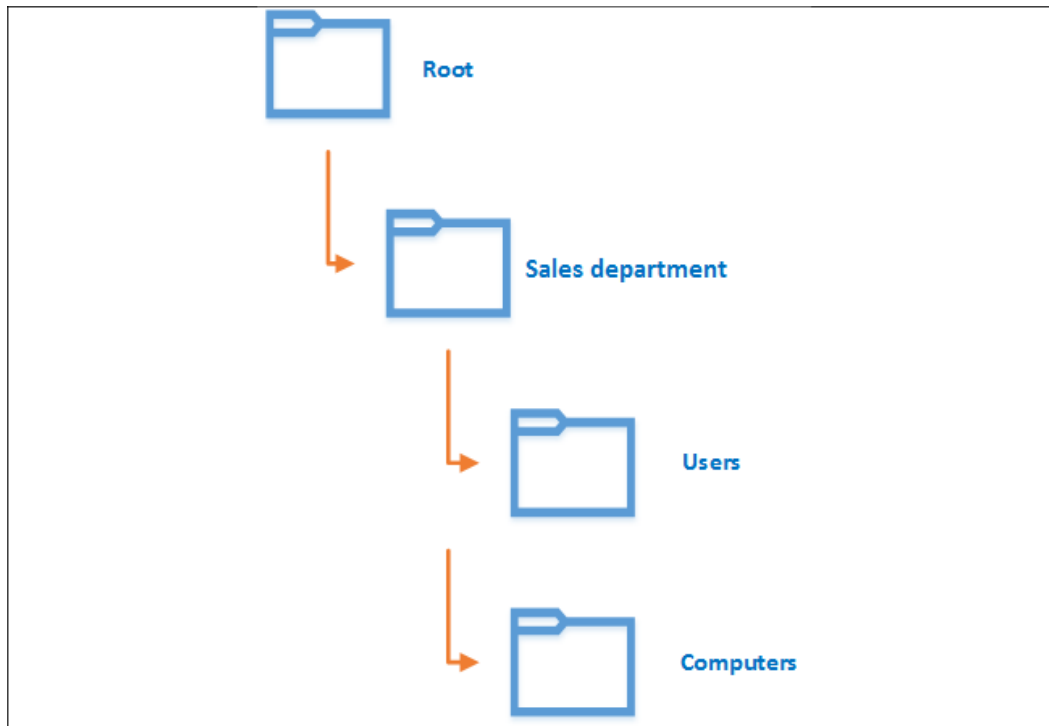


Figure 9.1: Hierarchical structure sample

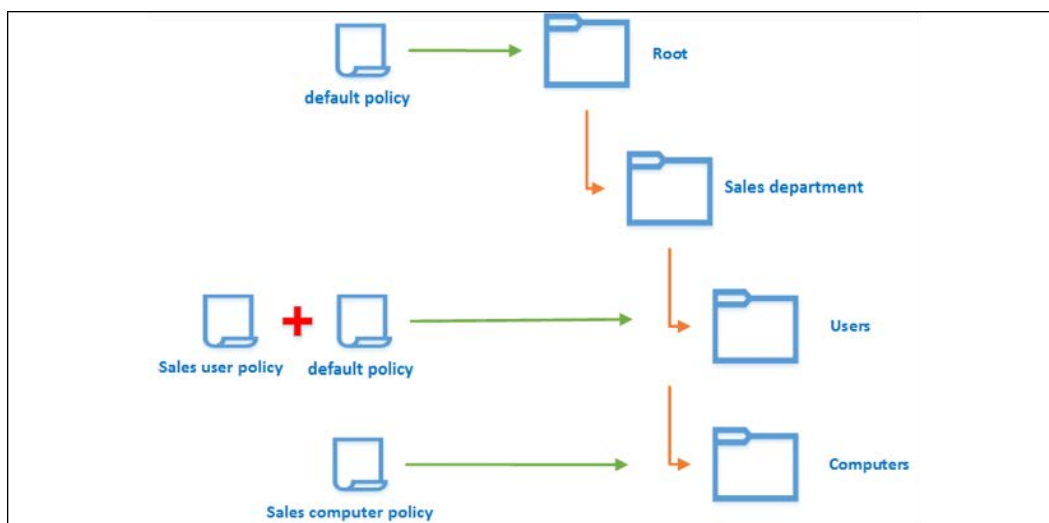


Figure 9.2: OUs with group policies

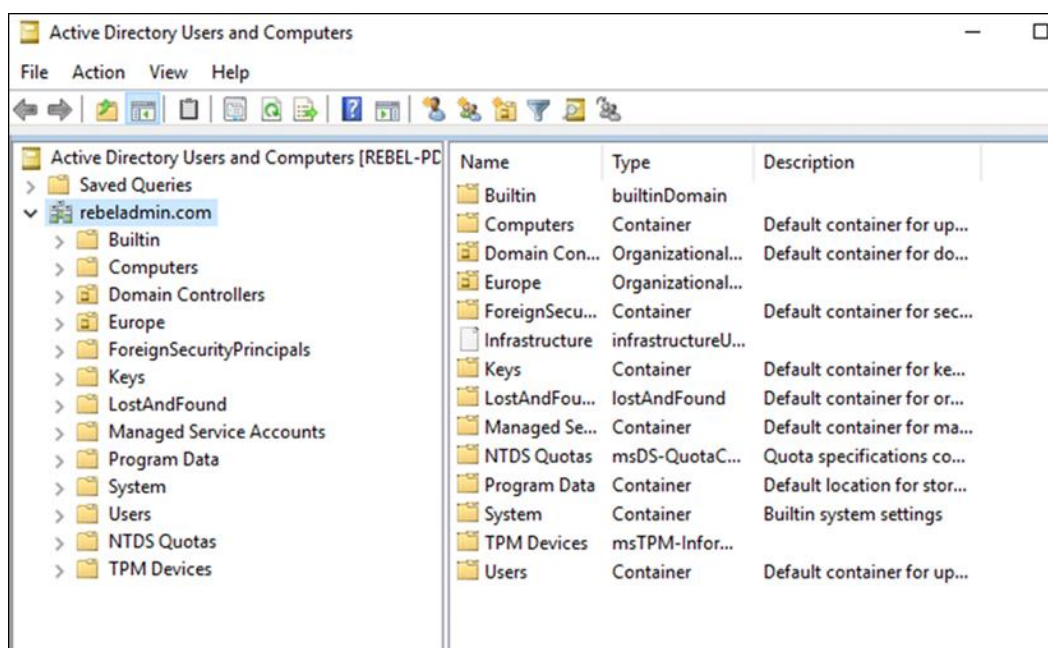


Figure 9.3: Containers and OUs

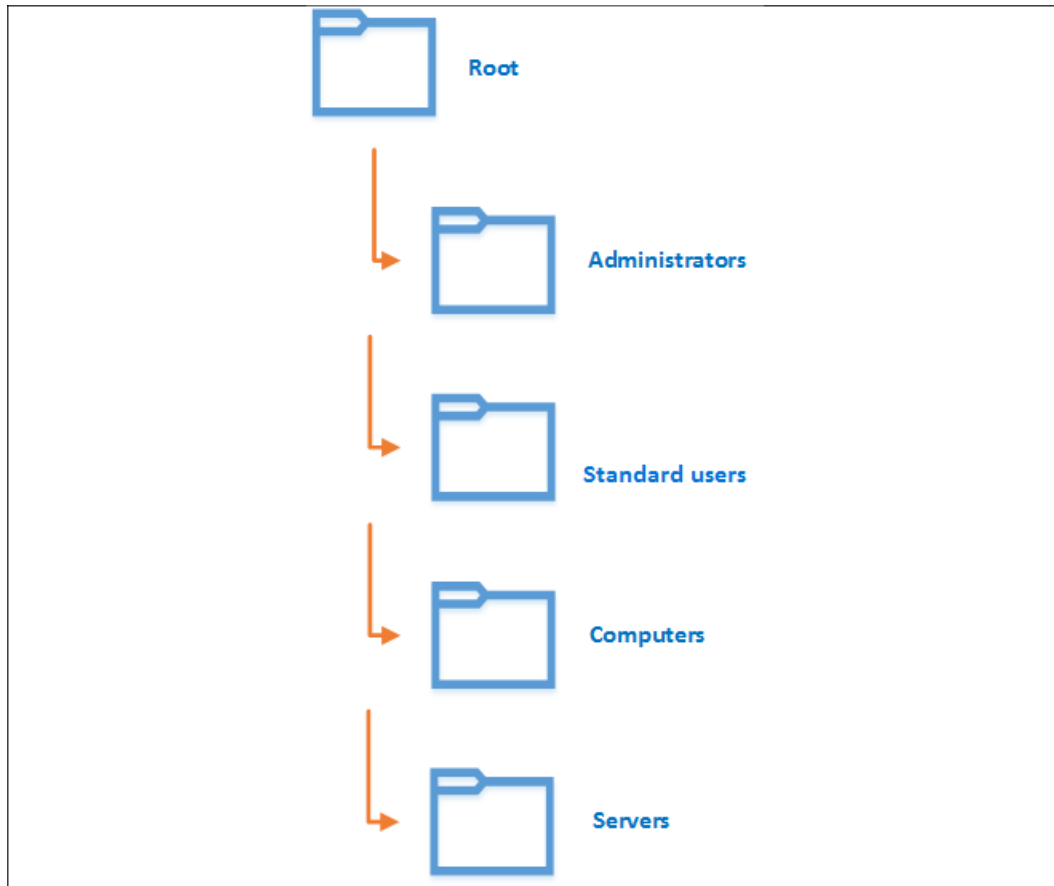
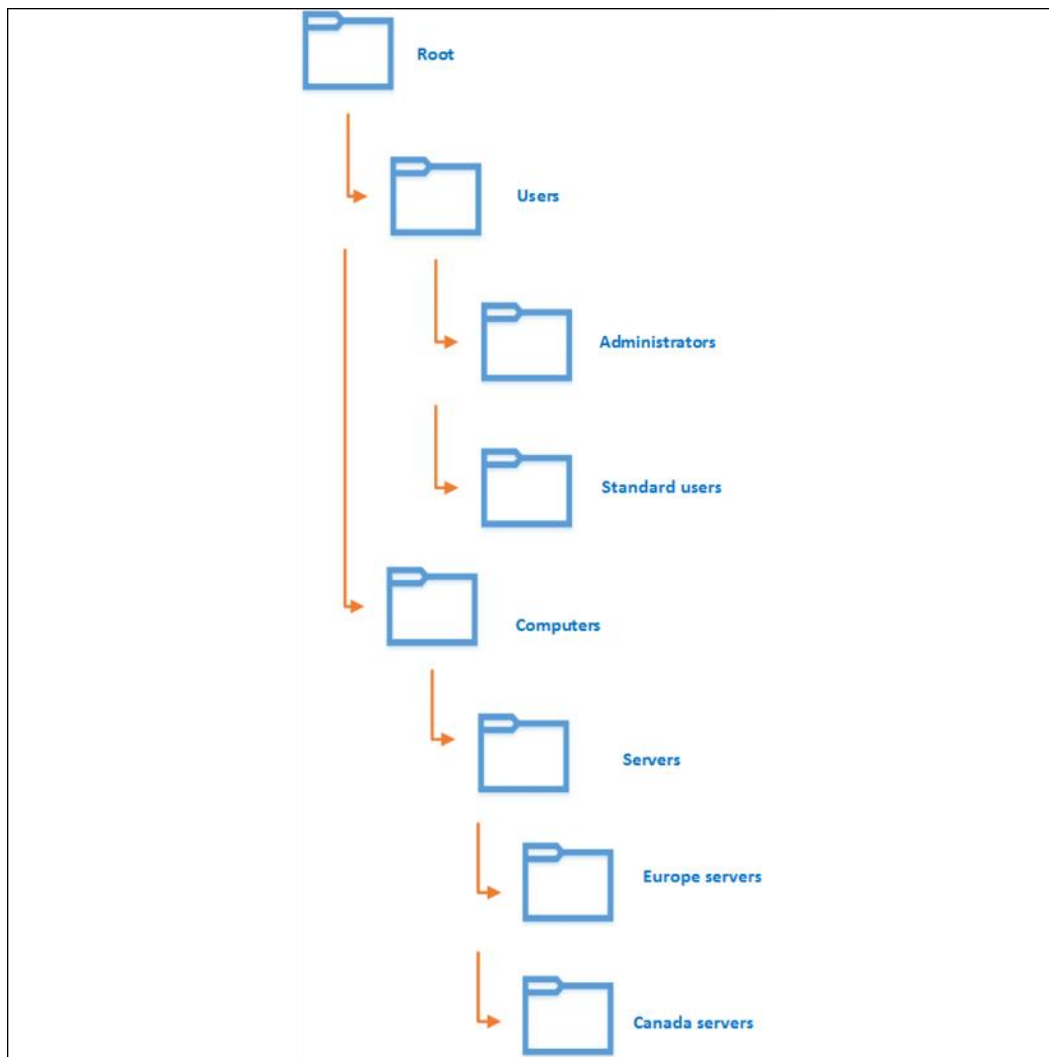
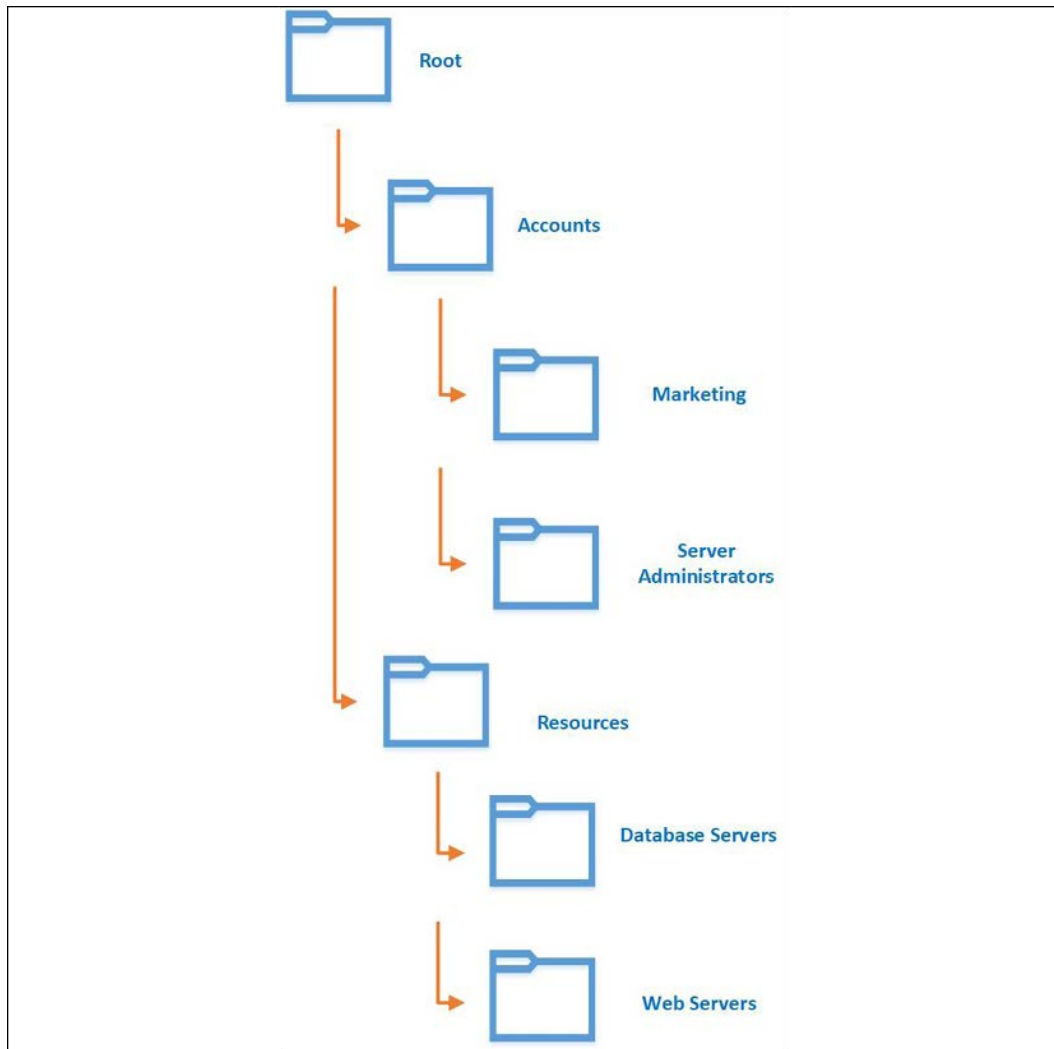


Figure 9.4: The container model

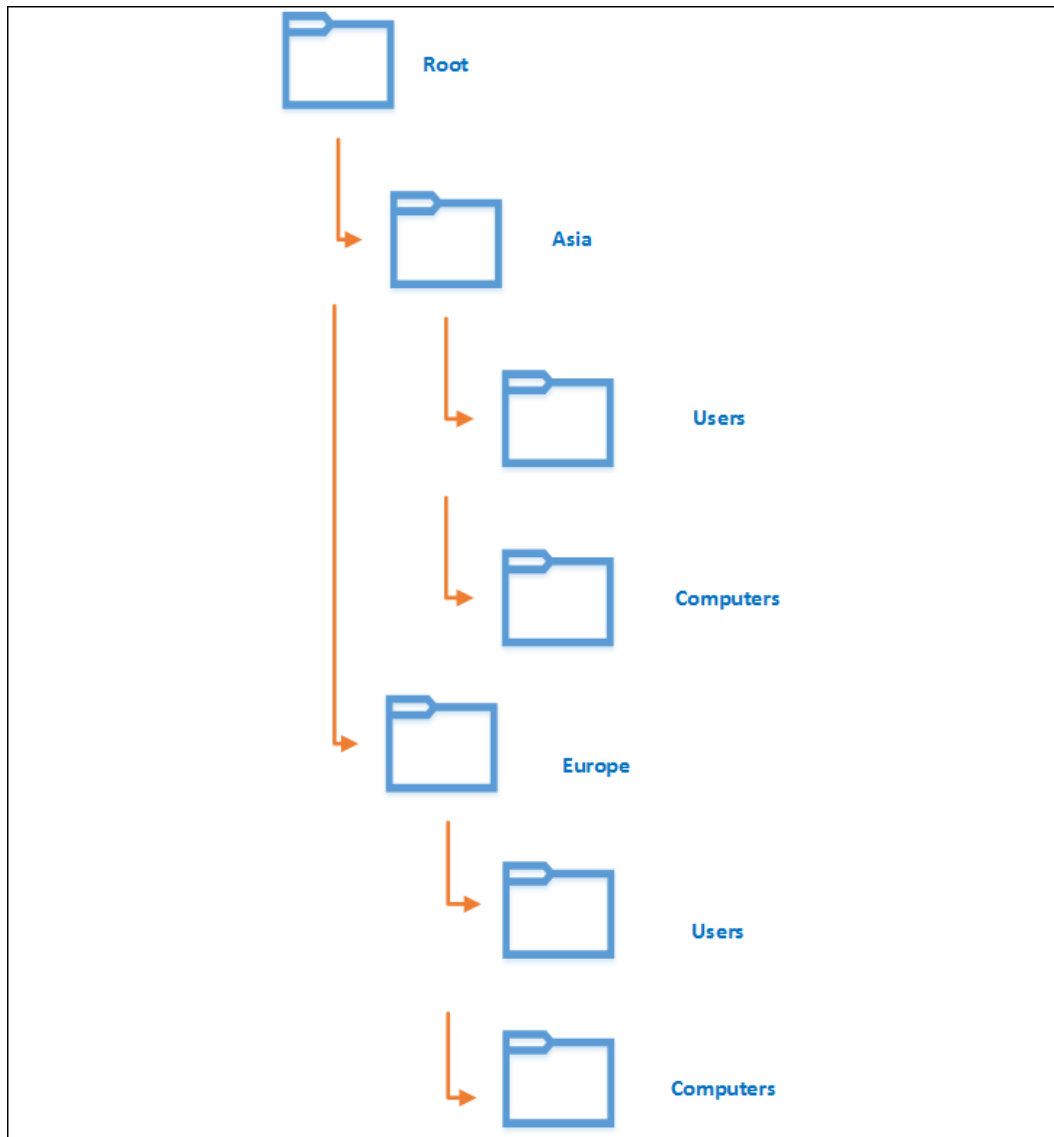


**Figure 9.5: The object type model**





**Figure 9.6: The functions model**



**Figure 9.7: The geographical model**

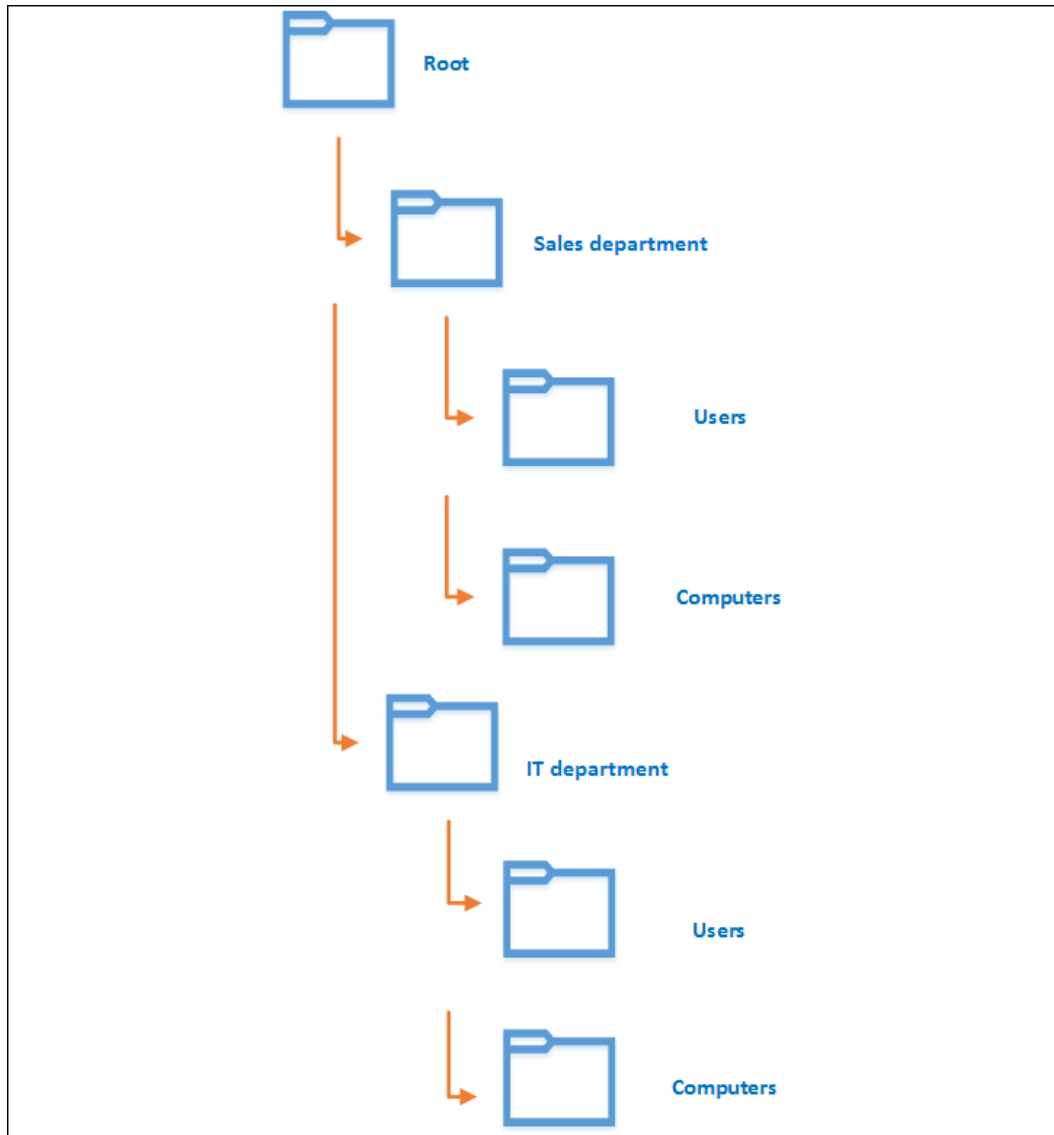
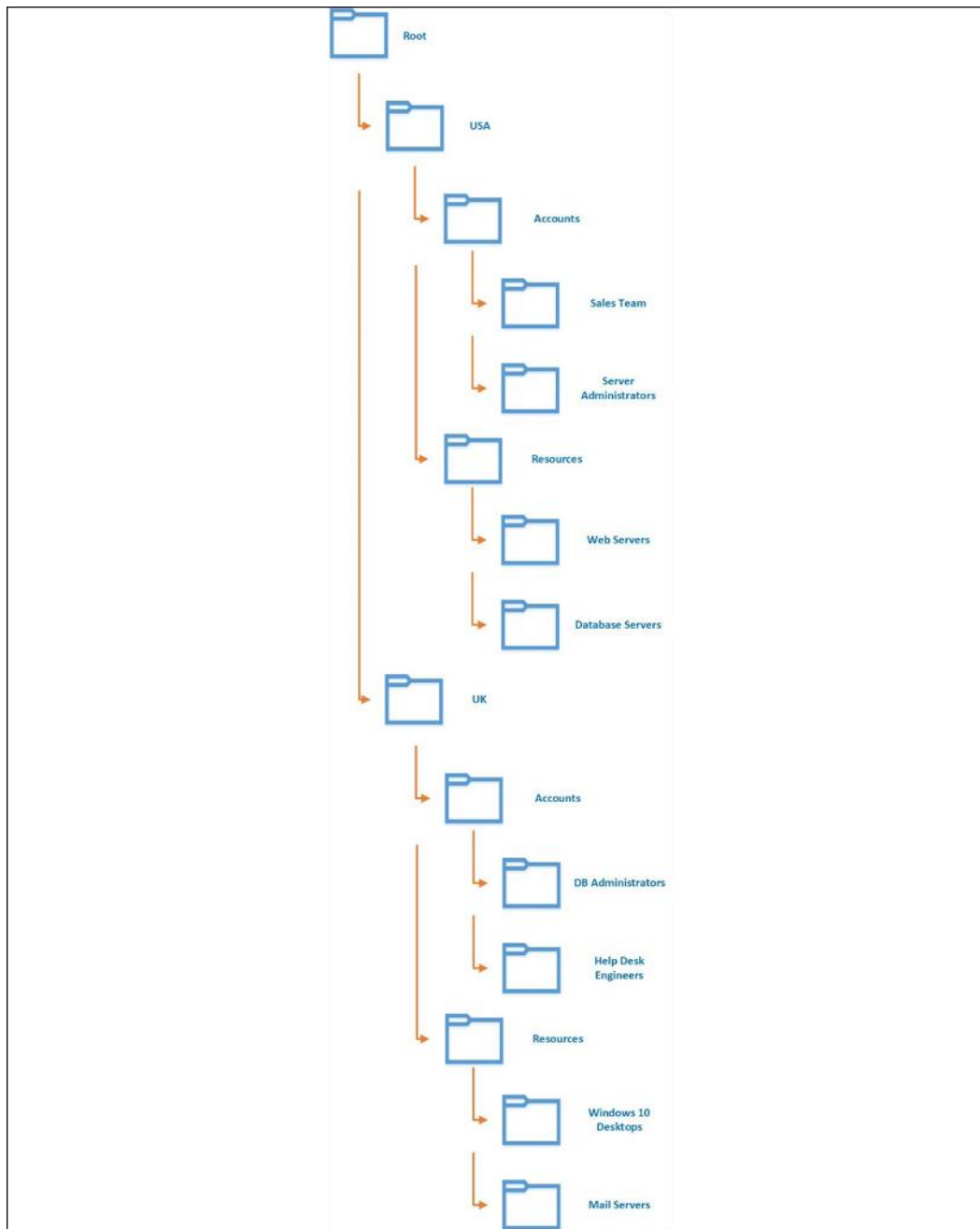


Figure 9.8: The department model



**Figure 9.9: The hybrid model**

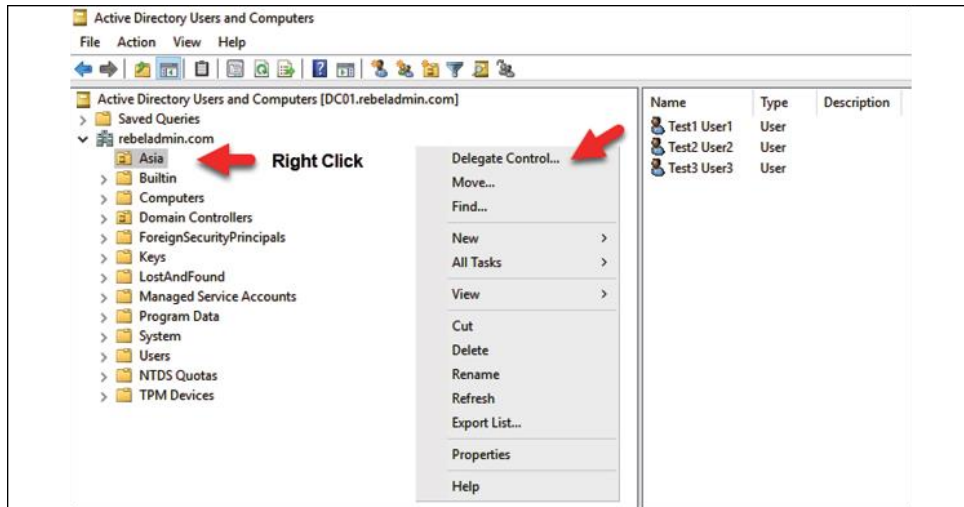


Figure 9.10: Delegate Control

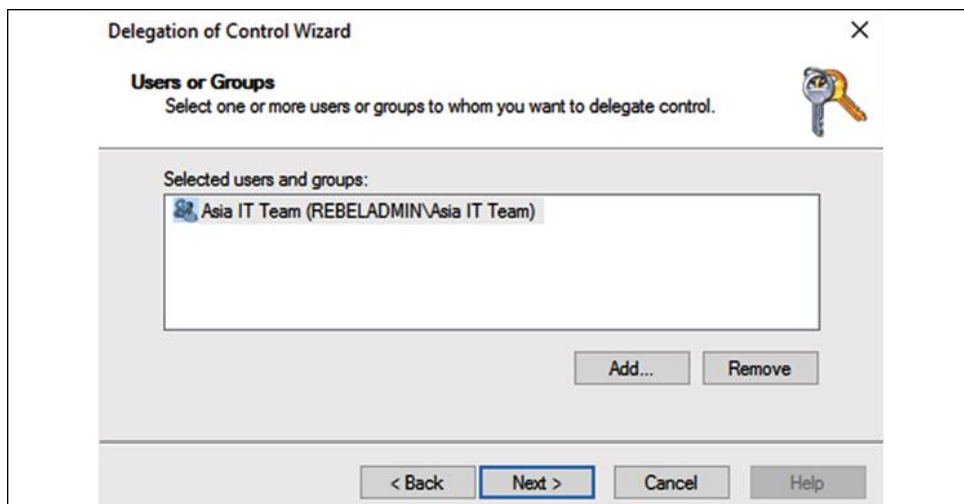


Figure 9.11: Delegate control – user/group selection

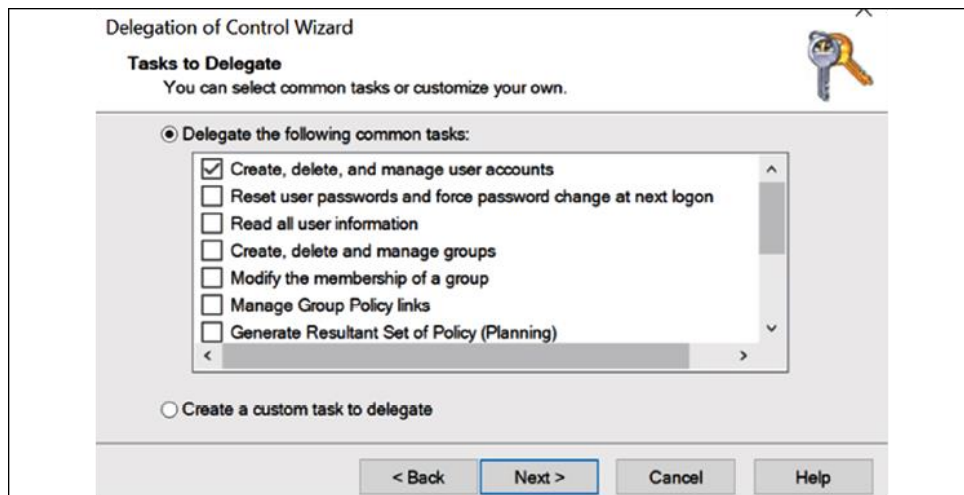


Figure 9.12: Delegate control – task selection

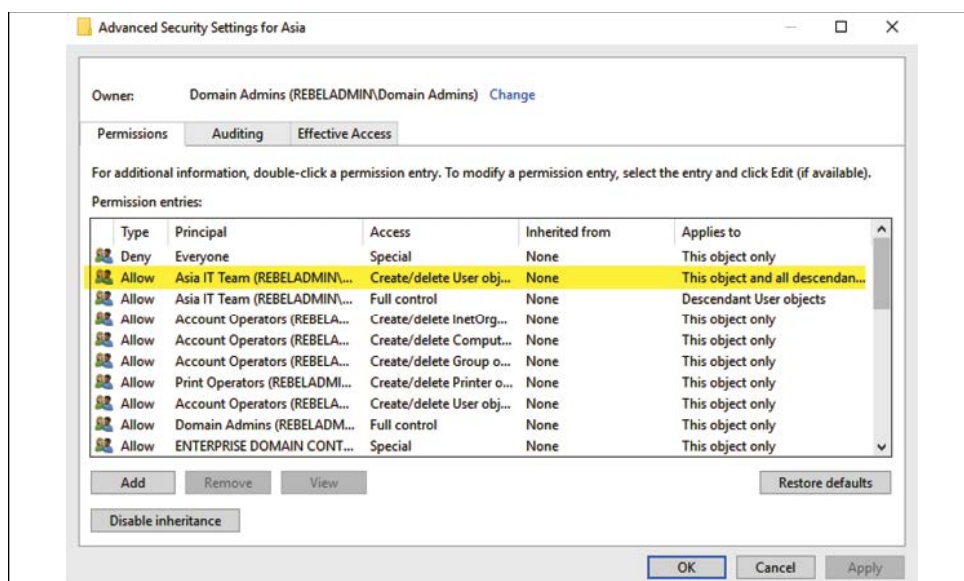


Figure 9.13: Advanced Security Settings

## Managing the OU structure

Similar to any other Active Directory object, the OU structure can be managed using **Active Directory Administrative Center (ADAC)**, **ADUC MMC**, and PowerShell. In this section, I am going to demonstrate how to manage the OU structure using PowerShell.

Let's start this with a new OU. We can use the `New-ADOrganizationalUnit` cmdlet to create a new OU. The complete syntax can be reviewed using the following command:

```
Get-Command New-ADOrganizationalUnit -Syntax
```

As the first step, I am going to create a new OU called Asia to represent the Asia branch:

```
New-ADOrganizationalUnit -Name "Asia" -Description "Asia Branch"
```

In the preceding command, `-Description` defines the description for the new OU. When there is no path defined, it will create the OU under the root. We can review the details of the new OU using the following command:

```
Get-ADOrganizationalUnit -Identity "OU=Asia,DC=rebeladmin,DC=com"
```

We can add/change the values of OU attributes using the following command:

```
Get-ADOrganizationalUnit -Identity "OU=Asia,DC=rebeladmin,DC=com" |  
Set-ADOrganizationalUnit -ManagedBy "Asia IT Team"
```

The preceding command will set the `ManagedBy` attribute to Asia IT Team.

When you use the `ManagedBy` attribute, make sure that you use an existing Active Directory object for the value. It can be an individual user object or a group object. If you don't use an existing object, the command will fail.

`ProtectedFromAccidentalDeletion` for the OU object is a nice safeguard we can apply. It will prevent accidental OU object deletion. This will be applied by default if you create an OU using ADAC, ADUC, or PowerShell:

```
Get-ADOrganizationalUnit -Identity "OU=Asia,DC=rebeladmin,DC=com" |  
Set-ADOrganizationalUnit -ProtectedFromAccidentalDeletion $true
```

As the next step, I am going to create a sub-OU under the Asia OU called Users:

```
New-ADOrganizationalUnit -Name "Users" -Path  
"OU=Asia,DC=rebeladmin,DC=com" -Description "Users in Asia Branch"
```

The preceding command will create an OU called Users under the OU=Asia,DC=rebeladmin,DC=com path. It is also protected from accidental deletion.

Now, we have the OU structure. The next step is to move objects to it. For that, we can use the `Move-ADObject` cmdlet:

```
Get-ADUser "tuser3" | Move-ADObject -TargetPath  
"OU=Users,OU=Asia,DC=rebeladmin,DC=com"
```

The preceding command will find the tuser3 user and move the object to OU=Users,OU=Asia,DC=rebeladmin,DC=com.

We can also move multiple objects to the new OU:

```
Get-ADUser -Filter 'Name -like "Test*"' -SearchBase  
"OU=Users,OU=Europe,DC=rebeladmin,DC=com" | Move-ADObject -TargetPath  
"OU=Users,OU=Asia,DC=rebeladmin,DC=com"
```

The preceding command will first search all of the user accounts that start with Test in OU=Users,OU=Europe,DC=rebeladmin,DC=com and then move all of the objects it finds to the new OU path.

If you have `ProtectedFromAccidentalDeletion` enabled on the objects, it will not allow you to move the objects to a different OU. It needs to be disabled before the object is moved, because the move operation is actually a copy and a delete operation of the original object.

If we need to remove the OU object, it can be done using the Remove-ADOrganizationalUnit cmdlet:

```
Remove-ADOrganizationalUnit  
"OU=Laptops,OU=Europe,DC=rebeladmin,DC=com"
```

The preceding command will remove the OU=Laptops,OU=Europe,DC=rebeladmin,DC=com OU.



# Chapter 10

## Figures

```
Administrator: PowerShell 7 (x64)

PowerShell 7.1.3
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\dfrancis> Get-GPO "Test Users"

DisplayName      : Test Users
DomainName       : rebeladmin.com
Owner            : REBELADMIN\Domain Admins
Id               : 5e373d3d-d606-4cd3-8ac5-fcc7e3e4fb7a
GpoStatus        : AllSettingsEnabled
Description      :
CreationTime     : 5/8/2021 3:04:51 PM
ModificationTime : 5/8/2021 3:04:50 PM
UserVersion      :
ComputerVersion  :
WmiFilter        :
```

Figure 10.1: GUID value of GPO



Figure 10.2: GPC information for policy

```

-----
Expanding base 'CN={E639ED67-A46F-4E12-87D1-44F61677B87E},CN=Policies,CN=System,DC=rebeladmin,DC=com'...
Getting 1 entries:
Dn: CN={E639ED67-A46F-4E12-87D1-44F61677B87E},CN=Policies,CN=System,DC=rebeladmin,DC=com
cn: {E639ED67-A46F-4E12-87D1-44F61677B87E};
displayName: Test Users;
distinguishedName: CN={E639ED67-A46F-4E12-87D1-44F61677B87E},CN=Policies,CN=System,DC=rebeladmin,DC=com;
dSCorePropagationData: 0x0 = ( );
flags: 0;
gPCFileSysPath: \\rebeladmin.com\SysVol\rebeladmin.com\Policies\{E639ED67-A46F-4E12-87D1-44F61677B87E};
gPCFunctionalityVersion: 2;
instanceType: 0x4 = ( WRITE );
name: {E639ED67-A46F-4E12-87D1-44F61677B87E};
objectCategory: CN=Group-Policy-Container,CN=Schema,CN=Configuration,DC=rebeladmin,DC=com;
objectClass (3): top; container; groupPolicyContainer;
objectGUID: cc8b3fd0-bc36-4807-aaba-06eb7199c8ab;
showInAdvancedViewOnly: TRUE;
uSNCreated: 20534;
uSNChanged: 20529;
versionNumber: 0;
whenChanged: 9/8/2021 9:47:54 PM Coordinated Universal Time;
whenCreated: 9/8/2021 9:47:54 PM Coordinated Universal Time;
-----

```

Figure 10.3: GPC information for policy – computer and user configurations

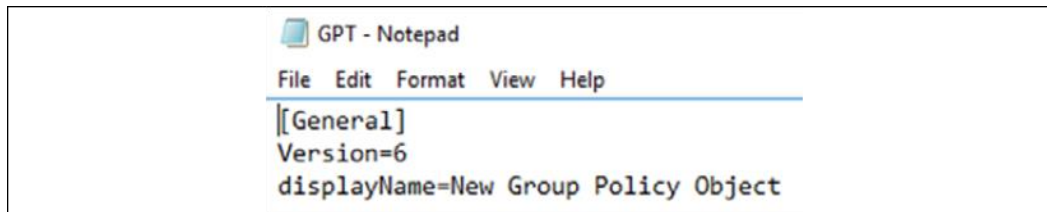


Figure 10.4: GPT.ini file

```

PS Microsoft.PowerShell.Core\FileSystem::\\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}\Machine> dir

Directory: \\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}\Machine

Mode                LastWriteTime         Length Name
----                -
d-----         25/02/2017         09:52       Applications
d-----         25/02/2017         09:53       Microsoft
d-----         25/02/2017         09:52       Scripts
-a-----         25/02/2017         11:55       8046 Registry.pol

PS Microsoft.PowerShell.Core\FileSystem::\\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}\Machine> cd ..
PS Microsoft.PowerShell.Core\FileSystem::\\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}> cd User
PS Microsoft.PowerShell.Core\FileSystem::\\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}\User> dir

Directory: \\rebeladmin.com\SYSVOL\rebeladmin.com\Policies\{721DA008-AB18-4DA1-A456-SC08EC0845A5}\User

Mode                LastWriteTime         Length Name
----                -
d-----         25/02/2017         12:35       Applications
d-----         25/02/2017         12:17       Documents & Settings
d-----         25/02/2017         12:17       Scripts

```

Figure 10.5: GPO folder structure

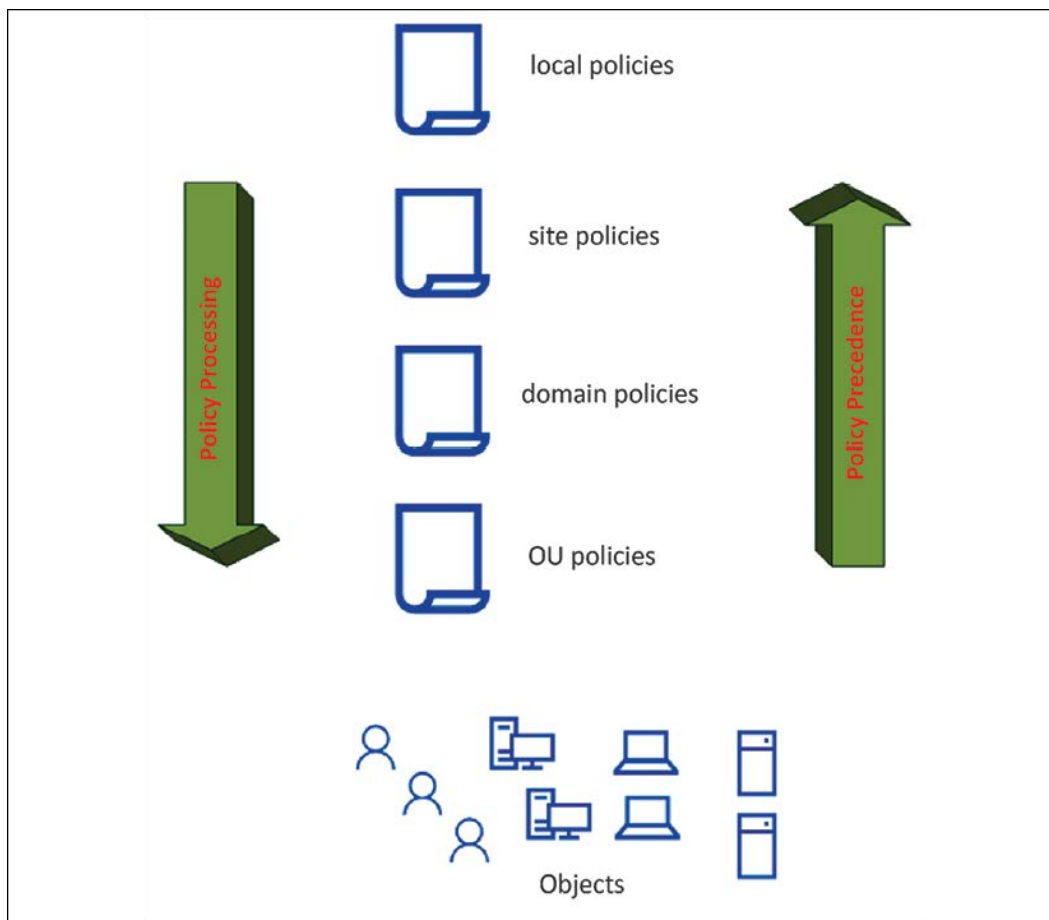


Figure 10.6: Group Policy processing order

Europe

Linked Group Policy Objects Group Policy Inheritance Delegation

This list does not include any GPOs linked to sites. For more details, see Help.

| Precedence | GPO                   | Location       | GPO Status | WMI Filter |
|------------|-----------------------|----------------|------------|------------|
| 1          | OU 1                  | Europe         | Enabled    | None       |
| 2          | Default Domain Policy | rebeladmin.com | Enabled    | None       |
| 3          | Test Users            | rebeladmin.com | Enabled    | None       |
| 4          | Root 1                | rebeladmin.com | Enabled    | None       |
| 5          | Root 2                | rebeladmin.com | Enabled    | None       |

Figure 10.7: Group Policy Inheritance

| Users  |                       |                |            |            |
|--|-----------------------|----------------|------------|------------|
| Linked Group Policy Objects   Group Policy Inheritance   Delegation              |                       |                |            |            |
| This list does not include any GPOs linked to sites. For more details, see Help. |                       |                |            |            |
| Precedence   | GPO                   | Location       | GPO Status | WMI Filter |
| 1  | Test Users            | Users          | Enabled    | None       |
| 2  | OU 1                  | Europe         | Enabled    | None       |
| 3  | Default Domain Policy | rebeladmin.com | Enabled    | None       |
| 4  | Root 1                | rebeladmin.com | Enabled    | None       |
| 5  | Root 2                | rebeladmin.com | Enabled    | None       |
| 6  | Site 1                | rebeladmin.com | Enabled    | None       |

Figure 10.8: Group Policy precedence

| Users  |            |          |            |            |
|--|------------|----------|------------|------------|
| Linked Group Policy Objects   Group Policy Inheritance   Delegation              |            |          |            |            |
| This list does not include any GPOs linked to sites. For more details, see Help. |            |          |            |            |
| Precedence   | GPO        | Location | GPO Status | WMI Filter |
| 1  | Test Users | Users    | Enabled    | None       |

Figure 10.9: Block Group Policy Inheritance

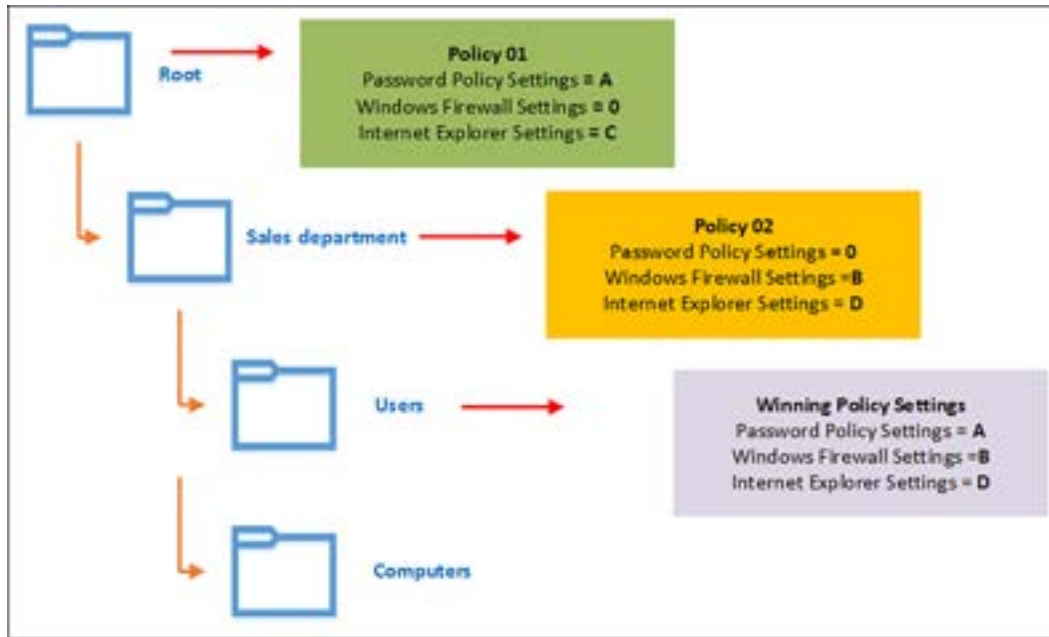


Figure 10.10: Group Policy conflicts example

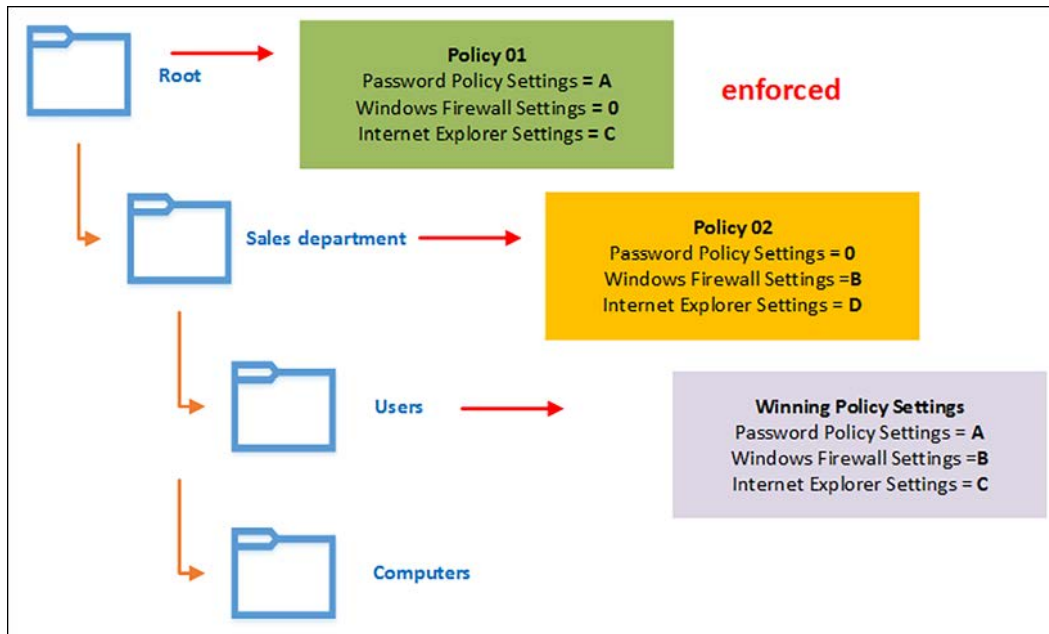


Figure 10.11: Enforced Group Policy

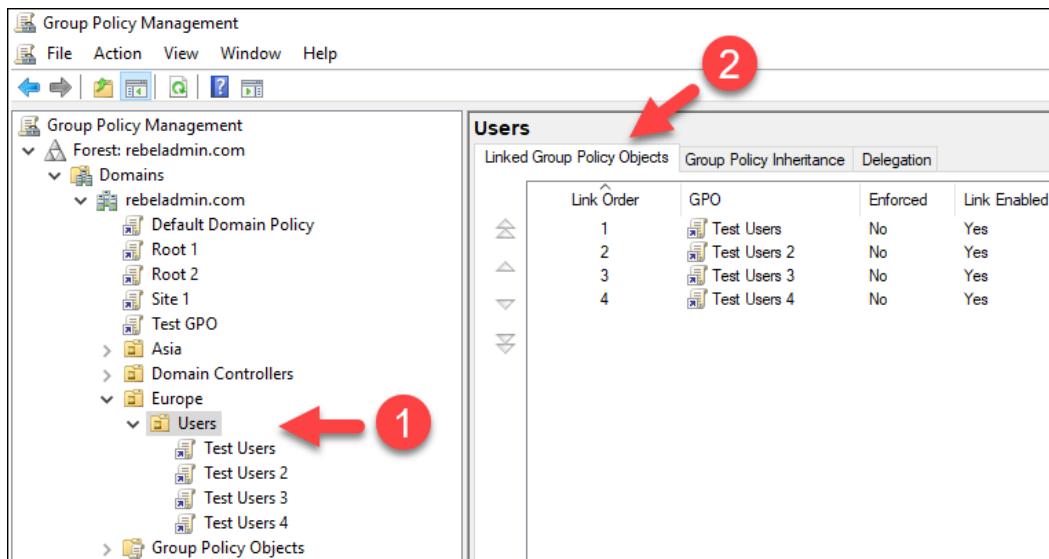


Figure 10.12: Group Policy processing at the same level

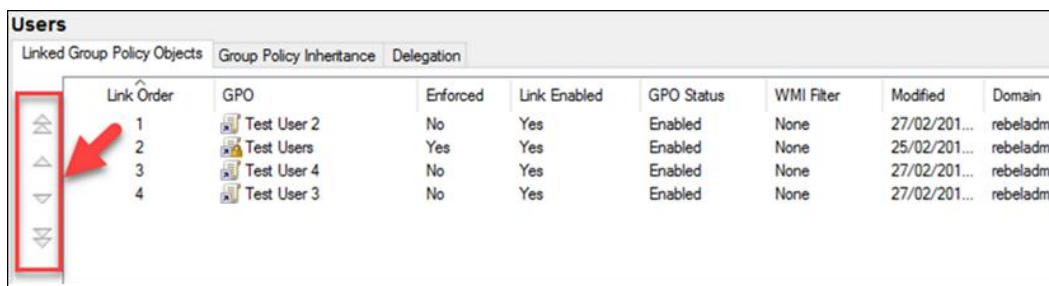


Figure 10.13: Group Policy Link Order



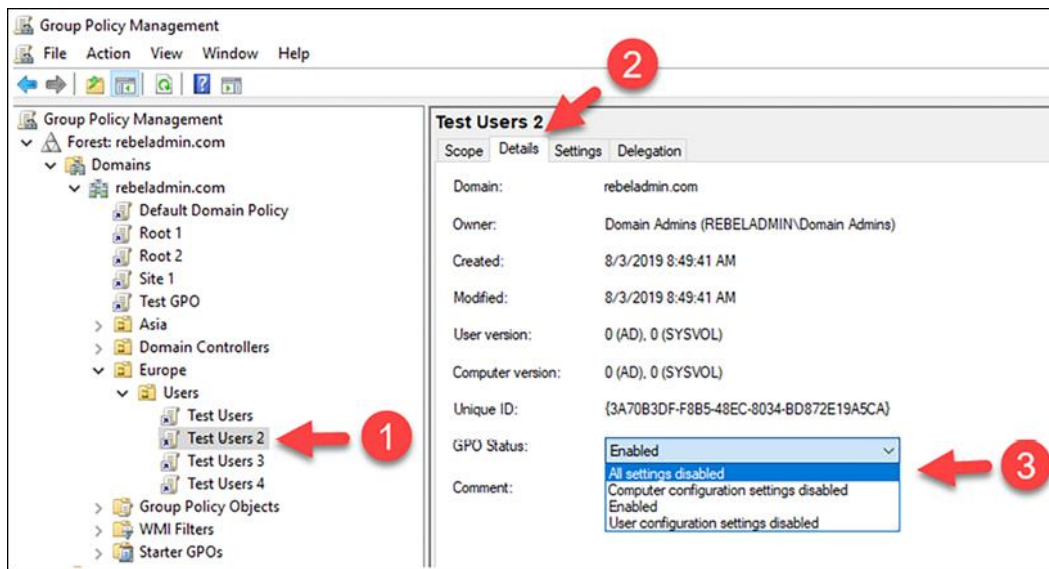


Figure 10.14: Group Policy status

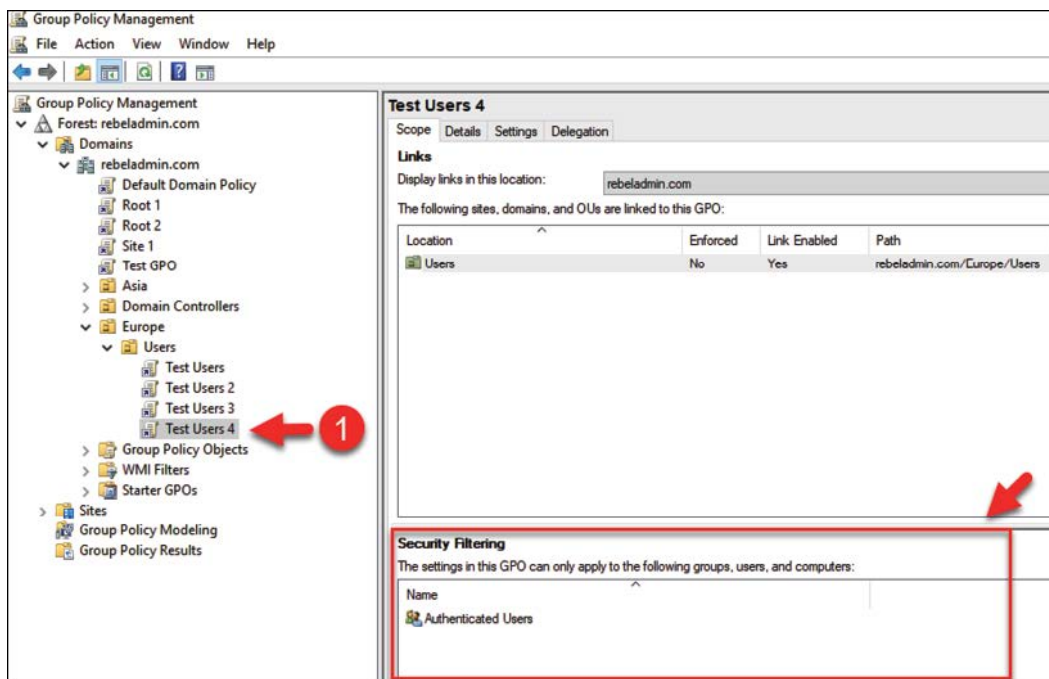


Figure 10.15: Security Filtering – default settings

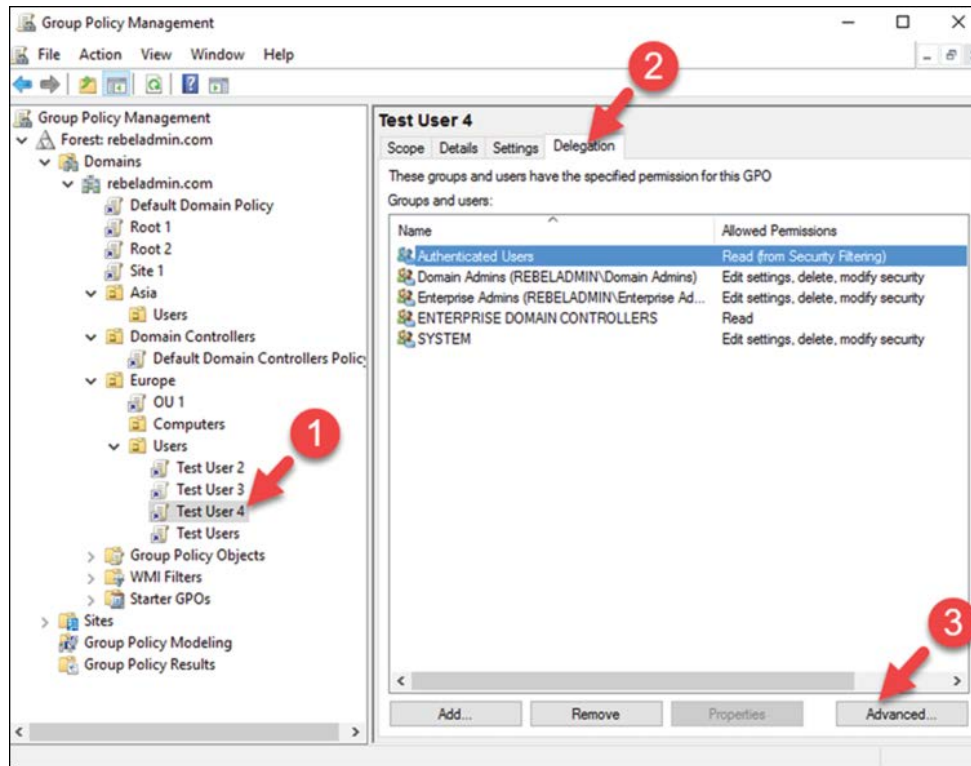


Figure 10.16: Group Policy delegation

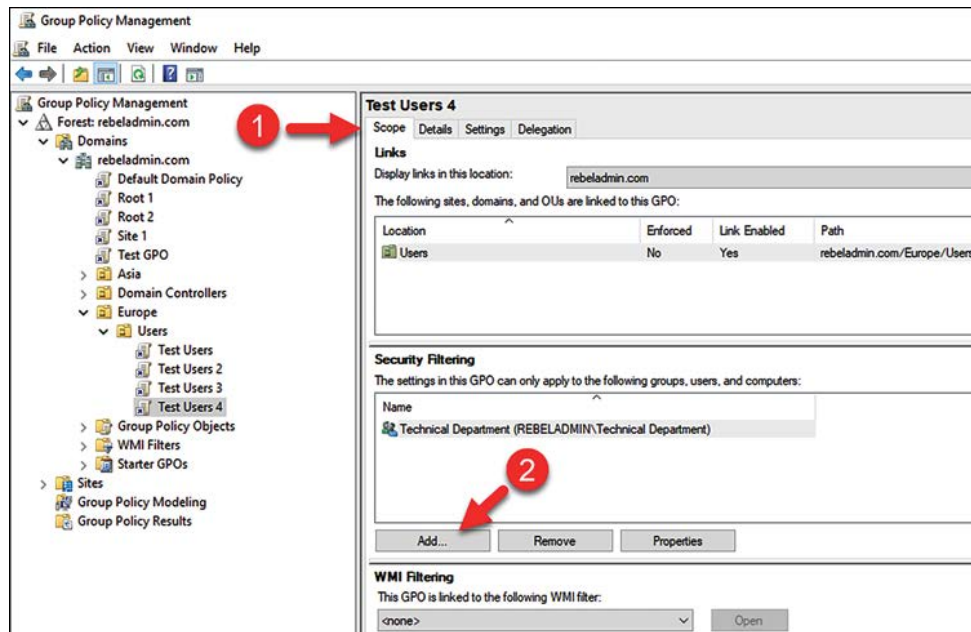


Figure 10.17: Group Policy Security Filtering with security groups



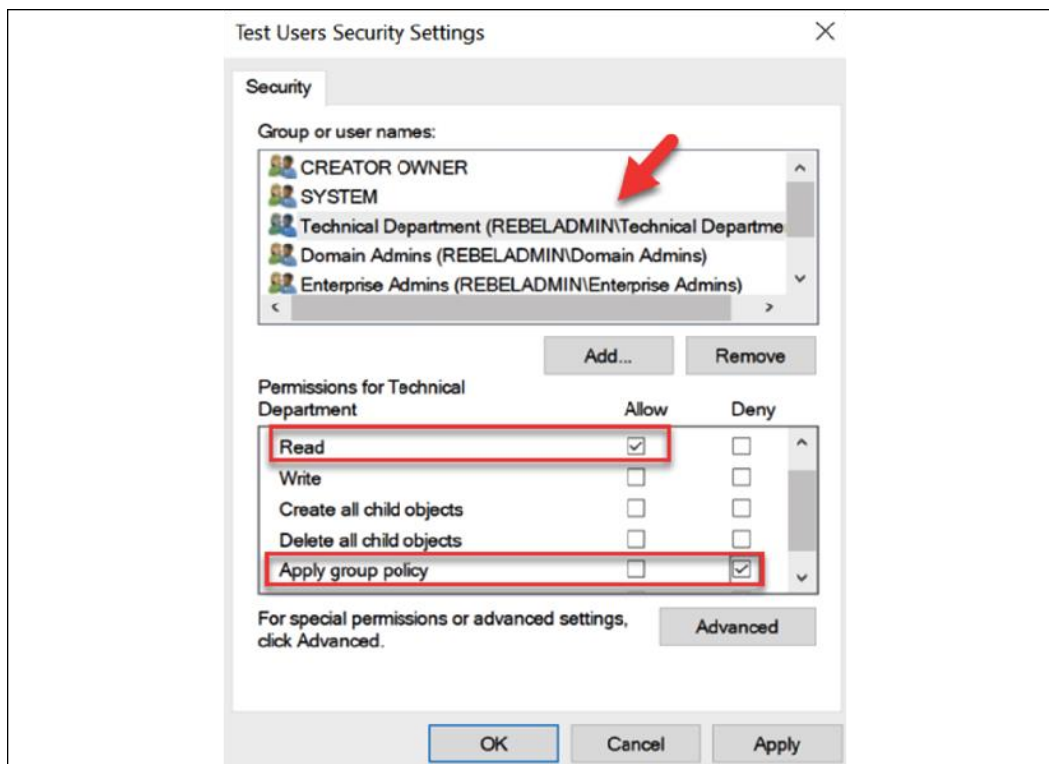


Figure 10.18: Group Policy permissions

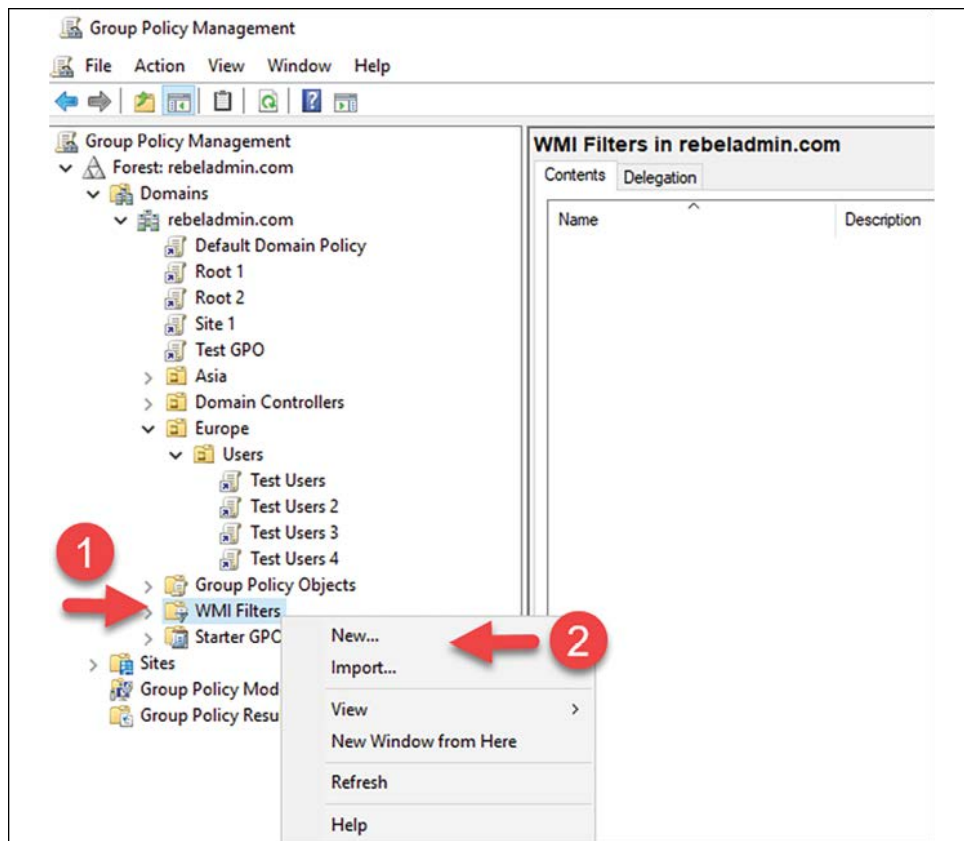


Figure 10.19: Creating WMI filters

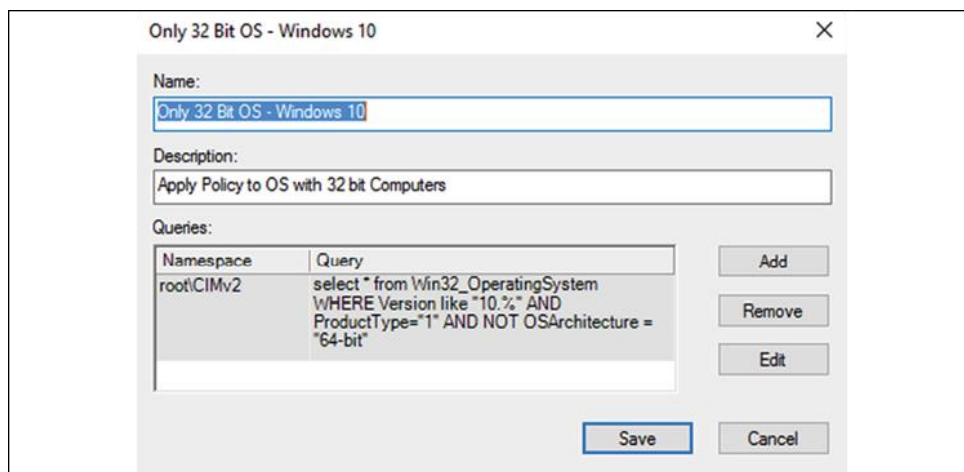


Figure 10.20: WMI filter

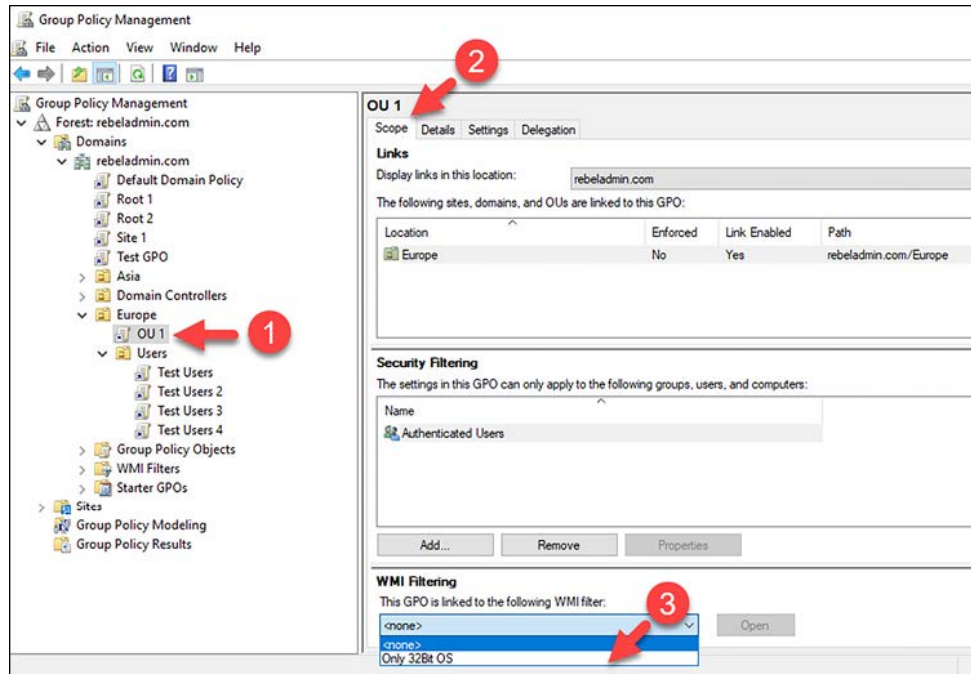


Figure 10.21: Selecting the WMI Filter

```
Administrator: Windows PowerShell
ite Name: Default-First-Site-Name
oaming Profile: N/A
ocal Profile: C:\Users\administrator
onnected over a slow link?: No

COMPUTER SETTINGS
-----
CN=REBEL-PC01,OU=Europe,DC=rebeladmin,DC=com
Last time Group Policy was applied: 02/03/2017 at 23:52:28
Group Policy was applied from: REBEL-PDC-01.rebeladmin.com
Group Policy slow link threshold: 500 kbps
Domain Name: REBELADMIN
Domain Type: windows 2008 or later

Applied Group Policy Objects
-----
Default Domain Policy

The following GPOs were not applied because they were filtered out
-----
OU 1
    Filtering: Denied (WMI Filter)
    WMI Filter: Only 32 Bit OS - Windows 10

Local Group Policy
    Filtering: Not Applied (Empty)

The computer is a part of the following security groups
-----
BUILTIN\Administrators
Everyone
BUILTIN\Users
NT AUTHORITY\NETWORK
NT AUTHORITY\Authenticated Users
This Organization
REBEL-PC01$
Domain Computers
Authentication authority asserted identity
System Mandatory Level
```

Figure 10.22: gpresult /r output

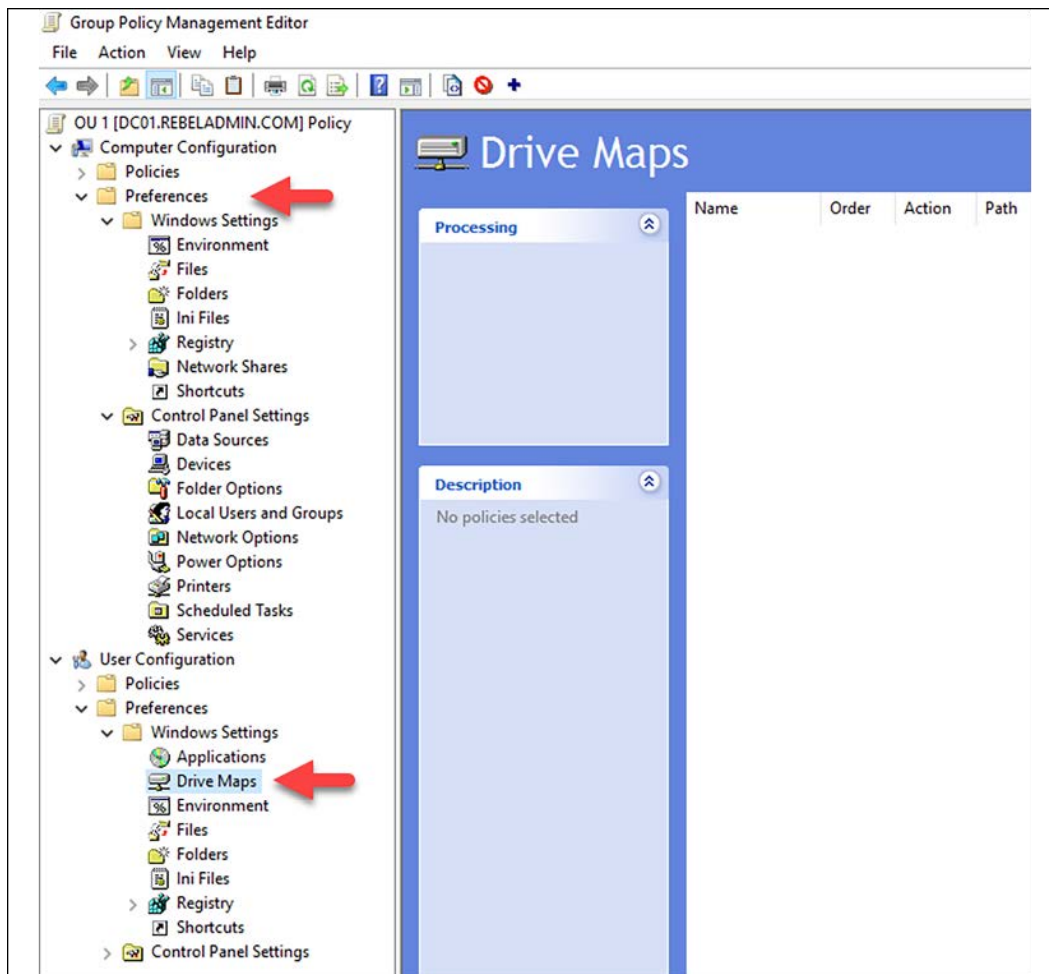


Figure 10.23: Drive Maps

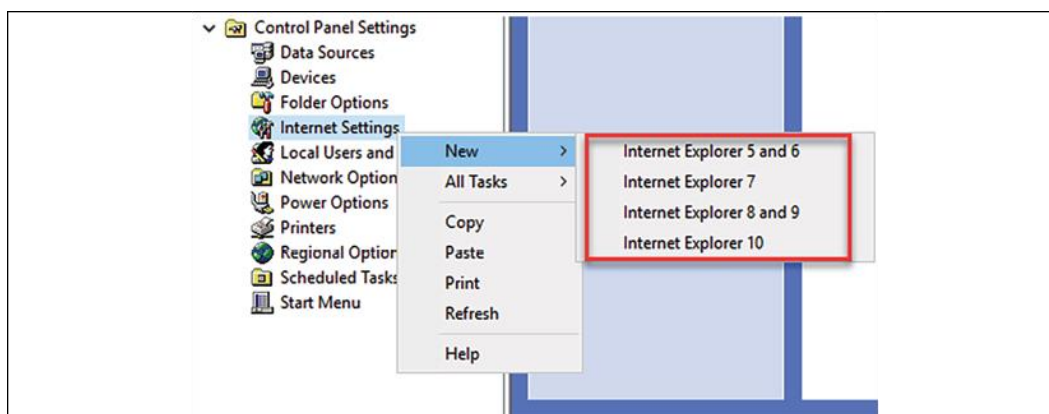


Figure 10.24: Internet Explorer settings

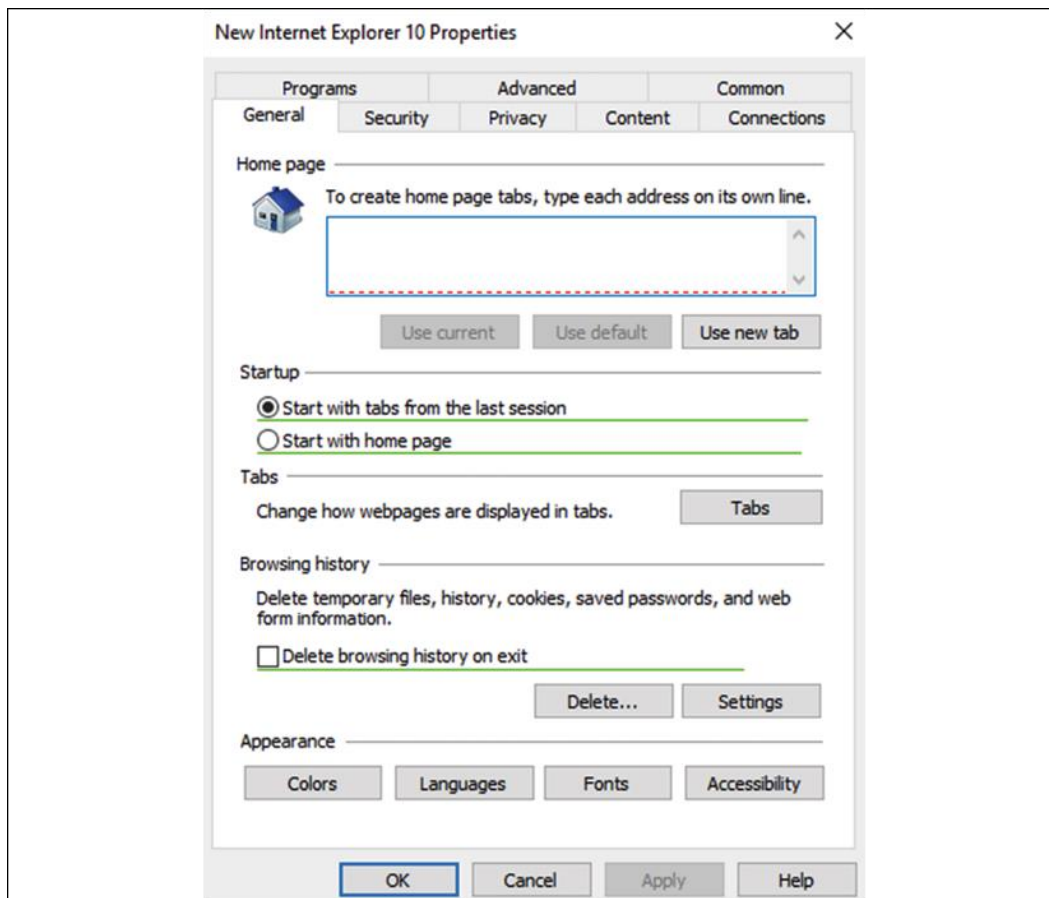


Figure 10.25: Applying Internet Explorer settings

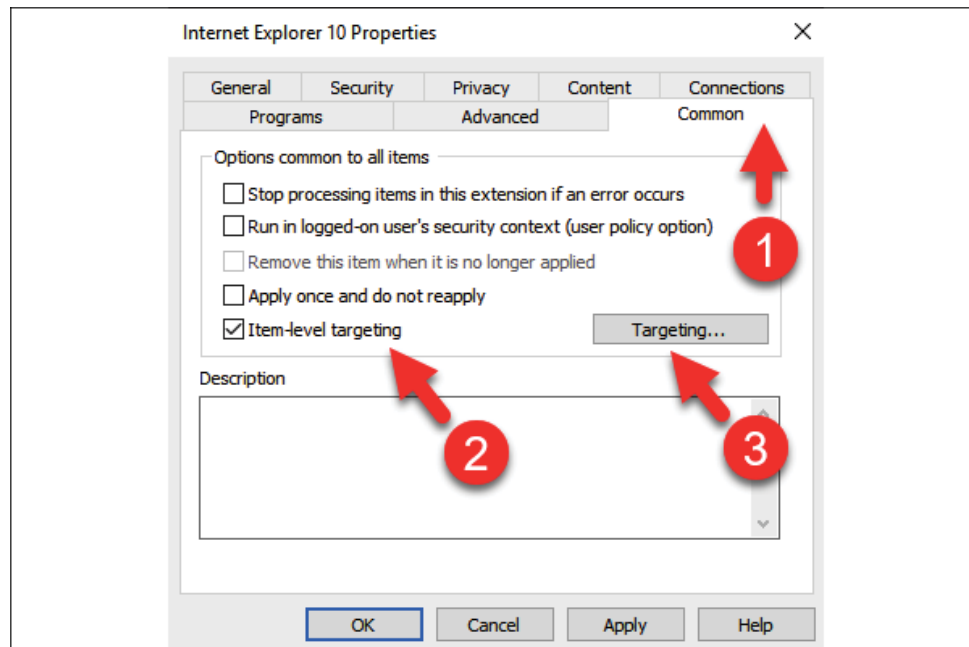


Figure 10.26: Item-level targeting

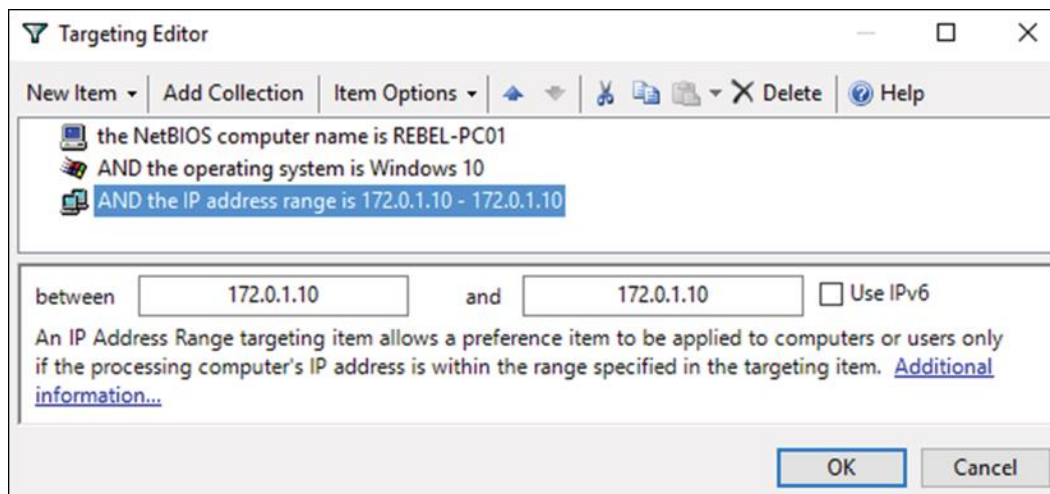


Figure 10.27: Targeting Editor

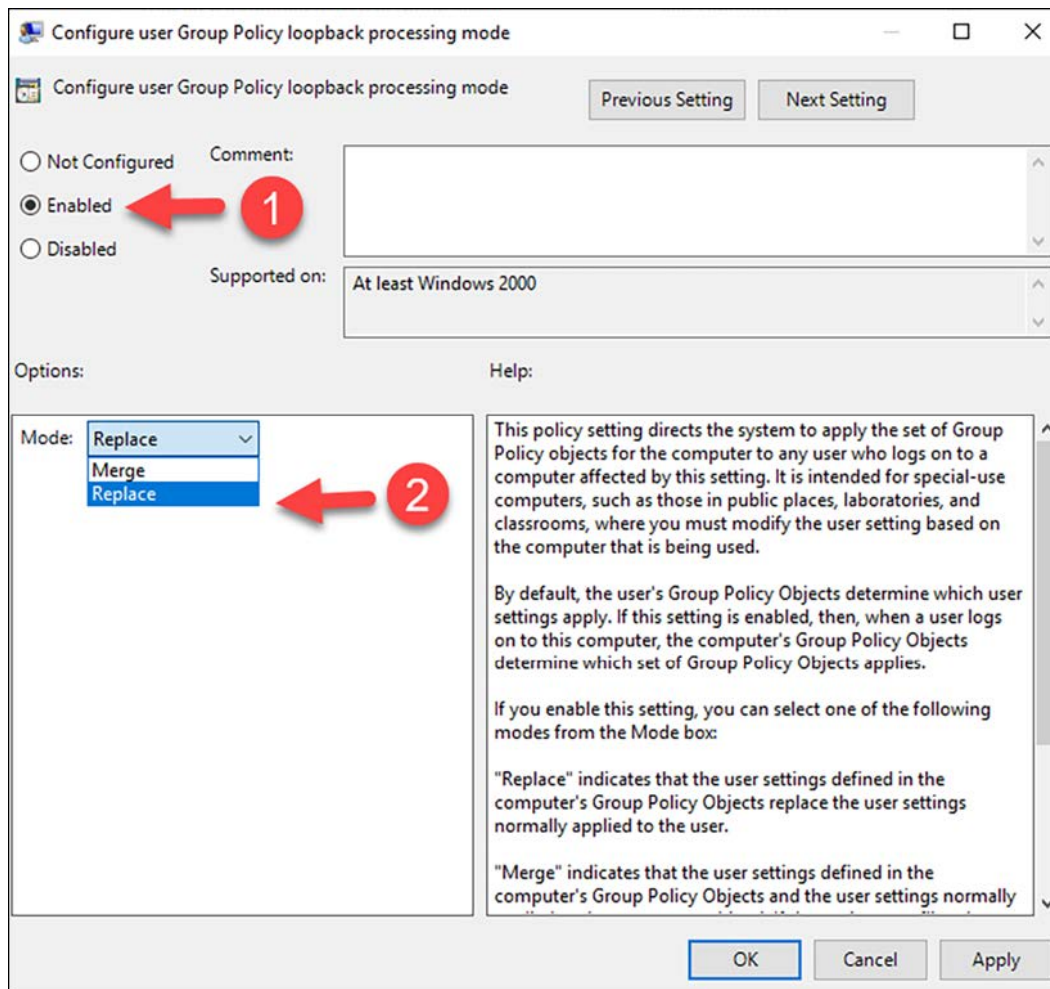
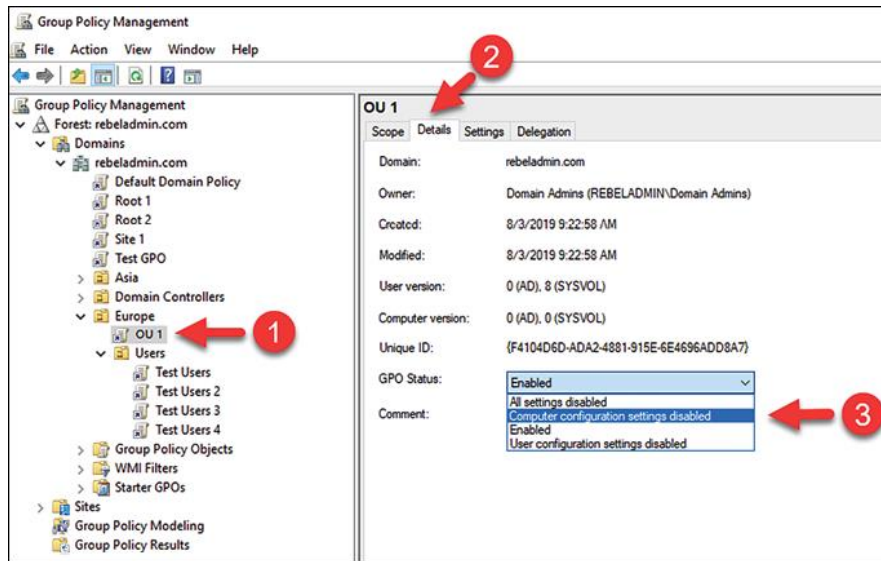


Figure 10.28: Loopback policy settings





**Figure 10.29: Changing the GPO status**

## Paths

- The default path for the **Group Policy template (GPT)** data is `\\rebeladmin.com\SYSVOL\rebeladmin.com\Policies`
- The policy setting is located at `Computer Configuration\Administrative Templates\System\Group Policy\Turn off Local Group Policy Objects Processing`.
- Asynchronous mode for slow links can be enabled via `Computer Configuration\Administrative Templates\System\Group Policy\Change Group Policy Processing` to run asynchronously when a slow link is detected.
- Asynchronous mode for remote desktop services can be enabled via `Computer Configuration\Administrative Templates\System\Group Policy\Allow asynchronous user Group Policy processing` when logging on through Remote Desktop Services.

## Links

We can use Microsoft **WMI Code Creator** to create WMI code: <https://bit.ly/3HR1sz1>.

# Tables

In the following table, I have listed a sample policy that we can use:

| Setting                                    | Value   |
|--|---------|
| Enforce Password History                   | 24      |
| Maximum Password Age                       | 30      |
| Minimum Password Age                       | 1       |
| Minimum Password Length                    | 8       |
| Password must meet complexity requirements | Enabled |

**Table 10.1**

## Commands

### Command 10.1

Before we look into datasets, we need to find the GUID value for the GPO. This can be done using the following command:

```
Get-GPO -name "Test Users"
```

The preceding PowerShell command will list the default properties of the Test Users GPO:

### Command 10.2

The Group Policy inheritance details can also be viewed by using the `Get-GPInheritance` PowerShell cmdlet.

```
Get-GPInheritance -Target "OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

### Command 10.3

In a similar scenario, Group Policy inheritance can be blocked at the OU level. This can be done by using the **Group Policy Management MMC** or the `Set-GPInheritance` PowerShell cmdlet:

```
Set-GPInheritance -Target "OU=Users,OU=Europe,DC=rebeladmin,DC=com" -IsBlocked Yes
```

The preceding command will block the Group Policy inheritance in OU=Users,OU=Europe,DC=rebeladmin,DC=com

### Command 10.4

A new GPO object can be created using the New-GPO PowerShell cmdlet:

```
New-GPO -Name GPO-Test-A
```

The preceding command will create a GPO called `GPO-Test-A`. By default, it will not link to any OU, domain, or site.

#### Command 10.5

Once an object is created, it can be linked to an OU, domain, or site by using the `New-GPLink` cmdlet:

```
New-GPLink -Name GPO-Test-A -Target  
"OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

The preceding command links a GPO called GPO-Test-A to OU=Users,OU=Europe,DC=rebeladmin,DC=com.

#### Command 10.6

Both cmdlets can be combined to create and link a GPO at the same time:

```
New-GPO -Name GPO-Test-B | New-GPLink -Target  
"OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

The preceding command will create a new GPO called GPO-Test-B and link it to OU=Users,OU=Europe,DC=rebeladmin,DC=com at the same time.

#### Command 10.7

To remove Group Policy from the Link Order list or from its location use the `Set-GPLink PowerShell` cmdlet:

```
Set-GPLink -Name GPO-Test-B -Target  
"OU=Users,OU=Europe,DC=rebeladmin,DC=com" -LinkEnabled No
```

The preceding command will disable the link between the GPO-Test-B GPO and OU=Users,OU=Europe,DC=rebeladmin,DC=com. This is usually used to temporarily disable a policy. It can be enabled at any time by using the `-LinkEnabled Yes` option.

#### Command 10.8

However, if this requirement is permanent, this GPO link can be completely removed by using the `Remove-GPLink` cmdlet. This will remove the link, but it will not delete the GPO. It will also not affect any other existing links in the GPO:

```
Remove-GPLink -Name GPO-Test-B -Target  
"OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

This command will remove the GPO-Test-B policy from OU=Users,OU=Europe,DC=rebeladmin,DC=com. It will remove the GPO from the **Precedence** list, as well as the **Link Order** list.

#### Command 10.9

If the GPO needs to be deleted completely, we can use the `Remove-GPO` cmdlet for that:

```
Remove-GPO -Name GPO-Test-A
```

The preceding command will delete the aforementioned GPO completely from the system. If the GPO was linked, it will forcefully remove it at the same time.

#### Command 10.10

Create a folder called PolicyDefinitions under

`\\rebeladmin.com\SYSTEM\rebeladmin.com\Policies`. The rebeladmin.com domain can be replaced by your own domain FQDN:

```
mkdir \\rebeladmin.com\SYSTEM\rebeladmin.com\Policies  
\PolicyDefinitions
```

After that, copy the policy definition data into this new folder:

```
Copy-Item C:\Windows\PolicyDefinitions\  
\\rebeladmin.com\SYSTEM\rebeladmin.com\Policies  
\PolicyDefinitions -Recurse -Force
```

This will also move ADML files into

`\\rebeladmin.com\SYSTEM\rebeladmin.com\Policies\PolicyDefinitions` with their language name. As an example, US English will be in `\\rebeladmin.com\SYSTEM\rebeladmin.com\Policies\PolicyDefinitions\en-US`.

#### Command 10.11

By clicking on the **Add** button, we can define `Namespace` and `WMI Query`. As an example, I have created a WMI query to filter the Windows 10 OS that is running the 32-bit version:

```
select * from Win32_OperatingSystem WHERE Version like "10.%" AND  
ProductType="1" AND NOT OSArchitecture = "64-bit"
```

In the following commands, you can find a few examples of commonly used WMI queries:

- To filter a Windows 8 64-bit OS, use the following command:

```
select * from Win32_OperatingSystem WHERE Version like "6.2%" AND  
ProductType="1" AND OSArchitecture = "64-bit"
```

- To filter a Windows 8 32-bit OS, use the following command:

```
select * from Win32_OperatingSystem WHERE Version like "6.2%" AND  
ProductType="1" AND NOT OSArchitecture = "64-bit"
```

- To filter any Windows Server 64-bit OS, use the following command:

```
select * from Win32_OperatingSystem where (ProductType = "2") OR  
(ProductType = "3") AND OSArchitecture = "64-bit"
```

- To apply a policy to a selected day of the week, use the following command:

```
select DayOfWeek from Win32_LocalTime where DayOfWeek = 1
```

In the preceding command, day 1 is Monday.

# Chapter 11

## Figures

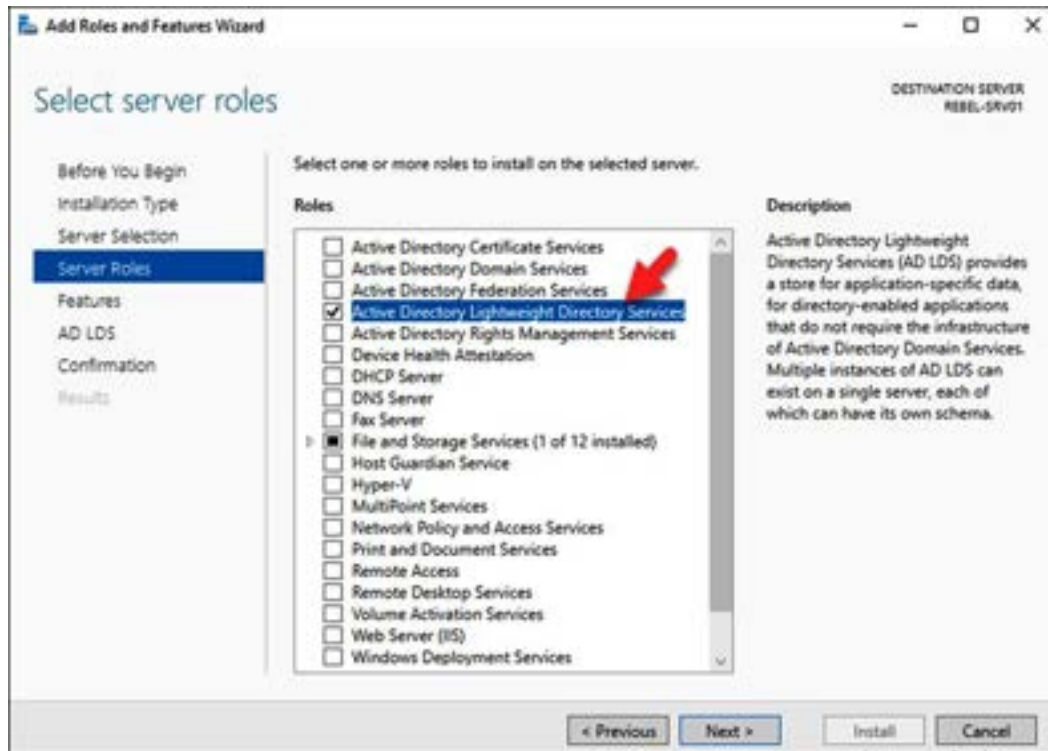


Figure 11.1: AD LDS role

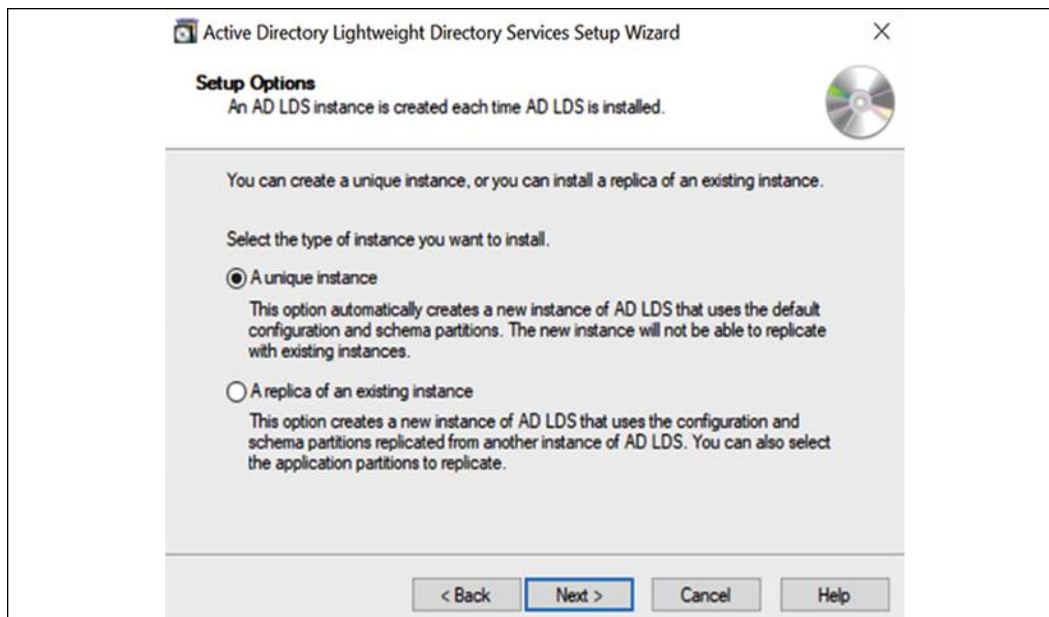


Figure 11.2: AD LDS instance type

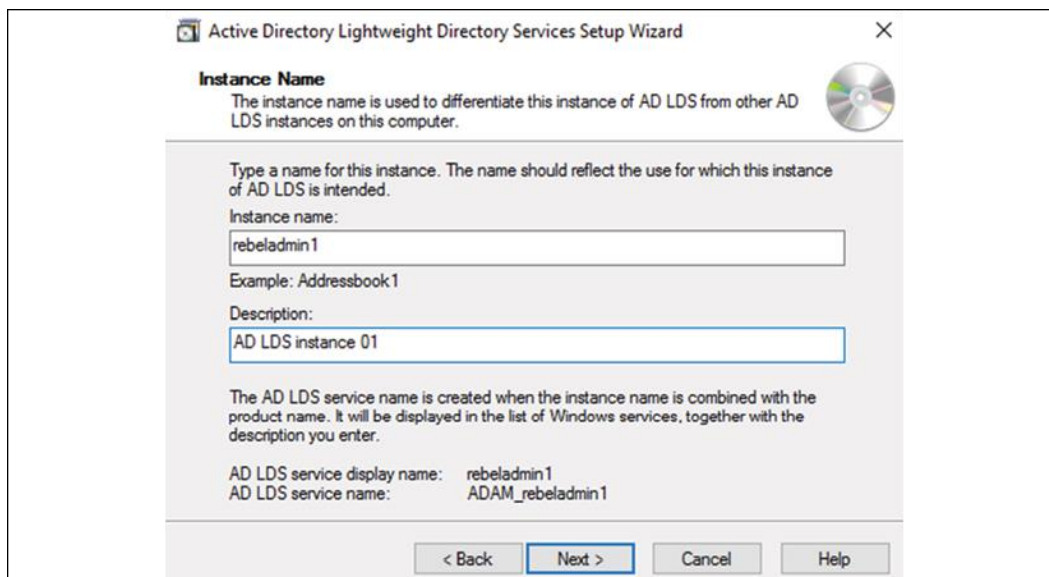


Figure 11.3: AD LDS Instance Name

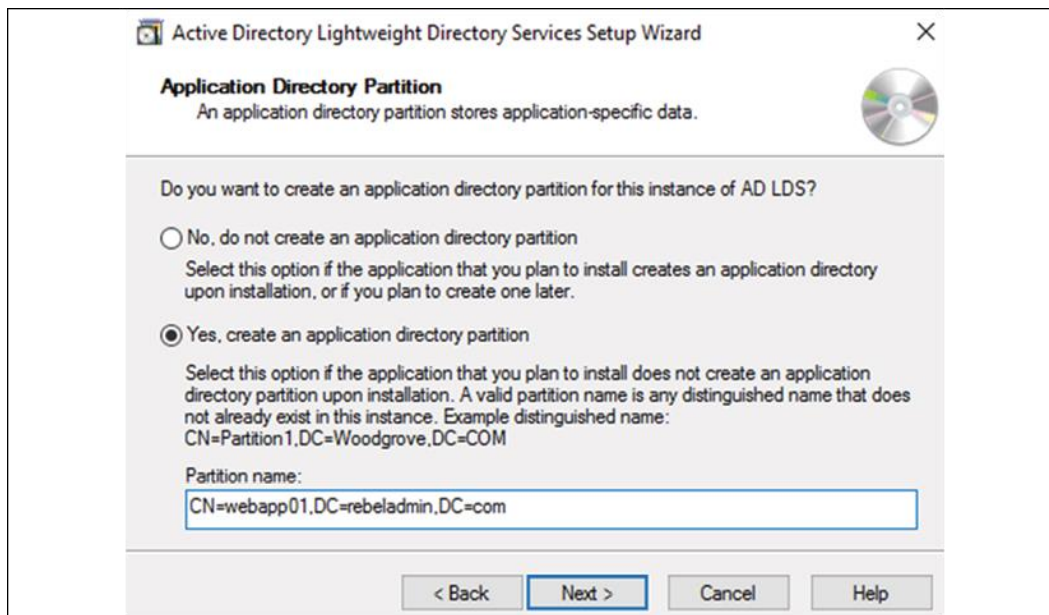


Figure 11.4: AD LDS application directory partition

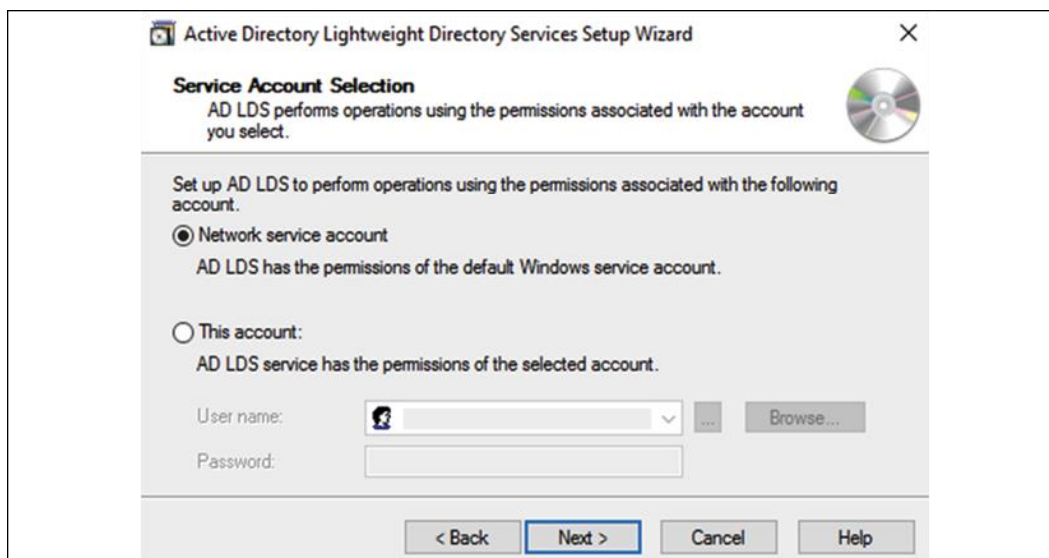


Figure 11.5: AD LDS service account



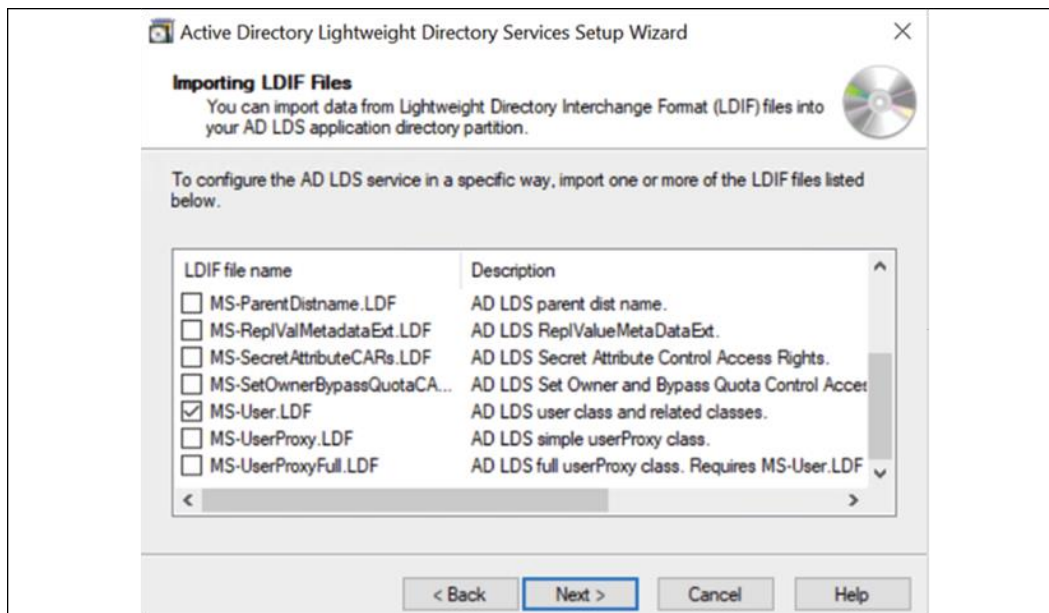


Figure 11.6: AD LDS – Importing LDIF Files

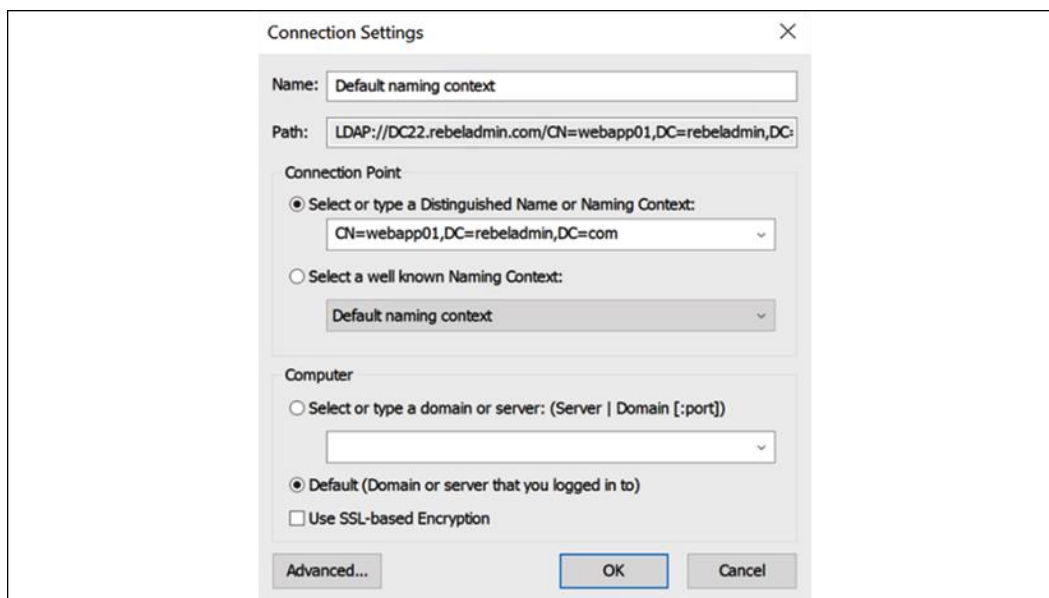


Figure 11.7: AD LDS Connection Settings

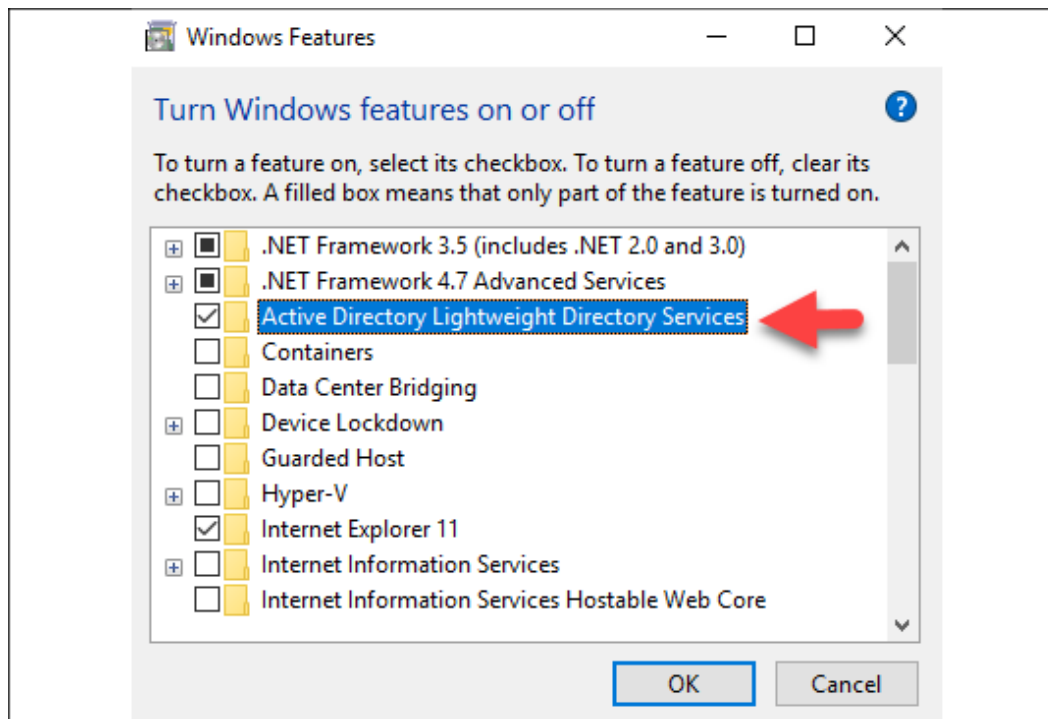


Figure 11.8: AD LDS Windows Features

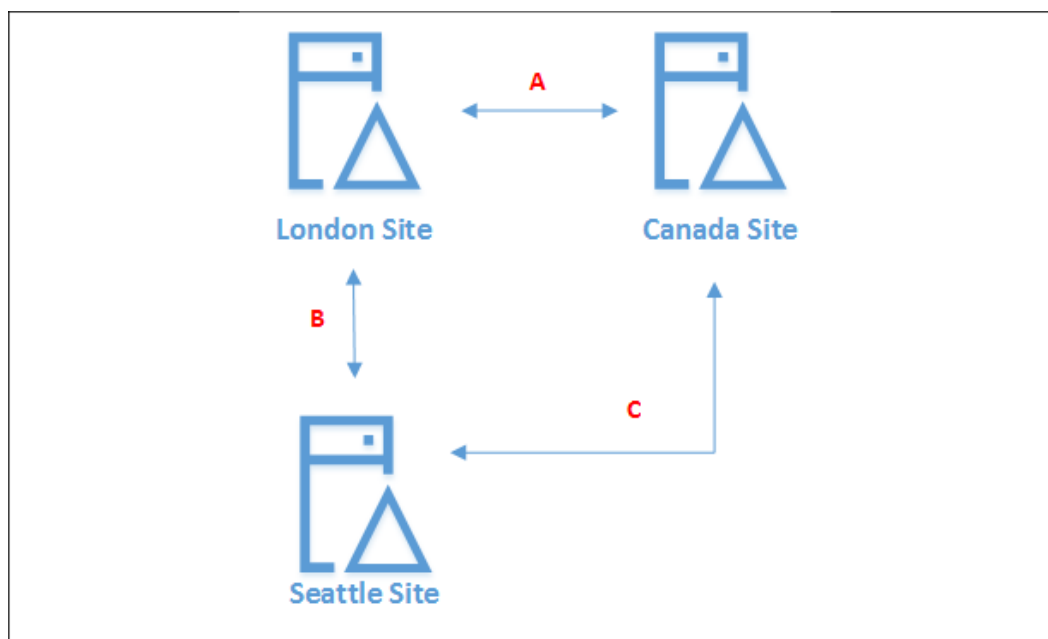


Figure 11.9: Site-link bridges example

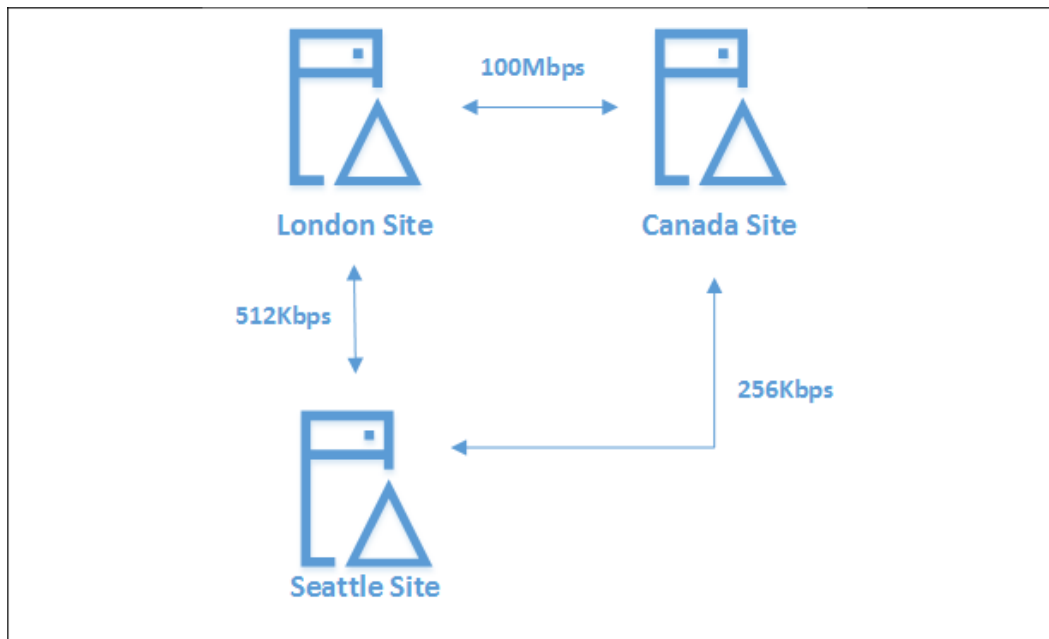


Figure 11.10: Site link cost example

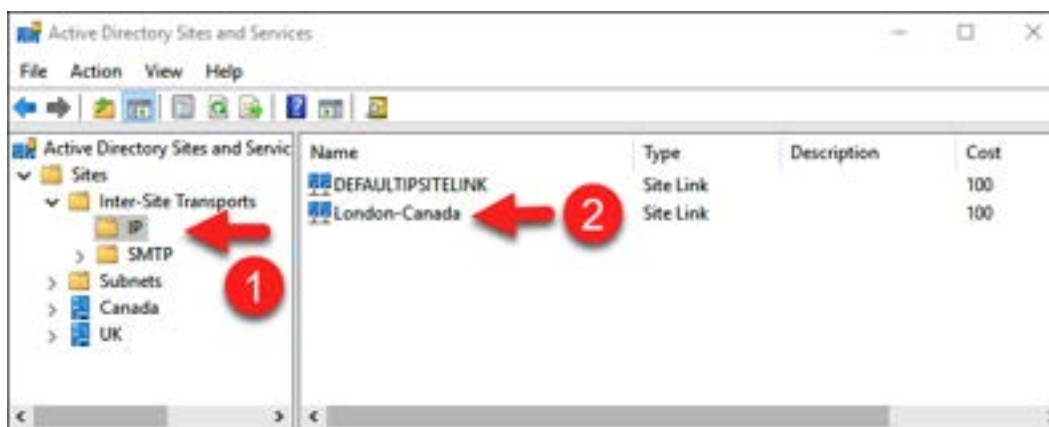


Figure 11.11: Site link



Figure 11.12: Site link replication schedule

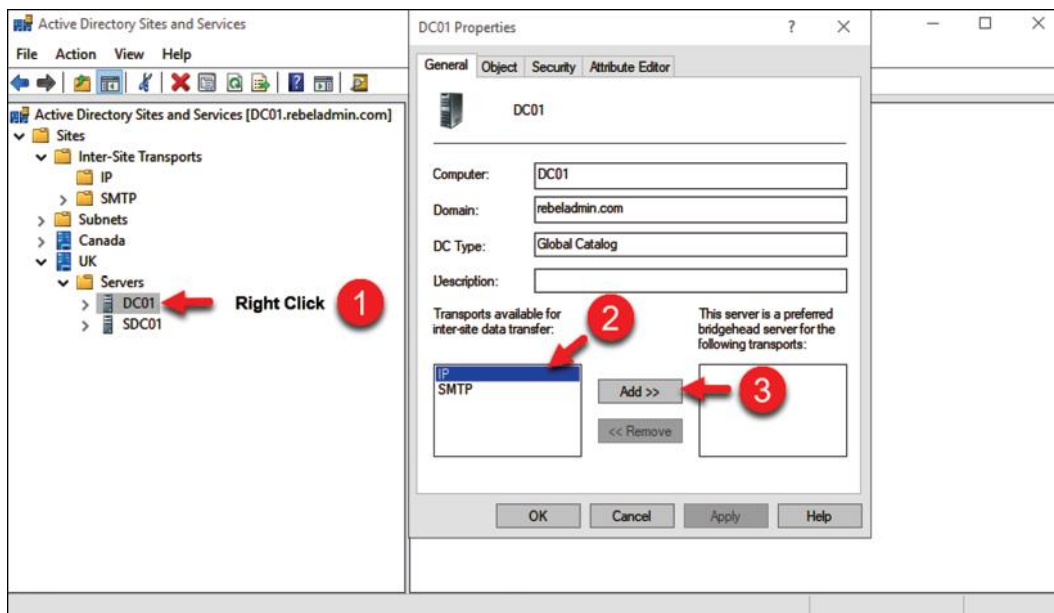


Figure 11.13: Bridgehead server selection

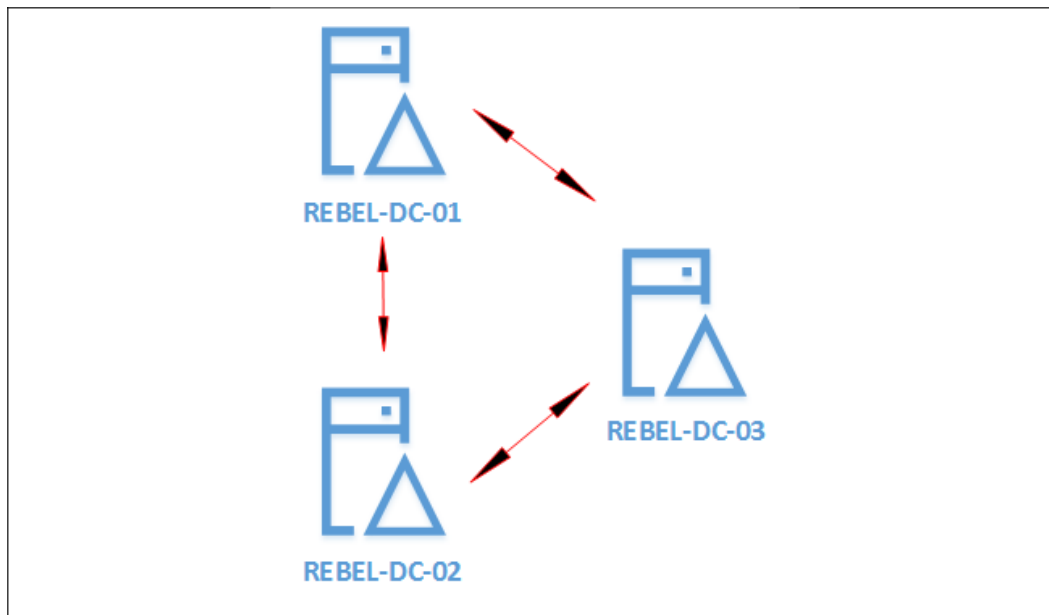


Figure 11.14: Intra-site replication

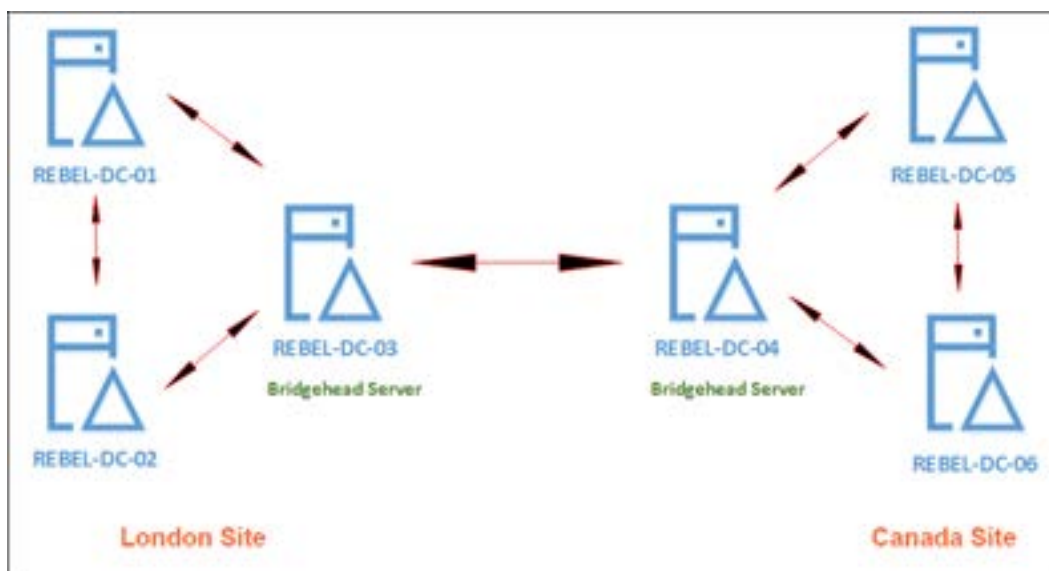
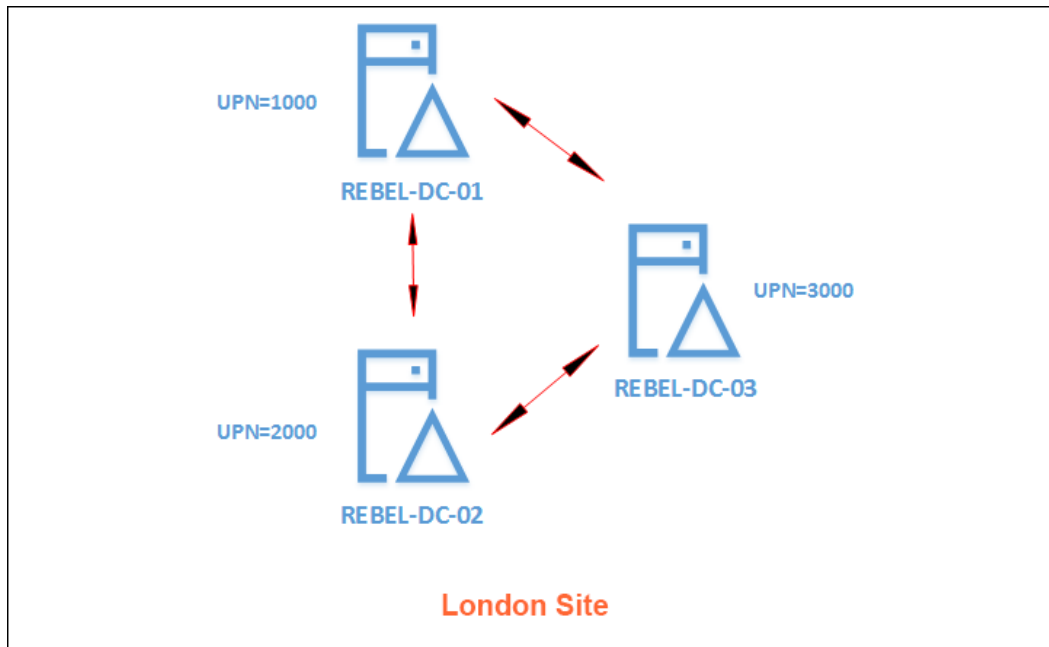


Figure 11.15: Inter-site replication



**Figure 11.16: UPN value**

## Commands

The other method is by using PowerShell cmdlets. These are the same commands that we use for AD DS user object management, with the only difference being the need to define the **DN** and server:

```
New-ADUser -name "tidris" -Displayname "Talib Idris" -server  
'localhost:389' -path "CN=webapp01,DC=rebeladmin,DC=com"
```

The preceding command creates a user account called tidris on the local LDS instance that runs on 389. Its DNS path is CN=webapp01,DC=rebeladmin,DC=com:

```
Get-ADUser -Filter * -SearchBase "CN=webapp01,DC=rebeladmin,DC=com" -  
server 'localhost:389'
```

The preceding command lists all the user accounts in the LDS instance, CN=webapp01,DC=rebeladmin,DC=com. If you'd like to learn about more commands, please refer to *Chapter 7, Managing Active Directory Objects*.

## Links

- Windows Server version 1709: <https://bit.ly/30WjqPl>.
- A step-by-step guide for FRS to DFSR migration is available on <https://bit.ly/2Zj1huT>.

## Tables

As an example, the logarithm of 512 is 2.709. When we divide 1,024 by 2.709, we get 377.999. So, the link cost of a 512 Kbps line is 378:

| Available bandwidth | Cost  |
|---------------------|-------|
| 9.6 Kbps            | 1,042 |
| 19.2 Kbps           | 798   |
| 38.4 Kbps           | 644   |
| 56 Kbps             | 586   |
| 64 Kbps             | 567   |
| 128 Kbps            | 486   |
| 256 Kbps            | 425   |
| 512 Kbps            | 378   |
| 1,024 Kbps          | 340   |
| 2,048 Kbps          | 309   |
| 4,096 Kbps          | 283   |
| 10 Mbps             | 257   |
| 100 Mbps            | 205   |
| 1,000 Mbps          | 171   |

**Table 11.1**

## Managing sites

When the first domain controller is introduced into the infrastructure, the system creates its first site as Default-First-Site-Name. This can be changed based on the requirements. We can review the existing site's configuration using the following PowerShell cmdlet:

```
Get-ADReplicationSite -Filter *
```

It will list the site's information for the AD environment.

Our example only has the default AD site. As this is the first step, we need to change it to a meaningful name so we can assign objects and configurations accordingly. To do that, we can use the Rename-ADObject cmdlet:

```
Rename-ADObject -Identity "CN=Default-First-Site-Name,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com" -NewName "LondonSite"
```

The preceding command renames the Default-First-Site-Name site to LondonSite. We also can change the site configuration values using the Set-ADReplicationSite cmdlet:

```
Get-ADReplicationSite -Identity LondonSite | Set-ADReplicationSite -Description "UK AD Site"
```

The preceding command changed the site description to UK AD Site.

We can create a new AD site using the New-ADReplicationSite cmdlet. The full description of the command can be viewed using Get-Command New-ADReplicationSite -Syntax:

```
New-ADReplicationSite -Name "CanadaSite" -Description "Canada AD Site"
```

The preceding command creates a new AD site called CanadaSite.

Once the sites are created, we need to move the domain controllers to the relevant sites. By default, all the domain controllers are placed under the default site, Default-First-Site-Name.

In the following command, we are listing all the domain controllers in the AD environment with filtered data to show the Name,ComputerObjectDN,Site attribute values:

```
Get-ADDomainController -Filter * | select Name,ComputerObjectDN,Site | fl
```

Now we have the list of domain controllers; in the next step, we can move the domain controller to the relevant site:

```
Move-ADDirectoryServer -Identity "REBEL-SDC-02" -Site "CanadaSite"
```

The preceding command will move the REBEL-SDC-02 domain controller to CanadaSite.

During the additional domain controller setup, we can define which site it will be assigned to. If the site already has domain controllers, it will do the initial replication from the site local domain controller. If it doesn't, it will replicate from any selected domain controller or, if not, from any available domain



controller. If the link bandwidth is an issue, it's recommended to promote the domain controller from a site that has fast links, and then move the domain controller to the relevant site.

## The site link bridge

We can create the site link bridge using the `New-ADReplicationSiteLinkBridge` cmdlet:

```
New-ADReplicationSiteLinkBridge -Name "London-Canada-Bridge" -  
SiteLinksIncluded "London-Canada","London-CanadaDRLink"
```

The preceding command creates a new site link bridge called London-Canada-Bridge using two site links: London-Canada and London-CanadaDRLink.

Using the `Set-ADReplicationSiteLinkBridge` cmdlet, the existing site link bridge value can change:

```
Set-ADReplicationSiteLinkBridge -Identity "London-Canada-Bridge" -  
SiteLinksIncluded @{Remove='London-CanadaDRLink'}
```

The preceding command removes the `London-CanadaDRLink` site link from the existing site link bridge, `London-Canada-Bridge`:

```
Set-ADReplicationSiteLinkBridge -Identity "London-Canada-Bridge" -  
SiteLinksIncluded @{Add='London-CanadaDRLink'}
```

The preceding command adds the given site link to the existing site link bridge.

# Chapter 12

## Figures

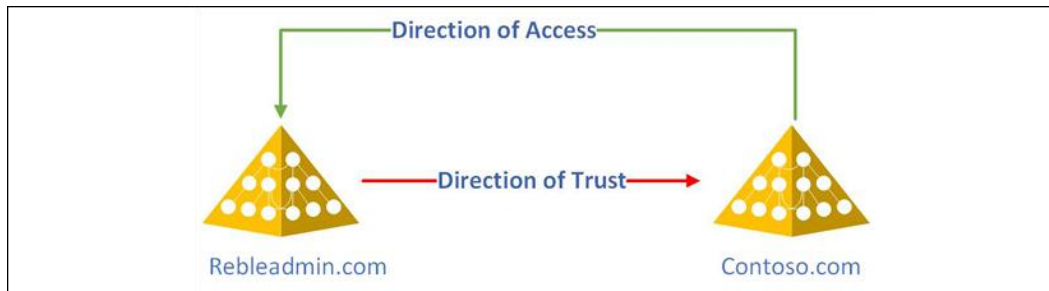


Figure 12.1: Direction of Trust vs Direction of Access

```
PS C:\Users\dfrancis> ping contoso.com

Pinging contoso.com [40.113.200.201] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 40.113.200.201:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PS C:\Users\dfrancis>
```

Figure 12.2: Ping test to check DNS

```
PS C:\Users\dfrancis> hostname
DC01
PS C:\Users\dfrancis> ping contoso.com

Pinging contoso.com [10.1.5.4] with 32 bytes of data:
Reply from 10.1.5.4: bytes=32 time=1ms TTL=128
Reply from 10.1.5.4: bytes=32 time=1ms TTL=128
Reply from 10.1.5.4: bytes=32 time=2ms TTL=128
Reply from 10.1.5.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.5.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms
PS C:\Users\dfrancis>
```

Figure 12.3: Ping result after conditional forwarder setup – contoso.com

```
Administrator: C:\Program Files\PowerShell\powershell
PS C:\Windows\System32> Add-OnsServerConditionalForwarderZone -Name "rebeladmin.com" -ReplicationScope "Forest" -MasterServers 10.1.0.4
PS C:\Windows\System32> ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.
PS C:\Windows\System32> ping rebeladmin.com

Pinging rebeladmin.com [10.1.0.4] with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=1ms TTL=128
Reply from 10.1.0.4: bytes=32 time=2ms TTL=128
Reply from 10.1.0.4: bytes=32 time=1ms TTL=128
Reply from 10.1.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms
PS C:\Windows\System32>
```

Figure 12.4: Ping result after conditional forwarder setup – rebeladmin.com

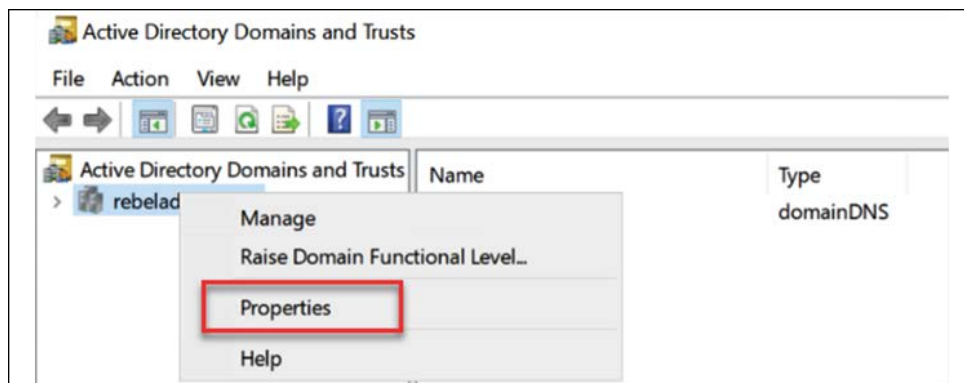


Figure 12.5: Domain Properties

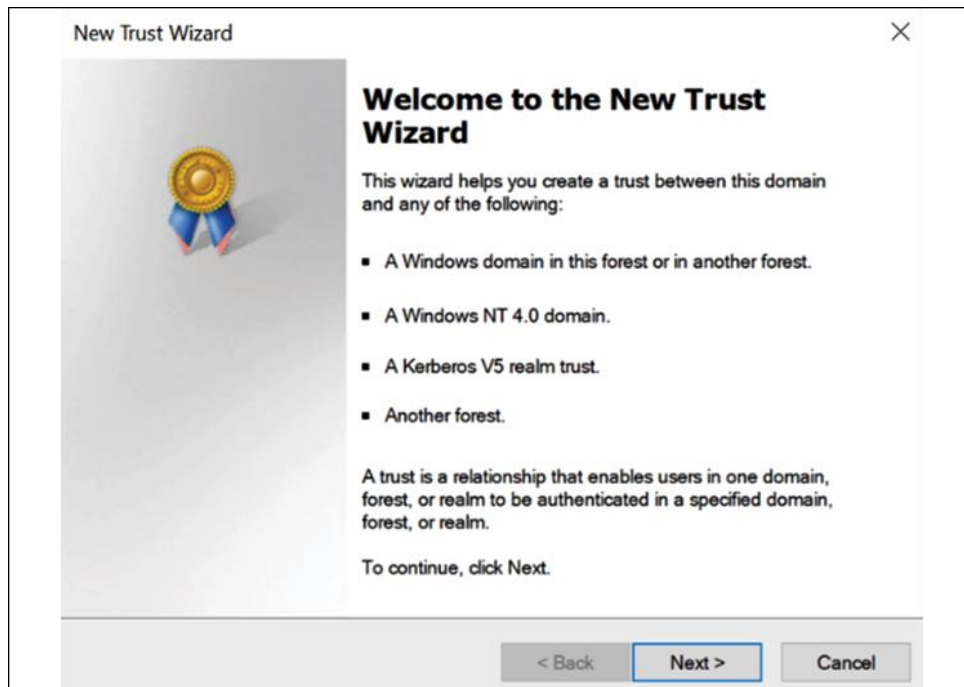


Figure 12.6: New Trust Wizard

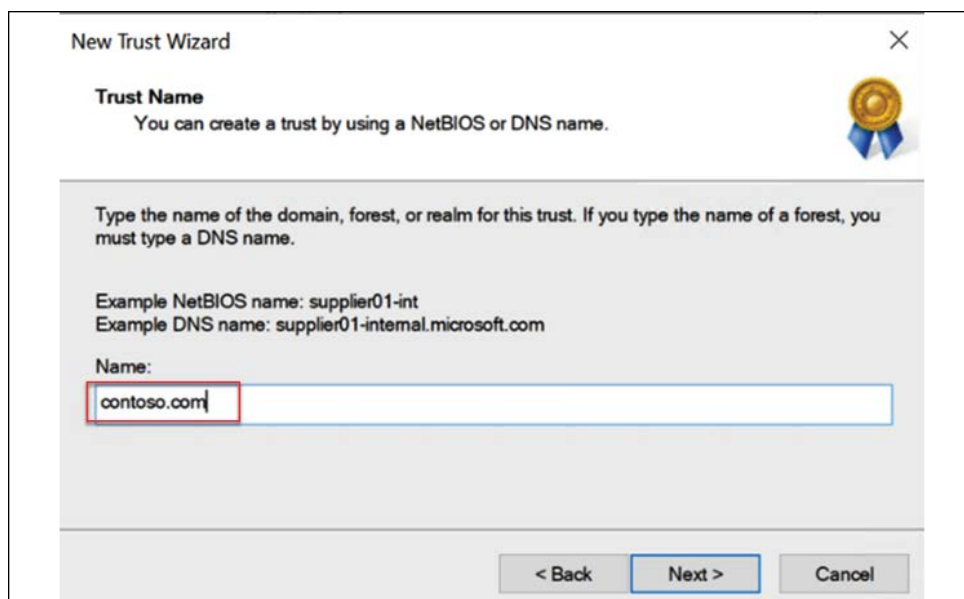


Figure 12.7: Remote Domain Name

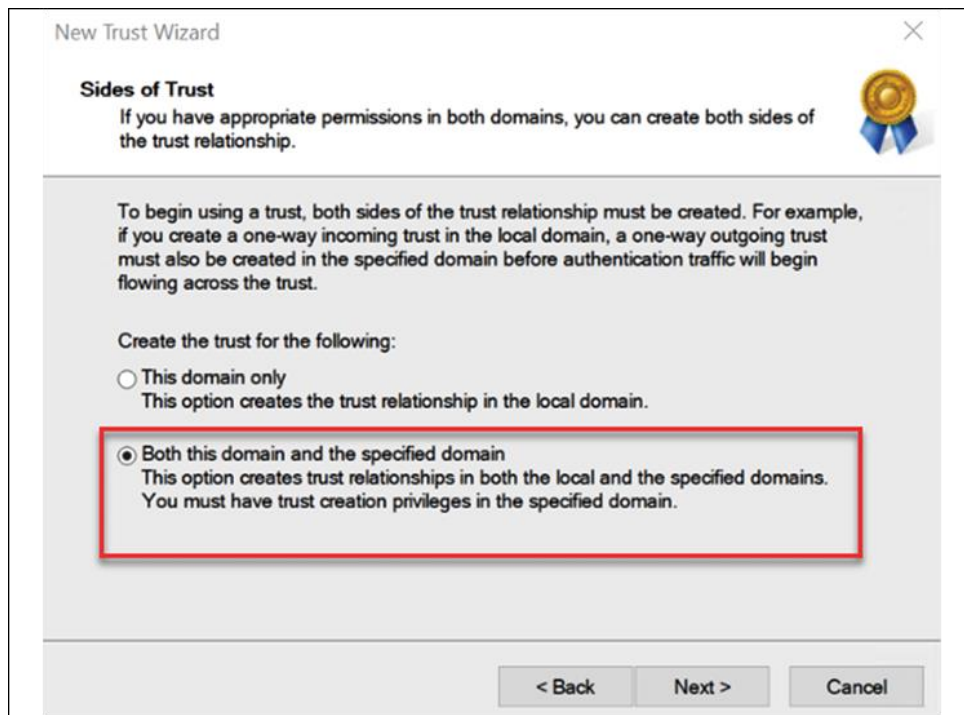


Figure 12.8: Create a trust on both sides

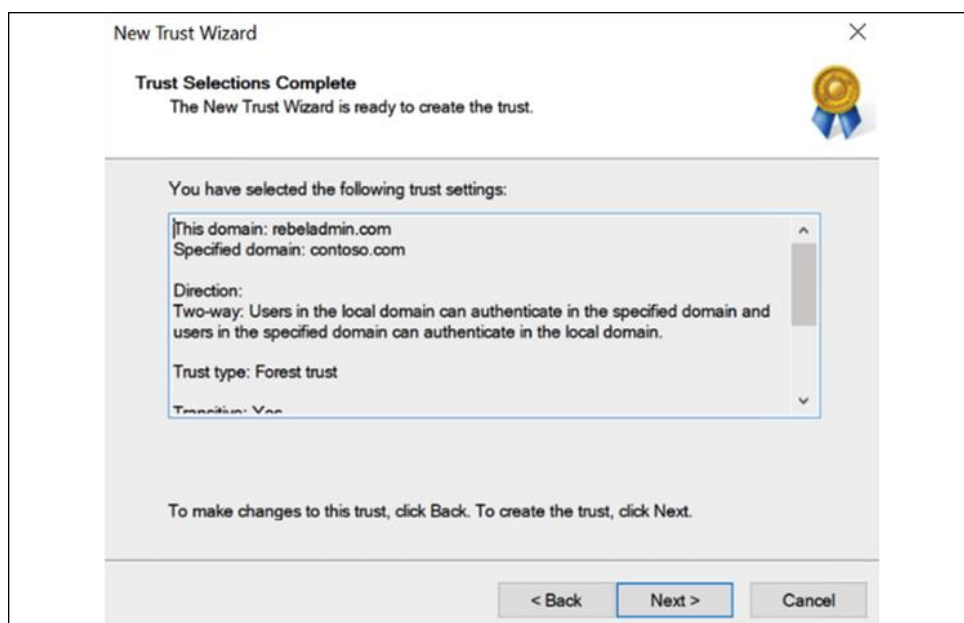


Figure 12.9: Verify Trust configuration

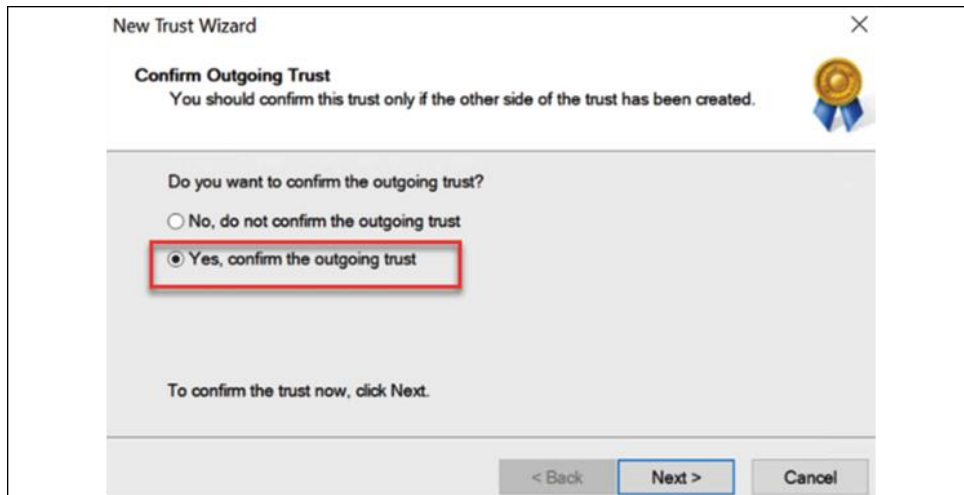


Figure 12.10: Confirm outgoing trust

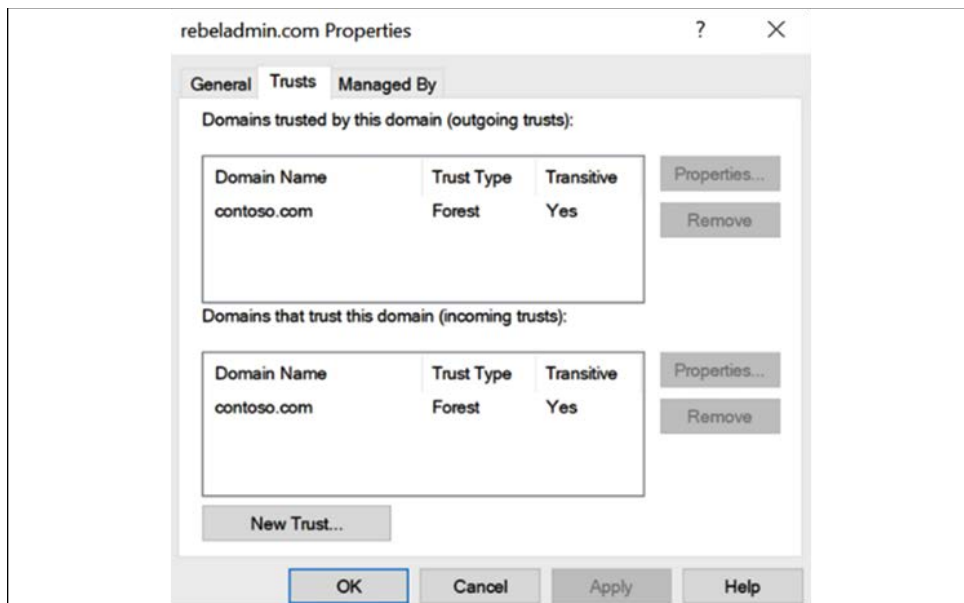


Figure 12.11: Trust details – rebeladmin.com

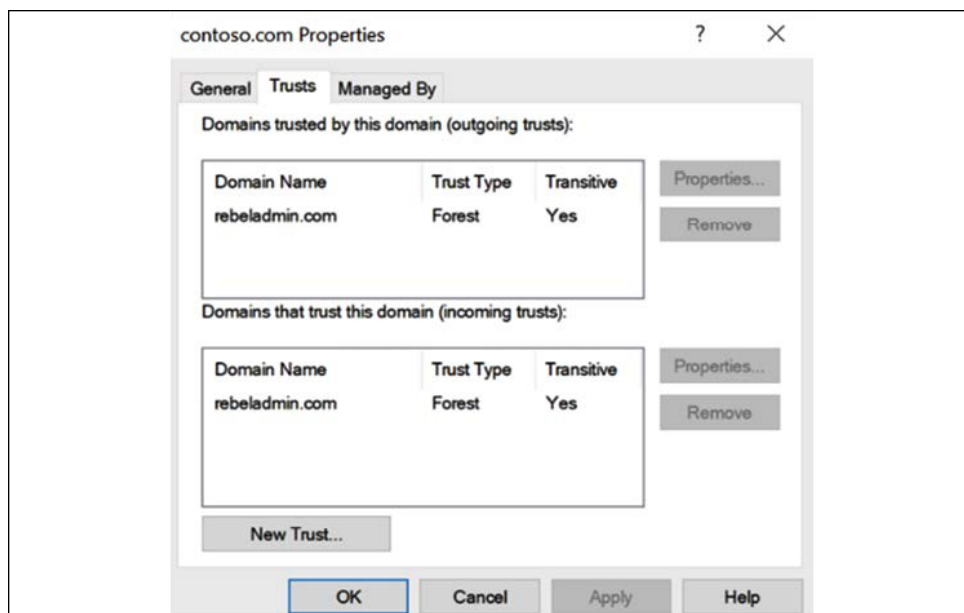


Figure 12.12: Trust details – contoso.com

```
Administrator: C:\Program Files\PowerShell7\powershell.exe
PowerShell 7.1.3
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Windows\System32> Get-ADUser -Server DC01.contoso.com -Filter * -SearchBase "OU=Test,DC=CONTOSO,DC=COM"

DistinguishedName : CN=usersa,OU=Test,DC=contoso,DC=com
Enabled            : True
GivenName         : usersa
Name              : usersa
ObjectClass       : user
ObjectGUID        : 198e7347-9362-481f-a826-15d8d4445167
SamAccountName    : usersa
SID               : S-1-5-21-1797065658-1832406859-3879835726-1602
Surname           :
UserPrincipalName : usersa@contoso.com

PS C:\Windows\System32>
```

Figure 12.13: Active Directory User Query – contoso.com

```
PS C:\Windows\System32> Get-ADUser -Server DC01.rebeladmin.com -Filter * -SearchBase "OU=Sales,DC=rebeladmin,DC=com"

DistinguishedName : CN=salesa,OU=Sales,DC=rebeladmin,DC=com
Enabled           : True
GivenName        : salesa
Name             : salesa
ObjectClass      : user
ObjectGUID       : 814ffd11-b6a6-486f-91aa-2ef798f976c1
SamAccountName   : salesa
SID              : S-1-5-21-4070376937-2589962512-1042476643-3601
Surname          :
UserPrincipalName : salesa@rebeladmin.com
```

Figure 12.14: Active Directory User Query – rebeladmin.com



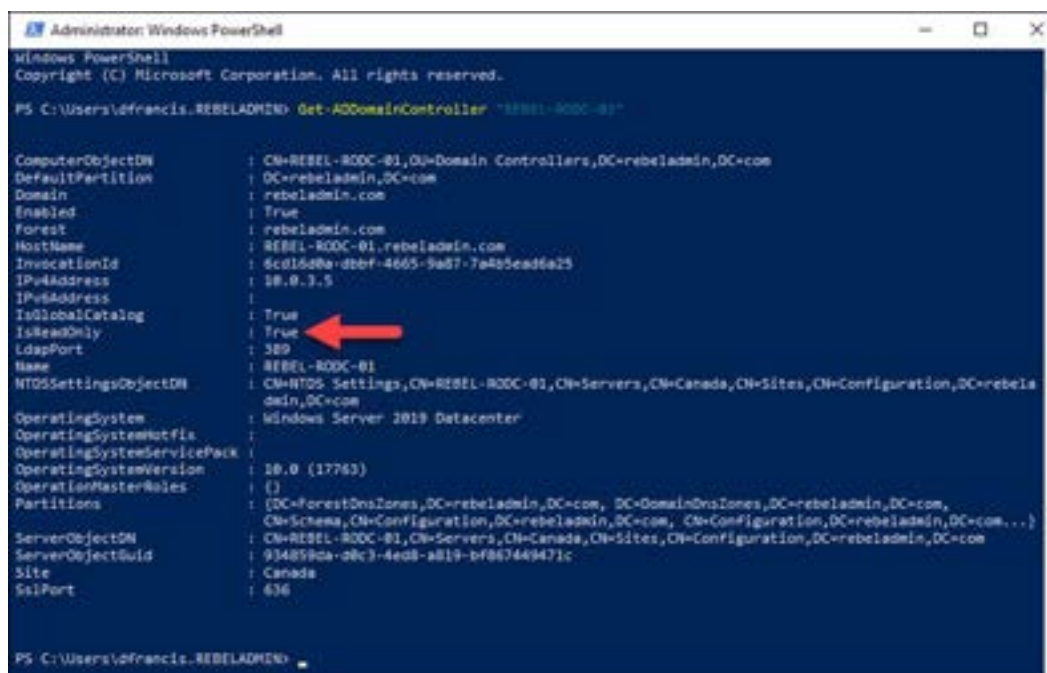
```

PS C:\Windows\System32> hostname
DC01
PS C:\Windows\System32> Get-ADDomain contoso.com

AllowedDNSSuffixes      : {}
ChildDomains            : {}
ComputersContainer      : CN=Computers,DC=contoso,DC=com
DeletedObjectsContainer : CN=Deleted Objects,DC=contoso,DC=com
DistinguishedName       : DC=contoso,DC=com
DNSRoot                 : contoso.com
DomainControllersContainer : OU=Domain Controllers,DC=contoso,DC=com
DomainMode              : Windows2016Domain
DomainSID               : S-1-5-21-1797065658-1832406859-3879835726
ForeignSecurityPrincipalsContainer : CN=ForeignSecurityPrincipals,DC=contoso,DC=com
Forest                  : contoso.com
InfrastructureMaster     : CON-DC01.contoso.com
LastLogonReplicationInterval :
LinkedGroupPolicyObjects : {CN={31B2F340-016D-11D2-945F-00C04FB984F9},CN=Policies,CN=System,DC=contoso,DC=com}
LostAndFoundContainer    : CN=LostAndFound,DC=contoso,DC=com
ManagedBy               :
Name                     : contoso
NetBIOSName              : CONTOSO
ObjectClass              : domainDNS
ObjectGUID              : bcb8dfca-26c5-4a54-bf16-37ef2e282473
ParentDomain             :
PDCEmulator              : CON-DC01.contoso.com
PublicKeyRequiredPasswordRolling : True
QuotasContainer          : CN=NTDS Quotas,DC=contoso,DC=com
ReadOnlyReplicaDirectoryServers : {}
ReplicaDirectoryServers  : {CON-DC01.contoso.com}
RIDMaster                : CON-DC01.contoso.com
SubordinateReferences    : {DC=ForestDnsZones,DC=contoso,DC=com, DC=DomainDnsZones,DC=contoso,DC=com, CN=Configuration,DC=contoso,DC=com}
SystemsContainer         : CN=System,DC=contoso,DC=com
UsersContainer           : CN=Users,DC=contoso,DC=com

```

Figure 12.15: Active Directory Domain Query – contoso.com



```

Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\francis.REBELADMIN> Get-ADDomainController "REBEL-RODC-01"

ComputerObjectDN      : CN=REBEL-RODC-01,OU=Domain Controllers,DC=rebeladmin,DC=com
DefaultPartition      : DC=rebeladmin,DC=com
Domain                : rebeladmin.com
Enabled               : True
Forest                : rebeladmin.com
HostName              : REBEL-RODC-01.rebeladmin.com
InvocationId          : 6c016d0e-dbbf-4665-9a87-7a4b5ead6a25
IPv4Address            : 10.0.3.5
IPv6Address           :
IsGlobalCatalog       : True
IsReadOnly            : True
LdapPort              : 389
Name                  : REBEL-RODC-01
NTDSSettingsObjectDN  : CN=NTDS Settings,CN=REBEL-RODC-01,CN=Servers,CN=Canada,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com
OperatingSystem        : Windows Server 2019 Datacenter
OperatingSystemHotfix  :
OperatingSystemServicePack :
OperatingSystemVersion : 10.0 (17763)
OperationMasterRoles   : {}
Partitions             : {DC=ForestDnsZones,DC=rebeladmin,DC=com, DC=DomainDnsZones,DC=rebeladmin,DC=com, CN=Schema,CN=Configuration,DC=rebeladmin,DC=com, CN=Configuration,DC=rebeladmin,DC=com...}
ServerObjectDN         : CN=REBEL-RODC-01,CN=Servers,CN=Canada,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com
ServerObjectGuid       : 934859ca-08c3-4e08-ab19-bf8674a9471c
Site                   : Canada
SslPort               : 636

```

Figure 12.16: RODC Settings



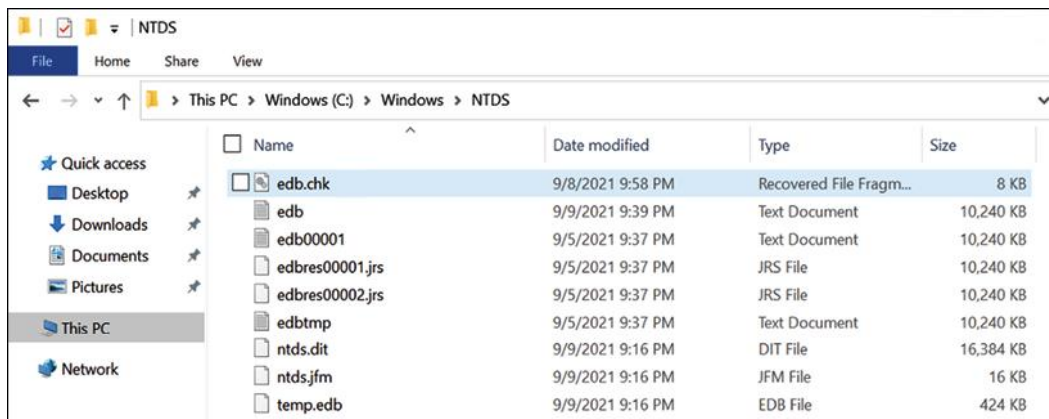


Figure 12.17: NTDS Folder

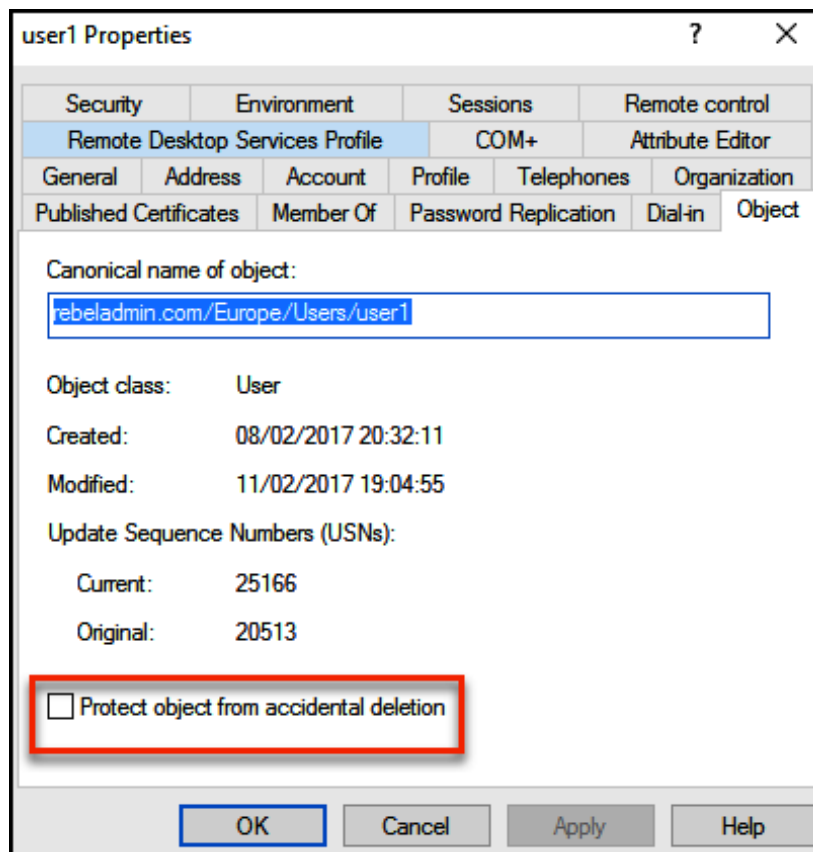


Figure 12.18: Protect objects from accidental deletion



Figure 12.19: Error Message – Protected Object



Figure 12.20: Deleted Active Directory Object

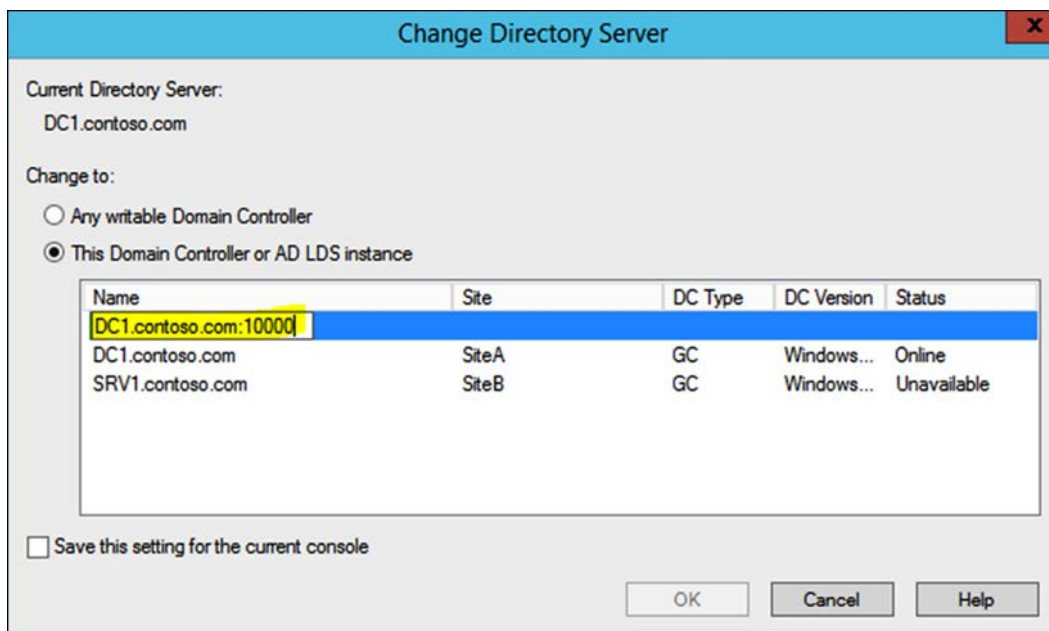


Figure 12.21: Connecting to Snapshot

## Tables

| Service              | Ports                  |
|----------------------|------------------------|
| LDAP                 | TCP 389                |
| LDAPS (SSL)          | TCP 636                |
| DNS                  | TCP/UDP 53             |
| RPC                  | TCP 135 TCP 1024-65535 |
| SMB                  | TCP 445                |
| Kerberos             | TCP/UDP 88             |
| Global Catalog       | TCP 3268               |
| Global Catalog (SSL) | TCP 3269               |

**Table 12.1 – Firewall ports**

| Domain         | Domain Controller    | IP Address  |
|----------------|----------------------|-------------|
| rebeladmin.com | DC01.rebeladmin.com  | 10.1.0.4/24 |
| contoso.com    | CON-DC01.contoso.com | 10.1.5.4/24 |

**Table 12.2 – IP address configuration of forests in domain environment**

## Commands

### Command 12.1

```
Add-DnsServerConditionalForwarderZone -Name "contoso.com" -  
ReplicationScope "Forest" -MasterServers 10.1.5.4
```

### Command 12.2

```
Add-DnsServerConditionalForwarderZone -Name "rebeladmin.com" -  
ReplicationScope "Forest" -MasterServers 10.1.0.4
```

### Command 12.3

```
Get-ADUser -Server CON-DC01.contoso.com -Filter * -SearchBase  
"OU=Test,DC=CONTOSO,DC=COM"
```

### Command 12.4

```
Get-ADDomain contoso.com
```

#### Command 12.5

```
Install-WindowsFeature -Name AD-Domain-Services -  
IncludeManagementTools
```

#### Command 12.6

```
Import-Module ADDSDeployment  
Install-ADDSDomainController `  
-Credential (Get-Credential) `  
-CriticalReplicationOnly:$false `  
-DatabasePath "C:\Windows\NTDS" `  
-DomainName "rebeladmin.com" `  
-LogPath "C:\Windows\NTDS" `  
-ReplicationSourceDC "REBEL-PDC-01.rebeladmin.com" `  
-SYSVOLPath "C:\Windows\SYSVOL" `  
-UseExistingAccount:$true `  
-Norebootoncompletion:$false  
-Force:$true
```

#### Command 12.7

```
Get-ADDomainControllerPasswordReplicationPolicy -Identity REBEL-RODC-  
01 -Allowed
```

#### Command 12.8

```
Get-ADDomainControllerPasswordReplicationPolicy -Identity REBEL-RODC-  
01 -Denied
```

#### Command 12.9

```
Add-ADDomainControllerPasswordReplicationPolicy -Identity REBEL-RODC-  
01 -AllowedList "user1"
```

#### Command 12.10

The following command will add the user object named user2 to the Denied list:

```
Add-ADDomainControllerPasswordReplicationPolicy -Identity REBEL-RODC-  
01 -DeniedList "user2"
```

#### Command 12.11

The database and log files cannot be moved while AD DS is running. Therefore, the first step of the action is to stop the service:

```
net stop ntds
```

#### Command 12.12

In my demonstration, I will move it to a folder called ADDB in a different partition:

```
ntdsutil  
activate instance ntds  
files  
move db to E:\ADDB  
move logs to E:\ADDB  
integrityquit  
quit
```

#### Command 12.13

Once it's completed, we need to start AD DS using the following command:

```
net start ntds
```

#### Command 12.14

Once the service stops (net stop ntds), we can run the defragmentation using the following commands:

```
Ntdsutil  
activate instance ntds  
files  
compact to E:\CompactDB  
quit  
quit
```

#### Command 12.15

Once this is completed, the compact database should be copied to the original ntds.dit location. This can be done by using the following command:

```
copy "E:\CompactDB\ntds.dit" "E:\ADDB\ntds.dit"
```

After that, we also need to delete the old log file:

```
del E:\ADDB\*.log
```

### Command 12.16

The AD Recycle Bin feature requires a minimum of a Windows Server 2008 R2 domain and a forest functional level. Once this feature is enabled, it cannot be disabled. This feature can be enabled using the following command:

```
Enable-ADOptionalFeature 'Recycle Bin Feature' -Scope  
ForestOrConfigurationSet -Target rebeladmin.com
```

In the preceding command, -Target can be changed with your domain name.

### Command 12.17

Once Recycle Bin Feature is enabled, we can revive the objects that have been deleted using the following command:

```
Get-ADObject -filter 'isdeleted -eq $true' -includeDeletedObjects
```

The preceding command searches for the objects where the isdeleted attributes are set to true.

### Command 12.18

Now, we know the deleted object and it can be restored using the following command:

```
Get-ADObject -Filter 'samaccountname -eq "dfrancis"' -  
IncludeDeletedObjects | Restore-ADObject
```

The preceding command restores the user object, dfrancis.

### Command 12.19

We can create the AD DS snapshot using ntdsutil. In order to run this, we need to have domain administrator privileges:

```
Ntdsutil  
Snapshot  
activate instance ntds  
create  
quit  
quit
```

### Command 12.20

Now, we have a snapshot, and at a later time, it can be mounted. To mount it, we need to use the following command:

```
Ntdsutil
Snapshot
activate instance ntds
list all
mount 1
quit
quit
```

The preceding command mounts a snapshot called 1 from the list, which is listed under the given mount points.

#### Command 12.21

The next step is to mount the snapshot, which can be done using the following command:

```
dsamain -dbpath C:$SNAP_201703152333_VOLUMEE$ADDBntds.dit -ldapport
10000
```

In the preceding command, `-dbpath` defines the AD DS database path, and `-ldapport` defines the port used for the snapshot. It can be any available TCP port.

#### Command 12.22

Once the snapshot is mounted, we can connect to it using the server's name and the LDAP port, 10000. Once the work is finished, it needs to be unmounted as well. To do that, we can use the following command:

```
Ntdsutil
Snapshot
activate instance ntds
list all
unmount 1
quit
quit
```

#### Command 12.23

The first step to proceed with configuration is to install the Windows backup feature in the Active Directory server:

```
Install-WindowsFeature -Name Windows-Server-Backup -
IncludeAllSubFeature
```

#### Command 12.24

Next, let's create a backup policy using the following command:

```
$BKPolicy = New-WBPolicy
```

#### **Command 12.25**

Then, let's go ahead and add a system state to the policy:

```
Add-WBSystemState -Policy $BKPolicy
```

#### **Command 12.26**

It also needs the backup volume path:

```
$Bkpath = New-WBBackupTarget -VolumePath "F:"
```

#### **Command 12.27**

Now, we need to map the policy with the path:

```
Add-WBBackupTarget -Policy $BKPolicy -Target $Bkpath
```

#### **Command 12.28**

Finally, we can run the backup using the following command:

```
Start-WBBackup -Policy $BKPolicy
```

#### **Command 12.29**

Once it's loaded in safe mode, we can use the following commands:

```
$ADBackup = Get-WBBackupSet | select -Last 1 Start-  
WBSystemStateRecovery -BackupSet $ADBackup
```

This will restore the most recent backup the system has taken.

## Chapter 13



## Figures

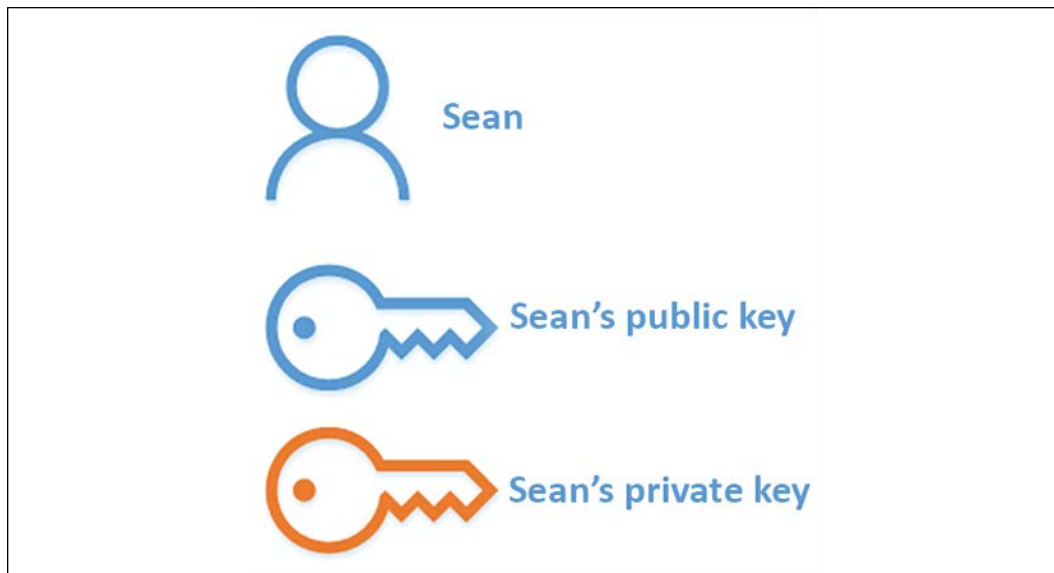


Figure 13.1: A user's key pair

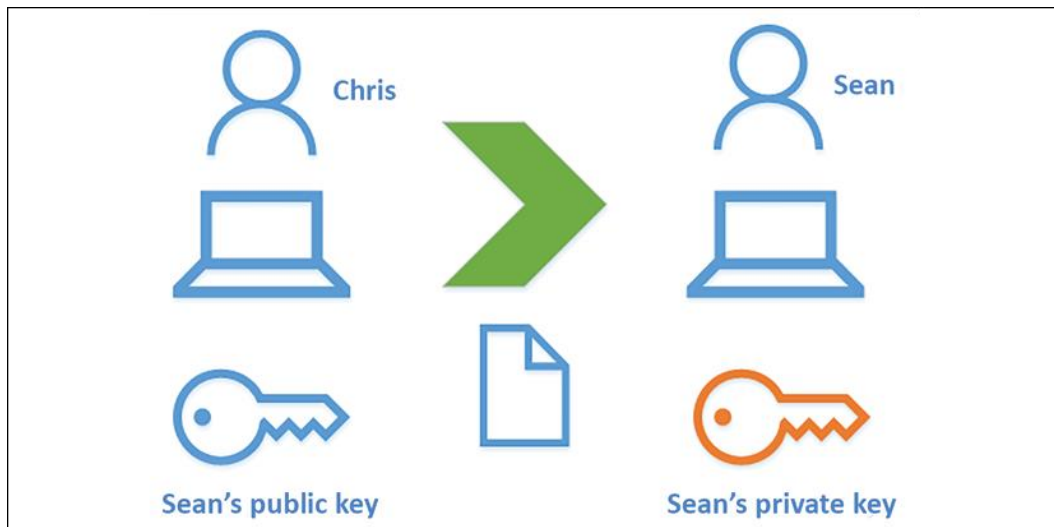


Figure 13.2: Digital encryption example

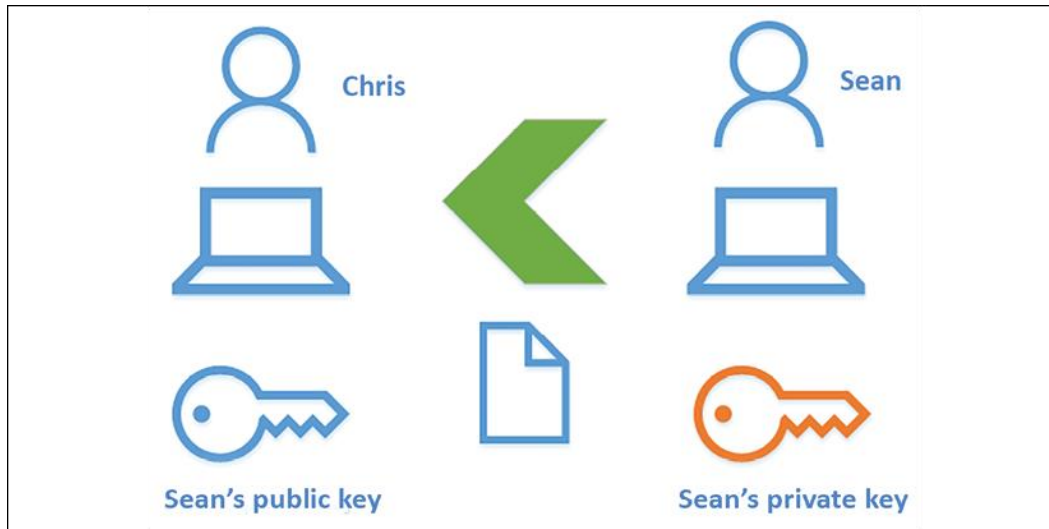


Figure 13.3: Digital signature example

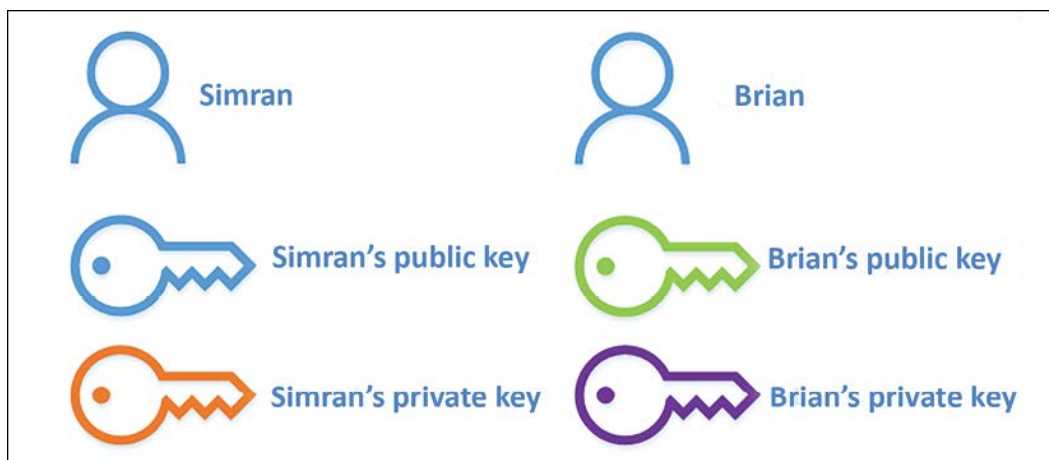


Figure 13.4: An example of key usage

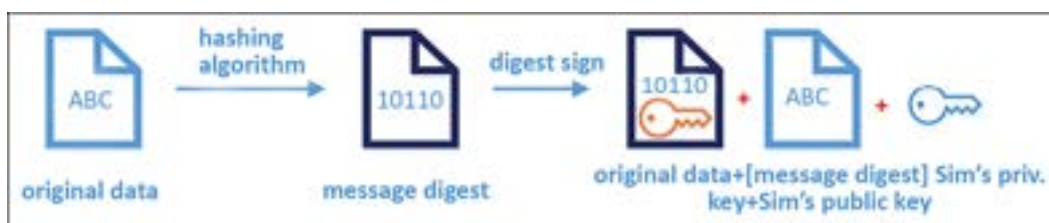


Figure 13.5: Data signing

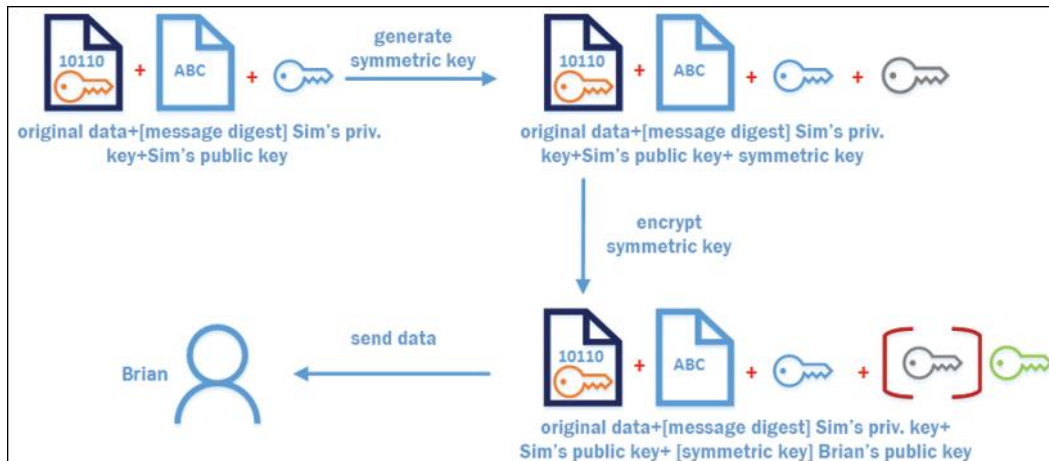


Figure 13.6: Data encryption

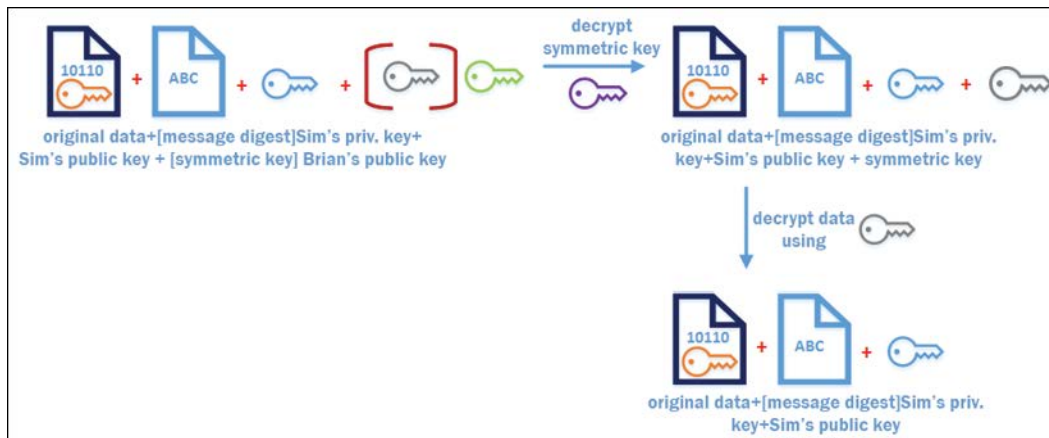


Figure 13.7: Data decryption

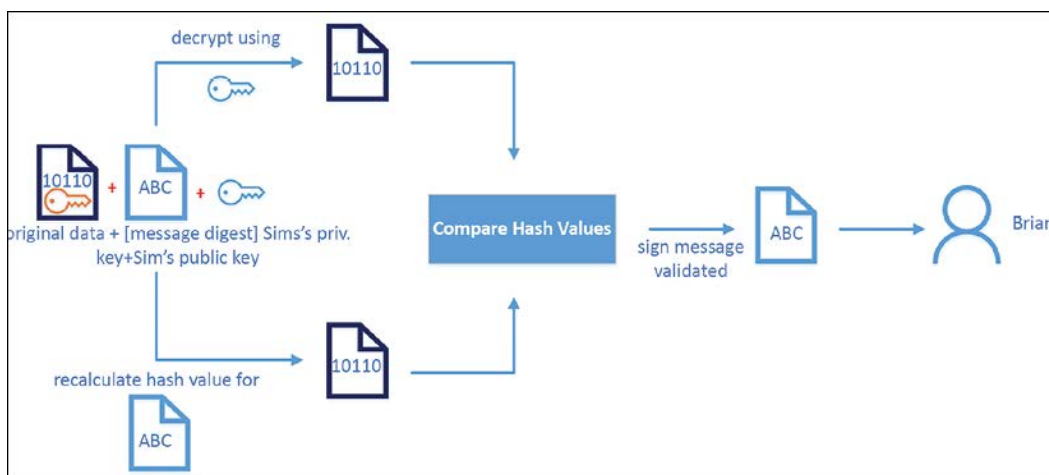


Figure 13.8: Verifying a signature

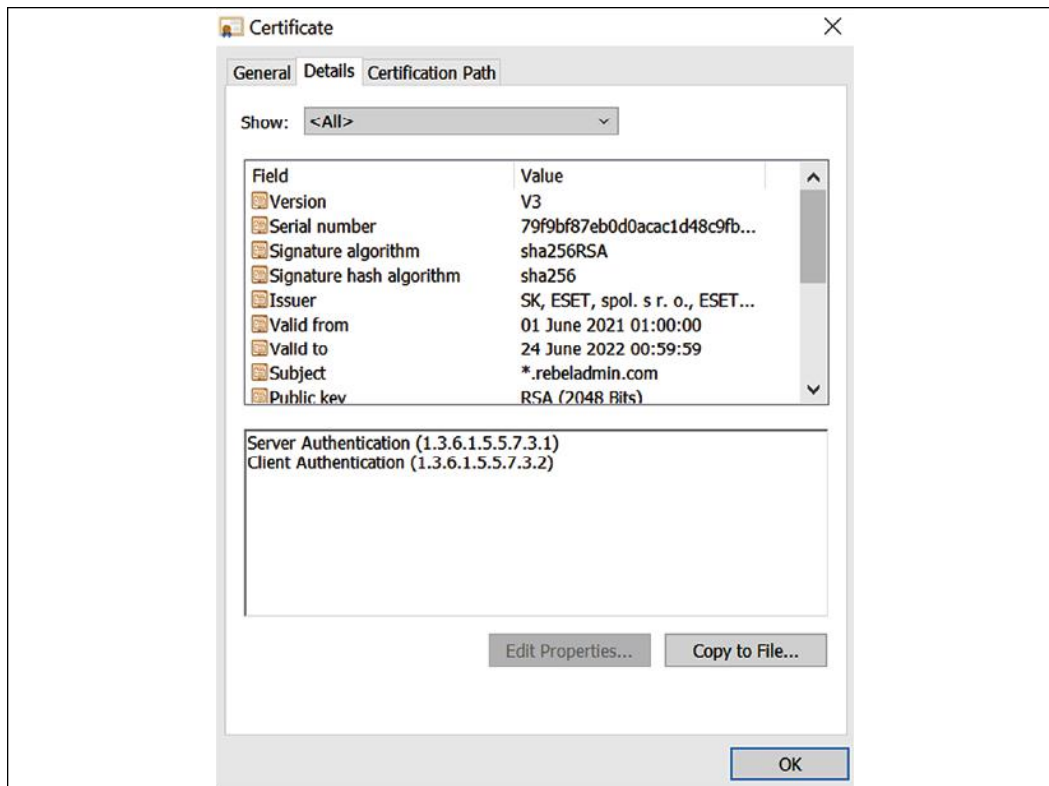


Figure 13.9: Sample certificate

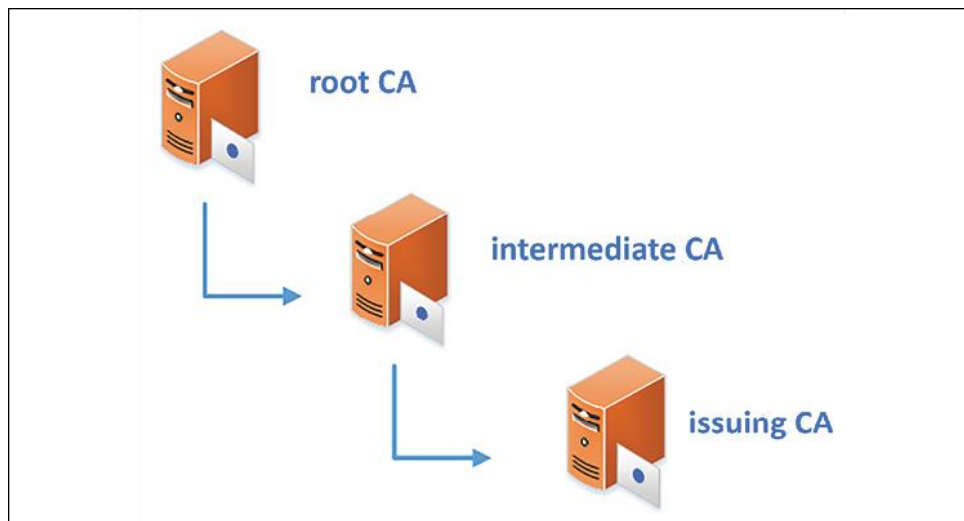


Figure 13.10: CA hierarchy



Figure 13.11: Single-tier model

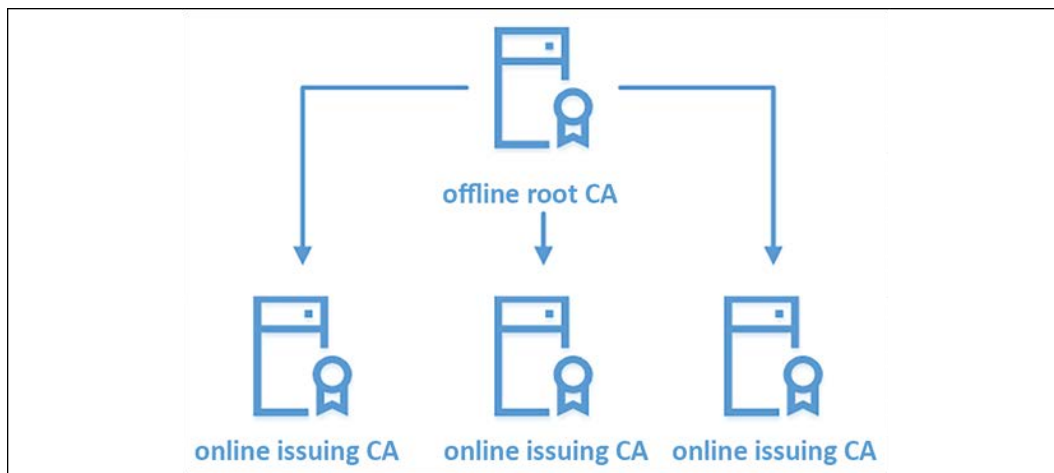


Figure 13.12: Two-tier model

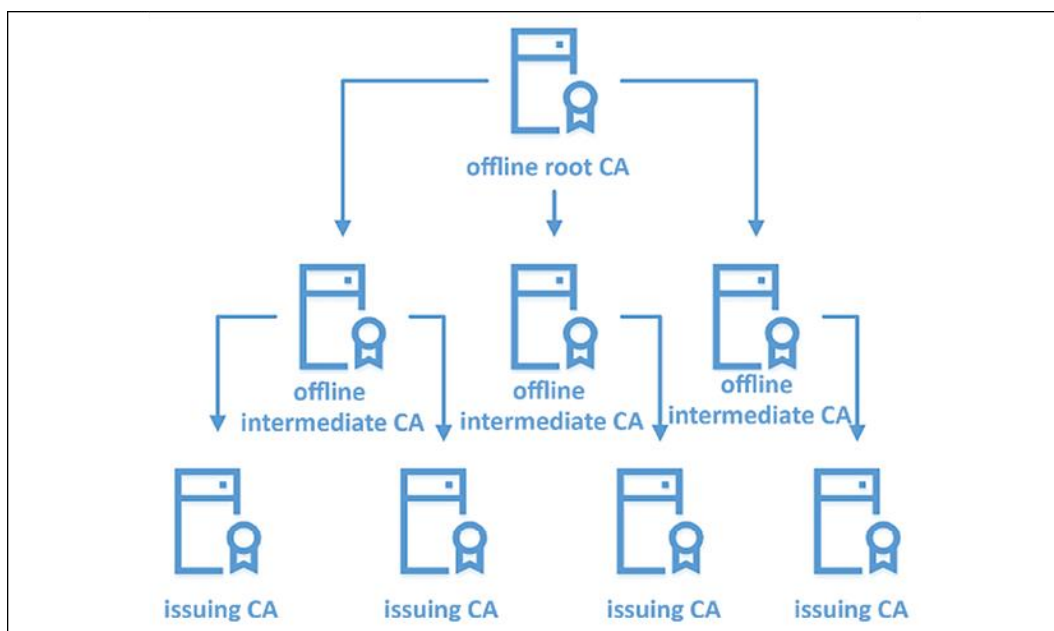


Figure 13.13: Three-tier model

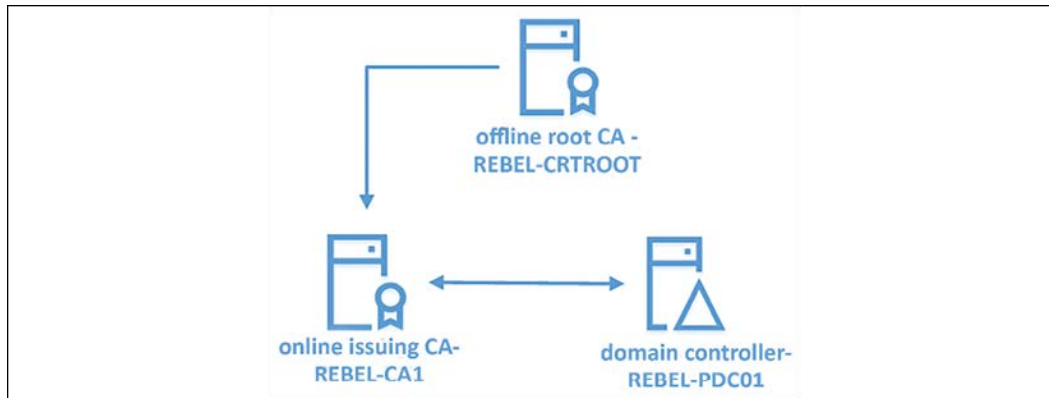


Figure 13.14: Planned PKI setup

```

PS C:\Users\dfrancis> Install-AdcsCertificationAuthority -CACommonName "REBELAdmin Root CA" -CAType StandaloneRootCA -CryptoProviderName "RSA#Microsoft Software Key Storage Provider" -HashAlgorithmName SHA256 -KeyLength 2048 -ValidityPeriodYears -ValidityPeriodUnits 20

Confirm
Are you sure you want to perform this action?
Performing the operation "Install-AdcsCertificationAuthority" on target "REBEL-CRTRoot".
[Y] Yes [A] Yes to All [N] No [L] No to All [?] Help (default is "Y"): A

RunspaceId : cc73471e-a2d8-4756-a194-d50383e01d84
ErrorId    : 0
ErrorString :
  
```

Figure 13.15: Configuring an AD CS role

```

PS C:\Windows\System32\CertSrv\CertEnroll> dir

Directory: C:\Windows\System32\CertSrv\CertEnroll

Mode                LastWriteTime         Length Name
----                -
-a---             5/28/2021 11:28 PM           694 REBELAdmin Root CA.crl
-a---             5/28/2021 11:13 PM           793 REBEL-CRTRoot_REBELAdmin Root CA.crt

PS C:\Windows\System32\CertSrv\CertEnroll>
  
```

Figure 13.18: Root certificate and CRL

```
Administrator: C:\Program Files\PowerShell\7\powershell.exe
PowerShell 7.1.4
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Windows\System32> cd c:/
PS C:\> certutil -f -dsPublish "REBEL-CTR00T_REBELAdmin Root CA.crt" RootCA
ldap:///CN=REBELAdmin Root CA,CN=Certification Authorities,CN=Public Key Services,CN=Services,CN=Configuration,DC=rebelad
min,DC=com/certificate

Certificate added to DS store.

ldap:///CN=REBELAdmin Root CA,CN=CAIA,CN=Public Key Services,CN=Services,CN=Configuration,DC=rebeladmin,DC=com/certificate

Certificate added to DS store.

CertUtil: -dsPublish command completed successfully.
PS C:\>
```

Figure 13.19: Publishing the root CA data

```
Administrator: C:\Program Files\PowerShell\7\powershell.exe
Type 'help' to get help.

PS C:\Windows\System32> Add-WindowsFeature AD-DC-Cert-Authority -IncludeManagementTools

Success Restart Needed Exit Code      Feature Result
-----
True      No          Success      {Active Directory Certificate Services, Cert-

PS C:\Windows\System32> Install-ADCS CertificationAuthority -CACommonName "REBELAdmin IssuingCA" -CAType EnterpriseSubord
inateCA -CryptoProviderName "Microsoft Software Key Storage Provider" -HashAlgorithmName SHA256 -KeyLength 2048

Confirm
Are you sure you want to perform this action?
Performing the operation "Install-ADCS CertificationAuthority" on target "DC21".
[Y] Yes  [A] Yes to All  [N] No  [L] No to All  [?] Help (default is "Y"): A
WARNING: The Active Directory Certificate Services installation is incomplete. To complete the installation, use the req
uest file "C:\DC21.rebeladmin.com_REBELAdmin IssuingCA.req" to obtain a certificate from the parent CA. Then, use the Ce
rtification Authority snap-in to install the certificate. To complete this procedure, right-click the node with the name
of the CA, and then click Install CA Certificate. The operation completed successfully. 0x0 (HRESULT: 0)

RunspaceId : 84254b4e-bd45-43a6-ae16-3fd28c7ae5b
ErrorId     : 388
ErrorString : The Active Directory Certificate Services installation is incomplete. To complete the installation, use
the request file "C:\DC21.rebeladmin.com_REBELAdmin IssuingCA.req" to obtain a certificate from the parent CA. Then, use the Certification Authority snap-in to install the certificate. To complete this
procedure, right-click the node with the name of the CA, and then click Install CA Certificate. The
operation completed successfully. 0x0 (HRESULT: 0)
```

Figure 13.20: Issuing CA role configuration

| pkiview - [Enterprise PKI\REBELAdmin Root CA (V0.0)] |        |                    |  |
|--|--------|--------------------|--|
| File Action View Help                                |        |                    |  |
|  |        |                    |  |
| Enterprise PKI                                       |        |                    |  |
| > REBELAdmin Root CA (V0.0)                          |        |                    |  |
| Name   | Status | Expiration Date    |  |
| REBELAdmin IssuingCA (V0.0)                          | OK     |                    |  |
| CA Certificate                                       | OK     | 5/28/2041 11:12 PM |  |
| CA Location #1                                       | OK     | 5/28/2041 11:12 PM |  |
| CA Location #2                                       | OK     | 5/28/2041 11:12 PM |  |
| CDP Location #1                                      | OK     | 8/28/2021 11:38 AM |  |
| CDP Location #2                                      | OK     | 8/28/2021 11:38 AM |  |

Figure 13.21: PKIView



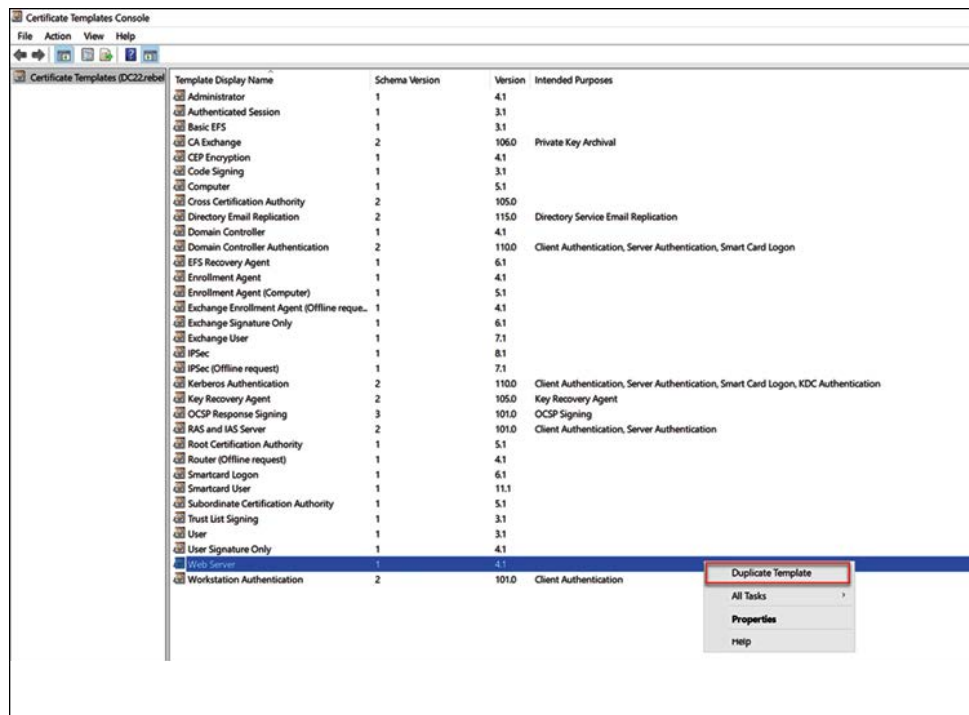


Figure 13.22: Duplicate certificate template

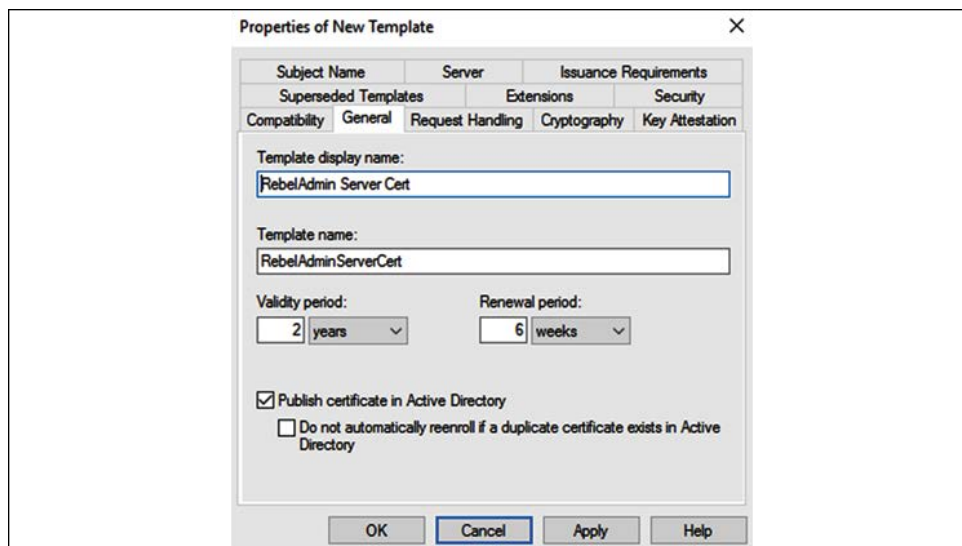


Figure 13.23: Properties of the new template



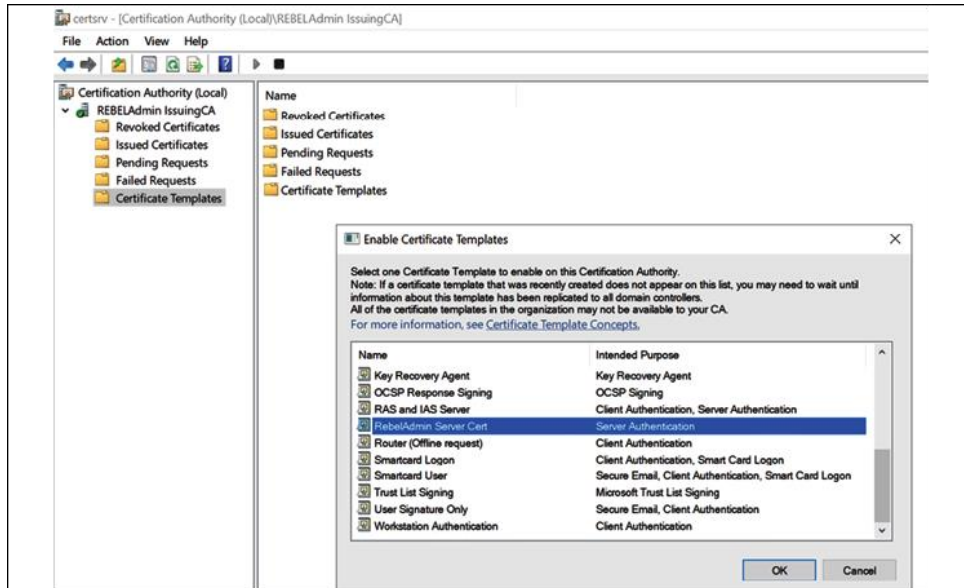


Figure 13.24: Publishing a new template



Figure 13.25: Requesting a new template

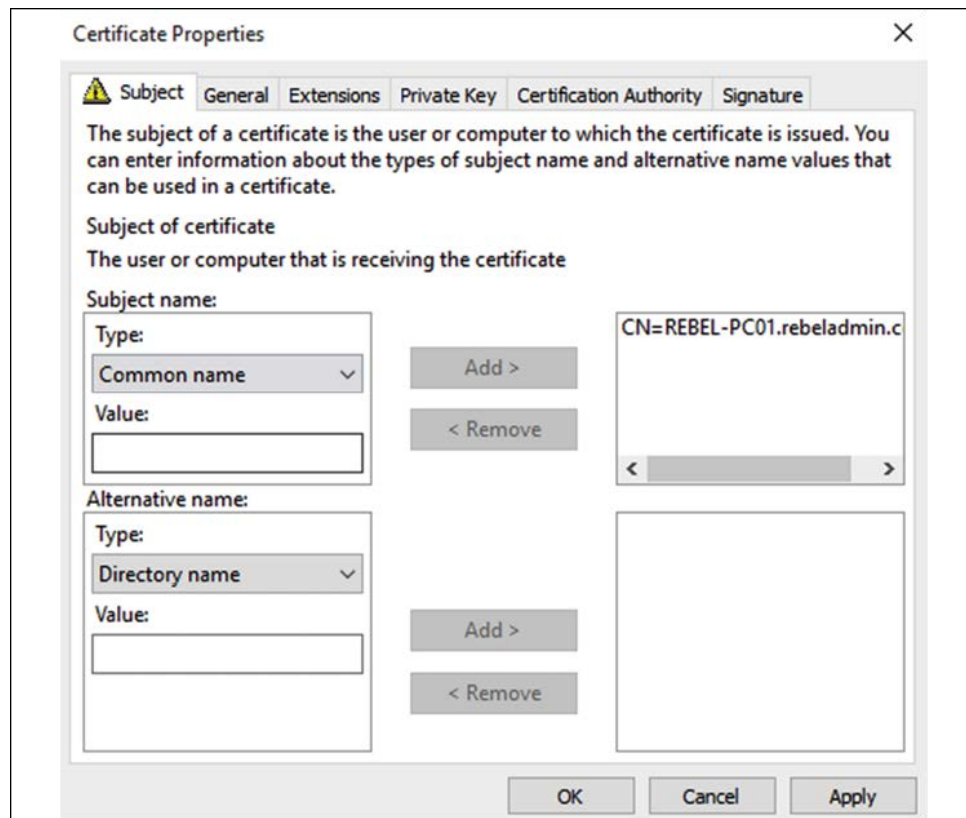


Figure 13.26: Additional information for the certificate request

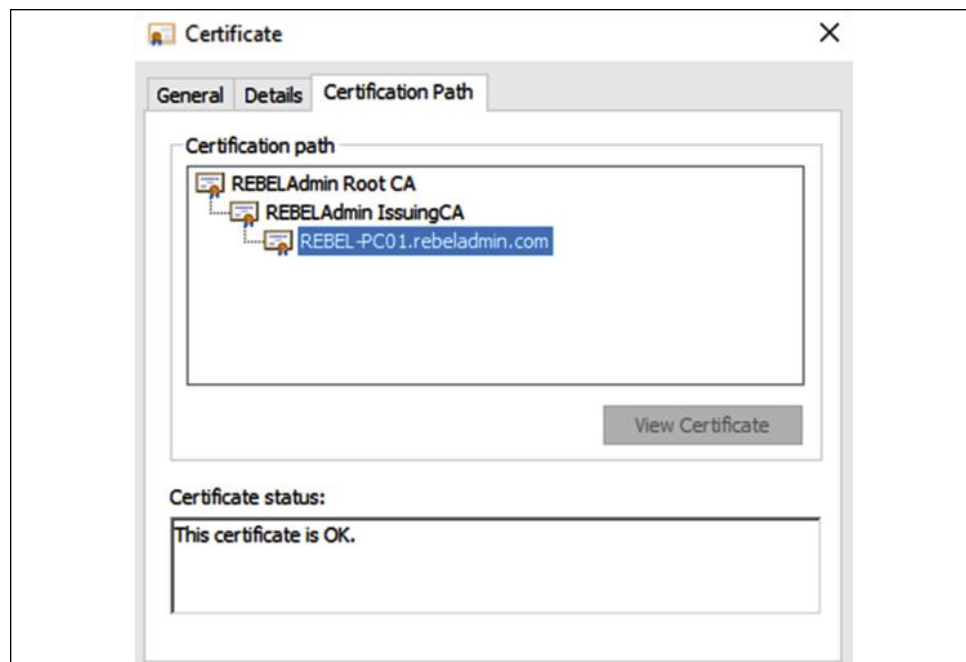
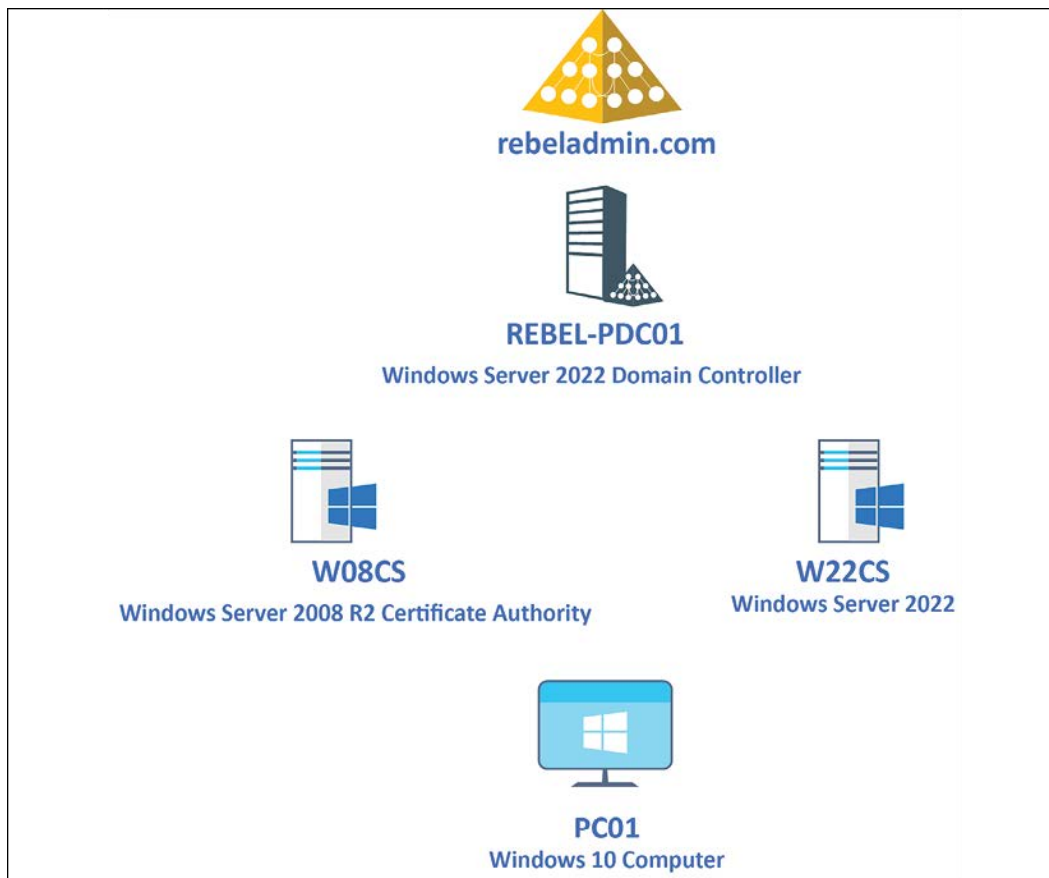


Figure 13.27: Certification path



**Figure 13.28: Demo environment**

```

Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2009 Microsoft Corporation. All rights reserved.

PS C:\Users\dfrancis.REBELADMIN> certutil -backup C:\CABackup
Enter new password:
Confirm new password:
Backed up keys and certificates for W08CS.rebeladmin.com\REBELADMIN CA to C:\CABackup\REBELADMIN CA.p12.
Full database backup for W08CS.rebeladmin.com\REBELADMIN CA.
Backing up Database files: 100%
Backing up Log files: 100%
Truncating Logs: 100%
Backed up database to C:\CABackup.
Database logs successfully truncated.
CertUtil: -backup command completed successfully.
PS C:\Users\dfrancis.REBELADMIN>
  
```

**Figure 13.29: Backup CA configuration**

| <input type="checkbox"/> Name | Date modified     | Type                     | Size |
|-------------------------------|-------------------|--------------------------|------|
| Database                      | 9/13/2021 9:53 PM | File folder              |      |
| REBELAdmin IssuingCA          | 9/13/2021 9:53 PM | Personal Information ... | 4 KB |

**Figure 13.30: CA backup content**

```
PS C:\Users\df Francis.REBELADMIN> Install-AdcsCertificationAuthority -CAType EnterpriseRootCa -CertFile "C:\CA\Backup\REBELADMIN CA.p12" -CertFilePassword (read-host "Cert Password" -assecurestring)
Cert Password: *****

Confirm
Are you sure you want to perform this action?
Performing the operation "Install-AdcsCertificationAuthority" on target "WSKCS".
[y] Yes [A] Yes to All [N] No [L] No to All [?] help (default is "Y"): A

RunspaceId : b448b17b-43cd-4942-a5cc-e9b4853ff155
ErrorId : 0
ErrorMessage :
```

Figure 13.31: Configuring an AD CS role with the existing CA certificate

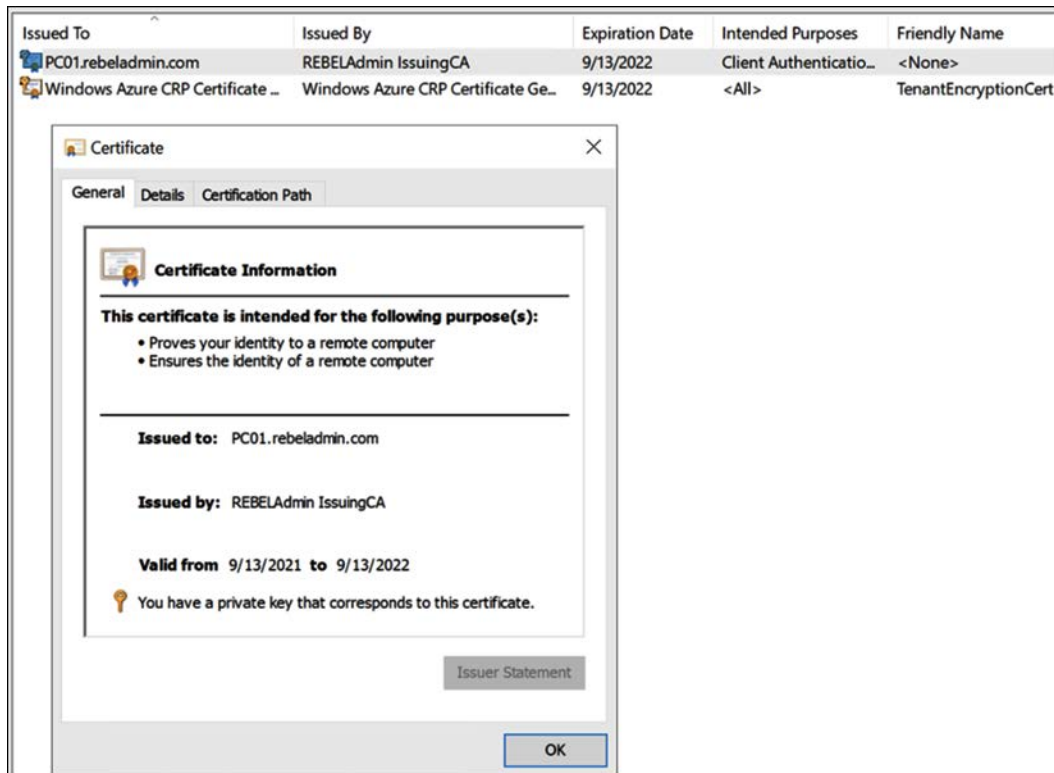


Figure 13.32: Existing certificate

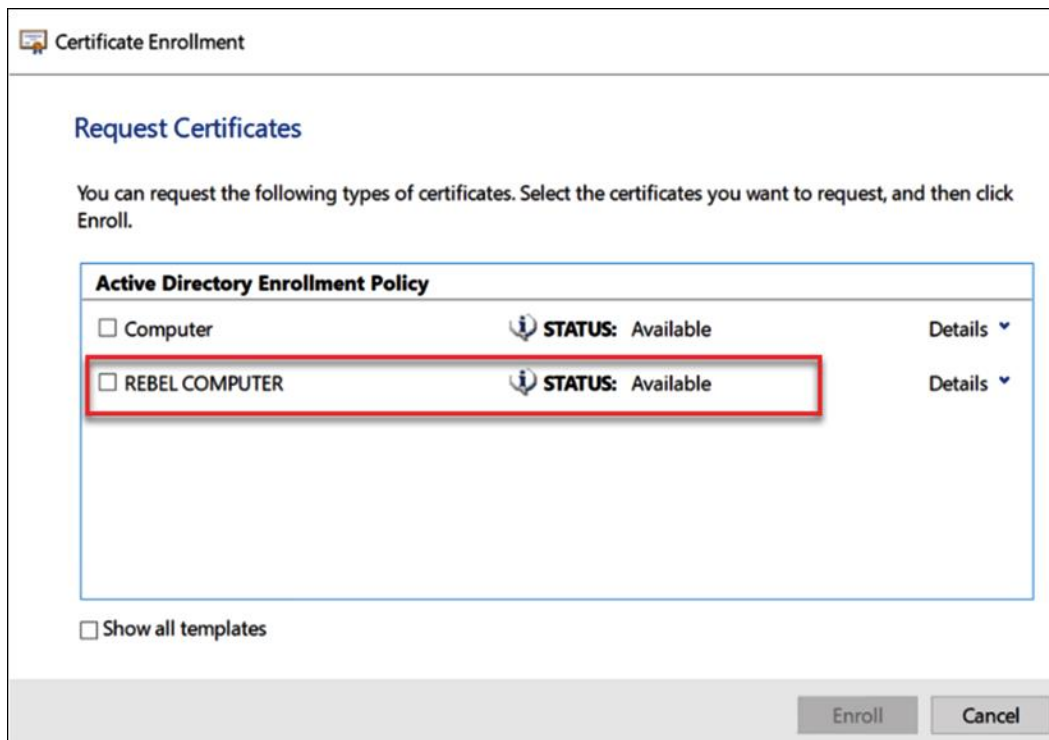


Figure 13.33: Requesting a new certificate

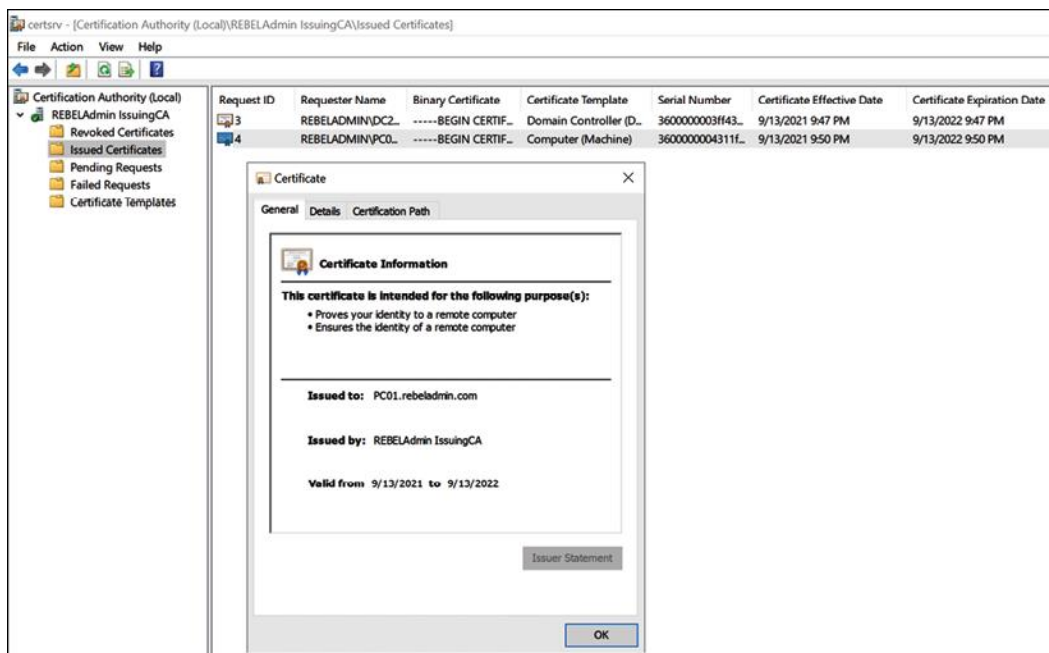


Figure 13.34: New certificate from the Windows Server 2022 CA

```

Administrator: PowerShell 7 (x64)
PowerShell 7.1.3
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\df Francis.REBELADMIN> Backup-CARoleService C:\CABackup
PS C:\Users\df Francis.REBELADMIN>

```

Figure 13.35: Backup CA configuration

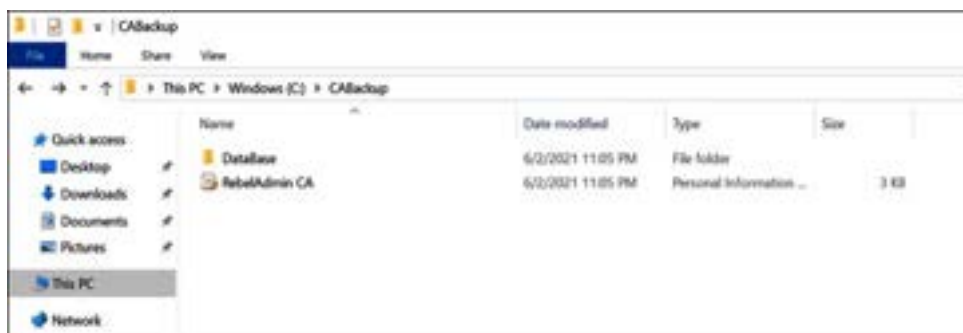


Figure 13.36: File in the CABackup location

## Tables

| Feature                                      | Standalone CA   | Enterprise CA                            |
|--|---|--|
| AD DS dependency                             | Does not depend on AD DS; can be installed on a member server or standalone server in a workgroup | Can only be installed on a member server |
| Operate offline                              | Can stay offline  | Cannot be offline                        |
| Customized certificate templates             | Only supports standard templates  | Supported                                |
| Supported enrollment methods                 | Manual or web enrollment  | Auto, manual, or web enrollment          |
| Certificate approval process                 | Manual  | Manual or automatic based on the policy  |
| User input for certificate fields            | Manual  | Retrieved from AD DS                     |
| Certificate issuing and managing using AD DS | N/A   | Supported                                |

Table 13.1 – the types of CA

| Option | Details   |
|--------|---|
| 0      | No changes.   |
| 1      | Publish a CA certificate to a given location.                           |
| 2      | Attach the AIA extensions of issued certificates.                       |
| 32     | Attach the <b>Online Certificate Status Protocol (OCSP)</b> extensions. |

**Table 13.2 – AIA locations**

| Host Name   | Operating System       | Role  |
|-------------|------------------------|---|
| REBEL-PDC01 | Windows Server 2022    | Primary Domain Controller in rebeladmin.com Active Directory Domain.                                |
| W08CS       | Windows Server 2008 R2 | Existing CA.  |
| W22CS       | Windows Server 2022    | After AD CS configuration is migrated, this server will become the CA in the rebeladmin.com domain. |
| PC01        | Windows 10             | Test PC.  |

**Table 13.3 – Role of server and PC**

## Commands

### Command 13.1

The first task is to install the AD CS role service. This can be done using the following command:

```
Add-WindowsFeature ADCS-Cert-Authority -IncludeManagementTools
```

### Command 13.2

Once the role service is installed, the next step is to configure the role and get the CA up and running:

```
Install-ADcsCertificationAuthority -CACommonName "REBELAdmin Root CA"
-CAType StandaloneRootCA -CryptoProviderName "RSA#Microsoft Software
Key Storage Provider" -HashAlgorithmName SHA256 -KeyLength 2048 -
ValidityPeriod Years -ValidityPeriodUnits 20
```

### Command 13.3

```
certutil.exe -setreg ca\DSConfigDN
CN=Configuration,DC=rebeladmin,DC=com
```

The preceding command needs to run using Command Prompt.

#### Command 13.4

The AIA location can be set using the certutil command.

```
certutil -setreg CA\CACertPublicationURLs  
"1:C:\Windows\system32\CertSrv\CertEnroll\%1_%3%4.crt\n2:ldap:///CN=%7  
,CN=AIA,CN=Public Key  
Services,CN=Services,%6%11\n2:http://crt.rebeladmin.com/CertEnroll/%1_  
%3%4.crt"
```

#### Command 13.5

Setting CA time limits - For this demo, I will set the certificate validity period to 10 years:

```
certutil -setreg ca\ValidityPeriod "Years"  
certutil -setreg ca\ValidityPeriodUnits 10
```

#### Command 13.6

Now we have all the settings submitted. To apply the changes, run the following command:

```
restart-service certsvc
```

#### Command 13.7

The next step is to create a new CRL, which can be generated using the following command:

```
certutil -crl
```

#### Command 13.8

Then, log in to the domain controller as Domain Admin or Enterprise Admin and run the following command:

```
certutil -f -dspublish "REBEL-CRTROOT_REBELAdmin Root CA.crt" RootCA
```

#### Command 13.9

This also needs to be published to Active Directory so that everyone in the domain is aware of it. To do that, copy the file from the root CA to the domain controller and run the following command:

```
certutil -f -dspublish "REBELAdmin Root CA.crl"
```



#### Command 13.10

The file needs to be copied from the issuing CA to the root CA, and then you need to execute the following command:

```
certreq -submit "REBEL-CA1.rebeladmin.com_REBELAdmin_IssuingCA.req"
```

#### Command 13.11

Once it has been issued, it needs to be exported and imported into the issuing CA:

```
certreq -retrieve 2 "C:\REBEL-  
CA1.rebeladmin.com_REBELAdmin_IssuingCA.crt"
```

The preceding command will export the certificate. The number 2 is the request ID in the CA Microsoft Management Console (MMC).

#### Command 13.12

Once the export is complete, move the file to the issuing CA, and from there, run the cert util install cert command.

```
Certutil -installcert "C:\REBEL-  
CA1.rebeladmin.com_REBELAdmin_IssuingCA.crtstart-service certsvc
```

#### Command 13.13

```
certutil -setreg CA\CACertPublicationURLs "1:  
C:\Windows\system32\CertSrv\CertEnroll\%1_%3%4.crt\n2:http://crt.rebel  
admin.com/CertEnroll/%1_%3%4.crt\n3:ldap:///CN=%7,CN=AIA,CN=Public Key  
Services,CN=Services,%6%11"
```

#### Command 13.14

```
certutil -setreg CA\CRLPeriodUnits 7  
certutil -setreg CA\CRLPeriod "Days"  
certutil -setreg CA\CRLOverlapPeriodUnits 3  
certutil -setreg CA\CRLOverlapPeriod "Days"  
certutil -setreg CA\CRLDeltaPeriodUnits 0  
certutil -setreg ca\ValidityPeriodUnits 3  
certutil -setreg ca\ValidityPeriod "Years"
```

#### Command 13.15

Once all this is done, in order to complete the configuration, restart the certificate service using the following command:

```
restart-service certsvc
```

#### Command 13.16

Last but not least, run the following command to generate the CRLs:

```
certutil -crl
```

#### Command 13.17

We also need to export the CA configuration settings saved under the

HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\CertSvc\Configuration registry key. To export the key, run the following PowerShell command:

```
reg.exe export  
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\CertSvc\Configuration C:\CABackup\careg.reg
```

The preceding command will back up the registry key to the C:\CABackup folder and save it as careg.reg.

#### Command 13.18

Run the following command to install the AD CS role:

```
Add-WindowsFeature ADCS-Cert-Authority -IncludeManagementTools
```

#### Command 13.19

Run the following command to configure AD CS role with the existing CA certificate:

```
Install-AdcsCertificationAuthority -CAType EnterpriseRootCa -CertFile  
"C:\CABackup\REBELADMIN CA.p12" -CertFilePassword (read-host "Cert  
Password" -assecurestring):
```

The preceding command configures the AD CS role with the existing CA certificate, which is saved as C:\CABackup\REBELADMIN CA.p12 from the previous CA backup.

## CDP locations

CDPs define the location from where the CRL can be retrieved. This is a web-based location and should be accessible via HTTP. This list will be used by the certificate validator to verify the given certificate against the revocation list.

Before we do this, we need to prepare the web server. It should be a domain member, similar to the issuing CA.

In my demonstration, I am going to use the same issuing CA as the CDP location.

The web server can be installed using the following command:

```
Install-WindowsFeature Web-WebServer -IncludeManagementTools
```

Next, create a folder and create a share so that it can be used as the virtual directory:

```
mkdir C:\CertEnroll
New-smbshare -name CertEnroll C:\CertEnroll -FullAccess
SYSTEM,"rebeladmin\Domain Admins" -ChangeAccess "rebeladmin\Cert
Publishers"
```

As part of the exercise, I am setting the share permissions to rebeladmin\Domain Admins (full access) and rebeladmin\Cert Publishers (change access).

After the folder has been created with the relevant permissions, we also need to copy the root CA certificate and the CRL file to it:

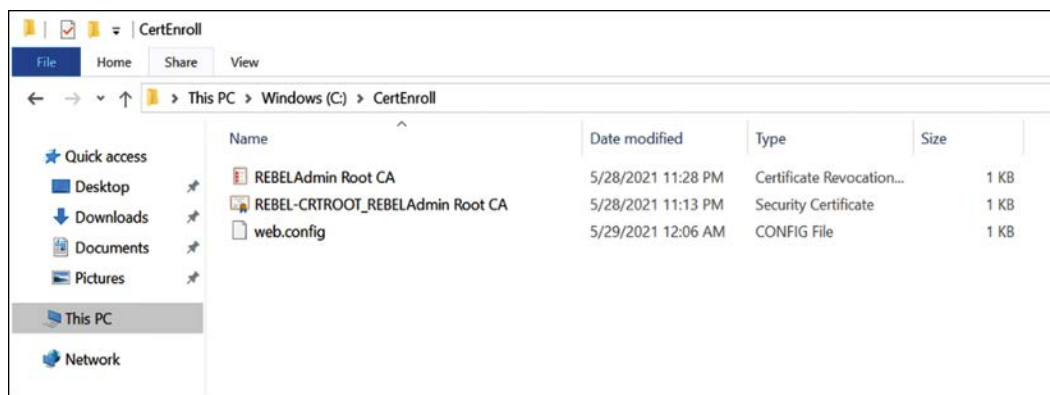


Figure 13.16: Configuring an AD CS role

After that, load the **Internet Information Services (IIS)** manager and add a virtual directory, CertEnroll, with the aforementioned path:

## CRL time limits

The CRL also has some associated time limits:

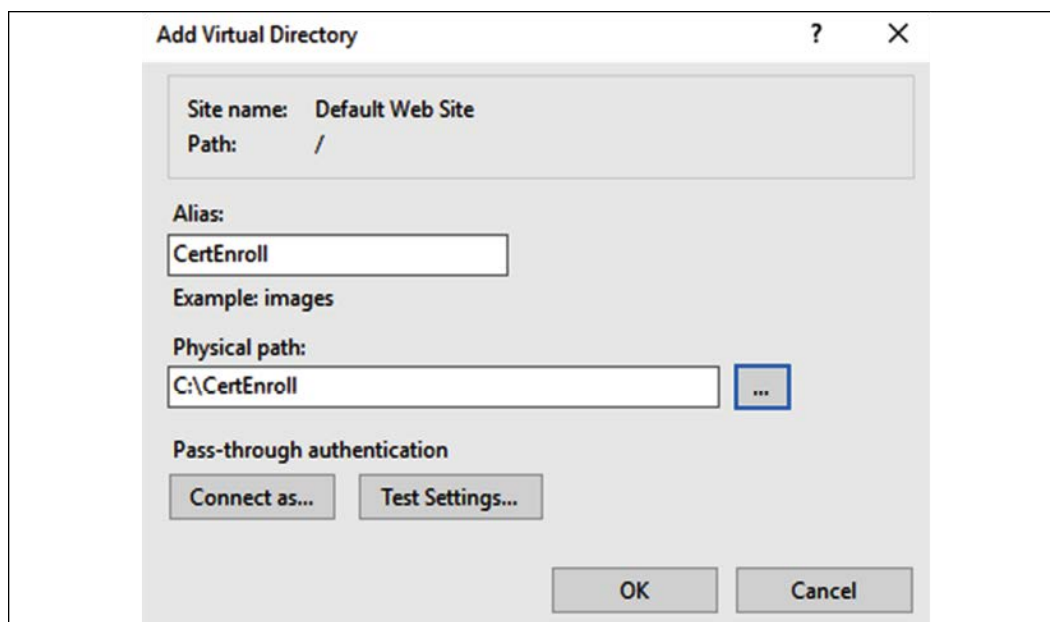
```
Certutil -setreg CA\CRLPeriodUnits 13
Certutil -setreg CA\CRLPeriod "Weeks"
Certutil -setreg CA\CRLDeltaPeriodUnits 0
Certutil -setreg CA\CRLOverlapPeriodUnits 6
Certutil -setreg CA\CRLOverlapPeriod "Hours"
```

In the preceding commands, the following is true:

- **CRLPeriodUnits**: This specifies the number of days, weeks, months, or years for which the CRL will be valid.
- **CRLPeriod**: This specifies whether the CRL validity period is measured by days, weeks, months, or years.
- **CRLDeltaPeriodUnits**: This specifies the number of days, weeks, months, or years that the delta CRL is valid for. Offline CAs should disable this.
- **CRLOverlapPeriodUnits**: This specifies the number of days, weeks, months, or years that the CRL can overlap.
- **CRLOverlapPeriod**: This specifies whether the CRL overlapping validity period is measured by days, weeks, months, or years.

Now we have all the settings submitted. To apply the changes, run the following command:

```
restart-service certsvc
```



**Figure 13.17: Setting up the CertEnroll virtual directory**

Last but not least, we need to create a DNS record for the service URL. In this demo, I am using **crt.rebeladmin.com** as the domain name. This will allow us to access the new distribution point using **http://crt.rebeladmin.com/CertEnroll**.

Now everything is ready, and we can publish the CDP settings using the following command:

```
certutil -setreg CA\CRLPublicationURLs
"1:C:\Windows\system32\CertSrv\CertEnroll\%3%8%9.crl
\n10:ldap:///CN=%7%8,CN=%2,CN=CDP,CN=Public Key
```

```
Services,CN=Services,%6%10\n2:http://crt.rebeladmin.com/CertEnroll/%3%8%9.crl"
```

The preceding command needs to run on the root CA server.

The single numbers in the command refer to the options, and numbers with % refer to the variables:

| Option | Details  |
|--------|--|
| 0      | No changes.  |
| 1      | Publish the CRL to the given location.   |
| 2      | Attach the CDP extensions of issued certificates.  |
| 4      | Include in the CRL to find the delta CRL locations.  |
| 8      | Specify whether there is a need to publish all CRL information to AD when publishing manually. |
| 64     | Delta CRL location.  |
| 128    | Include the <b>Issuing Distribution Point (IDP)</b> extension of the issued CRL.               |

All these settings can be specified using the GUI. To access it, go to **Server Manager | Tools | Certification Authority**, right-click and select **Properties** of the server, and then go to the **Extension** tab.

There, you can add the following variables using the GUI:

| Variable | GUI reference            | Details  |
|----------|--------------------------|--|
| %1       | <ServerDNSName>          | The DNS name of the CA server  |
| %2       | <ServerShortName>        | The NetBIOS name of the CA server  |
| %3       | <CAName>                 | The given name for the CA  |
| %4       | <CertificateName>        | The renewal extension of the CA  |
| %6       | <ConfigurationContainer> | DN of the configuration container in AD                                  |
| %7       | <CATruncatedName>        | Truncated name of the CA (32 characters)                                 |
| %8       | <CRLNameSuffix>          | Inserts a name suffix at the end of the filename before publishing a CRL |
| %9       | <DeltaCRLAllowed>        | Replaces CRLNameSuffix with a separate suffix to use the delta CRL       |
| %10      | <CDPObjectClass>         | The object class identifier for the CDP                                  |
| %11      | <CAObjectClass>          | The object class identifier for a CA                                     |

Once the CDP settings are in place, the next step is to go ahead and set up the AIA locations.

## Setting up the issuing CA

Now that we're done with the root CA setup, the next step is to set up the issuing CA. Issuing CAs will be run from a domain member server and will be AD-integrated. To begin the installation, log in to the server as the Domain Admin or Enterprise Admin.

1. The first task will be to install the AD CS role:

```
Add-WindowsFeature ADCS-Cert-Authority -IncludeManagementTools
```

2. I will use the same server for the Web Enrollment Role Service. This can be added using the following command:

```
Add-WindowsFeature ADCS-web-enrollment
```

3. After that, we can configure the role service using the following command:

```
Install-ADcsCertificationAuthority -CACommonName "REBELAdmin  
IssuingCA" -CAType EnterpriseSubordinateCA -CryptoProviderName  
"RSA#Microsoft Software Key Storage Provider" -HashAlgorithmName  
SHA256 -KeyLength 2048
```

4. To configure the Web Enrollment Role Service, use the following command:

```
Install-ADCSwebenrollment
```

5. This completes the initial role configuration process of the issuing CA. The next step is to create a certificate for the issuing CA.

# Chapter 14

## Figures

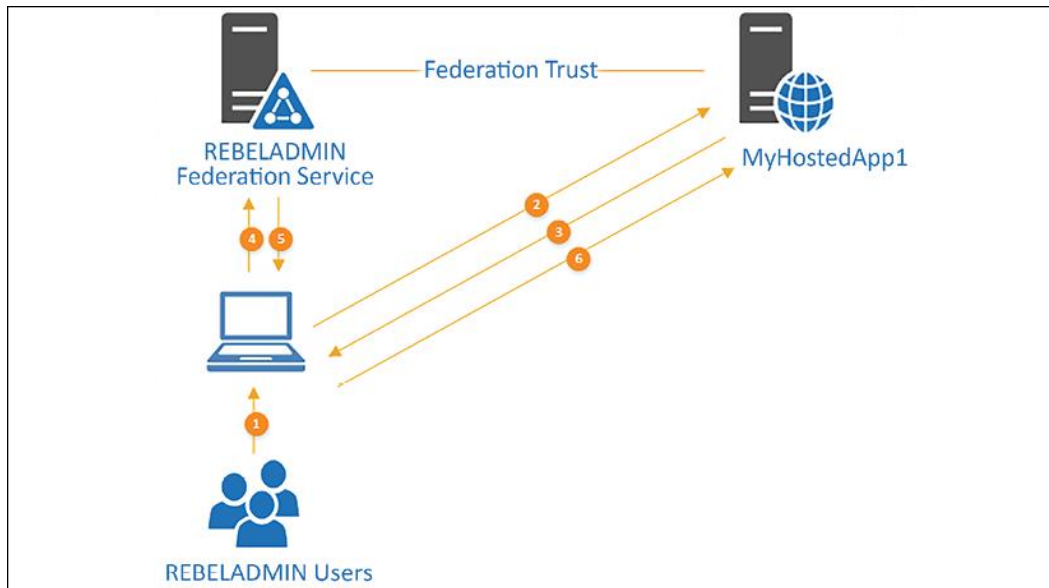


Figure 14.2: Federation trust in action

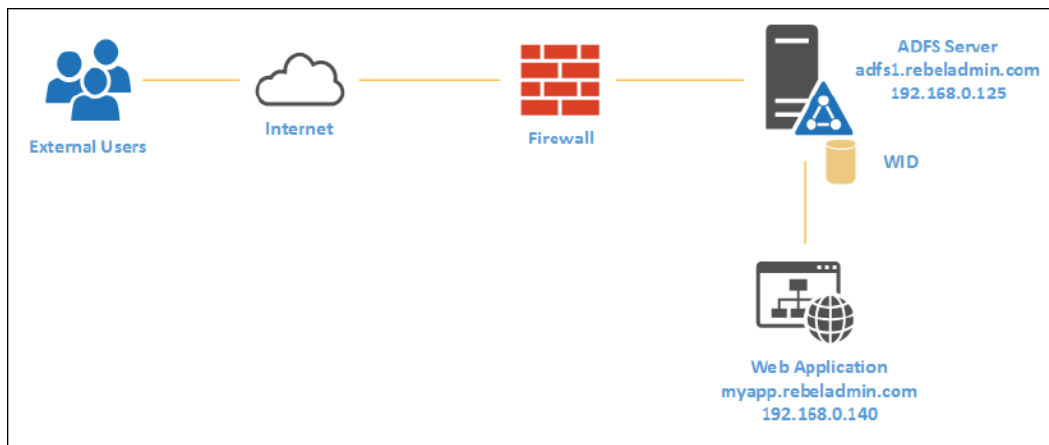
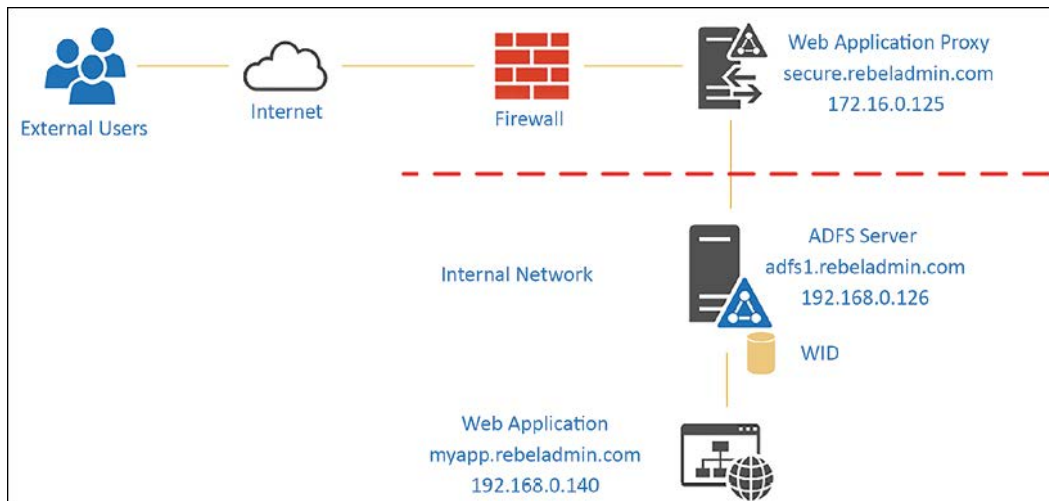
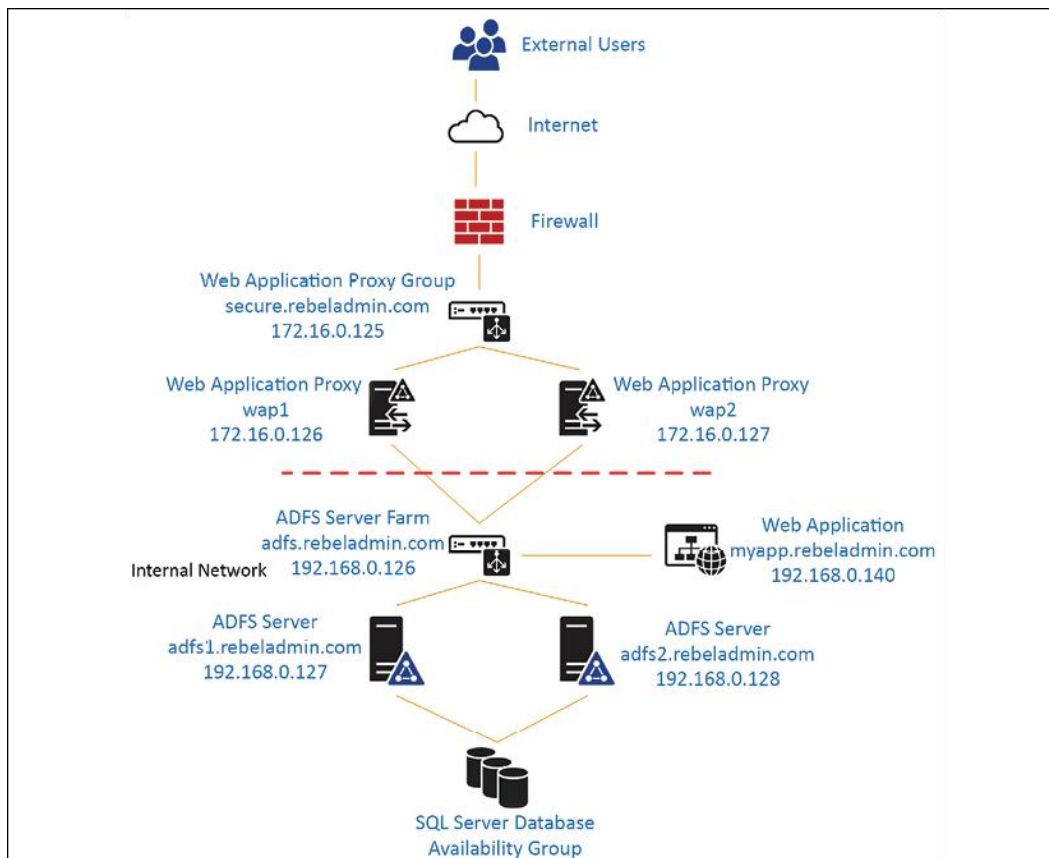


Figure 14.3: Single federation server deployment



**Figure 14.4: Single federation server and WAP deployment**



**Figure 14.5: A multiple federation server and multiple WAP server deployment**



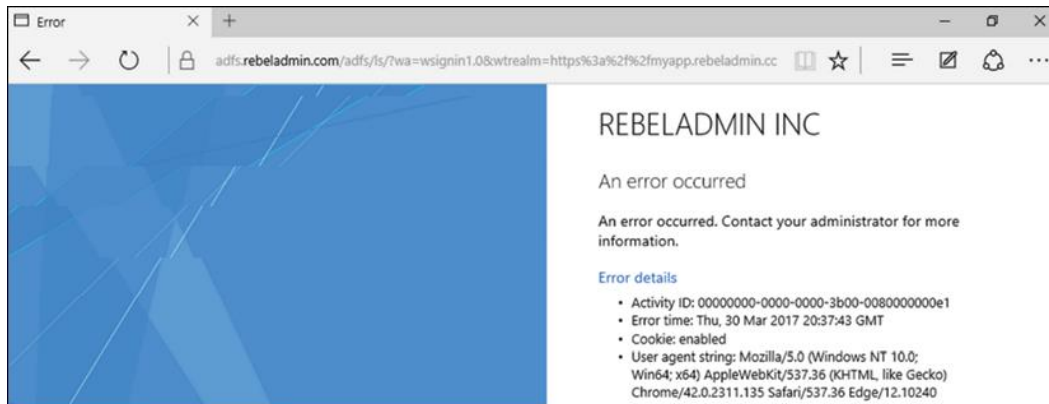


Figure 14.8: AD FS login page



Figure 14.9: Add Relying Party Trust

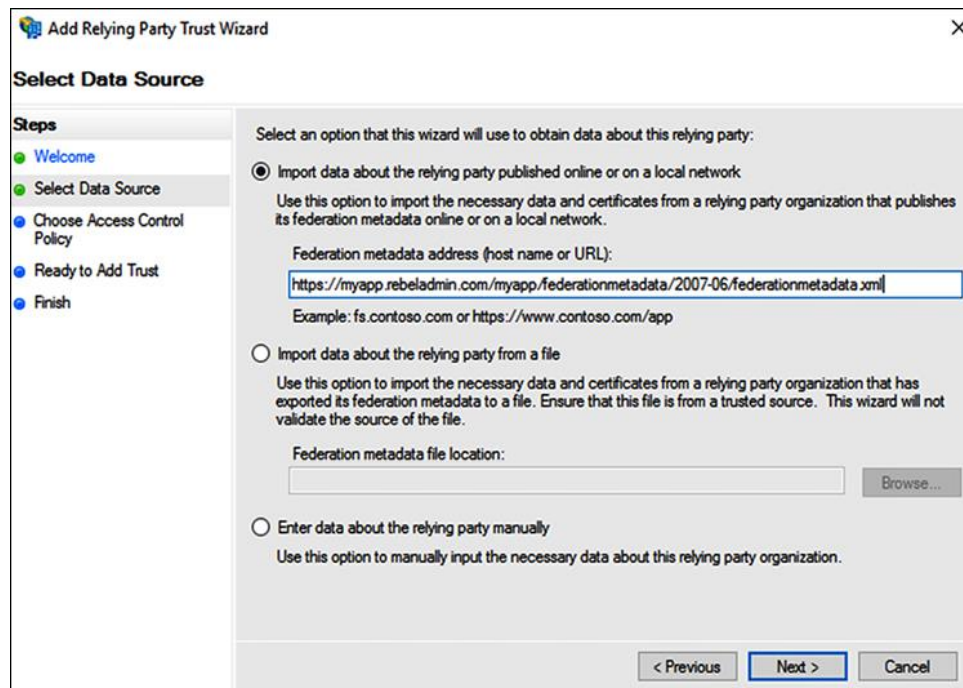


Figure 14.10: Configure the relying party trust

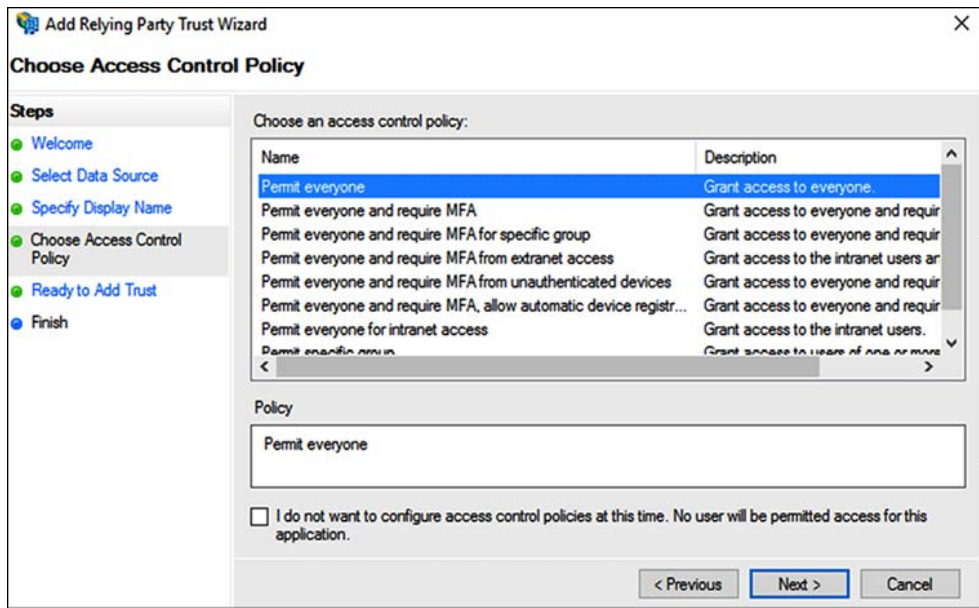


Figure 14.11: Relying party trust access control policies

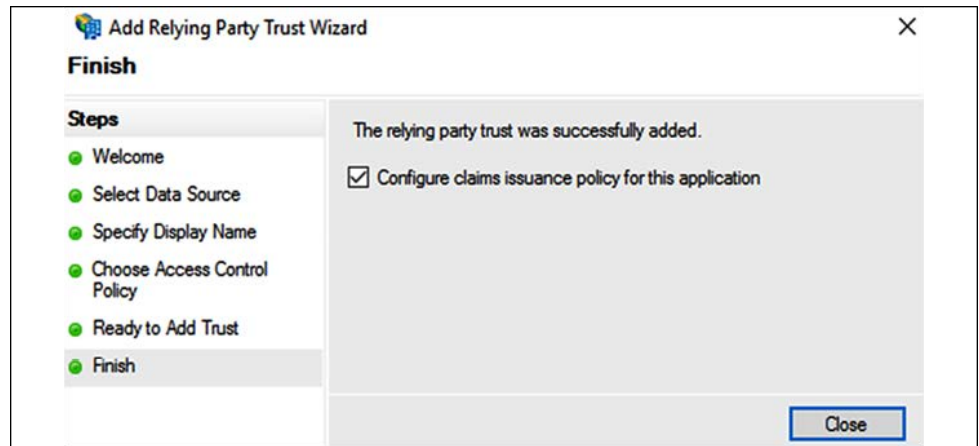


Figure 14.12: Completing the relying party trust wizard

https://myapp.rebeladmin.com/myapp/default.aspx

Welcome : REBELADMIN\dfrancis

Values from IIdentity

IsAuthenticated: True Name: REBELADMIN\dfrancis

Claims from ICClaimsIdentity

| Claim Type  | Claim Value  | Value Type | Sub    |
|---|--|------------|--------|
| http://schemas.microsoft.com/ws/2014/01/identity/claims/anchorclaimtype           | http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsaccountname     | string     | REBEL/ |
| http://schemas.xmlsoap.org/ws/2005/05/identity/claims/implicitupn                 | dfrancis@rebeladmin.com  | string     | REBEL/ |
| http://schemas.microsoft.com/claims/authnmethodsproviders                         | WindowsAuthentication  | string     | REBEL/ |
| http://schemas.xmlsoap.org/ws/2005/05/identity/claims/upn                         | dfrancis@rebeladmin.com  | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/primarygroupsid           | S-1-5-21-4041220333-1835452706-552999228-513                                   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-5-21-4041220333-1835452706-552999228-513                                   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-1-0  | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-5-32-545   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-5-2  | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-5-11   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-5-15   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/groupsid                  | S-1-18-1   | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/primarysid                | S-1-5-21-4041220333-1835452706-552999228-1186                                  | string     | REBEL/ |
| http://schemas.xmlsoap.org/ws/2005/05/identity/claims/name                        | REBELADMIN\dfrancis  | string     | REBEL/ |
| http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsaccountname        | REBELADMIN\dfrancis  | string     | REBEL/ |
| http://schemas.microsoft.com/claims/authnmethodsreferences                        | http://schemas.microsoft.com/ws/2008/06/identity/authenticationmethod/windows  | string     | REBEL/ |
| http://schemas.microsoft.com/claims/authnmethodsreferences                        | http://schemas.microsoft.com/ws/2008/06/identity/authenticationmethod/kerberos | string     | REBEL/ |
| http://schemas.microsoft.com/2012/01/requestcontext/claims/x-ms-client-user-agent | Mozilla/5.0 (Windows NT 10.0; WOW64; Trident/7.0; rv:11.0) like Gecko          | string     | REBEL/ |

Figure 14.13: Application access

```

Environment      : AzureCloud
Account          : dcadmin@REBELADMIN.onmicrosoft.com
TenantId         : 05c6f80c-61d9-44df-bd2d-4414a983c1d4
SubscriptionId   :
SubscriptionName :
CurrentStorageAccount :
  
```

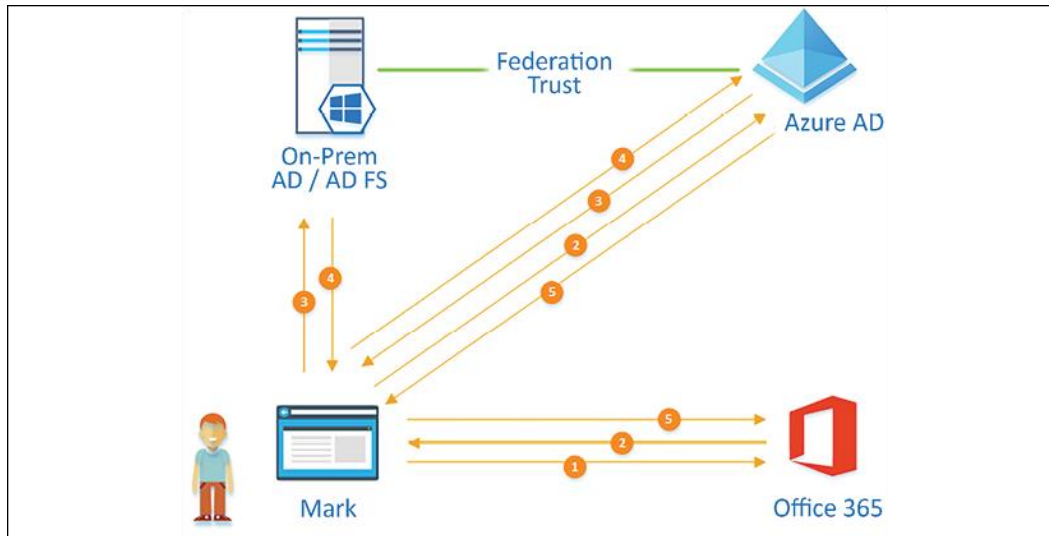
Figure 14.14: Azure TenantId

Console1 - [Console Root\Certificates (Local Computer)\Personal\Certificates]

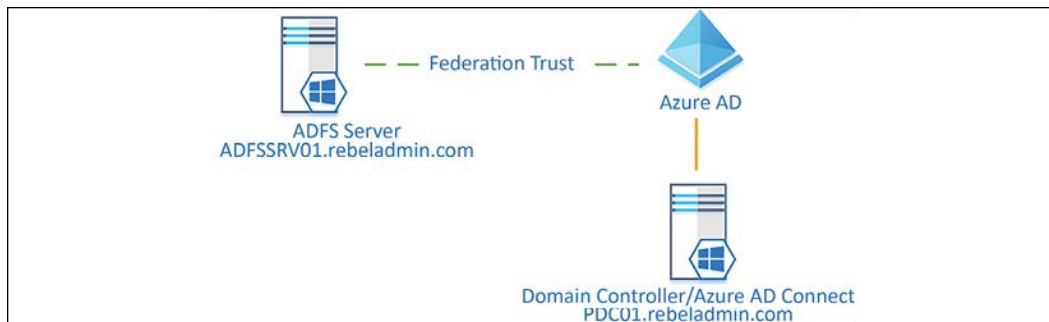
File Action View Favorites Window Help

|                                   | Issued To                         | Issued By                         | Expiration Date | Intended Purposes        | Friendly Name |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------|--------------------------|---------------|
| 05c6f80c-61d9-44df-bd2d-4414a9... | 05c6f80c-61d9-44df-bd2d-4414a9... | 05c6f80c-61d9-44df-bd2d-4414a9... | 7/28/2021       | Client Authentication    | <None>        |
| DC01.rebeladmin.com               | rebeladmin-DC01-CA                | rebeladmin-DC01-CA                | 7/25/2020       | Client Authentication... | <None>        |
| rebeladmin-DC01-CA                | rebeladmin-DC01-CA                | rebeladmin-DC01-CA                | 7/26/2024       | <All>                    | <None>        |

Figure 14.15: New certificate



**Figure 14.20: How AD FS federation works with Azure AD**



**Figure 14.21: Planned demo setup**

Home > REBELADMIN >

### Custom domain names

Azure Active Directory

+ Add custom domain Refresh Troubleshoot Columns Got feedback?

Looking to move an on premises application to the cloud and use Azure Active Directory Domain Services?

Search domains Add filters

| Name                     | Status    |
|--------------------------|-----------|
| rebeladm.onmicrosoft.com | Available |
| rebeladmin.com           | Verified  |

**Figure 14.22: Azure AD custom domain status**



Figure 14.25: Azure AD Connect Express Settings page

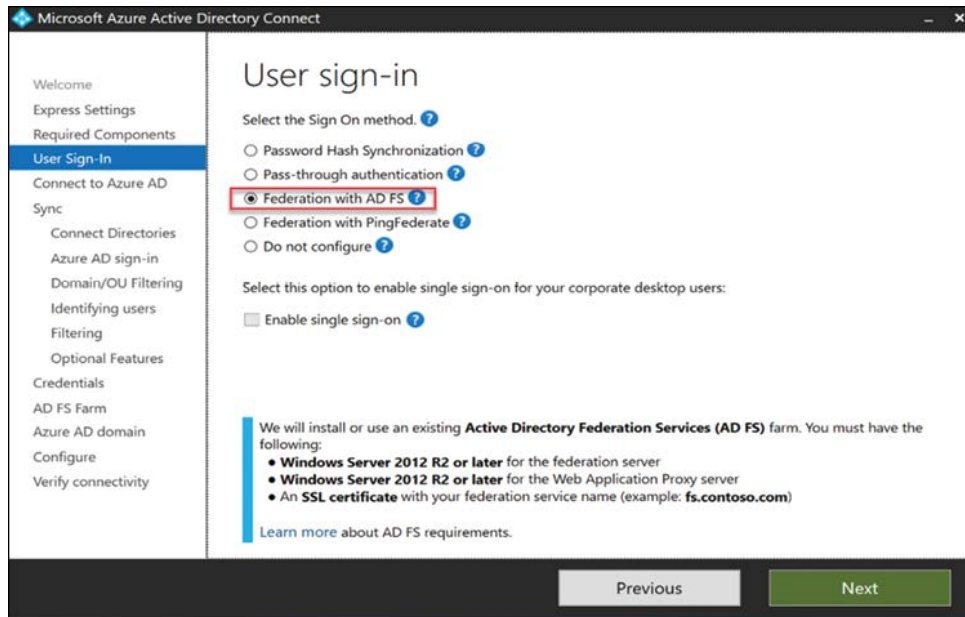


Figure 14.26: User sign-in method selection



Figure 14.27: AD FS farm configuration



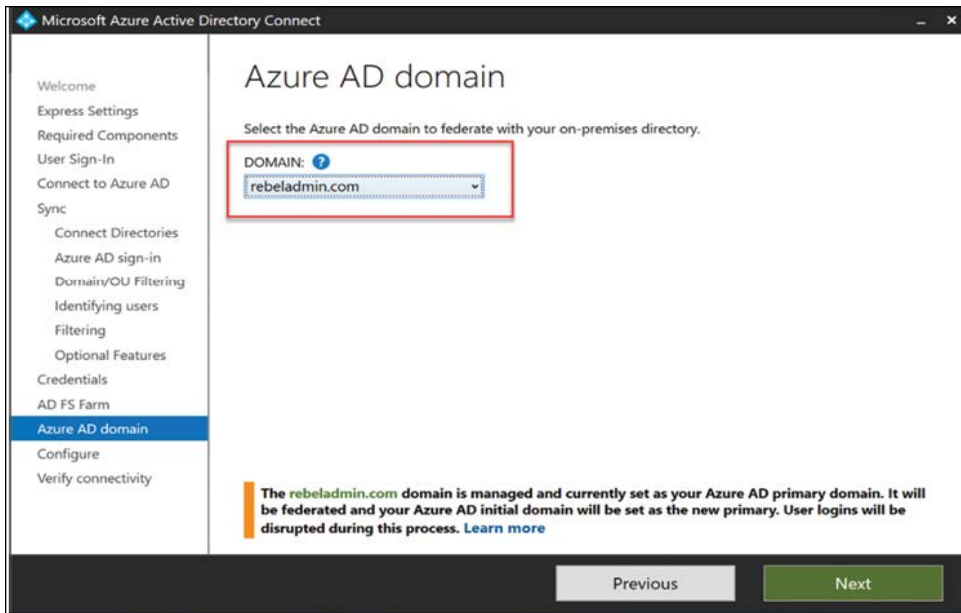


Figure 14.28: Select the domain to federate



Figure 14.29: Rebeladmin.com recognized as the federated domain

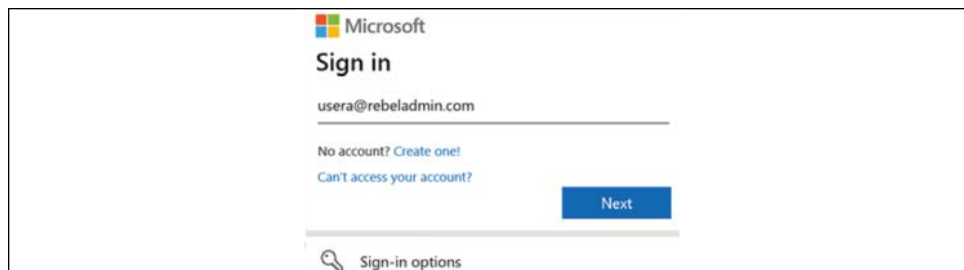
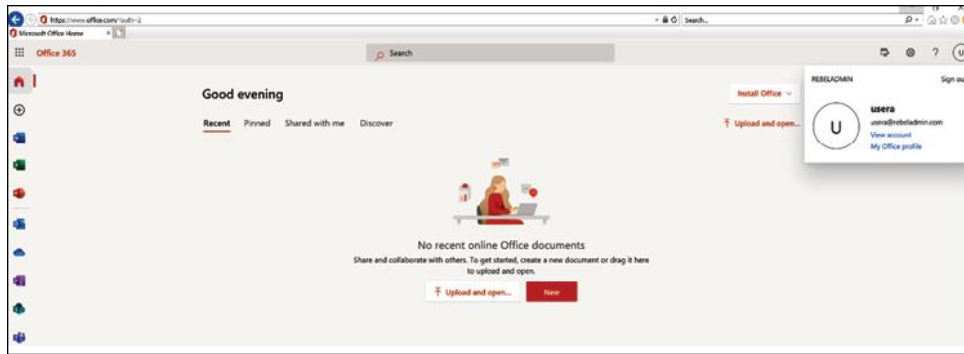


Figure 14.30: Azure AD user login page



Figure 14.31: User redirected to the AD FS login form



**Figure 14.32: User access to the Office 365 portal**

## Tables

| Claim type              | Description   |
|-------------------------|---|
| UPN                     | UPN of the user   |
| Email                   | RFC 5322-type email address   |
| Given name              | Given name of the user  |
| CN                      | CN value of the user account  |
| Name                    | Name of the user  |
| Surname                 | Surname of the user   |
| Windows account name    | Domain account in domain/user format                                    |
| Group                   | Group the user belongs to   |
| Role                    | Role of the user  |
| AD FS 1.x UPN           | UPN of the user when interacting with AD FS 1.x                         |
| AD FS 1.x email address | RFC 5322-type email address of the user when interacting with AD FS 1.x |

**Table 14.1 – AD FS claim types**

## Commands

### Command 14.1

In order to do that, log in to the Web Application Proxy server as an administrator and execute the following command:

```
Add-WebApplicationProxyApplication
-BackendServerUrl 'https://myapp.rebeladmin.com/myapp/'
-ExternalCertificateThumbprint
'3E0ED21E43BEB1E44AD9C252A92AD5AFB8E5722E'
-ExternalUrl 'https://myapp.rebeladmin.com/myapp/'
-Name 'MyApp'
-ExternalPreAuthentication AD FS
-ADFSRelyingPartyName 'myapp.rebeladmin.com'
```



### Command 14.2

First, we need to create a certificate, which will be used by the AD FS farm. This needs to run from the AD FS server:

```
$certbase64 = New-AdfsAzureMfaTenantCertificate -TenantID 05c6f80c-61d9-44df-bd2d-4414a983c1d4
```

The preceding command generates the new certificate. **TenantID** is the subscription ID you have from Azure. This can be found by running this:

```
Login-AzureRmAccount
```

The preceding command will ask for the credentials for Azure and once we provide them, it will list **TenantId**.

### Command 14.3

Before that, we need to connect to Azure AD by using Azure PowerShell. We can do that by using the following command:

```
Connect-MsolService
```

### Command 14.4

After that, we can pass the credentials by using the following command:

```
New-MsolServicePrincipalCredential -AppPrincipalId 981f26a1-7f43-403b-a875-f8b09b8cd720 -Type asymmetric -Usage verify -Value $certbase64
```

In the preceding command, AppPrincipalId defines the **Globally Unique Identifier (GUID)** for the Azure MFA client.

## Links

- More information about WS-Federation can be found at <https://ibm.co/3CGyRbO>.
- Risk assessment model: <https://bit.ly/3l2Qe0m>
- ESL: <https://bit.ly/3FLLy6T>

## Creating a certificate in an AD FS farm to connect to Azure MFA

First, we need to create a certificate, which will be used by the AD FS farm. This needs to run from the AD FS server:

```
$certbase64 = New-AdfsAzureMfaTenantCertificate -TenantID 05c6f80c-61d9-44df-bd2d-4414a983c1d4
```

The preceding command generates the new certificate. TenantID is the subscription ID you have from Azure. This can be found by running this:

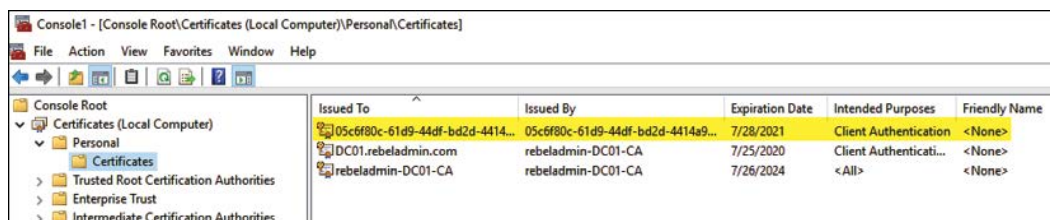
```
Login-AzureRmAccount
```

The preceding command will ask for the credentials for Azure and once we provide them, it will list TenantId:

```
Environment      : AzureCloud
Account          : dcadmin@REBELADMIN.onmicrosoft.com
TenantId         : 05c6f80c-61d9-44df-bd2d-4414a983c1d4
SubscriptionId   :
SubscriptionName :
CurrentStorageAccount :
```

Figure 14.14: Azure TenantId

This will create a certificate under **Certificates (Local Computer)**:



| Issued To                            | Issued By                            | Expiration Date | Intended Purposes     | Friendly Name |
|--------------------------------------|--------------------------------------|-----------------|-----------------------|---------------|
| 05c6f80c-61d9-44df-bd2d-4414a983c1d4 | 05c6f80c-61d9-44df-bd2d-4414a983c1d4 | 7/28/2021       | Client Authentication | <None>        |
| DC01.rebeladmin.com                  | rebeladmin-DC01-CA                   | 7/25/2020       | Client Authentication | <None>        |
| rebeladmin-DC01-CA                   | rebeladmin-DC01-CA                   | 7/26/2024       | <All>                 | <None>        |

Figure 14.15: New certificate

## Enabling AD FS servers to connect with the Azure MFA client

Now, we have the certificate, but we need to tell the Azure MFA client to use it as a credential to connect with AD FS.

Before that, we need to connect to Azure AD by using Azure PowerShell. We can do that by using the following command:

```
Connect-MsolService
```

Then, it will prompt you for your login and use your Azure Global Administrator account to connect.

After that, we can pass the credentials by using the following command:

```
New-MSolServicePrincipalCredential -AppPrincipalId 981f26a1-7f43-403b-a875-f8b09b8cd720 -Type asymmetric -Usage verify -Value $certbase64
```

In the preceding command, **AppPrincipalId** defines the **Globally Unique Identifier (GUID)** for the Azure MFA client.

## Enabling the AD FS farm to use Azure MFA

The next step of the configuration is to enable the AD FS farm to use Azure MFA. This can be done by using the following command:

```
Set-AdfsAzureMfaTenant -TenantId 05c6f80c-61d9-44df-bd2d-4414a983c1d4 -ClientId 981f26a1-7f43-403b-a875-f8b09b8cd720
```

In the preceding command, **TenantId** refers to the Azure tenant ID and **ClientId** represents the Azure MFA client's GUID.

Once the command successfully runs, we need to restart the AD FS service on each server in the farm:

```
PS C:\Users\Administrator\REBELADMI\Desktop> Set-AdfsAzureMfaTenant -TenantId 05c6f80c-61d9-44df-bd2d-4414a983c1d4 -ClientId 981f26a1-7f43-403b-a875-f8b09b8cd720
WARNING: PS0177: The authentication provider configuration data was successfully updated. Before your changes take effect, you must restart the AD FS Windows Service on each server in the farm.
PS C:\Users\Administrator\REBELADMI\Desktop>
```

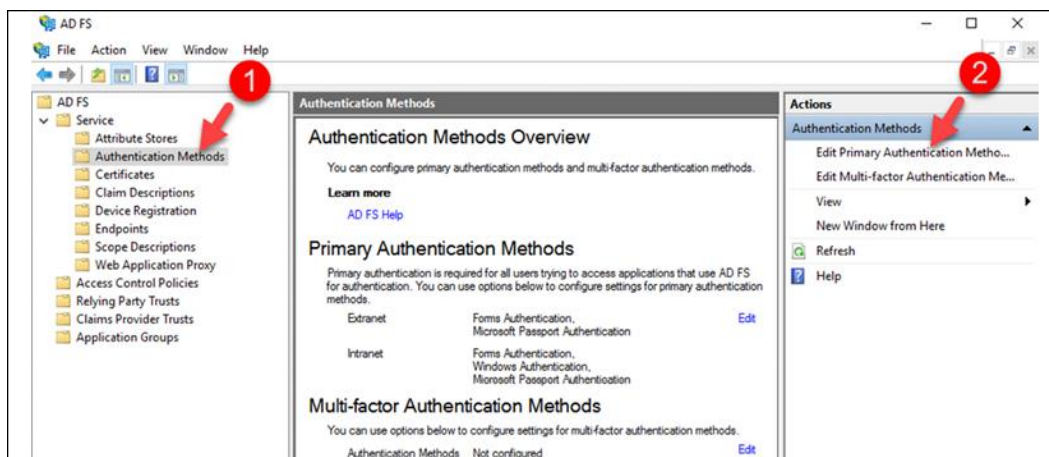
Figure 14.16: Enabling Azure MFA for AD FS

## Enabling Azure MFA for authentication

The last step of the configuration is to enable Azure MFA globally for the AD FS server.

In order to do that, log in to the AD FS server as the Enterprise Admin. Then, go to **Server Manager | Tools | AD FS Management**.

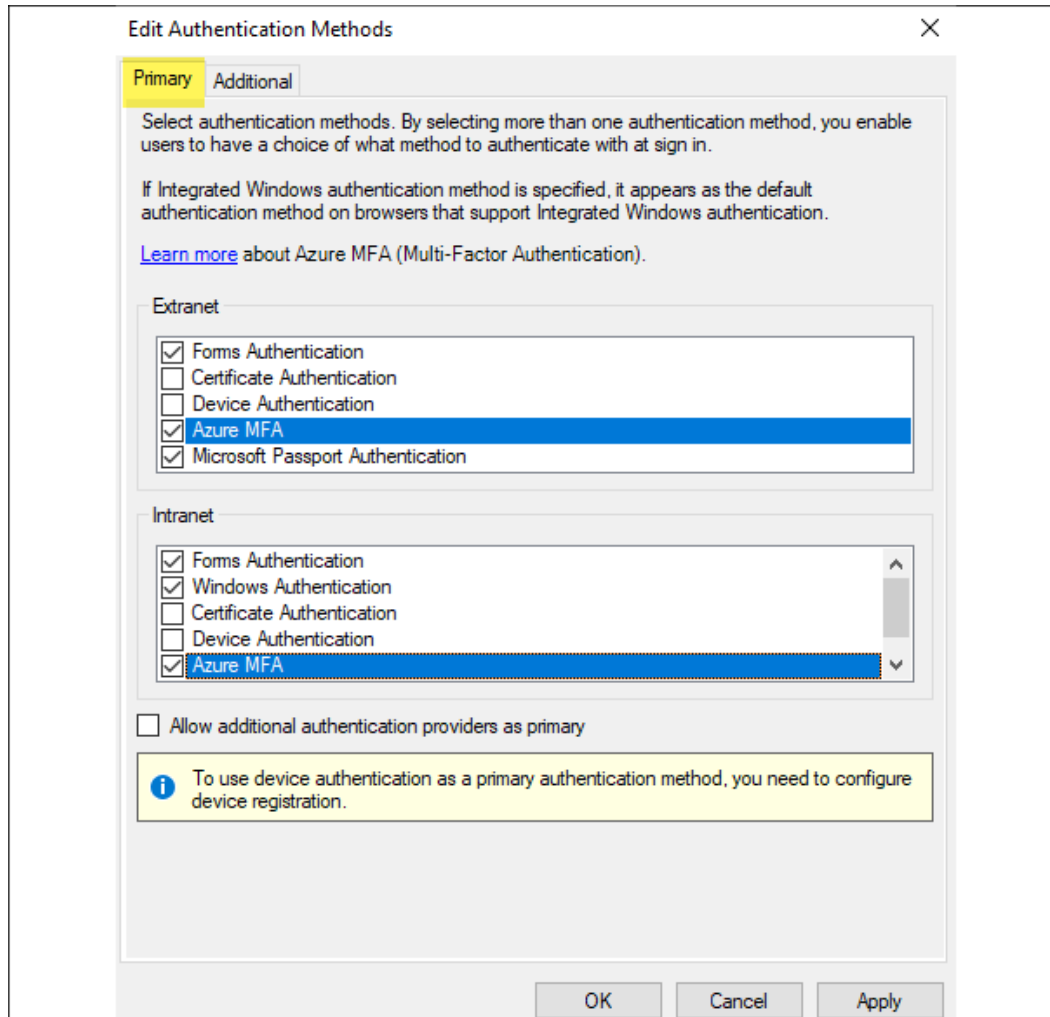
Then, in the console, navigate to **Service | Authentication Methods**. Then, in the **Actions** panel, click on **Edit Primary Authentication Method**:



**Figure 14.17: AD FS Authentication Methods**

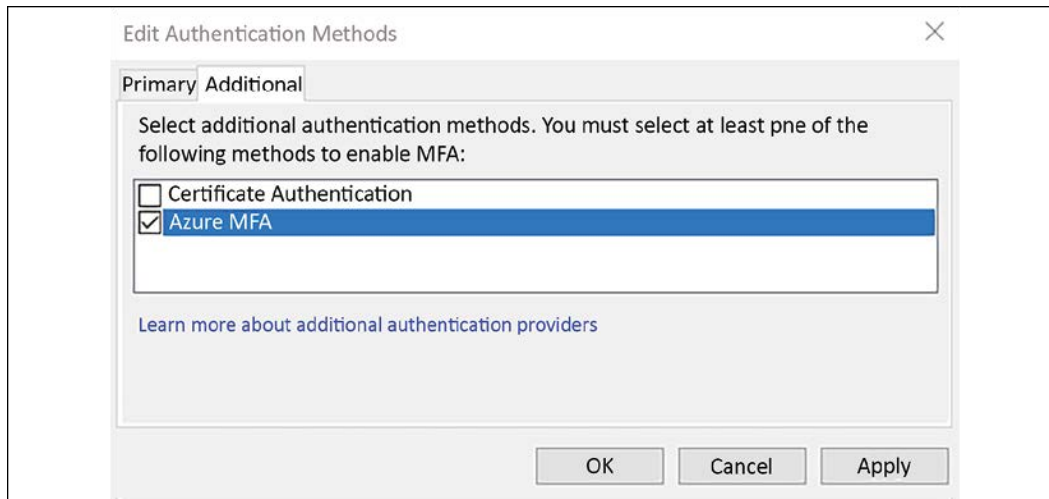
This opens up the window to configure global authentication methods. It has two tabs, and we can see **Azure MFA** on both. If Azure MFA is used as a primary method by removing other options, then AD FS will not ask for logins and will use MFA as the only authentication method.

Its operation boundaries can be set to intranet or extranet:



**Figure 14.18: AD FS Primary authentication methods**

Another option is to select MFA as the secondary authentication method:



**Figure 14.19: AD FS Additional authentication methods**

This finishes the Azure MFA integration, and users can use MFA based on the options selected in the preceding wizards.

## Installing the AD FS role

Before installation, the SSL certificate for `adfs.rebeladmin.com` needs to be installed in the computer account as it is required during the AD FS installation. This can be checked using the following command:

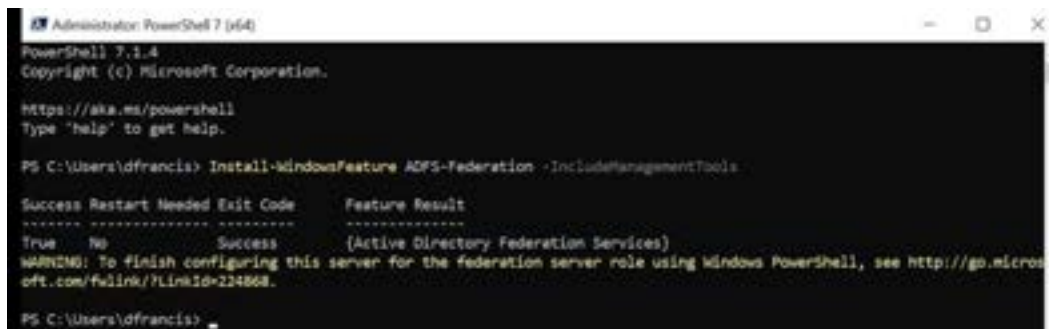
```
dir Cert:\LocalMachine\My
```

The AD FS server should be a member server of the domain and should log in as the domain administrator or the Enterprise Admin to do the installation.

The next step is to install the AD FS role service, which can be done by using the following PowerShell command:

```
Install-WindowsFeature ADFS-Federation -IncludeManagementTools
```

The following screenshot displays the output of the preceding command:

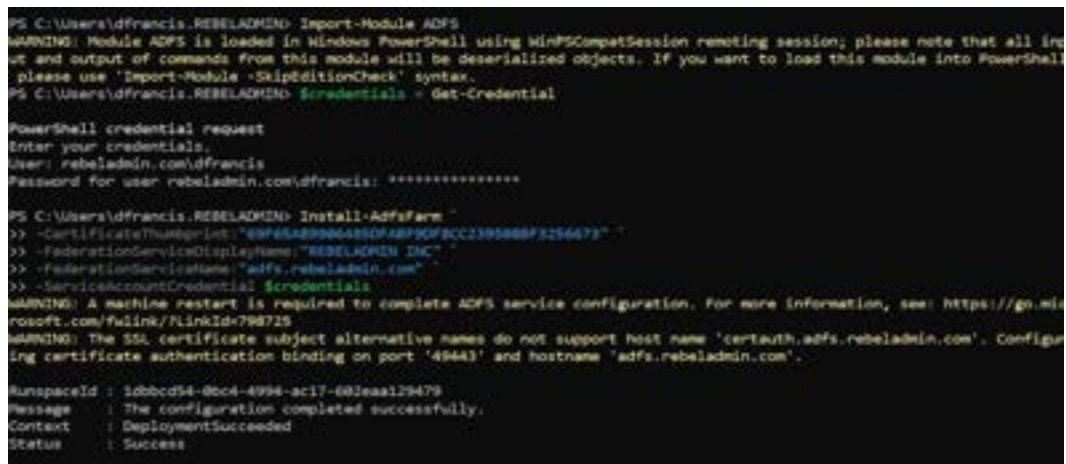


**Figure 14.6: Install the AD FS role**

Once this is completed, we need to configure the AD FS server. Let's use the following configuration for the demo setup:

```
Import-Module ADFS
$credentials = Get-Credential
Install-AdfsFarm `
-CertificateThumbprint:"938E369FA88B2F884A5BBC495F2338BE9FA0E0BB" `
-FederationServiceDisplayName:"REBELADMIN INC" `
-FederationServiceName:"adfs.rebeladmin.com" `
-ServiceAccountCredential $credentials
```

In this setup, we are using WID for AD FS, so there is no need for SQL configuration. In the preceding command, `CertificateThumbprint` specifies the SSL certificate (adfs.rebeladmin.com), and `FederationServiceDisplayName` specifies the display name of the federation service. `FederationServiceName` is the service name, and it should match the SSL we used. `ServiceAccountCredential` is used to define the service account details for the AD FS setup. In the end, the system needs to be restarted to apply the configuration:



```
PS C:\Users\df Francis.REBELADMIN> Import-Module ADFS
WARNING: Module ADFS is loaded in Windows PowerShell using WinFSCometSession remoting session; please note that all input and output of commands from this module will be deserialized objects. If you want to load this module into PowerShell, please use 'Import-Module -SkipEditionCheck' syntax.
PS C:\Users\df Francis.REBELADMIN> $credentials = Get-Credential

PowerShell credential request
Enter your credentials.
User: rebeladmin.com\df Francis
Password for user rebeladmin.com\df Francis: *****

PS C:\Users\df Francis.REBELADMIN> Install-AdfsFarm `
>> -CertificateThumbprint:"938E369FA88B2F884A5BBC495F2338BE9FA0E0BB" `
>> -FederationServiceDisplayName:"REBELADMIN INC" `
>> -FederationServiceName:"adfs.rebeladmin.com" `
>> -ServiceAccountCredential $credentials
WARNING: A machine restart is required to complete ADFS service configuration. For more information, see: https://go.microsoft.com/fwlink/?linkid=796725
WARNING: The SSL certificate subject alternative names do not support host name 'certauth.adfs.rebeladmin.com'. Configuring certificate authentication binding on port '49443' and hostname 'adfs.rebeladmin.com'.

RunspaceId : 1dbb0d54-d6c4-4994-ac17-603eaa129479
Message    : The configuration completed successfully.
Context     : DeploymentSucceeded
Status      : Success
```

**Figure 14.7: Configure the AD FS role**

The error about the alternative SSL name, `certauth.adfs.rebeladmin.com`, regards the certificate authentication. Before Windows Server 2016, this was an issue as the system didn't support different bindings for certificate authentication and device authentication on the same host. The default port 443 was used by the device authentication and couldn't have multiple bindings on the same channel.

In Windows Server 2016/2019/2022, this is possible and now, it supports two methods. The first option is to use the same host (`adfs.rebeladmin.com`) with different ports (`443` and `49443`). The second option is to use different hosts (`adfs.rebeladmin.com` and `certauth.adfs.rebeladmin.com`) with the same port (443). This requires an SSL certificate to support `certauth.adfs.rebeladmin.com` as an alternate subject name.

Once the reboot completes, we can check whether the installation was successful by using the following command:

```
Get-WinEvent "AD FS/Admin" | Where-Object {$_.ID -eq "100"} | fl
```

This will print the content of event 100, which confirms the successful AD FS installation.

## Installing WAP

The next step of the configuration is to install WAP. This doesn't need to be a domain-joined server and should be placed on the perimeter network. Before the installation process, install the required SSL certificates. In my demo, it is for \*.rebeladmin.com. We can verify this by using this:

```
dir Cert:\LocalMachine\My
```

Before proceeding, we also need to check whether a server can resolve to adfs.rebeladmin.com as WAP needs to connect to AD FS.

Once everything is confirmed, we can install the WAP role:

```
Install-WindowsFeature Web-Application-Proxy -IncludeManagementTools
```

Once it's completed, we can proceed with the configuration by using the following:

```
$credentials = Get-Credential
Install-WebApplicationProxy
-FederationServiceName "adfs.rebeladmin.com"
-FederationServiceTrustCredential $credentials
-CertificateThumbprint "3E0ED21E43BEB1E44AD9C252A92AD5AFB8E5722E"
```

In the preceding commands, FederationServiceName is used to define the AD FS service name, and it needs to match the name provided on the AD FS setup. FederationServiceTrustCredential is used to provide an account, which is authorized to register a new proxy server with AD FS. The account that is used here should have permissions to manage AD FS.

The CertificateThumbprint parameter is used to define the certificate for WAP. In our demo, it's the \*.rebeladmin.com certificate. At the end of the configuration, we need to restart the system to apply the changes.

Once the reboot is completed, we can confirm the health of the configuration using the following event log in the AD FS server:

```
Get-WinEvent "AD FS/Admin" | Where-Object {$_.ID -eq "396"} | fl
```

# Chapter 15

## Links

AIP implementation is a vast topic that is beyond the scope of this chapter. I have written a series of blog posts covering the implementation of AIP:

- *Step-by-Step Guide: Protect confidential data using Azure Information Protection:*  
<https://bit.ly/30NxJG1>
- *Step-by-Step Guide: Automatic Data Classification via Azure Information Protection:*  
<https://bit.ly/30ZZGe5>
- *Step-by-Step Guide: On-premise Data Protection via Azure Information Protection Scanner:*  
<https://bit.ly/3nKfieI>
- *Step-by-Step Guide: How to protect confidential emails using Azure Information Protection?:*  
<https://bit.ly/3I4LU0x>
- *Step-by-Step Guide: How to track shared documents using Azure Information Protection?:*  
<https://bit.ly/3FYNGZt>

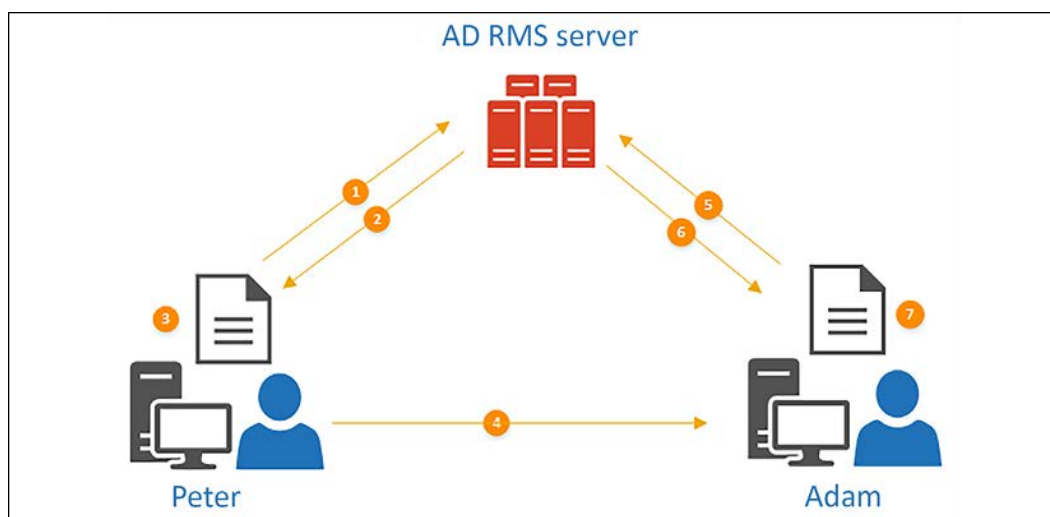
## Figures/Tables

**Table 15.1**

| Requirements                | Application  | Protected file types  |
|-----------------------------|--|---|
| Protect confidential files  | Microsoft Outlook Windows (version 2003 onward)<br>Office for macOS 2016:<br>Word<br>Excel<br>PowerPoint<br>PDF<br>Image processing<br>XPS Viewer<br>Gaaiho Doc<br>GigaTrust Desktop PDF Client for Adobe<br>Foxit PDF Reader<br>Nitro PDF Reader<br>Siemens JT2Go | .doc, .docm, .docx, .dot, .dotm, .dotx, .potm, .potx, .pps, .ppsm, .ppsx, .ppt, .pptm, .txt, .xml, .jpg, .jpeg, .pdf, .png, .tif, .tiff, .bmp, .gif, .jpe, .jfif, .jt, .xps |
| Protect confidential emails | Microsoft Outlook Windows (version 2003 and newer)<br>Office for macOS 2016  | .msg  |



|                                 |   |   |
|---------------------------------|---|---|
|                                 | Microsoft Exchange 2007 SP1   |   |
| Protect content on the intranet | Microsoft SharePoint 2007 and newer   | .doc, .docm, .docx, .dot, .dotm, .dotx, .potm, .potx, .pps, .ppsm, .ppsx, .ppt, .pptm, .txt, .xml, .jpg, .jpeg, .pdf, .png, .tif, .tiff, .bmp, .gif, .jpe, .jfif, .jt, .xps       |
| Protect mobile data             | Microsoft Word<br>Microsoft Word app<br>Microsoft Excel app<br>Microsoft Outlook app<br>Microsoft PowerPoint app<br>WordPad<br>Office for macOS 2016<br>Word Online<br>TITUS Docs<br>Foxit Reader | .doc, .docm, .docx, .dot, .dotm, .dotx, .potm, .potx, .pps, .ppsm, .ppsx, .ppt, .pptm, .txt, .xml, .jpg, .jpeg, .pdf, .png, .tif, .tiff, .bmp, .gif, .jpe, .jfif, .jt, .msg, .xps |



**Figure 15.1: AD RMS in action**

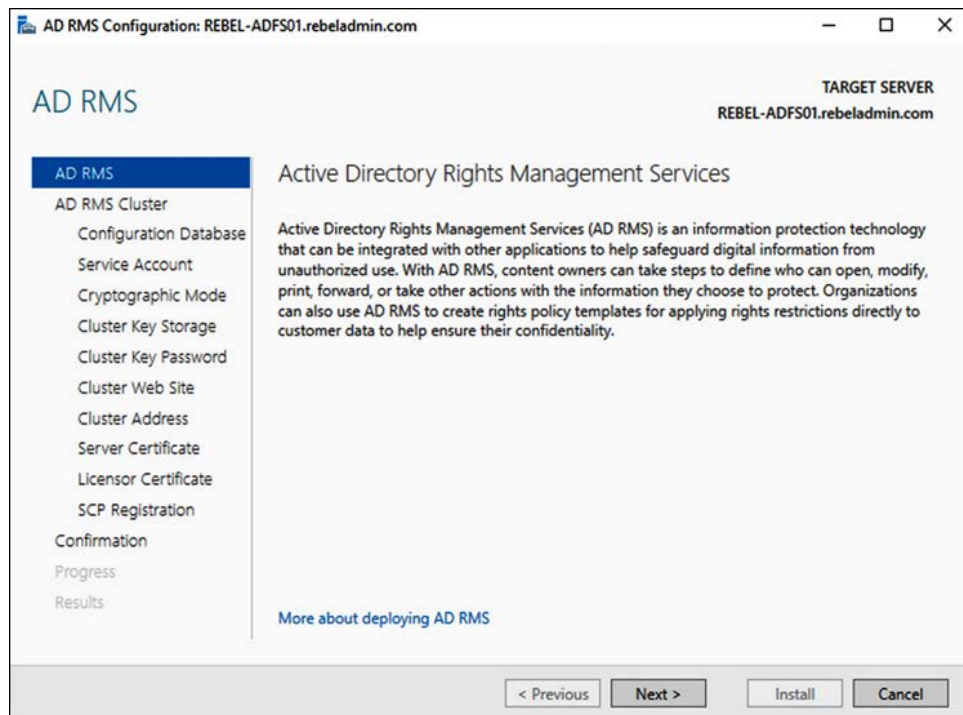


Figure 15.2: AD RMS configuration wizard

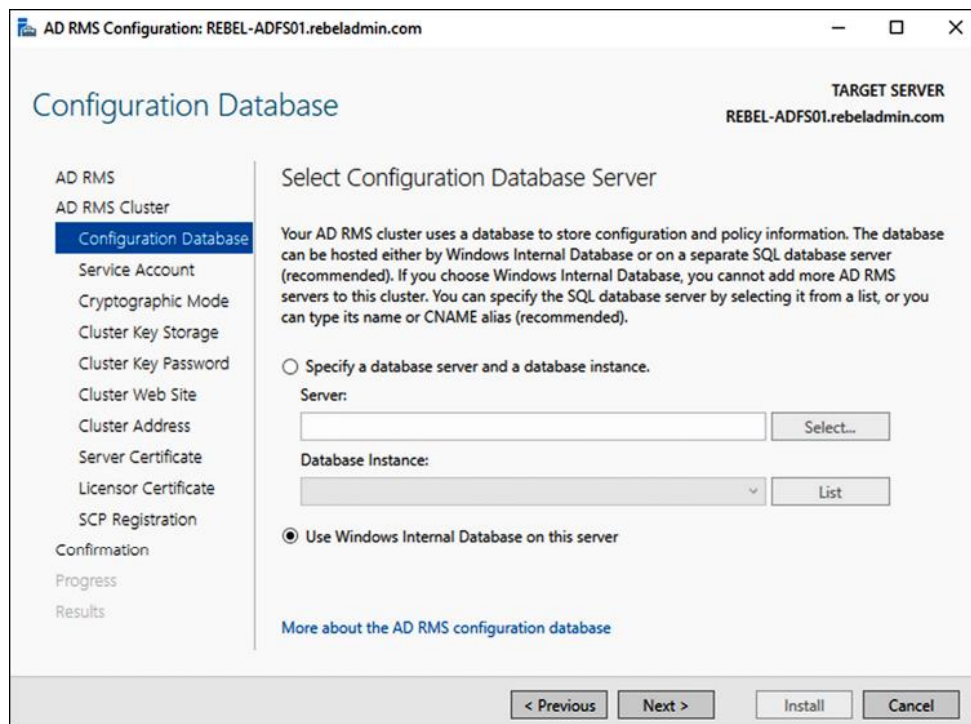


Figure 15.3: Creating WID for AD RMS

AD RMS Configuration: REBEL-ADFS01.rebeladmin.com

TARGET SERVER  
REBEL-ADFS01.rebeladmin.com

### Service Account

- AD RMS
- AD RMS Cluster
  - Configuration Database
  - Service Account**
  - Cryptographic Mode
  - Cluster Key Storage
  - Cluster Key Password
  - Cluster Web Site
  - Cluster Address
  - Server Certificate
  - Licensor Certificate
  - SCP Registration
- Confirmation
- Progress
- Results

#### Specify Service Account

The AD RMS cluster requires a domain user account so that it can communicate with other services and network computers. Specify a standard domain user account with no additional permissions.

Domain User Account:

[More about the AD RMS service account](#)

< Previous   Next >   Install   Cancel

Figure 15.4: Defining the AD RMS service account

AD RMS Configuration: REBEL-ADFS01.rebeladmin.com

TARGET SERVER  
REBEL-ADFS01.rebeladmin.com

### Cryptographic Mode

- AD RMS
- AD RMS Cluster
  - Configuration Database
  - Service Account
  - Cryptographic Mode**
  - Cluster Key Storage
  - Cluster Key Password
  - Cluster Web Site
  - Cluster Address
  - Server Certificate
  - Licensor Certificate
  - SCP Registration
- Confirmation
- Progress
- Results

#### Specify Cryptographic Mode

AD RMS can operate under two modes which differ on the basis of the cryptographic key length and the strength of signature hashes. Cryptographic mode 2 is recommended for new cluster deployments where you have ensured that all AD RMS client computers have been updated to support it. As cryptographic mode 2 cannot be undone, if you are unsure of full support within this cluster or any other clusters that it will share a trusted user domain (TUD) relationship with, select cryptographic mode 1 instead.

☒ Cryptographic Mode 2 (RSA 2048-bit keys/SHA-256 hashes)  
☐ Cryptographic Mode 1 (RSA 1024-bit keys/SHA-1 hashes)

[More about the AD RMS cryptographic mode](#)

< Previous   Next >   Install   Cancel

Figure 15.5: Defining the AD RMS cryptographic mode

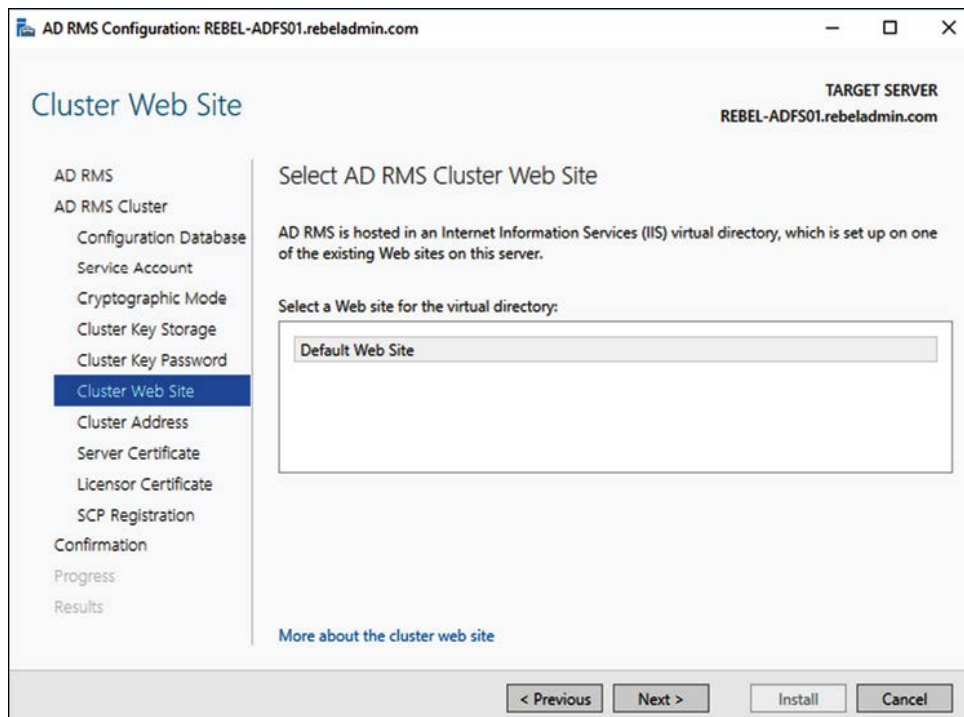


Figure 15.6: AD RMS cluster website settings

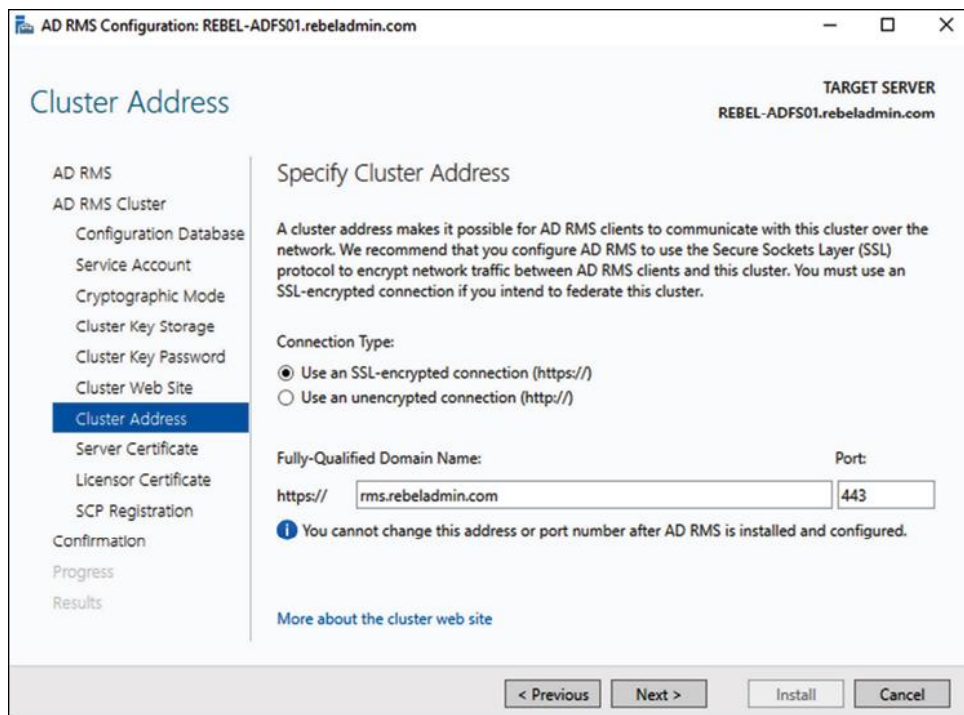


Figure 15.7: AD RMS cluster address

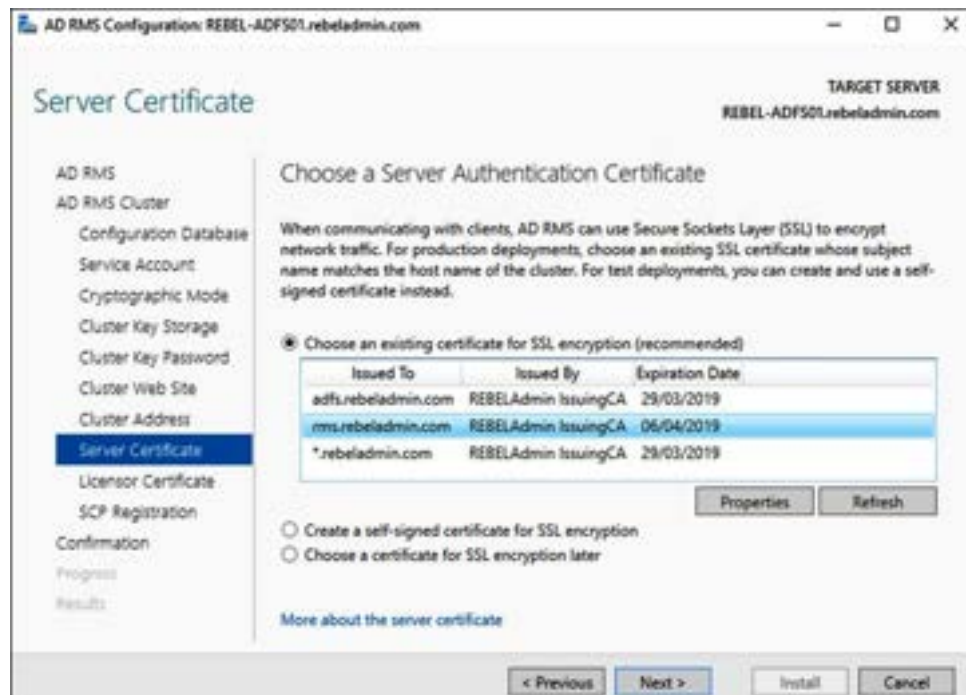


Figure 15.8: Selecting the server authentication certificate

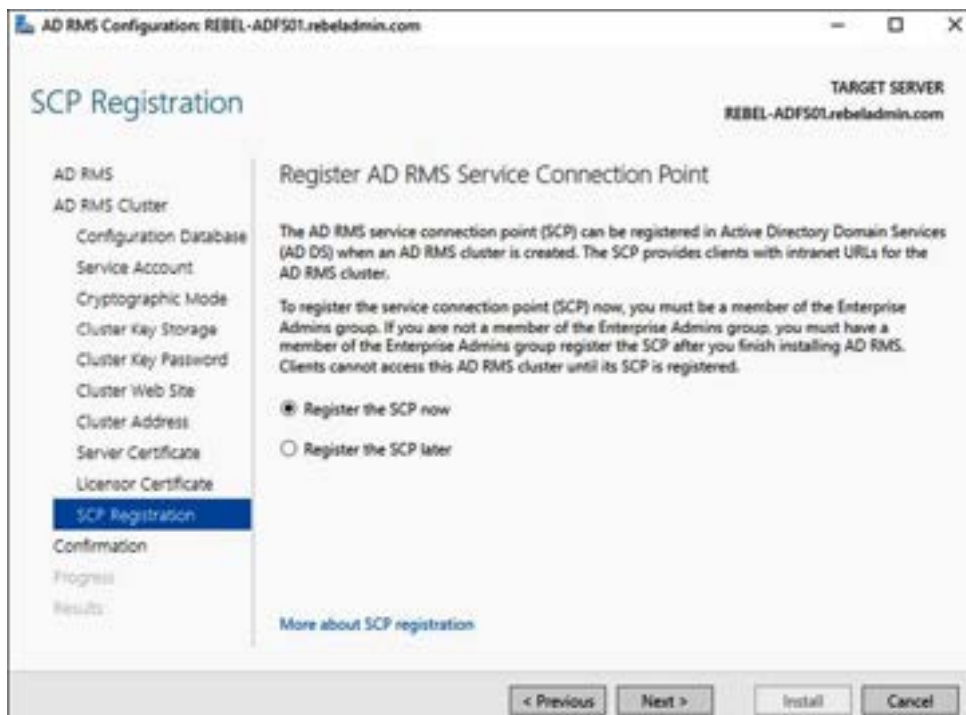


Figure 15.9: Registering an AD RMS SCP

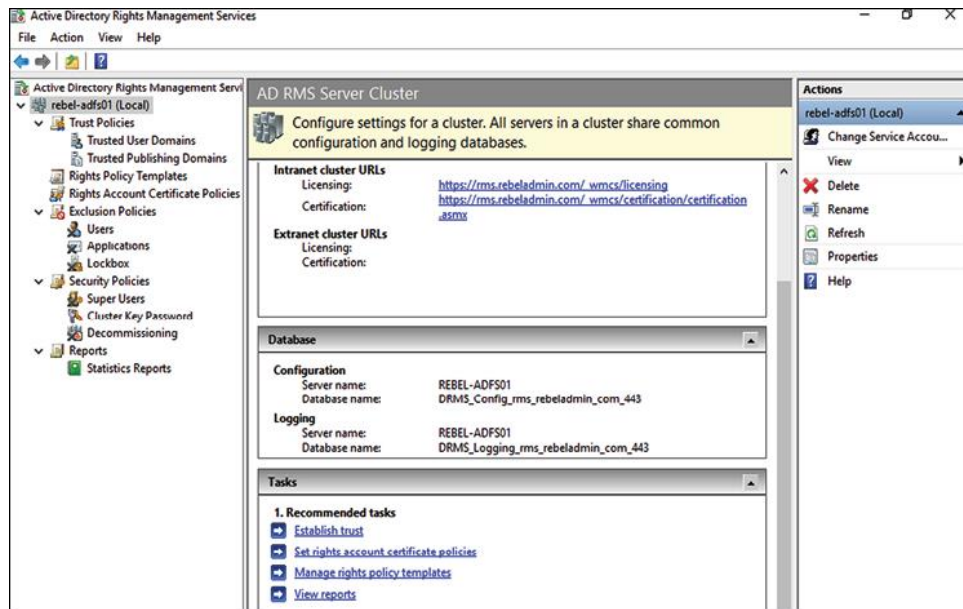


Figure 15.10: AD RMS server cluster

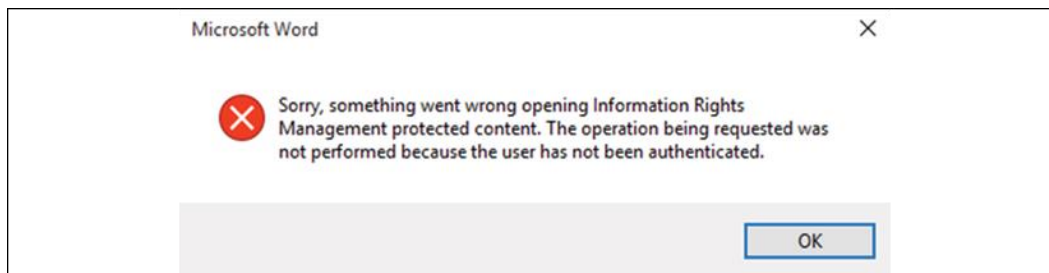


Figure 15.11: Service error due to trusted sites



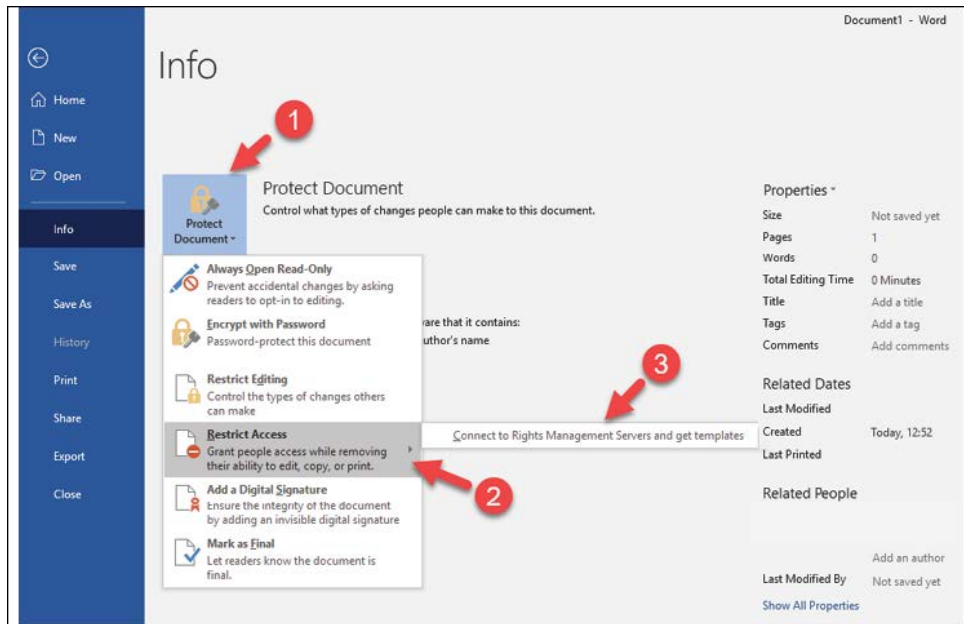


Figure 15.12: Connecting to the AD RMS server to get templates

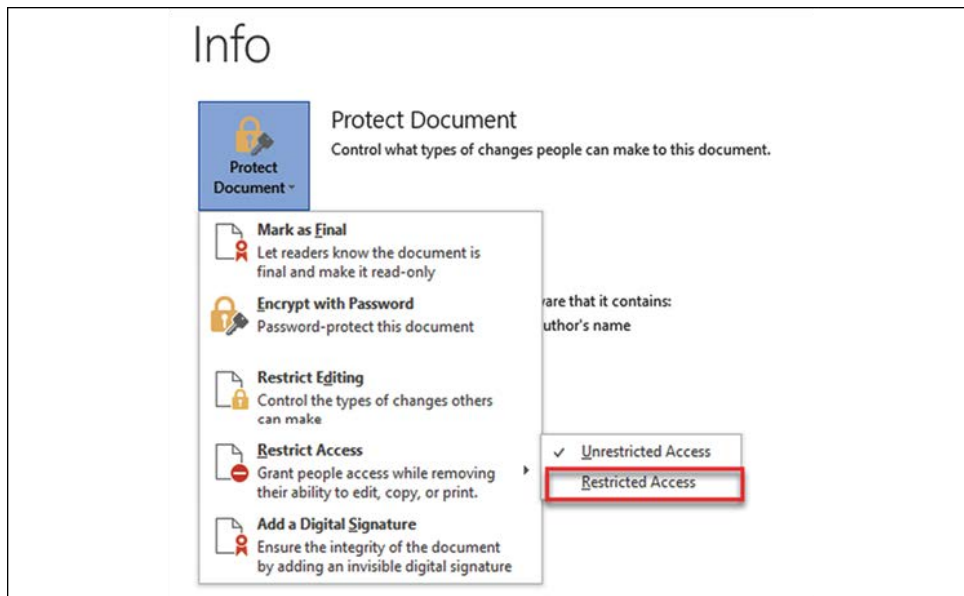


Figure 15.13: Protecting a Word document with AD RMS

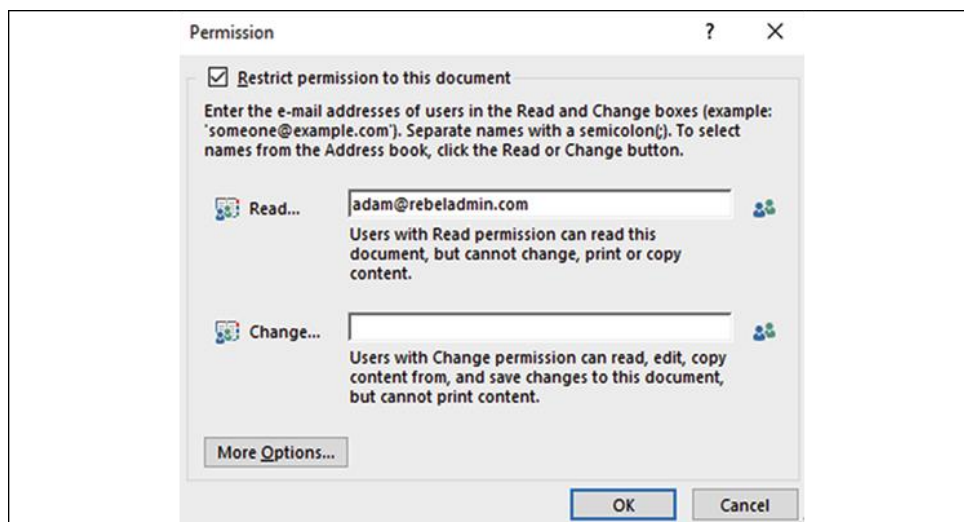


Figure 15.14: Document permissions

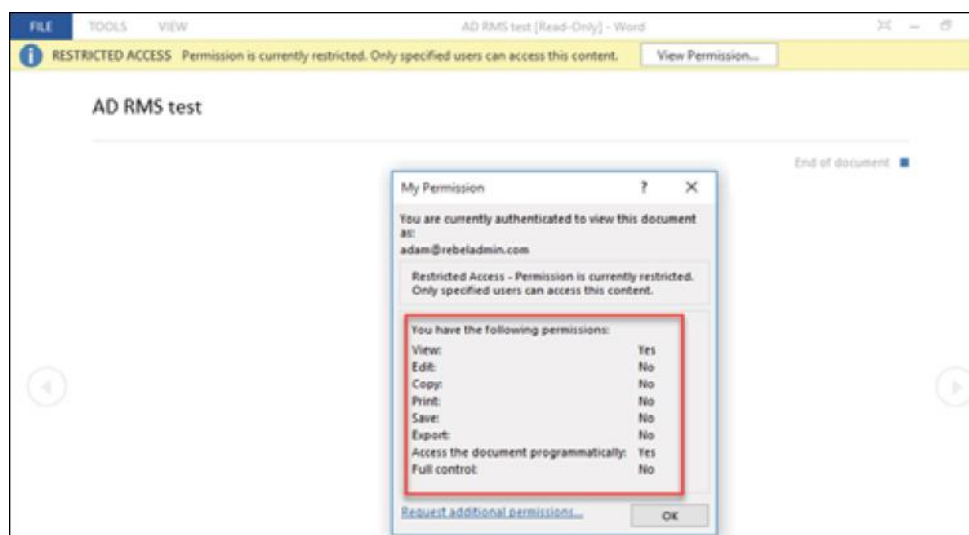


Figure 15.15: Viewing permissions

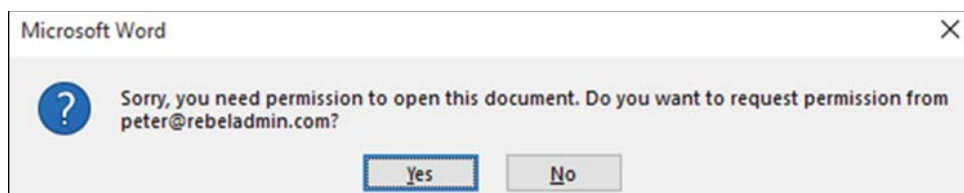


Figure 15.16: Error message



| Age 4–5   | Age 5–6  | Age 6 – 7  |
|---|--|--|
| <b>Reading at school</b><br>School Year: Reception<br>Band: Lilac   Level: 1<br>Band: Pink   Level: 1+<br>Band: Red   Level: 2<br>Band: Yellow   Level: 3 | <b>Reading at school</b><br>School Year: 1<br>Band: Blue   Level: 4<br>Band: Green   Level: 5<br>Band: Orange   Level: 6                                 | <b>Reading at school</b><br>School Year: 2<br>Band: Turquoise   Level: 7<br>Band: Purple   Level: 8<br>Band: Gold   Level: 9<br>Band: White   Level: 10<br>Band: Lime   Level: 11  |
| <b>Reading at home</b><br>Read with Oxford: <a href="#">Stage 2</a><br>eBook library: <a href="#">eBooks for 4–5 year olds</a>                            | <b>Reading at home</b><br>Read with Oxford: <a href="#">Stage 3</a> & <a href="#">Stage 4</a><br>eBook library: <a href="#">eBooks for 5–6 year olds</a> | <b>Reading at home</b><br>Read with Oxford: <a href="#">Stage 4</a> , <a href="#">Stage 5</a> & <a href="#">Stage 6</a><br>eBook library: <a href="#">eBooks for 6–7 year olds</a> |

Figure 15.17: Oxford reading levels

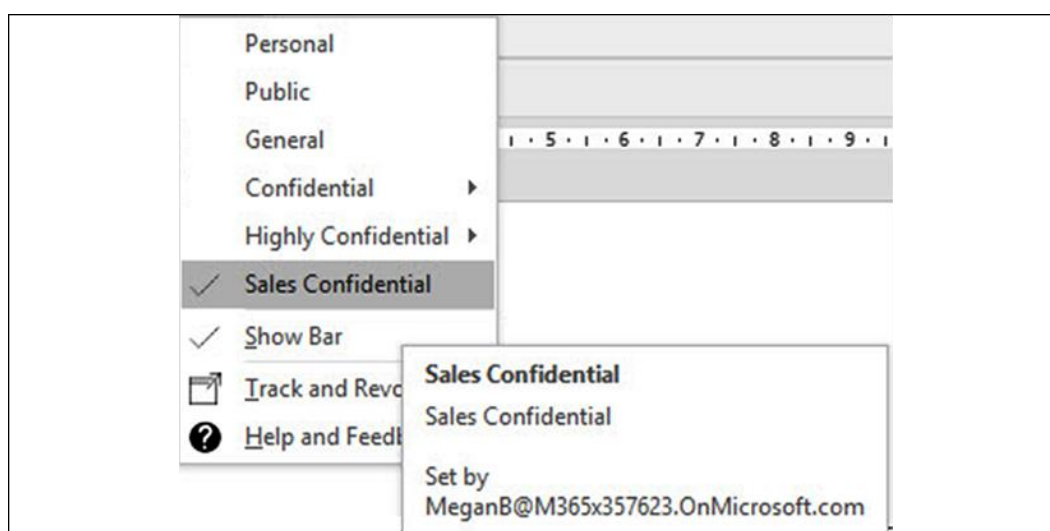


Figure 15.18: Example of labels

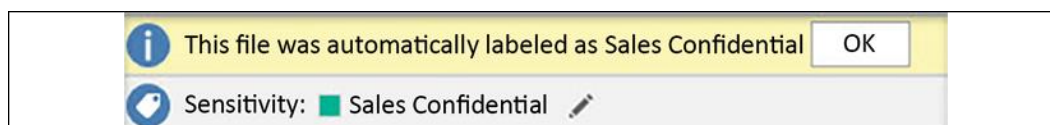


Figure 15.19: Automated classification

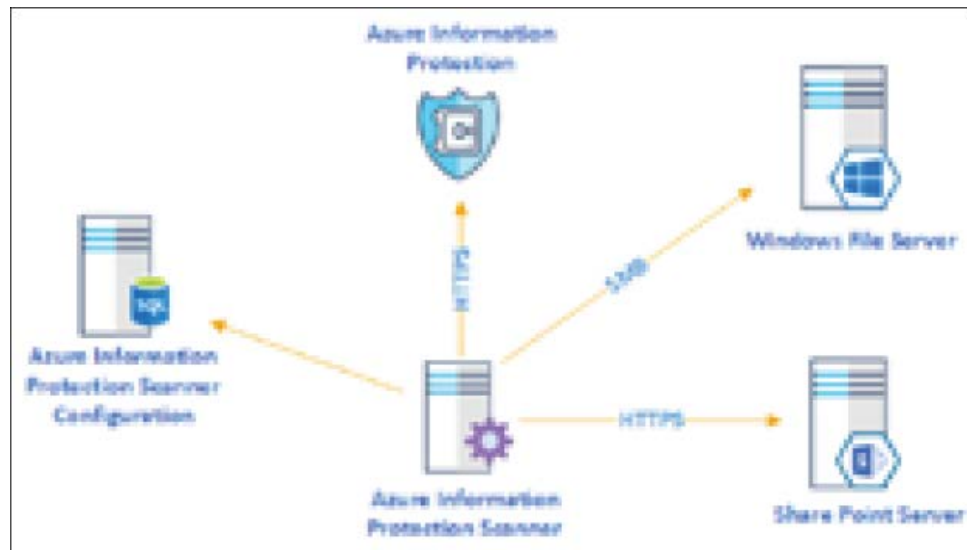


Figure 15.20: AIP scanner

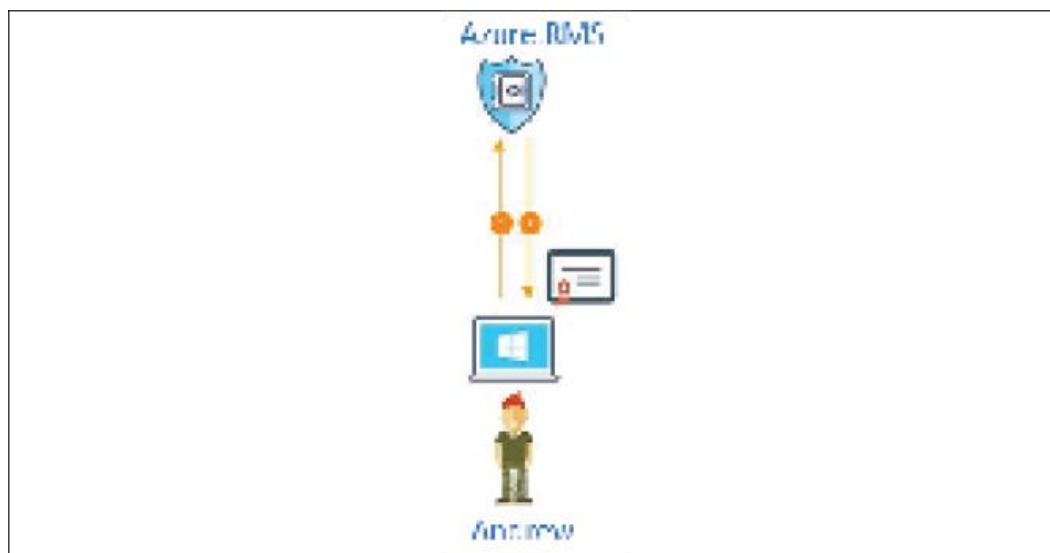


Figure 15.21: Initial communication with Azure RMS



Figure 15.22: Preparing for document protection

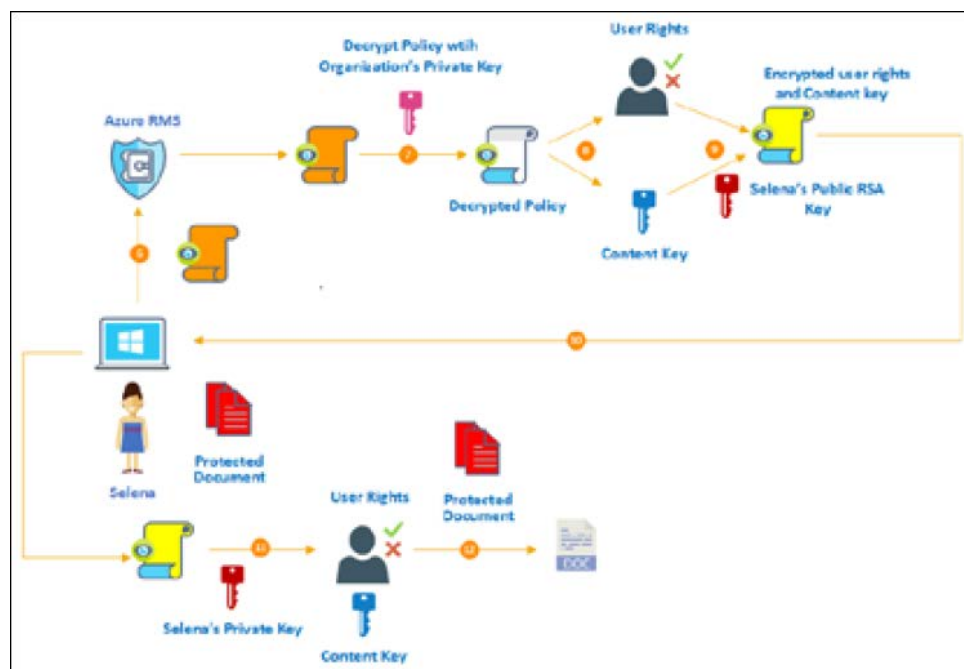


Figure 15.23: Data protection with Azure RMS

## Commands

### Command 15.1

```
Install-WindowsFeature ADRMS -IncludeManagementTools
```

# Chapter 16

## Figures



Figure 16.1: Authentication by using a secret

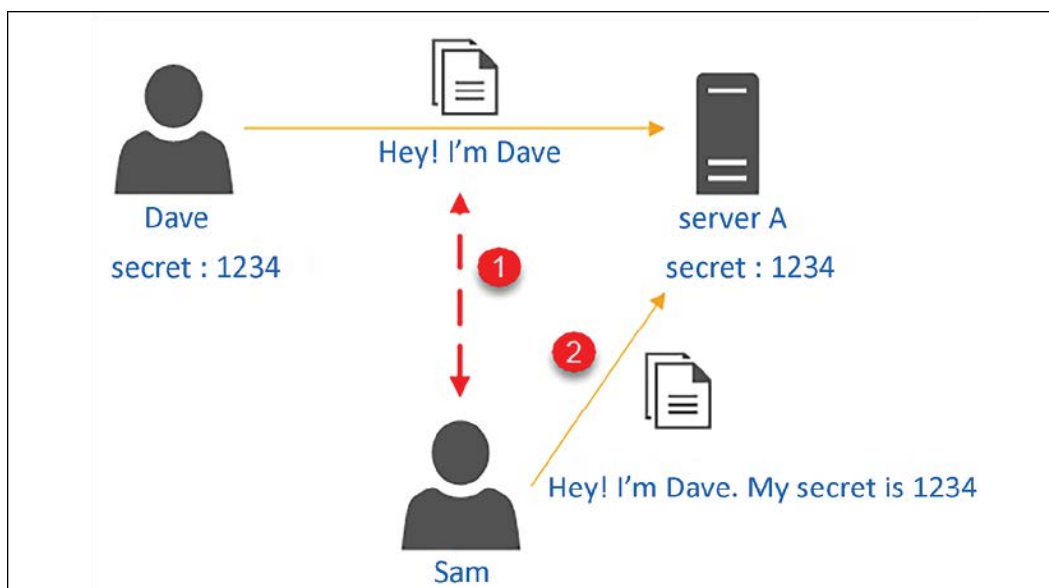


Figure 16.2: Man-in-the-middle attack

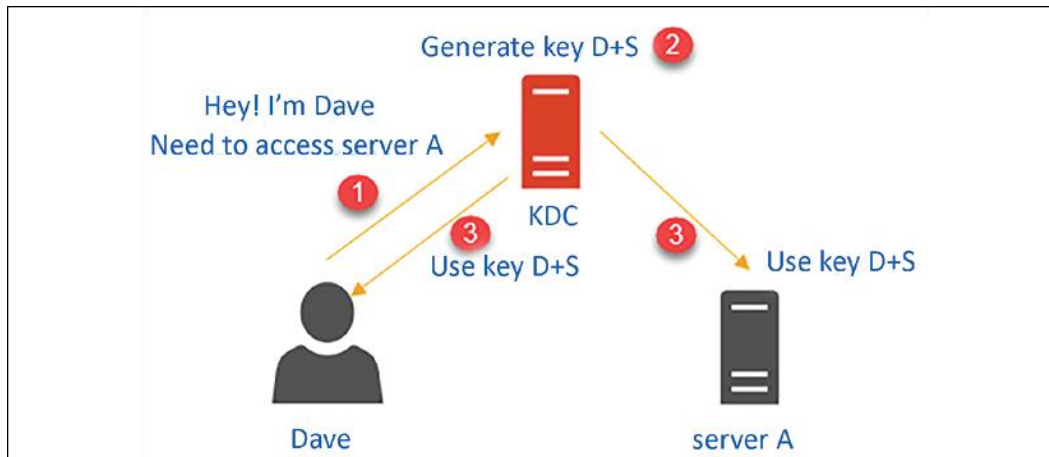


Figure 16.3: KDC in action

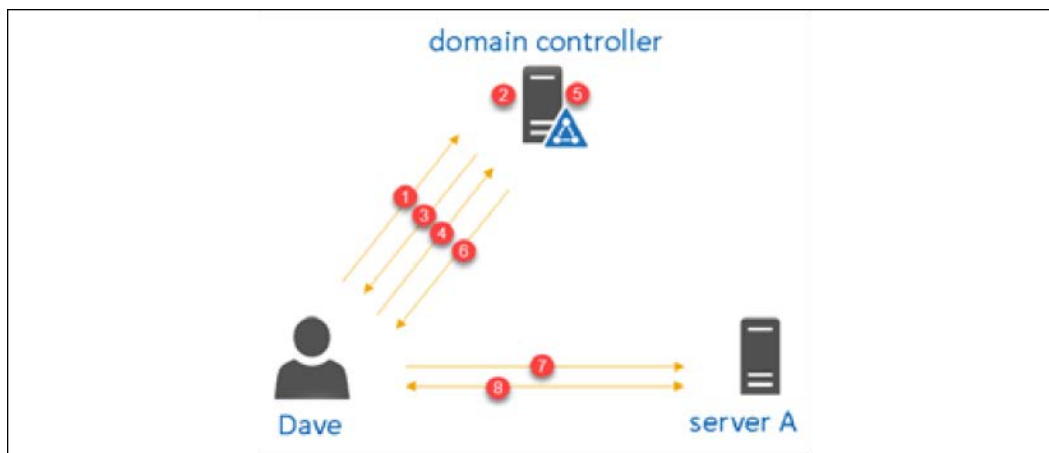
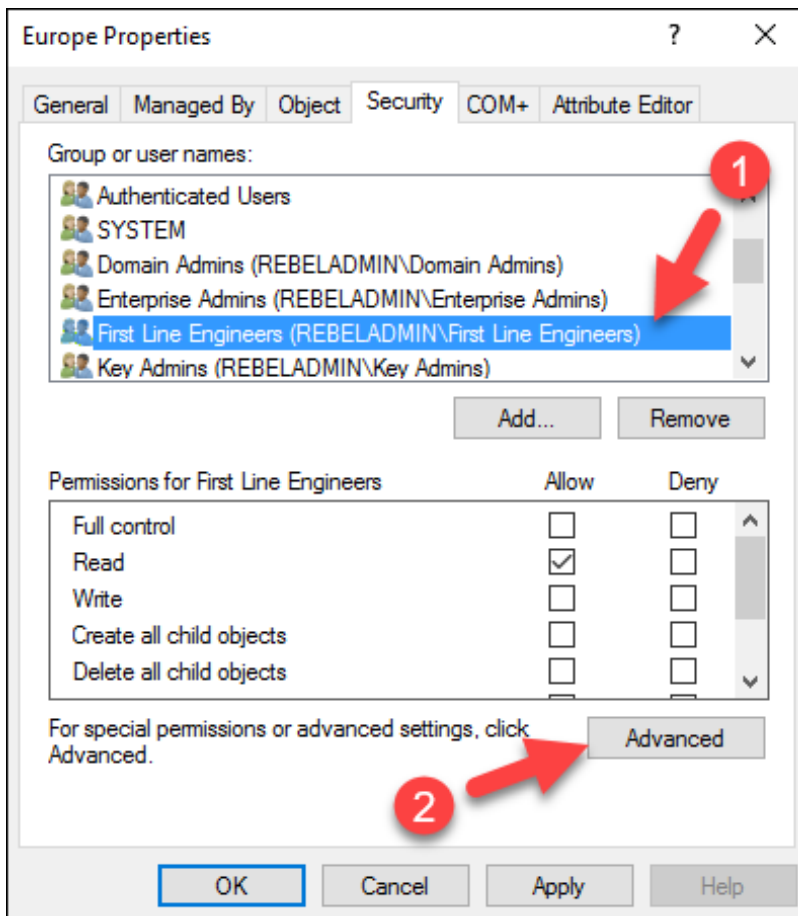


Figure 16.4: Authentication process in AD



**Figure 16.5: Open advanced permission settings for a group**

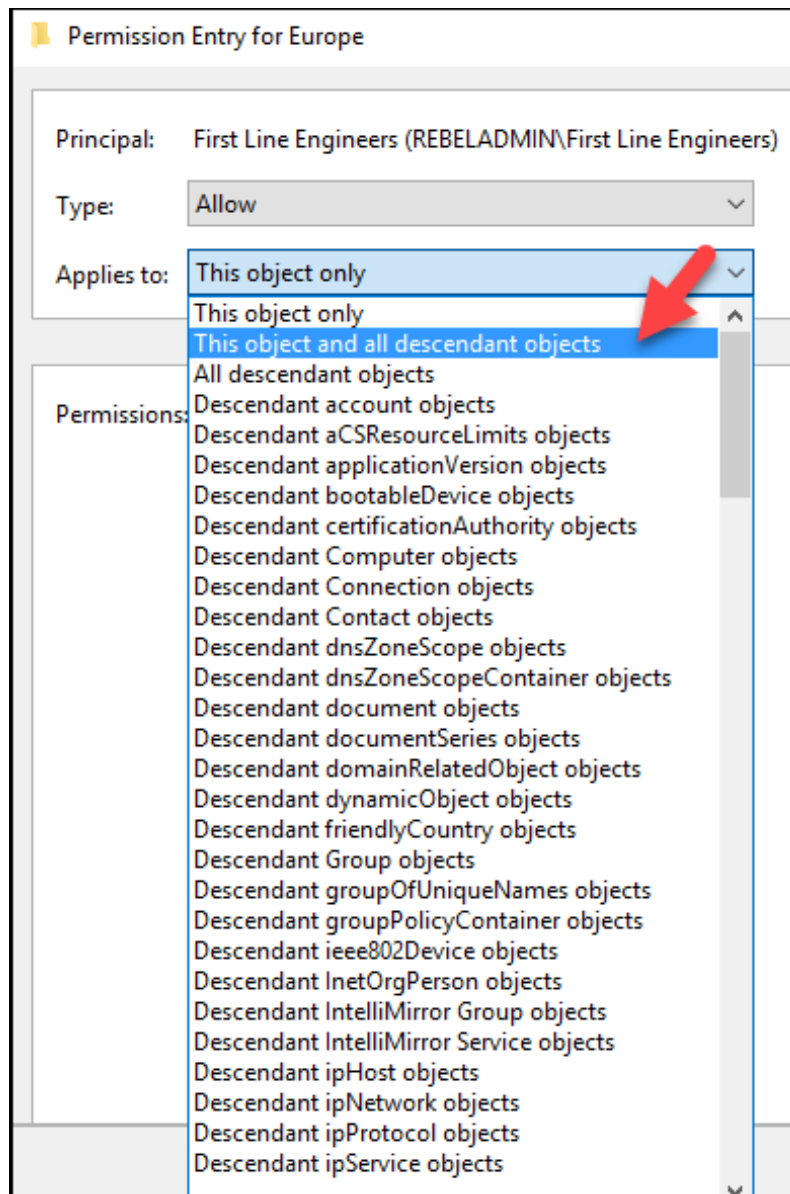


Figure 16.6: Advanced permission settings for a group

```
Administrator: PowerShell 7 (x64)
PowerShell 7.1.3
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\adam> New-ADUser -Name "Simon" -Path "OU=Users,OU=Asia,DC=rebeladmin,DC=com"
New-ADUser: Access is denied.
PS C:\Users\adam>
```

Figure 16.7: ACL permissions are preventing the provision of a new user account

```
C:\Program Files\PowerShell\7\powershell.exe
PowerShell 7.1.4
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\adam> Remove-ADUser -Identity "DN=Dishan Francis,OU=Europe,DC=rebeladmin,DC=com"

Confirm
Are you sure you want to perform this action?
Performing the operation "Remove" on target "DN=Dishan Francis,OU=Europe,DC=rebeladmin,DC=com".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): Y
Remove-ADUser: Access is denied.
PS C:\Users\adam>
```

Figure 16.8: ACL permissions are preventing the provision of a new user account

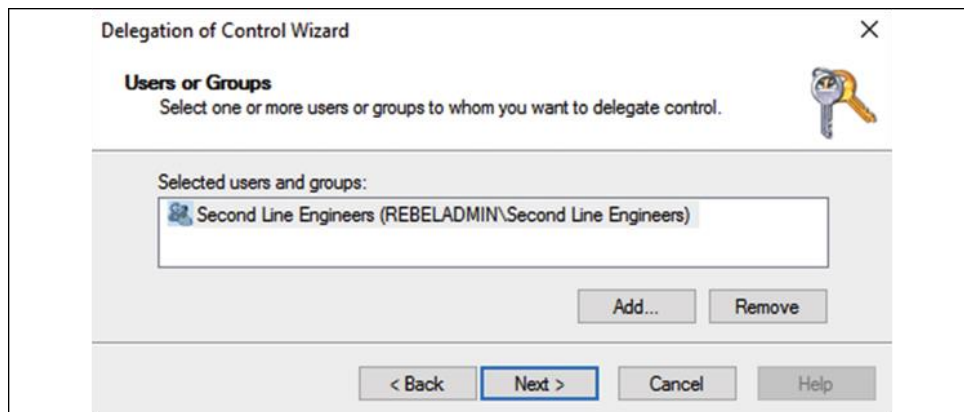


Figure 16.9: Delegating control for a group



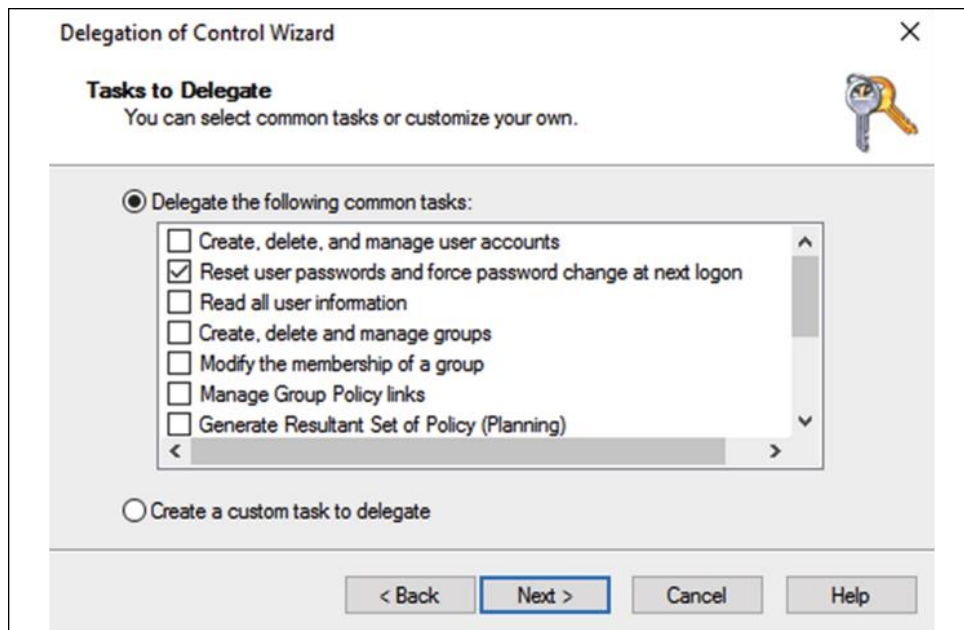


Figure 16.10: Delegate tasks

```
PS C:\Windows\System32> Remove-ADUser -Identity "CN=Dishan Francis,OU=Users,OU=Europe,DC=rebeladmin,DC=com"
Confirm
Are you sure you want to perform this action?
Performing the operation "Remove" on target "CN=Dishan Francis,OU=Users,OU=Europe,DC=rebeladmin,DC=com".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): Y
Remove-ADUser: Access is denied.
PS C:\Windows\System32>
```

Figure 16.11: Can't remove user as no delegated permissions



Figure 16.12: Password policy settings

```

PowerShell 7.1.3
Copyright (c) Microsoft Corporation.

https://aka.ms/powershell
Type 'help' to get help.

PS C:\Windows\System32> Get-ADFineGrainedPasswordPolicy -Identity "Domain Admin Password Policy"

AppliesTo          : {}
ComplexityEnabled   : True
DistinguishedName   : CN=Domain Admin Password Policy,CN=Password Settings
                    : Container,CN=System,DC=rebeladmin,DC=com
LockoutDuration     : 08:00:00
LockoutObservationWindow : 08:00:00
LockoutThreshold     : 3
MaxPasswordAge      : 30.00:00:00
MinPasswordAge      : 7.00:00:00
MinPasswordLength   : 12
Name               : Domain Admin Password Policy
ObjectClass         : msDS-PasswordSettings
ObjectGUID         : bef98e70-ba1a-48d9-b762-221f22784c88
PasswordHistoryCount : 50
Precedence          : 1
ReversibleEncryptionEnabled : False

PS C:\Windows\System32>

```

Figure 16.13: Properties of the password policy

```

PS C:\Windows\System32> Get-ADGroup -Identity "Protected Users"

DistinguishedName : CN=Protected Users,CN=Users,DC=rebeladmin,DC=com
GroupCategory     : Security
GroupScope        : Global
Name              : Protected Users
ObjectClass       : group
ObjectGUID        : 685c8266-fdf3-4092-8207-c3a57a16f0fa
SamAccountName    : Protected Users
SID               : S-1-5-21-1495263175-677223849-3620536339-525

```

Figure 16.14: Properties of the Protected Users group

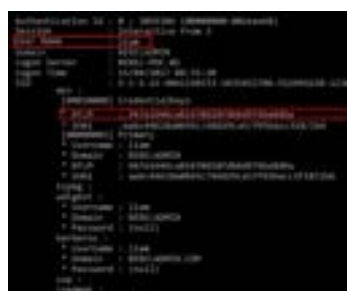


Figure 16.15: Viewing a hash value using Mimikatz



Figure 16.16: Viewing a hash value using Mimikatz of a user in the Protected Users group

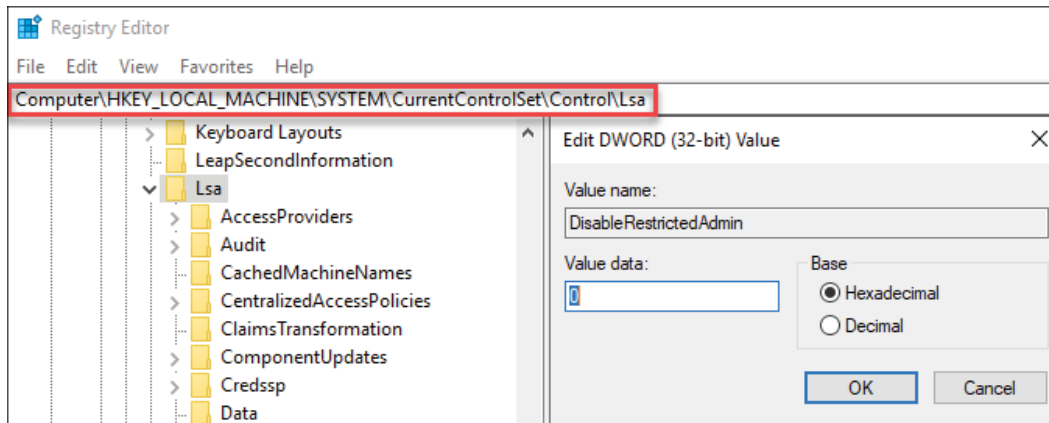


Figure 16.17: Registry key value

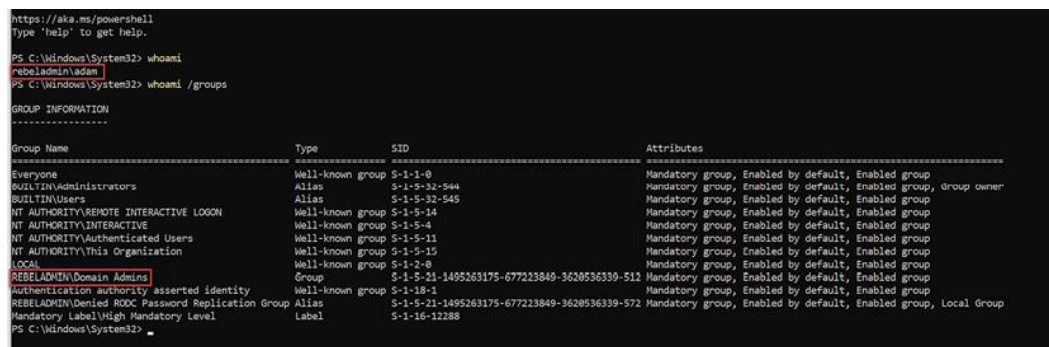


Figure 16.18: User's group memberships

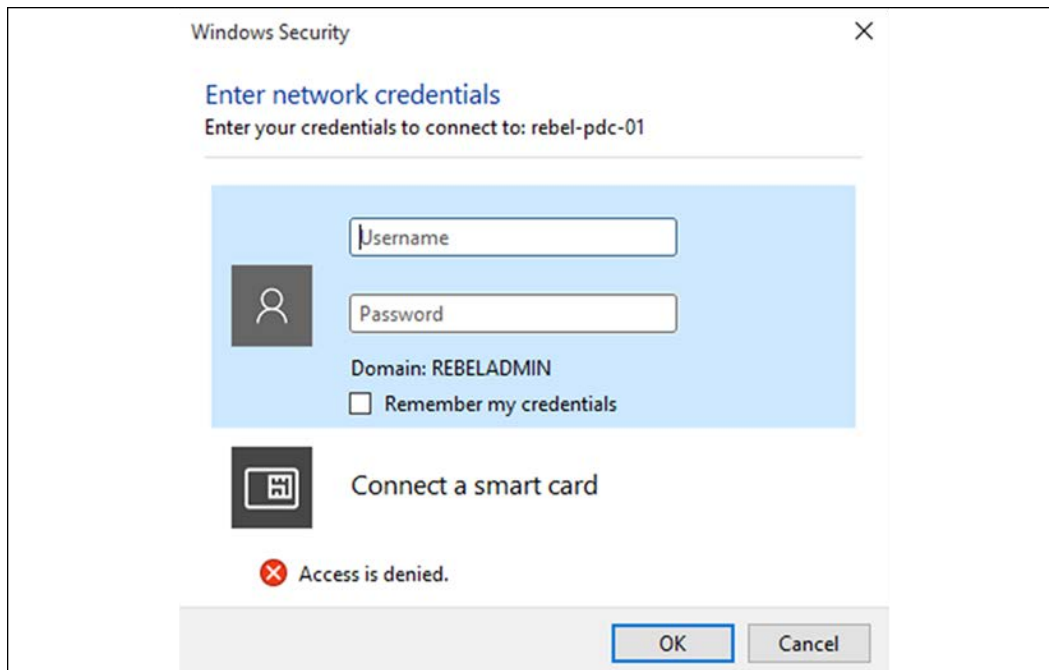


Figure 16.19: Login error

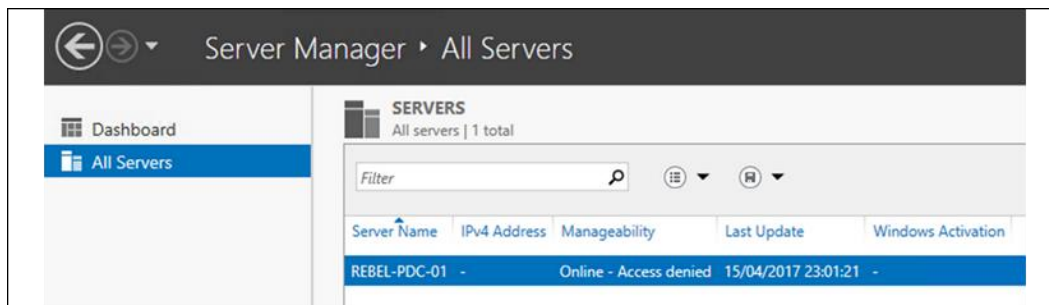


Figure 16.20: Server Manager access denied error

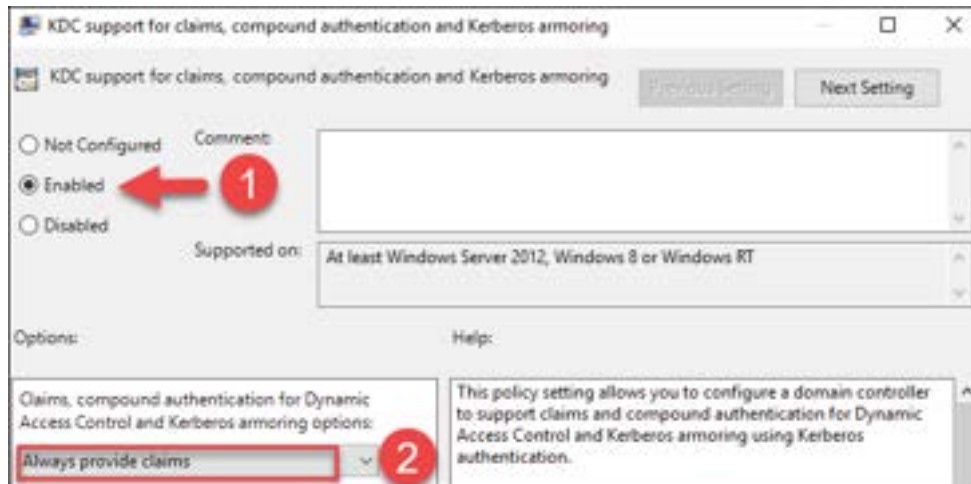


Figure 16.21: Enabling KDC support for claims, compound authentication, and Kerberos armoring policy setting

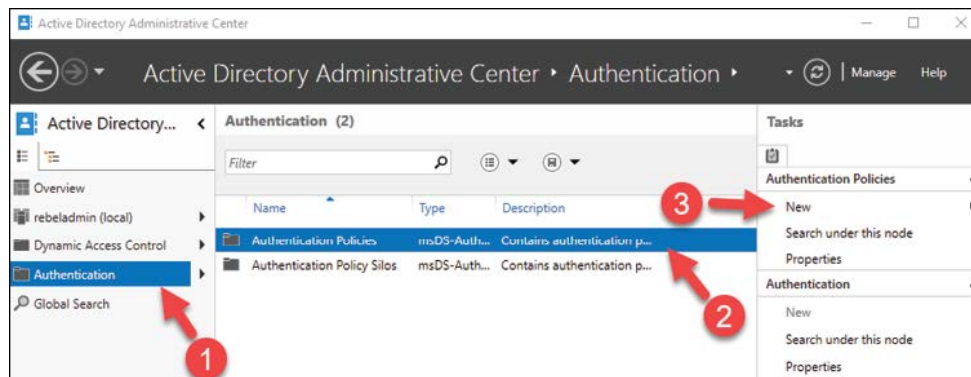


Figure 16.22: Creating a new authentication policy

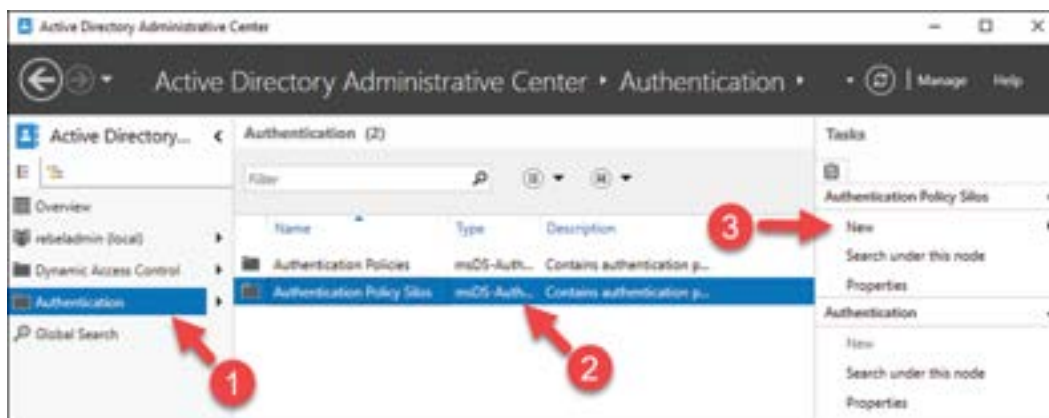


Figure 16.23: Creating new authentication policy silos

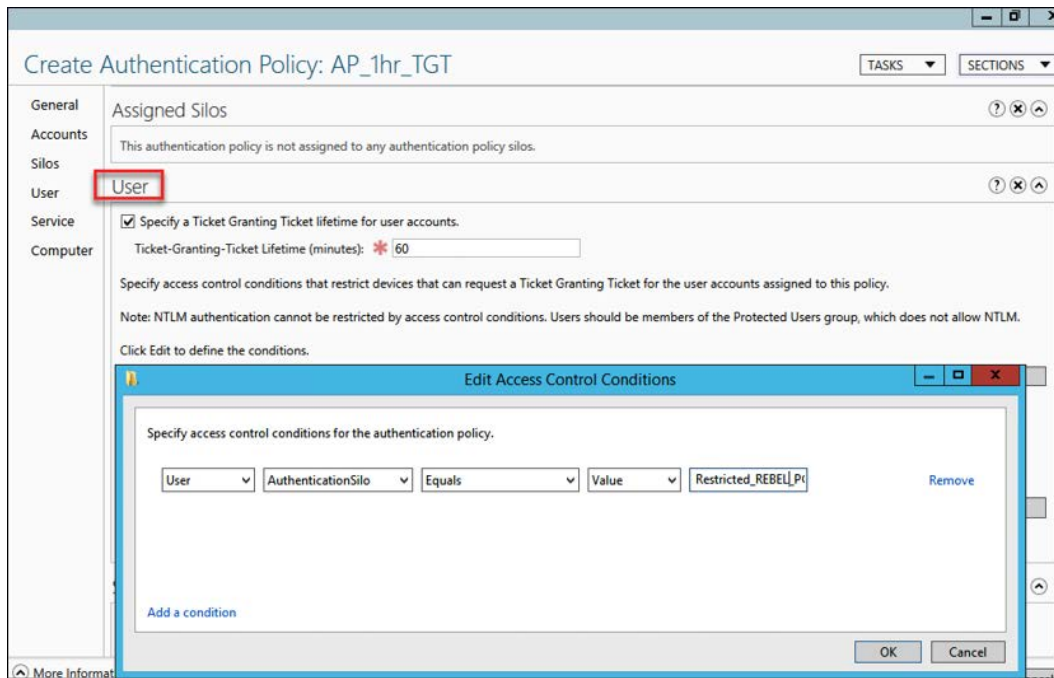


Figure 16.24: Edit Access Control Conditions

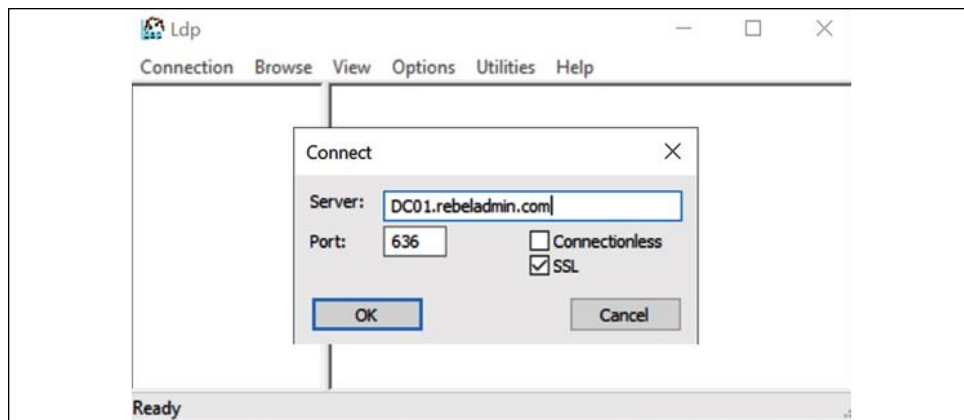


Figure 16.25: Testing a secure LDAP connection

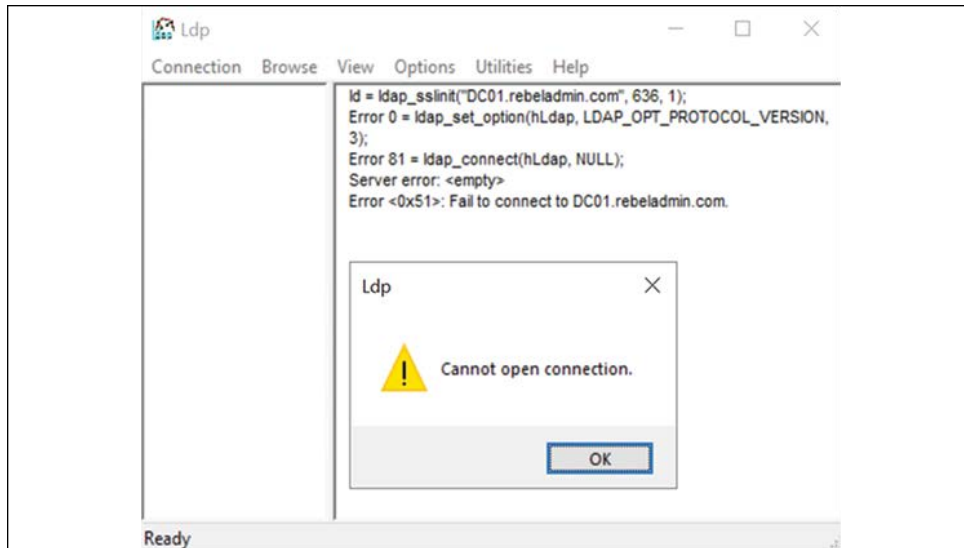


Figure 16.26: Secure LDAP connection fails

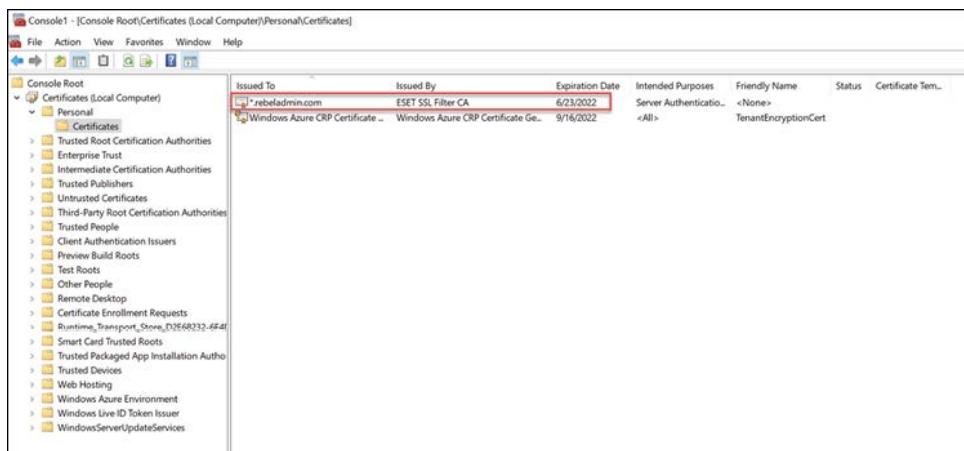


Figure 16.27: Installing a certificate in the domain controller



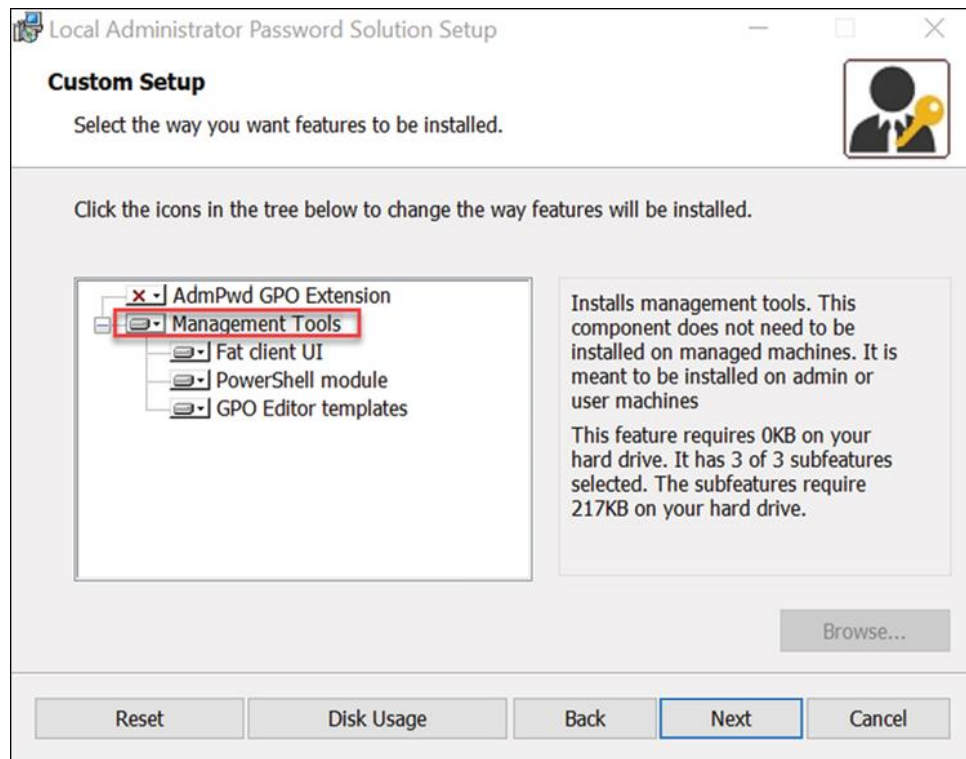


**Figure 16.28: Successful connection with secure LDAP**



**Figure 16.29: Microsoft LAPS installation wizard**





**Figure 16.30: Installing Management Tools**

```
PS C:\Users\dfrancis> Update-AdmPwdADSchema

Operation      DistinguishedName      Status
-----
AddSchemaAttribute cn=ms-Mcs-AdmPwdExpirationTime,CN=Schema,CN=Configuration,DC=rebeladmin,DC=com Success
AddSchemaAttribute cn=ms-Mcs-AdmPwd,CN=Schema,CN=Configuration,DC=rebeladmin,DC=com Success
ModifySchemaClass cn=computer,CN=Schema,CN=Configuration,DC=rebeladmin,DC=com Success

PS C:\Users\dfrancis>
```

**Figure 16.31: Updating the AD schema**

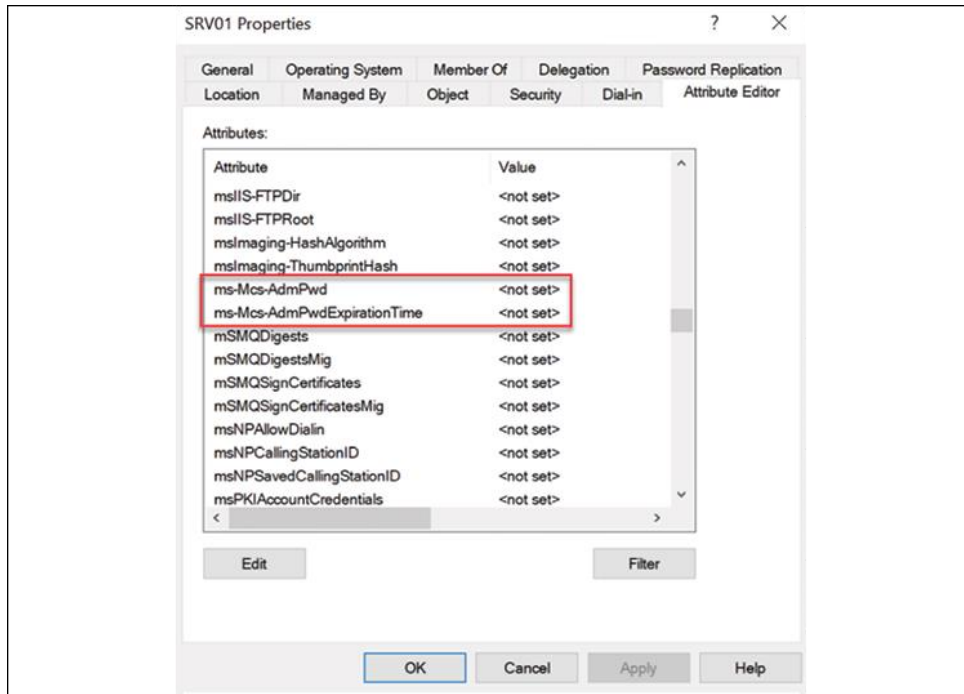


Figure 16.32: New attributes under the computer object

```
PS C:\Users\df Francis> Set-AdmPwdComputerSelfPermission -OrgUnit RAServers
```

| Name      | DistinguishedName                 | Status    |
|-----------|-----------------------------------|-----------|
| *****     | *****                             | *****     |
| RAServers | OU=RAServers,DC=rebeladmin,DC=com | Delegated |

```
PS C:\Users\df Francis>
```

Figure 16.33: Changing computer object permissions

```
PS C:\Windows\System32> Find-AdmPwdExtendedRights -Identity "RAServers"
```

| ObjectDN                          | ExtendedRightHolders                            |
|-----------------------------------|---|
| -----                             | -----   |
| OU=RAServers,DC=rebeladmin,DC=com | {NT AUTHORITY\SYSTEM, REBELADMIN\Domain Admins} |

```
PS C:\Windows\System32>
```

Figure 16.34: Verifying extended rights

```

PS C:\Windows\System32> Find-AdmPwdExtendedRights -Identity "RAServers" | fl

RunspaceId      : e7e145eb-a254-457a-a987-b93d3dfe28a8
ObjectDN        : OU=RAServers,DC=rebeladmin,DC=com
ExtendedRightHolders : {NT AUTHORITY\SYSTEM, REBELADMIN\Domain Admins, REBELADMIN\ITAdmins}

PS C:\Windows\System32>

```

Figure 16.35: Updated extended rights

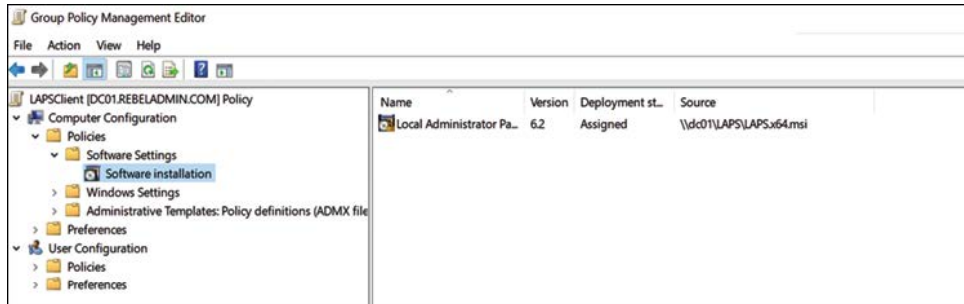


Figure 16.36: Installing an agent using a GPO



Figure 16.37: Microsoft LAPS GPO settings

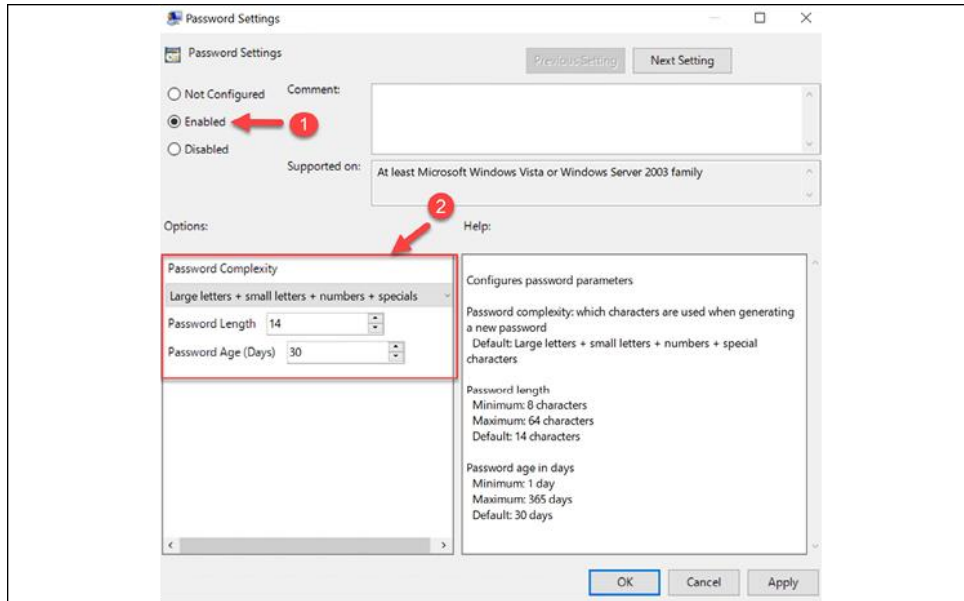


Figure 16.38: Microsoft LAPS GPO settings (password)

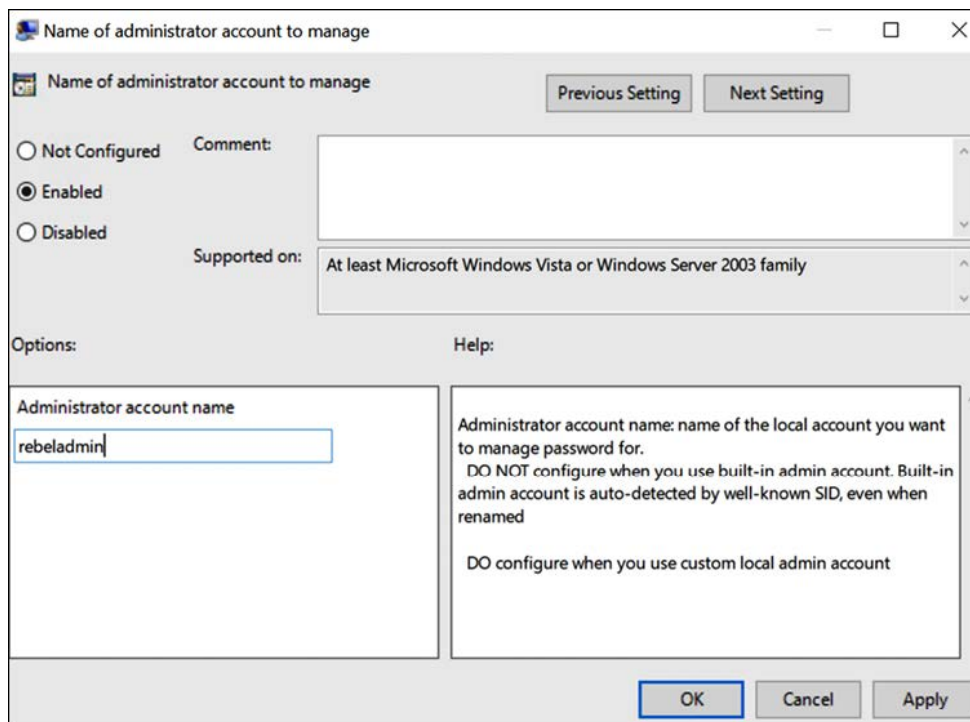


Figure 16.39: Microsoft LAPS GPO settings (Name of administrator account to manage)

LAPS UI

Computer name: SRV01 Search

Password: oGYV+dRZ ( [ ] 47-

Password expires: 8/7/2021 10:54:21 PM

New expiration time (leave as is for immediate expiration): Thursday . July 8, 2021 10:54:50 PM Set Exit

Figure 16.40: Checking the local administrator password using LAPS UI

```
PS C:\Windows\System32> Get-AdmPwdPassword -ComputerName SRV01
```

| ComputerName | DistinguishedName                           | Password        | ExpirationTimestamp  |
|--------------|---|-----------------|----------------------|
| SRV01        | CN=SRV01,OU=RSAServers,DC=rebeladmin,DC=com | oGYV+dRZ([ ]47- | 8/7/2021 10:54:21 PM |

Figure 16.41: Checking the local administrator password using PowerShell

Home > Contoso > Security > Authentication methods

Authentication methods | Password protection

Manage

- Policies
- Password protection

Monitoring

- Activity
- User registration details
- Registration and reset events
- Bulk operation results

Custom smart lockout

Lockout threshold: 10

Lockout duration in seconds: 60

Custom banned passwords

Enforce custom list: Yes

Custom banned password list: rebeladmin

Password protection for Windows Server Active Directory

Enable password protection on Windows Server Active Directory: Yes

Mode: Enforced

Figure 16.42: Enabling password protection on Windows AD

```
PS C:\Users\dfancis.M065X420225> Set-ADAccountPassword -Identity testuser -Reset -NewPassword (ConvertTo-SecureString -
AsPlainText "rebeladmin@123" -Force)
Set-ADAccountPassword: The password does not meet the length, complexity, or history requirement of the domain.
```

Figure 16.43: Test user password change

# Commands

## Command 16.1

```
New-ADUser -Name "Dale"  
-Path "OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

## Command 16.2

```
New-ADUser -Name "Simon"  
-Path "OU=Users,OU=Asia,DC=rebeladmin,DC=com"
```

## Command 16.3

```
Remove-ADUser -Identity "CN=Dishan Francis,  
OU=Users,OU=Europe,DC=rebeladmin,DC=com"
```

## Command 16.4

```
Set-ADAccountPassword -Identity difrancis
```

## Command 16.5

Remove-ADUser -Identity "CN=Dishan Francis,  
OU=Users,OU=Europe,DC=rebeladmin,DC=com"16.6

```
New-ADFineGrainedPasswordPolicy -Name "Domain Admin Password Policy" -  
Precedence 1 `   
-MinPasswordLength 12 -MaxPasswordAge "30" -MinPasswordAge "7" `   
-PasswordHistoryCount 50 -ComplexityEnabled:$true `   
-LockoutDuration "8:00" `   
-LockoutObservationWindow "8:00" -LockoutThreshold 3 `   
-ReversibleEncryptionEnabled:$false
```

## Command 16.7

```
Get-ADFineGrainedPasswordPolicy -Identity "Domain Admin Password  
Policy"
```

## Command 16.8

```
Add-ADFineGrainedPasswordPolicySubject -Identity "Domain Admin  
Password Policy" -Subjects "Domain Admins"16.9
```

```
Get-ADFineGrainedPasswordPolicy -Identity "Domain Admin Password Policy" | Format-Table AppliesTo -AutoSize
```

#### Command 16.10

```
Get-ADFineGrainedPasswordPolicy -Filter * | Format-Table Name,Precedence,AppliesTo -AutoSize
```

#### Command 16.11

```
Get-ADGroup -Identity "Protected Users"
```

#### Command 16.12

```
Get-ADGroup -Identity "Protected Users" | Add-ADGroupMember -Members "CN=Adam,CN=Users,DC=rebeladmin,DC=com"
```

#### Command 16.13

```
Get-ADGroupMember -Identity "Protected Users"
```

#### Command 16.14

```
New-ADAuthenticationPolicy -Name "AP_1hr_TGT" -UserTGTLifetimeMins 60 -Enforce
```

#### Command 16.15

```
New-ADAuthenticationPolicySilo -Name Restricted_REBEL_PC01 -UserAuthenticationPolicy AP_1hr_TGT -ComputerAuthenticationPolicy AP_1hr_TGT -ServiceAuthenticationPolicy AP_1hr_TGT -Enforce
```

#### Command 16.16

```
Grant-ADAuthenticationPolicySiloAccess -Identity Restricted_REBEL_PC01 -Account Peter
```

#### Command 16.17

```
Get-ADComputer -Filter 'Name -like "REBEL-PC01"' | Grant-ADAuthenticationPolicySiloAccess -Identity Restricted_REBEL_PC01
```

**Command 16.18**

```
Set-ADAccountAuthenticationPolicySilo -Identity Peter -  
AuthenticationPolicySilo Restricted_REBEL_PC01 -AuthenticationPolicy  
AP_1hr_TGT
```

**Command 16.19**

```
Get-ADComputer -Filter 'Name -like "REBEL-PC01"' | Set-  
ADAccountAuthenticationPolicySilo -AuthenticationPolicySilo  
Restricted_REBEL_PC01 -AuthenticationPolicy AP_1hr_TGT
```

**Command 16.20**

```
Set-ADAuthenticationPolicy -Identity AP_1hr_TGT -  
UserAllowedToAuthenticateFrom  
"O:SYG:SYD:(XA;OICI;CR;;;WD;(@USER.ad://ext/AuthenticationSilo ==  
`"Restricted_REBEL_PC01`")")"
```

**Command 16.21**

```
Import-module AdmPwd.PS
```

**Command 16.22**

```
Set-AdmPwdComputerSelfPermission -OrgUnit RAServers
```

**Command 16.23**

```
Import-module AdmPwd.PS
```

**Command 16.24**

```
Find-AdmPwdExtendedRights -Identity "RAServers"
```

**Command 16.25**

```
Set-AdmPwdReadPasswordPermission -Identity "RAServers" -  
AllowedPrincipals "ITAdmins"
```

**Command 16.26**



```
Find-AdmPwdExtendedRights -Identity "RAServers" | fl
```

#### Command 16.27

```
Get-AdmPwdPassword -ComputerName SRV01
```

#### Command 16.28

```
Import-Module AzureADPasswordProtection  
Register-AzureADPasswordProtectionProxy -AccountUpn  
'admin@rebeladm.onmicrosoft.com'
```

#### Command 16.29

```
Import-Module AzureADPasswordProtection  
Register-AzureADPasswordProtectionForest -AccountUpn  
'admin@rebeladm.onmicrosoft.com'
```

#### Command 16.30

```
Set-ADAccountPassword -Identity testuser -Reset -NewPassword  
(ConvertTo-SecureString -AsPlainText "rebeladmin@A123" -Force)
```

# Chapter 17

## Advanced AD Management with PowerShell

The very first **Active Directory (AD)** instance I set up was based on Windows Server 2003. It was a completely different approach from today's Active Directory installations. In Windows Server 2003, there were a lot of prerequisite tasks, such as installing a DNS role, setting up DNS zones, and adding the domain prefix. Even those tasks were directly related to **Active Directory Domain Services (AD DS)**, and I had to configure them separately prior to running the `DCPROMO.exe` command. But today, the Active Directory role installation process is very straightforward. With basic knowledge and resources, anyone can get a domain controller up and running with a few clicks.

Microsoft has made server role installations and configurations easy over the years, not just AD DS. The main reason behind all these enhancements was to save time for engineers. Installations, configurations, and repetitive infrastructure tasks take up the majority of an engineer's time. Also with the pandemic, an engineer has to wear many hats as businesses shrink IT budgets. To save time on repetitive administrative tasks, we should be looking at automation technologies. In the early days, we used `DOS` commands, VBScript, and batch files to automate administrative tasks. But there were problems with that. Applications, server roles, and services had limitations on working with these automation technologies. Not every function available in the GUI supported the use of commands or scripts. This lack of support and lack of flexibility was holding engineers back from automating tasks.

To bring automation to the next level, Microsoft released a more flexible, more powerful, more integrated scripting language.

PowerShell 1.0 was the starting point and it was available to the public from November 2006. During the last decade, there have been a few versions released and it's now at version 5.1 (mainstream). Microsoft also released a separate version of PowerShell called PowerShell Core 6.0 (January 10, 2018). It was compatible with Linux and macOS as well. Now it has been replaced by PowerShell 7.0. In *Chapter 2, Active Directory Domain Services 2022*, I mentioned PowerShell 7 and throughout this book, I have used PowerShell 7 for configurations and the administration of Active Directory roles. In this chapter, I will explain how we can use PowerShell to further improve AD DS environment management.

We are also going to look at managing identities in a hybrid environment using Azure AD PowerShell and Microsoft Graph.

The cmdlets and scripts used in this chapter were written and tested in an environment that has the following:

- Windows Server 2022
- An AD domain and forest functional level set to Windows Server 2016
- PowerShell 7.1

- Azure AD Premium P2

In this chapter, we will cover the following topics:

- PowerShell scripts and commands that can be used to manage AD objects
- PowerShell scripts and commands that can be used to manage and troubleshoot AD replication
- PowerShell scripts and commands that can be used to manage identities in a hybrid environment using the Azure AD PowerShell module
- Microsoft Graph for Hybrid Identity management

Before we start using PowerShell for Active Directory management, we need to make sure relevant tools are installed and configured.

## AD management with PowerShell – preparation

A PowerShell module includes assemblies, scripts, and functionalities. In order to use the functionalities, we need to import the module. After that, we can call for the contents of the module to manage relevant server roles, services, or features.

Before we start Active Directory management with PowerShell, first we need to import the ActiveDirectory module.

There are a few ways to do this. These include installing the AD DS server role or by installing **Remote Server Administration Tools (RSAT)**:

- **AD DS server role:**
  - a. If we install the AD DS server role using Server Manager, the Active Directory module for Windows PowerShell is installed as a feature:

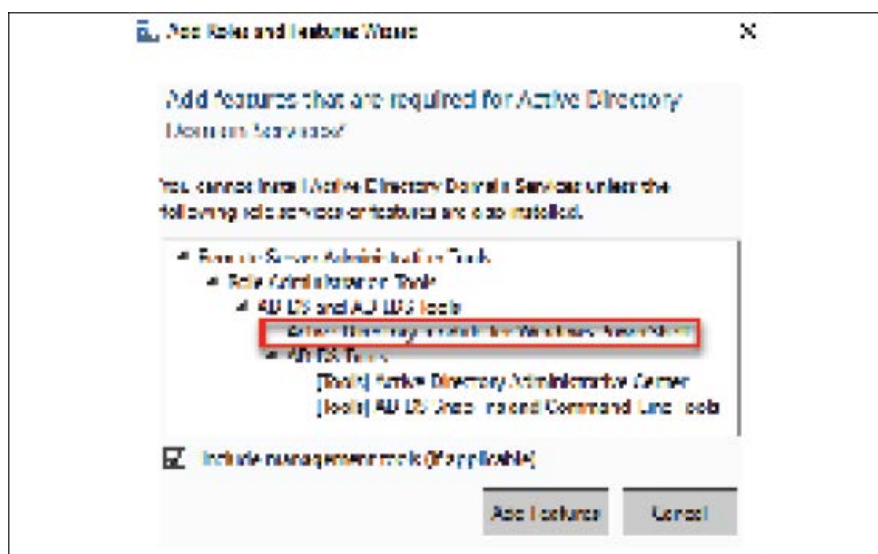


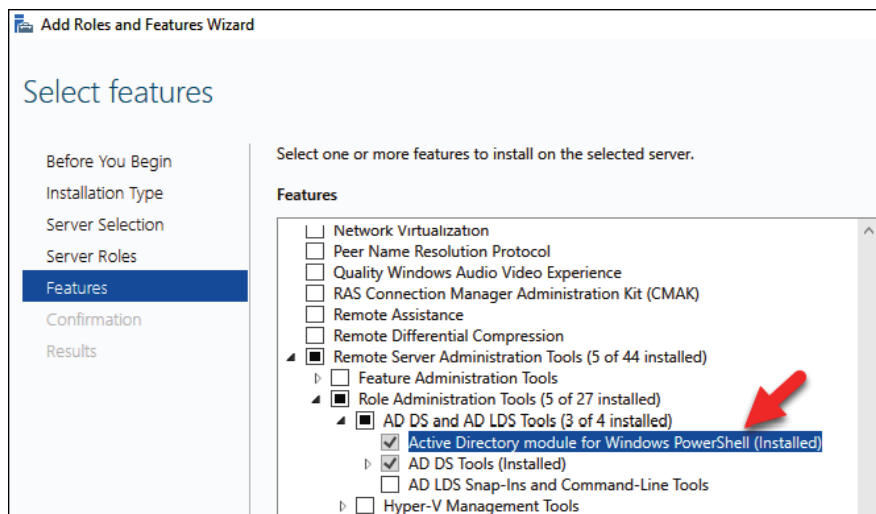
Figure 17.1: Active Directory module for Windows PowerShell feature

- b. If the AD DS role is installed using PowerShell, we need to include the management tools by using -IncludeManagementTools. Otherwise, by default, it will not install the module:

```
Install-WindowsFeature -Name AD-Domain-Services -  
IncludeManagementTools
```

- **Remote Server Administration Tools:**

- c. Even if the server doesn't have the AD DS role installed, the existing domain environment can be managed using the AD DS PowerShell module. The AD PowerShell module is included with RSAT and can be installed using Server Manager or PowerShell.
- d. On Server Manager, it can be found by navigating to **Features | Remote Server Administration Tools | Role Administration Tools | AD DS and AD LDS Tools | Active Directory module for PowerShell**, as shown in the following screenshot:



**Figure 17.2: Active Directory module for Windows PowerShell feature under RSAT**

- e. It can also be installed using PowerShell:

```
Add-WindowsFeature RSAT-AD-PowerShell
```

It is also possible to install RSAT on the Windows desktop OS. As an example, RSAT for Windows 10 can be downloaded from <https://bit.ly/3HZ5k0W>.

## PowerShell 7

In the preceding section, I explained how we can prepare native Windows PowerShell for Active Directory administration. Most of the scripts and commands used in this book also work with native Windows PowerShell. But PowerShell 7 works in a different way. It doesn't come as part of Windows and needs to be installed separately as an application. To install PowerShell 7, please follow the following guide: <https://bit.ly/30Pu4HM>

After prerequisites are in place, we can list all the commands available under the module using the following command:

```
Get-Command -Module ActiveDirectory
```

There are about 147 commands under the module. The complete syntax for any command can be viewed using this command:

```
Get-Command commandname -Syntax
```

As an example, the following command will list the syntax for the New-ADUser command:

```
Get-Command New-ADUser -Syntax
```

The `Get-Help` command provides help for any command. As an example, the following command provides help for the `New-ADUser` command:

```
Get-Help New-ADUser
```

We also can view an example for the New-ADUser command using this:

```
Get-Help New-ADUser -Example
```

More information on the command can be viewed using this:

```
Get-Help New-ADUser -Detailed
```

Technical information on the command can be viewed using the following:

```
Get-Help New-ADUser -Full
```

Online information about the command can be viewed using this:

```
Get-Help New-ADUser -Online
```

In this section, we learned how to install the Active Directory module for PowerShell. We also learned about the basic functions of the module. Now, let's move on and further explore the Active Directory management capabilities of the module.

## AD management commands and scripts

The module has 147 commands, and they can be used in countless different ways to manage the Active Directory environment. In this section, we will look at the capabilities of these commands and see how we can use them to improve Active Directory management.

I'd like to start this section by explaining how we can review the existing configuration of an Active Directory environment. The quick way to review the directory server configuration and capabilities is to use the following command:

```
Get-ADRootDSE
```

This command provides important information, such as forest and domain functional levels, the default naming context, the current time, and the currently logged-in domain controller.

The next step is to find the domain controllers in the domain. We can use the following to list the domain controller name, the IP address, the status of the global catalog server, and the **Flexible Single Master Operation (FSMO)** roles:

```
Get-ADDomainController -Filter * | Select-Object  
Name,IPv4Address,IsGlobalCatalog,OperationMasterRoles
```

It is also important to know about the Active Directory site as it explains the physical topology of Active Directory:

```
Get-ADDomainController -Filter * | Select-Object Name,IPv4Address,Site
```

An Active Directory forest can have multiple domains. The following commands will list the forest names, the domain name, the domain controller, the IP address, and the Active Directory site:

```
$Forestwide = (Get-ADForest).Domains | %{ Get-ADDomainController -  
Filter * -Server $_ }  
write-output $Forestwide -Filter * | Select-Object  
Name,Forest,Domain,IPv4Address,Site
```

If we know the domain name, we can list the domain controllers and the **read-only domain controller (RODC)** using the following command:

```
$Domain = Read-Host 'What is your Domain Name ?'  
Get-ADDomain -Identity $Domain | select  
ReplicaDirectoryServers,ReadOnlyReplicaDirectoryServer
```

With this command, the system will ask the user to input the domain name. Once the user replies, it lists the domain controllers.

In the preceding command, ReplicaDirectoryServers represents the read and write domain controllers, and ReadOnlyReplicaDirectoryServer represents the RODCs.

## Replication

Data replication is crucial for a healthy Active Directory environment. For a given domain controller, we can find its inbound replication partners using this:

```
Get-ADReplicationPartnerMetadata -Target REBEL-SRV01.rebeladmin.com
```

The preceding command provides a detailed description of the replication health of the given domain controller, including the last successful replication, replication partition, server, and so on.

We can list all the inbound replication partners for the given domain using the following command:

```
Get-ADReplicationPartnerMetadata -Target "rebeladmin.com" -Scope  
Domain
```

In the preceding command, the scope is defined as the domain. This can be changed to the forest to get a list of the inbound partners in the forest. The output is based on the default partition. If needed, the

partition can be changed using `-Partition` to a configuration or schema partition. It will list the relevant inbound partners for the selected partition.

The associated replication failures for a site, forest, domain, and domain controller can be found using the `Get-ADReplicationFailure` cmdlet:

```
Get-ADReplicationFailure -Target REBEL-SRV01.rebeladmin.com
```

The preceding command will list the replication failures for the given domain controller.

Replication failures for the domain can be found using this:

```
Get-ADReplicationFailure -Target rebeladmin.com -Scope Domain
```

Replication failures for the forest can be found using the following command:

```
Get-ADReplicationFailure -Target rebeladmin.com -Scope Forest
```

Replication failures for the site can be found using the following command:

```
Get-ADReplicationFailure -Target LondonSite -Scope Site
```

In the preceding command, `LondonSite` can be replaced with a relevant site name.

Using both `Get-ADReplicationPartnerMetadata` and `Get-ADReplicationFailure`, I have created the following PowerShell script to generate a replication health report against a specific domain controller.

The first part of the script is used to define the objects that we'll use throughout the script:

```
## Active Directory Domain Controller Replication Status##
$domaincontroller = Read-Host 'What is your Domain Controller?'
## Define Objects ##
$report = New-Object PSObject -Property @{
    ReplicationPartners = $null
    LastReplication = $null
    FailureCount = $null
    FailureType = $null
    FirstFailure = $null
}
```

In the preceding script, I have given an option for the engineer to specify the name of the domain controller:

```
$domaincontroller = Read-Host 'What is your Domain Controller?'
```

In the next part of the script, I am collecting the following data, which describes the replication connection status with the other domain controllers:

- Replication partner (ReplicationPartners)
- Last successful replication (LastReplication)

```
## Replication Partners ##
$report.ReplicationPartners = (Get-ADReplicationPartnerMetadata -
Target $domaincontroller).Partner
$report.LastReplication = (Get-ADReplicationPartnerMetadata -Target
$domaincontroller).LastReplicationSuccess
```

Then, I also gather the following data, which helps engineers to troubleshoot replication issues, if any exist:

- Active Directory replication failure count (FailureCount)
- Active Directory replication failure type (FailureType)
- Active Directory replication failure first recorded time (FirstFailure)

```
## Replication Failures ~##
$report.FailureCount = (Get-ADReplicationFailure -Target
$domaincontroller).FailureCount
$report.FailureType = (Get-ADReplicationFailure -Target
$domaincontroller).FailureType
$report.FirstFailure = (Get-ADReplicationFailure -Target
$domaincontroller).FirstFailureTime
```

The last part of the script formats the output of the collected data:

```
## Format Output ##
$report | select
ReplicationPartners,LastReplication,FirstFailure,FailureCount,FailureT
ype | Out-GridView
```

The aforementioned script is displayed in an easy way for readers to understand. When it is used in PowerShell, make sure to prevent extra line spaces.

Further to Active Directory replication topologies, there are two types of replication:

- **Intra-site:** Replication between domain controllers in the same Active Directory site
- **Inter-site:** Replication between domain controllers in different Active Directory sites

We can review AD replication site objects using the Get-ADReplicationSite cmdlet. The following command returns all the Active Directory replication sites in the Active Directory forest:

```
Get-ADReplicationSite -Filter *
```

We can review Active Directory replication site links on the Active Directory forest using the following command:

```
Get-ADReplicationSiteLink -Filter *
```

In site links, the most important information is to know the site cost and the replication schedule. This allows us to understand the replication topology and expected delays in replication.



The following command lists all the replication site links, which includes the CanadaSite along with the site link name, link cost, and replication frequency:

```
Get-ADReplicationSiteLink -Filter {SitesIncluded -eq "CanadaSite"} |  
Format-Table Name,Cost,ReplicationFrequencyInMinutes -AutoSize
```

A site link bridge can be used to bundle two or more site links and enable transitivity between site links.

Site link bridge information can be retrieved using the following command:

```
Get-ADReplicationSiteLinkBridge -Filter *
```

An AD site uses multiple IP subnets that are assigned to sites for its operations. It is important to associate these subnets with AD sites so that domain controllers know which computer is located at which site.

The following command will list all the subnets in the forest in a table with the subnet name and Active Directory site:

```
Get-ADReplicationSubnet -Filter * | Format-Table Name,Site -AutoSize
```

Bridgehead servers operate as the primary communication point to handle the replication data that comes in and goes out of the Active Directory site.

We can list all the preferred bridgehead servers in a domain:

```
$BHservers = ([adsisearcher]"LDAP://CN=IP,CN=Inter-Site  
Transports,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com").bridgehead  
ServerListBL  
$BHservers | Out-GridView
```

In the preceding command, the `bridgeheadServerListBL` attribute value is retrieved via the ADSI connection.

Information about the replication topology helps engineers in many ways, especially if engineers are troubleshooting Active Directory replication issues or performing an Active Directory audit. By using the preceding commands, I have created the following script to gather Active Directory replication topology data in one go.

As usual, the first part of the script is dedicated to defining objects:

```
## Script to gather information about Replication Topology ##  
## Define Objects ##  
$replreport = New-Object PSObject -Property @{  
    Domain = $null  
}
```

Before we move on to the replication, it is good to collect the Active Directory domain information. This is important if an organization is using multiple domains as we can easily separate the reports:

```
## Find Domain Information ##  
$replreport.Domain = (Get-ADDomain).DNSroot
```

I have used the next section of the script to list the Active Directory sites:

```
## List down the AD sites in the Domain ##
$a = (Get-ADReplicationSite -Filter *)
Write-Host "#####" $replreport.Domain "Domain AD Sites" "#####"
$a | Format-Table Description,Name -AutoSize
```

Then, I am going to collect data about the Active Directory replication site link and the Active Directory replication site link bridge by using the following:

```
## List down Replication Site link Information ##
$b = (Get-ADReplicationSiteLink -Filter *)
Write-Host "#####" $replreport.Domain "Domain AD Replication
SiteLink Information" "#####"
$b | Format-Table Name,Cost,ReplicationFrequencyInMinutes -AutoSize
## List down SiteLink Bridge Information ##
$c = (Get-ADReplicationSiteLinkBridge -Filter *)
Write-Host "#####" $replreport.Domain "Domain AD SiteLink Bridge
Information" "#####"
$c | select Name,SiteLinksIncluded | Format-List
```

In a computer network, there can be multiple IP subnets. These subnets need to be assigned correctly to Active Directory sites. This way, Active Directory Domain Controller computers know which site they belong to. This also has a direct impact on Active Directory replication. In the next section, we are going to collect Active Directory subnet information and the preferred bridgehead servers for the domain:

```
## List down Subnet Information ##
$d = (Get-ADReplicationSubnet -Filter * | select Name,Site)
Write-Host "#####" $replreport.Domain "Domain Subnet Information"
"#####"
$d | Format-Table Name,Site -AutoSize
## List down Preferred BridgeHead Servers ##
$e = ([adsisearcher]"LDAP://CN=IP,CN=Inter-Site
Transports,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com").bridgehead
ServerListBL
Write-Host "#####" $replreport.Domain "Domain Preferred BridgeHead
Servers" "#####"
$e
## End of the Script ##
```

The aforementioned script is displayed in a way that's easy for readers to understand. When it is used in PowerShell, make sure to prevent extra line spaces.

In the preceding script, we need to replace the ADSI connection with the relevant domain name:

```
$e = ([adsisearcher]"LDAP://CN=IP,CN=Inter-Site
Transports,CN=Sites,CN=Configuration,DC=rebeladmin,DC=com")
```

Healthy replication is critical for Active Directory Domain controllers. The time it takes to replicate a change to all the domain controllers depends on the number of domain controllers in place,

geographical locations, replication schedules, etc. In some situations, we have to force the replication of objects and in the next section, we are going to look into it in detail.

## Replicating a specific object

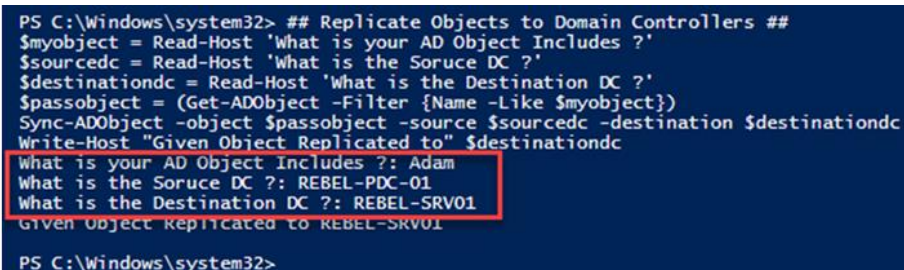
Once an object is added to a domain controller, it needs to be replicated to all other domain controllers. Otherwise, users will face issues during login using AD-integrated applications and services. The replication is dependent on many different factors, such as the replication schedule and intra-site connectivity. Sometimes, we need to force the replication between domain controllers:

```
## Replicate Object to From Domain Controller to Another ##
$myobject = Read-Host 'What is your AD Object Includes ?'
$sourcedc = Read-Host 'What is the Source DC ?'
$destinationdc = Read-Host 'What is the Destination DC ?'
$passobject = (Get-ADObject -Filter {Name -Like $myobject})
Sync-ADObject -object $passobject -source $sourcedc -destination $destinationdc
Write-Host "Given Object Replicated to" $destinationdc
```

The preceding script will ask a few questions:

- **Name of object:** This need not be a **distinguished name (DN)**. All that is needed is that text be included in the object name field.
- **Source DC:** The hostname of the source DC.
- **Destination DC:** The hostname of the destination DC.

Once the relevant information is provided, the object will be forcibly replicated:



```
PS C:\Windows\system32> ## Replicate Objects to Domain Controllers ##
$myobject = Read-Host 'What is your AD Object Includes ?'
$sourcedc = Read-Host 'What is the Source DC ?'
$destinationdc = Read-Host 'What is the Destination DC ?'
$passobject = (Get-ADObject -Filter {Name -Like $myobject})
Sync-ADObject -object $passobject -source $sourcedc -destination $destinationdc
Write-Host "Given Object Replicated to" $destinationdc
What is your AD Object Includes ? : Adam
What is the Source DC ? : REBEL-PDC-01
What is the Destination DC ? : REBEL-SRV01
Given Object Replicated to REBEL-SRV01
PS C:\Windows\system32>
```

**Figure 17.3: Replicating a specific object**

In this section of the chapter, we learned how the Active Directory module for PowerShell can be used to review the topology of an Active Directory environment. We also learned how we can audit, troubleshoot, and manage Active Directory replication using PowerShell. In the next section, we are going to look into Active Directory object management.

# Users and groups

In this section, let's look at PowerShell commands and scripts that we can use to manage AD users and groups.

## Last logon time

On certain occasions, we are required to find when a user successfully logs on to a domain. This can be for audit purposes or for troubleshooting purposes:

```
$username = Read-Host 'What is the User account you looking for ?'
$dcs = Get-ADDomainController -Filter {Name -like "*"}
foreach($dc in $dcs)
{
    $hostname = $dc.HostName
    $user = Get-ADUser $username -Server $hostname -Properties
lastLogon
    $lngexpires = $user.lastLogon
    if (-not ($lngexpires)) {$lngexpires = 0 }
    If (($lngexpires -eq 0) -or ($lngexpires -gt
[DateTime]::MaxValue.Ticks))
    {
        $LastLogon = "User Never Logged In"
    }
    Else
    {
        $Date = [DateTime]$lngexpires
        $LastLogon = $Date.AddYears(1600).ToLocalTime()
    }
}
Write-Host $username "last logged on at:" $LastLogon
```

The preceding script will ask for the username of the account and, once it is provided, the system will search for the lastLogon attribute value on all available domain controllers. If it cannot be found, it will return User Never Logged In or, if found, it will return the last logon timestamp.

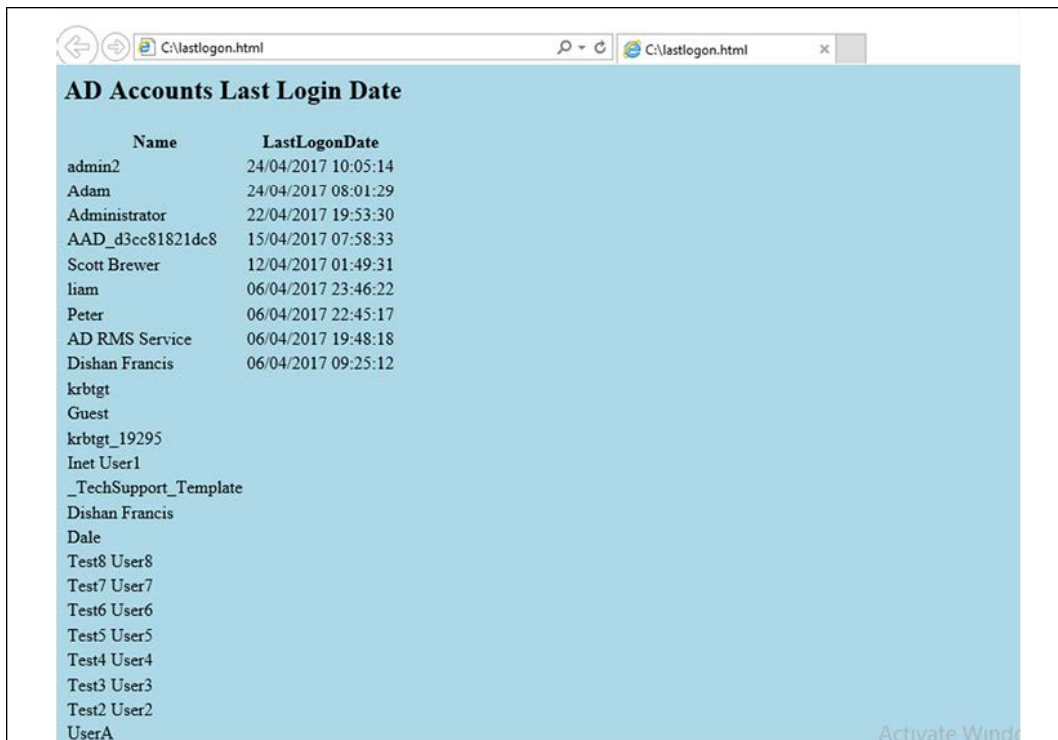
## Last login date report

Periodic housekeeping in AD is required for integrity. There may be user objects that have not been used for years. If we can create a report along with the last login dates, we can use it as a reference to clean up objects:

```
## Script For Filter user with Last logon Time ##
$htmlformat = "<style>BODY{background-color:LightBlue;}</style>"
Get-ADUser -Filter * -Properties "LastLogonDate" | sort-object -
property lastlogondate -descending | Select-Object Name,LastLogonDate
| ConvertTo-HTML -head $htmlformat -body "<H2>AD Accounts Last Login
```

```
Date">" | Out-File C:\lastlogon.html
Invoke-Expression C:\lastlogon.html
```

This script creates an HTML report that includes all the user accounts with their last login date timestamps:



| Name                  | LastLogonDate       |
|-----------------------|---------------------|
| admin2                | 24/04/2017 10:05:14 |
| Adam                  | 24/04/2017 08:01:29 |
| Administrator         | 22/04/2017 19:53:30 |
| AAD_d3cc81821dc8      | 15/04/2017 07:58:33 |
| Scott Brewer          | 12/04/2017 01:49:31 |
| liam                  | 06/04/2017 23:46:22 |
| Peter                 | 06/04/2017 22:45:17 |
| AD RMS Service        | 06/04/2017 19:48:18 |
| Dishan Francis        | 06/04/2017 09:25:12 |
| krbtgt                |                     |
| Guest                 |                     |
| krbtgt_19295          |                     |
| Inet User1            |                     |
| _TechSupport_Template |                     |
| Dishan Francis        |                     |
| Dale                  |                     |
| Test8 User8           |                     |
| Test7 User7           |                     |
| Test6 User6           |                     |
| Test5 User5           |                     |
| Test4 User4           |                     |
| Test3 User3           |                     |
| Test2 User2           |                     |
| UserA                 |                     |

**Figure 17.4: Last login date HTML report**

Some of the accounts in the above reports don't show the last login date value. It means no one has logged into those accounts yet.

## Login failures report

It is important to know about failed attempts to log in to the DC, not just the successful attempts. These can be a result of potentially malicious activity.

The following script will create a report to indicate the login failures on a given domain controller:

```
## Report for DC login Failures ##
$failedevent = $null
$Date= Get-date
$dc = Read-Host 'What is the Domain Controller ?'
$Report= "C:\auditreport.html"
$HTML=@"
<title>Failed Login Report for $dc</title>
<style>
BODY{background-color :LightBlue}
</style>
```

```
"@
$failedevent = Get-Eventlog security -Computer $dc -InstanceId 4625 -
After (Get-Date).AddDays(-7) |
Select TimeGenerated,ReplacementStrings |
% {
New-Object PSObject -Property @{
SourceComputer = $_.ReplacementStrings[13]
UserName = $_.ReplacementStrings[5]
SourceIPAddress = $_.ReplacementStrings[19]
Date = $_.TimeGenerated
}
}
$failedevent | ConvertTo-Html -Property
SourceComputer,UserName,SourceIPAddress,Date -head $HTML -body
"<H2>Failed Login Report for $dc</H2>"|
Out-File $Report
Invoke-Expression C:\auditreport.html
```

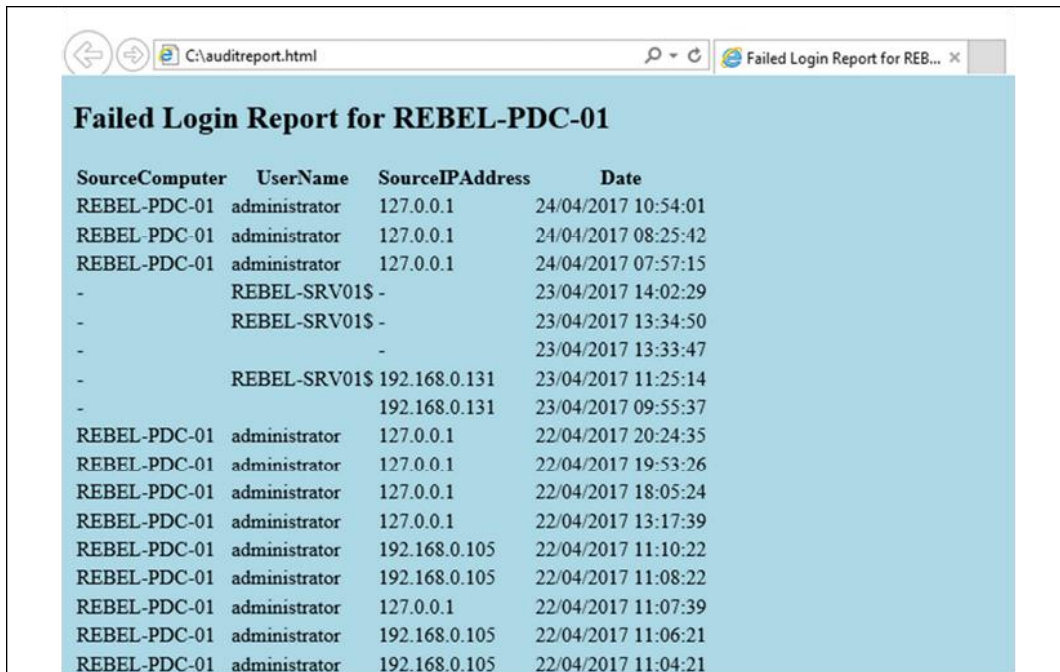
The aforementioned script is displayed in a way that's easy for readers to understand. When it is used in PowerShell, make sure to prevent extra line spaces.

When you run the preceding script, it will ask for the name of the domain controller that you wish to run this report against.

Then, in the background, it will search for event 4625 in the event viewer and then list the following data in a report:

- The source computer
- The username
- The source IP address
- The event time

The following screenshot shows the failed login report for REBEL-PDC-01:



| SourceComputer | UserName      | SourceIPAddress | Date                |
|----------------|---------------|-----------------|---------------------|
| REBEL-PDC-01   | administrator | 127.0.0.1       | 24/04/2017 10:54:01 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 24/04/2017 08:25:42 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 24/04/2017 07:57:15 |
| -              | REBEL-SRV01\$ | -               | 23/04/2017 14:02:29 |
| -              | REBEL-SRV01\$ | -               | 23/04/2017 13:34:50 |
| -              | -             | -               | 23/04/2017 13:33:47 |
| -              | REBEL-SRV01\$ | 192.168.0.131   | 23/04/2017 11:25:14 |
| -              | -             | 192.168.0.131   | 23/04/2017 09:55:37 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 22/04/2017 20:24:35 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 22/04/2017 19:53:26 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 22/04/2017 18:05:24 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 22/04/2017 13:17:39 |
| REBEL-PDC-01   | administrator | 192.168.0.105   | 22/04/2017 11:10:22 |
| REBEL-PDC-01   | administrator | 192.168.0.105   | 22/04/2017 11:08:22 |
| REBEL-PDC-01   | administrator | 127.0.0.1       | 22/04/2017 11:07:39 |
| REBEL-PDC-01   | administrator | 192.168.0.105   | 22/04/2017 11:06:21 |
| REBEL-PDC-01   | administrator | 192.168.0.105   | 22/04/2017 11:04:21 |

**Figure 17.5: Login failures report**

The login failures records are different from one server to another. So when it comes to troubleshooting, make sure you select the correct domain controller.

## Finding the locked-out account

If password policies are defined, accounts with a large number of login failures will be locked out. Locked-out accounts in an AD environment can be found using the following command:

```
Search-ADAccount -Lockedout | Select name,samAccountName,Lockedout
```

If any of those in the list need to be unlocked, we can use the `Unlock-ADAccount` cmdlet to unlock an account.

For an individual account, perform the following command:

```
Unlock-ADAccount tuser4
```

For all the accounts on the list, perform the following command:

```
Search-ADAccount -Lockedout | Unlock-ADAccount
```

It is not a good practice to unlock all the accounts unless there is a specific reason.

## Password expire report

Issues due to expired passwords are a common support call type for helpdesks. The following script can generate a report about expiring passwords:

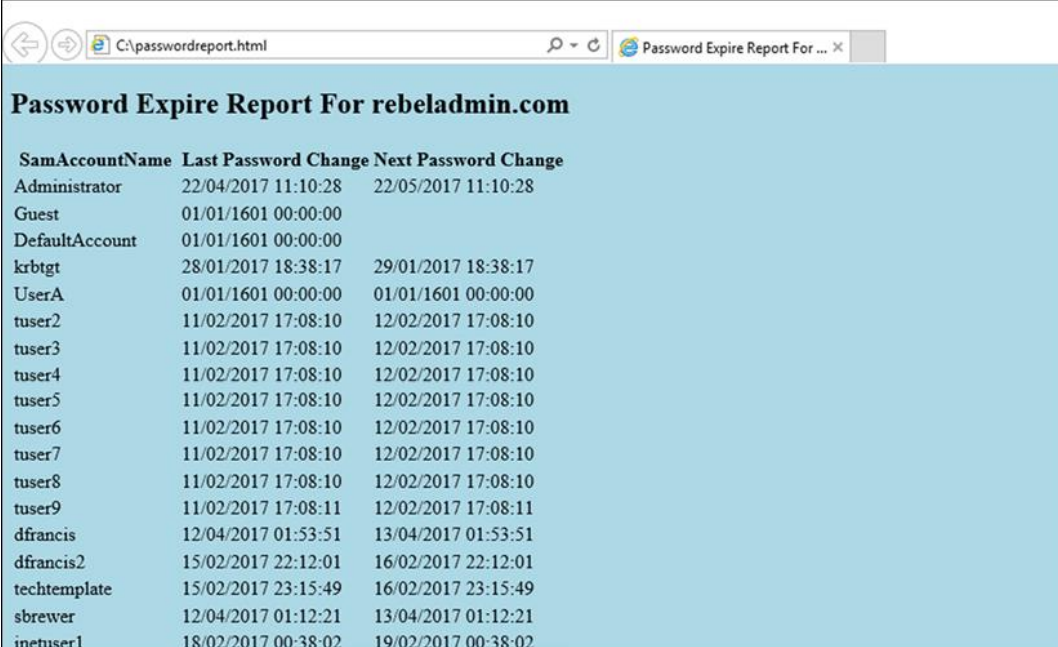


```
## Password Expire Report ##
$passwordreport = $null
$dc = (Get-ADDomain | Select DNSRoot).DNSRoot
$Report= "C:\passwordreport.html"
$HTML=@
<title>Password Expire Report For $dc</title>
<style>
BODY{background-color :LightBlue}
</style>
"@
$passwordreport = Get-ADUser -filter * -Properties
"SamAccountName","pwdLastSet","msDS-UserPasswordExpiryTimeComputed" |
Select-Object -Property "SamAccountName",@{Name="Last Password
Change";Expression={ [datetime]::FromFileTime($_.pwdLastSet) }},@{Name
="Next Password Change";Expression={ [datetime]::FromFileTime($_.msDS-
UserPasswordExpiryTimeComputed) }}
$passwordreport | ConvertTo-Html -Property "SamAccountName","Last
Password Change","Next Password Change"-head $HTML -body "<H2>Password
Expire Report For $dc</H2>" |
Out-File $Report
Invoke-Expression C:\passwordreport.html
```

The aforementioned script is displayed in a way that's easy for readers to understand. When it is used in PowerShell, make sure to prevent extra line spaces.

This script will search for the attribute values for **SamAccountName**, **pwdLastSet**, and **msDS-UserPasswordExpiryTimeComputed** in every user object.

Then, they will be presented in an HTML report:



| SamAccountName | Last Password Change | Next Password Change |
|----------------|----------------------|----------------------|
| Administrator  | 22/04/2017 11:10:28  | 22/05/2017 11:10:28  |
| Guest          | 01/01/1601 00:00:00  |                      |
| DefaultAccount | 01/01/1601 00:00:00  |                      |
| krbtgt         | 28/01/2017 18:38:17  | 29/01/2017 18:38:17  |
| UserA          | 01/01/1601 00:00:00  | 01/01/1601 00:00:00  |
| tuser2         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser3         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser4         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser5         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser6         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser7         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser8         | 11/02/2017 17:08:10  | 12/02/2017 17:08:10  |
| tuser9         | 11/02/2017 17:08:11  | 12/02/2017 17:08:11  |
| dfrancis       | 12/04/2017 01:53:51  | 13/04/2017 01:53:51  |
| dfrancis2      | 15/02/2017 22:12:01  | 16/02/2017 22:12:01  |
| techtemplate   | 15/02/2017 23:15:49  | 16/02/2017 23:15:49  |
| sbrewer        | 12/04/2017 01:12:21  | 13/04/2017 01:12:21  |
| inetuser1      | 18/02/2017 00:38:02  | 19/02/2017 00:38:02  |



**Figure 17.6: Password expire report**

All these reports can run as scheduled jobs and were developed to be sent over as an email every week or month. This saves administrators time and also prevents mistakes that can occur with manual tasks.

## Review the membership of the high-level administrative groups

As a security best practice, it is important to limit the number of privileged accounts used in an Active Directory environment. Sometimes we add users to privileged groups temporarily to do certain tasks and then forget to remove the permissions later on. Therefore, it is important to review members of the sensitive groups periodically and update those as required. In Active Directory, the following security groups are identified as sensitive groups:

- Enterprise Admins
- Schema Admins
- Domain Admins
- Account Operators (if present)
- Server Operators (if present)
- Print Operators (if present)
- DHCP Administrators
- DNSAdmins

To review the membership of a sensitive group we can use the following command:

```
Get-ADGroupMember -Identity "Domain Admins"
```

In the preceding command, Domain Admins is the group name and it can be replaced with any other sensitive group name. Once we have the list of members, the next step is to find out if those accounts are actively used. To do that we can use the value of the LastLogonDate user attribute. By considering all of the above requirements, I created the following scripts to list down all the sensitive groups with their members and LastLogonDate values:

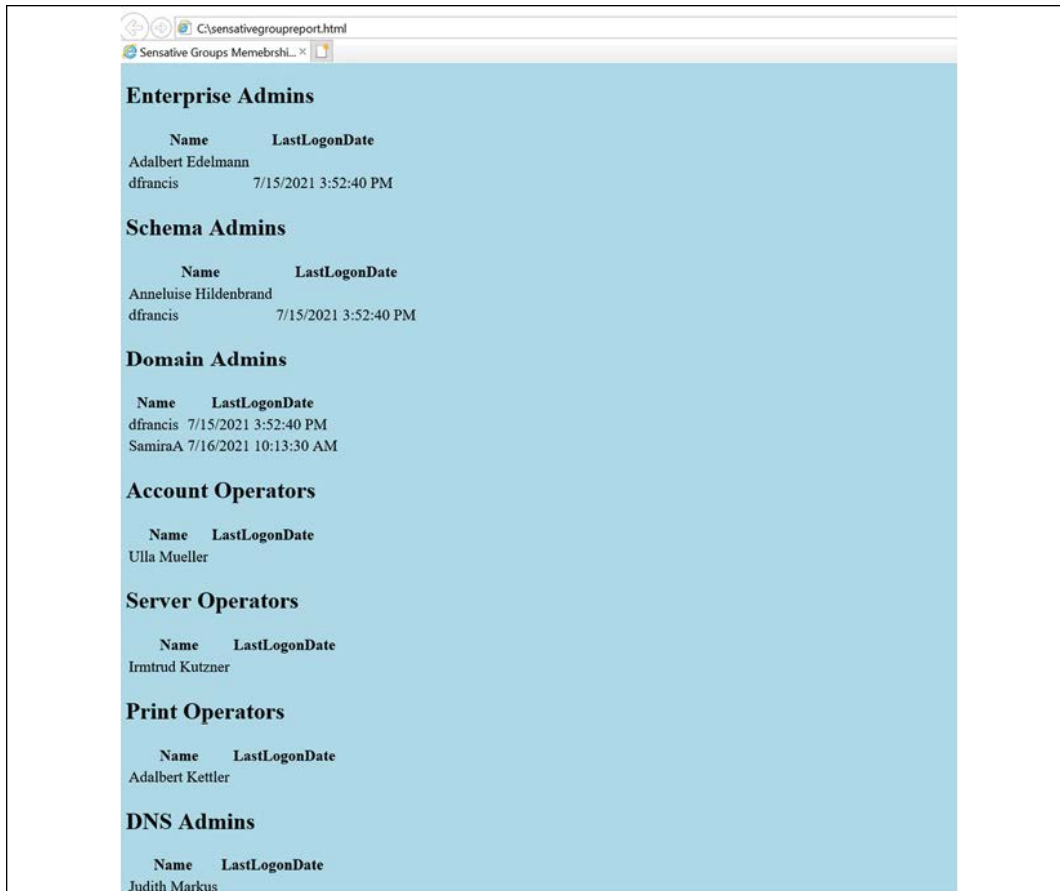
```
## Sensitive Group Report ##
$HTML=@
<title>Sensitive Groups Membership Report</title>
<style>
BODY{background-color :LightBlue}
</style>
"@
$enterpriseadmins = Get-ADGroupMember -Identity "Enterprise Admins" |
where {$_.objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | select Name,LastLogonDate | ConvertTo-Html -Property
```

```

"Name","LastLogonDate" -Fragment -PreContent "<h2>Enterprise
Admins</h2>"
$schemaadmins = Get-ADGroupMember -Identity "Schema Admins" | where
{$_objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
select Name,LastLogonDate | ConvertTo-Html -Property
"Name","LastLogonDate" -Fragment -PreContent "<h2>Schema Admins</h2>"
$domainadmins = Get-ADGroupMember -Identity "Domain Admins" | where
{$_objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
select Name,LastLogonDate | ConvertTo-Html -Property
"Name","LastLogonDate" -Fragment -PreContent "<h2>Domain Admins</h2>"
$accountoperators = Get-ADGroupMember -Identity "Account Operators" |
where {$_objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | select Name,LastLogonDate | ConvertTo-Html -Property
"Name","LastLogonDate" -Fragment -PreContent "<h2>Account
Operators</h2>"
$serveroperators = Get-ADGroupMember -Identity "Server Operators" |
where {$_objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | select
Name,LastLogonDate | ConvertTo-Html -Property "Name","LastLogonDate" -
Fragment -PreContent "<h2>Server Operators</h2>"
$printoperators = Get-ADGroupMember -Identity "Print Operators" |
where {$_objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | select Name,LastLogonDate | ConvertTo-Html -Property
"Name","LastLogonDate" -Fragment -PreContent "<h2>Print
Operators</h2>"
$dnsadmins = Get-ADGroupMember -Identity "DnsAdmins" | where
{$_objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
select Name,LastLogonDate | ConvertTo-Html -Property
"Name","LastLogonDate" -Fragment -PreContent "<h2>DNS Admins</h2>"
$Reportvalues = ConvertTo-HTML -Body "$enterpriseadmins $schemaadmins
$domainadmins $accountoperators $serveroperators $printoperators
$dnsadmins" -Head $HTML
$Reportvalues | Out-File "C:\sensitivegroupreport.html"

```

The preceding script will produce an HTML report similar to below.



| Enterprise Admins |                      |
|-------------------|----------------------|
| Name              | LastLogonDate        |
| Adalbert Edelmann |                      |
| dfrancis          | 7/15/2021 3:52:40 PM |

| Schema Admins         |                      |
|-----------------------|----------------------|
| Name                  | LastLogonDate        |
| Anneluise Hildenbrand |                      |
| dfrancis              | 7/15/2021 3:52:40 PM |

| Domain Admins |                       |
|---------------|-----------------------|
| Name          | LastLogonDate         |
| dfrancis      | 7/15/2021 3:52:40 PM  |
| SamiraA       | 7/16/2021 10:13:30 AM |

| Account Operators |               |
|-------------------|---------------|
| Name              | LastLogonDate |
| Ulla Mueller      |               |

| Server Operators |               |
|------------------|---------------|
| Name             | LastLogonDate |
| Imtrud Kutzner   |               |

| Print Operators  |               |
|------------------|---------------|
| Name             | LastLogonDate |
| Adalbert Kettler |               |

| DNS Admins    |               |
|---------------|---------------|
| Name          | LastLogonDate |
| Judith Markus |               |

**Figure 17.7: Sensitive group memberships**

In this report, the LastLogonDate value can be used as a reference and if the account is not used often, we can go ahead and remove it from the sensitive groups.

In the script, I didn't mention DHCP Administrators as it is a local group.

In the above report, we are listing all the users in sensitive groups. Then it is up to engineers to tidy up the group membership. However, we can further develop this script and list down users who haven't logged in for a certain number of days. Then engineers can use it as a starting point to update the group memberships.

```
## Sensitive Group Members Inactive for 30 days ##
$30Days = (get-date).adddays(-30)
$HTML=@
<title>Sensitive Groups Membership Report : Users Inactive for 30
days</title>
<style>
BODY{background-color :LightBlue}
</style>
"@
$enterpriseadmins = Get-ADGroupMember -Identity "Enterprise Admins" |
where {$_.objectclass -eq 'user'} | Get-ADUser -Properties
```

```

LastLogonDate |Where {$_.LastLogonDate -le $30Days}| select
Name,LastLogonDate | ConvertTo-Html -Property "Name","LastLogonDate" -
Fragment -PreContent "<h2>Enterprise Admins</h2>"
$schemaadmins = Get-ADGroupMember -Identity "Schema Admins" | where
{$_.objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
Where {$_.LastLogonDate -le $30Days}| select Name,LastLogonDate |
ConvertTo-Html -Property "Name","LastLogonDate" -Fragment -PreContent
"<h2>Schema Admins</h2>"
$domainadmins = Get-ADGroupMember -Identity "Domain Admins" | where
{$_.objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
Where {$_.LastLogonDate -le $30Days}| select Name,LastLogonDate |
ConvertTo-Html -Property "Name","LastLogonDate" -Fragment -PreContent
"<h2>Domain Admins</h2>"
$accountoperators = Get-ADGroupMember -Identity "Account Operators" |
where {$_.objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | Where {$_.LastLogonDate -le $30Days}| select
Name,LastLogonDate | ConvertTo-Html -Property "Name","LastLogonDate" -
Fragment -PreContent "<h2>Account Operators</h2>"
$serveroperators = Get-ADGroupMember -Identity "Server Operators" |
where {$_.objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | Where {$_.LastLogonDate -le $30Days}| select
Name,LastLogonDate | ConvertTo-Html -Property "Name","LastLogonDate" -
Fragment -PreContent "<h2>Server Operators</h2>"
$printoperators = Get-ADGroupMember -Identity "Print Operators" |
where {$_.objectclass -eq 'user'} | Get-ADUser -Properties
LastLogonDate | Where {$_.LastLogonDate -le $30Days}| select
Name,LastLogonDate | ConvertTo-Html -Property "Name","LastLogonDate" -
Fragment -PreContent "<h2>Print Operators</h2>"
$dnsadmins = Get-ADGroupMember -Identity "DnsAdmins" | where
{$_.objectclass -eq 'user'} | Get-ADUser -Properties LastLogonDate |
Where {$_.LastLogonDate -le $30Days}| select Name,LastLogonDate |
ConvertTo-Html -Property "Name","LastLogonDate" -Fragment -PreContent
"<h2>DNS Admins</h2>"
$Reportvalues = ConvertTo-HTML -Body "$enterpriseadmins $schemaadmins
$domainadmins $accountoperators $serveroperators $printoperators
$dnsadmins" -Head $HTML
$Reportvalues | Out-File "C:\inactiveusers.html"

```

In the above, I am creating an HTML report that lists down the members of sensitive groups who haven't logged in for the last 30 days.

## Dormant accounts

In Active Directory, at least 10% of user accounts are dormant (inactive) accounts. These accounts can represent:

- Test accounts
- Contractors

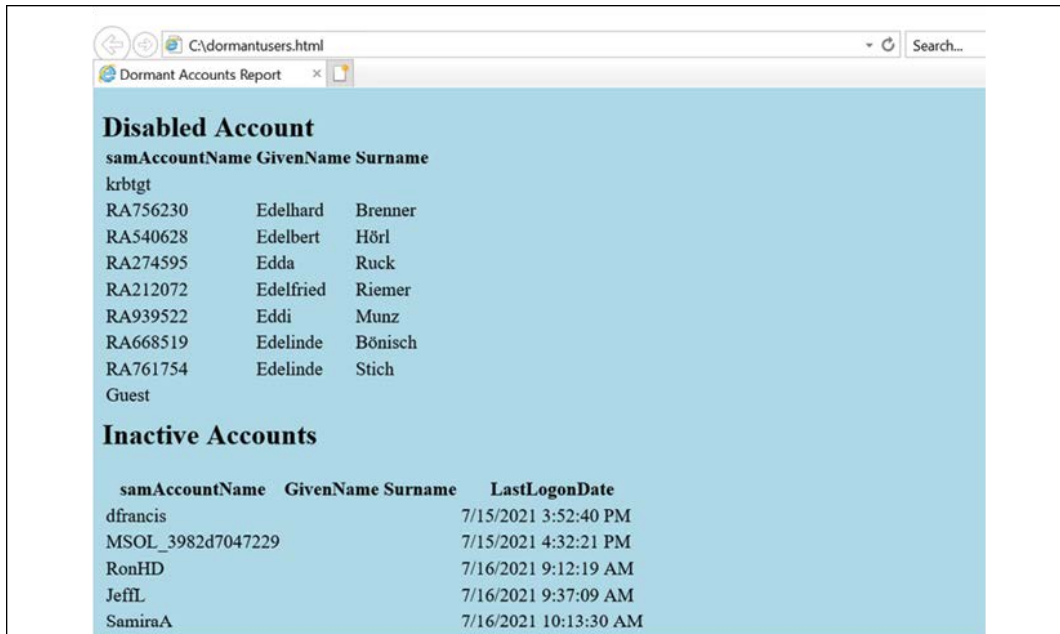
- Former employees
- Disabled accounts

It is important to review these dormant accounts periodically and remove all unnecessary accounts from Active Directory as they are a possible security threat. If it is not possible to remove some of these accounts, at least remove them from sensitive groups and disable the accounts.

We can find these accounts in Active Directory by looking at the `LastLogonDate` attribute value and the account status. By considering these requirements, I created the following script to find dormant accounts:

```
## Dormant Accounts ##
$InactiveDate = (Get-Date).Adddays(-30)
$HTML=@
<title>Dormant Accounts Report</title>
<style>
BODY{background-color :LightBlue}
</style>
"@
$disabledaccounts = Get-ADUser -Filter {Enabled -eq $false} | select
samAccountName,GivenName,Surname | ConvertTo-Html -Property
"samAccountName","GivenName","Surname" -Fragment -PreContent
"<h2>Disabled Account</h2>"
$inactiveaccounts = Get-ADUser -Filter {LastLogonDate -lt
$InactiveDate -and Enabled -eq $true} -Properties LastLogonDate |
select samAccountName,GivenName,Surname,LastLogonDate | ConvertTo-Html
-Property "samAccountName","GivenName","Surname","LastLogonDate" -
Fragment -PreContent "<h2>Inactive Accounts</h2>"
$Reportvalues = ConvertTo-HTML -Body "$disabledaccounts
$inactiveaccounts" -Head $HTML
$Reportvalues | Out-File "C:\dormantusers.html"
```

In the above, I am looking for disabled accounts by using `Get-ADUser -Filter {Enabled -eq $false} | select samAccountName,GivenName,Surname`. Then, after that, I am searching for users who have been inactive for the last 30 days by using `Get-ADUser -Filter {LastLogonDate -lt $InactiveDate -and Enabled -eq $true} -Properties LastLogonDate | select samAccountName,GivenName,Surname,LastLogonDate`. Here, I am ignoring disabled accounts as they are already recorded as separate entities. At the end, I am passing the findings to an HTML report called `dormantusers.html`.



| Disabled Account |           |         |
|------------------|-----------|---------|
| samAccountName   | GivenName | Surname |
| krbtgt           |           |         |
| RA756230         | Edelhard  | Brenner |
| RA540628         | Edelbert  | Hörl    |
| RA274595         | Edda      | Ruck    |
| RA212072         | Edelfried | Riemer  |
| RA939522         | Eddi      | Munz    |
| RA668519         | Edelinde  | Bönisch |
| RA761754         | Edelinde  | Stich   |
| Guest            |           |         |

| Inactive Accounts |           |         |                       |
|-------------------|-----------|---------|-----------------------|
| samAccountName    | GivenName | Surname | LastLogonDate         |
| dfrancis          |           |         | 7/15/2021 3:52:40 PM  |
| MSOL_3982d7047229 |           |         | 7/15/2021 4:32:21 PM  |
| RonHD             |           |         | 7/16/2021 9:12:19 AM  |
| JeffL             |           |         | 7/16/2021 9:37:09 AM  |
| SamiraA           |           |         | 7/16/2021 10:13:30 AM |

**Figure 17.8: Dormant accounts**

If required, this data can also be exported into a CSV file. But in these examples, I used the HTML format to show the results in a user-friendly way.

## Users with the Password Never Expires setting

In an Active Directory environment, we use password policies to enforce users to follow complexity standards and other best practices related to passwords. Users should use complex passwords and should update their passwords at regular intervals. This is one of the basic requirements of identity protection. However, if the user account has the Password Never Expires setting enabled, the user will not be forced to update the passwords according to the password policy.

We can find Active Directory user accounts that have the Password Never Expires setting enabled by using the following PowerShell commands:

```
Get-ADUser -Filter {passwordNeverExpires -eq $true -and Enabled -eq $true} -Properties * | Select samAccountName, GivenName, Surname
```

In the preceding command, I am looking for the `passwordNeverExpires` attribute value and if it's set to true, it means the setting is enabled. At the same time, I also checked if the user account is active.



```
Administrator: PowerShell (x64)
PowerShell 7.1.4
Copyright (c) Microsoft Corporation.
https://aka.ms/powershell
Type 'help' to get help.

PS C:\Users\dfrancis> Get-ADUser -Filter '(passwordNeverExpires -eq $true -and Enabled -eq $true) -Properties * | Select-Object samAccountName, GivenName, Surname

samAccountName GivenName Surname
-----
user2           Test User 2
difrancis       Dishan   Francis
adam            adam
```

**Figure 17.9: Users with the Password Never Expires setting**

In the next section of this chapter, we are going to look into managing Active Directory objects in a hybrid environment.

## Azure Active Directory PowerShell

Similar to on-prem Active Directory, we also can use PowerShell to manage Azure Active Directory.

Let's see why we should use PowerShell to manage Azure Active Directory:

- **Early bird access to features:** Microsoft keeps releasing new features, bug fixes, updates, and feature enhancements more frequently to Azure AD services than on-prem Active Directory.

Microsoft releases new features to the public in two stages. In the first stage, they are released as a preview version. This is not recommended for use in production, but IT professionals can use them for testing and provide feedback to Microsoft. At this stage, the features can have many updates and, most of the time, it will take some time to update the GUI accordingly. Some of these changes will not be available on the GUI until general release. But if we are using PowerShell, we do not have to wait. We can have early access to features as soon as they are released.

- **Faster response:** The Azure Active Directory portal has many different windows, wizards, and forms to configure and manage users, groups, roles, and associated features. The GUI makes it easy to do things, but it takes time. As an example, if you add a user account using the Azure AD portal, you have to go to four sub-windows at least. But PowerShell allows us to do it using one window and a few lines of commands.
- **Granular control:** The Azure AD portal visualizes the data and configuration of the service using different windows. However, it may not always show what we want. As an example, let's assume we are looking for a specific value in two user accounts. If we use the GUI, we need to go to a few different windows to gather this information. But using a PowerShell command or script, we will be able to gather the same information in one window. This is really helpful when troubleshooting.
- **Microsoft Graph integration:** Microsoft Graph provides a unified programmability model to access a vast amount of data in Microsoft 365, Azure Active Directory, Enterprise Mobility Suite,

Windows 10, and so on. As part of it, the Azure AD PowerShell for Graph module allows you to retrieve data, update directory configurations, add/update/remove objects, and configure features via Microsoft Graph.

In this chapter, I will be using the Azure Active Directory PowerShell for Graph module to manage an Azure AD hybrid environment.

## Installation

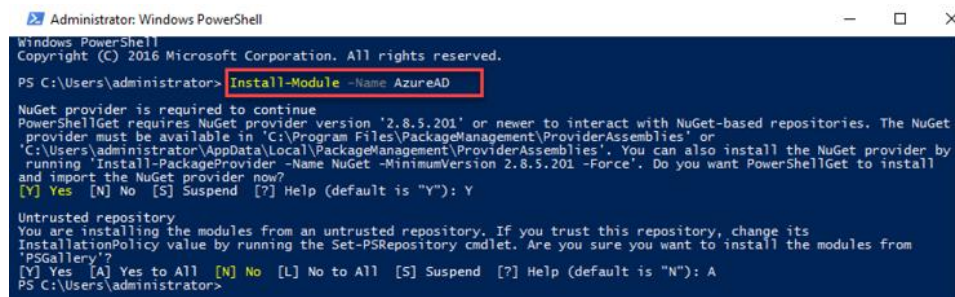
The Azure Active Directory PowerShell for Graph module comes in two versions. The public preview version is the most recent, but it is not recommended for use in production.

The installation steps for this version can be found at <https://bit.ly/3HR3EpU>.

The general availability version is the stable, recommended version for production environments. It can be installed on any computer that runs Windows Server 2008 R2 or above with the latest updates. Microsoft .NET Framework 4.5 or above is also required.

Once the prerequisites are in place, perform the following steps:

1. Log in to the computer you have selected for the Azure Active Directory PowerShell for Graph module.
2. Launch the PowerShell console as an administrator.
3. Run the `Install-Module -Name AzureAD` command. Answer Yes if it is a required repository update:

A screenshot of a Windows PowerShell console window titled "Administrator: Windows PowerShell". The prompt is "PS C:\Users\administrator>". The command "Install-Module -Name AzureAD" has been entered and is highlighted with a red rectangle. Below the command, the console displays the following text: "NuGet provider is required to continue", "PowerShellGet requires NuGet provider version '2.8.5.201' or newer to interact with NuGet-based repositories. The NuGet provider must be available in 'C:\Program Files\PackageManagement\ProviderAssemblies' or 'C:\Users\administrator\AppData\Local\PackageManagement\ProviderAssemblies'. You can also install the NuGet provider by running 'Install-PackageProvider -Name NuGet -MinimumVersion 2.8.5.201 -Force'. Do you want PowerShellGet to install and import the NuGet provider now?", "[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y", "Untrusted repository", "You are installing the modules from an untrusted repository. If you trust this repository, change its InstallationPolicy value by running the Set-PSRepository cmdlet. Are you sure you want to install the modules from 'PSGallery'?", "[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): A", and the prompt "PS C:\Users\administrator>".

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\Users\administrator> Install-Module -Name AzureAD

NuGet provider is required to continue
PowerShellGet requires NuGet provider version '2.8.5.201' or newer to interact with NuGet-based repositories. The NuGet
provider must be available in 'C:\Program Files\PackageManagement\ProviderAssemblies' or
'C:\Users\administrator\AppData\Local\PackageManagement\ProviderAssemblies'. You can also install the NuGet provider by
running 'Install-PackageProvider -Name NuGet -MinimumVersion 2.8.5.201 -Force'. Do you want PowerShellGet to install
and import the NuGet provider now?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y

Untrusted repository
You are installing the modules from an untrusted repository. If you trust this repository, change its
InstallationPolicy value by running the Set-PSRepository cmdlet. Are you sure you want to install the modules from
'PSGallery'?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): A
PS C:\Users\administrator>
```

**Figure 17.10: Install AzureAD PowerShell module**

4. After installation, we can verify the module installation using `Get-Module AzureAD`.
5. After successfully installing the module, run `Connect-AzureAD` to initiate a connection to the Azure AD tenant.
6. Then, it will prompt you with a login window. Use Azure AD global administrator account details to connect.

Now we have the Azure Active Directory PowerShell for Graph module installed. Let's see how we can manage an Azure AD hybrid environment using this module.



Azure AD and MSOL modules are not supported in PowerShell 7.x. Therefore, here, I am using default Windows PowerShell running on Windows 10.

## General commands

We can start by listing all the available commands under the Azure AD module, which can be done by using the following:

```
Get-Command -module AzureAD
```

We can view the full syntax for a command by using the `Get-Help` command. As an example, we can view the full syntax for the `Get-AzureADUser` command using the following:

```
Get-Help Get-AzureADUser
```

We can verify the status of Azure AD domains using the following command:

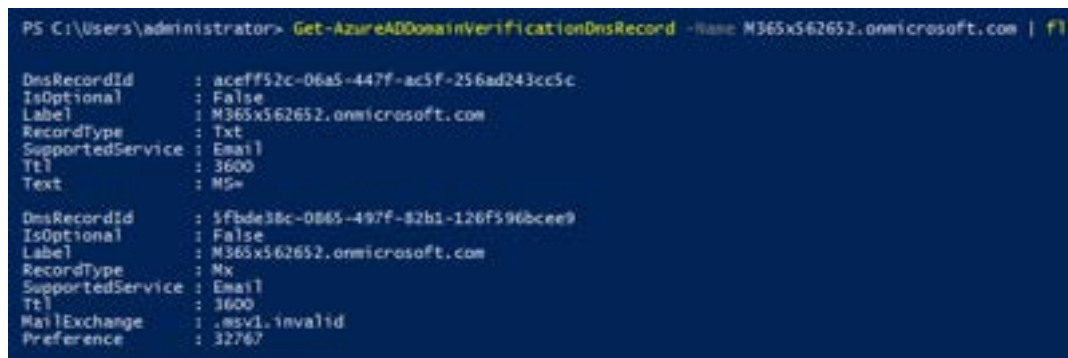
```
Get-AzureADDomain | fl
```

The preceding command helps to identify the domain verification status by referring to the value of the `IsVerified` attribute.

If you are using a custom domain in Azure AD, we need to verify ownership of the domain using DNS records. If it is not verified, we can retrieve the required DNS records by using the following command:

```
Get-AzureADDomainVerificationDnsRecord -Name  
M365x562652.onmicrosoft.com | fl
```

In the preceding example, `M365x562652.onmicrosoft.com` represents the domain name:



```
PS C:\Users\administrator> Get-AzureADDomainVerificationDnsRecord -Name M365x562652.onmicrosoft.com | fl  
DnsRecordId      : aceff52c-06a5-447f-ac5f-256ad243cc5c  
IsOptional       : False  
Label            : M365x562652.onmicrosoft.com  
RecordType       : Txt  
SupportedService : Email  
Ttl              : 3600  
Text             : MS=
```

```
DnsRecordId      : 5fbde38c-0865-497f-82b1-126f596bcee9  
IsOptional       : False  
Label            : M365x562652.onmicrosoft.com  
RecordType       : Mx  
SupportedService : Email  
Ttl              : 3600  
MailExchange     : .msv1.invalid  
Preference       : 32767
```

**Figure 17.11: Required DNS records for domain verifications**

We can view the details of the Azure AD tenant by using the following:

```
Get-AzureADTenantDetail | fl
```

In a hybrid environment, the health of the on-prem AD sync is crucial. We can view the time of the last directory sync by using the following command:

```
Get-AzureADTenantDetail | select CompanyLastDirSyncTime
```

## Managing users

We can view the user account details for a known account using the following:

```
Get-AzureADUser -ObjectId AdeleV@M365x562652.OnMicrosoft.com | fl
```

In the preceding command, `AdeleV@M365x562652.OnMicrosoft.com` represents the UPN of the user.

We also can use user attributes to find user account details:

```
Get-AzureADUser -Filter "startswith(GivenName,'Adele')"
```

The preceding command will filter Azure AD users with `GivenName` as Adele.

We can also filter users based on a specific attribute value:

```
Get-AzureADUser -Filter "GivenName eq 'Adele'"
```

The preceding command will search for the exact user with the given name value Adele.

In my demo environment, I'd like to see a list of disabled accounts. I can do this using the following command:

```
Get-AzureADUser -All $true -Filter 'accountEnabled eq false'
```

We can modify the output of the filtered data further:

```
Get-AzureADUser -All $true -Filter 'accountEnabled eq false' | select  
DisplayName,UserPrincipalName,Department
```

The preceding command will display the value of the `DisplayName`, `UserPrincipalName`, and `Department` attributes of the filtered accounts.

In a hybrid environment, we can filter accounts that are synced from on-prem AD by using the following:

```
Get-AzureADUser -All $true -Filter 'DirSyncEnabled eq true'
```

In the preceding command, the value of the `DirSyncEnabled` attribute defines whether it's a cloud-only account or a synced account.

We also can check the last sync value for the synced accounts:

```
Get-AzureADUser -All $true -Filter 'DirSyncEnabled eq true' | select  
DisplayName,UserPrincipalName,LastDirSyncTime
```

In the preceding command, the `LastDirSyncTime` value defines the last sync time of the object.

We can also export the output to a CSV file using the `Export-CSV` command:

```
Get-AzureADUser -All $true -Filter 'DirSyncEnabled eq true' | select  
DisplayName,UserPrincipalName,LastDirSyncTime | Export-CSV -Path  
.\syncaccount.csv
```

The ImmutableID value of a user account is used to map an Azure AD user object to an on-prem user object. ImmutableID does have a relationship with on-prem user accounts' ObjectGUID. We can use this to identify cloud-only users. If it is a cloud-only user, the ImmutableID value should be null:

```
Get-AzureADUser -All $true | where-Object {$_.ImmutableId -eq $null}
```

The preceding command returns a list of all the cloud-only accounts. We can export the required attribute values to CSV by using the following:

```
Get-AzureADUser -All $true | where-Object {$_.ImmutableId -eq $null} |  
select DisplayName,UserPrincipalName | Export-CSV -Path  
.\cloudaccount.csv
```

Another important thing related to accounts is licences. If we are going to use Azure AD's premium features, we need to have relevant licenses assigned. By default, a user only has Azure AD free version features.

To view licenses associated with a user account, we can use the following command:

```
Get-AzureADUserLicenseDetail -ObjectId  
MeganB@M365x562652.OnMicrosoft.com | fl
```

The preceding command will return the licenses associated with the user  
MeganB@M365x562652.OnMicrosoft.com.

We also can view the subscribed SKUs using the following command:

```
Get-AzureADSubscribedSku | fl
```

The preceding command lists all the details about licenses that are associated with the tenant. However, we only need to know how many licenses have been used and how many licenses are available. We can do this using the following command:

```
Get-AzureADSubscribedSku | select SkuPartNumber,ConsumedUnits -  
ExpandProperty PrepaidUnits
```

In the preceding example, the SkuPartNumber value represents the license part number. The value of the enabled field represents the number of purchased licenses. ConsumedUnits represents the number of consumed licenses.

Let's move on and see how we can assign a new license to a user.

In my environment, I have a user who synced from on-prem Azure AD who doesn't have a license assigned:

```
Get-AzureADUserLicenseDetail -ObjectId  
ADJellison@M365x562652.onmicrosoft.com | fl
```

The following screenshot displays the output of the preceding command:

A screenshot of a PowerShell terminal window. The prompt is 'C:\Users\administrator>'. The command entered is 'Get-AzureADUserLicenseDetail -ObjectId ADJellison@M365x562652.onmicrosoft.com | fl'. The output is partially visible, showing 'Enabled' and 'ConsumedUnits'.

**Figure 17.12: Check Azure AD license assignment**

As a first step, let's create objects to use in the license assignment process:

```
$newlicence = New-Object -TypeName  
Microsoft.Open.AzureAD.Model.AssignedLicense  
$newlicenceadd = New-Object -TypeName  
Microsoft.Open.AzureAD.Model.AssignedLicenses
```

Then, we need to find the **SkuId** of the licenses.

I am going to assign the **ENTERPRISEPREMIUM** license to the user:

```
$newlicence.SkuId = (Get-AzureADSubscribedSku | Where-Object -Property  
SkuPartNumber -Value "ENTERPRISEPREMIUM" -EQ).SkuId
```

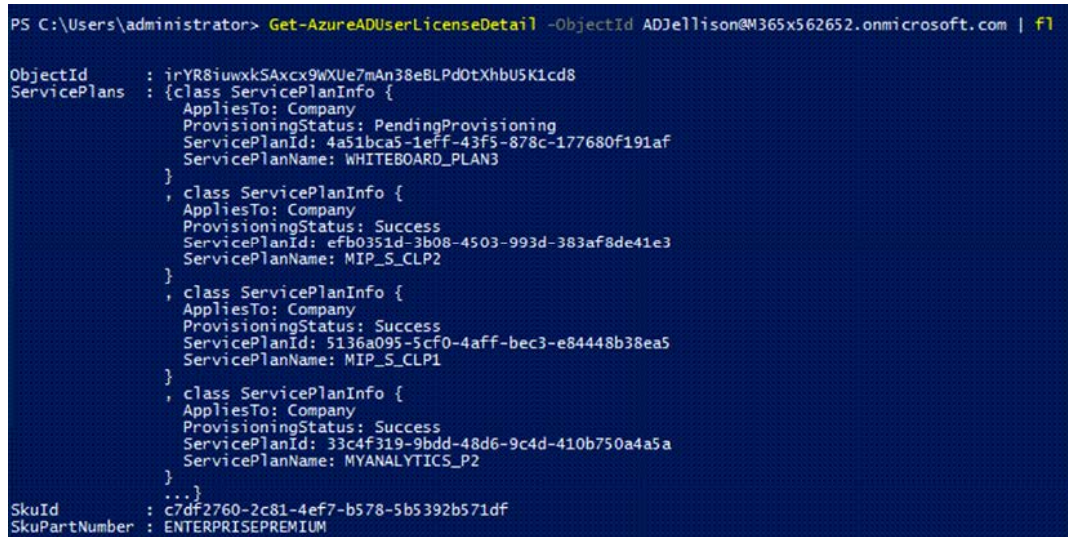
Then, we need to assign the licenses to the object:

```
$newlicenceadd.AddLicenses = $newlicence
```

Now, we can go ahead and assign the license to the user:

```
Set-AzureADUserLicense -ObjectId  
"ADJellison@M365x562652.onmicrosoft.com" -AssignedLicenses  
$newlicenceadd
```

The preceding command assigns **ENTERPRISEPREMIUM** licenses to the user **ADJellison@M365x562652.onmicrosoft.com**:



```
PS C:\Users\administrator> Get-AzureADUserLicenseDetail -ObjectId ADJellison@M365x562652.onmicrosoft.com | fl  
  
ObjectId      : irYR8iuwxkSAXcx9WUe7mAn38e8LPdOtXhbU5K1cd8  
ServicePlans  : {class ServicePlanInfo {  
    AppliesTo: Company  
    ProvisioningStatus: PendingProvisioning  
    ServicePlanId: 4a51bca5-1eff-43f5-878c-177680f191af  
    ServicePlanName: WHITEBOARD_PLAN3  
  },  
  class ServicePlanInfo {  
    AppliesTo: Company  
    ProvisioningStatus: Success  
    ServicePlanId: efb0351d-3b08-4503-993d-383af8de41e3  
    ServicePlanName: MIP_S_CLP2  
  },  
  class ServicePlanInfo {  
    AppliesTo: Company  
    ProvisioningStatus: Success  
    ServicePlanId: 5136a095-5cf0-4aff-bec3-e84448b38ea5  
    ServicePlanName: MIP_S_CLP1  
  },  
  class ServicePlanInfo {  
    AppliesTo: Company  
    ProvisioningStatus: Success  
    ServicePlanId: 33c4f319-9bdd-48d6-9c4d-410b750a4a5a  
    ServicePlanName: MYANALYTICS_P2  
  },  
  ...  
}  
SkuId         : c7df2760-2c81-4ef7-b578-5b5392b571df  
SkuPartNumber : ENTERPRISEPREMIUM
```

**Figure 17.13: Assign license to user**

It is a must to set the UsageLocation value for users who sync from on-prem AD before assigning licenses. We can do this using **Set-AzureADUser -ObjectId ADJellison@M365x562652.onmicrosoft.com -UsageLocation "US"**.

We can remove the licenses assigned using the following command:

```
$licenseB = New-Object -TypeName
Microsoft.Open.AzureAD.Model.AssignedLicenses
$licenseB.RemoveLicenses = (Get-AzureADSubscribedSku | Where-Object
{$_.SkuPartNumber -eq 'ENTERPRISEPREMIUM'}).SkuId
Set-AzureADUserLicense -ObjectId
"ADJellison@M365x562652.onmicrosoft.com" -AssignedLicenses $licenseB
```

Using the preceding commands, I have created a script to do the following:

- Search for users who synced from on-prem AD
- Of those users, select the users who don't have Azure AD licenses assigned
- Set the UsageLocation value for selected users
- Assign Azure AD licenses to selected users

```
#####Script to Assign Licences to Synced Users from On-Permis
AD#####
Import-Module AzureAD
Connect-AzureAD
###Filter Synced Users who doesn't have licence assigned#####
$ADUsers = Get-AzureADUser -All $true -Filter 'DirSyncEnabled eq true'
$notlicenced = Get-AzureADUser -All $true | Where-Object
{$ADUsers.AssignedLicenses -ne $null} | select ObjectId | Out-File -
FilePath C:\users.txt
#####Set UsageLocation value to sync users#####
(Get-Content "C:\users.txt" | select-object -skip 3) | ForEach { Set-
AzureADUser -ObjectId $_ -UsageLocation "US" }
#####Set User Licenes#####
$newlicence = New-Object -TypeName
Microsoft.Open.AzureAD.Model.AssignedLicense
$newlicenceadd = New-Object -TypeName
Microsoft.Open.AzureAD.Model.AssignedLicenses
$newlicence.SkuId = (Get-
AzureADSubscribedSku | Where-Object -Property SkuPartNumber -Value
"ENTERPRISEPREMIUM" -EQ).SkuId
$newlicenceadd.AddLicenses = $newlicence
(Get-Content "C:\users.txt" | select-object -skip 3) | ForEach { Set-
AzureADUserLicense -ObjectId $_ -AssignedLicenses $newlicenceadd }
```

In a hybrid environment, users are mainly created through on-prem Active Directory, but there are occasions when we need to add cloud-only accounts. This is mainly for cloud management tasks.

We can create a new user by using the following command:

```
$Userpassword = New-Object -TypeName
Microsoft.Open.AzureAD.Model.PasswordProfile
$Userpassword.Password = "London@1234"
New-AzureADUser -DisplayName "Andrew Xavier" -PasswordProfile
$Userpassword -UserPrincipalName
```

```
"Andrew.Xavier@M365x562652.onmicrosoft.com" -AccountEnabled $true -
MailNickName "AndrewXavier"
```

In the preceding command, `-PasswordProfile` is used to define the password profile for the new user account. `-MailNickName` defines the value for the user's mail nickname. In the preceding example, add a new user account, `Andrew.Xavier@M365x562652.onmicrosoft.com`, with the password `London@1234`.

We also can create multiple user accounts using CSV files. In the following example, I am using a CSV file to create users. The CSV file contains the following:

```
UserPrincipalName, DisplayName, MailNickName
DishanM@M365x562652.onmicrosoft.com, Dishan Melroy, DishanMel
JackM@M365x562652.onmicrosoft.com, Jack May, JackMay
RicahrdP@M365x562652.onmicrosoft.com, Richard Parker, RichardPar
```

Then, I can create these new users using the following:

```
$Userpassword = New-Object -TypeName
Microsoft.Open.AzureAD.Model.PasswordProfile
$Userpassword.Password = "London@1234"
Import-Csv -Path C:\newuser.csv | foreach {New-AzureADUser -
UserPrincipalName $_.UserPrincipalName -DisplayName $_.DisplayName -
MailNickName $_.MailNickName -PasswordProfile $Userpassword -
AccountEnabled $true}
```

By using the preceding commands, I have created a script to do the following:

- Create new user accounts using a CSV file
- Set `UsageLocation` for new user accounts
- Assign `ENTERPRISEPREMIUM` licenses to users

```
#####A Script to create new users and assign Azure AD
licences#####
Import-Module AzureAD
Connect-AzureAD
#####Create New Users using CSV #####
$Userpassword = New-Object -TypeName
Microsoft.Open.AzureAD.Model.PasswordProfile
$Userpassword.Password = "London@1234"
Import-Csv -Path C:\newuser.csv | foreach {New-AzureADUser -
UserPrincipalName $_.UserPrincipalName -DisplayName $_.DisplayName -
MailNickName $_.MailNickName -PasswordProfile $Userpassword -
UsageLocation "US" -AccountEnabled $true} | select ObjectId | Out-File
-FilePath C:\users.txt
#####Assign Licences#####
$newlicence = New-Object -TypeName
Microsoft.Open.AzureAD.Model.AssignedLicense
$newlicenceadd = New-Object -TypeName
```



```
Microsoft.Open.AzureAD.Model.AssignedLicenses
$newlicence.SkuId = (Get-AzureADSubscribedSku | Where-Object -Property
SkuPartNumber -Value "ENTERPRISEPREMIUM" -EQ).SkuId
$newlicenceadd.AddLicenses = $newlicence
(Get-Content "C:\users.txt" | select-object -skip 3) | ForEach { Set-
AzureADUserLicense -ObjectId $_ -AssignedLicenses $newlicenceadd }
```

To remove an Azure AD user, we can use the following:

```
Remove-AzureADUser -ObjectId "JDAllen@M365x562652.onmicrosoft.com"
```

We can combine it with a user search using the following command:

```
Get-AzureADUser -Filter "startswith(DisplayName,'Dishan')" | Remove-
AzureADUser
```

The preceding command will search for user accounts that have a `DisplayName` that starts with Dishan. If there are any, the second part of the command will remove them.

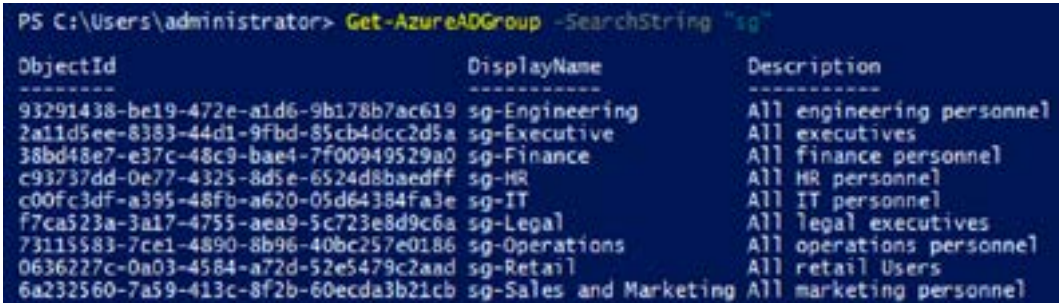
## Managing groups

Azure AD groups also work similarly to on-prem AD groups. They can be used to manage permissions in an effective manner. In a hybrid environment, there will be cloud-only groups as well as synced groups from the on-prem AD environment. In this section, we are going to look into group management using the Azure Active Directory PowerShell for Graph module.

Let's start with listing groups. We can search for a group using the following command:

```
Get-AzureADGroup -SearchString "sg"
```

In the preceding command, `SearchString` is used to define the search criteria. The preceding example will list any groups containing sg in the `DisplayName` field:



```
PS C:\Users\administrator> Get-AzureADGroup -SearchString "sg"

ObjectId                               DisplayName                               Description
-----
93291438-be19-472e-a1d6-9b178b7ac619 sg-Engineering                           All engineering personnel
2a11d5ee-8383-44d1-9fbd-85cb4dcc2d5a sg-Executive                             All executives
38bd48e7-e37c-48c9-bae4-7f00949529a0 sg-Finance                               All finance personnel
c93737dd-0e77-4325-8d5e-6524d8baedff sg-HR                                    All HR personnel
c00fc3df-a395-48fb-a620-05d64384fa3e sg-IT                                    All IT personnel
f7ca523a-3a17-4755-aea9-5c723e8d9c6a sg-Legal                                 All legal executives
73115583-7ce1-4890-8b96-40bc257e0186 sg-Operations                             All operations personnel
0636227c-0a03-4584-a72d-52e5479c2aad sg-Retail                                All retail Users
6a232560-7a59-413c-8f2b-60ecda3b21cb sg-Sales and Marketing                    All marketing personnel
```

Figure 17.14: Search for groups

In the search result, we can see the `ObjectId` for the group. Once we know the `ObjectId`, we can see the details of the group using the following command:

```
Get-AzureADGroup -ObjectId 93291438-be19-472e-a1d6-9b178b7ac619 | fl
```

In a hybrid environment, there will be security groups that have synced from the on-premises Active Directory. We can filter these groups using the following:

```
Get-AzureADGroup -Filter 'DirSyncEnabled eq true' | select  
ObjectId, DisplayName, LastDirSyncTime
```

In the preceding example, the `LastDirSyncTime` column displays the last successful sync time of the group.

We can filter cloud-only groups using the following command:

```
Get-AzureADGroup -All $true | where-Object  
{$_ .OnPremisesSecurityIdentifier -eq $null}
```

In the preceding command, we are using the `OnPremisesSecurityIdentifier` attribute to filter the groups. This attribute only has value if it is synced from on-premises AD.

We can view group memberships by using the following:

```
Get-AzureADGroupMember -ObjectId 2a11d5ee-8383-44d1-9fbd-85cb4dcc2d5a
```

In the preceding command, we are using `ObjectId` to uniquely identify the group.

We can add members to the group using the `Add-AzureADGroupMember` cmdlet:

```
Add-AzureADGroupMember -ObjectId 2a11d5ee-8383-44d1-9fbd-85cb4dcc2d5a  
-RefObjectId a6aeced9-909e-4684-8712-d0f242451338
```

In the preceding command, the `ObjectId` value represents the group, and the `RefObjectId` value represents the user.

We can remove a member from the group by using the following command:

```
Remove-AzureADGroupMember -ObjectId 2a11d5ee-8383-44d1-9fbd-  
85cb4dcc2d5a -MemberId a6aeced9-909e-4684-8712-d0f242451338
```

In the preceding command, the `ObjectId` value represents the group, and the `MemberId` value represents the user's `ObjectId`.

We can also combine the `Add-AzureADGroupMember` cmdlet with the `Get-AzureADUser` cmdlet to add bulk users to a group.

In the following script, I used the `Get-AzureADUser` cmdlet to search for users in Marketing Department, and then used `Add-AzureADGroupMember` to add those users to Sales Group as members:

```
#####Script to Add Multiple users to Security Group#####  
Import-Module AzureAD  
Connect-AzureAD  
##### Search for users in Marketing Department #####  
Get-AzureADUser -All $true -Filter "Department eq 'Marketing'" |  
select ObjectId | Out-File -FilePath C:\salesusers.txt  
#####Add Users to Sales Group#####
```



```
(Get-Content "C:\salesusers.txt" | select-object -skip 3) | ForEach {  
Add-AzureADGroupMember -ObjectId f9f51d29-e093-4e57-ad79-2fc5ae3517db  
-RefObjectId $_ }
```

In a hybrid environment, security groups are mainly synced from on-prem AD. But there can be requirements for cloud-only groups as well. We can create a cloud-only group by using the following:

```
New-AzureADGroup -DisplayName "REBELADMIN Sales Team" -MailEnabled  
$false -MailNickName "salesteam" -SecurityEnabled $true
```

The following screenshot displays the output of the preceding command:



The screenshot shows a PowerShell command prompt with the command `New-AzureADGroup -DisplayName "REBELADMIN Sales Team" -MailEnabled $false -MailNickName "salesteam" -SecurityEnabled $true` and its output. The output is a table with three columns: `ObjectId`, `DisplayName`, and `Description`. The first row of data shows the `ObjectId` as `7592b555-343d-4f73-a6f1-2270d7cf014f` and the `DisplayName` as `REBELADMIN Sales Team`.

| ObjectId                             | DisplayName           | Description |
|--------------------------------------|-----------------------|-------------|
| 7592b555-343d-4f73-a6f1-2270d7cf014f | REBELADMIN Sales Team |             |

**Figure 17.15: Create a cloud-only group**

The preceding command creates a security group called REBELADMIN Sales Team. This group is not a mail-enabled group.

We can remove an Azure AD group using the following command:

```
Remove-AzureADGroup -ObjectId 7592b555-343d-4f73-a6f1-2270d7cf014f
```

In the preceding command, the `ObjectId` value defines the group.

Apart from security groups, Azure AD also has predefined administrative roles, which can be used to assign access permissions to Azure AD and other cloud services. There are more than 35 predefined administrative roles. Each role has its own set of permissions. More details about these roles can be found at <https://bit.ly/3r5FMcs>.

We can list all the administrative roles using the following:

```
Get-AzureADDirectoryRoleTemplate
```

By default, only a few administrative roles are enabled. We can list these roles using the following:

```
Get-AzureADDirectoryRole
```

Here, the company administrator directory role represents the Azure AD global administrators.

We can enable the administrative role using the following:

```
Enable-AzureADDirectoryRole -RoleTemplateId e6d1a23a-da11-4be4-9570-  
befc86d067a7
```

In the preceding command, the `RoleTemplateId` value represents the administrative role.

We can assign the administrative role to a user by using the following command:

```
Add-AzureADDirectoryRoleMember -ObjectId b63c1671-625a-4a80-8bae-  
6487423909ca -RefObjectId 581c7265-c8cc-493b-9686-771b2f10a77e
```

In the preceding command, the `ObjectId` value represents the administrative role. `RefObjectId` is the object ID value of the user.

We can list members of the administrative role using the following:

```
Get-AzureADDirectoryRoleMember -ObjectId 36b9ac02-9dfc-402a-8d44-ba2d8995dc06
```

In the preceding command, `ObjectId` represents the administrative role.

We can remove a member from the role using the following command:

```
Remove-AzureADDirectoryRoleMember -ObjectId 36b9ac02-9dfc-402a-8d44-ba2d8995dc06 -MemberId 165ebcb7-f07d-42d2-a52e-90f44e71e4a1
```

In the preceding command, `MemberId` is equal to the user's object ID value.

This marks the end of this section. There are lots of cmdlets that can still be used to manage Azure AD, but here I explained the cmdlets that will be required for day-to-day operations.

## Microsoft Graph

Microsoft Graph is like a gateway that allows users to access enormous amounts of data and collect information from:

1. Microsoft 365 core services (for example, Office 365, Microsoft Search, OneDrive, SharePoint)
2. Identity and Security Services (for example, Azure AD, Defender 365, Endpoint Manager)
3. Windows 10 services

Microsoft Graph connects to the above services by using REST APIs and client libraries to retrieve required data.

We can use three methods to interact with Microsoft Graph data:

1. The Microsoft Graph API endpoint (<https://bit.ly/3DSbZHF>) can be used to access data and information collected from various Microsoft services. This data can be processed and present in the way an organization/individual requires. Also, this data can be used to develop rich applications/services.
2. Microsoft Graph connectors help to bring third-party application/service data to Microsoft Search so all company data can be searched from one location. Some of these connectors are built by Microsoft and others are built by partners. You can access the connectors gallery by using <https://bit.ly/3FMBaft>.
3. Microsoft Graph Data Connect allows us to access Microsoft Graph data at scale. This gives engineers a granular level of control over Microsoft Graph data. Microsoft Graph Data Connect also provides a unique set of tools that can be used to build intelligent applications.

Based on the requirements, we can use one or more of the above methods to access Microsoft Graph data.

In this section, I am going to demonstrate how we can use Microsoft Graph to access Azure AD data.

## Microsoft Graph Explorer

Graph Explorer is a Microsoft-developed tool that allows you to make Microsoft Graph REST API requests. This tool can be accessed using <https://bit.ly/3l6EF8m>.

The first thing we need to do on the page is to log in. Then we need to grant permissions to Microsoft Graph to access data. To do that, go to the **Modify permissions (Preview)** tab and give consent to grant relevant permissions.



Figure 17.16: Grant permissions to user

After relevant permissions are in place, we can go ahead and query data using Microsoft Graph Explorer. Let's go ahead and start with a user query.

In this example, I would like to view the account details of the `IsaiahL@MSDx927799.OnMicrosoft.com` user. To do that, I am going to use the `GET` HTTP method and the `https://graph.microsoft.com/v1.0/users/IsaiahL@rebeladmin.OnMicrosoft.com` query.

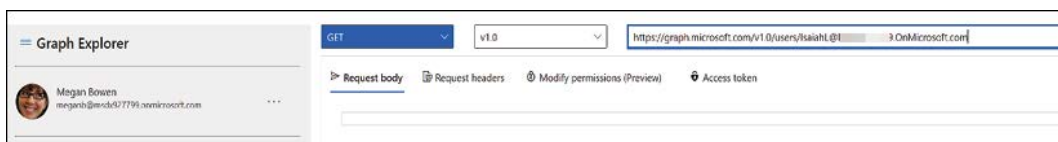


Figure 17.17: User query

Then Microsoft Graph responds to the query with the following data:

```

{
  "@odata.context": "https://graph.microsoft.com/v1.0/$metadata#users/$entity",
  "businessPhones": [
    "+1 918 555 0101"
  ],
  "displayName": "Isaiah Langer",
  "givenName": "Isaiah",
  "jobTitle": "Sales Rep",
  "mail": "IsaiahL@.OnMicrosoft.com",
  "mobilePhone": null,
  "officeLocation": "20/1101",
  "preferredLanguage": null,
  "surname": "Langer",
  "userPrincipalName": "IsaiahL@.OnMicrosoft.com",
  "id": "0bb2ceaa-244f-4ea9-aa71-"
}

```

**Figure 17.18: Output of user query**

According to the above data, the user has the jobTitle attribute value as Sales Rep. This user has been promoted recently and I need to change the title to Sales Manager. To do that, we need to use the **PATCH HTTP** method:

```

PATCH
https://graph.microsoft.com/v1.0/users/IsaiahL@rebeladmin.OnMicrosoft.com

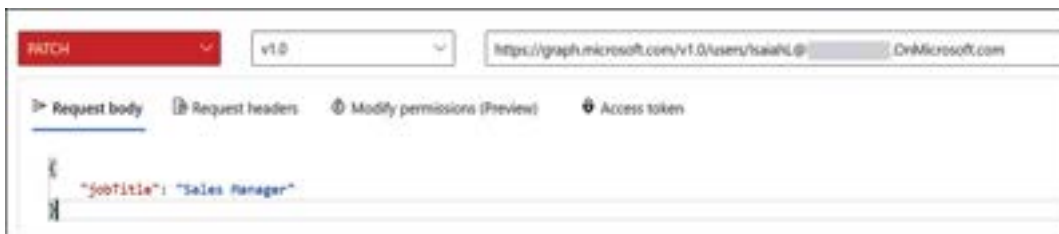
```

Before I run the query under the request body, I define the new values I need to apply:

```

{
  "jobTitle": "Sales Manager"
}

```



**Figure 17.19: Update attribute value**

After I run the query successfully, I can see the relevant attribute has a new value.

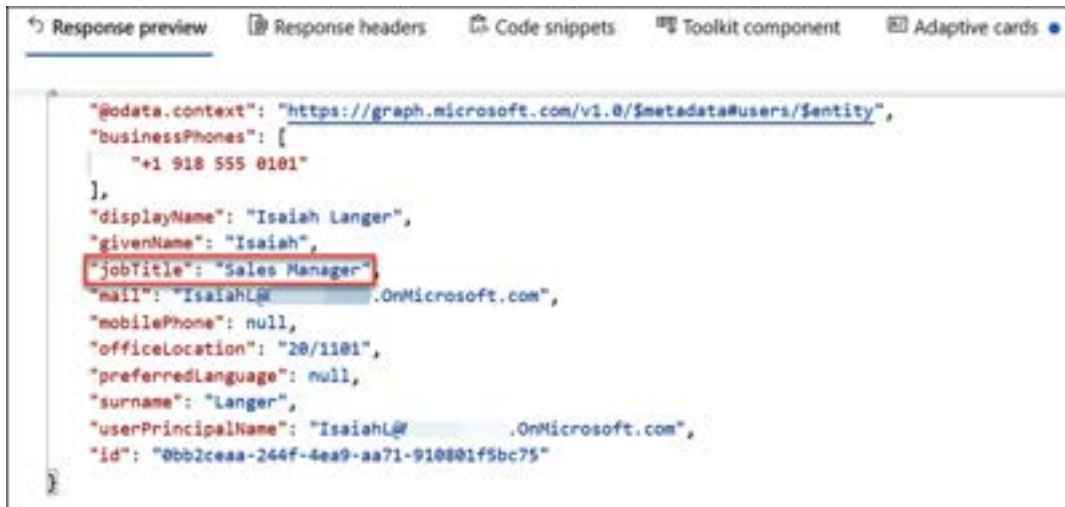


Figure 17.20: Confirm new attribute value

As the next step, I would like to list my domains under Azure AD. To do that, I can use:

```
GET https://graph.microsoft.com/v1.0/domains
```

It returns the details about all the domains under the current subscription. If we need to view data related to a particular domain, we can do it by using:

```
GET https://graph.microsoft.com/v1.0/domains/rebeladmin.OnMicrosoft.com
```

In the preceding command, `rebeladmin.OnMicrosoft.com` is the FQDN.



Figure 17.21: Domain information

As we can see, it provides rich data about the domain. Microsoft Graph Explorer can also be used to create, modify, and delete data by using the HTTP methods `POST` and `DELETE`. As an example, if the domain name is not verified, I can force the verification of the domain by using:

```
POST
https://graph.microsoft.com/v1.0/domains/rebeladmin.onmicrosoft.com/verify
```

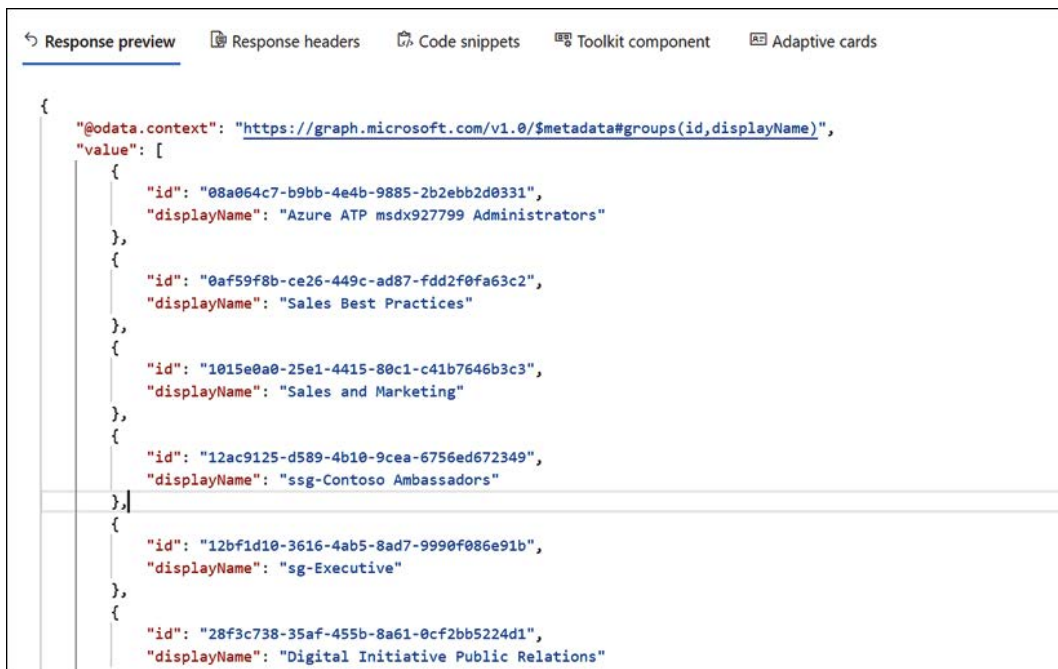
Next, I would like to list all the groups in Azure AD. For that, I can use:

```
GET https://graph.microsoft.com/v1.0/groups
```

The above command lists down all the groups in the directory with attribute values, but I am more interested in finding out the id and displayName values of the groups.

So, I am going to modify the query and only select id and **displayName** values:

```
GET https://graph.microsoft.com/v1.0/groups?$select=id,displayName
```

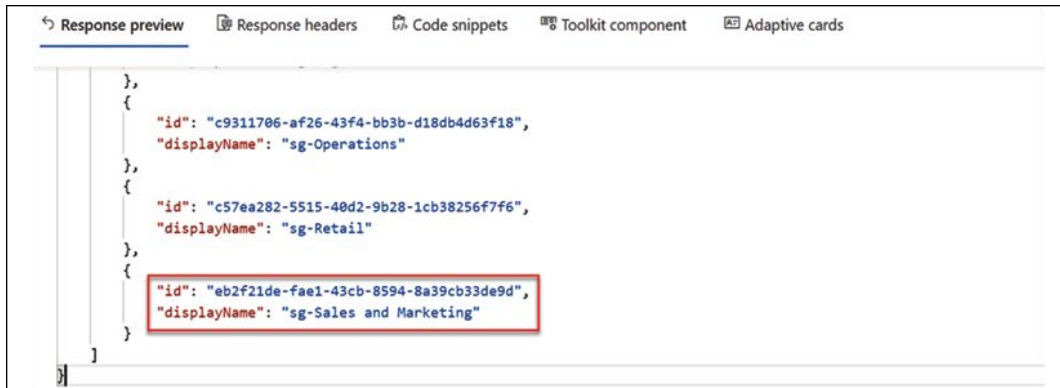


**Figure 17.22: List groups**

But this is still a long list. I want to search for groups that start with the letters sg. To do that, we can use:

```
GET
https://graph.microsoft.com/v1.0/groups?$filter=startswith(displayName, 'sg')&$select=id,displayName
```

From the group list, I am more interested in the sg-Sales and Marketing. Let's take note of the group id value for future use.

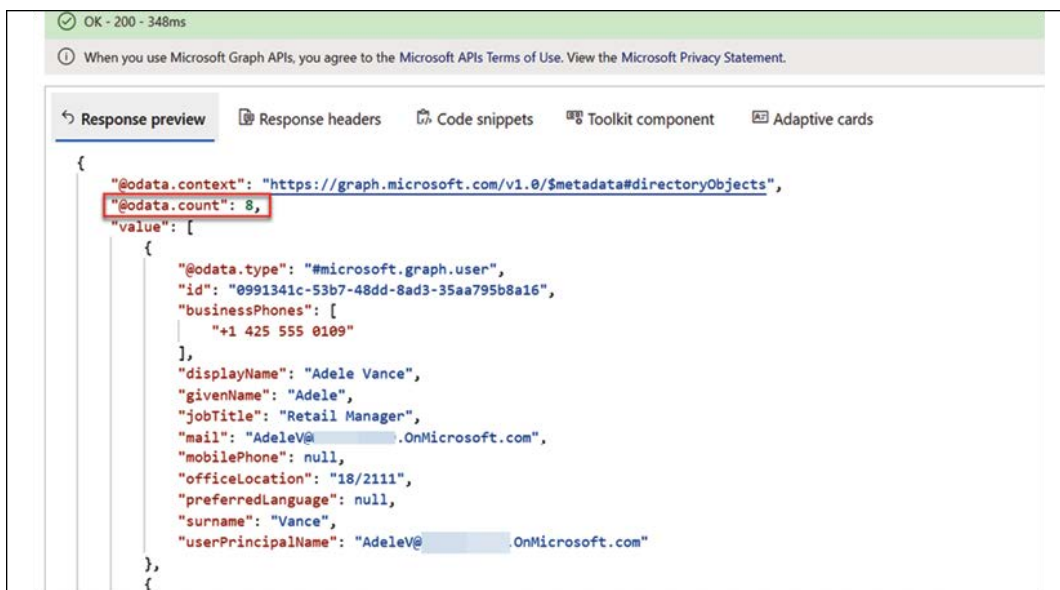


**Figure 17.23: List of groups contain "sg"**

As the next step, I would like to get a list of members of sg-Sales and Marketing. We can do this by using:

```
GET https://graph.microsoft.com/v1.0/groups/{eb2f21de-fae1-43cb-8594-8a39cb33de9d}/members?$count=true
```

In the above command, `eb2f21de-fae1-43cb-8594-8a39cb33de9d` is the group ID of the sg-Sales and Marketing group.



**Figure 17.24: List members of a group**

As we can see above, the query has a response with a list of all the users. In response, the `@odata.count` value represents the number of members in the group.

I have a new user called Megan with the object ID `086ba971-ecc2-49a5-a063-6e2d4fba9e9b`. I would like to add this user to the sg-Sales and Marketing group. This task includes two steps.

As the first step, we need to paste the following command in the query window:



```
POST https://graph.microsoft.com/v1.0/groups/{eb2f21de-fae1-43cb-8594-8a39cb33de9d}/members/$ref
```

In the above, `eb2f21de-fae1-43cb-8594-8a39cb33de9d` is the group ID value.

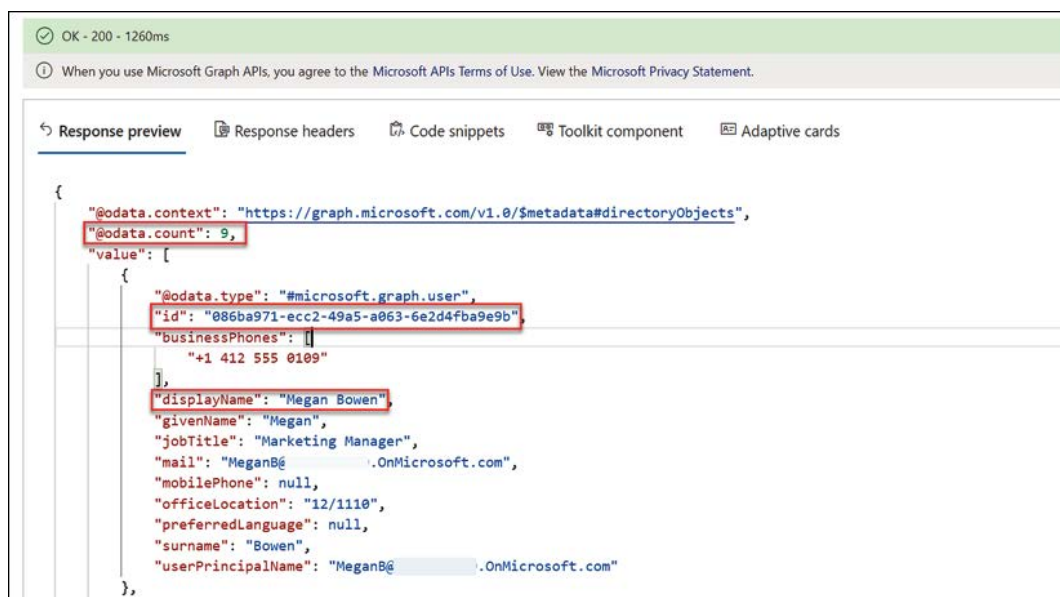
Then, under the Request body section, I use the following command:

```
{
  "@odata.id":
  "https://graph.microsoft.com/v1.0/directoryObjects/{086ba971-ecc2-49a5-a063-6e2d4fba9e9b}"
}
```

This is the reference for the new member object ID. In the above, `086ba971-ecc2-49a5-a063-6e2d4fba9e9b` is the object ID of the user Megan.

After that, we can run the query. If it is successful, we should get a `No Content - 204` response.

After that, I rerun the command to list down members of sg-Sales and Marketing and now I can see the new user as a member.



**Figure 17.25: Add user to a group**

We also can delete a member from a group by using the `DELETE HTTP` method. If we need to remove Megan from the group, we can use:

```
DELETE https://graph.microsoft.com/v1.0/groups/{eb2f21de-fae1-43cb-8594-8a39cb33de9d}/members/{086ba971-ecc2-49a5-a063-6e2d4fba9e9b}/$ref
```

In the preceding command, `eb2f21de-fae1-43cb-8594-8a39cb33de9d` is the object ID of the group and `086ba971-ecc2-49a5-a063-6e2d4fba9e9b` is the object ID of the user Megan.



In this section of the chapter, I have used several examples to show how we can use Microsoft Graph with Azure AD. This is a vast topic but I believe, now, you have an idea of how Microsoft Graph works. For more information, please visit <https://bit.ly/3HS0MJq>.

## Summary

PowerShell has become the most powerful script language for Windows systems. PowerShell is very useful for systems management but is also an incredibly powerful tool for managing Active Directory infrastructures. Throughout the book, I have used PowerShell for Active Directory configuration and management.

Furthermore, I have shared different commands and scripts that can be used to manage an Active Directory environment efficiently.

Toward the end of the chapter, you learned how to manage Azure AD using the Azure Active Directory PowerShell for Graph module. We also looked into Microsoft Graph and learned how to use it to manage Azure AD. In the next chapter, we will look at Azure AD closely and learn how to manage identities in a hybrid environment.

# Chapter 18

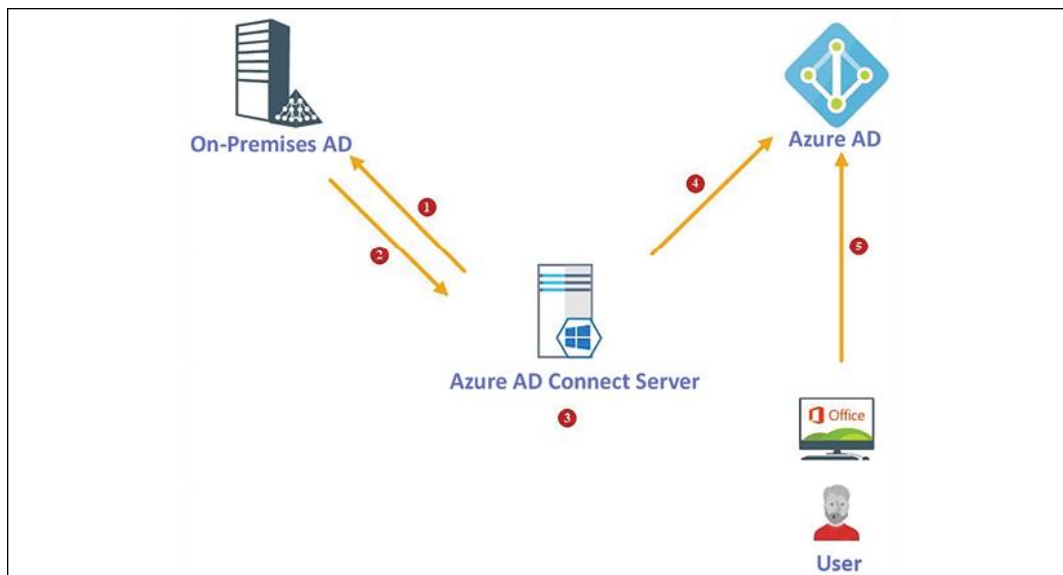
## Links

Over the years, I have written many articles about Azure AD-related security features. I have listed some of those for reference:

- Step-by-Step Guide to Azure AD Privileged Identity Management – Part 1: <https://bit.ly/3rkJ1Np>
- Step-by-Step Guide to Azure AD Privileged Identity Management – Part 2: <https://bit.ly/3oY6QHW>
- Step-by-Step guide to setup temporally privilege access using Azure AD Privileged Identity Management: <https://bit.ly/3nKZgkm>
- Step-by-Step guide: Privileged access management in office 365: <https://bit.ly/2ZjMBf1>
- Step-by-Step Guide: Protect confidential data using Azure information protection: <https://bit.ly/30UIwy2>
- Step-by-Step Guide: Automatic Data Classification via Azure Information Protection: <https://bit.ly/3cHejVY>
- Step-by-Step Guide: On-premise Data Protection via Azure Information Protection Scanner: <https://bit.ly/3DNPO5f>
- Step-by-Step Guide: How to protect confidential emails using Azure information protection?: <https://bit.ly/3FH7sID>
- Step-by-Step Guide: How to track shared documents using Azure information Protection?: <https://bit.ly/3xq3MYP>
- Step-by-Step Guide to Azure AD Password-less Authentication (public-preview): <https://bit.ly/3l7qiAV>
- Step-by-Step Guide: Using Microsoft Authenticator app (Public preview) to reset Azure AD user password: <https://bit.ly/3cO16KU>
- Azure AD Self-Service password reset for Windows 7/8.1 Devices: <https://bit.ly/32ukbjE>
- Conditional Access Policies with Azure Active Directory: <https://bit.ly/3l4Tb0v>
- Conditional Access with Azure AD B2B: <https://bit.ly/3l4AtpX>
- Step-by-Step guide to control data access using Azure cloud app security (based on content type): <https://bit.ly/3FitlqX>

- Step-by-Step guide to manage Impossible travel activity alert using Azure cloud app security: <https://bit.ly/3r4p792>
- Step-by-Step guide to block data download using Azure Cloud App security: <https://bit.ly/3r2PCeX>
- More info about Microsoft's Cloud Adoption Framework (CAF) is available on [bit.ly/3nLQW3W](https://bit.ly/3nLQW3W).
- For more details on cost of different Azure AD versions, visit [bit.ly/3cGtNtm](https://bit.ly/3cGtNtm).
- Azure AD password-less authentication: [bit.ly/3HJ6g9z](https://bit.ly/3HJ6g9z)
- Hashes stored in AD are in the Message Digest 4 (MD4) algorithm format ([bit.ly/3l4TvfJ](https://bit.ly/3l4TvfJ)).
- Password-Based Key Derivation Function 2 (PBKDF2) ([bit.ly/3cJ5JpW](https://bit.ly/3cJ5JpW)).
- Valid Azure subscription: [bit.ly/3oV95Ma](https://bit.ly/3oV95Ma)
- More information about ports can be found at [bit.ly/3r5zJo5](https://bit.ly/3r5zJo5). The service URL and IP range information can be found at <https://bit.ly/3nManck>.
- Azure portal as Global Administrator (<https://bit.ly/30XzSig>).
- There are three levels of subscription for the service and you can find more details about these on <https://bit.ly/3nLCc4Y>.
- Download the latest version of Azure AD Connect from <https://bit.ly/3l6JZZr>.

## Figures



**Figure 18.1: Password hash synchronization process**

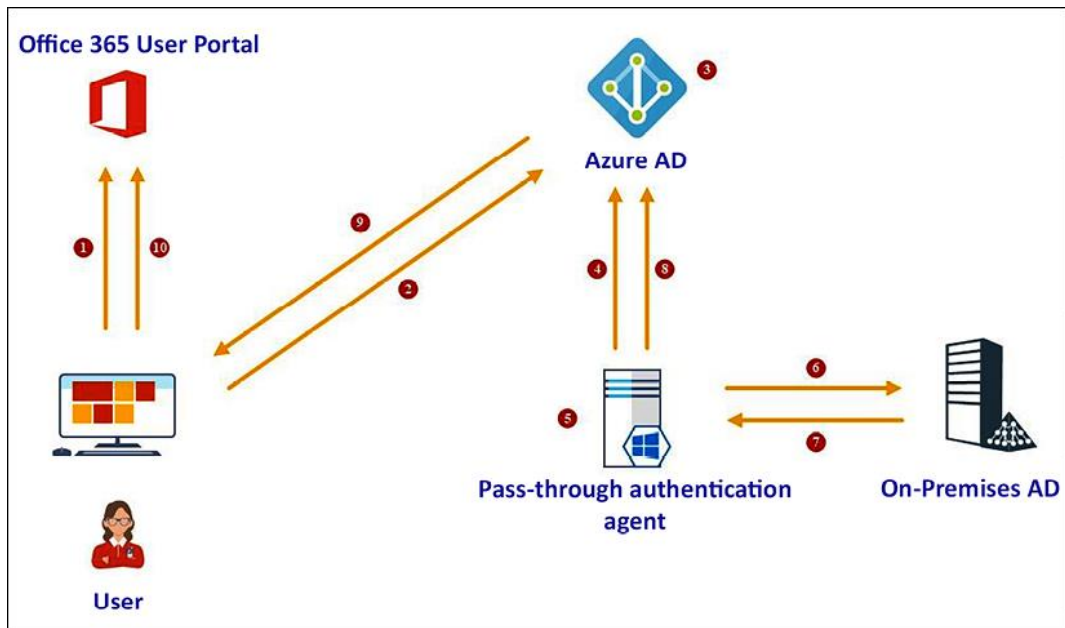


Figure 18.2: Pass-through authentication flow

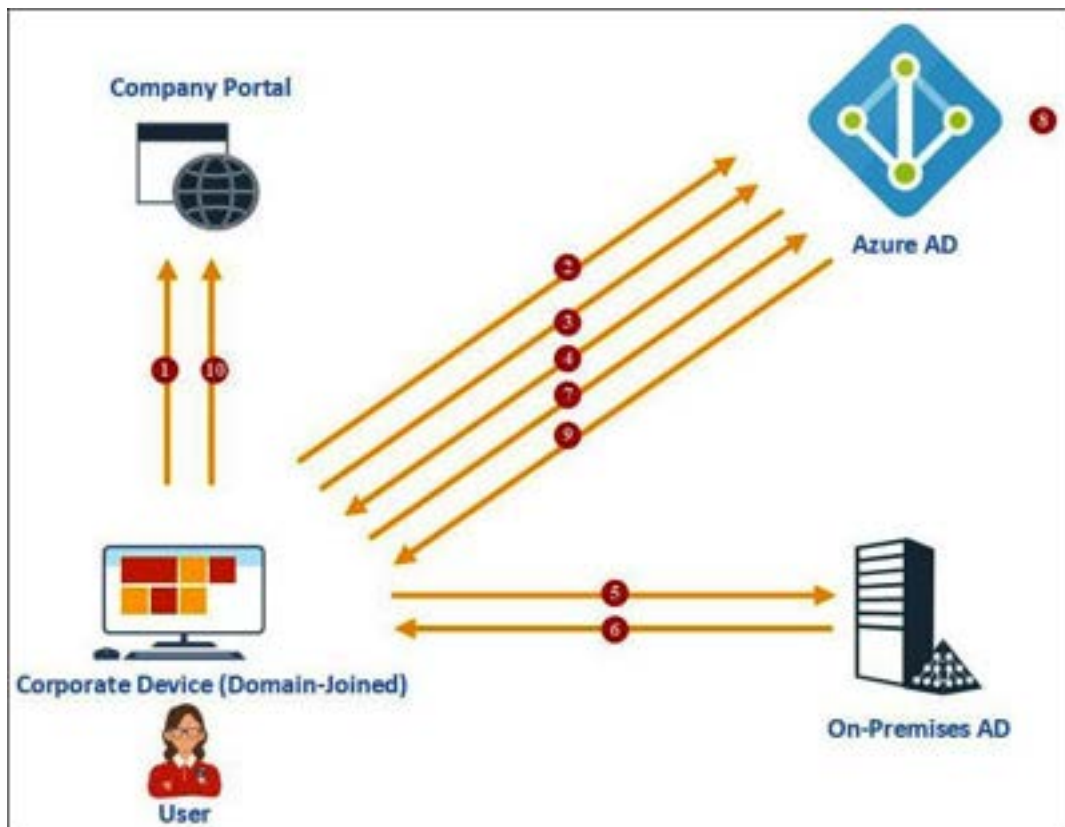


Figure 18.3: Seamless-SSO flow

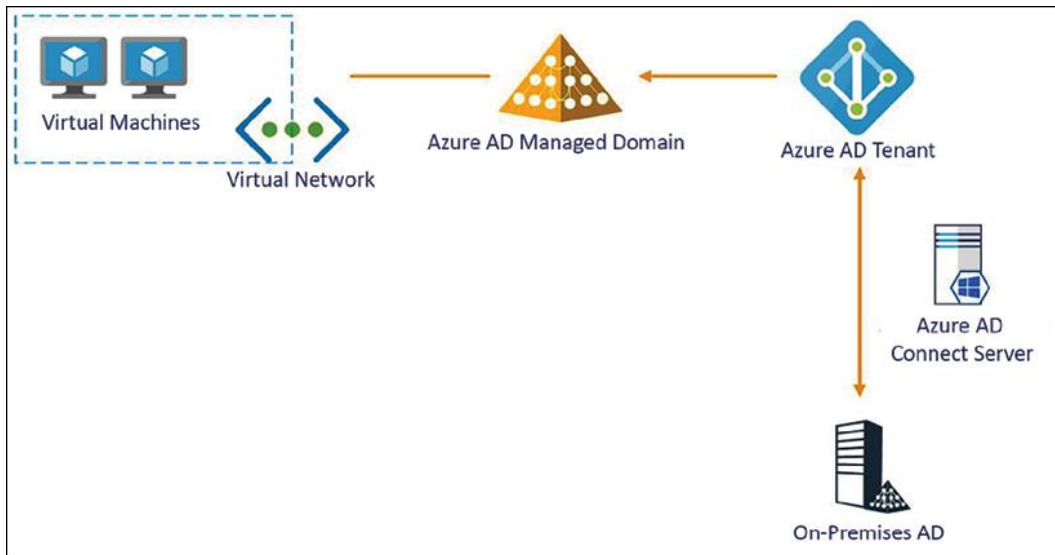


Figure 18.4: Azure AD hybrid topology with Azure AD managed domain

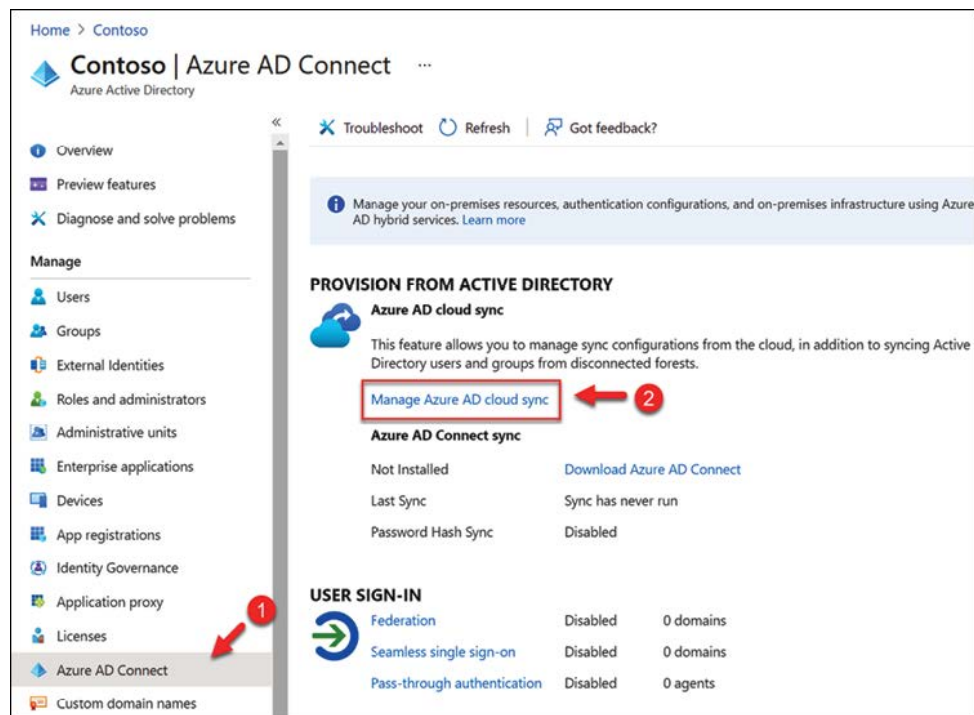


Figure 18.5: Manage Azure AD cloud sync

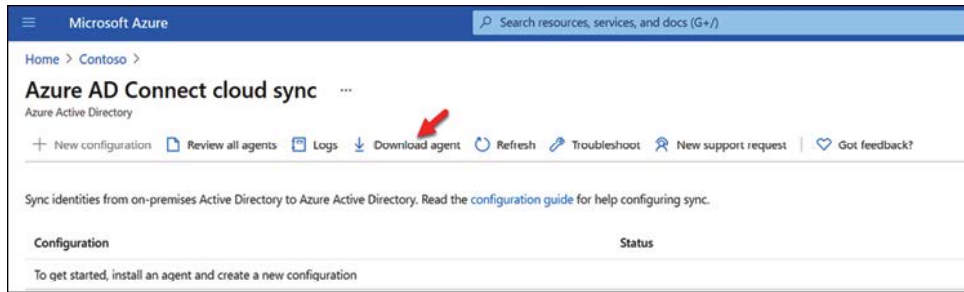


Figure 18.6: Download Azure AD cloud sync agent

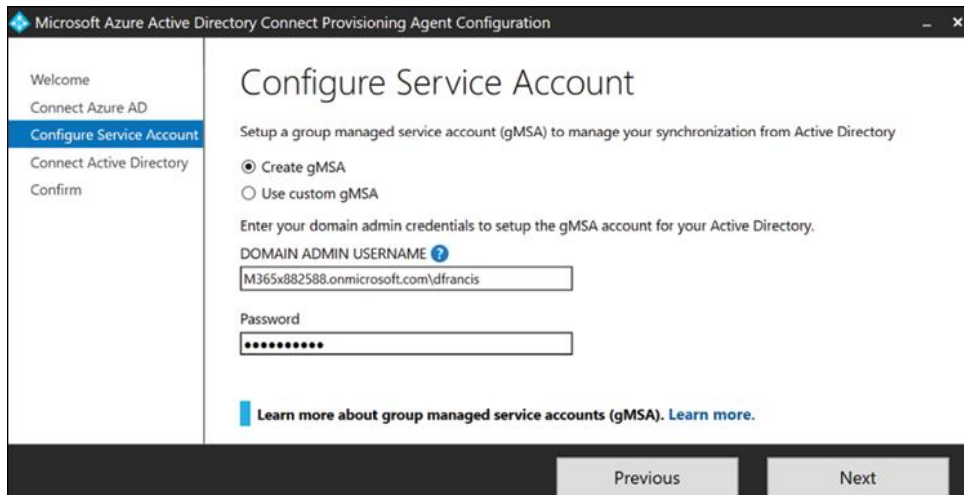


Figure 18.7: Create a gMSA account

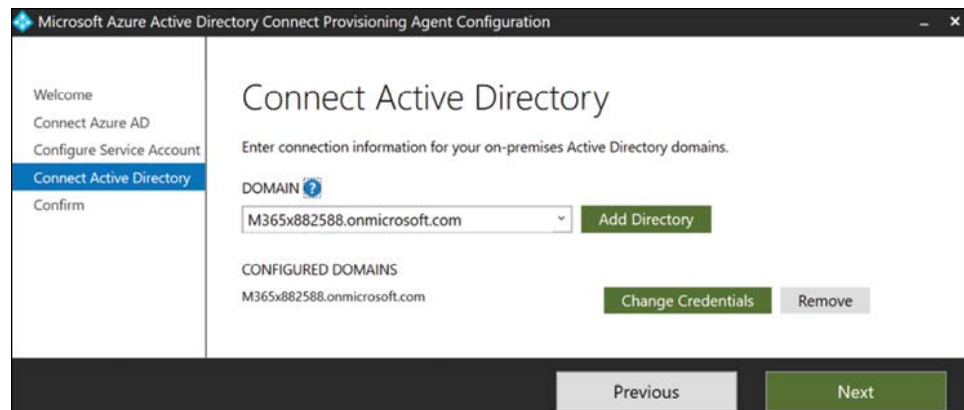


Figure 18.8: Connect to local AD

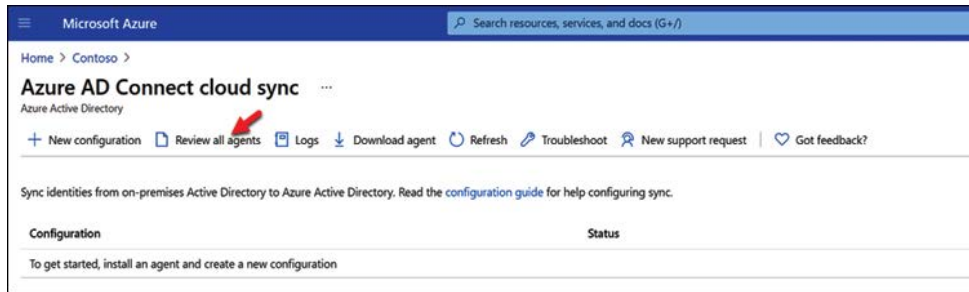


Figure 18.9: Review all agents option

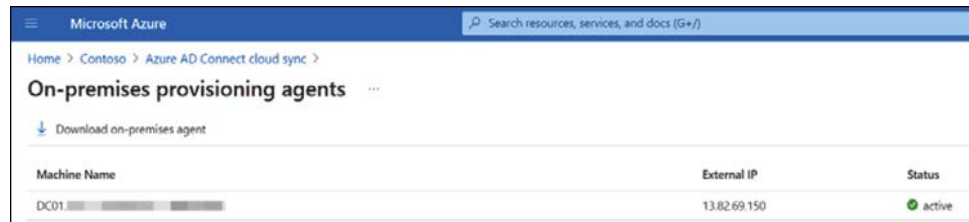


Figure 18.10: Health status of provisioning agents

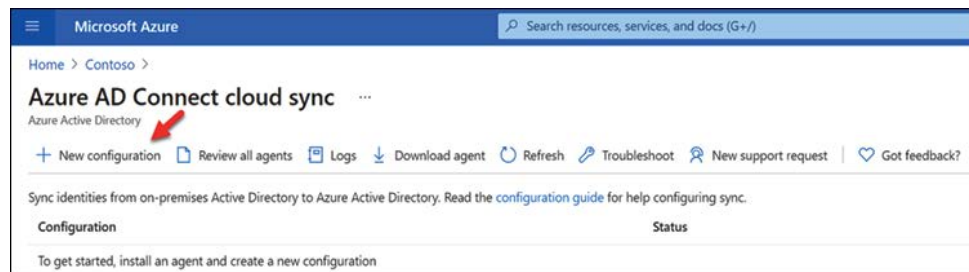


Figure 18.11: Set up new Azure AD cloud sync configuration

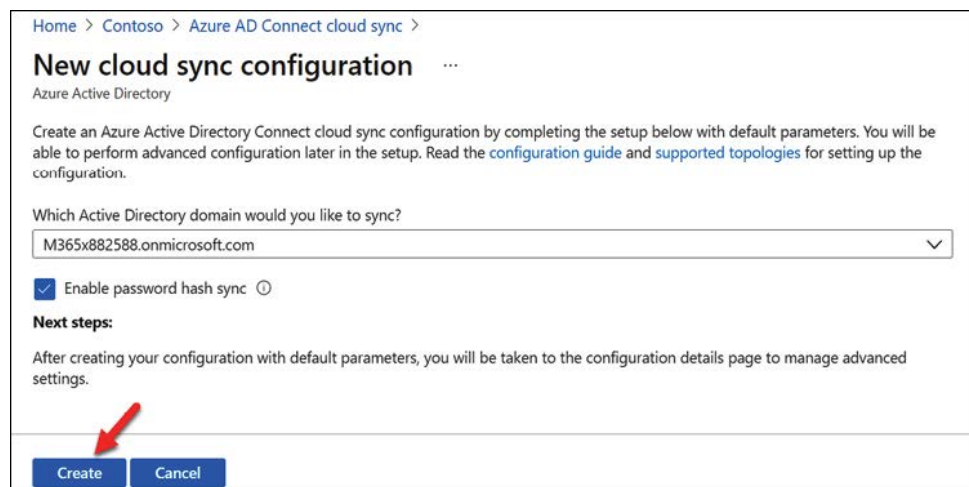





Figure 18.12: Azure AD cloud sync configuration – domain settings

Home > Contoso > Azure AD Connect cloud sync >

## Edit cloud sync configuration ...

Azure Active Directory

 Save  Restart sync  Delete

Configure

Read the [configuration guide](#) for help configuring sync.

- Scope** ⓘ  
Active Directory domain: **M365x882588.onmicrosoft.com**  
Scope users: All users in scope  
[Click to edit scoping filters](#)
- Manage attributes** ⓘ  
Sync password hashes: ☒ Enable  
Map attributes: [Click to edit mappings](#)
- Validate (recommended)** ⓘ  
Verify that sync is working as expected before enabling the configuration by testing with individual users. Quickly create, update, or disable the user's account in the target app based on your configuration.  
[Provision a user](#)
- Settings** ⓘ  
Notification email:  ✓  
Prevent accidental deletion: ☒  
Accidental delete threshold:
- Deploy** ⓘ  
Enabling this will sync the users and groups that are in scope as identified by this configuration.

Figure 18.13: Save Azure AD cloud sync configuration settings



Search users ADD Filter

807 users found

|                          | Name             | ID | User principal name             | ID | User type | Directory sync | Monthly issuer | Company name    |
|--------------------------|------------------|----|---------------------------------|----|-----------|----------------|----------------|-----------------|
| <input type="checkbox"/> | Abraham Pavlik   |    | Abraham.Pavlik@M365u862588...   |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Adelgunde Wilcox |    | Adelgunde.Wilcox@M365u862588... |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Adelheid Denner  |    | Adelheid.Denner@M365u862588...  |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Adolfus Wagle    |    | Adolfus.Wagle@M365u862588...    |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Agata Hammer     |    | Agata.Hammer@M365u862588...     |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Albert Elert     |    | Albert.Elert@M365u862588...     |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alex Lile        |    | Alex.Lile@M365u862588...        |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alex Reimer      |    | Alex.Reimer@M365u862588...      |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alex Wilcox      |    | Alex.Wilcox@M365u862588...      |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alf Wirth        |    | Alf.Wirth@M365u862588...        |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alfred Bader     |    | Alfred.Bader@M365u862588...     |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alois Schenker   |    | Alois.Schenker@M365u862588...   |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alan Dreyer      |    | Alan.Dreyer@M365u862588...      |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alma Heilmann    |    | Alma.Heilmann@M365u862588...    |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alma Schenker    |    | Alma.Schenker@M365u862588...    |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Alvinus Hall     |    | Alvinus.Hall@M365u862588...     |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Amadeus Hall     |    | Amadeus.Hall@M365u862588...     |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Amelatus Huggert |    | Amelatus.Huggert@M365u862588... |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Amelia Hall      |    | Amelia.Hall@M365u862588...      |    | Member    | Yes            |                | Rebelshin Corp. |
| <input type="checkbox"/> | Amelia Spitzer   |    | Amelia.Spitzer@M365u862588...   |    | Member    | Yes            |                | Rebelshin Corp. |

[Load more](#)

Figure 18.14: Sync status of user accounts

## Create virtual network ...

**Basics** IP Addresses Security Tags Review + create

Azure Virtual Network (VNet) is the fundamental building block for your private network in Azure. VNet enables many types of Azure resources, such as Azure Virtual Machines (VM), to securely communicate with each other, the internet, and on-premises networks. VNet is similar to a traditional network that you'd operate in your own data center, but brings with it additional benefits of Azure's infrastructure such as scale, availability, and isolation. [Learn more about virtual network](#)

**Project details**

Subscription \* ⓘ REBELSS

Resource group \* ⓘ REBELBOOK [Create new](#)

**Instance details**

Name \* REBELVMNet ✓

Region \* (US) East US

[Review + create](#) [< Previous](#) [Next : IP Addresses >](#) [Download a template for automation](#)

Figure 18.15: Create a new virtual network

## Create virtual network ...

Basics IP Addresses Security Tags Review + create

The virtual network's address space, specified as one or more address prefixes in CIDR notation (e.g. 192.168.1.0/24).

**IPv4 address space**

10.2.0.0/16    10.2.0.0 - 10.2.255.255 (65536 addresses)

☐ Add IPv6 address space ⓘ

The subnet's address range in CIDR notation (e.g. 192.168.1.0/24). It must be contained by the address space of the virtual network.

+ Add subnet    Remove subnet

| Subnet name  | Subnet address range | NAT gateway |
|--|----------------------|-------------|
| <div style="border: 1px solid red; padding: 2px;">REBEL-VN01</div> | 10.2.0.0/24          | -           |

ⓘ Use of a NAT gateway is recommended for outbound internet access from a subnet. You can deploy a NAT gateway and assign it to a subnet after you create the virtual network. [Learn more](#)

Review + create
< Previous
Next : Security >
[Download a template for automation](#)

Figure 18.16: Virtual network subnet settings

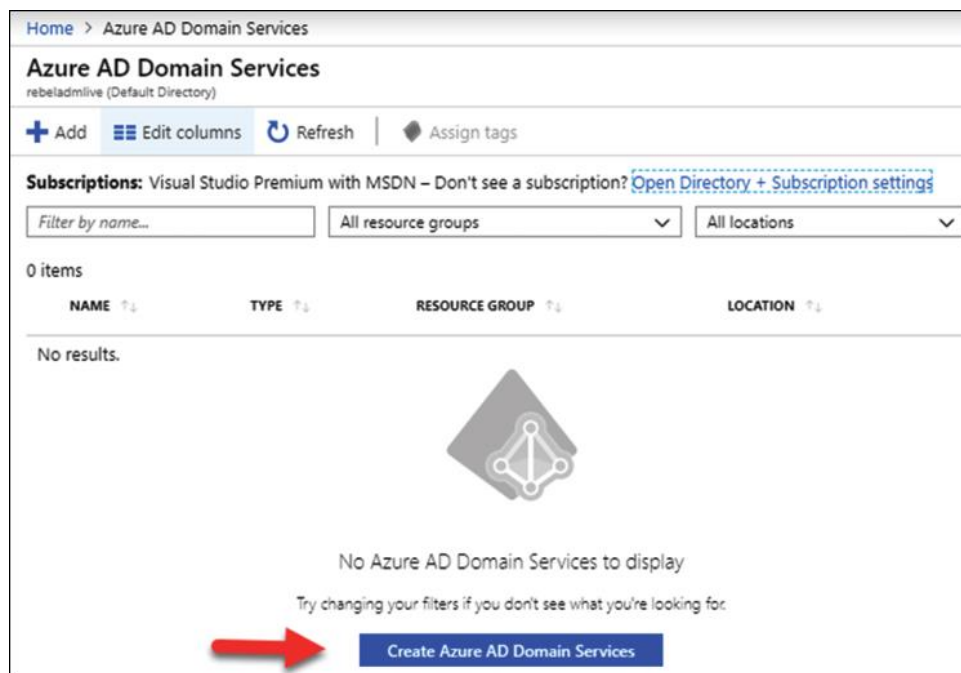


Figure 18.17: Initiating Azure AD DS setup

## Create Azure AD Domain Services

[\\* Basics](#) [\\* Networking](#) **Administration** [Synchronization](#) [Security Settings](#) [Tags](#) [Review + create](#)

Azure AD Domain Services provides managed domain services such as domain join, group policy, LDAP, and Kerberos/NTLM authentication. You can use Azure AD Domain Services without needing to manage, patch, or service domain controllers in the cloud. For ease and simplicity, defaults have been specified to provide a one-click deployment. [Learn more](#)

### Project details

When choosing the basic information needed for Azure AD Domain Services, keep in mind that the subscription, resource group, DNS domain name, and location cannot be changed after creation.

Subscription \*

Resource group \* ⓘ  [Create new](#)

[Help me choose the subscription and resource group](#)

DNS domain name \* ⓘ

[Help me choose the DNS name](#)

Region \* ⓘ

SKU \* ⓘ

[Help me choose a SKU](#)

Forest type \* ⓘ ☒ User ☐ Resource

[Help me choose a forest type](#)

[Review + create](#) [Previous](#) [Next](#)

Figure 18.18: Azure AD DS configuration

[Home](#) > [Azure AD Domain Services](#) >

## Create Azure AD Domain Services

[\\* Basics](#) **[\\* Networking](#)** [Administration](#) [Synchronization](#) [Security Settings](#) [Tags](#) [Review + create](#)

Azure AD Domain Services uses a dedicated subnet within a virtual network to hold all of its resources. If using an existing network, ensure that the network configuration does not block the ports required for Azure AD Domain Services to run. [Learn more](#)

Virtual network \* ⓘ  [Create new](#)

[Help me choose the virtual network and address](#)

Subnet \* ⓘ  [Manage](#)

[Help me choose the subnet and NSG](#)

**i** A network security group will be automatically created and associated to the subnet to protect AAD Domain Services. The network security group will be configured according to [guidelines for configuring NSGs](#).

[Review + create](#) [Previous](#) [Next](#)

Figure 18.19: Azure AD DS – virtual network settings

The screenshot shows the 'Administration' tab in the Azure AD DS configuration interface. At the top, there are tabs for Basics, Networking, Administration (selected), Synchronization, Security Settings, Tags, and Review + create. Below the tabs, a message states: 'Use these settings to specify which users should have administrative privileges and be notified of problems on your managed domain. [Learn more](#)'. The 'AAD DC Administrators' section includes a link to 'Manage group membership' and a link 'Help me choose AAD DC Admins'. The 'Notifications' section explains that selected groups will be notified of alerts. Two checkboxes are checked: 'All Global Administrators of the Azure AD directory.' and 'Members of the AAD DC Administrators group.' There is a text input field for 'Additional email recipients' with the placeholder 'Add another email to be contacted at'. A link 'Help me choose who gets notifications' is at the bottom left. At the bottom, there are three buttons: 'Review + create' (highlighted in blue), 'Previous', and 'Next'.

Figure 18.20: Azure AD DS – Domain Admin settings

The screenshot shows the 'Synchronization' tab in the Azure AD DS configuration interface. At the top, there are tabs for Basics, Networking, Administration, Synchronization (selected), Security Settings, Tags, and Review + create. Below the tabs, a message states: 'Azure AD Domain Services provides a one-way synchronization from Azure Active Directory to the managed domain. In addition, only certain attributes are synchronized down to the managed domain, along with groups, group memberships, and passwords. [Learn more](#)'. The 'Synchronization type' section has two buttons: 'All' (selected) and 'Scoped'. A link 'Help me choose the synchronization type' is below. A blue information box contains the text: 'Scoped synchronization can be modified with different group selections or converted to synchronize all users and groups. Changes to synchronization settings are not immediate. Please allow time for changes to complete. [More information](#)'. At the bottom, there are three buttons: 'Review + create' (highlighted in blue), 'Previous', and 'Next'.

Figure 18.21: Azure AD DS – synchronization scope

The screenshot shows the 'Azure AD Domain Services' instance overview page. At the top, there are tabs for Basics, Networking, Administration, Synchronization, Security Settings, Tags, and Review + create. Below the tabs, there is a section for 'Subscriptions' with a table showing the subscription details. The table has columns for 'Name', 'Status', 'Created on', 'Updated on', and 'Subscription'. The table contains one row with the following data:

| Name              | Status  | Created on           | Updated on           | Subscription                            |
|-------------------|---------|----------------------|----------------------|---|
| azuread-ds-xxxxxx | Running | 2019-01-01T00:00:00Z | 2019-01-01T00:00:00Z | Visual Studio Premium with IntelliSense |

Figure 18.22: Azure AD DS instance

## Required configuration steps



### Update DNS server settings for your virtual network

Update the DNS server settings for your virtual network to point to the IP addresses (10.2.0.4 and 10.2.0.5) where Azure AD Domain Services is available.

[More information](#)

[Configure](#)

Figure 18.23: Update DNS records

Home > rebeladmlive.onmicrosoft.com > REBELVMNet

## REBELVMNet | DNS servers

Virtual network

Search (Ctrl+/,)

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

### Settings

- Address space
- Connected devices
- Subnets
- DDoS protection
- Firewall
- Security
- DNS servers**
- Peerings
- Service endpoints
- Private endpoints

DNS servers ⓘ

☐ Default (Azure-provided)

☒ Custom

| IP Address |
|------------|
| 10.2.0.4   |
| 10.2.0.5   |

[Add DNS server](#)

Figure 18.24: Custom DNS servers

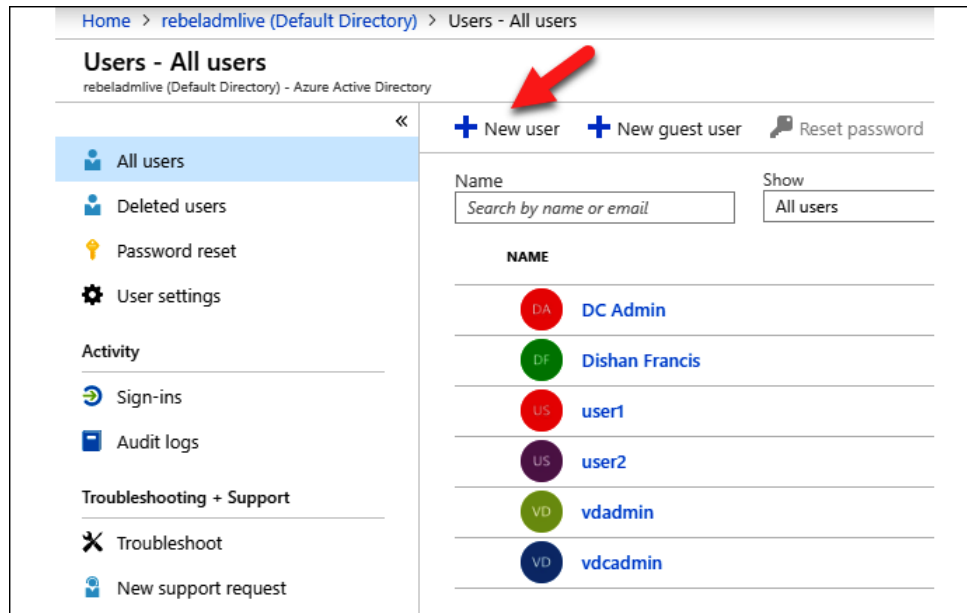


Figure 18.25: Create new user

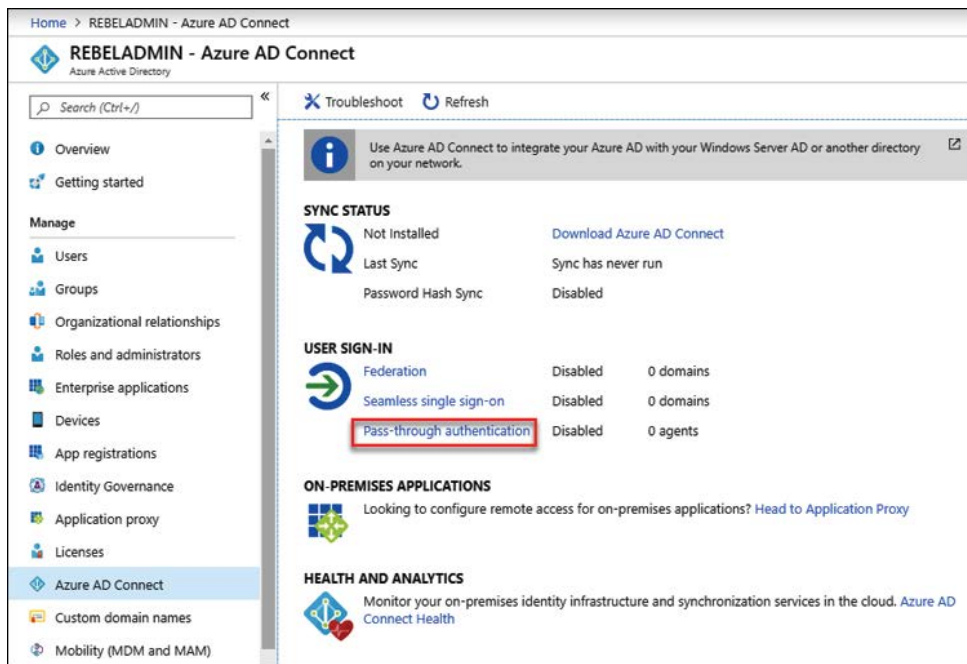


Figure 18.26: Pass-through authentication settings

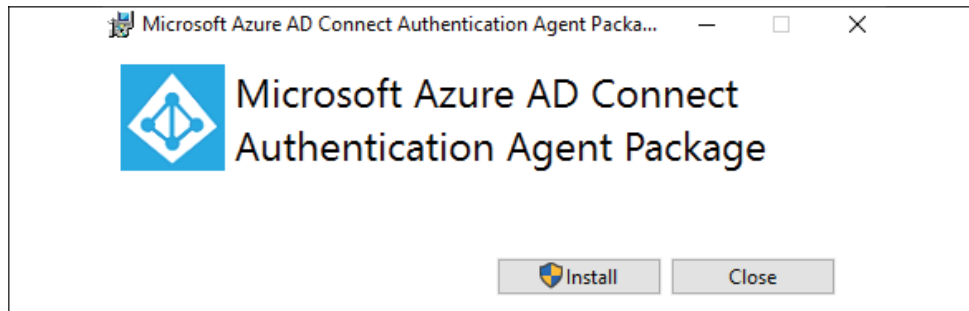


Figure 18.27: Start Azure AD Connect authentication agent installation

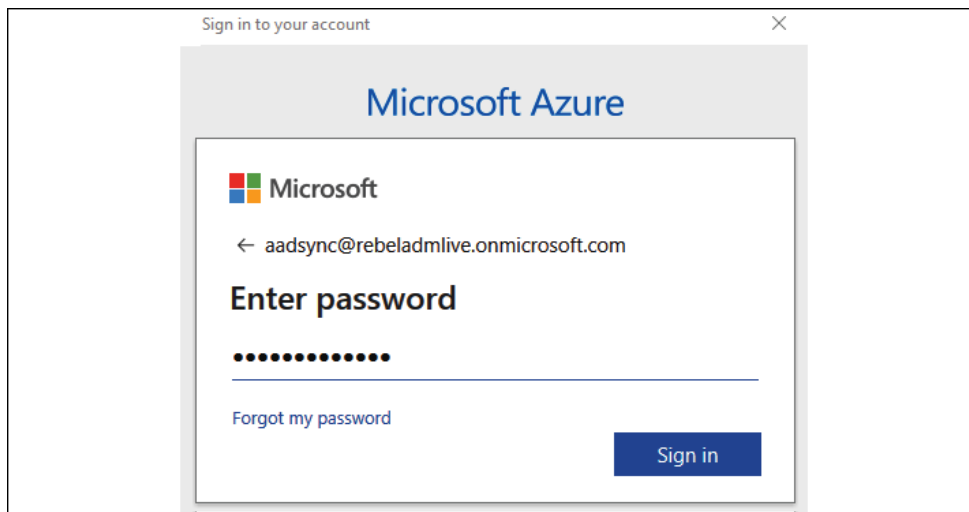


Figure 18.28: Azure AD authentication

Home > rebeladmlive (Default Directory) > Azure AD Connect > Pass-through authentication

| Pass-through authentication   |        |        |          |
|---|--------|--------|----------|
| Azure Active Directory  |        |        |          |
| <a href="#">Download</a> <a href="#">Troubleshoot</a> <a href="#">Refresh</a> |        |        |          |
| AUTHENTICATION AGENT  | IP     | STATUS | WARNINGS |
| ▼ Default group for Pass-through Authentication                               |        |        |          |
| RDC01.rebeladmlive.onmicrosoft.com  | 77.98. | Active |          |

Figure 18.29: Pass-through authentication agent status



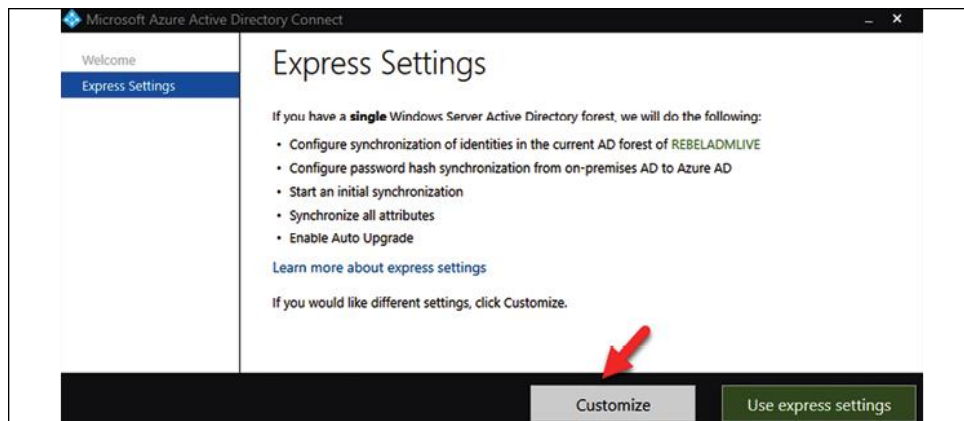


Figure 18.30: Azure AD Connect express setup

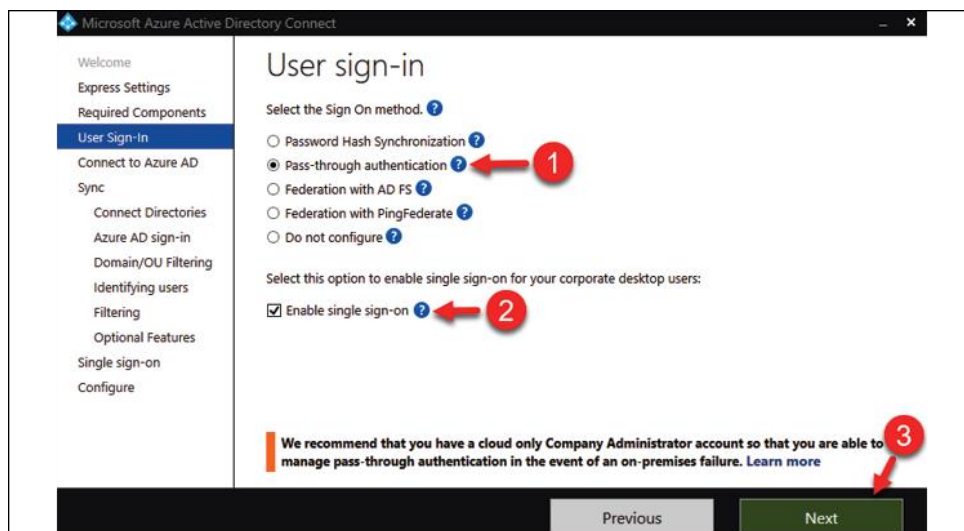


Figure 18.31: Azure AD Connect pass-through authentication setting



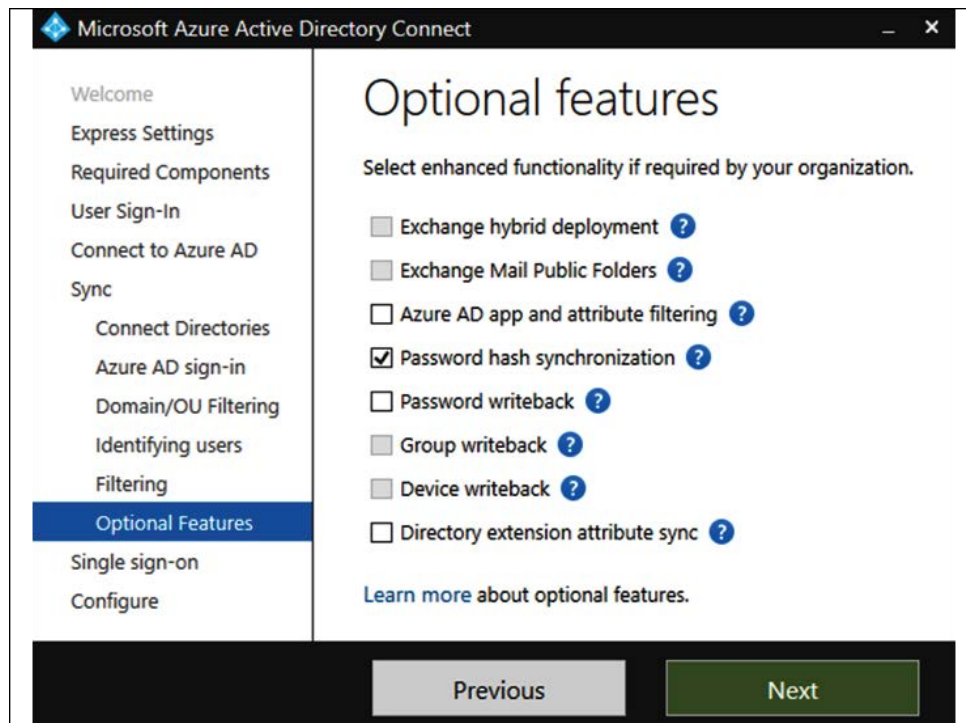


Figure 18.32: Azure AD Connect Optional features selection

Synchronization Service Manager on RDC01

File Tools Actions Help

Operations Connectors Metaverse Designer Metaverse Search

Connector Operations

| Name                     | Profile Name         | Status               | Start Time          | End Time            |
|--------------------------|----------------------|----------------------|---------------------|---------------------|
| rebeladmlive.onmicros... | Export               | success              | 6/5/2019 1:13:38 AM | 6/5/2019 1:13:38 AM |
| rebeladmlive.onmicros... | Export               | success              | 6/5/2019 1:13:12 AM | 6/5/2019 1:13:38 AM |
| rebeladmlive.onmicros... | Full Synchronization | success              | 6/5/2019 1:13:05 AM | 6/5/2019 1:13:11 AM |
| rebeladmlive.onmicros... | Full Synchronization | success              | 6/5/2019 1:12:52 AM | 6/5/2019 1:13:04 AM |
| rebeladmlive.onmicros... | Full Import          | completed-no-objects | 6/5/2019 1:12:46 AM | 6/5/2019 1:12:52 AM |
| rebeladmlive.onmicros... | Full Import          | success              | 6/5/2019 1:12:42 AM | 6/5/2019 1:12:46 AM |

Profile Name: Export User Name: REBELADMLIVE\AAD\_d040988f9a33

Step Type: Export Partition: default

Start Time: 6/5/2019 1:13:12 AM End Time: 6/5/2019 1:13:38 AM Status: success

| Export Statistics | Count |
|-------------------|-------|
| Adds              | 107   |
| Updates           | 1     |
| Renames           | 0     |
| Deletes           | 0     |
| Delete Adds       | 0     |

| Connection Status |
|-------------------|
| Export Errors     |

Figure 18.33: Azure AD Connect synchronization status



Figure 18.36: SSL certificate

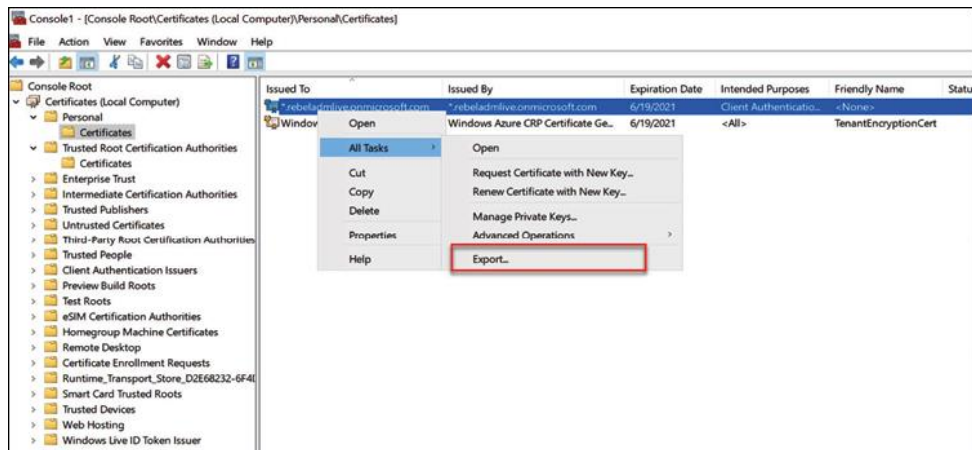


Figure 18.37: Export SSL certificate



Figure 18.38: Export private key

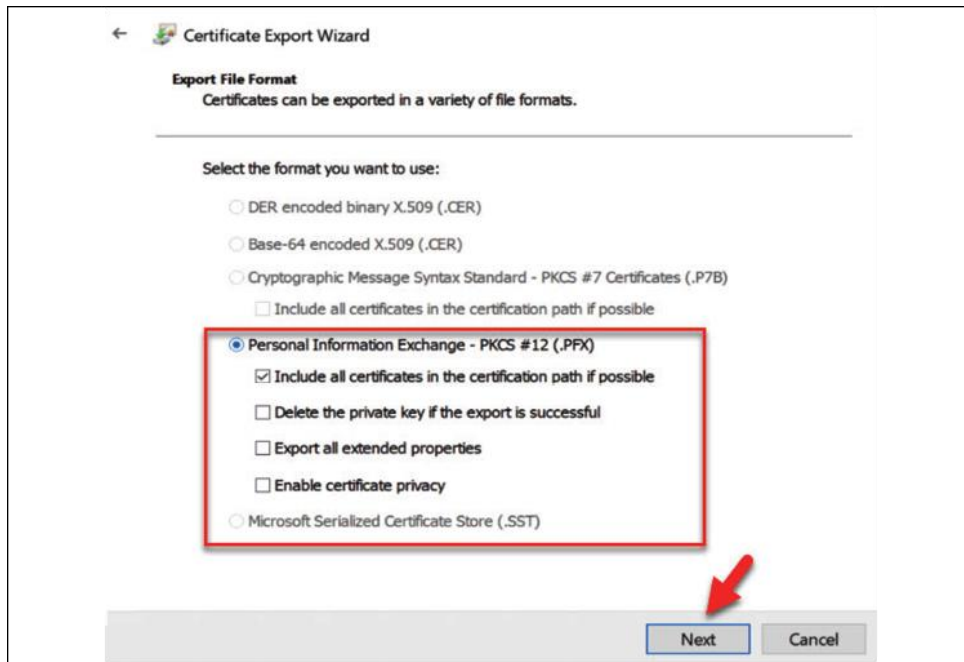


Figure 18.39: Export as PFX

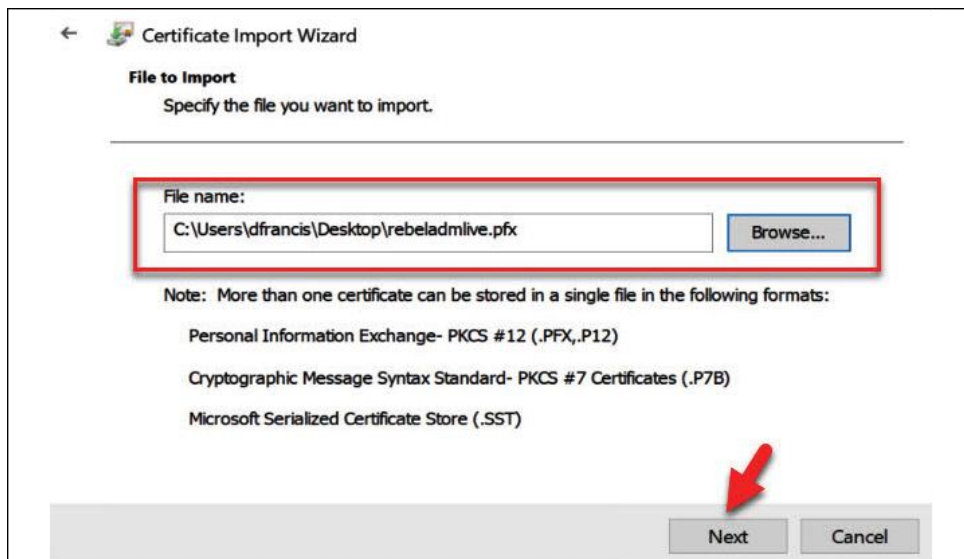


Figure 18.40: PFX file path

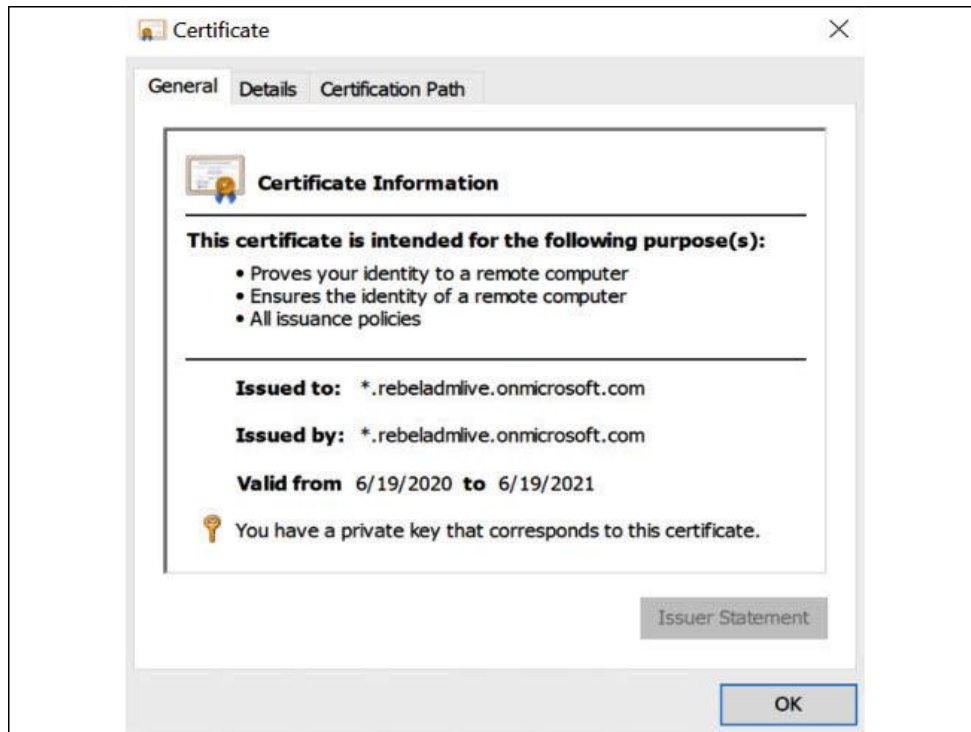


Figure 18.41: Certificate status

**rebeladmlive.onmicrosoft.com**  
 Azure AD Domain Services

Delete

Overview

Activity log

Access control (IAM)

Settings

Properties

**Secure LDAP**

Synchronization

Health

Notification settings

SKU

Monitoring

Diagnostic settings

Logs

Workbooks

Support + troubleshooting

Troubleshoot

New support request

**rebeladmlive.onmicrosoft.com**
Running
View health

### Azure AD Domain Services SKUs

Choose Azure AD Domain Services SKU for your organization

Azure AD Domain Services is available in multiple service tiers, known as SKUs. These SKUs provide predictable pricing, varying performance levels, and selectable enterprise and premium features.

[More information](#)

Choose SKU

### Required configuration steps

#### Enable Azure AD Domain Services password hash synchronization

Users cannot bind using secure LDAP or sign in to the managed domain, until you enable password hash synchronization to Azure AD Domain Services. Follow the instructions below, depending on the type of users in your Azure AD directory. Complete both sets of instructions if you have a mix of cloud-only and synced user accounts in your Azure AD directory.

- [Instructions for cloud-only user accounts](#)
- [Instructions for synced user accounts](#)

Figure 18.42: Secure LDAP feature

**rebeladmlive.onmicrosoft.com** | Secure LDAP

Discard
Change Certificate

Overview

Activity log

Access control (IAM)

Settings

Properties

**Secure LDAP**

Synchronization

Health

Notification settings

SKU

Monitoring

Diagnostic settings

Logs

Workbooks

Support + troubleshooting

Troubleshoot

New support request

Secure LDAP - Disabled

Thumbprint - Not available

Allow secure LDAP access - Disabled

Certificate expires - Not available

Secure LDAP

Disable

Enable

Allow secure LDAP access over the Internet

Disable

Enable

Upload a PKIX file containing the certificate to be used for secure LDAP access to this managed domain

PKIX file with secure LDAP certificate \*

rebeladmlive.pfx

Password to decrypt PKIX file \*

rebeladmlive



Your subnet is protected by network security group rule. To give user access to secure LDAP endpoint, please ensure "allow" rule on port 688 is configured with proper IP ranges on the network security group.

Users cannot bind using secure LDAP or sign in to the managed domain until you enable password hash synchronization to Azure AD Domain Services. Follow the instructions below, depending on the type of users in your Azure AD directory. Complete both sets of instructions if you have a mix of cloud-only and synced user accounts in your Azure AD directory.

- [Instructions for cloud-only user accounts](#)
- [Instructions for synced user accounts](#)

Figure 18.43: Configure secure LDAP

Home >

 rebeladmlive.onmicrosoft.com | Properties 

Azure AD Domain Services

Search (Ctrl+/) <<

- Overview
- Activity log
- Access control (IAM)

**Settings**

- Properties**
- Secure LDAP
- Synchronization
- Health
- Notification settings
- SKU

**Monitoring**

- Diagnostics settings
- Logs
- Workbooks

**Support + troubleshooting**

- Troubleshoot
- New support request



|   |  |
|---|--|
| DNS domain name                               | rebeladmlive.onmicrosoft.com   |
| Location                                      | East US  |
| SKU   | Standard   |
| Forest type                                   | User   |
| Available in virtual network/subnet           | aadds-vnet/aadds-subnet  |
| Network security group associated with subnet | aadds-nsg  |
| IP address on virtual network                 | 10.0.0.5 10.0.0.4  |
| Secure LDAP                                   | Enabled  |
| Secure LDAP certificate thumbprint            |  |
| Secure LDAP certificate expires               | Sat, 19 Jun 2021 21:01:12 GMT  |
| Secure LDAP external IP address               | 52.188.114.225   |

Figure 18.44: Public IP details



Home > rebeladmlive.onmicrosoft.com | Properties 

Azure AD Domain Services

Search (Ctrl+J) <<

Overview

Activity log

Access control (IAM)

Settings

**Properties**

Secure LDAP

Synchronization

Health

Notification settings

SKU

Monitoring

Diagnostic settings

Logs

Workbooks

Support + troubleshooting

Troubleshoot

New support request

DNS domain name

rebeladmlive.onmicrosoft.com

Location

East US

SKU

Standard

Forest type

User

Available in virtual network/subnet

[aadds-vnet/aadds-subnet](#)

Network security group associated with subnet

[aadds-nsg](#)


IP address on virtual network

10.0.0.5 10.0.0.4

Secure LDAP

Enabled

Secure LDAP certificate thumbprint



Secure LDAP certificate expires


Sat, 19 Jun 2021 21:01:12 GMT

Secure LDAP external IP address


52.188.114.225

Figure 18.45: NSG details



 Add inbound security rule

✕

 Basic

Source \* ⓘ

IP Addresses

Source IP addresses/CIDR ranges \* ⓘ

52.136.127.107

Source port ranges \* ⓘ

\*

Destination \* ⓘ

Any

Destination port ranges \* ⓘ

636

Protocol \*

Any TCP UDP ICMP

Action \*

Allow Deny

Priority \* ⓘ

311

Name \*

secureLDAP

Description

Allow Secure LDAP

Add

Figure 18.46: Create a new inbound security rule

```
hosts - Notepad
File Edit Format View Help
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#       102.54.94.97       rhino.acme.com           # source server
#       38.25.63.10       x.acme.com               # x client host
#
# localhost name resolution is handled within DNS itself.
#       127.0.0.1         localhost
#       ::1               localhost
52.188.114.225 ldaps.rebeladmlive.onmicrosoft.com
```

Figure 18.47: Host entry

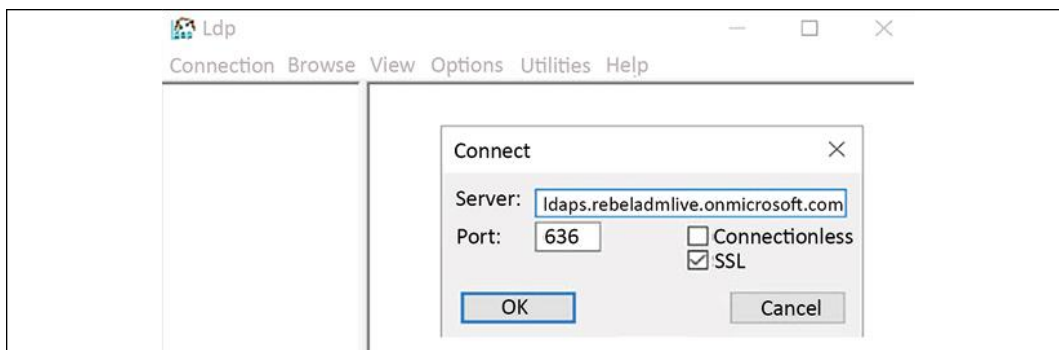


Figure 18.48: ldp.exe connection settings



Figure 18.49: Secure LDAP connection status

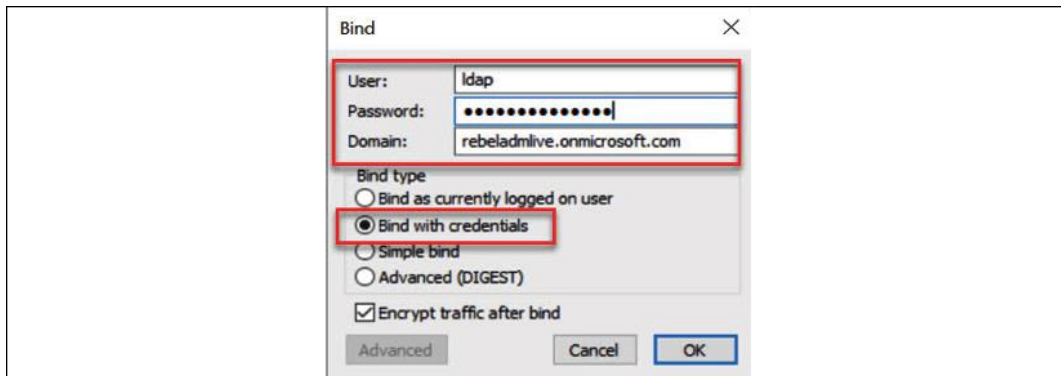


Figure 18.50: Bind with credentials

```
53 = ldap_set_option(ld, LDAP_OPT_ENCRYPT, 1)
res = ldap_bind_s(ld, NULL, &NtAuthIdentity, NEGOTIATE (1158)); // v.3
      {NtAuthIdentity: User='ldap'; Pwd=<unavailable>; domain = 'rebeladmlive.onmicrosoft.com'}
Authenticated as: 'REBELADMLIVE\ldap'.
```

Figure 18.51 : Bind status



Figure 18.52: Browse data

rebeladmlive.onmicrosoft.com | Properties

Azure AD Domain Services

Search (Ctrl+ /)

Overview

Activity log

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Settings

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Synchronization

Replica sets (preview)

Health

Notification settings

SKU

Monitoring

Diagnostics settings

Logs

Workbooks

Support + troubleshooting

Troubleshoot

New support request

DNS domain name

rebeladmlive.onmicrosoft.com

Locations

East US

Forest type

User

Virtual Networks/Subnets

East US/REBELVN1/aadds-subnet

Network Security Groups

East US/aadds-nsg

IP addresses

East US/10.0.0.5 10.0.0.4

Secure LDAP

Disabled

Secure LDAP external IP addresses

East US/Not applicable

Synchronization

All

Admin group

AAD DC Administrators

Figure 18.53: Virtual network details

```

PS C:\WINDOWS\system32> Get-AzVirtualNetwork -Name REBELVN1 -ResourceGroupName REBELRG1

Name                : REBELVN1
ResourceGroupName   : REBELRG1
Location            : eastus
Id                  : /subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/virtualNetworks/REBELVN1
Etag                : W/"060920b2-f2c4-4750-a683-2bf02c53e1f5"
ResourceGuid        : b92b07f0-bc0a-4be1-ac65-f6edd079b6e6
ProvisioningState    : Succeeded
Tags                :
AddressSpace        : {
                        "AddressPrefixes": [
                          "10.0.0.0/16"
                        ]
                      }
DhcpOptions          : {}
Subnets             : [
                        {
                          "Delegations": [],
                          "Name": "vmsubnet",
                          "Etag": "W/"060920b2-f2c4-4750-a683-2bf02c53e1f5"",
                          "Id": "/subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/virtualNetworks/REBELVN1/subnets/vmsubnet",
                          "AddressPrefix": [
                            "10.0.2.0/24"
                          ],
                          "IpConfigurations": [],
                          "ServiceAssociationLinks": [],
                          "ResourceNavigationLinks": [],
                          "ServiceEndpoints": [],
                          "ServiceEndpointPolicies": [],
                          "PrivateEndpoints": [],
                          "ProvisioningState": "Succeeded",
                          "PrivateEndpointNetworkPolicies": "Enabled",
                          "PrivateLinkServiceNetworkPolicies": "Enabled"
                        },
                        {
                          "Delegations": [],
                          "Name": "aadds-subnet",
                          "Etag": "W/"060920b2-f2c4-4750-a683-2bf02c53e1f5"",
                          "Id": "/subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/virtualNetworks/REBELVN1/subnets/aadds-subnet",
                          "AddressPrefix": [
                            "10.0.0.0/24"
                          ],
                          "IpConfigurations": [
                            {
                              "Id": "/subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/networkInterfaces/aadds-a54e5dd88ed040ad99e0123dd9eff27d-nic/ipConfigurations/AK7YRUSX5DFUP-0Ipcfg"
                            },
                            {
                              "Id": "/subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/networkInterfaces/aadds-3af56a67fb2f4119b1d6a09c7a7dc4ee-nic/ipConfigurations/AY1216C20X-HWJFIpcfg"
                            }
                          ],
                          "ServiceAssociationLinks": [],
                          "ResourceNavigationLinks": [],
                          "NetworkSecurityGroup": {
                            "Id": "/subscriptions/.../resourceGroups/REBELRG1/providers/Microsoft.Network/networkSecurityGroups/aadds-nsg"
                          },
                          "ServiceEndpoints": [],
                          "ServiceEndpointPolicies": [],
                          "PrivateEndpoints": [],
                          "ProvisioningState": "Succeeded",
                          "PrivateEndpointNetworkPolicies": "Enabled",
                          "PrivateLinkServiceNetworkPolicies": "Enabled"
                        }
                      ]
VirtualNetworkPeerings : []
EnabledDdosProtection : false
DdosProtectionPlan     : null

```

Figure 18.54: Current configuration of the virtual network

```

PS C:\WINDOWS\system32> New-AzResourceGroup -Name REBELDRRG1 -Location "West US"

ResourceGroupName : REBELDRRG1
Location           : westus
ProvisioningState  : Succeeded
Tags               :
ResourceId          : /subscriptions/.../resourceGroups/REBELDRRG1

PS C:\WINDOWS\system32>

```

Figure 18.55: Create a resource group

[illegible]

**Figure 18.56: Set up a new virtual network for a replica set**

```

1  # Importing the required modules
2  import pandas as pd
3  import numpy as np
4  from sklearn.preprocessing import StandardScaler
5  from sklearn.model_selection import train_test_split
6  from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
7  from sklearn.svm import SVC
8  from sklearn.ensemble import RandomForestClassifier
9  from sklearn.neural_network import MLPClassifier
10 from sklearn.metrics import roc_auc_score
11
12 # Loading the dataset
13 data = pd.read_csv('data.csv')
14
15 # Splitting the data into training and testing sets
16 X_train, X_test, y_train, y_test = train_test_split(data, data['category'],
17                                                    test_size=0.2,
18                                                    random_state=42)
19
20 # Feature Scaling
21 scaler = StandardScaler()
22 X_train = scaler.fit_transform(X_train)
23 X_test = scaler.transform(X_test)
24
25 # Training the models
26 svm = SVC(kernel='rbf')
27 svm.fit(X_train, y_train)
28
29 rf = RandomForestClassifier(n_estimators=100)
30 rf.fit(X_train, y_train)
31
32 mlp = MLPClassifier(hidden_layer_sizes=(100, 100))
33 mlp.fit(X_train, y_train)
34
35 # Evaluating the models
36 svm_pred = svm.predict(X_test)
37 rf_pred = rf.predict(X_test)
38 mlp_pred = mlp.predict(X_test)
39
40 svm_acc = accuracy_score(y_test, svm_pred)
41 rf_acc = accuracy_score(y_test, rf_pred)
42 mlp_acc = accuracy_score(y_test, mlp_pred)
43
44 print(f'SVM Accuracy: {svm_acc}')
45 print(f'Random Forest Accuracy: {rf_acc}')
46 print(f'Neural Network Accuracy: {mlp_acc}')
47
48 # Confusion Matrix and Classification Report
49 svm_cm = confusion_matrix(y_test, svm_pred)
50 rf_cm = confusion_matrix(y_test, rf_pred)
51 mlp_cm = confusion_matrix(y_test, mlp_pred)
52
53 svm_report = classification_report(y_test, svm_pred)
54 rf_report = classification_report(y_test, rf_pred)
55 mlp_report = classification_report(y_test, mlp_pred)
56
57 print(svm_report)
58 print(rf_report)
59 print(mlp_report)
60
61 # ROC Curve
62 svm_roc_auc = roc_auc_score(y_test, svm.predict_proba(X_test)[:, 1])
63 rf_roc_auc = roc_auc_score(y_test, rf.predict_proba(X_test)[:, 1])
64 mlp_roc_auc = roc_auc_score(y_test, mlp.predict_proba(X_test)[:, 1])
65
66 print(f'SVM ROC AUC: {svm_roc_auc}')
67 print(f'Random Forest ROC AUC: {rf_roc_auc}')
68 print(f'Neural Network ROC AUC: {mlp_roc_auc}')

```

**Figure 18.57: Global VNet peering**

```

1 # Import the necessary libraries and data
2 import pandas as pd
3 import numpy as np
4 from sklearn.preprocessing import StandardScaler
5 from sklearn.model_selection import train_test_split
6 from sklearn.metrics import accuracy_score, confusion_matrix, roc_auc_score
7 from sklearn.svm import SVC
8 from sklearn.ensemble import RandomForestClassifier
9 from sklearn.linear_model import LogisticRegression
10 from sklearn.metrics import classification_report
11
12 # Load the dataset
13 data = pd.read_csv('data.csv')
14
15 # Split the data into training and testing sets
16 X_train, X_test, y_train, y_test = train_test_split(data, data['target'],
17                                                    test_size=0.2,
18                                                    random_state=42)
19
20 # Standardize the features
21 scaler = StandardScaler()
22 X_train = scaler.fit_transform(X_train)
23 X_test = scaler.transform(X_test)
24
25 # Train the models
26 svm = SVC()
27 svm.fit(X_train, y_train)
28
29 rf = RandomForestClassifier()
30 rf.fit(X_train, y_train)
31
32 lr = LogisticRegression()
33 lr.fit(X_train, y_train)
34
35 # Evaluate the models
36 svm_pred = svm.predict(X_test)
37 rf_pred = rf.predict(X_test)
38 lr_pred = lr.predict(X_test)
39
40 # Print the accuracy scores
41 print('SVM Accuracy: %.4f' % accuracy_score(y_test, svm_pred))
42 print('RF Accuracy: %.4f' % accuracy_score(y_test, rf_pred))
43 print('LR Accuracy: %.4f' % accuracy_score(y_test, lr_pred))
44
45 # Print the confusion matrices
46 svm_cm = confusion_matrix(y_test, svm_pred)
47 rf_cm = confusion_matrix(y_test, rf_pred)
48 lr_cm = confusion_matrix(y_test, lr_pred)
49
50 # Print the ROC AUC scores
51 svm_auc = roc_auc_score(y_test, svm.predict_proba(X_test)[:, 1])
52 rf_auc = roc_auc_score(y_test, rf.predict_proba(X_test)[:, 1])
53 lr_auc = roc_auc_score(y_test, lr.predict_proba(X_test)[:, 1])
54
55 # Print the classification reports
56 svm_report = classification_report(y_test, svm_pred)
57 rf_report = classification_report(y_test, rf_pred)
58 lr_report = classification_report(y_test, lr_pred)
59
60 # Print the results
61 print('SVM Results:')
62 print(svm_report)
63 print('RF Results:')
64 print(rf_report)
65 print('LR Results:')
66 print(lr_report)

```

**Figure 18.58: Global VNet peering**



Figure 18.59: Add replica set

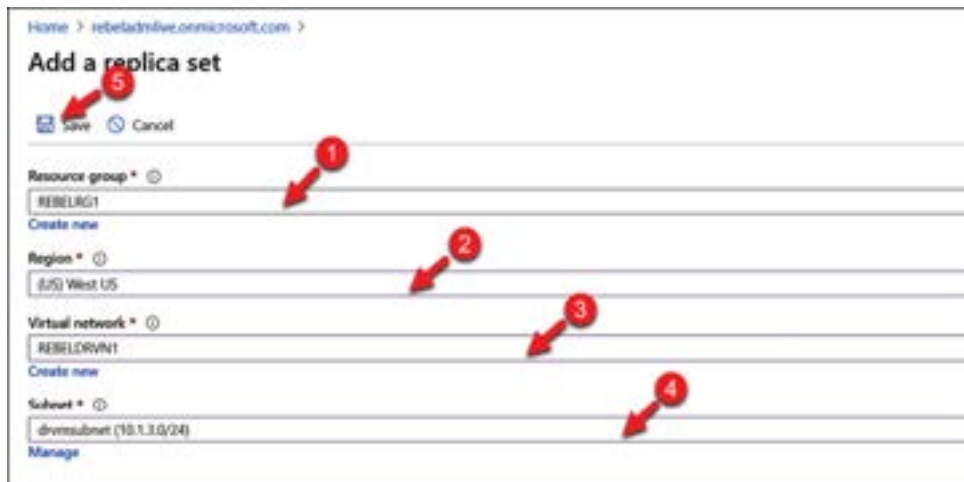


Figure 18.60: Configure a replica set

rebeladmlive.onmicrosoft.com | Replica sets (preview)

Azure AD Domain Services

Search (Ctrl+/) « + Add Refresh

Overview  
Activity log  
Access control (IAM)  
Settings  
Properties  
Secure LDAP  
Synchronization  
Replica sets (preview)  
Health  
Notification settings  
SKU  
Monitoring

Configuring replica sets for the directory. This operation may take a while.

| Region  | Virtual network/Subnet | IP Addresses       | Status       |
|---------|------------------------|--------------------|--------------|
| East US | REBELVN1/aadds-subnet  | 10.0.0.5, 10.0.0.4 | Running      |
| West US | REBELDRVN1/drvmsubnet  |                    | Provisioning |

Figure 18.61: Replica set provisioning

Home > AAD\_DomainServices\_ReplicaSet\_20200830224736Z | Overview

Deployment

Search (Ctrl+/) « Delete Cancel Redeploy Refresh

Overview  
Inputs  
Outputs  
Template

✓ Your deployment is complete

Deployment name: AAD\_DomainServices\_ReplicaSet\_20200830224... Start time: 8/30/2020, 11:47:40 PM  
Subscription: REBELSS Correlation ID: b40eac31-f510-452f-ab0f-24cbb7dc716e  
Resource group: REBELRG1

Deployment details (Download)  
Next steps  
Go to resource

Figure 18.62: Status of the provisioning task



rebeladmlive.onmicrosoft.com | Replica sets (preview)

Search (Ctrl+F) + Add Refresh

| Overview             | Region  | Virtual network/Subnet | IP Addresses       | Status  |
|----------------------|---------|------------------------|--------------------|---------|
| Activity log         | East US | REBELVN1/wadls-subnet  | 10.0.0.5, 10.0.0.4 | Running |
| Access control (IAM) | West US | REBELDVN1/dnvroutenet  | 10.1.3.4           | Running |

Settings

- Properties
- Secure LDAP
- Synchronization
- Replica sets (preview)
- Health
- Notification settings
- SKU

Monitoring

- Diagnostic settings
- Logs
- Workbooks

Support + troubleshooting

- Troubleshoot
- New support request

Figure 18.63: Status of the replica set

## Code blocks

### Command 18.1

```
New-Item
'HKLM:\SOFTWARE\WOW6432Node\Microsoft\ .NETFramework\v4.0.30319' -Force
| Out-Null

New-ItemProperty -path
'HKLM:\SOFTWARE\WOW6432Node\Microsoft\ .NETFramework\v4.0.30319' -name
'SystemDefaultTlsVersions' -value '1'

PropertyType 'DWord' -Force | Out-Null

New-ItemProperty -path
'HKLM:\SOFTWARE\WOW6432Node\Microsoft\ .NETFramework\v4.0.30319' -name
'SchUseStrongCrypto' -value '1' -PropertyType 'DWord' -Force | Out-
Null
```

```
New-Item 'HKLM:\SOFTWARE\Microsoft\.NETFramework\v4.0.30319' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SOFTWARE\Microsoft\.NETFramework\v4.0.30319' -name  
'SystemDefaultTlsVersions' -value '1' -PropertyType 'DWord' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SOFTWARE\Microsoft\.NETFramework\v4.0.30319' -name  
'SchUseStrongCrypto' -value '1' -PropertyType 'DWord' -Force | Out-Null
```

```
New-Item  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Server' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Server' -name 'Enabled' -value '1' -PropertyType  
'DWord' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Server' -name 'DisabledByDefault' -value 0 -  
PropertyType 'DWord' -Force | Out-Null
```

```
New-Item  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Client' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Client' -name 'Enabled' -value '1' -PropertyType  
'DWord' -Force | Out-Null
```

```
New-ItemProperty -path  
'HKLM:\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.2\Client' -name 'DisabledByDefault' -value 0 -  
PropertyType 'DWord' -Force | Out-Null
```

```
Write-Host 'TLS 1.2 has been enabled.'
```

### Powershell script 18.2

```
$adConnector = "<CASE SENSITIVE AD CONNECTOR NAME>"
$azureadConnector = "<CASE SENSITIVE AZURE AD CONNECTOR NAME>"
Import-Module adsync
$c = Get-ADSyncConnector -Name $adConnector
$p = New-Object
Microsoft.IdentityManagement.PowerShell.ObjectModel.ConfigurationParameter "Microsoft.Synchronize.ForceFullPasswordSync", String, ConnectorGlobal, $null, $null, $null
$p.Value = 1
$c.GlobalParameters.Remove($p.Name)
$c.GlobalParameters.Add($p)
$c = Add-ADSyncConnector -Connector $c
Set-ADSyncAADPasswordSyncConfiguration -SourceConnector $adConnector -TargetConnector $azureadConnector -Enable $false
Set-ADSyncAADPasswordSyncConfiguration -SourceConnector $adConnector -TargetConnector $azureadConnector -Enable $true
```

### Command 18.3

```
Login-AzAccount
$DomainServicesResource = Get-AzResource -ResourceType
"Microsoft.AAD/DomainServices"
$securitySettings =
@{"DomainSecuritySettings"=@{"NtlmV1"="Disabled";"SyncNtlmPasswords"="Enabled";"TlsV1"="Disabled"}}
Set-AzResource -Id $DomainServicesResource.ResourceId -Properties
$securitySettings -Verbose -Force
```

### Command 18.4

```
$vnet1 = Get-AzVirtualNetwork -Name REBELVN1 -ResourceGroupName
REBELRG1
$vnet2 = Get-AzVirtualNetwork -Name REBELDRVN1 -ResourceGroupName
REBELDRRG1
Add-AzVirtualNetworkPeering -Name REBELVN1toEBELDRVN1 -VirtualNetwork
$vnet1 -RemoteVirtualNetworkId $vnet2.Id
```

### Command 18.5

```
$vnet1 = Get-AzVirtualNetwork -Name REBELVN1 -ResourceGroupName  
REBELRG1  
$vnet2 = Get-AzVirtualNetwork -Name REBELDRVN1 -ResourceGroupName  
REBELDRRG1  
Add-AzVirtualNetworkPeering -Name REBELDRVN1toREBELVN1 -VirtualNetwork  
$vnet2 -RemoteVirtualNetworkId $vnet1.Id
```

#### Command 18.6

```
$domainname="rebeladmlive.onmicrosoft.com"  
$certlife=Get-Date  
New-SelfSignedCertificate -Subject *.$domainname -NotAfter  
$certlife.AddDays(365) -KeyUsage DigitalSignature, KeyEncipherment -  
Type SSLServerAuthentication -DnsName *.$domainname, $domainname
```

In the above, replace `rebeladmlive.onmicrosoft.com` with your Azure AD DS instance name.

# Chapter 19

## Figures

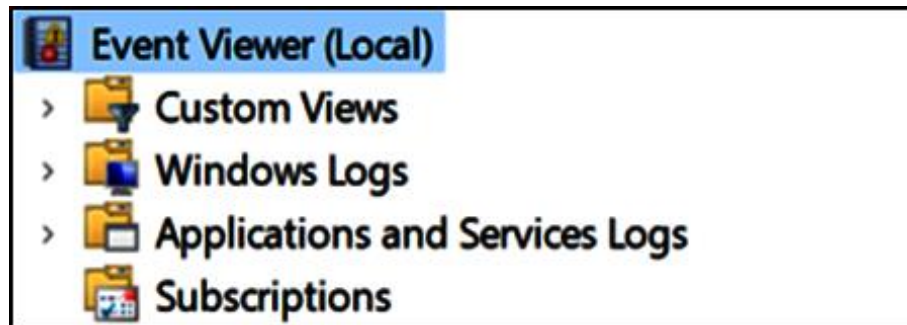


Figure 19.1: Windows Event Viewer

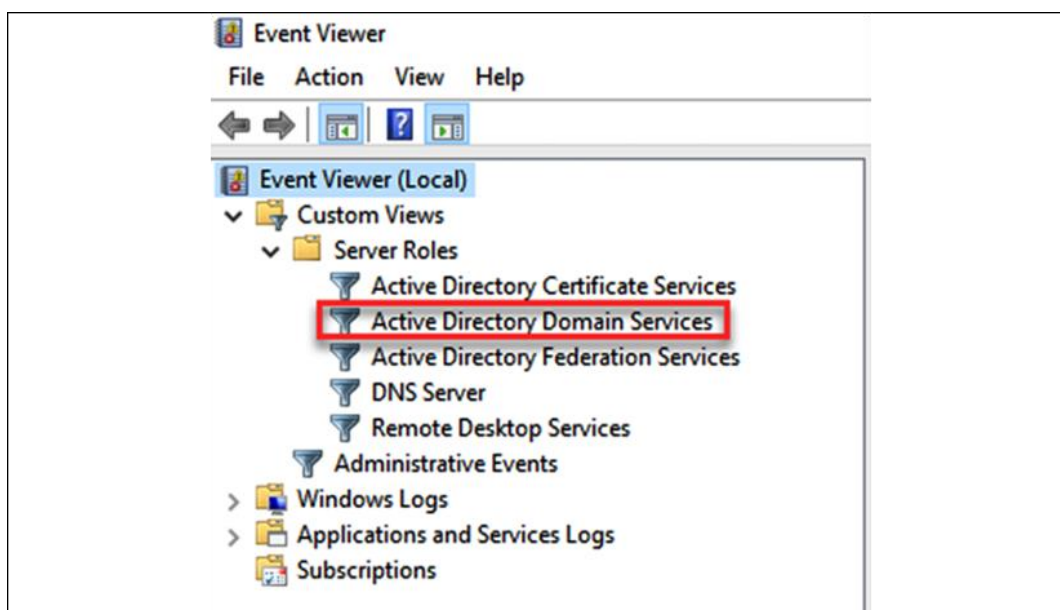


Figure 19.2: Windows Event Viewer Role logs

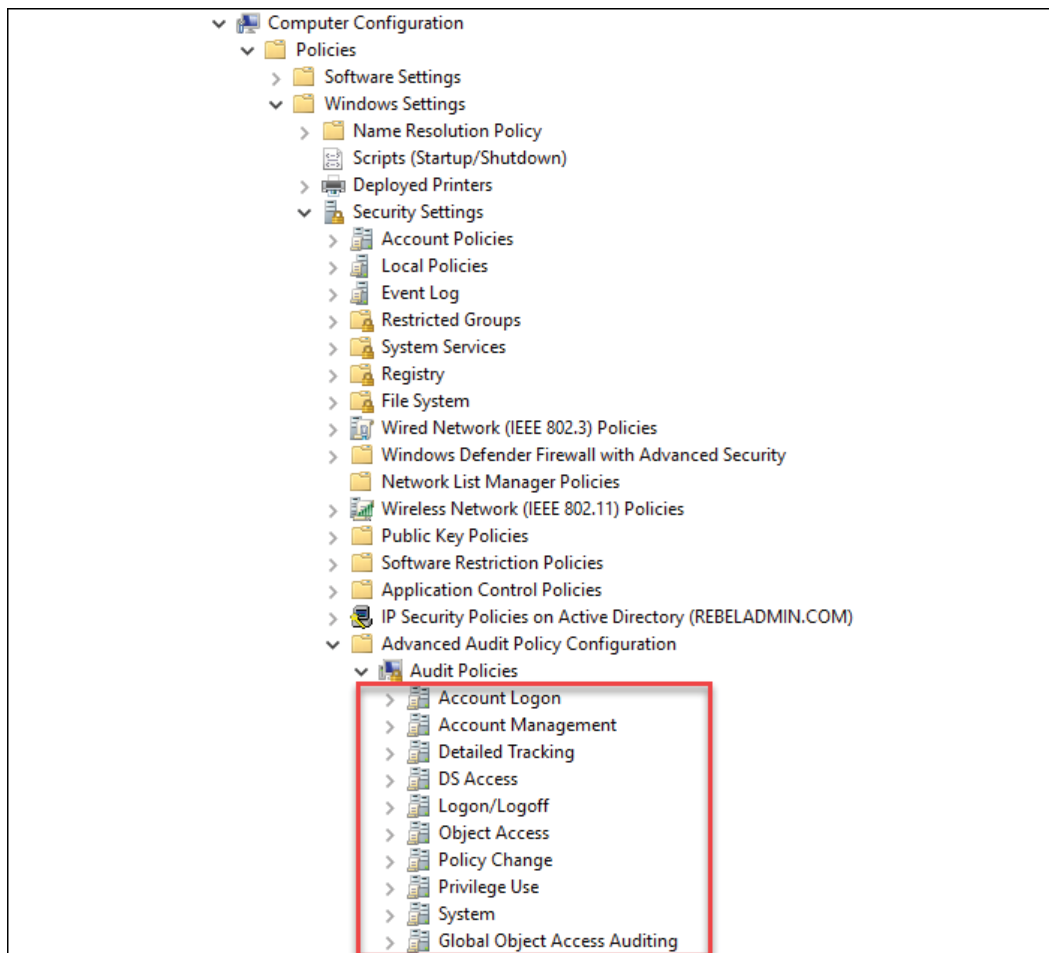


Figure 19.3: Advanced audit logs

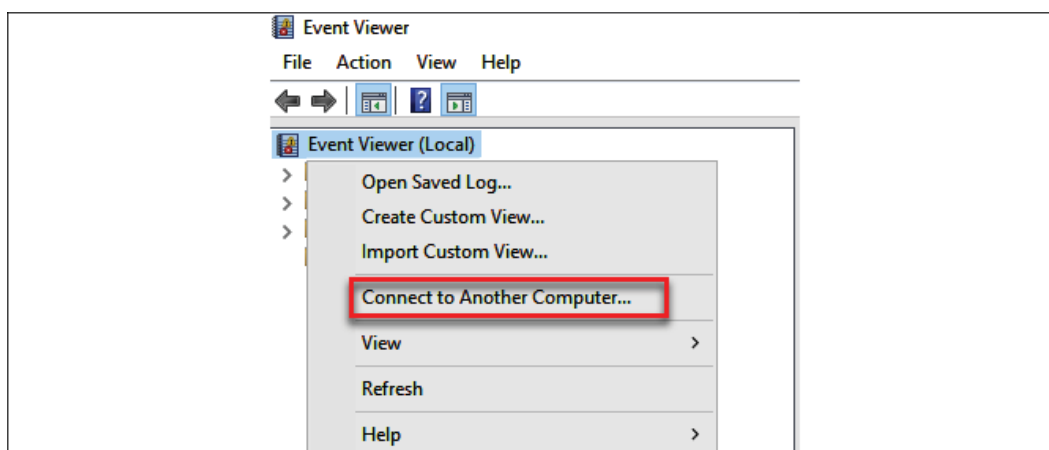


Figure 19.4: Review events on another computer

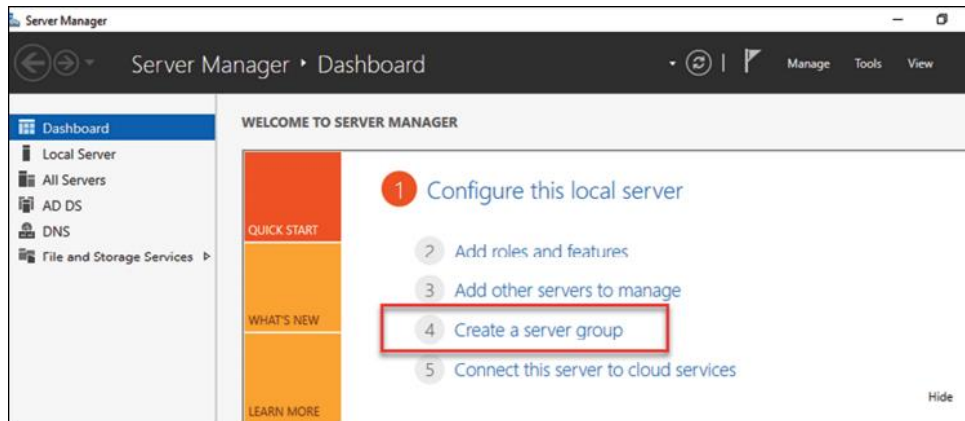


Figure 19.5: Create a server group

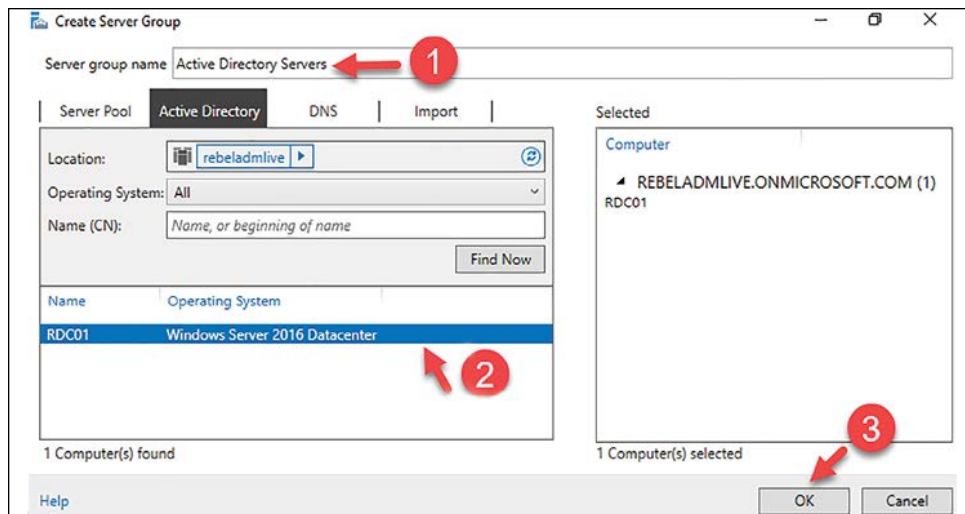


Figure 19.6: Add servers

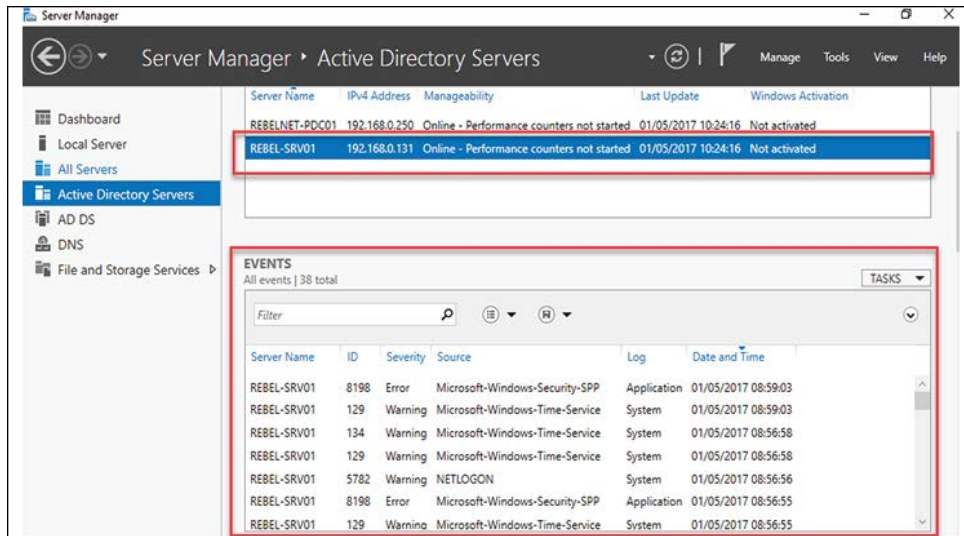


Figure 19.7: Events from the remote server

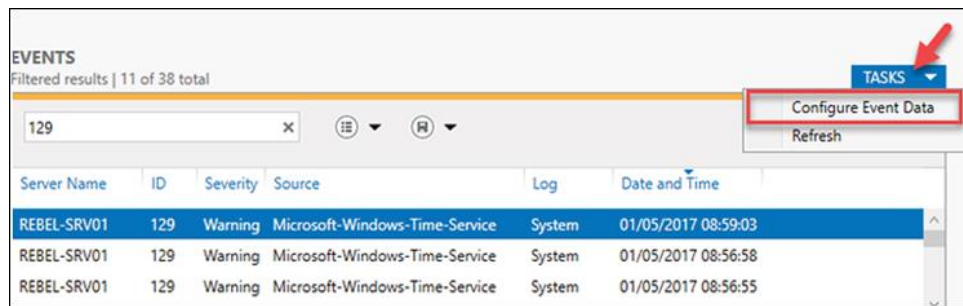


Figure 19.8: Configure Event Data option



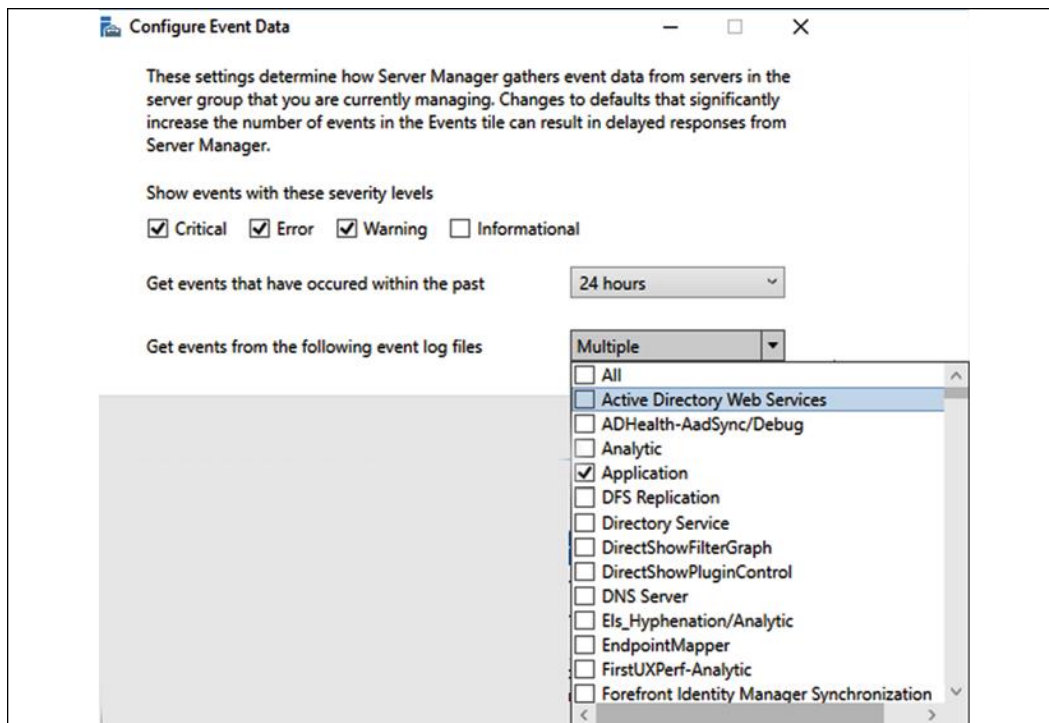


Figure 19.9: Configure Event Data window

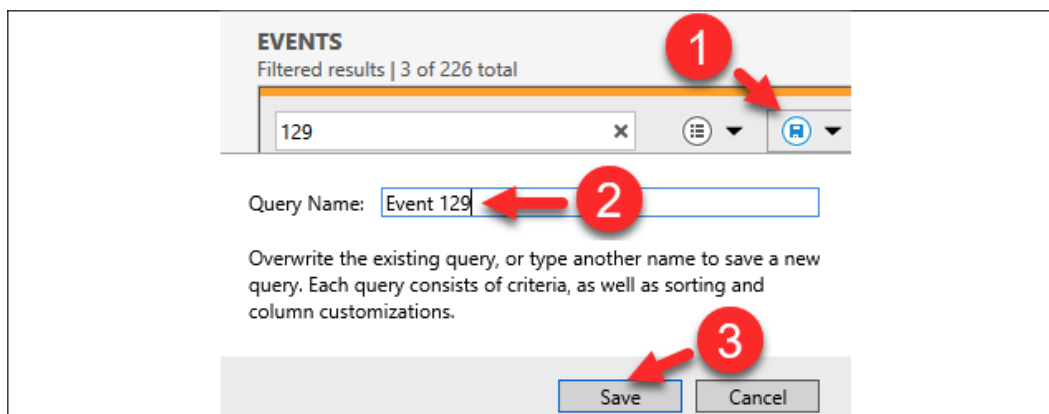


Figure 19.10: Save a query

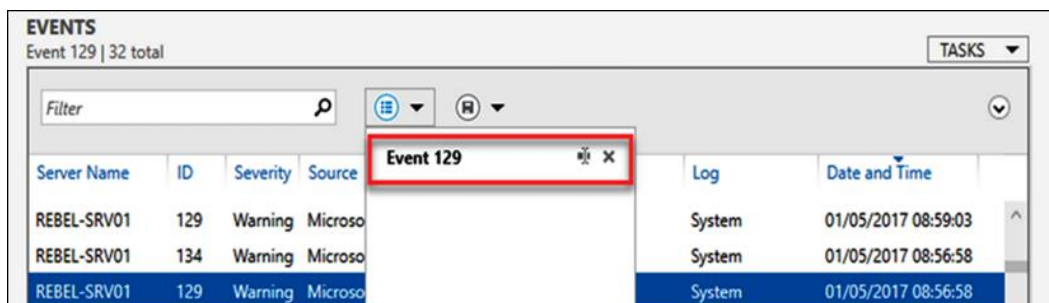


Figure 19.11: Access a saved query

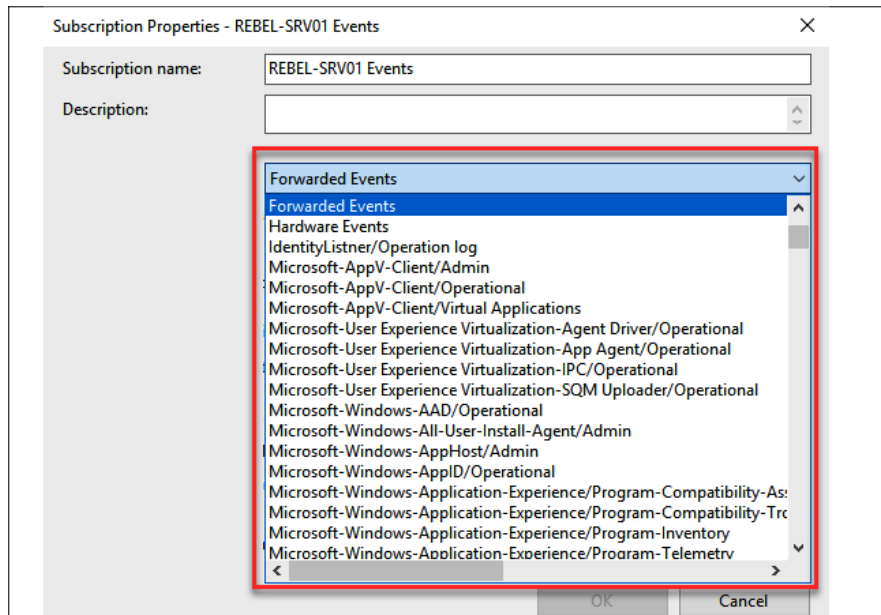


Figure 19.12: Event subscription

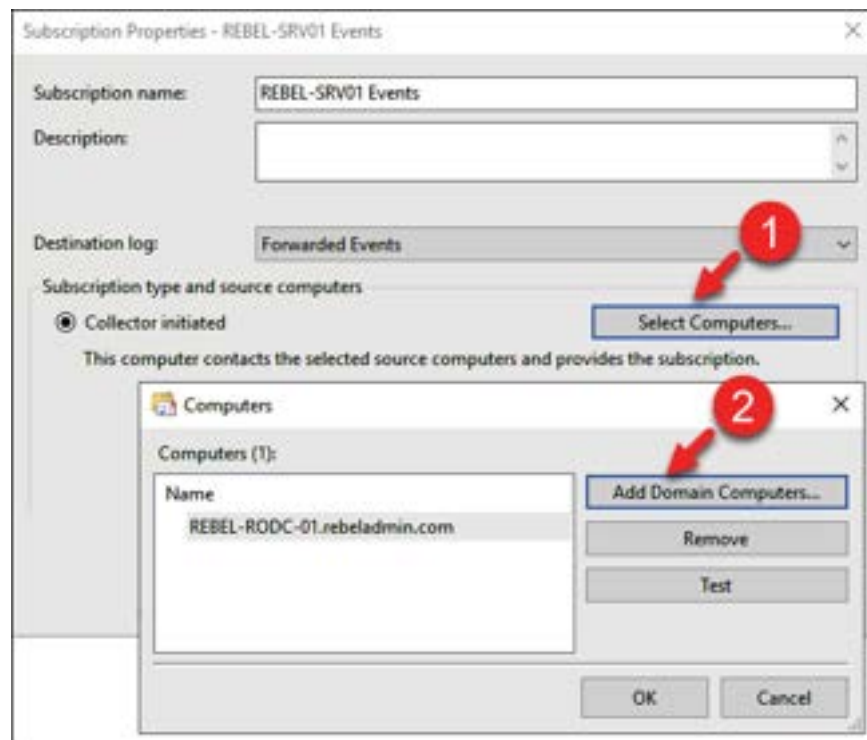


Figure 19.13: Select source computer

Query Filter

Filter XML

Logged: Any time

Event level: ☒ Critical ☒ Warning ☐ Verbose  
☒ Error ☒ Information

☒ By log Event logs: Application, Security, Setup, System, Forwarded E

☐ By source Event sources:

Includes/Excludes Event IDs: Enter ID numbers and/or ID ranges separated by commas. To exclude criteria, type a minus sign first. For example 1,3,5-99,-76

<All Event IDs>

Task category:

Keywords:

User: <All Users>

Computer(s): <All Computers>

Clear

OK Cancel

Figure 19.14: Query events

Advanced Subscription Settings

User Account:  
The selected account must have read access to the source logs

☐ Machine Account

☒ Specific User

THEREBELADMIN\Administrator User and Password...

Event Delivery Optimization:

☒ Normal

☐ Minimize Bandwidth

☐ Minimize Latency

☐ Custom

Protocol: HTTP Port: 5985

OK Cancel

Figure 19.15: Advanced Subscription Settings

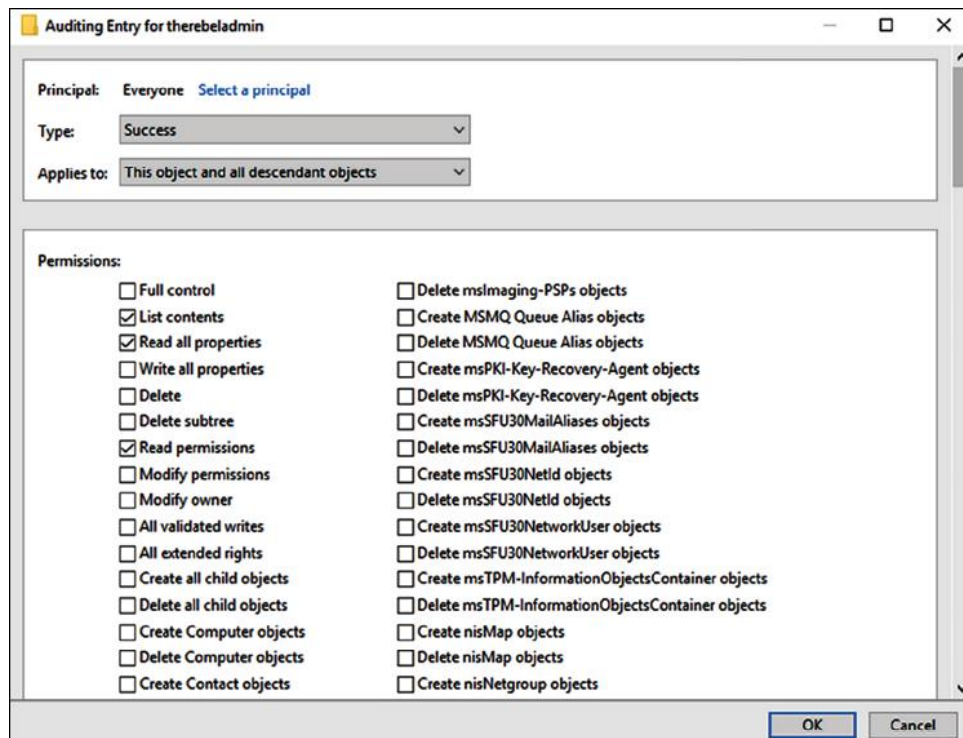


Figure 19.16: SACL entry

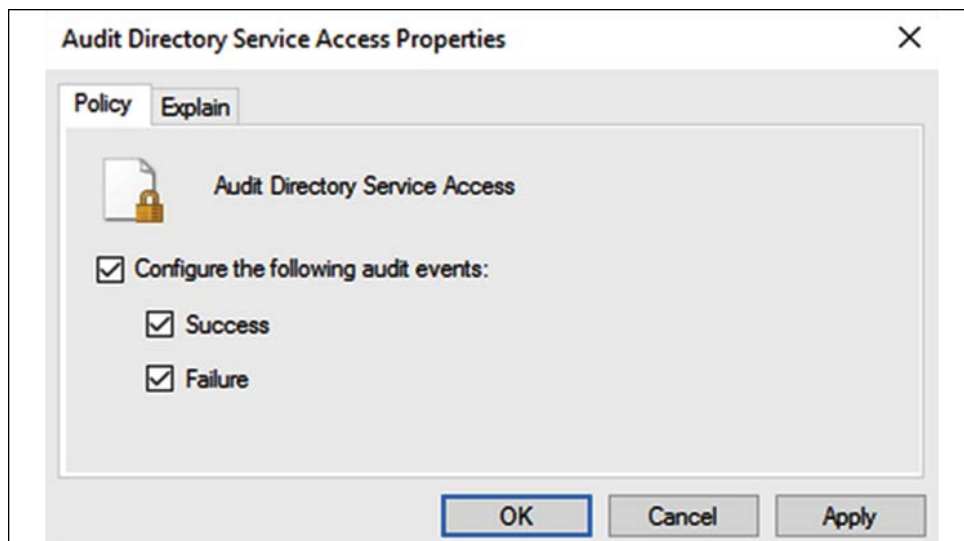


Figure 19.17: Audit Directory Service Access events





| Subcategory  | Audit Events        |
|--|---------------------|
|  Audit Detailed Directory Service Replication | Success and Failure |
|  Audit Directory Service Access               | Success and Failure |
|  Audit Directory Service Changes              | Success and Failure |
|  Audit Directory Service Replication          | Success and Failure |

Figure 19.18: Audit categories

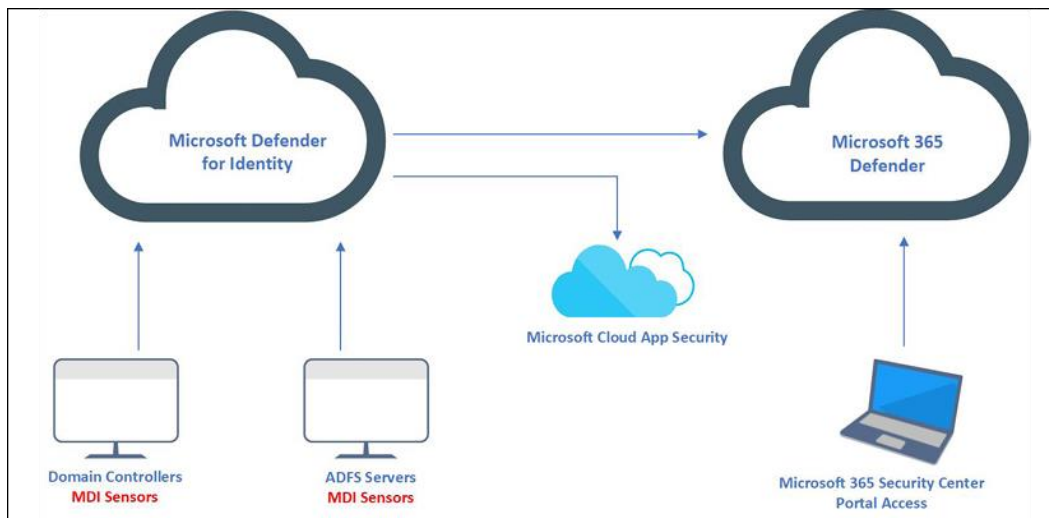


Figure 19.19: MDI architecture





|   |                  |                         |
|---|------------------|-------------------------|
|  Application Management                          | Processes in...  | Manual                  |
|  AppX Deployment Service (AppXSVC)               | Provides inf...  | Manual                  |
|  Auto Time Zone Updater                          | Automatica...    | Disabled                |
|  Azure AD Connect Health Sync Insights Service   | Azure AD C...    | Running Automatic (D... |
|  Azure AD Connect Health Sync Monitoring Service | Azure AD C...    | Running Automatic (D... |
|  Background Intelligent Transfer Service         | Transfers fil... | Manual                  |
|  Background Tasks Infrastructure Service         | Windows in...    | Running Automatic       |

Figure 19.20: Azure AD Connect health services

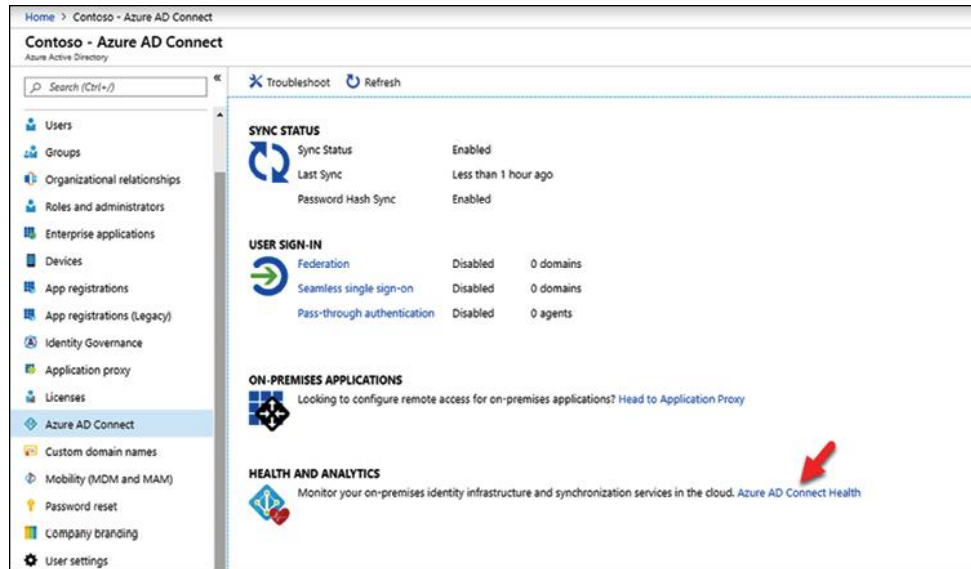


Figure 19.21: Azure AD Connect Health access

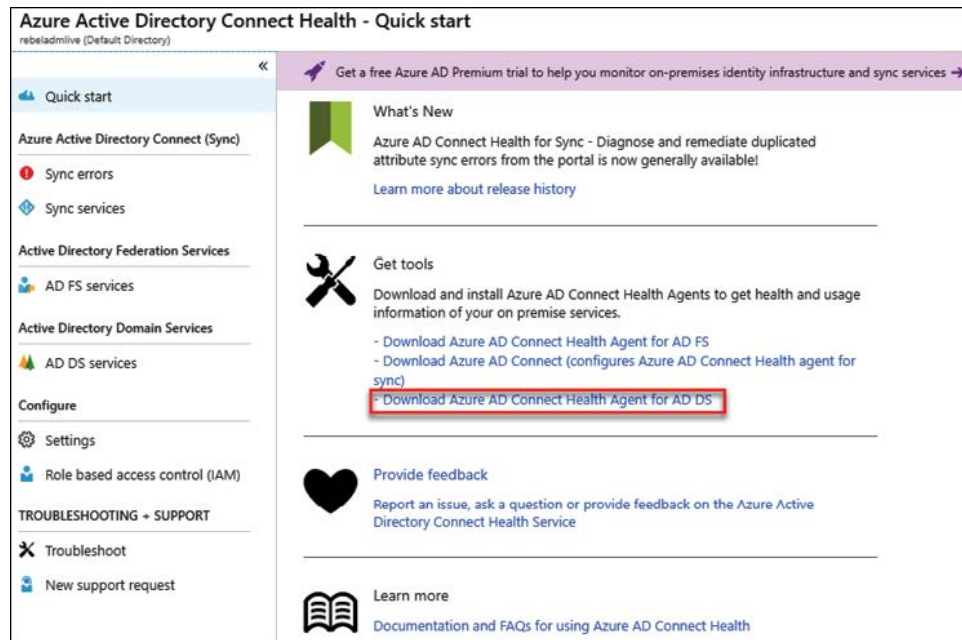


Figure 19.22: Download Azure AD Connect Health Agent for AD DS



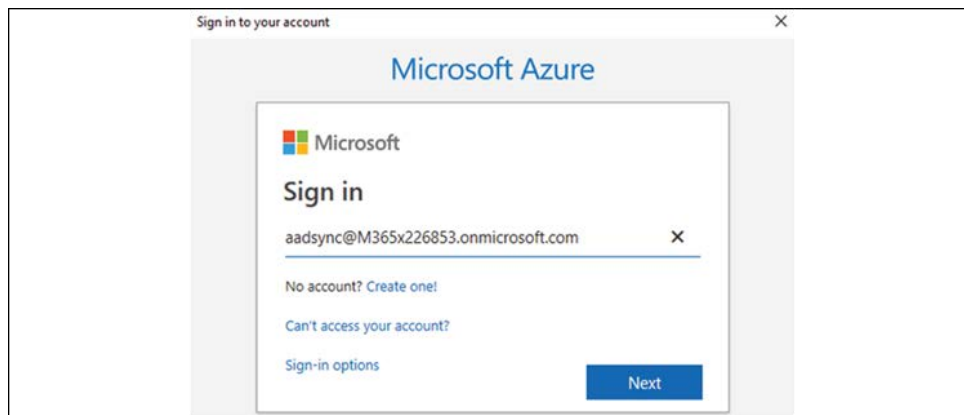


Figure 19.23: Azure AD login

```
Administration Windows PowerShell
2019-06-09 17:46:38.941 AHealthServiceUri (ARM): https://management.azure.com/providers/Microsoft.
DHybridHealthService/
2019-06-09 17:46:38.941 AAdybridHealthServiceUri: https://adds.aadconnecthealth.azure.com/
2019-06-09 17:46:38.957 AHealthServiceUri (ARM): https://management.azure.com/providers/Microsoft.
DHybridHealthService/
2019-06-09 17:46:38.957 AAdybridHealthServiceUri: https://adds.aadconnecthealth.azure.com/
2019-06-09 17:46:39.535 AHealthServiceApiVersion: 2014-01-01
2019-06-09 17:49:09.957 Detecting AdDomainService roles...
2019-06-09 17:49:10.114 Detected the following role(s) for M365x226853.onmicrosoft.com:
2019-06-09 17:49:10.114 Active Directory Domain Services
2019-06-09 17:49:19.379 Acquiring Monitoring Service certificate using tenant.cert
2019-06-09 17:49:23.019 Successfully acquired and stored Monitoring Service certificate: Subject=C
=POC01, CN=f609ba2e-559f-435f-ba98-1d421b9425cd, OU=Microsoft ADFS Agent, Issuer=CN=Microsoft Poli
yKeyservice Certificate Authority, Thumbprint=13c6fDCC094f5890d7936c61f18A41A4E00f889A
2019-06-09 17:49:23.035 Fetched and stored agent credentials successfully...
2019-06-09 17:49:23.035 Starting agent services...
2019-06-09 17:49:38.973 Started agent services successfully...
2019-06-09 17:49:49.426 Agent registration completed successfully.
Detailed log file created in temporary directory:
C:\Users\dfrancis\AppData\Local\Temp\AdHealthAddAgentConfiguration.2019-06-09_18-46-38.log
PS C:\Windows\system32>
```

Figure 19.24: Azure AD Connect Health service registration

Home > Contoso > Azure AD Connect > Azure Active Directory Connect Health - Sync services

### Azure Active Directory Connect Health - Sync services

Contoso

Quick start

- Azure Active Directory Connect (Sync)
  - Sync errors
  - Sync services**
- Active Directory Federation Services
  - AD FS services
- Active Directory Domain Services
  - AD DS services
- Configure
  - Settings
  - Role based access control (RBAC)
- TROUBLESHOOTING - SUPPORT
  - Troubleshoot
  - New support request

| SERVICE NAME                | ACTIVE ALERTS | LAST UPDATED         | STATUS  |
|-----------------------------|---------------|----------------------|---------|
| M365x226853.onmicrosoft.com | 0             | 09/06/2019, 21:27:52 | Healthy |

Figure 19.25: Sync errors and Sync services

Home > Contoso > Azure AD Connect > Azure Active Directory Connect Health - Sync services > M365x226853.onmicrosoft.com

## M365x226853.onmicrosoft.com

Delete Settings

Overview

Azure Active Directory Connect Servers

1

|       |         |
|-------|---------|
| PDC01 | Healthy |
|-------|---------|

Operations

Alerts

M365x226853.onmicrosoft.com

0 active

|                             |   |
|-----------------------------|---|
| Active                      | 0 |
| Resolved from last 24 hours | 0 |

Last export to Azure AD

M365x226853.onmicrosoft.com

Exported 6/9/2019, 9:16:08 PM

Sync Error

AadSyncService-M365x226853...

0

Figure 19.26: Overview of Azure AD Connect Health



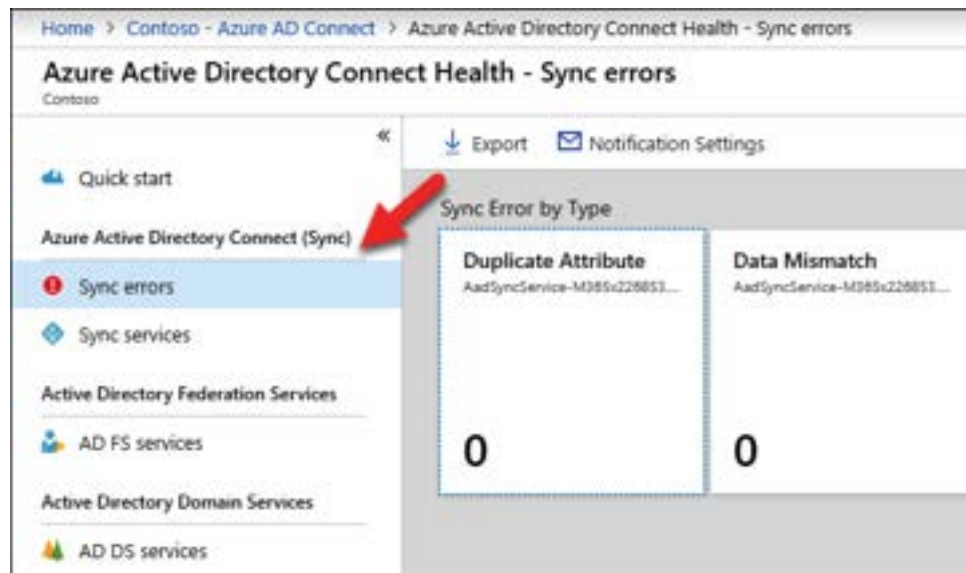


Figure 19.27: Sync errors



Figure 19.28: AD DS services

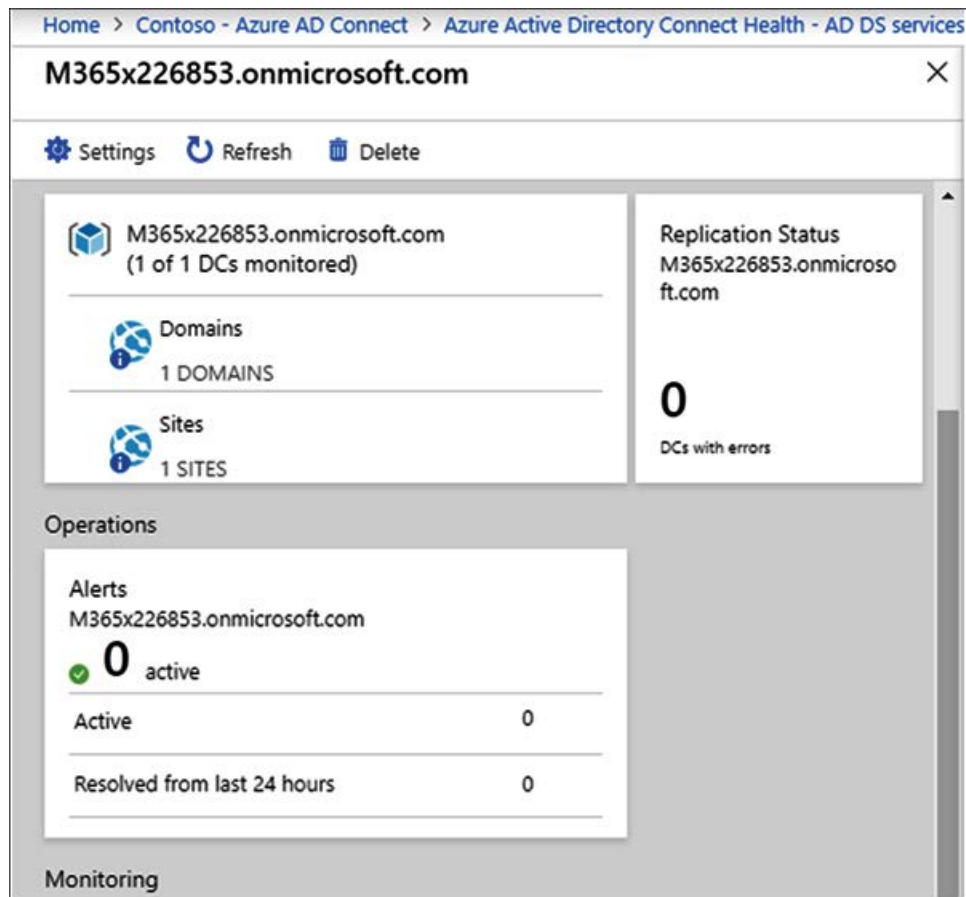


Figure 19.29: health

## Code blocks

### Command 19.1

```
Add-ADGroupMember -identity 'Event Log Readers'
-members REBELNET-PDC01$
```

### Code 19.1

```
wevtutil sl security
/ca:'O:BAG:SYD:(A;;0xf0005;;;SY)(A;;0x5;;;BA)(A;;0x1;;;S-1-5-32-
573)(A;;0x1;;;S-1-5-20)'
```

O:BAG:SYD:(A;;0xf0005;;;SY)(A;;0x5;;;BA)(A;;0x1;;;S-1-5-32-573)(A;;0x1;;;S-1-5-20) contains READ permission settings for network service account (A;;0x1;;;). In the preceding code, the SID value for the network service account is (S-1-5-20), and

the channel access value is

```
(O:BAG:SYD:(A;;0xf0005;;;SY)(A;;0x5;;;BA)(A;;0x1;;;S-1-5-32-573)).
```

#### Command 19.2

```
Get-EventLog -List
```

#### Command 19.3

```
Get-EventLog -LogName 'Directory Service' | fl
```

#### Command 19.4

```
Get-EventLog -Newest 5 -LogName 'Directory Service' -EntryType Error
```

#### Command 19.5

```
Get-EventLog -Newest 5 -LogName 'Directory Service' -EntryType Error -  
After (Get-Date).AddDays(-1)
```

#### Command 19.6

```
Get-EventLog -Newest 5 -LogName 'Directory Service' -ComputerName  
'REBEL-SRV01' | fl -Property *
```

#### Command 19.7

```
Get-EventLog -Newest 5 -LogName 'Directory Service' -ComputerName  
"localhost","REBEL-SRV01"
```

#### Command 19.8

```
Get-EventLog -LogName 'Directory Service' -Source "NTDS KCC"
```

#### Command 19.9

```
Get-EventLog -LogName 'Directory Service' | where {$_.eventID -eq  
1000}
```

## Tables

| Event ID | Event message                           |
|----------|---|
| 4662     | An operation was performed on an object |

**Table 19.1**

| Event ID | Event message                             |
|----------|---|
| 5136     | A directory service object was modified.  |
| 5137     | A directory service object was created.   |
| 5138     | A directory service object was undeleted. |
| 5139     | A directory service object was moved.     |
| 5141     | A directory service object was deleted.   |

**Table 19.2**

| Event ID | Event message   |
|----------|---|
| 4932     | Synchronization of a replica of an AD naming context has begun. |
| 4933     | Synchronization of a replica of an AD naming context has ended. |

**Table 19.3**

| Event ID | Event message  |
|----------|--|
| 4928     | An AD replica source naming context was established.   |
| 4929     | An AD replica source naming context was removed.       |
| 4930     | An AD replica source naming context was modified.      |
| 4931     | An AD replica destination naming context was modified. |
| 4934     | Attributes of an AD object were replicated.            |
| 4935     | Replication failure start.                             |
| 4936     | Replication failure end.                               |
| 4937     | A lingering object was removed from a replica.         |

**Table 19.4**

| Protocol | TCP/UDP     | Port | To/From                              | Direction |
|----------|-------------|------|--------------------------------------|-----------|
| SSL      | TCP         | 443  | Defender for Identity cloud services | Outbound  |
| SSL      | TCP         | 444  | Sensor service                       | Both      |
| DNS      | TCP and UDP | 53   | Sensors to DNS Servers               | Outbound  |
| Netlogon | TCP/UDP     | 445  | Sensors to all devices               | Outbound  |
| RADIUS   | UDP         | 1813 | RADIUS to sensors                    | Inbound   |

|               |     |      |                        |          |
|---------------|-----|------|------------------------|----------|
| NTLM over RPC | TCP | 135  | Sensors to all devices | Outbound |
| NetBIOS       | UDP | 137  | Sensors to all devices | Outbound |
| TLS to RDP    | TCP | 3389 | Sensors to all devices | Outbound |

**Table 19.5**