Cybersecurity & Cloud Computing

PROJECT#2
ACTIVE DIRECTORY

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Submitted To :

Mohammed Ghori

Date : 4 April 2025

Contents

Problem Definition
PART 1

1.1 Question

In this project, you deploy and configure Windows clients within an enterprise environment. It is worth 40% of your final grade. It consists of two main parts :

- **Server configuration (here Windows 2025)**
- **Client configuration (here Windows 11)**

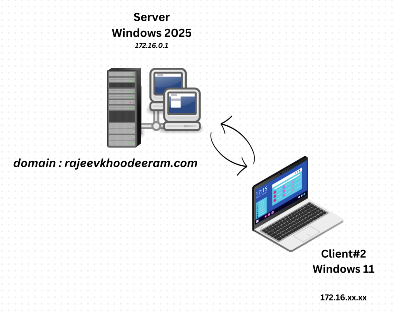
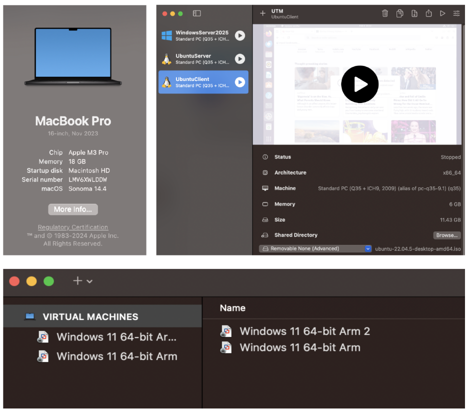


Figure 1.1: Current setup

1.2 Step 1.Optionally remove any existing virtual machines from the class within Hyper-V Manager on your Windows host .

Kindly note that with the exception of Windows 11 which is on VMFusion,the Windows 2025 server is on UTM. All these virtualization are on a MacBook Pro AppleM3 which acts as the host. Earlier versions of Windows could not be installed due to ARM architecture requirement of the MAC host.



MacBook Pro
16-inch, Nov 2023

Chip Apple M3 Pro
Memory 18 GB
Startup disk Macintosh HD
Serial number LMV6XWLDDW
macOS Sonoma 14.4

More Info...

Regulatory Certification
™ and © 1983-2024 Apple Inc.
All Rights Reserved.

UTM
UbuntuClient

WindowsServer2025 Standard PC (Q35 + ICH...
UbuntuServer Standard PC (Q35 + ICH...
UbuntuClient Standard PC (Q35 + ICH...

Status Stopped
Architecture x86_64
Machine Standard PC (Q35 + ICH9, 2009) (alias of pc-q35-9.1) (q35)
Memory 6 GB
Size 11.43 GB
Shared Directory Browse...
Removable None (Advanced) ubuntu-22.04.5-desktop-amd64.iso

VIRTUAL MACHINES
Windows 11 64-bit Ar...
Windows 11 64-bit Arm

Name
Windows 11 64-bit Arm 2
Windows 11 64-bit Arm

Figure 1.2: Configuration used in this project

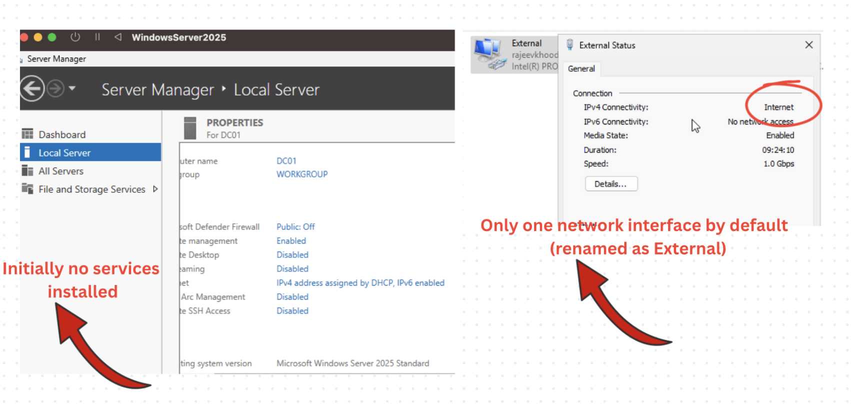
Client and Server Configuration PART 2

2.1 Target : This part will consist of configuring the server and as such covers Steps 2 to 6 as part of the Project.

2.2 Step 2 : Virtual Switches - External and Private

Ensure that you have the same two virtual switches within Hyper-V Manager that we used in class:

- **An external virtual switch that is bound to the network interface on your host OS that provides Internet access**



PROPERTIES
For DC01

uter name DC01
group WORKGROUP

soft Defender Firewall Public: Off
te management Enabled
te Desktop Disabled
eaming Disabled
et IPv4 address assigned by DHCP, IPv6 enabled
Arc Management Disabled
te SSH Access Disabled

ting system version Microsoft Windows Server 2025 Standard

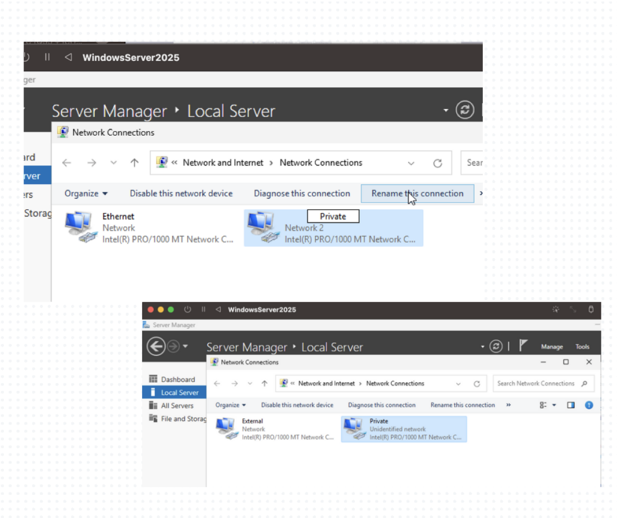
Connection
IPv4 Connectivity: Internet
IPv6 Connectivity: No network access
Media State: Enabled
Duration: 09:24:10
Speed: 1.0 Gbps

Initially no services installed

Only one network interface by default (renamed as External)

Figure 2.1: Initial setup with no Services and only one network interface - External

- **A private virtual switch**



Ethernet
Network
Intel(R) PRO/1000 MT Network C...

Private
Network 2
Intel(R) PRO/1000 MT Network C...

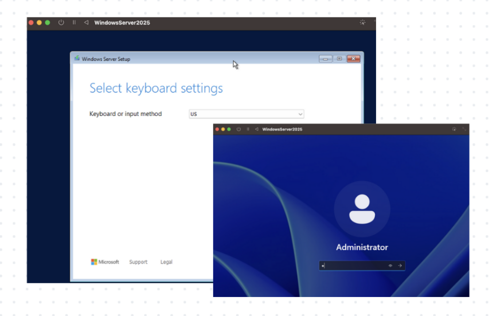
External
Network
Intel(R) PRO/1000 MT Network C...

Private
Unidentified network
Intel(R) PRO/1000 MT Network C...

Figure 2.2: Adding a private switch or another network interface

2.3 Step 3 : Creating DC01 - Windows Server 2025 (*in my case !!*)

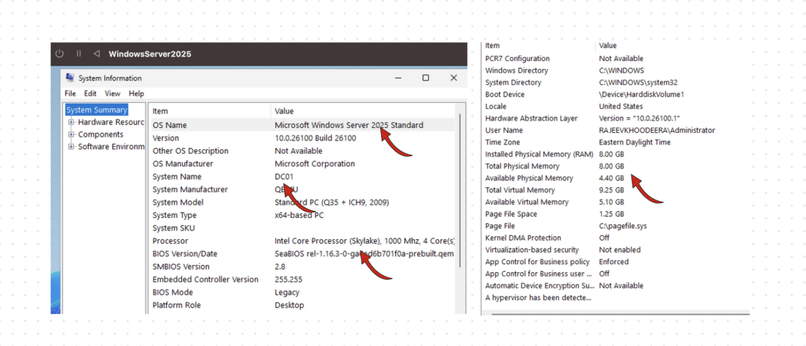
Create a Hyper-V virtual machine called DC01 (2GB of RAM minimum, connected to external virtual switch) and install Windows Server 2019 Standard Edition. In this section, the steps to install the Windows Server 2025 are listed.



Select keyboard settings

Keyboard or input method: US

Figure 2.3: Installation of Windows Server 2025



Item	Value
OS Name	Microsoft Windows Server 2025 Standard
Version	10.0.26100 Build 26100
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	DC01
System Manufacturer	QEMU
System Model	Standard PC (Q35 + ICH9, 2009)
System Type	x64-based PC
System SKU	
Processor	Intel Core Processor (Skylake), 1000 Mhz, 4 Core(s)
BIOS Version/Date	SeaBIOS rel-1.16.3-0-ga6ed6b701f0a-prebuilt.qem
SMBIOS Version	2.8
Embedded Controller Version	255.255
BIOS Mode	Legacy
Platform Role	Desktop

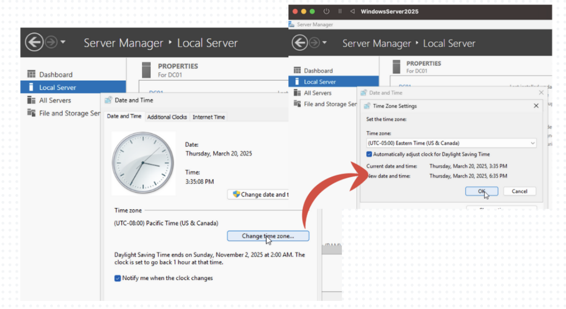
Item	Value
PCR7 Configuration	Not Available
Windows Directory	C:\WINDOWS
System Directory	C:\WINDOWS\system32
Boot Device	\Device\HarddiskVolume1
Locale	United States
Hardware Abstraction Layer	Version = "10.0.26100.1"
User Name	RAJEEVKHOODEERA\Administrator
Time Zone	Eastern Daylight Time
Installed Physical Memory (RAM)	8.00 GB
Total Physical Memory	8.00 GB
Available Physical Memory	4.40 GB
Total Virtual Memory	9.25 GB
Available Virtual Memory	5.10 GB
Page File Space	1.25 GB
Page File	C:\pagefile.sys
Kernel DMA Protection	Off
Virtualization-based security	Not enabled
App Control for Business policy	Enforced
App Control for Business user ...	Off
Automatic Device Encryption Su...	Not Available
A hypervisor has been detecte...	

Figure 2.4: Properties of Windows Server 2025

2.4 Step 4 : Configuring Active Directory

On your DC virtual machine:

- **Set the correct time/zone**



Date:
Thursday, March 20, 2025

Time:
3:35:08 PM

Time zone
(UTC-08:00) Pacific Time (US & Canada)

Daylight Saving Time ends on Sunday, November 2, 2025 at 2:00 AM. The clock is set to go back 1 hour at that time.

☑ Notify me when the clock changes

Set the time zone:

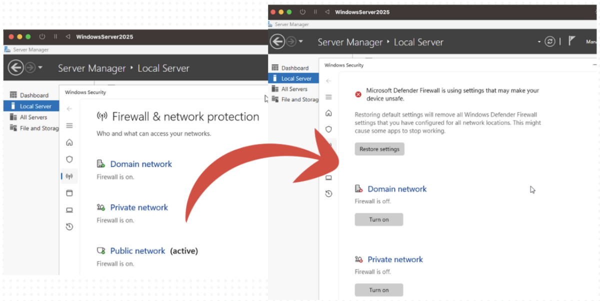
Time zone:
(UTC-05:00) Eastern Time (US & Canada)

☑ Automatically adjust clock for Daylight Saving Time

Current date and time: Thursday, March 20, 2025, 3:35 PM
New date and time: Thursday, March 20, 2025, 6:35 PM

Figure 2.5: Changing Timezone

- **Disable Windows Firewall for all profiles**



Firewall & network protection
Who and what can access your networks.

Domain network
Firewall is on.

Private network
Firewall is on.

Public network (active)
Firewall is on.

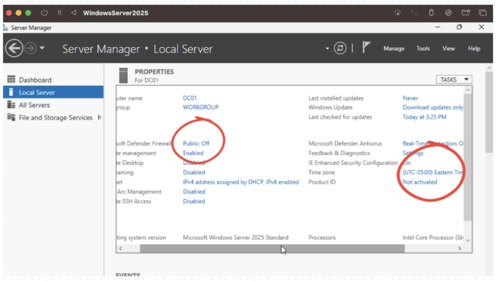
Microsoft Defender Firewall is using settings that may make your device unsafe.

Restoring default settings will remove all Windows Defender Firewall settings that you have configured for all network locations. This might cause some apps to stop working.

Domain network
Firewall is off.

Private network
Firewall is off.

Figure 2.6: Disabling Windows Firewall

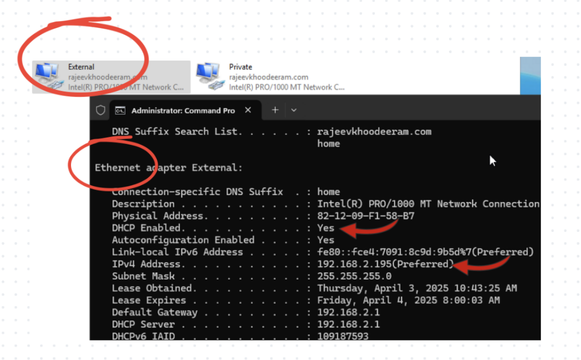


uter name DC01
roup WORKGROUP
soft Defender Firewall Public: Off
te management Enabled
te Desktop Disabled
aming Disabled
et IPv4 address assigned by DHCP, IPv6 enabled
Arc Management Disabled
te SSH Access Disabled
ting system version Microsoft Windows Server 2025 Standard

Last installed updates Never
Windows Update Download updates only
Last checked for updates Today at 3:25 PM
Microsoft Defender Antivirus Real-Time Protection: O
Feedback & Diagnostics Settings
IE Enhanced Security Configuration On
Time zone (UTC-05:00) Eastern Tim
Product ID Not activated
Processors Intel Core Processor (Sk

Figure 2.7: Checking timezone and firewall

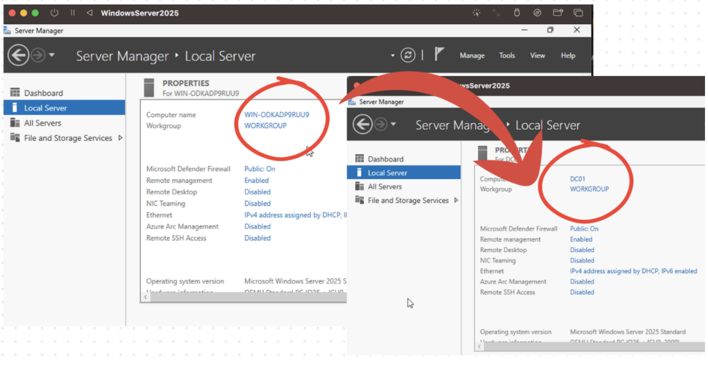
- **Rename your network interface to External. Note the IP address obtained from DHCP on this External IP for a later step**


External
rajeevkhoodeeram.com
Intel(R) PRO/1000 MT Network C...
Private
rajeevkhoodeeram.com
Intel(R) PRO/1000 MT Network C...
Administrator: Command Pro

```
   DNS Suffix Search List. . . . . . : rajeevkhoodeeram.com
                                       home

Ethernet adapter External:

   Connection-specific DNS Suffix  . : home
   Description . . . . . . . . . . . : Intel(R) PRO/1000 MT Network Connection
   Physical Address. . . . . . . . . : 82-12-09-F1-58-B7
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::fce4:7091:8c9d:9b5d%7(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.2.195(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Thursday, April 3, 2025 10:43:25 AM
   Lease Expires . . . . . . . . . . : Friday, April 4, 2025 8:00:03 AM
   Default Gateway . . . . . . . . . : 192.168.2.1
   DHCP Server . . . . . . . . . . . : 192.168.2.1
   DHCPv6 IAID . . . . . . . . . . . : 109187593
```

Figure 2.8: External interface and its DHCP address (here *192.168.2.195*) which will be used later for Wkstn01

- **Change the computer name to DC01 (rebooting afterwards).**



For WIN-ODKADP9RUU9

Computer name WIN-ODKADP9RUU9
Workgroup WORKGROUP

Microsoft Defender Firewall Public: On
Remote management Enabled
Remote Desktop Disabled
NIC Teaming Disabled
Ethernet IPv4 address assigned by DHCP, I
Azure Arc Management Disabled
Remote SSH Access Disabled

Operating system version Microsoft Windows Server 2025 S

Compute DC01
Workgroup WORKGROUP

Microsoft Defender Firewall Public: On
Remote management Enabled
Remote Desktop Disabled
NIC Teaming Disabled
Ethernet IPv4 address assigned by DHCP, IPv6 enabled
Azure Arc Management Disabled
Remote SSH Access Disabled

Operating system version Microsoft Windows Server 2025 Standard

Figure 2.9: Renaming Windows Server to DC01

- **Install AD DS and configure your system as a domain controller for a new forest and domain called yourname.com (where yourname is your full name).**

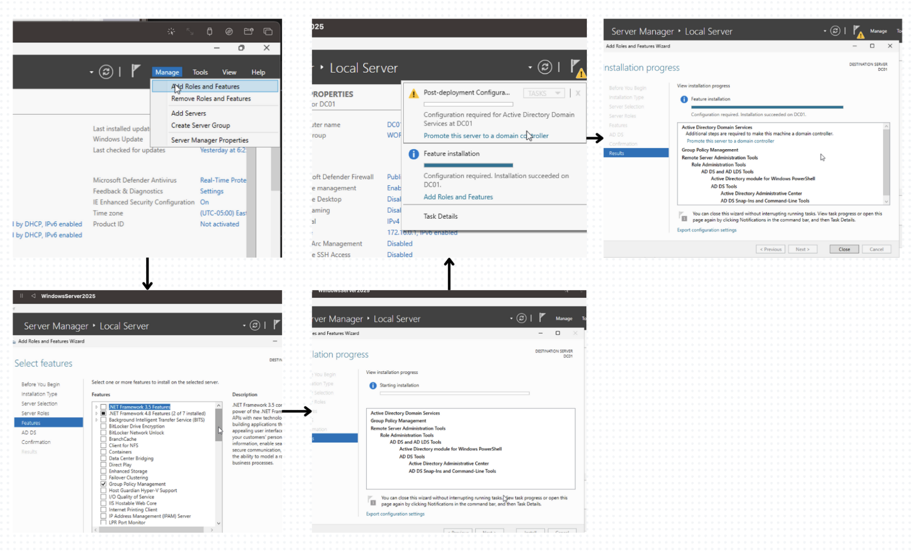

Manage
Tools
View
Help
Add Roles and Features
Remove Roles and Features
Add Servers
Create Server Group
Server Manager Properties
Local Server
Post-deployment Configuration
Configuration required for Active Directory Domain Services at DC01
Promote this server to a domain controller
Feature installation
Configuration required. Installation succeeded on DC01.
Add Roles and Features
Task Details
Installation progress
Select features
Active Directory Domain Services
Group Policy Management
Remote Server Administration Tools
Role Administration Tools
AD DS and AD LDS Tools
Active Directory module for Windows PowerShell
AD DS Tools
Active Directory Administrative Center
AD DS Snap-Ins and Command-Line Tools
Close

Figure 2.10: Installing Active Directory

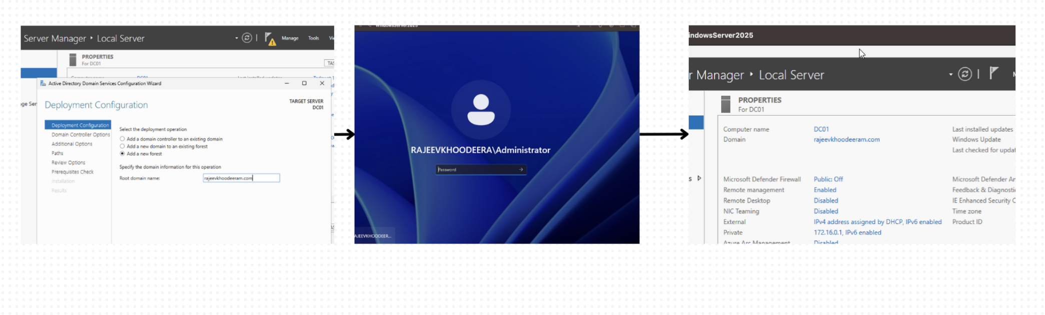

Server Manager • Local Server
Active Directory Domain Services Configuration Wizard
Deployment Configuration
Select the deployment operation
○ Add a domain controller to an existing domain
○ Add a new domain to an existing forest
● Add a new forest
Specify the domain information for this operation
Root domain name:
rajeevkhoodeeram.com
RAJEEVKHOODEERA\Administrator
PROPERTIES
For DC01
Computer name
DC01
Domain
rajeevkhoodeeram.com

Figure 2.11: Configuring domain name (*fullname.com*) –> rajeevkhoodeeram.com

2.5 Step 5 : Adding a second network interface

Within the virtual machine Settings for DC01 in Hyper-V Manager, add a second network interface that is connected to the private virtual switch.

2.6 Step 6 : Configuring DHCP server

Within your DC01 virtual machine:

- **Rename your second network interface to Private and configure a static IP address of 172.16.0.1 (subnet mask 255.255.0.0).**

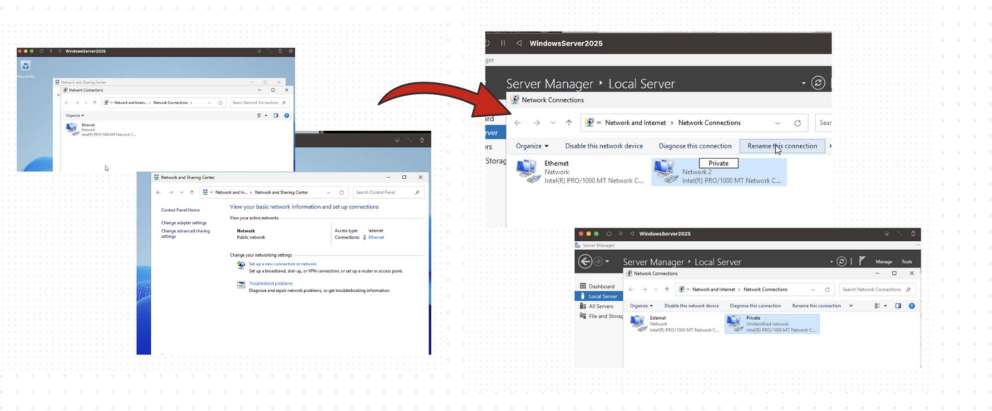
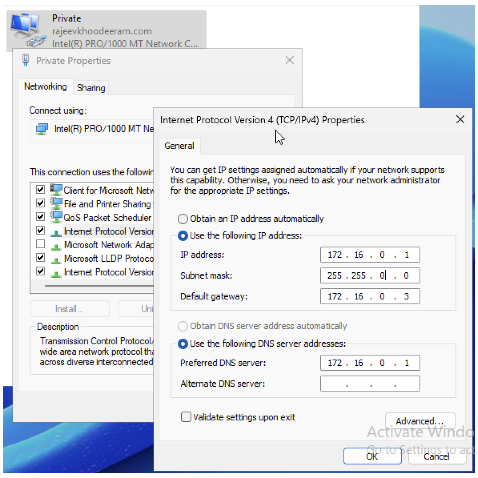

WindowsServer2025
Server Manager • Local Server
Network Connections
Network and Internet › Network Connections
Organize ▾
Disable this network device
Diagnose this connection
Rename this connection
Ethernet
Network
Intel(R) PRO/1000 MT Network C...
Private
Network 2
Intel(R) PRO/1000 MT Network C...
Network and Sharing Center
View your basic network information and set up connections
Dashboard
Local Server
All Servers
File and Storag
Unidentified network

Figure 2.12: Adding a second network interface


Private
rajeevkhoodeeram.com
Intel(R) PRO/1000 MT Network C...
Private Properties
Networking
Sharing
Connect using:
Intel(R) PRO/1000 MT Ne
This connection uses the followin
☑ Client for Microsoft Netw
☑ File and Printer Sharing
☑ QoS Packet Scheduler
☑ Internet Protocol Versior
☐ Microsoft Network Adap
☑ Microsoft LLDP Protoco
☑ Internet Protocol Versior
Install...
Uni
Description
Transmission Control Protocol/
wide area network protocol th
across diverse interconnected
Activate Windo
Go to Settings to ac

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 172 . 16 . 0 . 1

Subnet mask: 255 . 255 . 0 . 0

Default gateway: 172 . 16 . 0 . 3

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server: 172 . 16 . 0 . 1

Alternate DNS server: . . .

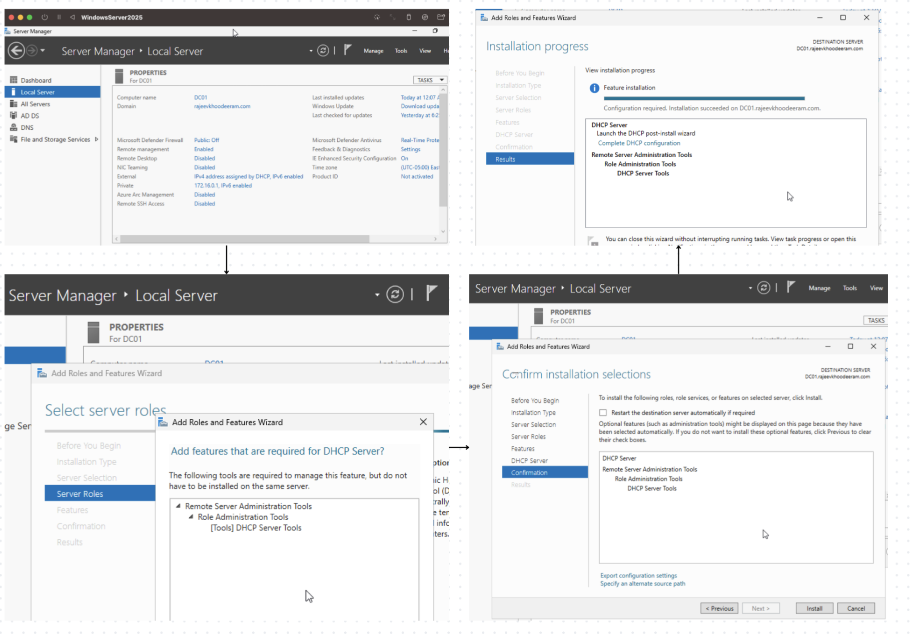
☐ Validate settings upon exit

Advanced...

OK Cancel

Figure 2.13: Configuring Private network interface

- **Install the DHCP Server role, authorize it in AD, and configure a new scope that hands out the range 172.16.0.100-172.16.0.200 (subnet mask 255.255.255.0).**



Add features that are required for DHCP Server?

The following tools are required to manage this feature, but do not have to be installed on the same server.

- Remote Server Administration Tools
  - Role Administration Tools
    - [Tools] DHCP Server Tools

Confirm installation selections

DESTINATION SERVER
DC01.rajeevkhoodeeram.com

To install the following roles, role services, or features on selected server, click Install.

☐ Restart the destination server automatically if required

Optional features (such as administration tools) might be displayed on this page because they have been selected automatically. If you do not want to install these optional features, click Previous to clear their check boxes.

DHCP Server
Remote Server Administration Tools
Role Administration Tools
DHCP Server Tools

Installation progress

View installation progress

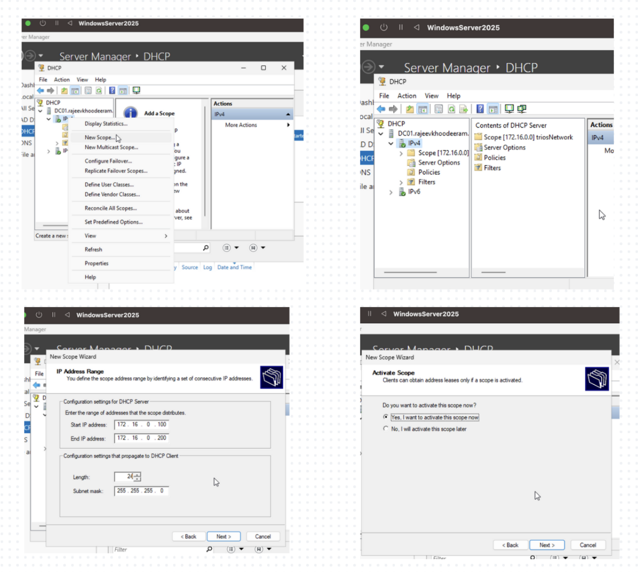
Feature installation

Configuration required. Installation succeeded on DC01.rajeevkhoodeeram.com.

DHCP Server
Launch the DHCP post-install wizard
Complete DHCP configuration
Remote Server Administration Tools
Role Administration Tools
DHCP Server Tools

You can close this wizard without interrupting running tasks. View task progress or open this

Figure 2.14: Installing the DHCP Server



IP Address Range
You define the scope address range by identifying a set of consecutive IP addresses.

Configuration settings for DHCP Server
Enter the range of addresses that the scope distributes.
Start IP address: 172 . 16 . 0 . 100
End IP address: 172 . 16 . 0 . 200

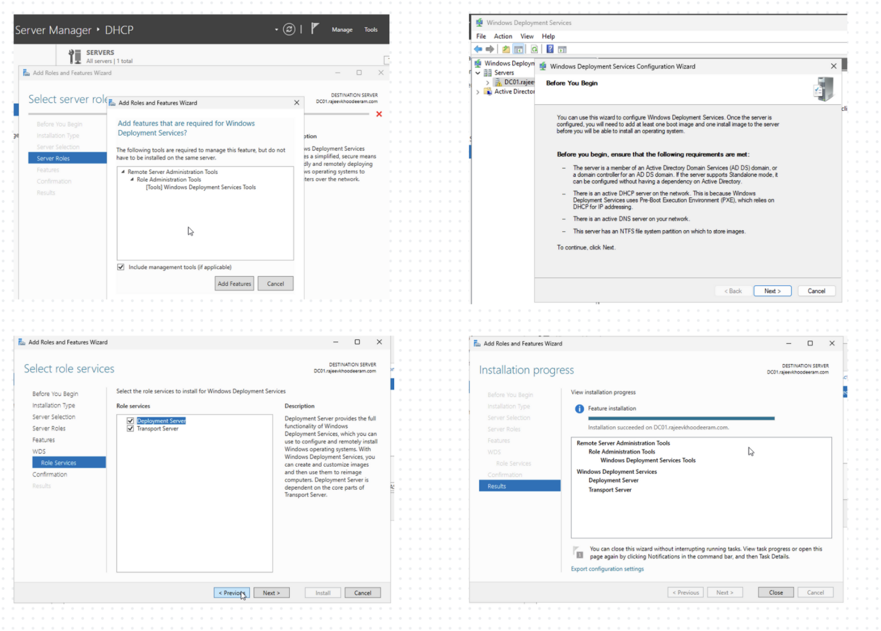
Configuration settings that propagate to DHCP Client
Length: 24
Subnet mask: 255 . 255 . 255 . 0

Activate Scope
Clients can obtain address leases only if a scope is activated.

Do you want to activate this scope now?
● Yes, I want to activate this scope now
○ No, I will activate this scope later

Figure 2.15: Configuring the DNS scope

- **Install WDS and configure it to deploy the boot.wim and install.wim from your Windows 10 DVD ISO, ensuring that computers are not automatically joined to the domain following the imaging process.**



DESTINATION SERVER
DC01.rajeevkhoodeeram.com

Add features that are required for Windows Deployment Services?

The following tools are required to manage this feature, but do not have to be installed on the same server.

- Remote Server Administration Tools
  - Role Administration Tools
    - [Tools] Windows Deployment Services Tools

☑ Include management tools (if applicable)

You can use this wizard to configure Windows Deployment Services. Once the server is configured, you will need to add at least one boot image and one install image to the server before you will be able to install an operating system.

Before you begin, ensure that the following requirements are met:

– The server is a member of an Active Directory Domain Services (AD DS) domain, or a domain controller for an AD DS domain. If the server supports Standalone mode, it can be configured without having a dependency on Active Directory.

– There is an active DHCP server on the network. This is because Windows Deployment Services uses Pre-Boot Execution Environment (PXE), which relies on DHCP for IP addressing.

– There is an active DNS server on your network.

– This server has an NTFS file system partition on which to store images.

To continue, click Next.

Select the role services to install for Windows Deployment Services

Role services
☑ Deployment Server
☑ Transport Server

Description
Deployment Server provides the full functionality of Windows Deployment Services, which you can use to configure and remotely install Windows operating systems. With Windows Deployment Services, you can create and customize images and then use them to reimage computers. Deployment Server is dependent on the core parts of Transport Server.

View installation progress

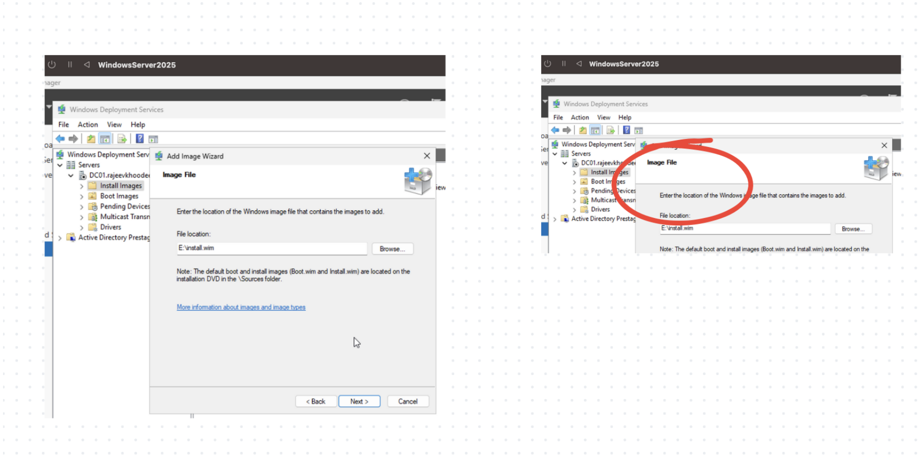
Feature installation

Installation succeeded on DC01.rajeevkhoodeeram.com.

Remote Server Administration Tools
    Role Administration Tools
        Windows Deployment Services Tools
Windows Deployment Services
    Deployment Server
    Transport Server

You can close this wizard without interrupting running tasks. View task progress or open this page again by clicking Notifications in the command bar, and then Task Details.

Figure 2.16: Configuring Windows Deployment Server

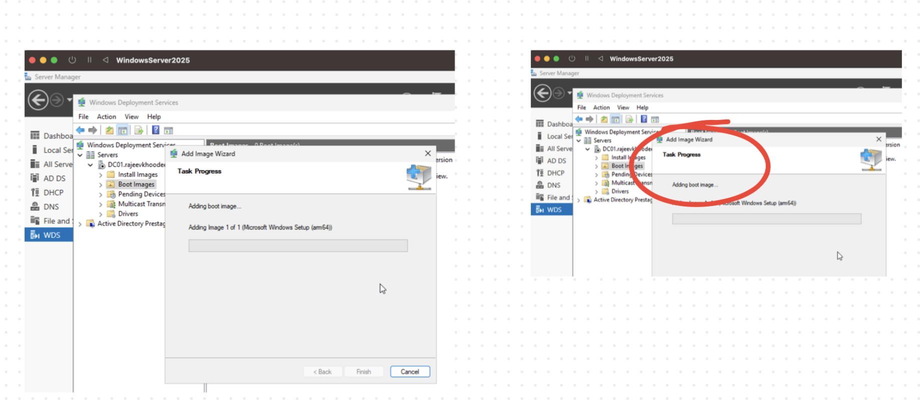


Enter the location of the Windows image file that contains the images to add.

File location:
E:\install.wim

Note: The default boot and install images (Boot.wim and Install.wim) are located on the installation DVD in the \Sources folder.

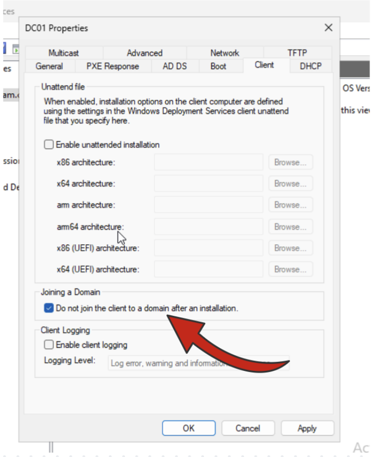
Figure 2.17: Configuring install images



Adding boot image...

Adding Image 1 of 1 (Microsoft Windows Setup (arm64))

Figure 2.18: Configuring boot images



Unattend file

When enabled, installation options on the client computer are defined using the settings in the Windows Deployment Services client unattend file that you specify here.

☐ Enable unattended installation

x86 architecture:

x64 architecture:

arm architecture:

arm64 architecture:

x86 (UEFI) architecture:

x64 (UEFI) architecture:

Joining a Domain

☑ Do not join the client to a domain after an installation.

Client Logging

☐ Enable client logging

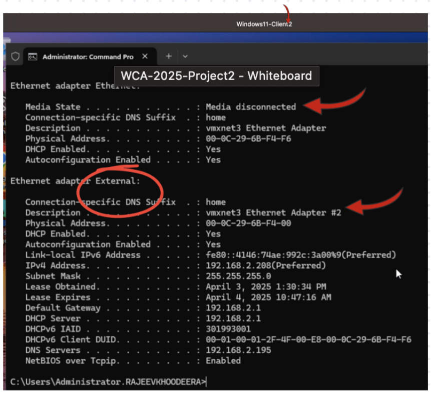
Logging Level: Log error, warning and informatio

Figure 2.19: Ensuring computers are not automatically joined to the domain

2.7 Step 7. Create a virtual machine called Wkstn01

This step has been skipped but WDS has been installed on the server DC01.

2.8 Step 8 : Change the network interface within virtual machine Settings of Wkstn01 to use the external virtual switch



```
Ethernet adapter Ethernet:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : home
   Description . . . . . . . . . . . : vmxnet3 Ethernet Adapter
   Physical Address. . . . . . . . . : 00-0C-29-6B-F4-F6
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter External:

   Connection-specific DNS Suffix  . : home
   Description . . . . . . . . . . . : vmxnet3 Ethernet Adapter #2
   Physical Address. . . . . . . . . : 00-0C-29-6B-F4-00
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::4146:74ae:992c:3a00%9(Preferred)
   IPv4 Address. . . . . . . . . . . : 192.168.2.208(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : April 3, 2025 1:30:34 PM
   Lease Expires . . . . . . . . . . : April 4, 2025 10:47:16 AM
   Default Gateway . . . . . . . . . : 192.168.2.1
   DHCP Server . . . . . . . . . . . : 192.168.2.1
   DHCPv6 IAID . . . . . . . . . . . : 301993001
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2F-4F-00-E8-00-0C-29-6B-F4-F6
   DNS Servers . . . . . . . . . . . : 192.168.2.195
   NetBIOS over Tcpip. . . . . . . . : Enabled

C:\Users\Administrator.RAJEEVKHOODEERA>
```

Figure 2.20: Disabling the private switch and enabling the External switch to be used by Wkstn01

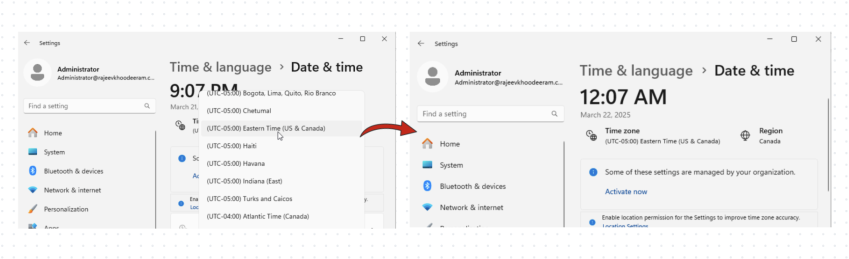
2.9 Step 9 : Perform an upgrade of your Windows 10 system to Windows 11.

Unfortunately, this step could not be carried out due to the ARM architecture of the MAC host which require ARM-enabled operating system and as such only Windows 11 flavors are available to install.

2.10 Step 10 : Windows Client configuration : Wkstn01

On your Wkstn01 virtual machine:

- Set the correct time/zone.



Time & language › Date & time

9:07 PM
March 21,

(UTC-05:00) Bogota, Lima, Quito, Rio Branco
(UTC-05:00) Chetumal
(UTC-05:00) Eastern Time (US & Canada)
(UTC-05:00) Haiti
(UTC-05:00) Havana
(UTC-05:00) Indiana (East)
(UTC-05:00) Turks and Caicos
(UTC-04:00) Atlantic Time (Canada)

Time & language › Date & time

12:07 AM
March 22, 2025

Time zone: (UTC-05:00) Eastern Time (US & Canada)

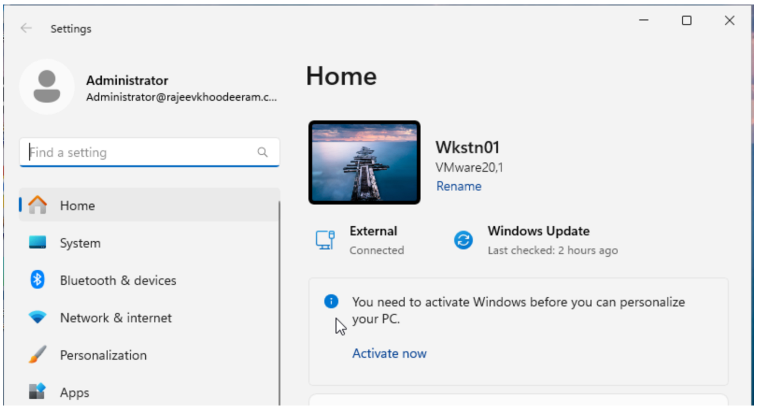
Region: Canada

Some of these settings are managed by your organization.
Activate now

Enable location permission for the Settings to improve time zone accuracy.
Location Settings

Figure 2.21: Changing timezone for Wkstn01

- Rename your network interface to External.



Wkstn01
VMware20,1

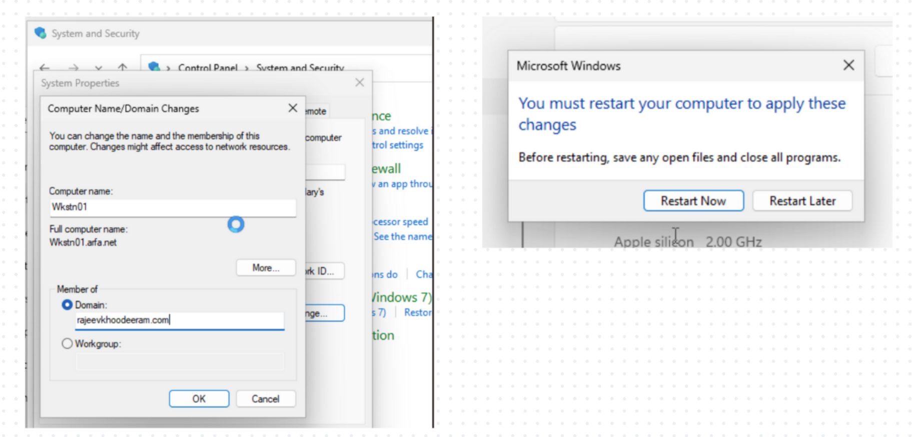
External
Connected

Windows Update
Last checked: 2 hours ago

You need to activate Windows before you can personalize your PC.
Activate now

Figure 2.22: Renaming network interface to External

- Change the computer name to Wkstn01 (rebooting afterwards).



Computer Name/Domain Changes

You can change the name and the membership of this computer. Changes might affect access to network resources.

Computer name: Wkstn01

Full computer name: Wkstn01.arfa.net

Member of
● Domain: rajeevkhoodeeram.com
○ Workgroup:

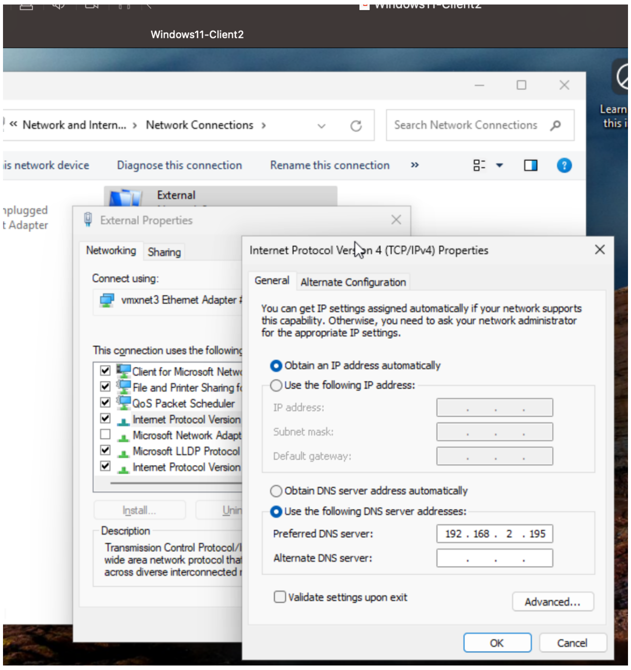
Microsoft Windows

You must restart your computer to apply these changes

Before restarting, save any open files and close all programs.

Figure 2.23: Renaming computer name

- In the properties of your External network interface, configure a static DNS server address of IPofDC (where IPofDC is the IP address on the External interface on DC01 that you recorded earlier in Step 4).



Windows11-Client2

Internet Protocol Version 4 (TCP/IPv4) Properties

General | Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically
○ Use the following IP address:

IP address: . . .
Subnet mask: . . .
Default gateway: . . .

○ Obtain DNS server address automatically
● Use the following DNS server addresses:

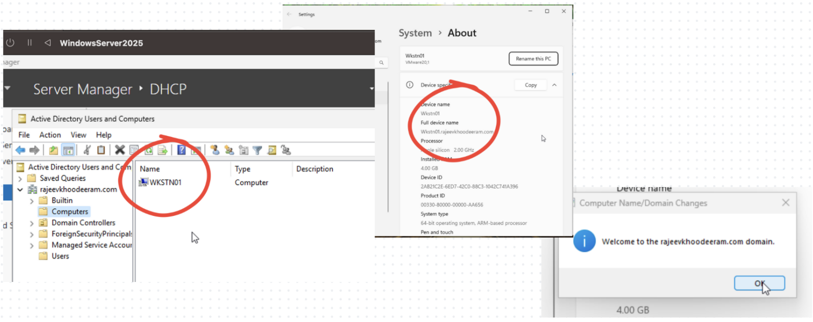
Preferred DNS server: 192 . 168 . 2 . 195
Alternate DNS server: . . .

□ Validate settings upon exit

« Network and Intern... › Network Connections ›
Search Network Connections
is network device
Diagnose this connection
Rename this connection
External
External Properties
Networking
Sharing
Connect using:
vmxnet3 Ethernet Adapter
This connection uses the following
☑ Client for Microsoft Netw
☑ File and Printer Sharing f
☑ QoS Packet Scheduler
☑ Internet Protocol Version
□ Microsoft Network Adapt
☑ Microsoft LLDP Protocol
☑ Internet Protocol Version
Install...
Description
Transmission Control Protocol/
wide area network protocol that
across diverse interconnected
Advanced...
OK
Cancel

Figure 2.24: Configuring static DNS server address of Wkstn01

- Join your Windows system to the yourname.com domain (where yourname is your full name: FirstnameLastname).



WindowsServer2025

Server Manager ‣ DHCP

Active Directory Users and Computers

Name	Type	Description
WKSTN01	Computer	

System › About

Wkstn01
VMware20,1

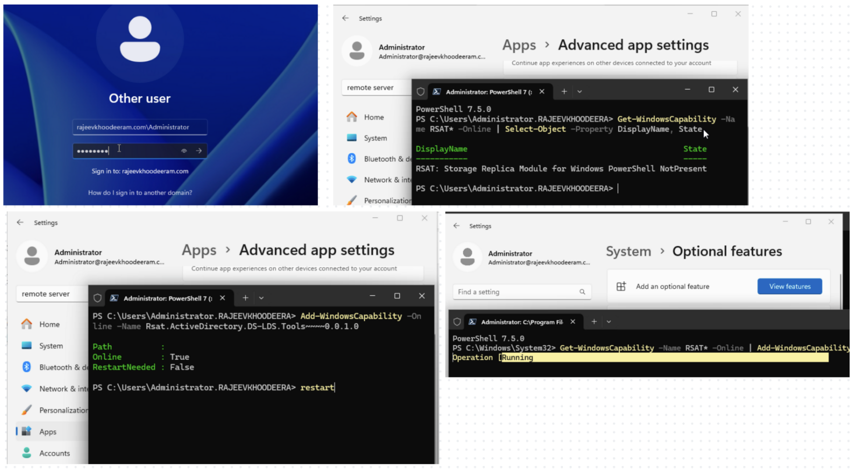
Device name
Wkstn01
Full device name
Wkstn01.rajeevkhoodeeram.com
Processor
Apple silicon 2.00 GHz
Installed RAM
4.00 GB
Device ID
2AB21C2E-6ED7-42C0-88C3-1042C741A396
Product ID
00330-80000-00000-AA656
System type
64-bit operating system, ARM-based processor
Pen and touch

Computer Name/Domain Changes

Welcome to the rajeevkhoodeeram.com domain.

Figure 2.25: Connecting Wkstn01 on domain *rajeevkhoodeeram.com*

- Log in to the domain using the domain Administrator account and install the Remote Server Administration Tools (RSAT).



Other user
rajeevkhoodeeram.com\Administrator
Sign in to: rajeevkhoodeeram.com
How do I sign in to another domain?
Settings
Administrator
Administrator@rajeevkhoodeeram.c...
Apps › Advanced app settings
Continue app experiences on other devices connected to your account
remote server
Home
System
Bluetooth & d
Network & int
Personalization
Apps
Accounts
Administrator: PowerShell 7 (
System › Optional features
Find a setting
Add an optional feature
View features
Administrator: C:\Program Fil

```
PowerShell 7.5.0
PS C:\Users\Administrator.RAJEEVKHOODEERA> Get-WindowsCapability -Na
me RSAT* -Online | Select-Object -Property DisplayName, State

DisplayName                                        State
-----------                                        -----
RSAT: Storage Replica Module for Windows PowerShell NotPresent

PS C:\Users\Administrator.RAJEEVKHOODEERA> |
```

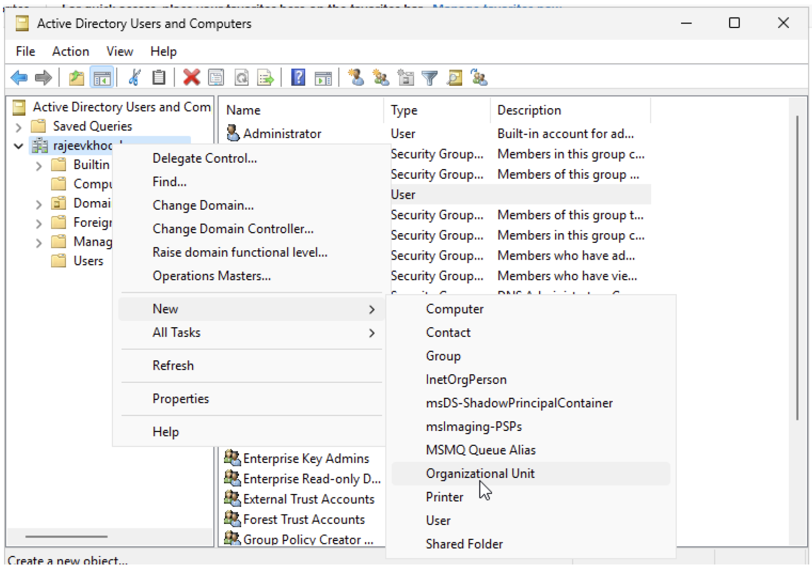
```
PS C:\Users\Administrator.RAJEEVKHOODEERA> Add-WindowsCapability -On
line -Name Rsat.ActiveDirectory.DS-LDS.Tools~~~~0.0.1.0

Path          :
Online        : True
RestartNeeded : False

PS C:\Users\Administrator.RAJEEVKHOODEERA> restart
```

```
PowerShell 7.5.0
PS C:\Windows\System32> Get-WindowsCapability -Name RSAT* -Online | Add-WindowsCapability
Operation [Running
```

Figure 2.26: Installing RSAT on Wkstn01 using Powershell

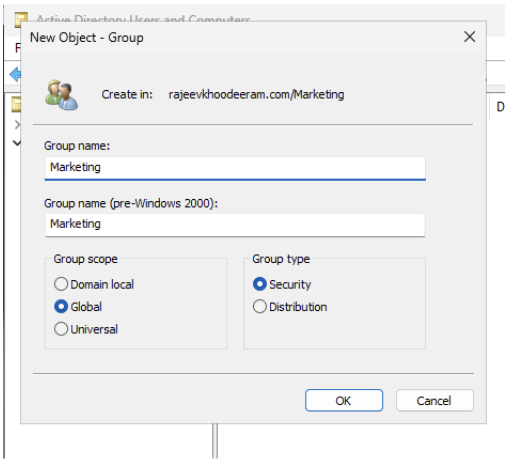
2.11 Step 11 : Within Active Directory Users and Computers (either on DC01 or within RSAT)

- Create a Marketing OU under your domain.



Name	Type	Description
Administrator	User	Built-in account for ad...
	Security Group...	Members in this group c...
	Security Group...	Members of this group ...
	User	
	Security Group...	Members of this group t...
	Security Group...	Members in this group c...
	Security Group...	Members who have ad...
	Security Group...	Members who have vie...
Enterprise Key Admins		
Enterprise Read-only D...		
External Trust Accounts		
Forest Trust Accounts		
Group Policy Creator ...		

Figure 2.27: Creating the Marketing OU



Create in: rajeevkhoodeeram.com/Marketing

Group name:
Marketing

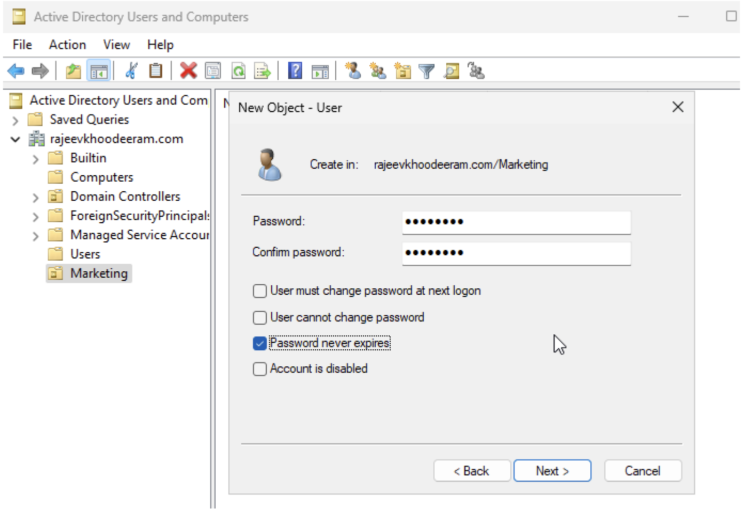
Group name (pre-Windows 2000):
Marketing

Group scope
○ Domain local
● Global
○ Universal

Group type
● Security
○ Distribution

Figure 2.28: Creating the Marketing Global group with Rajeev.Khoodeeram (1)

- Create a user for yourself (Firstname.Lastname) within the Marketing OU that has a password of your choice.



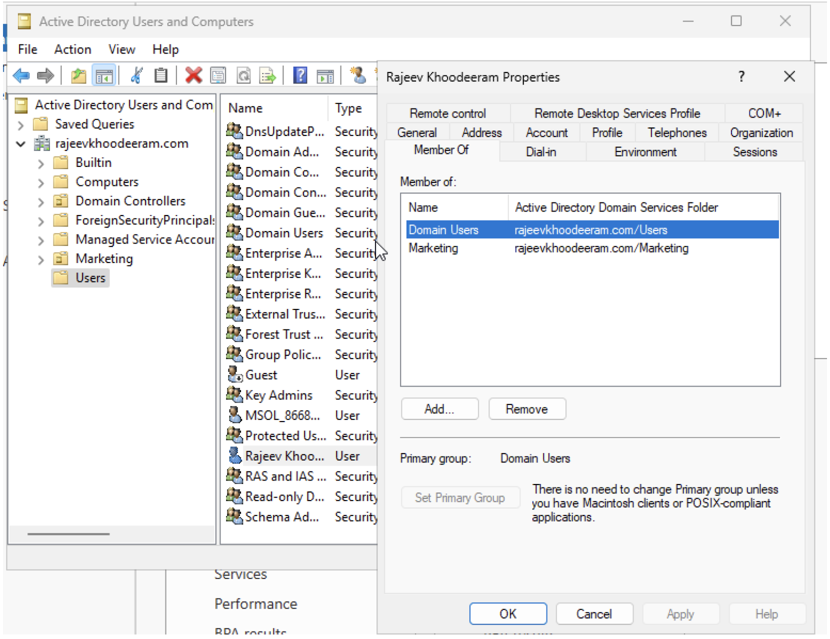
Create in: rajeevkhoodeeram.com/Marketing

Password: ••••••••

Confirm password: ••••••••

□ User must change password at next logon
□ User cannot change password
☑ Password never expires
□ Account is disabled

Figure 2.29: Creating the user Rajeev.Khoodeeram in Marketing OU



Name	Type
DnsUpdateP...	Security
Domain Ad...	Security
Domain Co...	Security
Domain Con...	Security
Domain Gue...	Security
Domain Users	Security
Enterprise A...	Security
Enterprise K...	Security
Enterprise R...	Security
External Trus...	Security
Forest Trust ...	Security
Group Polic...	Security
Guest	User
Key Admins	Security
MSOL_8668...	User
Protected Us...	Security
Rajeev Khoo...	User
RAS and IAS ...	Security
Read-only D...	Security
Schema Ad...	Security

Member of:

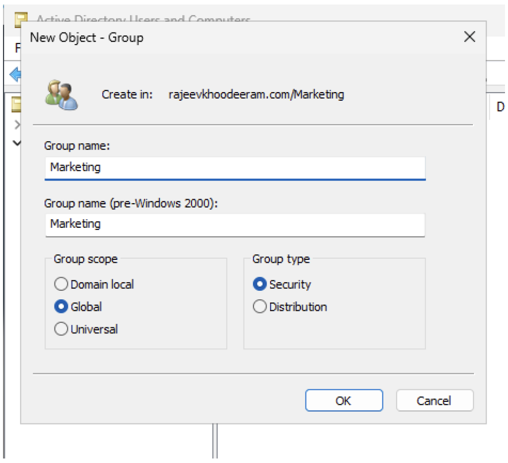
Name	Active Directory Domain Services Folder
Domain Users	rajeevkhoodeeram.com/Users
Marketing	rajeevkhoodeeram.com/Marketing

Primary group: Domain Users

There is no need to change Primary group unless you have Macintosh clients or POSIX-compliant applications.

Figure 2.30: Verification of user Rajeev.khoodeeram (see Member of) in Marketing OU

- Create a Marketing Global group that includes your user account.


New Object - Group

Create in: rajeevkhoodeeram.com/Marketing

Group name: Marketing

Group name (pre-Windows 2000): Marketing

Group scope: ○ Domain local ● Global ○ Universal

Group type: ● Security ○ Distribution

Figure 2.31: Creating the Marketing Global group with Rajeev.Khoodeeram (2)

- Move the Wkstn01 computer account into the Marketing OU

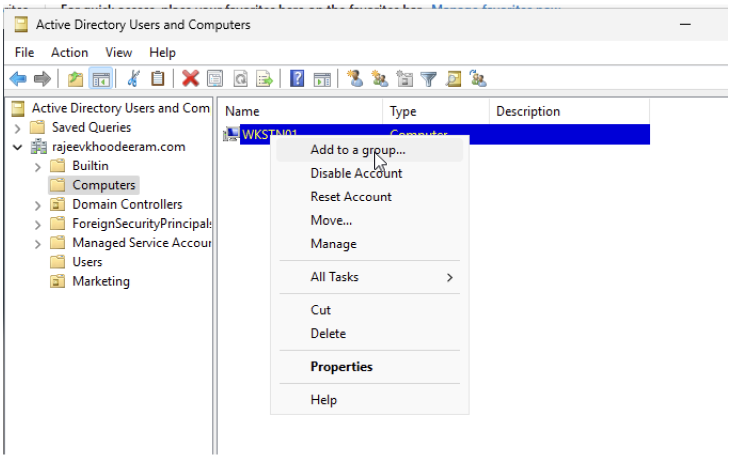
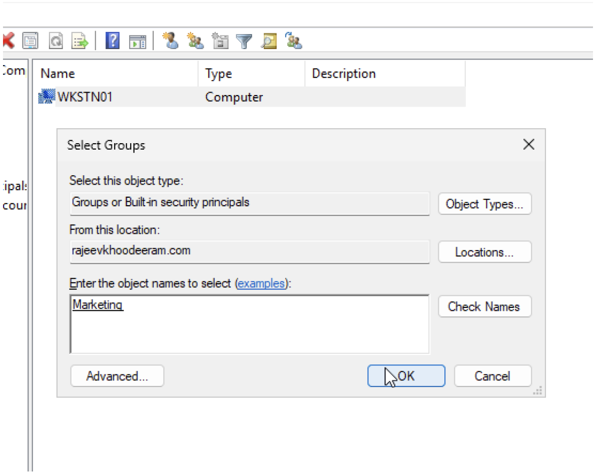


Figure 2.32: Adding Wkstn01 in Marketing OU (1)

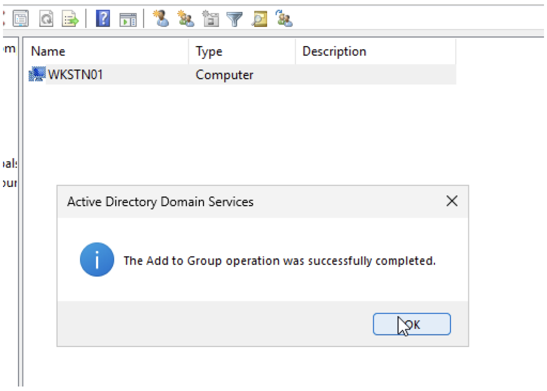

Select Groups

Select this object type: Groups or Built-in security principals

From this location: rajeevkhoodeeram.com

Enter the object names to select (examples): Marketing

Figure 2.33: Adding Wkstn01 in Marketing OU (2)



Active Directory Domain Services

The Add to Group operation was successfully completed.

Figure 2.34: Confirmation of Wkstn01 in Marketing OU

2.12 Step 12 : Within Group Policy Management (either on DC01 or within RSAT)

- Create a GPO called Marketing Lockdown.

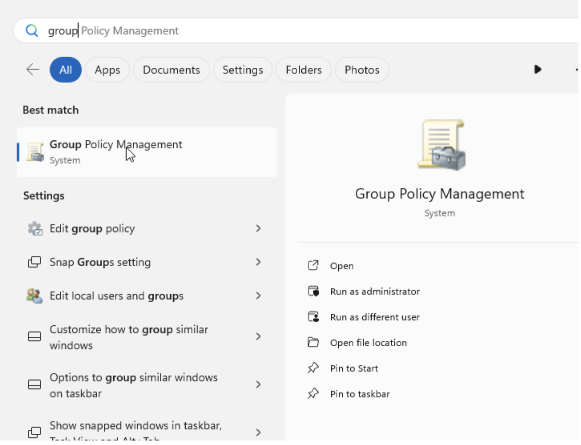

group Policy Management

Figure 2.35: Launching the Group Policy Management window

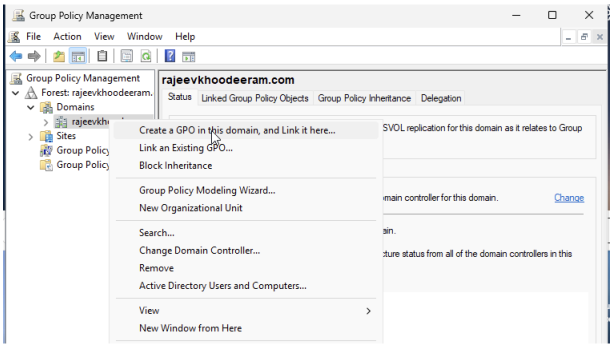
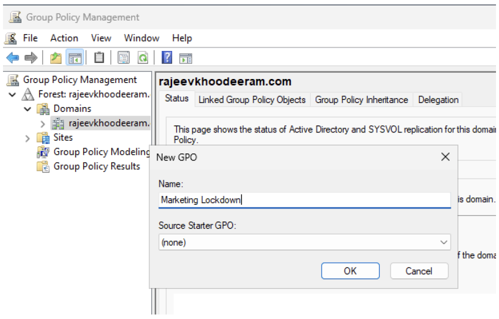

Group Policy Management
File
Action
View
Window
Help
Group Policy Management
Forest: rajeevkhoodeeram.
Domains
rajeevkh
Sites
Group Policy
Group Policy
rajeevkhoodeeram.com
Status
Linked Group Policy Objects
Group Policy Inheritance
Delegation
Create a GPO in this domain, and Link it here...
Link an Existing GPO...
Block Inheritance
Group Policy Modeling Wizard...
New Organizational Unit
Search...
Change Domain Controller...
Remove
Active Directory Users and Computers...
View
New Window from Here
SVOL replication for this domain as it relates to Group
main controller for this domain.
Change
ain.
ture status from all of the domain controllers in this

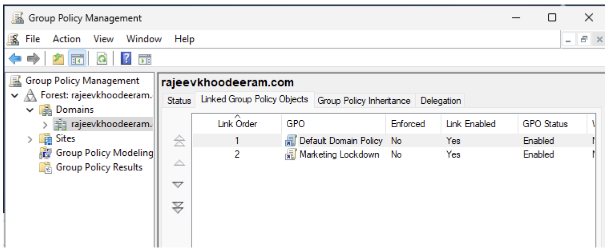
Figure 2.36: Creation of GPO "Marketing Lockdown" (1)


New GPO

Name:
Marketing Lockdown

Source Starter GPO:
(none)

Figure 2.37: Creation of GPO "Marketing Lockdown" (2)

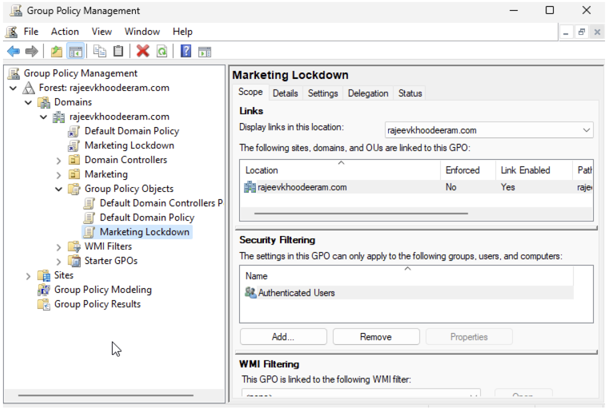


rajeevkhoodeeram.com

Link Order	GPO	Enforced	Link Enabled	GPO Status
1	Default Domain Policy	No	Yes	Enabled
2	Marketing Lockdown	No	Yes	Enabled

Figure 2.38: Creation of GPO "Marketing Lockdown" (3)

- Configure the Marketing Lockdown GPO to restrict users from accessing Settings and Control Panel.



Marketing Lockdown

Links

Display links in this location: rajeevkhoodeeram.com

The following sites, domains, and OUs are linked to this GPO:

Location	Enforced	Link Enabled	Path
rajeevkhoodeeram.com	No	Yes	raje

Security Filtering

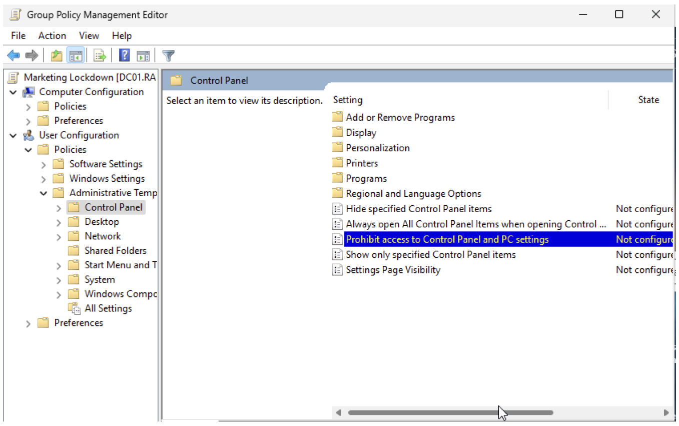
The settings in this GPO can only apply to the following groups, users, and computers:

Name
Authenticated Users

WMI Filtering

This GPO is linked to the following WMI filter:

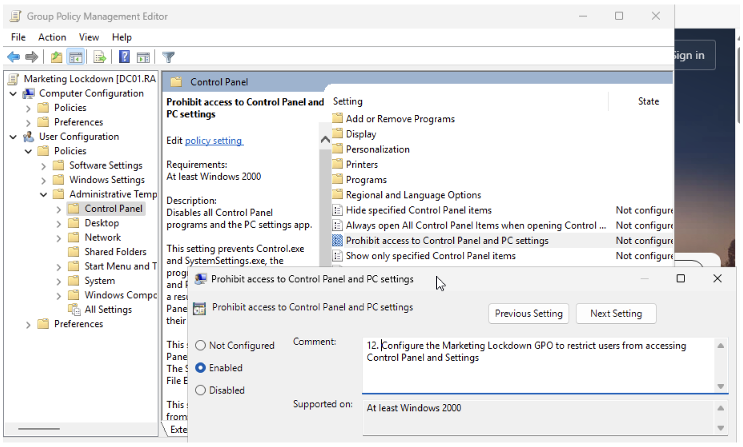
Figure 2.39: Adding restriction to the Marketing Lockdown GPO



Select an item to view its description.

Setting	State
Add or Remove Programs	
Display	
Personalization	
Printers	
Programs	
Regional and Language Options	
Hide specified Control Panel items	Not configure
Always open All Control Panel Items when opening Control ...	Not configure
Prohibit access to Control Panel and PC settings	Not configure
Show only specified Control Panel items	Not configure
Settings Page Visibility	Not configure

Figure 2.40: Prohibiting access to control Panel and Settings (1)



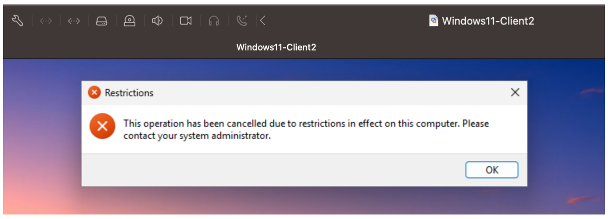
Prohibit access to Control Panel and PC settings

○ Not Configured
● Enabled
○ Disabled

Comment: 12. Configure the Marketing Lockdown GPO to restrict users from accessing Control Panel and Settings

Supported on: At least Windows 2000

Figure 2.41: Prohibiting access to control Panel and Settings (2)

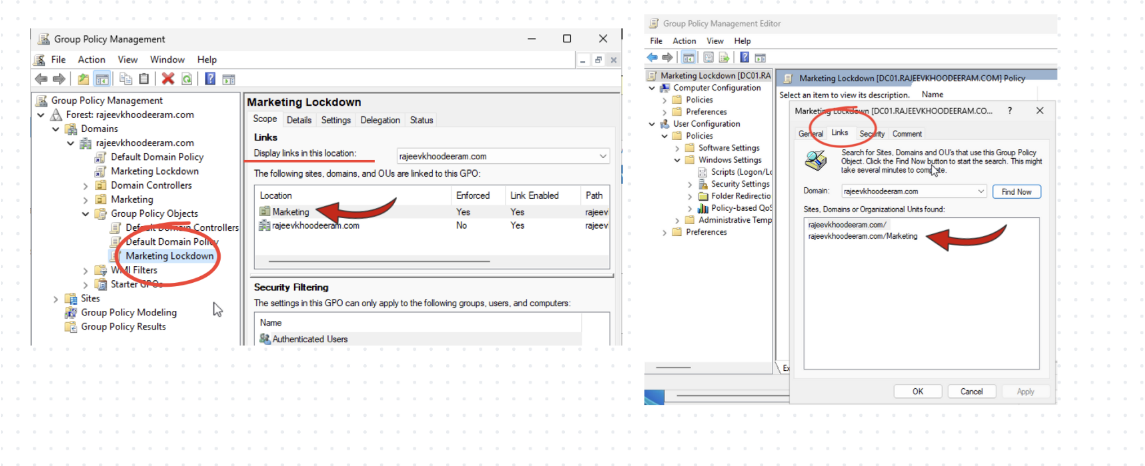


Restrictions

This operation has been cancelled due to restrictions in effect on this computer. Please contact your system administrator.

Figure 2.42: Verification of the restriction to control Panel and Settings

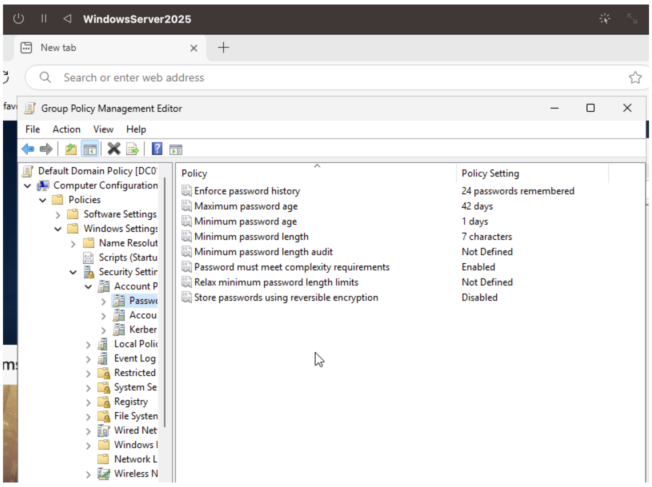
- Link the Marketing Lockdown GPO to the Marketing OU.



Group Policy Management
File Action View Window Help
Group Policy Management
Forest: rajeevkhoodeeram.com
Domains
rajeevkhoodeeram.com
Default Domain Policy
Marketing Lockdown
Domain Controllers
Marketing
Group Policy Objects
Default Domain Controllers
Default Domain Policy
Marketing Lockdown
WMI Filters
Starter GPOs
Sites
Group Policy Modeling
Group Policy Results
Marketing Lockdown
Scope Details Settings Delegation Status
Links
Display links in this location: rajeevkhoodeeram.com
The following sites, domains, and OUs are linked to this GPO:
Location Enforced Link Enabled Path
Marketing Yes Yes rajeev
rajeevkhoodeeram.com No Yes rajeev
Security Filtering
The settings in this GPO can only apply to the following groups, users, and computers:
Name
Authenticated Users
Group Policy Management Editor
Marketing Lockdown [DC01.RAJEEVKHOODEERAM.COM] Policy
General Links Security Comment
Search for Sites, Domains and OU's that use this Group Policy Object. Click the Find Now button to start the search. This might take several minutes to complete.
Domain: rajeevkhoodeeram.com
Find Now
Sites, Domains or Organizational Units found:
rajeevkhoodeeram.com/
rajeevkhoodeeram.com/Marketing
OK Cancel Apply

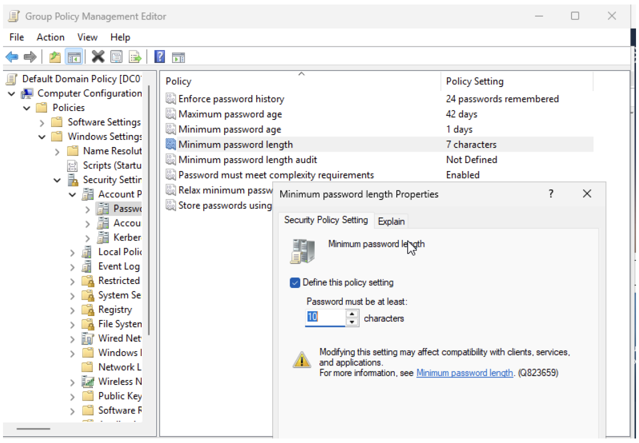
Figure 2.43: Linking Marketing Lockdown to Marketing OU

- Modify the Default Domain Policy GPO to ensure that users in the domain must have complex passwords that are a minimum of 10 characters in length, and must be changed every 30 days.



Policy	Policy Setting
Enforce password history	24 passwords remembered
Maximum password age	42 days
Minimum password age	1 days
Minimum password length	7 characters
Minimum password length audit	Not Defined
Password must meet complexity requirements	Enabled
Relax minimum password length limits	Not Defined
Store passwords using reversible encryption	Disabled

Figure 2.44: Modifying Default domain policy



Policy	Policy Setting
Enforce password history	24 passwords remembered
Maximum password age	42 days
Minimum password age	1 days
Minimum password length	7 characters
Minimum password length audit	Not Defined
Password must meet complexity requirements	Enabled
Relax minimum passw	
Store passwords using	

Minimum password length

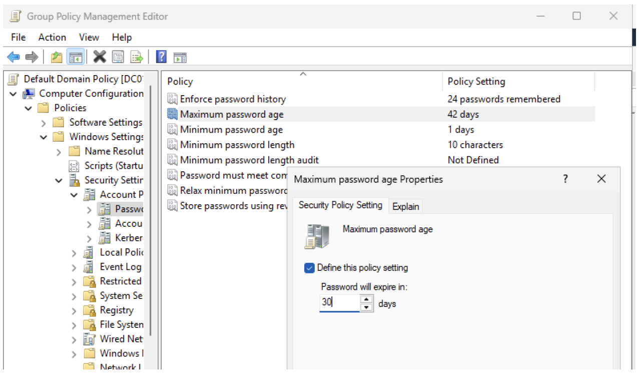
☑ Define this policy setting

Password must be at least:

10 characters

Modifying this setting may affect compatibility with clients, services, and applications.
For more information, see Minimum password length. (Q823659)

Figure 2.45: Implementing minimum of 10 characters in length for password



Policy	Policy Setting
Enforce password history	24 passwords remembered
Maximum password age	42 days
Minimum password age	1 days
Minimum password length	10 characters
Minimum password length audit	Not Defined
Password must meet com	
Relax minimum passworc	
Store passwords using rev	

Maximum password age

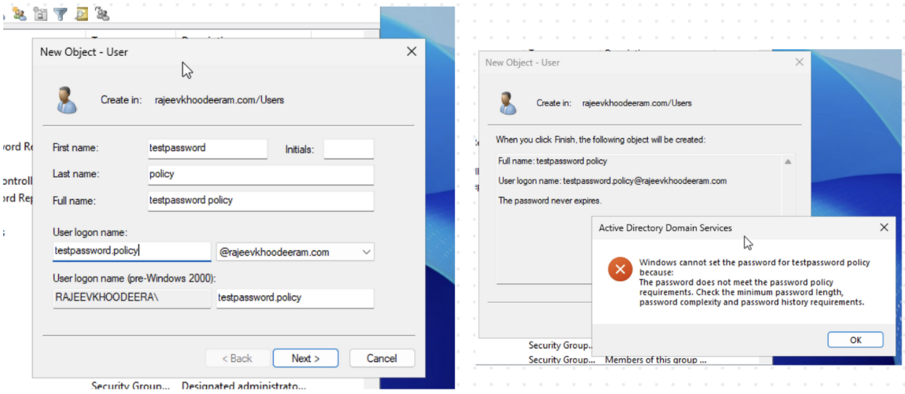
☑ Define this policy setting

Password will expire in:

30 days

Figure 2.46: Implementing password policy to be changed every 30 days

Let us do a final check to see if the password policy has been correctly implemented.



New Object - User

Create in: rajeevkhoodeeram.com/Users

First name: testpassword

Initials:

Last name: policy

Full name: testpassword policy

User logon name: testpassword.policy @rajeevkhoodeeram.com

User logon name (pre-Windows 2000): RAJEEVKHOODEERA\ testpassword.policy

New Object - User

Create in: rajeevkhoodeeram.com/Users

When you click Finish, the following object will be created:

Full name: testpassword policy

User logon name: testpassword.policy@rajeevkhoodeeram.com

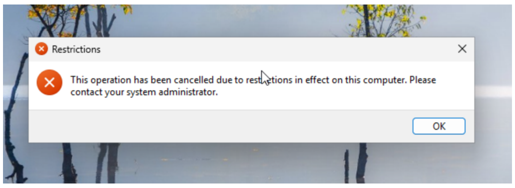
The password never expires.

Active Directory Domain Services

Windows cannot set the password for testpassword policy because:
The password does not meet the password policy requirements. Check the minimum password length, password complexity and password history requirements.

Figure 2.47: Testing of password policy of 10 characters minimum

2.13 Step 13 : Accessing Settings / Control Panel



Restrictions

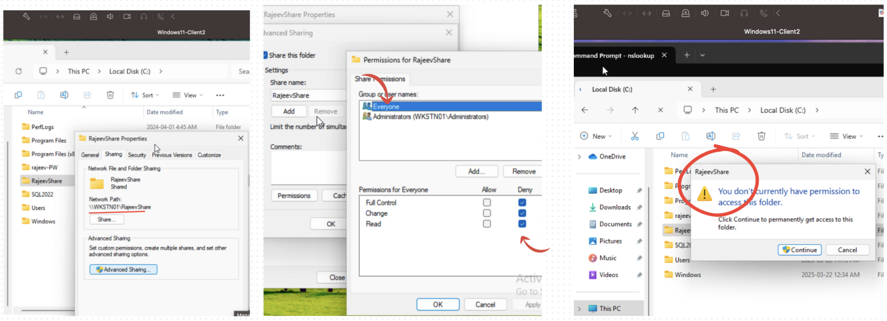
This operation has been cancelled due to restrictions in effect on this computer. Please contact your system administrator.

Figure 2.48: Verifying access to Control Panel - Access is denied

2.14 Step 14 : Permissions and System Restore

Log off Wkstn01, and log in again as the domain Administrator.

- Add your domain user account (Firstname.Lastname) to the local Administrators group.
- Create a folder called C:\FirstnameShare on your computer and share it, ensuring that only your domain user account has Full Control share permission.



RajeevShare Properties

Network File and Folder Sharing

RajeevShare
Shared

Network Path:
\\WKSTN01\RajeevShare

Advanced Sharing

Set custom permissions, create multiple shares, and set other advanced sharing options.

Share name: RajeevShare

Permissions for RajeevShare

Group or user names:
Everyone
Administrators (WKSTN01\Administrators)

Permissions for Everyone	Allow	Deny
Full Control	☐	☑
Change	☐	☑
Read	☐	☑

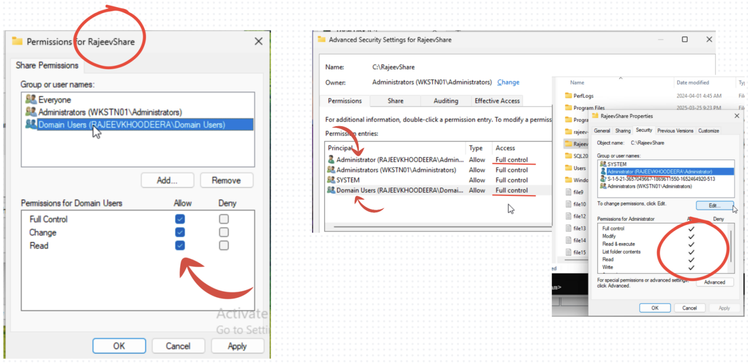
RajeevShare

You don't currently have permission to access this folder.

Click Continue to permanently get access to this folder.

Figure 2.49: Other users are denied access to the shared folder

- Set the NTFS permissions on the C:\FirstnameShare folder to ensure that your domain user account (Firstname.Lastname) has Full Control (leaving existing permissions in place).



Permissions for RajeevShare

Share Permissions

Group or user names:
Everyone
Administrators (WKSTN01\Administrators)
Domain Users (RAJEEVKHOODEERA\Domain Users)

Permissions for Domain Users	Allow	Deny
Full Control	☑	□
Change	☑	□
Read	☑	□

Advanced Security Settings for RajeevShare

Name: C:\RajeevShare
Owner: Administrators (WKSTN01\Administrators) Change

For additional information, double-click a permission entry. To modify a permiss

Permission entries:

Principal	Type	Access
Administrator (RAJEEVKHOODEERA\Admin...	Allow	Full control
Administrators (WKSTN01\Administrators)	Allow	Full control
SYSTEM	Allow	Full control
Domain Users (RAJEEVKHOODEERA\Domai...	Allow	Full control

RajeevShare Properties

Object name: C:\RajeevShare

Group or user names:
SYSTEM
Administrator (RAJEEVKHOODEERA\Administrator)
S-1-5-21-3657049667-1869611550-1652464920-513
Administrators (WKSTN01\Administrators)

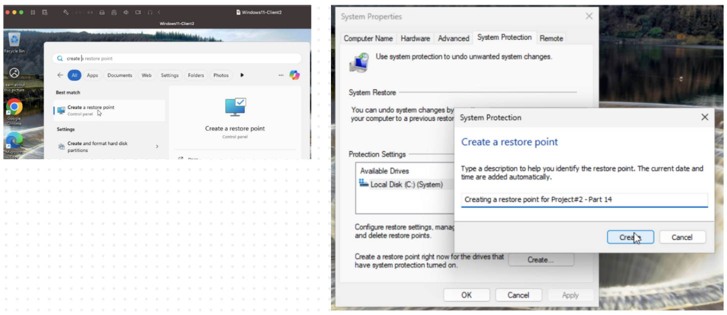
To change permissions, click Edit.

Permissions for Administrator	Allow	Deny
Full control	✓	
Modify	✓	
Read & execute	✓	
List folder contents	✓	
Read	✓	
Write	✓	

For special permissions or advanced settings, click Advanced.

Figure 2.50: Setting NTFS permission on the shared folder (Domain users only)

- Create a System Restore checkpoint.



System Properties

Use system protection to undo unwanted system changes.

System Restore

You can undo system changes by your computer to a previous restor

Protection Settings

Available Drives
Local Disk (C:) (System)

Configure restore settings, manag and delete restore points.

Create a restore point right now for the drives that have system protection turned on.

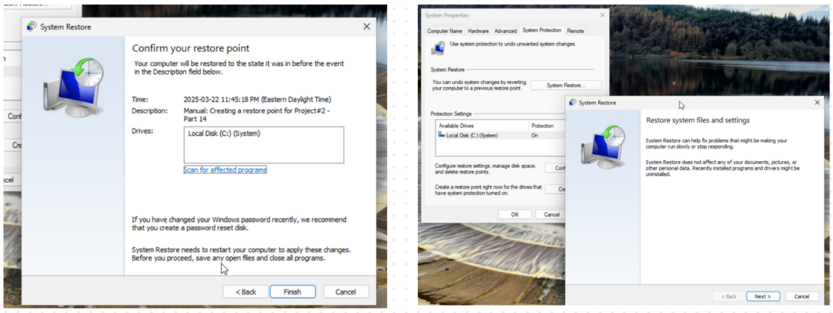
System Protection

Create a restore point

Type a description to help you identify the restore point. The current date and time are added automatically.

Creating a restore point for Project#2 - Part 14

Figure 2.51: System restore (1)



System Restore

Confirm your restore point

Your computer will be restored to the state it was in before the event in the Description field below.

Time: 2025-03-22 11:45:18 PM (Eastern Daylight Time)
Description: Manual: Creating a restore point for Project#2 - Part 14
Drives: Local Disk (C:) (System)

If you have changed your Windows password recently, we recommend that you create a password reset disk.

System Restore needs to restart your computer to apply these changes. Before you proceed, save any open files and close all programs.

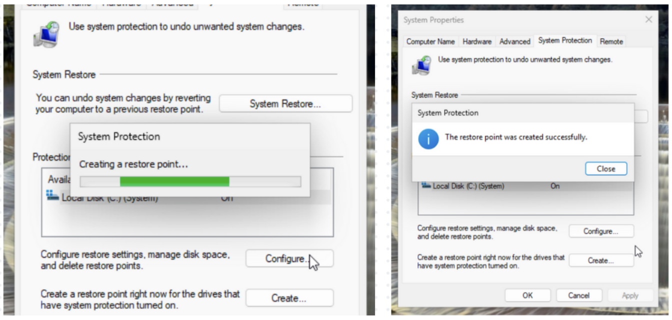
System Restore

Restore system files and settings

System Restore can help fix problems that might be making your computer run slowly or stop responding.

System Restore does not affect any of your documents, pictures, or other personal data. Recently installed programs and drivers might be uninstalled.

Figure 2.52: System restore (2)



Use system protection to undo unwanted system changes.

System Restore

You can undo system changes by reverting your computer to a previous restore point.

System Protection

Creating a restore point...

Local Disk (C:) (System) On

Configure restore settings, manage disk space, and delete restore points.

Create a restore point right now for the drives that have system protection turned on.

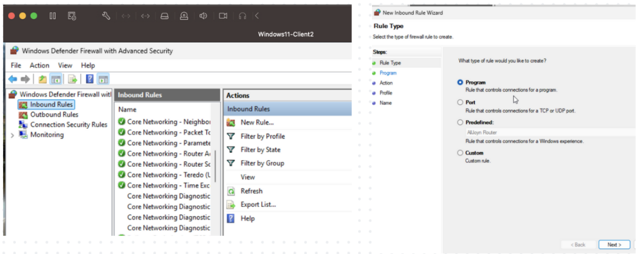
System Properties

System Protection

The restore point was created successfully.

Figure 2.53: System restore (3)

- Create an exception in Windows Firewall for DOOM traffic (TCP port 666).


Windows11-Client2
Windows Defender Firewall with Advanced Security
File
Action
View
Help
Inbound Rules
Outbound Rules
Connection Security Rules
Monitoring
Name
Core Networking - Neighbo
Core Networking - Packet T
Core Networking - Paramete
Core Networking - Router A
Core Networking - Router S
Core Networking - Teredo (
Core Networking - Time Exc
Core Networking Diagnostic
Core Networking Diagnostic
Core Networking Diagnostic
Core Networking Diagnostic
Actions
Inbound Rules
New Rule...
Filter by Profile
Filter by State
Filter by Group
View
Refresh
Export List...
Help
Steps:
Rule Type
Program
Action
Profile
Name
< Back
Next >

New Inbound Rule Wizard

Rule Type

Select the type of firewall rule to create.

What type of rule would you like to create?

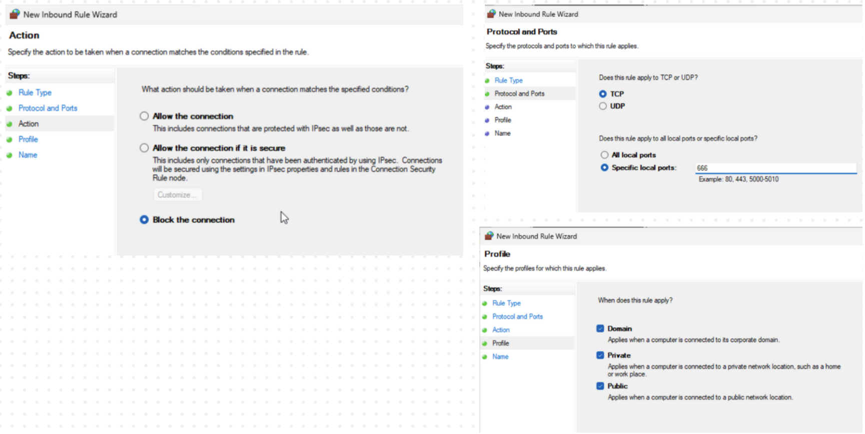
● Program
Rule that controls connections for a program.

○ Port
Rule that controls connections for a TCP or UDP port.

○ Predefined:
AllJoyn Router
Rule that controls connections for a Windows experience.

○ Custom
Custom rule.

Figure 2.54: Exception in Windows Firewall for DOOM traffic (1)



New Inbound Rule Wizard

Action

Specify the action to be taken when a connection matches the conditions specified in the rule.

What action should be taken when a connection matches the specified conditions?

○ Allow the connection
This includes connections that are protected with IPsec as well as those are not.

○ Allow the connection if it is secure
This includes only connections that have been authenticated by using IPsec. Connections will be secured using the settings in IPsec properties and rules in the Connection Security Rule node.

● Block the connection

New Inbound Rule Wizard

Protocol and Ports

Specify the protocols and ports to which this rule applies.

Does this rule apply to TCP or UDP?

● TCP
○ UDP

Does this rule apply to all local ports or specific local ports?

○ All local ports
● Specific local ports: 666
Example: 80, 443, 5000-5010

New Inbound Rule Wizard

Profile

Specify the profiles for which this rule applies.

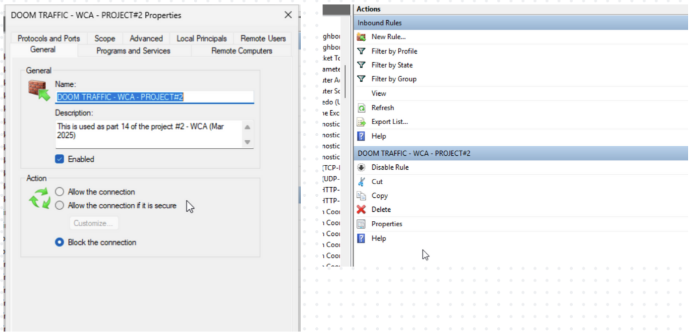
When does this rule apply?

☑ Domain
Applies when a computer is connected to its corporate domain.

☑ Private
Applies when a computer is connected to a private network location, such as a home or work place.

☑ Public
Applies when a computer is connected to a public network location.

Figure 2.55: Exception in Windows Firewall for DOOM traffic (2)



DOOM TRAFFIC - WCA - PROJECT#2 Properties

Name: DOOM TRAFFIC - WCA - PROJECT#2

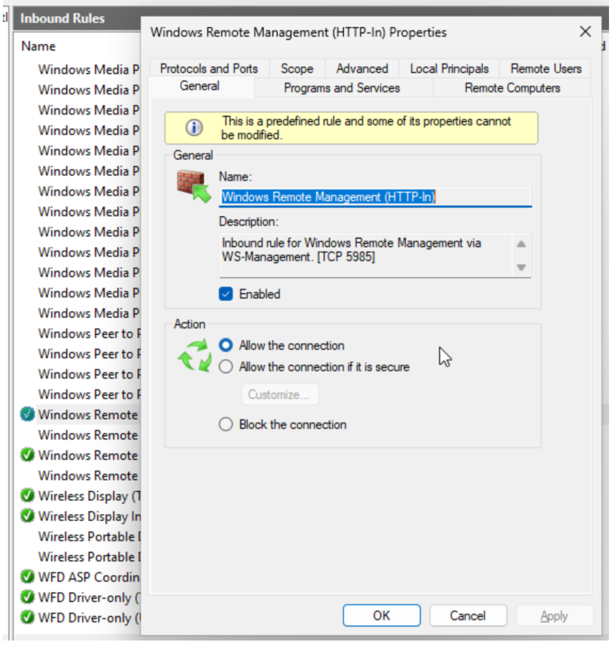
Description: This is used as part 14 of the project #2 - WCA (Mar 2025)

☑ Enabled

Action:
○ Allow the connection
○ Allow the connection if it is secure
● Block the connection

Figure 2.56: Exception in Windows Firewall for DOOM traffic (3)

- Enable WinRM (test remote PowerShell access using Enter-PSSession from DC01).



Windows Remote Management (HTTP-In) Properties

This is a predefined rule and some of its properties cannot be modified.

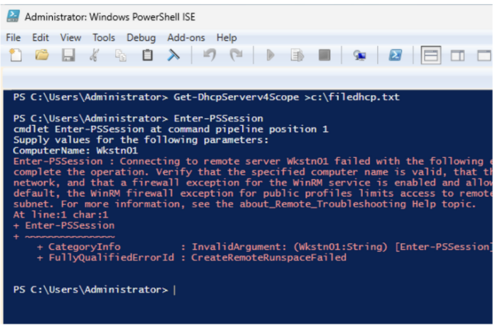
Name: Windows Remote Management (HTTP-In)

Description: Inbound rule for Windows Remote Management via WS-Management. [TCP 5985]

☑ Enabled

Action:
● Allow the connection
○ Allow the connection if it is secure
○ Block the connection

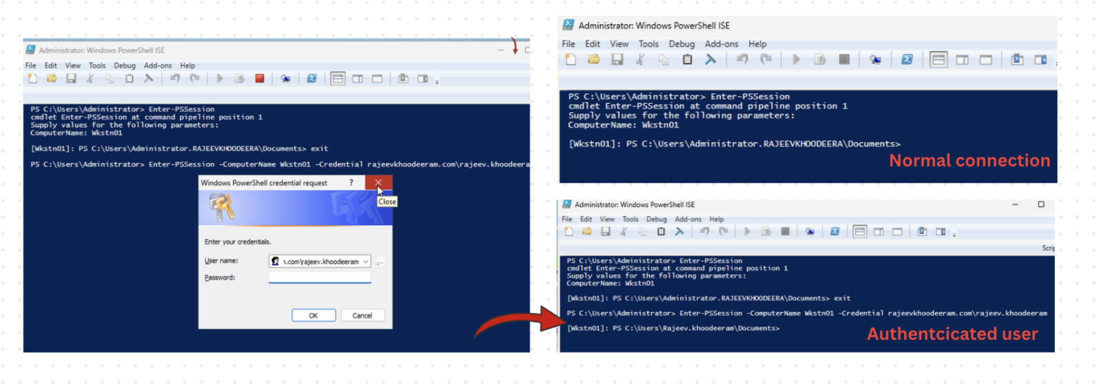
Figure 2.57: WinRM activation



Administrator: Windows PowerShell ISE

```
PS C:\Users\Administrator> Get-DhcpServerv4Scope >c:\filedhcp.txt

PS C:\Users\Administrator> Enter-PSSession
cmdlet Enter-PSSession at command pipeline position 1
Supply values for the following parameters:
ComputerName: Wkstn01
Enter-PSSession : Connecting to remote server Wkstn01 failed with the following e
complete the operation. Verify that the specified computer name is valid, that th
network, and that a firewall exception for the WinRM service is enabled and allow
default, the WinRM firewall exception for public profiles limits access to remote
subnet. For more information, see the about_Remote_Troubleshooting Help topic.
At line:1 char:1
+ Enter-PSSession
+ ~~~~~~~~~~~~~~~
    + CategoryInfo          : InvalidArgument: (Wkstn01:String) [Enter-PSSession]
    + FullyQualifiedErrorId : CreateRemoteRunspaceFailed


PS C:\Users\Administrator> |
```

Figure 2.58: Testing remote PowerShell - In case Firewall or any other issue



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

```
PS C:\Users\Administrator> Enter-PSSession
cmdlet Enter-PSSession at command pipeline position 1
Supply values for the following parameters:
ComputerName: Wkstn01

[Wkstn01]: PS C:\Users\Administrator.RAJEEVKHOODEERA\Documents> exit

PS C:\Users\Administrator> Enter-PSSession -ComputerName Wkstn01 -Credential rajeevkhoodeeram.com\rajeev.khoodeera
```

Windows PowerShell credential request
Close

Enter your credentials.

User name: ı.com\rajeev.khoodeeram

Password:

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

```
PS C:\Users\Administrator> Enter-PSSession
cmdlet Enter-PSSession at command pipeline position 1
Supply values for the following parameters:
ComputerName: Wkstn01

[Wkstn01]: PS C:\Users\Administrator.RAJEEVKHOODEERA\Documents>
```

Normal connection

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

```
PS C:\Users\Administrator> Enter-PSSession
cmdlet Enter-PSSession at command pipeline position 1
Supply values for the following parameters:
ComputerName: Wkstn01

[Wkstn01]: PS C:\Users\Administrator.RAJEEVKHOODEERA\Documents> exit

PS C:\Users\Administrator> Enter-PSSession -ComputerName Wkstn01 -Credential rajeevkhoodeeram.com\rajeev.khoodeeram

[Wkstn01]: PS C:\Users\Rajeev.khoodeeram\Documents>
```

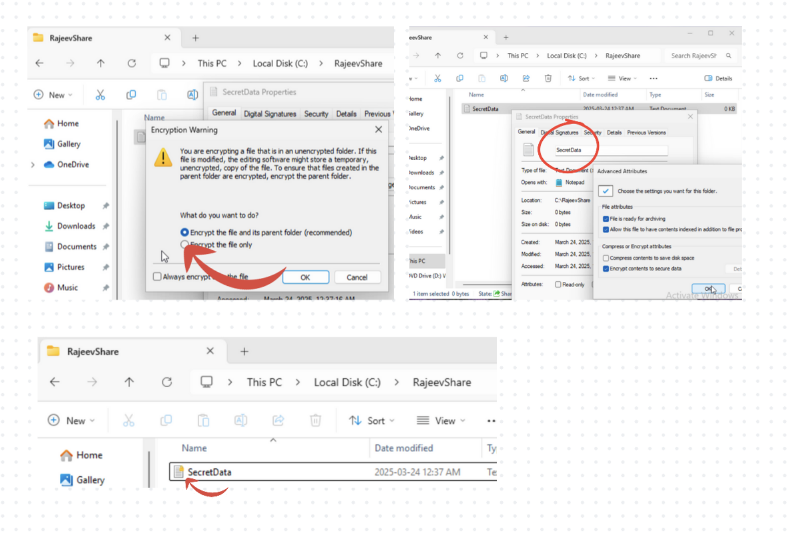
Authentcicated user

Figure 2.59: Remote Powershell is working either as administrator or any authenticated user on the domain

Step 15 : Powershell - Client (Wkstn01) PART 3

3.1 Target : Log off Wkstn01, and log in again as your user (Fname.Lname)

- Access your shared folder and create a new file within it called SecretData.txt that contains a line of your choice. Next, encrypt the SecretData.txt file using EFS.



Encryption Warning

You are encrypting a file that is in an unencrypted folder. If this file is modified, the editing software might store a temporary, unencrypted, copy of the file. To ensure that files created in the parent folder are encrypted, encrypt the parent folder.

What do you want to do?

○ Encrypt the file and its parent folder (recommended)

○ Encrypt the file only

□ Always encrypt only the file

Advanced Attributes

Choose the settings you want for this folder.

File attributes

☑ File is ready for archiving

☑ Allow this file to have contents indexed in addition to file properties

Compress or Encrypt attributes

□ Compress contents to save disk space

☑ Encrypt contents to secure data

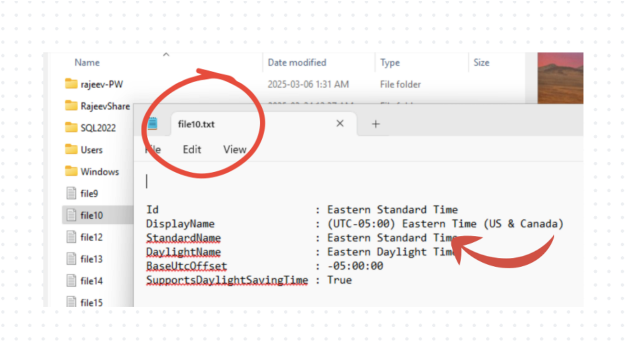
Figure 3.1: File SecretData.txt is encrypted - see Yellow lock on the file icon

- Open PowerShell as Administrator and run the following commands

1. gpresult /r /z >c:\file9.txt
2. Get-TimeZone >c:\file10.txt
3. Get-NetIPConfiguration >c:\file11.txt
4. Gwmi win32_product >c:\file12.txt
5. net share firstnameshare >c:\file13.txt
6. icacls c:\firstnameshare >c:\file14.txt
7. Get-ComputerRestorePoint >c:\file15.txt
8. Get-NetFirewallRule >c:\file16.txt.
9. test-wsman >c:\file17.txt
10. cipher c:\firstnameshare\SecretData.txt >c:\file18.txt
11. tar –a –c –f c:\yournameWkstn01.zip c:\file*.txt

3.2 gpresult /r /z >c:\file9.txt

The gpresult command in Windows is used to display Group Policy information for a system or a user. It helps to diagnose and view the Group Policy settings applied to a computer or user, and it can be useful for troubleshooting Group Policy issues.

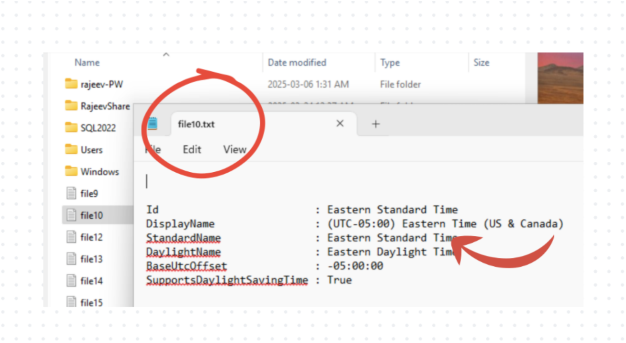


```
Id                         : Eastern Standard Time
DisplayName                : (UTC-05:00) Eastern Time (US & Canada)
StandardName               : Eastern Standard Time
DaylightName               : Eastern Daylight Time
BaseUtcOffset              : -05:00:00
SupportsDaylightSavingTime : True
```

Figure 3.2: Showing group and group policy set earlier for Wkstn01

3.3 Get-TimeZone >c:\file10.txt

The Get-TimeZone cmdlet in PowerShell retrieves the current time zone of your system (here *Wkstn01*).

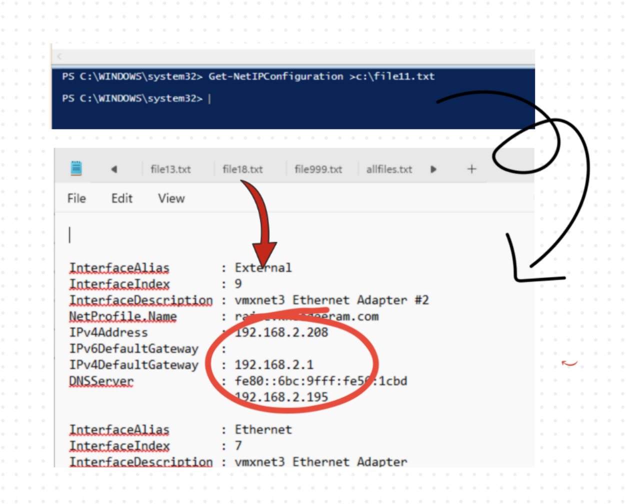


```
Id                         : Eastern Standard Time
DisplayName                : (UTC-05:00) Eastern Time (US & Canada)
StandardName               : Eastern Standard Time
DaylightName               : Eastern Daylight Time
BaseUtcOffset              : -05:00:00
SupportsDaylightSavingTime : True
```

Figure 3.3: Verification of the correct time zone (EST) in Wkstn01

3.4 Get-NetIPConfiguration >c:\file11.txt

The Get-NetIPConfiguration cmdlet retrieves detailed network adapter configuration information, including IP addresses, DNS settings, and default gateways. Here, the server 192.168.2.195 (DC01) is also acting as the DNS server and they are both on the same "external" switch.



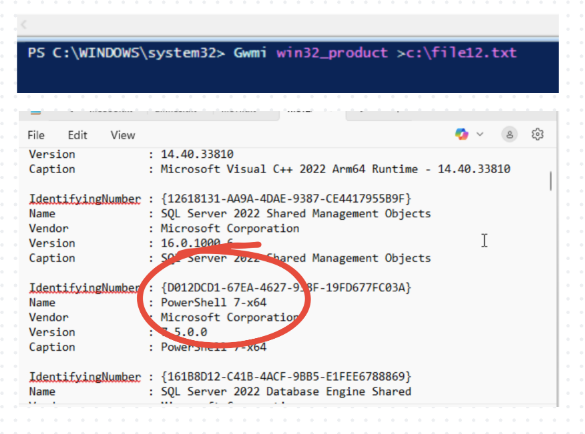
```
PS C:\WINDOWS\system32> Get-NetIPConfiguration >c:\file11.txt
PS C:\WINDOWS\system32> |
```

```
InterfaceAlias       : External
InterfaceIndex       : 9
InterfaceDescription : vmxnet3 Ethernet Adapter #2
NetProfile.Name      : ra[illegible]eeram.com
IPv4Address          : 192.168.2.208
IPv6DefaultGateway   :
IPv4DefaultGateway   : 192.168.2.1
DNSServer            : fe80::6bc:9fff:fe5[illegible]:1cbd
                       192.168.2.195

InterfaceAlias       : Ethernet
InterfaceIndex       : 7
InterfaceDescription : vmxnet3 Ethernet Adapter
```

Figure 3.4: Getting the network configuration of Wkstn01 which is configured to access the server on the same subnet (192.168.2.xx)

3.5 Gwmi win32_product >c:\file12.txt

The command gwmi Win32_Product retrieves a list of installed applications on a Windows system using Windows Management Instrumentation (WMI).



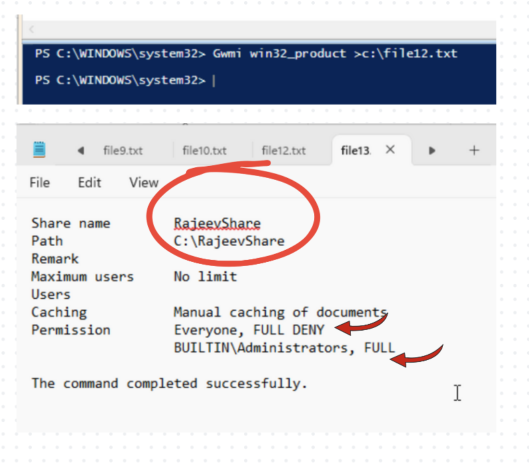
```
PS C:\WINDOWS\system32> Gwmi win32_product >c:\file12.txt
```

```
Version           : 14.40.33810
Caption           : Microsoft Visual C++ 2022 Arm64 Runtime - 14.40.33810

IdentifyingNumber : {12618131-AA9A-4DAE-9387-CE4417955B9F}
Name              : SQL Server 2022 Shared Management Objects
Vendor            : Microsoft Corporation
Version           : 16.0.1000.6
Caption           : SQL Server 2022 Shared Management Objects

IdentifyingNumber : {D012DCD1-67EA-4627-9[illegible]BF-19FD677FC03A}
Name              : PowerShell 7-x64
Vendor            : Microsoft Corporation
Version           : 7.5.0.0
Caption           : PowerShell 7-x64

IdentifyingNumber : {161B8D12-C41B-4ACF-9BB5-E1FEE6788869}
Name              : SQL Server 2022 Database Engine Shared
```

Figure 3.5: Example of installed applications - see PowerShell

3.6 net share firstnameshare >c:\file13.txt

The net share command is used to manage shared folders on a Windows computer. By default, everyone gets read-only access to a share. Here, the domain users have been granted Full access to RajeevShare, everyone else has READ-ONLY access.



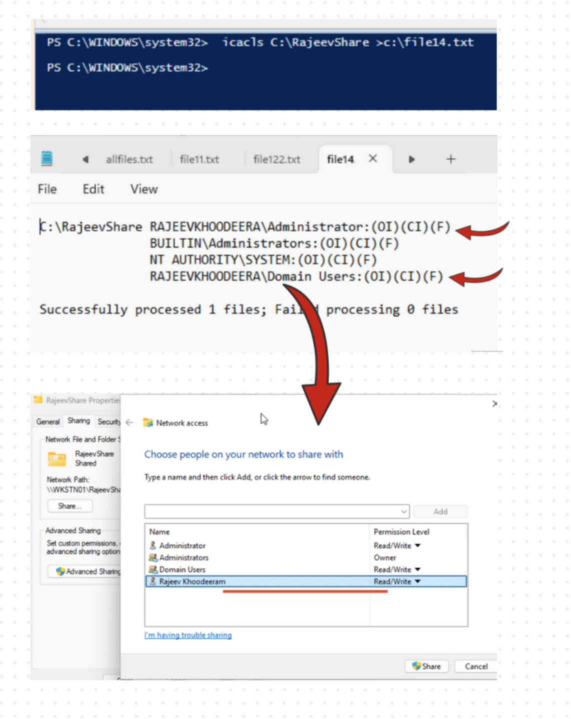
```
PS C:\WINDOWS\system32> Gwmi win32_product >c:\file12.txt
PS C:\WINDOWS\system32> |
```

```
Share name        RajeevShare
Path              C:\RajeevShare
Remark
Maximum users     No limit
Users
Caching           Manual caching of documents
Permission        Everyone, FULL DENY
                  BUILTIN\Administrators, FULL

The command completed successfully.
```

Figure 3.6: Showing network share in Wkstn01

3.7 icacls c:\firstnameshare >c:\file14.txt

The icacls command is used to view, modify, backup, and restore file and folder permissions (Access Control Lists, or ACLs) on Windows systems. Kindly note the flags OI (Object inherit), CI (Container Inherit), and F (full) which are used to define inheritance and permissions settings. for example F is for Full Access and OI allows files to inherit the permissions from the parent folder.



```
PS C:\WINDOWS\system32>  icacls C:\RajeevShare >c:\file14.txt
PS C:\WINDOWS\system32>
```

```
C:\RajeevShare RAJEEVKHOODEERA\Administrator:(OI)(CI)(F)
               BUILTIN\Administrators:(OI)(CI)(F)
               NT AUTHORITY\SYSTEM:(OI)(CI)(F)
               RAJEEVKHOODEERA\Domain Users:(OI)(CI)(F)

Successfully processed 1 files; Failed processing 0 files
```

Choose people on your network to share with

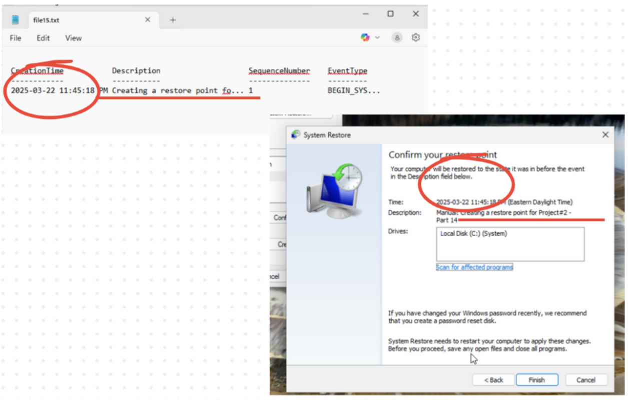
Type a name and then click Add, or click the arrow to find someone.

Name	Permission Level
Administrator	Read/Write ▾
Administrators	Owner
Domain Users	Read/Write ▾
Rajeev Khoodeeram	Read/Write ▾

Figure 3.7: Kindly note that the shared folder RajeevShare is expected to be accessible to local administrators and domain users

3.8 Get-ComputerRestorePoint >c:\file15.txt

The Get-ComputerRestorePoint cmdlet is a PowerShell command that is specifically used to retrieve information about restore points on a computer.



```
CreationTime           Description                   SequenceNumber    EventType
------------           -----------                   --------------    ---------
2025-03-22 11:45:18 PM Creating a restore point fo... 1                BEGIN_SYS...
```

System Restore

Confirm your restore point

Your computer will be restored to the state it was in before the event in the Description field below.

Time: 2025-03-22 11:45:18 PM (Eastern Daylight Time)

Description: Manual: Creating a restore point for Project#2 - Part 14

Drives: Local Disk (C:) (System)

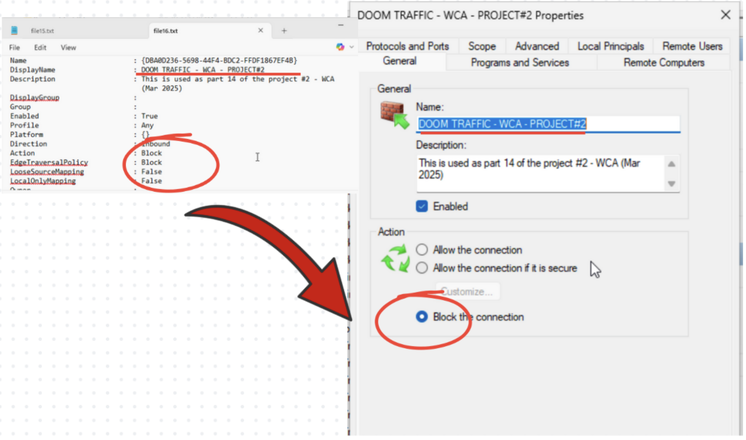
If you have changed your Windows password recently, we recommend that you create a password reset disk.

System Restore needs to restart your computer to apply these changes. Before you proceed, save any open files and close all programs.

Figure 3.8: Cross checking of the restore point created earlier (see matching date/time and Description)

3.9 Get-NetFirewallRule >c:\file16.txt.

The Get-NetFirewallRule cmdlet is used to retrieve Windows Firewall rules on a system. It allows you to view all configured inbound and outbound rules, along with their properties like action, direction, and protocol.



```
Name                  : {DBA0D236-5698-44F4-BDC2-FFDF1867EF4B}
DisplayName           : DOOM TRAFFIC - WCA - PROJECT#2
Description           : This is used as part 14 of the project #2 - WCA
                        (Mar 2025)
DisplayGroup          :
Group                 :
Enabled               : True
Profile               : Any
Platform              : {}
Direction             : Inbound
Action                : Block
EdgeTraversalPolicy   : Block
LooseSourceMapping    : False
LocalOnlyMapping      : False
```

DOOM TRAFFIC - WCA - PROJECT#2 Properties

General

Name: DOOM TRAFFIC - WCA - PROJECT#2

Description: This is used as part 14 of the project #2 - WCA (Mar 2025)

☑ Enabled

Action

○ Allow the connection

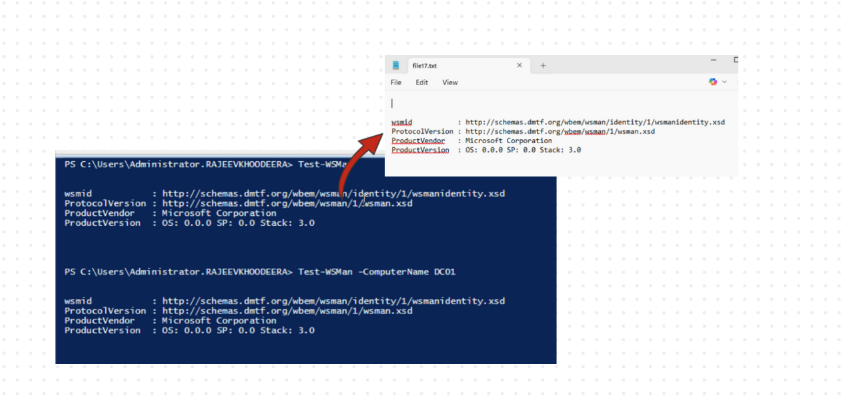
○ Allow the connection if it is secure

● Block the connection

Figure 3.9: Verification of the DOOM rule created earlier (see matching name and description)

3.10 test-wsman >c:\file17.txt

The Test-WsMan cmdlet is used to test Windows Remote Management (WinRM) connectivity on a local or remote computer. It checks whether the WinRM service is running and properly configured on the target machine.



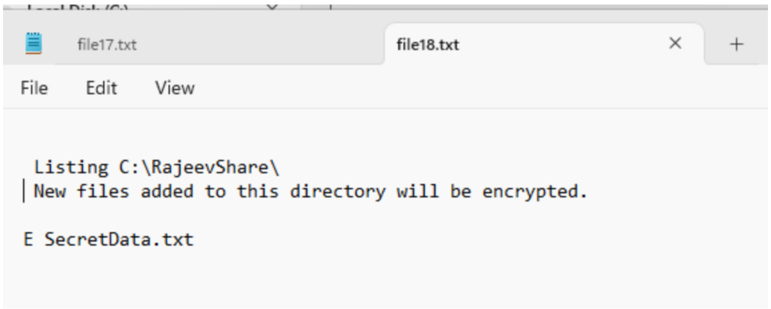
```
wsmid           : http://schemas.dmtf.org/wbem/wsman/identity/1/wsmanidentity.xsd
ProtocolVersion : http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd
ProductVendor   : Microsoft Corporation
ProductVersion  : OS: 0.0.0 SP: 0.0 Stack: 3.0
```

```
PS C:\Users\Administrator.RAJEEVKHOODEERA> Test-WSMa

wsmid           : http://schemas.dmtf.org/wbem/wsman/identity/1/wsmanidentity.xsd
ProtocolVersion : http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd
ProductVendor   : Microsoft Corporation
ProductVersion  : OS: 0.0.0 SP: 0.0 Stack: 3.0


PS C:\Users\Administrator.RAJEEVKHOODEERA> Test-WSMan -ComputerName DC01

wsmid           : http://schemas.dmtf.org/wbem/wsman/identity/1/wsmanidentity.xsd
ProtocolVersion : http://schemas.dmtf.org/wbem/wsman/1/wsman.xsd
ProductVendor   : Microsoft Corporation
ProductVersion  : OS: 0.0.0 SP: 0.0 Stack: 3.0
```

Figure 3.10: Testing Remote Management Connectivity

3.11 cipher c:\firstnameshare\SecretData.txt >c:\file18.txt

The cipher command is used in Windows to manage encryption on files and directories, particularly with the Encrypting File System (EFS).

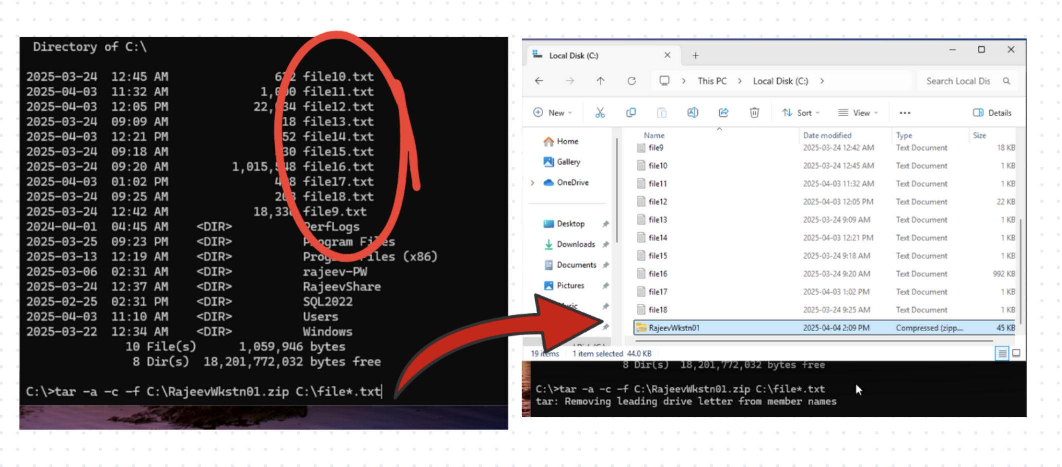


```
 Listing C:\RajeevShare\
 New files added to this directory will be encrypted.

E SecretData.txt
```

Figure 3.11: Checking encryption status of SecretData.txt ('E' prefixing the filename means Encrypted)

3.12 tar –a –c –f c:\yournameWkstn01.zip c:\file*.txt

The tar command is typically used for archiving files and directories in Unix-based operating systems but has been integrated also in Windows. It stands for "tape archive" and is used to create, extract, and manage compressed archives.
In this case, we are compressing all the files (*) into rajeevWkstn01.zip (which is bundled as part of the project submission).



```
 Directory of C:\

2025-03-24  12:45 AM               6 2 file10.txt
2025-04-03  11:32 AM             1, 00 file11.txt
2025-04-03  12:05 PM            22, 34 file12.txt
2025-03-24  09:09 AM               18 file13.txt
2025-04-03  12:21 PM               52 file14.txt
2025-03-24  09:18 AM               30 file15.txt
2025-03-24  09:20 AM         1,015, 48 file16.txt
2025-04-03  01:02 PM               4 8 file17.txt
2025-03-24  09:25 AM               20  file18.txt
2025-03-24  12:42 AM            18,33  file9.txt
2024-04-01  04:45 AM    <DIR>          PerfLogs
2025-03-25  09:23 PM    <DIR>          Program Files
2025-03-13  12:19 AM    <DIR>          Program Files (x86)
2025-03-06  02:31 AM    <DIR>          rajeev-PW
2025-03-24  12:37 AM    <DIR>          RajeevShare
2025-02-25  02:31 PM    <DIR>          SQL2022
2025-04-03  11:10 AM    <DIR>          Users
2025-03-22  12:34 AM    <DIR>          Windows
              10 File(s)      1,059,946 bytes
               8 Dir(s)  18,201,772,032 bytes free

C:\>tar -a -c -f C:\RajeevWkstn01.zip C:\file*.txt
```

Name	Date modified	Type	Size
file9	2025-03-24 12:42 AM	Text Document	18 KB
file10	2025-03-24 12:45 AM	Text Document	1 KB
file11	2025-04-03 11:32 AM	Text Document	1 KB
file12	2025-04-03 12:05 PM	Text Document	22 KB
file13	2025-03-24 9:09 AM	Text Document	1 KB
file14	2025-04-03 12:21 PM	Text Document	1 KB
file15	2025-03-24 9:18 AM	Text Document	1 KB
file16	2025-03-24 9:20 AM	Text Document	992 KB
file17	2025-04-03 1:02 PM	Text Document	1 KB
file18	2025-03-24 9:25 AM	Text Document	1 KB
RajeevWkstn01	2025-04-04 2:09 PM	Compressed (zipp...	45 KB

19 items   1 item selected 44.0 KB

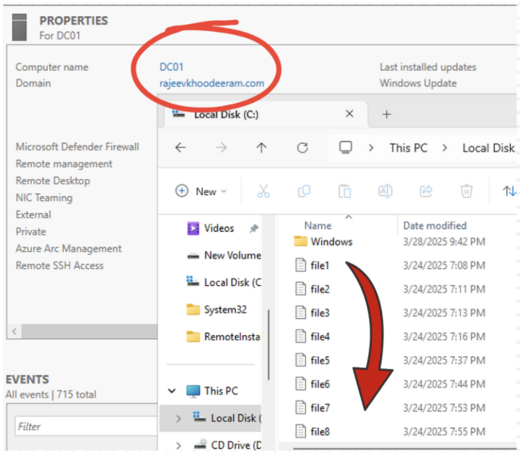
```
               8 Dir(s)  18,201,772,032 bytes free

C:\>tar -a -c -f C:\RajeevWkstn01.zip C:\file*.txt
tar: Removing leading drive letter from member names
```

Figure 3.12: Compressing all files which starts with file* into the zipped file RajeevWkstn01.zip

Step 16 : PowerShell - Server (DC01) PART 4

4.1 Target : Log in to your DC01 virtual machine, open PowerShell as Administrator and run the following commands:

1. gpresult /r /z >c:\file1.txt
2. Get-TimeZone >c:\file2.txt
3. Get-NetFirewallProfile >c:\file3.txt
4. Get-NetIPConfiguration >c:\file4.txt
5. Get-DhcpServerv4Scope >c:\file5.txt
6. Get-WdsBootImage >c:\file6.txt
7. Get-WdsInstallImage >c:\file7.txt
8. Get-ADOrganizationalUnit >c:\file8.txt
9. tar –a –c –f c:\yournameDC01.zip c:\file*.txt



PROPERTIES
For DC01

Computer name DC01
Domain rajeevkhoodeeram.com

Last installed updates Windows Update

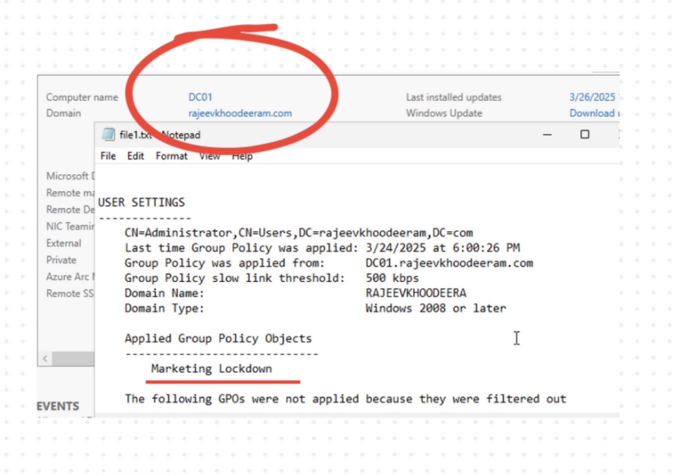
Name	Date modified
Windows	3/28/2025 9:42 PM
file1	3/24/2025 7:08 PM
file2	3/24/2025 7:11 PM
file3	3/24/2025 7:13 PM
file4	3/24/2025 7:16 PM
file5	3/24/2025 7:37 PM
file6	3/24/2025 7:44 PM
file7	3/24/2025 7:53 PM
file8	3/24/2025 7:55 PM

EVENTS
All events | 715 total

Figure 4.1: All files generated for this section

4.2 gpresult /r /z >c:\file1.txt

The gpresult command in Windows is used to display Group Policy information for a system or a user. It helps to diagnose and view the Group Policy settings applied to a computer or user, and it can be useful for troubleshooting Group Policy issues.

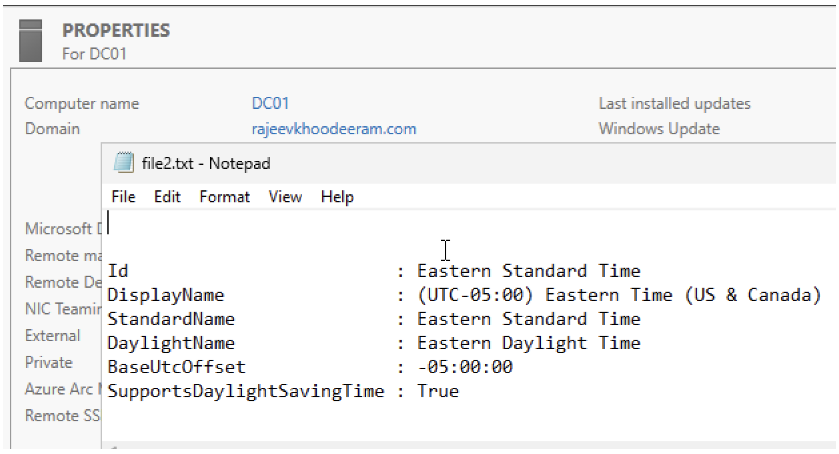


Computer name DC01
Domain rajeevkhoodeeram.com
Last installed updates 3/26/2025
Windows Update Download

```
USER SETTINGS
--------------
    CN=Administrator,CN=Users,DC=rajeevkhoodeeram,DC=com
    Last time Group Policy was applied: 3/24/2025 at 6:00:26 PM
    Group Policy was applied from:      DC01.rajeevkhoodeeram.com
    Group Policy slow link threshold:   500 kbps
    Domain Name:                        RAJEEVKHOODEERA
    Domain Type:                        Windows 2008 or later

    Applied Group Policy Objects
    -----------------------------
        Marketing Lockdown

    The following GPOs were not applied because they were filtered out
```

Figure 4.2: Getting the group policy of the server or PDC (see extract for the Marketing Lockdown policy)

4.3 Get-TimeZone >c:\file2.txt



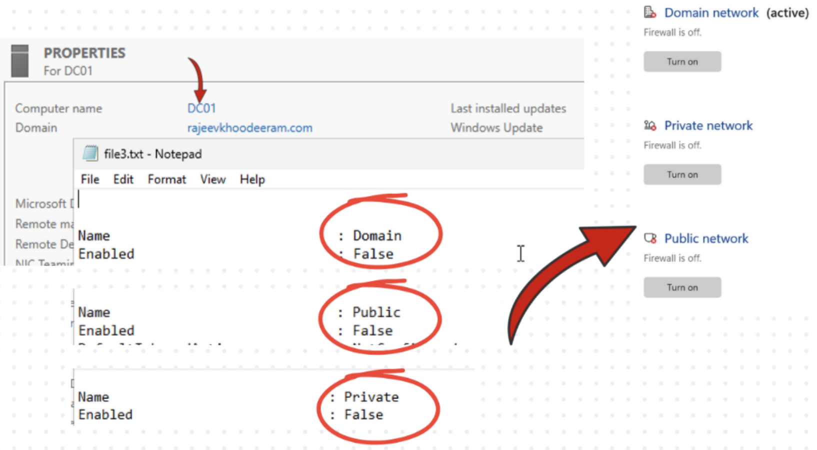
Computer name DC01
Domain rajeevkhoodeeram.com
Last installed updates
Windows Update

```
Id                         : Eastern Standard Time
DisplayName                : (UTC-05:00) Eastern Time (US & Canada)
StandardName               : Eastern Standard Time
DaylightName               : Eastern Daylight Time
BaseUtcOffset              : -05:00:00
SupportsDaylightSavingTime : True
```

Figure 4.3: Checking Time/Zone Settings for the server DC01

4.4 Get-NetFirewallProfile >c:\file3.txt

The Get-NetFirewallProfile command in PowerShell is used to retrieve the Firewall profile settings in Windows. It allows you to view the current configuration of the Windows Firewall on your computer, including whether the firewall is enabled or disabled for the different network profiles: Domain, Private, and Public.

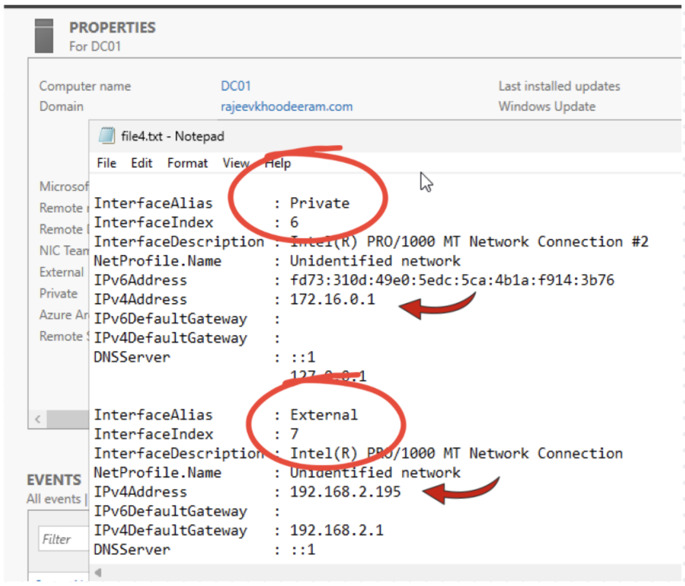


```
Name                  : Domain
Enabled               : False

Name                  : Public
Enabled               : False

Name                  : Private
Enabled               : False
```

Figure 4.4: Firewall settings for network profiles : Domain, Private and Public

4.5 Get-NetIPConfiguration >c:\file4.txt

This cmdlet is used to get information about the IP configuration of network adapters on the local machine. It displays details such as the IPv4 and IPv6 addresses, subnet masks, default gateways, and DNS servers for each network interface.

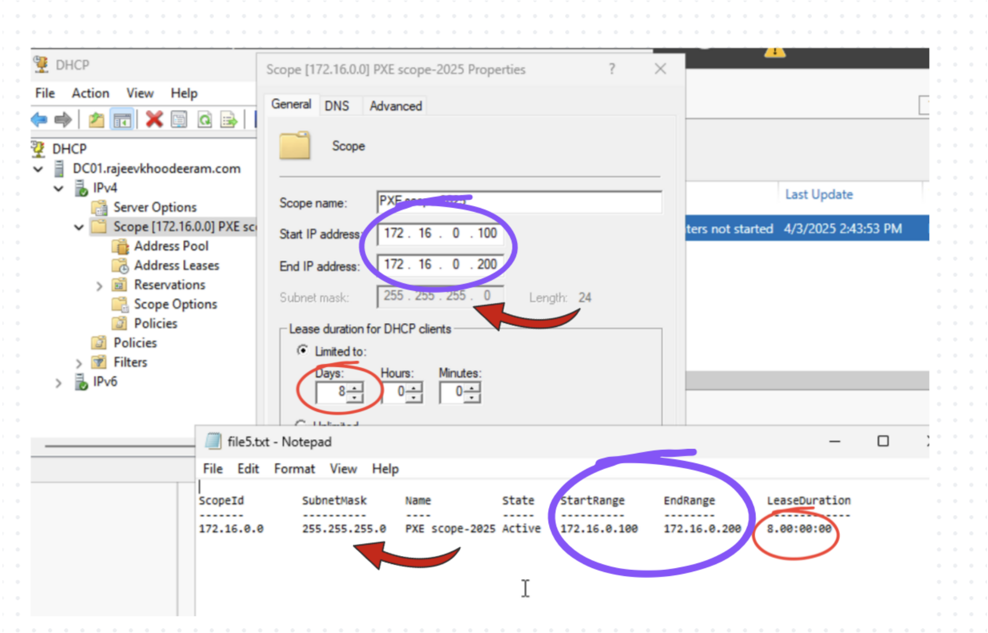


```
InterfaceAlias       : Private
InterfaceIndex       : 6
InterfaceDescription : Intel(R) PRO/1000 MT Network Connection #2
NetProfile.Name      : Unidentified network
IPv6Address          : fd73:310d:49e0:5edc:5ca:4b1a:f914:3b76
IPv4Address          : 172.16.0.1
IPv6DefaultGateway   :
IPv4DefaultGateway   :
DNSServer            : ::1
                       127.0.0.1

InterfaceAlias       : External
InterfaceIndex       : 7
InterfaceDescription : Intel(R) PRO/1000 MT Network Connection
NetProfile.Name      : Unidentified network
IPv4Address          : 192.168.2.195
IPv6DefaultGateway   :
IPv4DefaultGateway   : 192.168.2.1
DNSServer            : ::1
```

Figure 4.5: Getting details of the network interfaces on the server, DC01

4.6 Get-DhcpServerv4Scope >c:\file5.txt

The Get-DhcpServerv4Scope PowerShell cmdlet is used to retrieve information about IPv4 DHCP scopes on a Windows DHCP Server. It helps administrators manage DHCP configurations by displaying details such as the scope ID, subnet mask, name, lease duration, and address range.



Scope name: PXE

Start IP address: 172 . 16 . 0 . 100

End IP address: 172 . 16 . 0 . 200

Subnet mask: 255 . 255 . 255 . 0 Length: 24

Lease duration for DHCP clients

● Limited to:

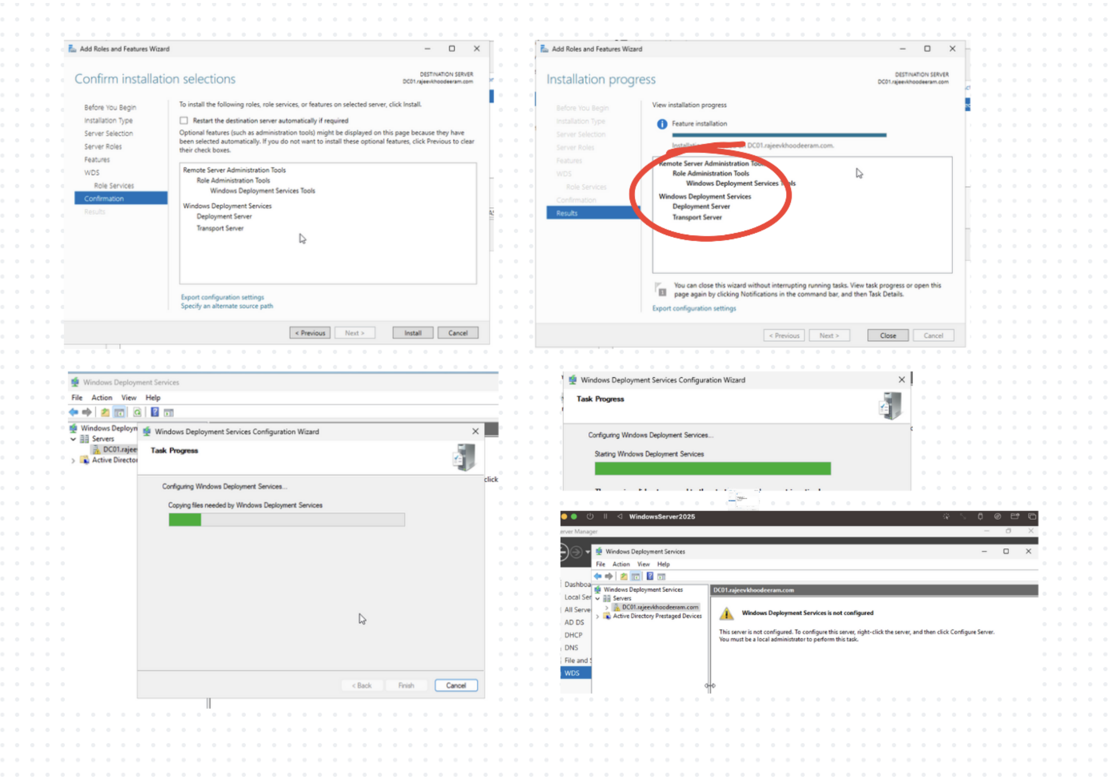
Days: 8 Hours: 0 Minutes: 0

```
ScopeId         SubnetMask      Name            State  StartRange      EndRange        LeaseDuration
-------         ----------      ----            -----  ----------      --------        -------------
172.16.0.0      255.255.255.0   PXE scope-2025 Active 172.16.0.100    172.16.0.200    8.00:00:00
```

Figure 4.6: Listing some details of the DNS and its scope

4.7 Get-WdsBootImage >c:\file6.txt

The Get-WdsBootImage cmdlet is used in Windows Deployment Services (WDS) to retrieve information about the boot images that have been added to the WDS server.



To install the following roles, role services, or features on selected server, click Install.

□ Restart the destination server automatically if required

Optional features (such as administration tools) might be displayed on this page because they have been selected automatically. If you do not want to install these optional features, click Previous to clear their check boxes.

Remote Server Administration Tools
Role Administration Tools
Windows Deployment Services Tools
Windows Deployment Services
Deployment Server
Transport Server

Export configuration settings
Specify an alternate source path
< Previous
Next >
Install
Cancel
Add Roles and Features Wizard
Installation progress
DESTINATION SERVER
DC01.rajeevkhoodeeram.com
View installation progress
Feature installation

Installation ... on DC01.rajeevkhoodeeram.com.

Remote Server Administration Tools
Role Administration Tools
Windows Deployment Services Tools
Windows Deployment Services
Deployment Server
Transport Server

You can close this wizard without interrupting running tasks. View task progress or open this page again by clicking Notifications in the command bar, and then Task Details.

Export configuration settings
< Previous
Next >
Close
Cancel
Windows Deployment Services
File
Action
View
Help
Windows Deployment Services Configuration Wizard
Task Progress

Configuring Windows Deployment Services...

Copying files needed by Windows Deployment Services

Configuring Windows Deployment Services...

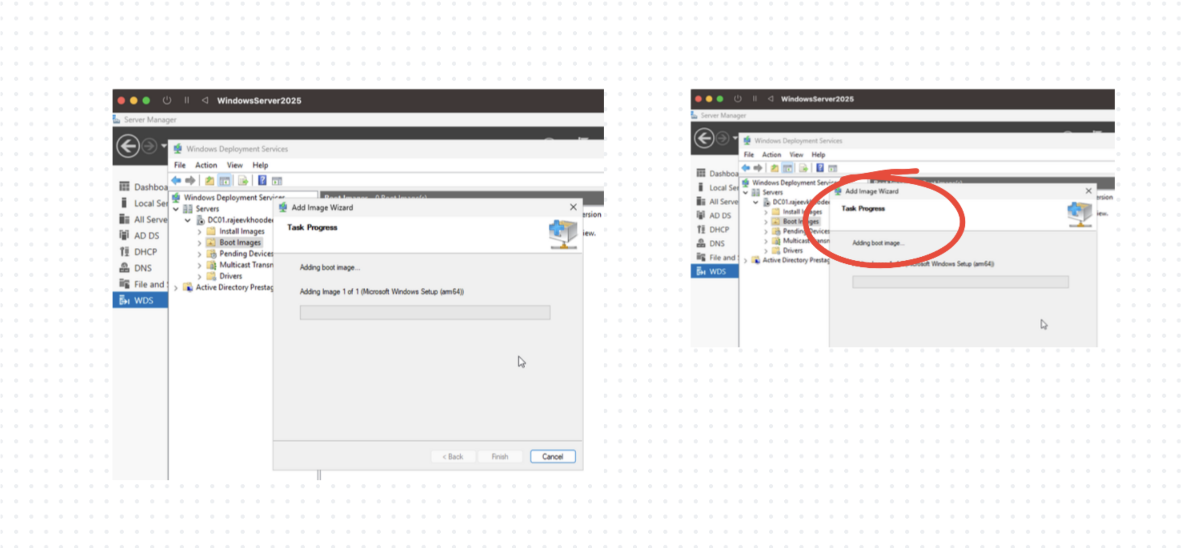
Starting Windows Deployment Services

WindowsServer2025
Server Manager
Windows Deployment Services
File
Action
View
Help
Dashboard
Local Server
All Servers
AD DS
DHCP
DNS
File and
WDS
Windows Deployment Services
Servers
DC01.rajeevkhoodeeram.com
Active Directory Prestaged Devices
DC01.rajeevkhoodeeram.com

Windows Deployment Services is not configured

This server is not configured. To configure this server, right-click the server, and then click Configure Server. You must be a local administrator to perform this task.

Figure 4.7: Installing Windows Deployment Services



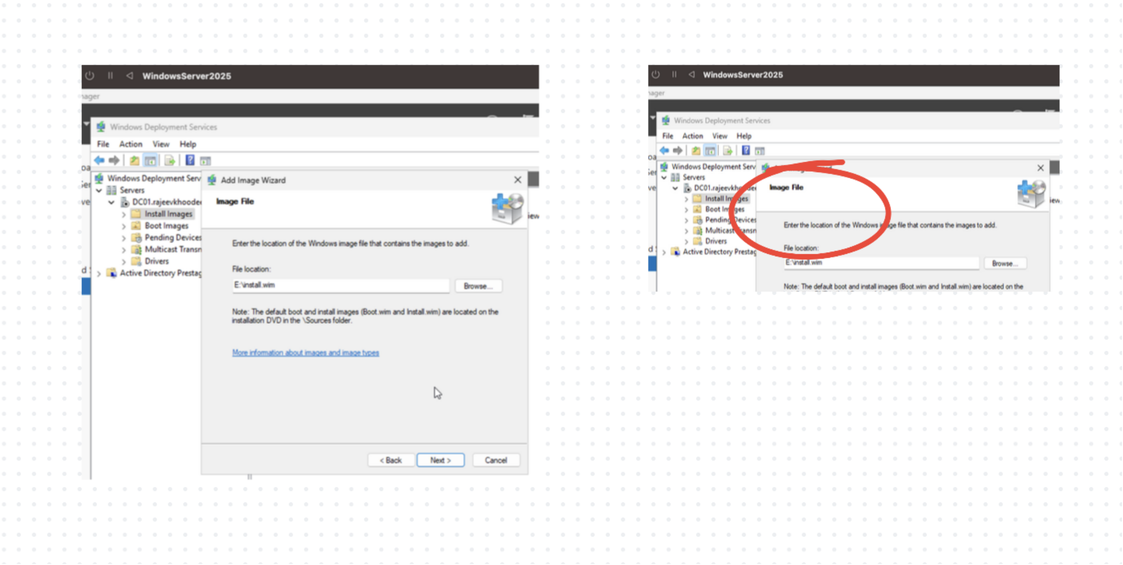
Adding boot image...

Adding Image 1 of 1 (Microsoft Windows Setup (arm64))

Figure 4.8: Configuring the boot image (RemoteInstall/boot.wim)

4.8 Get-WdsInstallImage >c:\file7.txt

The Get-WdsInstallImage cmdlet is part of the Windows Deployment Services (WDS) PowerShell module, and it retrieves information about the install images (the OS images used for installation) available on a WDS server.



Add Image Wizard

Image File

Enter the location of the Windows image file that contains the images to add.

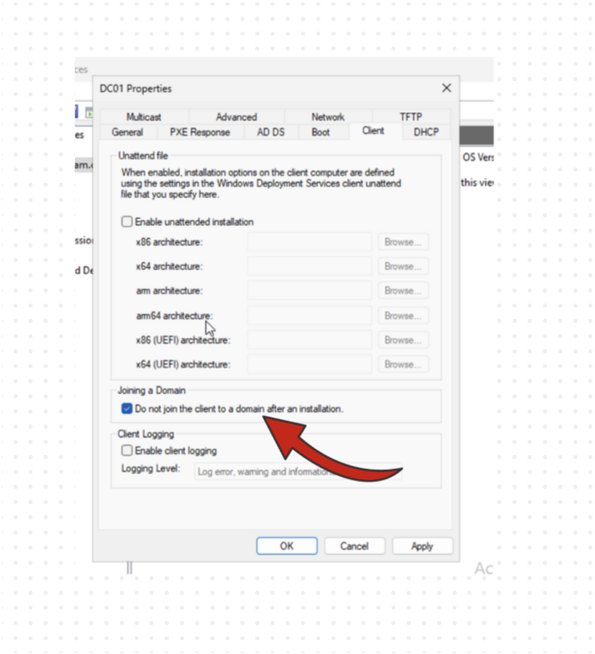
File location:

E:\install.wim

Note: The default boot and install images (Boot.wim and Install.wim) are located on the installation DVD in the \Sources folder.

More information about images and image types

Figure 4.9: Configuring the boot image (RemoteInstall/image.wim)



Unattend file

When enabled, installation options on the client computer are defined using the settings in the Windows Deployment Services client unattend file that you specify here.

□ Enable unattended installation

x86 architecture:

x64 architecture:

arm architecture:

arm64 architecture:

x86 (UEFI) architecture:

x64 (UEFI) architecture:

Joining a Domain

☑ Do not join the client to a domain after an installation.

Client Logging

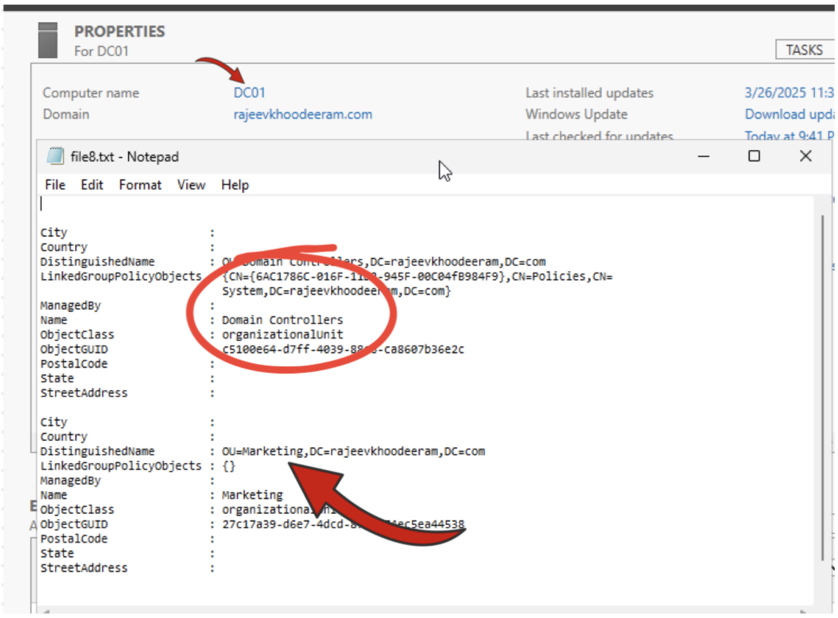
□ Enable client logging

Logging Level: Log error, warning and informatio

Figure 4.10: Client must not be installed by default on the domain

4.9 Get-ADOrganizationalUnit >c:\file8.txt

The Get-ADOrganizationalUnit cmdlet is used in PowerShell to retrieve Organizational Units (OUs) from Active Directory. OUs are containers within Active Directory used to organize and manage objects like users, groups, and computers.



PROPERTIES
For DC01

Computer name	DC01	Last installed updates	3/26/2025 11:3
Domain	rajeevkhoodeeram.com	Windows Update	Download upd
		Last checked for updates	Today at 9:41 P

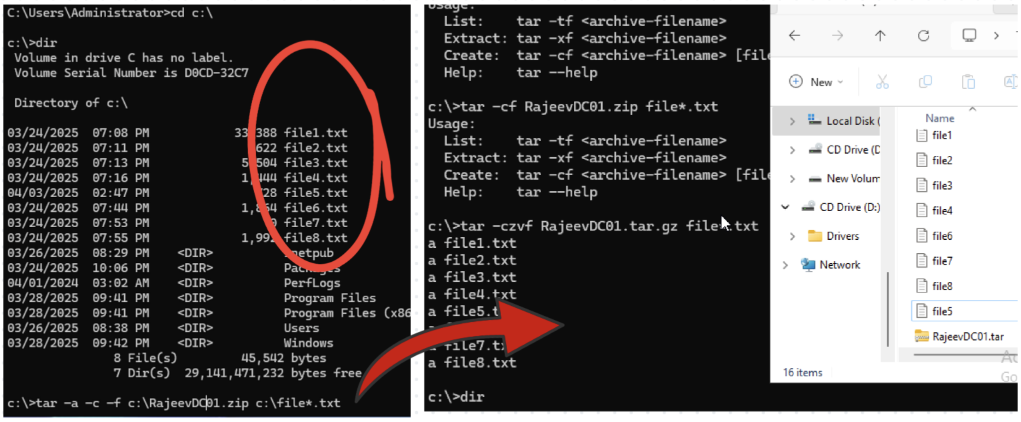
file8.txt - Notepad

```
City                      :
Country                   :
DistinguishedName         : OU=Domain Controllers,DC=rajeevkhoodeeram,DC=com
LinkedGroupPolicyObjects  : {CN={6AC1786C-016F-11 -945F-00C04fB984F9},CN=Policies,CN=
                            System,DC=rajeevkhoodee m,DC=com}
ManagedBy                 :
Name                      : Domain Controllers
ObjectClass               : organizationalUnit
ObjectGUID                : c5100e64-d7ff-4039-88 -ca8607b36e2c
PostalCode                :
State                     :
StreetAddress             :

City                      :
Country                   :
DistinguishedName         : OU=Marketing,DC=rajeevkhoodeeram,DC=com
LinkedGroupPolicyObjects  : {}
ManagedBy                 :
Name                      : Marketing
ObjectClass               : organizationalUnit
ObjectGUID                : 27c17a39-d6e7-4dcd-8 ec5ea44538
PostalCode                :
State                     :
StreetAddress             :
```

Figure 4.11: Checking the OU "Marketing" has been correctly created on DC01

4.10 tar –a –c –f c:\yournameDC01.zip c:\file*.txt

The tar command is typically used for archiving files and directories in Unix-based operating systems but has been integrated also in Windows. It stands for "tape archive" and is used to create, extract, and manage compressed archives.
In this case, we are compressing all the files (*) into rajeevDC01.zip (which is bundled as part of the project submission).



```
C:\Users\Administrator>cd c:\

c:\>dir
 Volume in drive C has no label.
 Volume Serial Number is D0CD-32C7

 Directory of c:\

03/24/2025  07:08 PM            33,388 file1.txt
03/24/2025  07:11 PM               622 file2.txt
03/24/2025  07:13 PM             5,504 file3.txt
03/24/2025  07:16 PM             1,444 file4.txt
04/03/2025  02:47 PM               728 file5.txt
03/24/2025  07:44 PM             1,854 file6.txt
03/24/2025  07:53 PM                 0 file7.txt
03/24/2025  07:55 PM             1,992 file8.txt
03/26/2025  08:29 PM    <DIR>          inetpub
03/24/2025  10:06 PM    <DIR>          Packages
04/01/2024  03:02 AM    <DIR>          PerfLogs
03/28/2025  09:41 PM    <DIR>          Program Files
03/28/2025  09:41 PM    <DIR>          Program Files (x86
03/26/2025  08:38 PM    <DIR>          Users
03/28/2025  09:42 PM    <DIR>          Windows
               8 File(s)         45,542 bytes
               7 Dir(s)  29,141,471,232 bytes free

c:\>tar -a -c -f c:\RajeevDC01.zip c:\file*.txt
```

```
Usage:
  List:    tar -tf <archive-filename>
  Extract: tar -xf <archive-filename>
  Create:  tar -cf <archive-filename> [fil
  Help:    tar --help

c:\>tar -cf RajeevDC01.zip file*.txt
Usage:
  List:    tar -tf <archive-filename>
  Extract: tar -xf <archive-filename>
  Create:  tar -cf <archive-filename> [fil
  Help:    tar --help

c:\>tar -czvf RajeevDC01.tar.gz file*.txt
a file1.txt
a file2.txt
a file3.txt
a file4.txt
a file5.t
a file6.txt
a file7.tx
a file8.txt

c:\>dir
```

Figure 4.12: Compressing all files which starts with file* into the zipped file RajeevDC01.tar

Conclusion
PART 5
5.1 Final takeaways

Completing a Windows client-server deployment requires strong planning, configuration, and automation skills, and be able to do it is a great achievement. PowerShell scripting, combined with best security practices, have allowed me to be more efficient. According to my experience from this project, regular backups, monitoring, and policy enforcement will ensure Active Directory, networking, DHCP, and DNS services run smoothly (which is critical for a network administrator).

In this project, many networking services have been successfully installed and configured which have allowed me to get a solid understanding of 3 main concepts : *networking* (IP addressing, subnets and some networking commands like ping, nslookup, etc), *client-server configuration* on domain and last, *security enforcement* through firewall and group policies. Example of services installed for this project are :

- Active Directory
- Dynamic Host Configuration (server - DHCP)
- Domain Name Server (DNS)
- Remote Server Administration Tools (RSAT)
- Windows Deployment Server (WDS)

This project has demonstrated how virtualization plays a critical role in deploying and simulating client-server administration. Whether it is for the setting up of Active Directory, DHCP, DNS, networking, or PowerShell automation, virtualization provides an efficient, cost-effective, and scalable environment for learning, testing, and deploying IT infrastructures, and prepares future IT professionals (*like us !!!*) for real-world enterprise environments. I am thankful to all friends in the group who have contributed to some way or another to the increased knowledge during this Windows Client Administration course at **tRIOS college**, and I am grateful to Mr Mohammed Ghori for his valuable guidance.

*For years, I was primarily focused on software development, but now I'm expanding my expertise into networking (**is this called getting out of your comfort zone ?**). This Diploma in CyberSecurity and Cloud Computing provides another layer of skills - I am just starting loving it, and it seems that the journey is going to be fun...*