

# Computer Networking

Created by Maria Ferrara

## OBJECTIVE

Create a client server switched local area network, with secure endpoints.

Instructions Scenario:

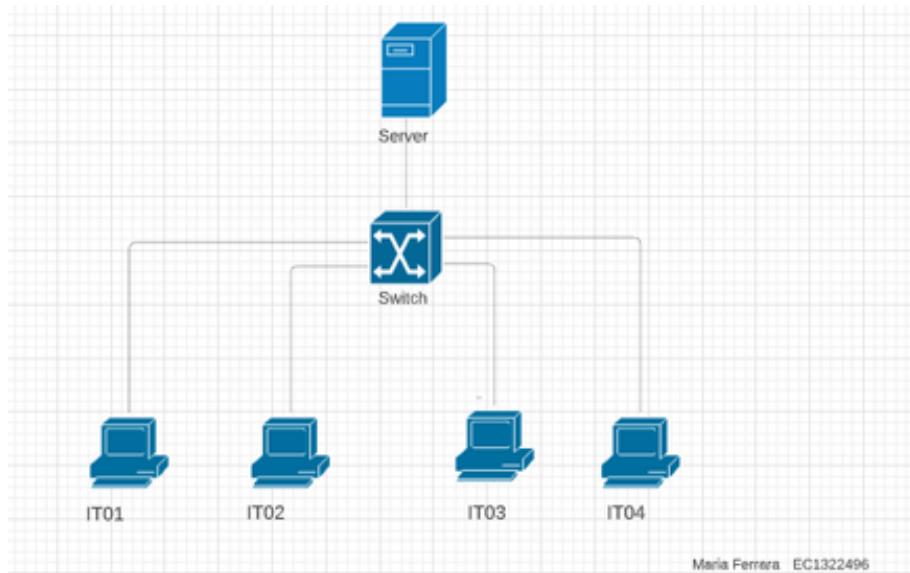
You have been tasked with the setting up and configuring of a small local area network. This network should be set up with an emphasis on securing the endpoints of the network. To comply with this requirement, you can choose any suitable network operating system.

rio:

You have been tasked with the setting up and configuring of a small local area network. This network should be set up with an emphasis on securing the endpoints of the network. To comply with this requirement, you can choose any suitable network operating system.

# Stage 1—Network Topology

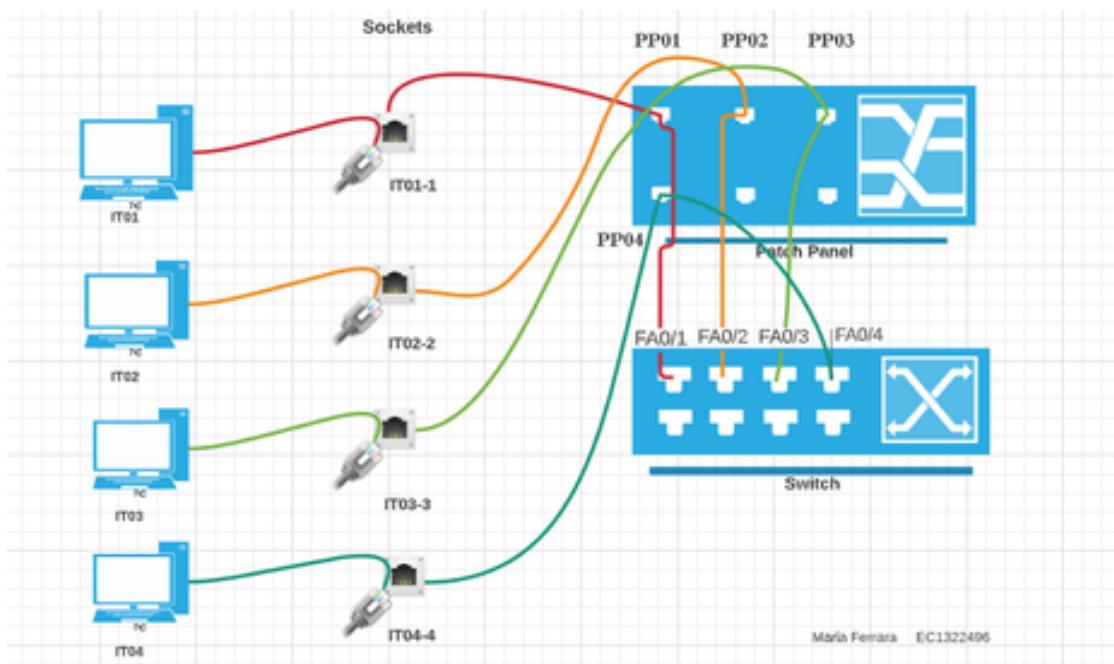
I picked a star topology as it's the most sufficient and suitable topology for this network.



*Logical diagram*

## Advantages

- This topology has a centralised management which assists in monitoring the network traffic.
- Using this topology allows adding new nodes/devices without interrupting the existing network
- If a problem occurs in nodes it won't affect the whole network and it can be troubleshooted easily.



*Physical diagram*

## Disadvantages

- It requires more cable length and it's more expensive than other topologies,
- The network relies on central devices to function if it goes down the all network won't work.

## Stage 2—Network hosts naming convention

| DEPARTMENT       | ROOM NUMBER | HOSTS NAMES/RANGE |
|------------------|-------------|-------------------|
| IT               | ROOM1       | IT01-IT224        |
| HR               | ROOM2       | HR01-HR224        |
| ADMIN            | ROOM3       | ADM01-ADMN224     |
| MANAGEMENT       | ROOM4       | MNGT01-MNGT224    |
| ACCOUNTING       | ROOM5       | ACC01-ACC1022     |
| MARKETING        | ROOM6       | MARK01-MARK2046   |
| SALES            | ROOM7       | SALES01-SALES4094 |
| CUSTOMER SERVICE | ROOM8       | CS01-CS8190       |

I decided to build a local area network for an organisation with multiple departments. I categories each department by colour, room number and added the department abbreviation as the prefix, followed by the host number.

| IT-DEPARTMENT | HOST | SOCKET NUMBER | PATCH PANEL | SWITCH PORT |
|---------------|------|---------------|-------------|-------------|
| 1             | IT01 | IT01-1        | PP01        | FA0/1       |
| 2             | IT02 | IT02-2        | PP02        | FA0/2       |
| 3             | IT03 | IT03-3        | PP03        | FA0/3       |
| 4             | IT04 | IT04-4        | PP04        | FA0/4       |
| 5             | IT05 | IT05-5        | PP05        | FA0/5       |
| 6             | IT06 | IT06-6        | PP06        | FA0/6       |
| 7             | IT07 | IT07-7        | PP07        | FA0/7       |
| 8             | IT08 | IT08-8        | PP08        | FA0/8       |
| 9             | IT09 | IT09-9        | PP09        | FA0/9       |
| 10            | IT10 | IT010-10      | PP10        | FA0/10      |

I designed the first 10 host in the subnet to show the concept for the whole network.

| Network 172.18.128.0 |                 |               |                               |                 |
|----------------------|-----------------|---------------|-------------------------------|-----------------|
| DEPARTMENT           | SUBNETS         | SUBNET MASK   | IP ADDRESSES RANGE            | AVAILABLE HOSTS |
| IT                   | 172.18.128.0/24 | 255.255.255.0 | 172.18.128.0 - 172.18.128.255 | 254             |
| HR                   | 172.18.129.0/24 | 255.255.255.0 | 172.18.129.0 - 172.18.129.255 | 254             |
| ADMIN                | 172.18.130.0/24 | 255.255.255.0 | 172.18.130.0 - 172.19.130.255 | 254             |
| MANAGEMENT           | 172.18.131.0/24 | 255.255.255.0 | 172.18.131.0 - 172.19.131.255 | 254             |
| ACCOUNTING           | 172.18.132.0/22 | 255.255.252.0 | 172.18.132.0 - 172.19.135.255 | 1022            |
| MARKETING            | 172.18.136.0/21 | 255.255.248.0 | 172.18.136.0 - 172.19.143.255 | 2046            |
| SALES                | 172.18.144.0/20 | 255.255.240.0 | 172.18.144.0 - 172.19.159.255 | 4094            |
| CUSTOMER SERVICE     | 172.18.160.0/19 | 255.255.224.0 | 172.18.160.0 - 172.19.191.255 | 8190            |
| OTHER                | 172.18.192.0/18 | 255.255.192.0 | 172.18.192.0 - 172.18.255.255 | 16382           |

### Stage 3 – Logical addressing structure for the network hosts



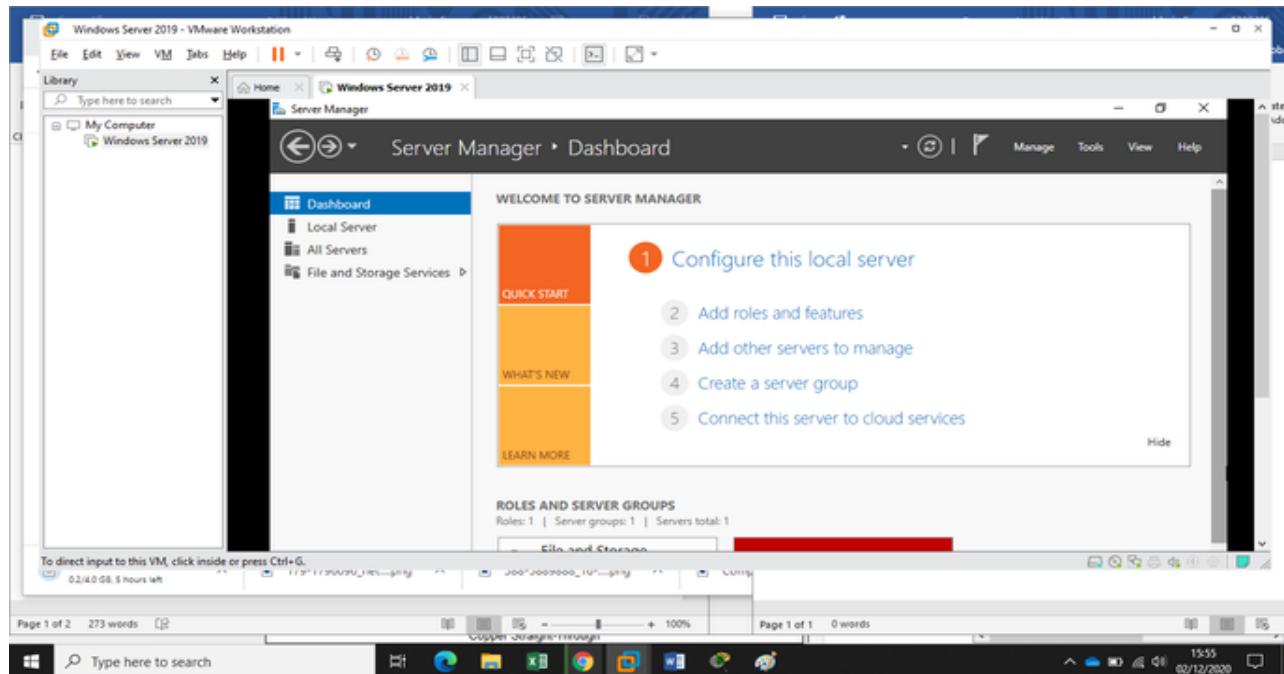
I divided the network 172.18.128.0/17 into smaller subnets to accommodate the smaller departments/rooms highlighted in the orange/yellow patterns and created bigger subnets for larger departments in green patterns. I left half of the network untouched as it can be utilised at a later date to subnet the network further. For example, to add more departments for business expansion. Shown in blue in the diagram.

| IT-DEPARTMENT | HOST  | SOCKET NUMBER | PATCH PANEL | SWITCH1 PORT | IP ADDRESSES  | SUBNET MASK   |
|---------------|-------|---------------|-------------|--------------|---------------|---------------|
| 1             | ROOM1 | IT01          | PP01        | FA0/1        | 172.18.128.20 | 255.255.255.0 |
| 2             | ROOM1 | IT02          | PP02        | FA0/2        | 172.18.128.21 | 255.255.255.0 |
| 3             | ROOM1 | IT03          | PP03        | FA0/3        | 172.18.128.22 | 255.255.255.0 |
| 4             | ROOM1 | IT04          | PP04        | FA0/4        | 172.18.128.23 | 255.255.255.0 |
| 5             | ROOM1 | IT05          | PP05        | FA0/5        | 172.18.128.24 | 255.255.255.0 |
| 6             | ROOM1 | IT06          | PP06        | FA0/6        | 172.18.128.25 | 255.255.255.0 |
| 7             | ROOM1 | IT07          | PP07        | FA0/7        | 172.18.128.26 | 255.255.255.0 |
| 8             | ROOM1 | IT08          | PP08        | FA0/8        | 172.18.128.27 | 255.255.255.0 |
| 9             | ROOM1 | IT09          | PP09        | FA0/9        | 172.18.128.28 | 255.255.255.0 |
| 10            | ROOM1 | IT10          | PP10        | FA0/10       | 172.18.128.29 | 255.255.255.0 |

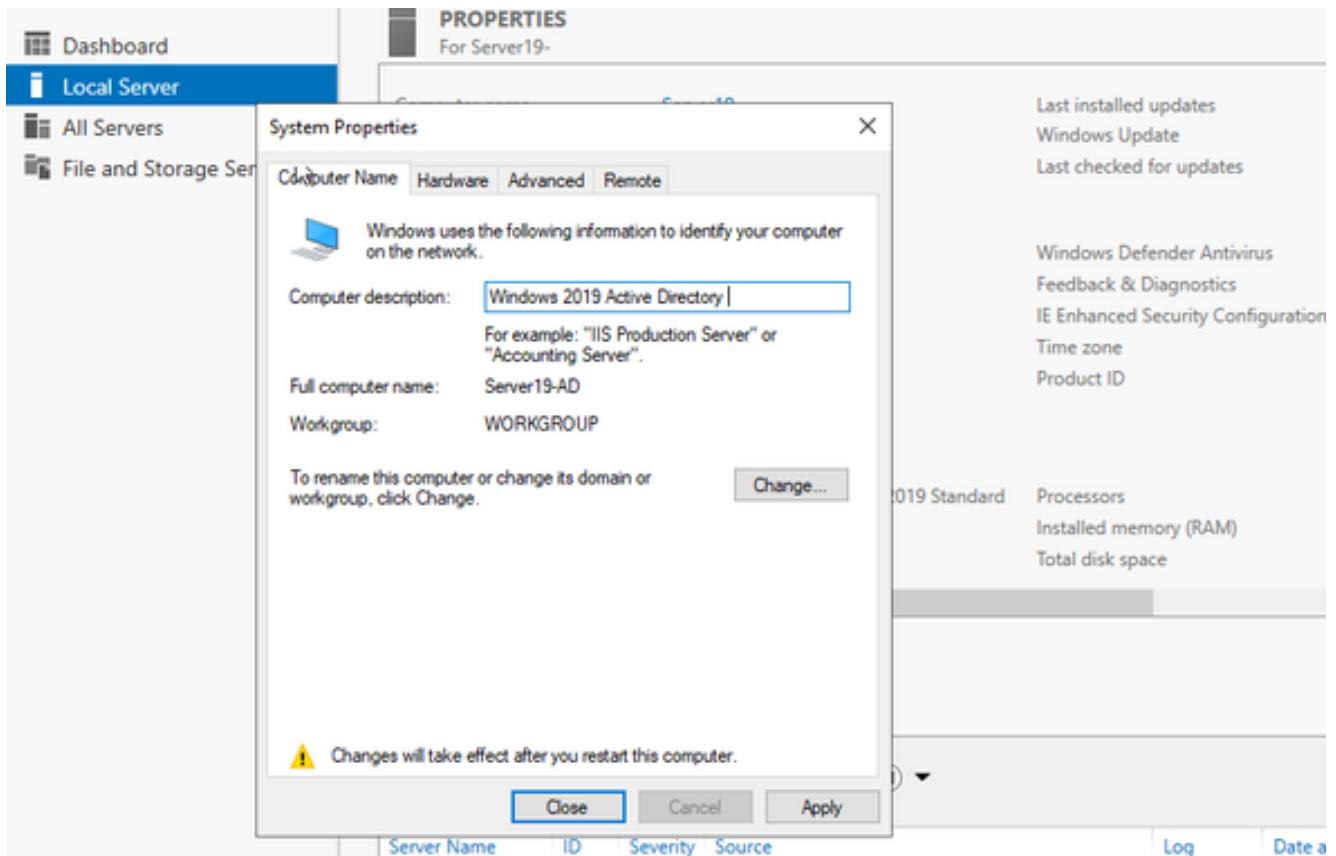
In the IT department subnet, I have reserved the first 19 addresses for static addresses so the first available IP addresses

is 172.18.128.20 up to 172.18.128.254.

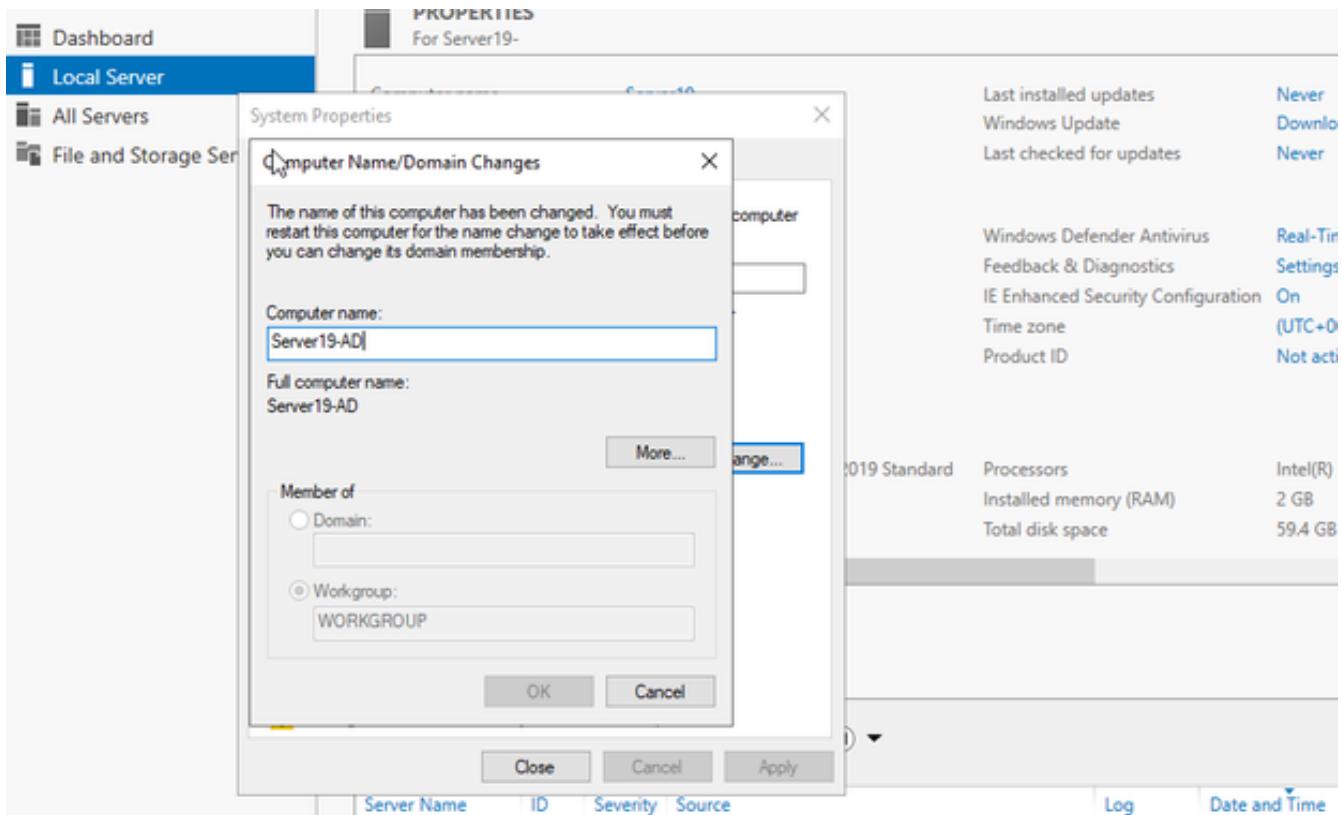
## Stage 4 – Network authentication services and name resolution



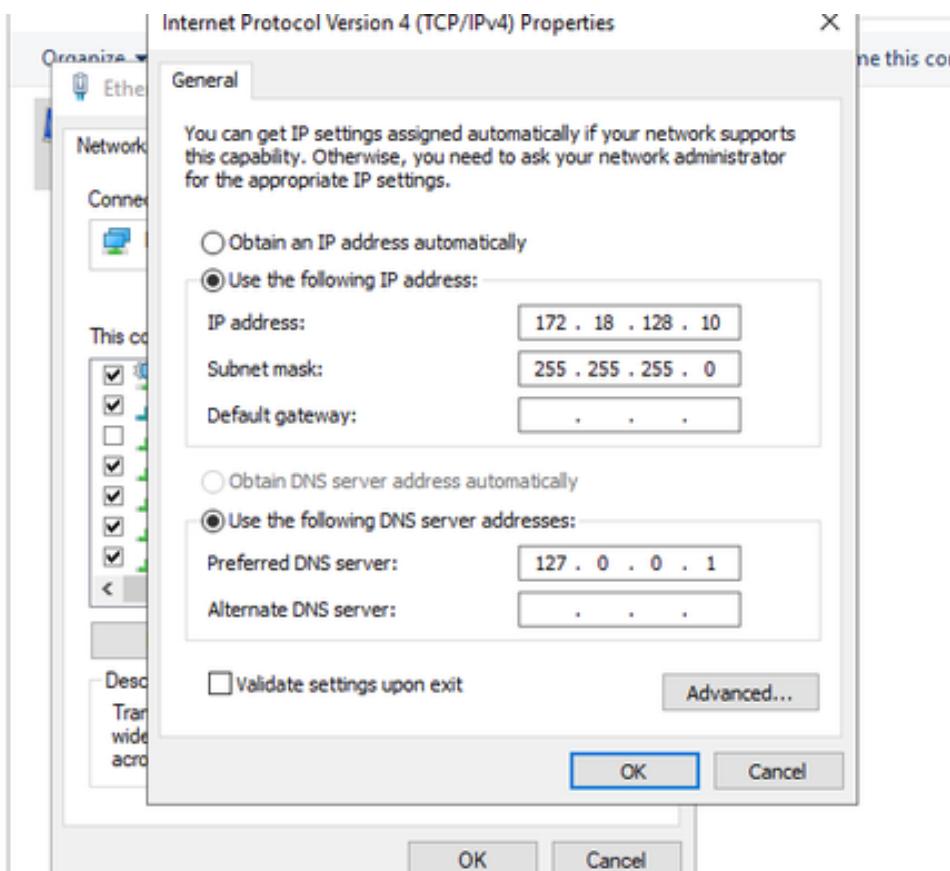
On VMWare I went to Server Manager → Dashboard



I clicked on computer name -> and added Computer description



Then I clicked "Change" -> changed server name to "Server19-AD"



After restarting VMware, I went to Network -> Settings -> Ethernet-> Change adaptor options -> right click then Properties-> Internet protocol version

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.1]
(c) 2018 Microsoft Corporation. All rights reserved.

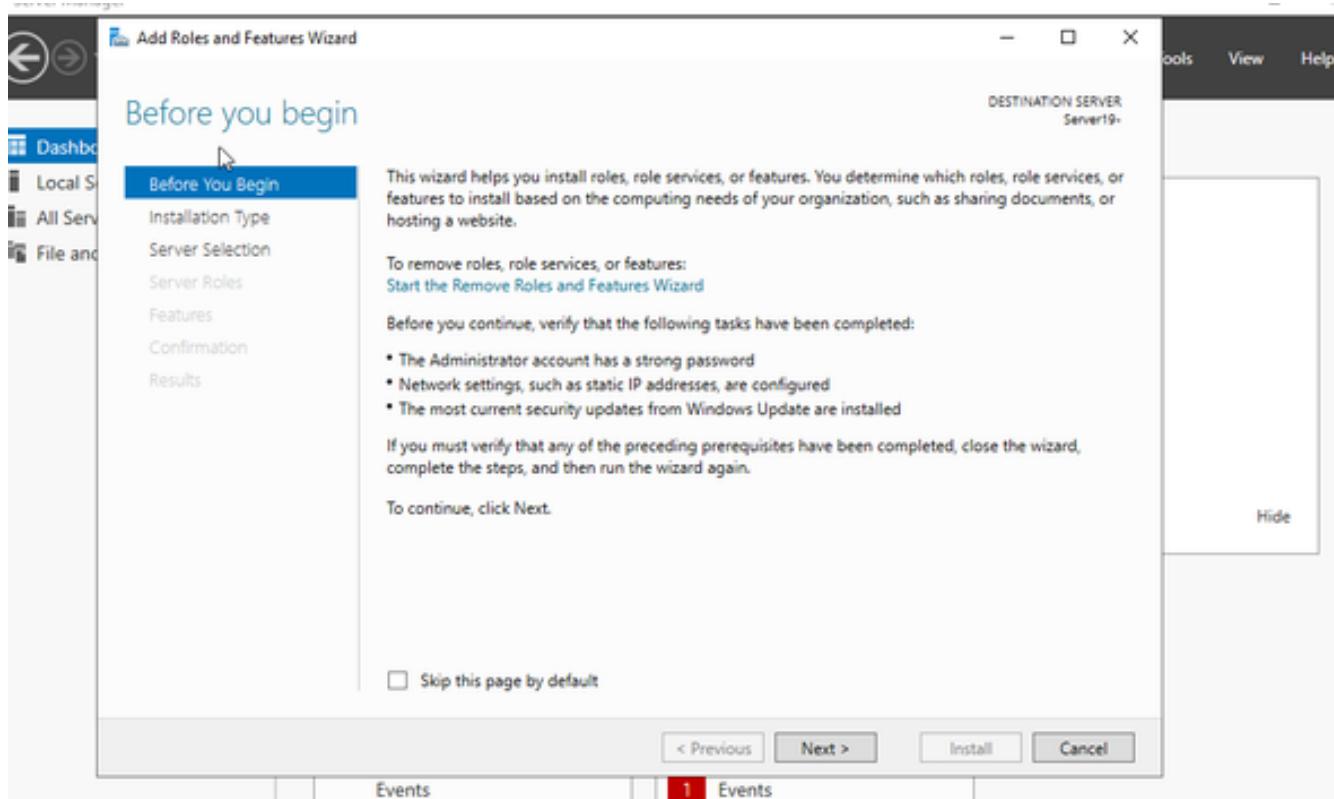
C:\Users\Administrator>ipconfig

Windows IP Configuration

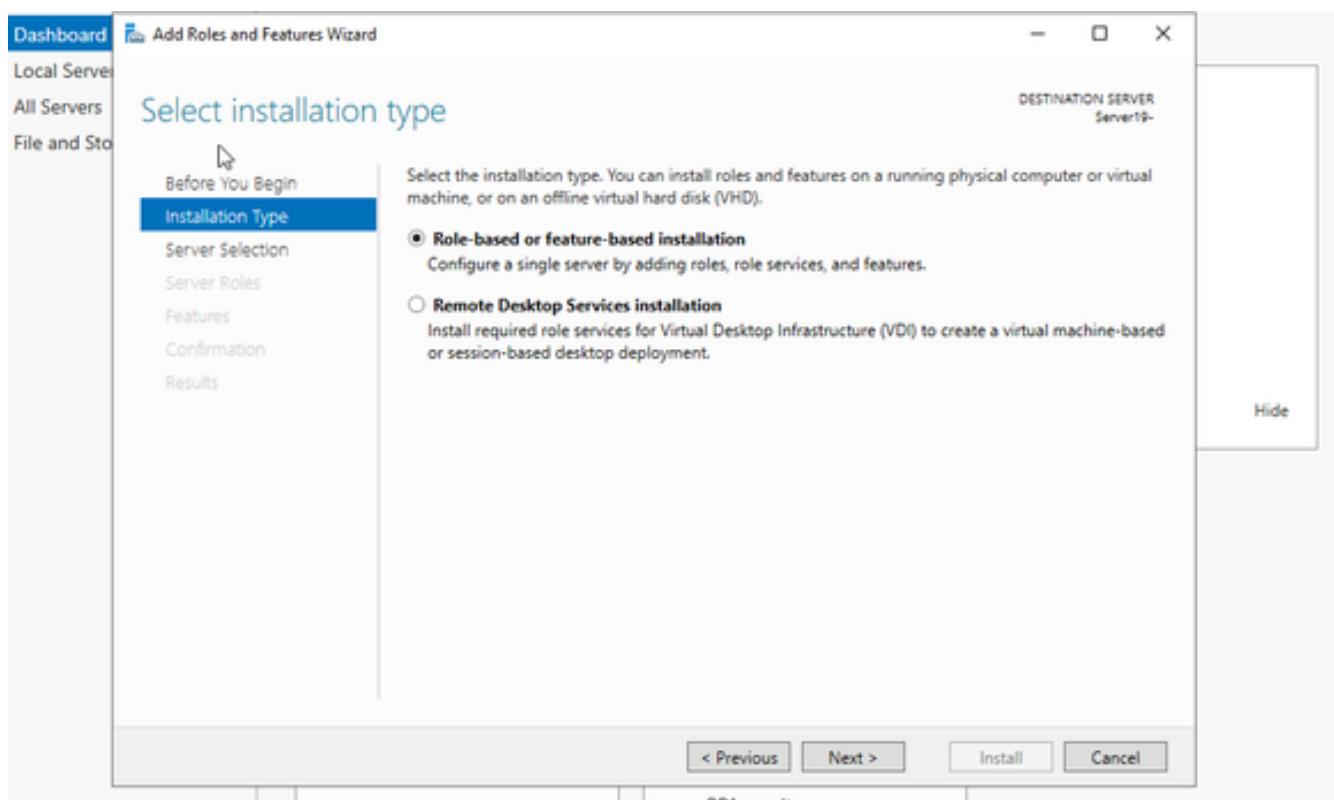
Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . . . . . fe80::711e:2737:ef4:e160%11
IPv4 Address . . . . . : 172.18.128.10
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :
```

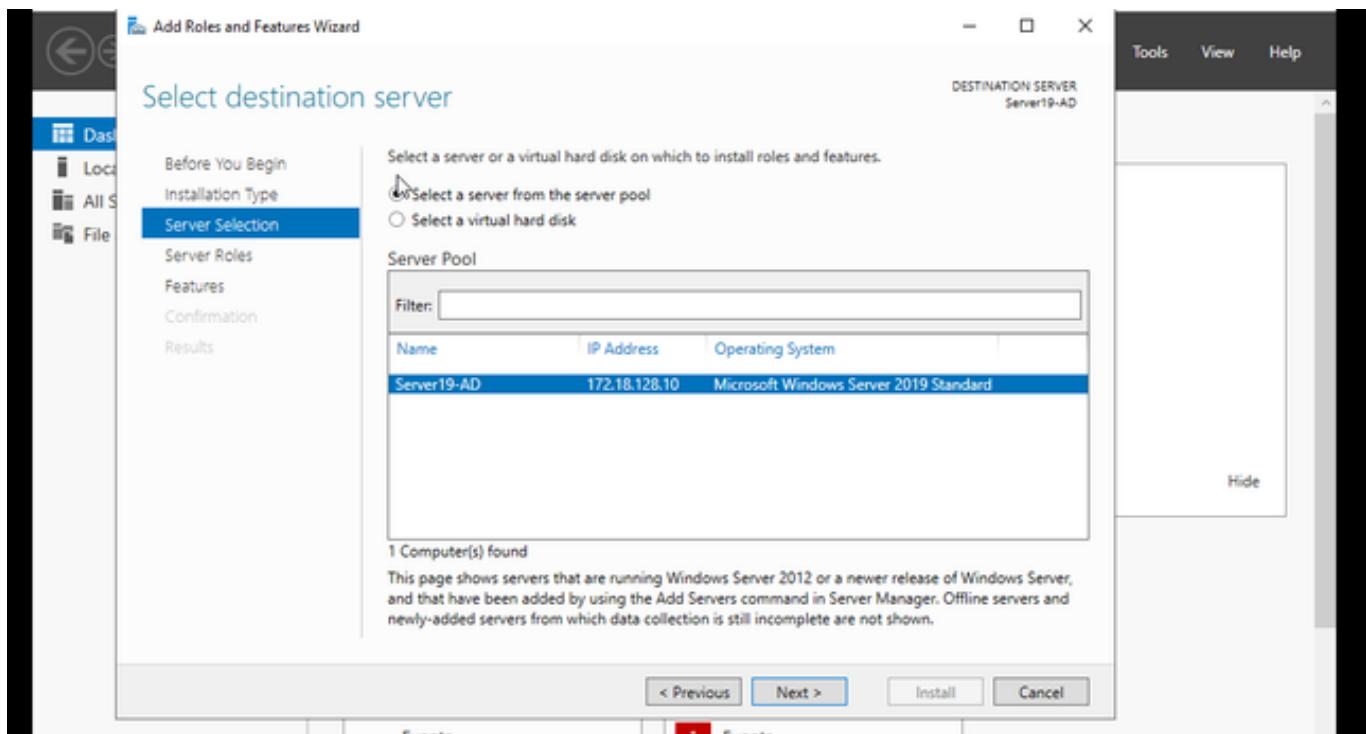
Search -> "cmd" -> "ipconfig" -> new ip address showed



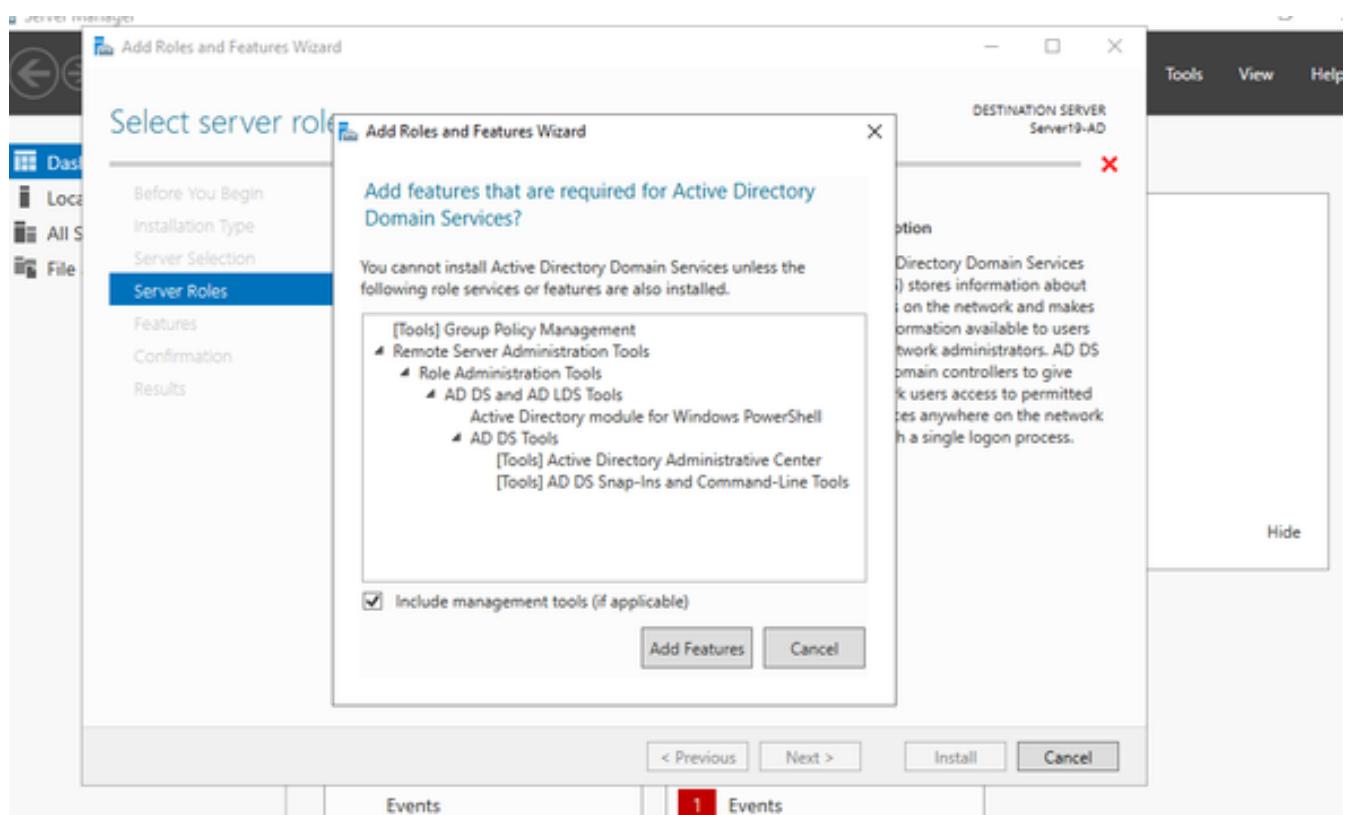
Then I clicked -> Server Manager-> Dashboard-> Add roles and features wizard -> "Next"



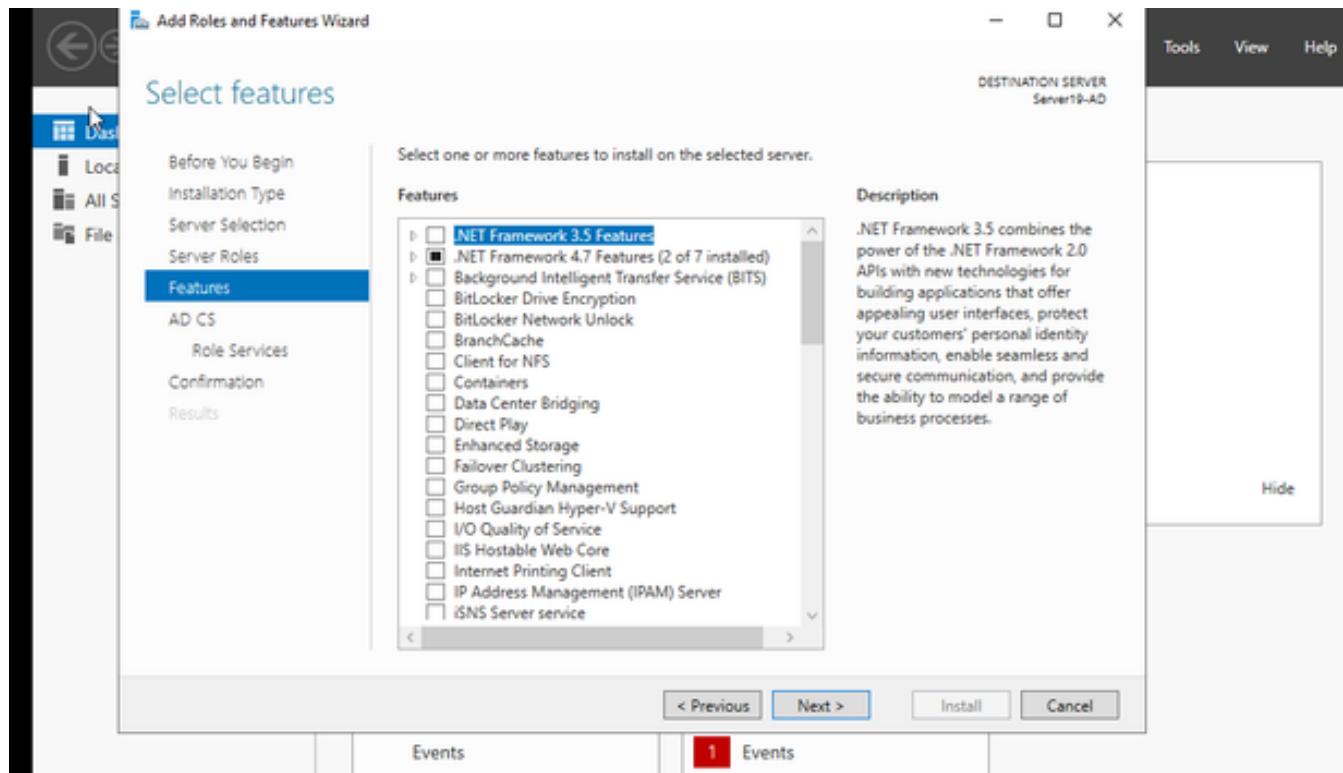
Clicked “Next” again



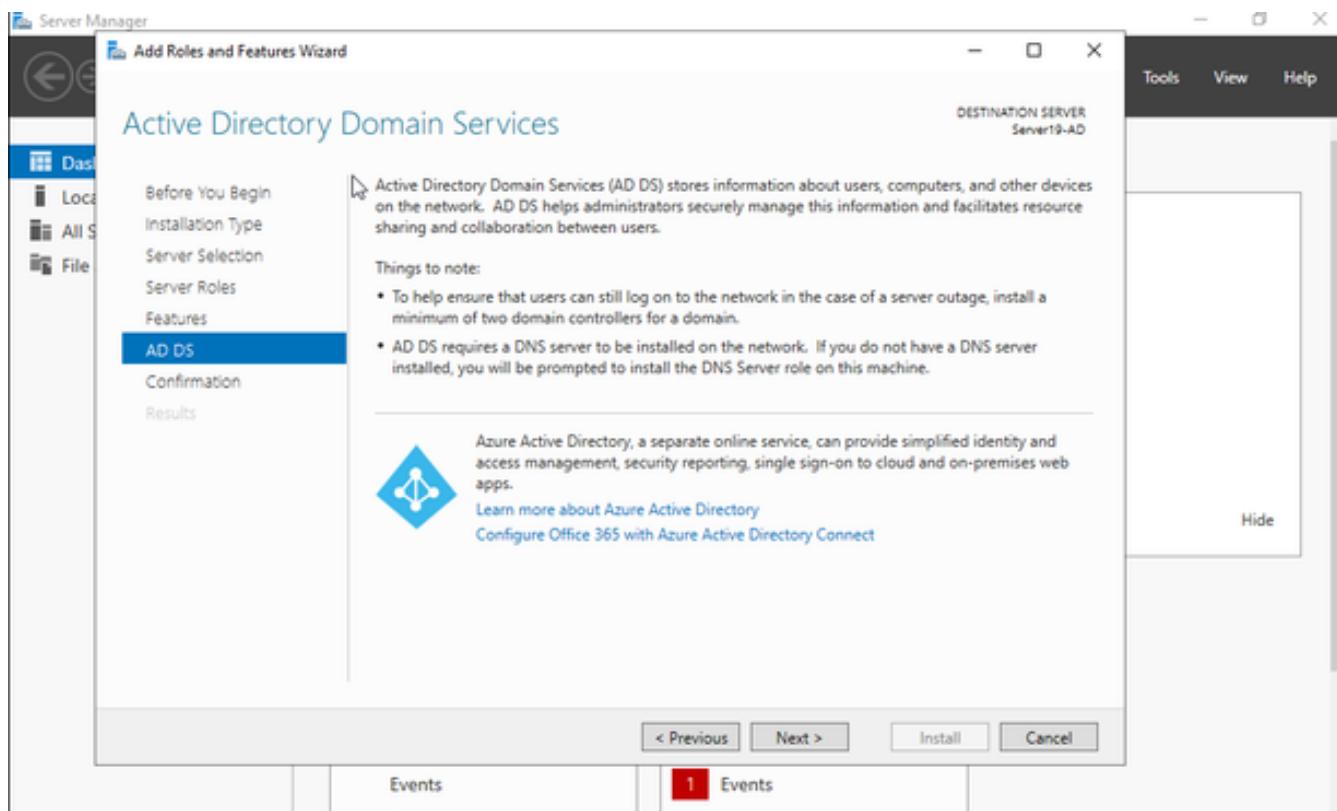
Selected “Server19-AD” from list of available servers → clicked “Next”



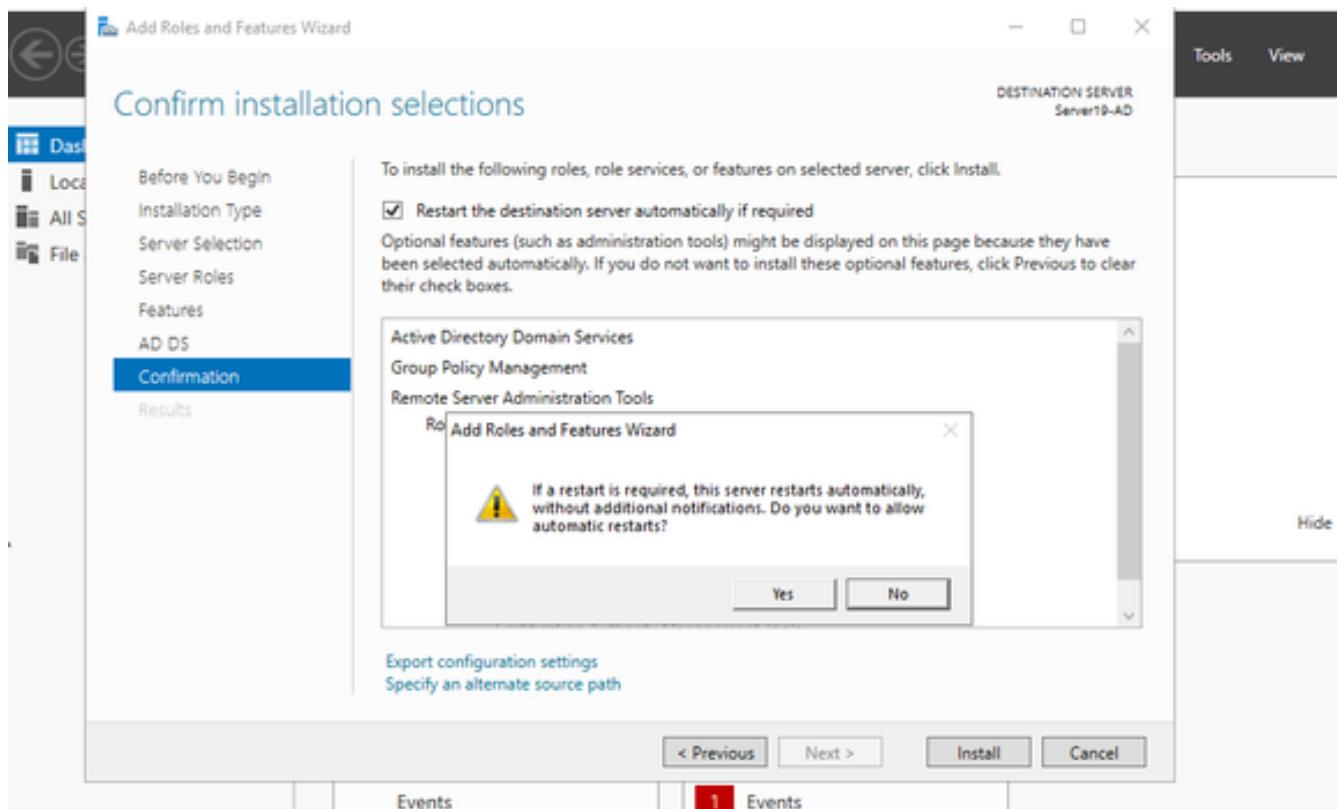
Selected “Active Directory Domain Services” → clicked “Add Features” → “Next”



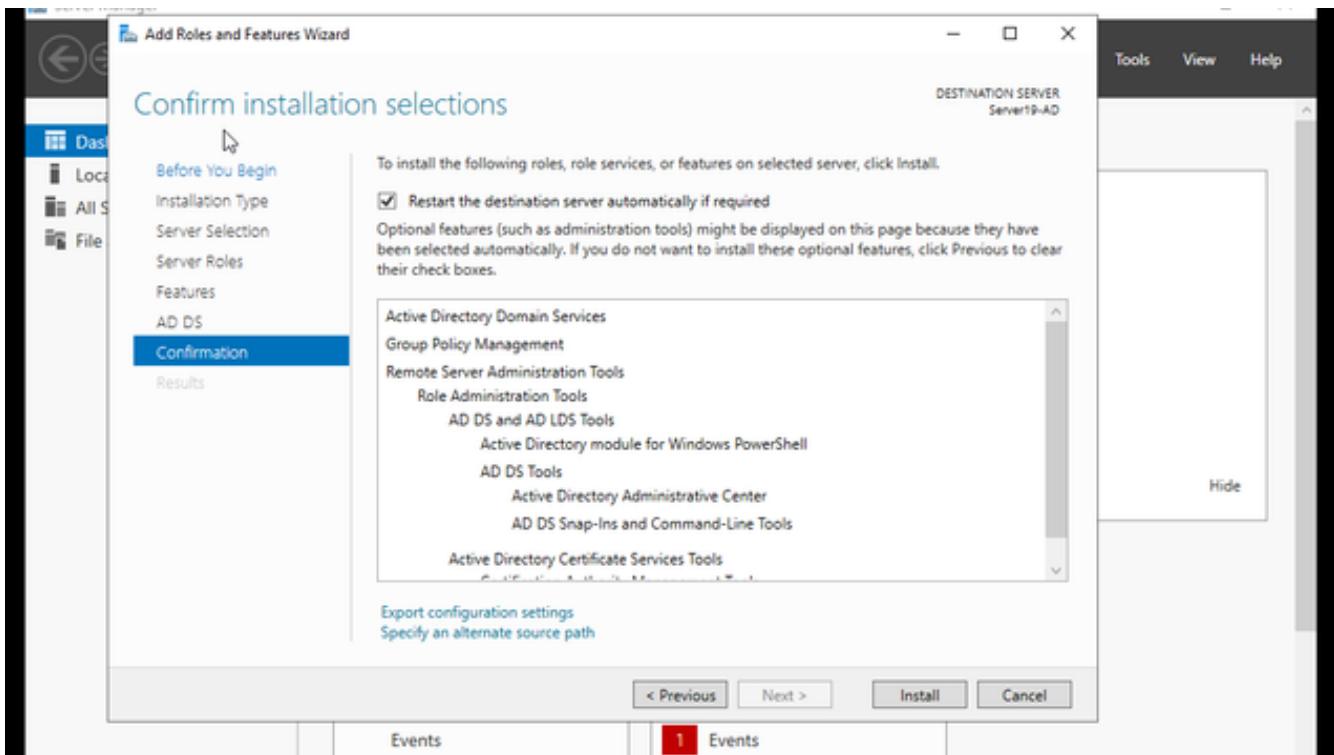
Clicked “Next”



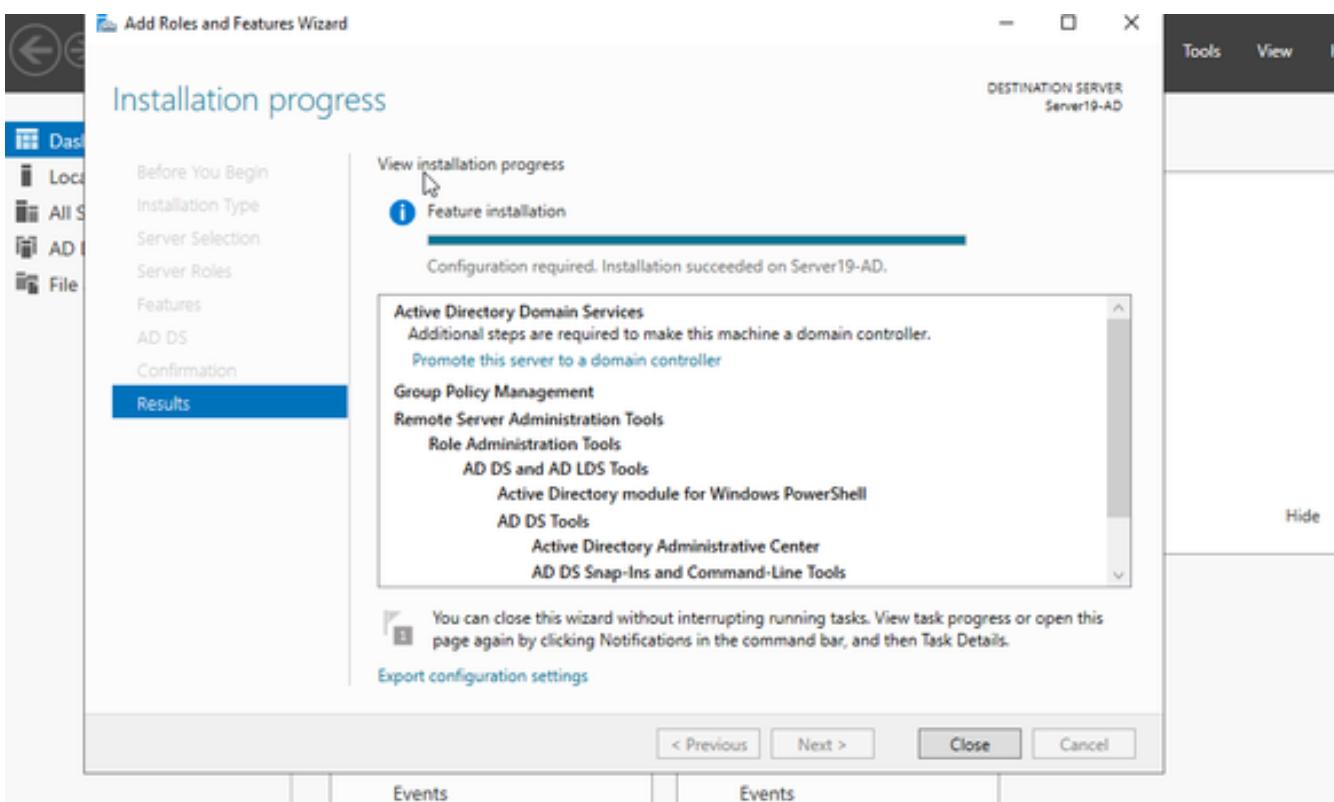
Clicked "Next" again



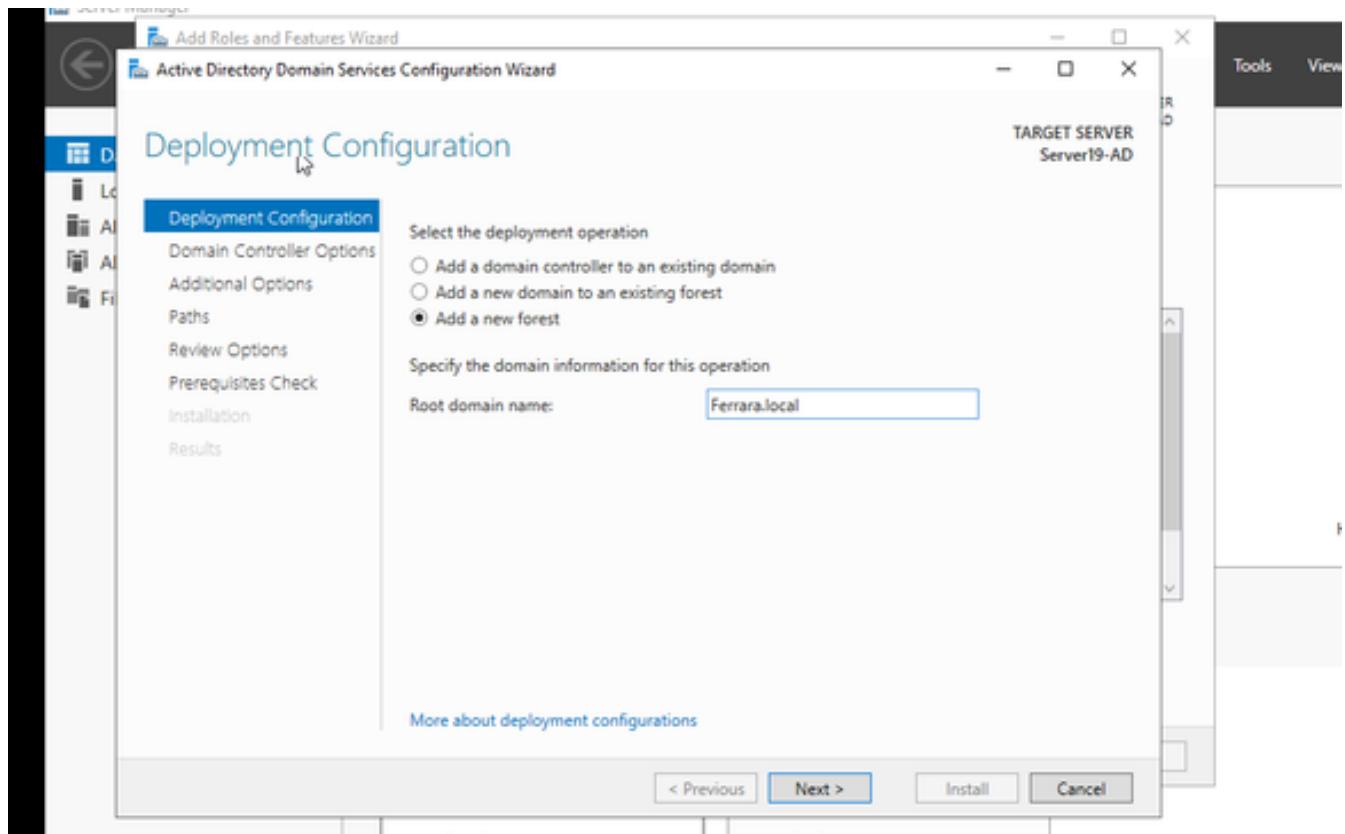
Clicked "Restart the destination server automatically if required" -> then I clicked "Yes"



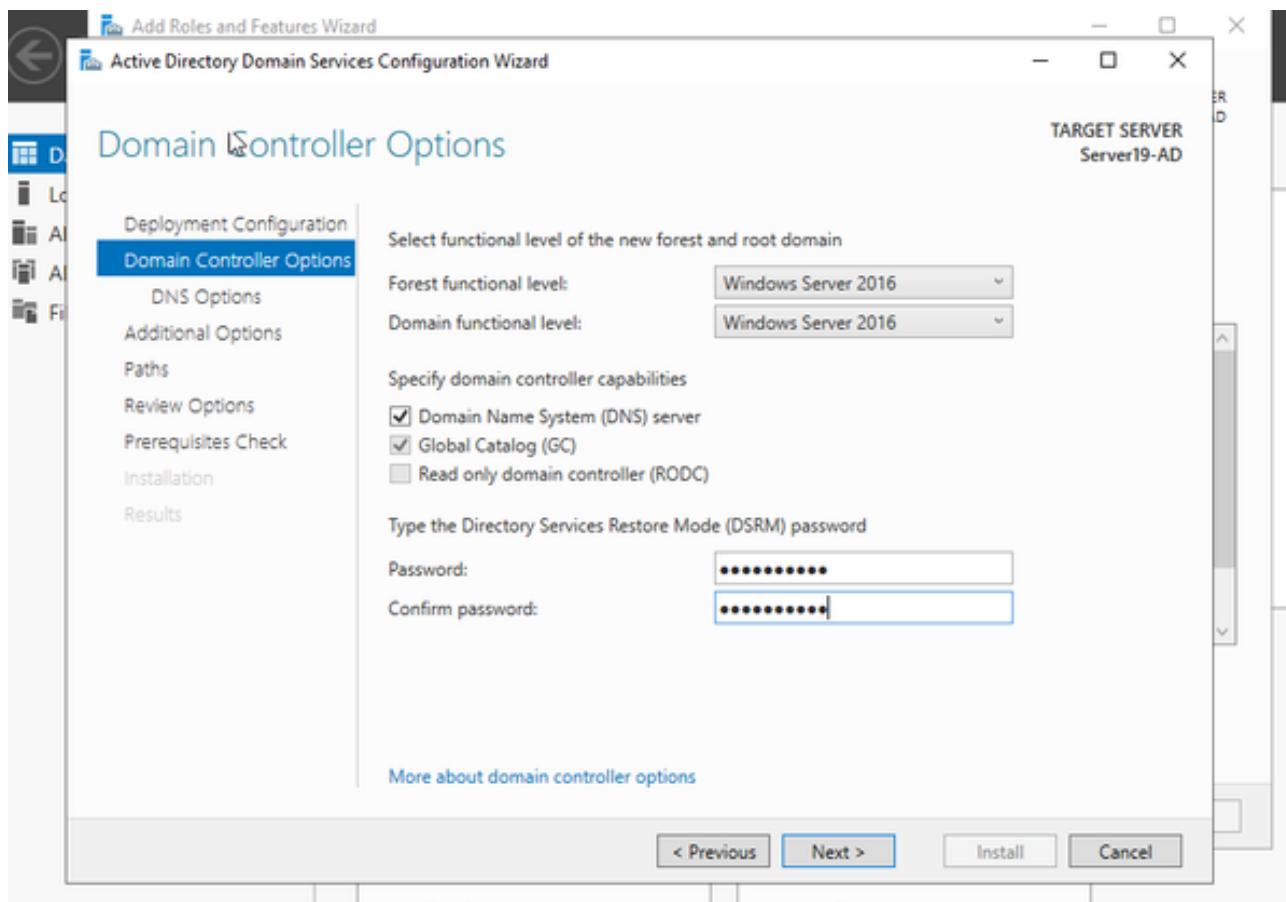
Then I clicked "Install"



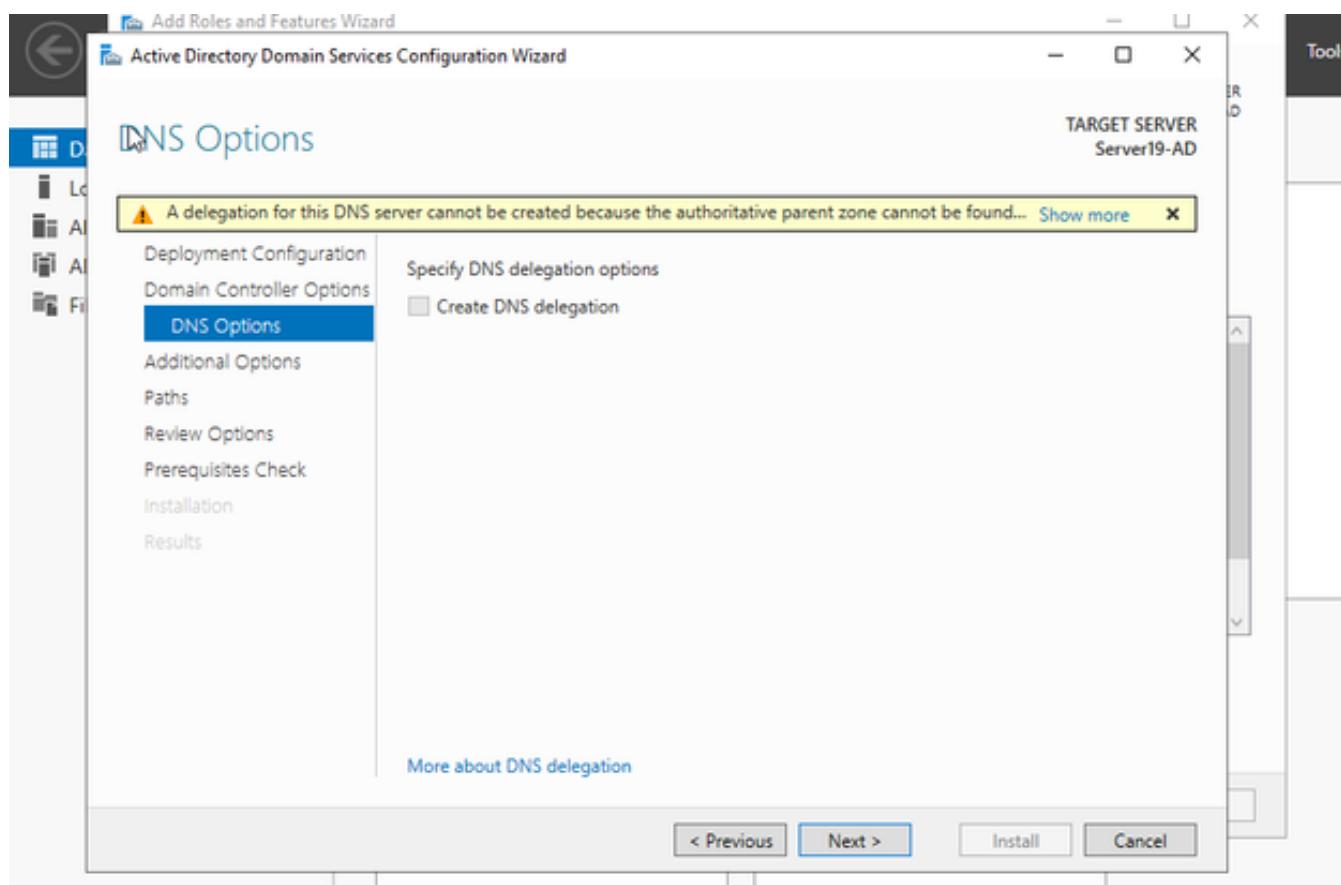
Then I clicked "Promote this server to a domain controller"



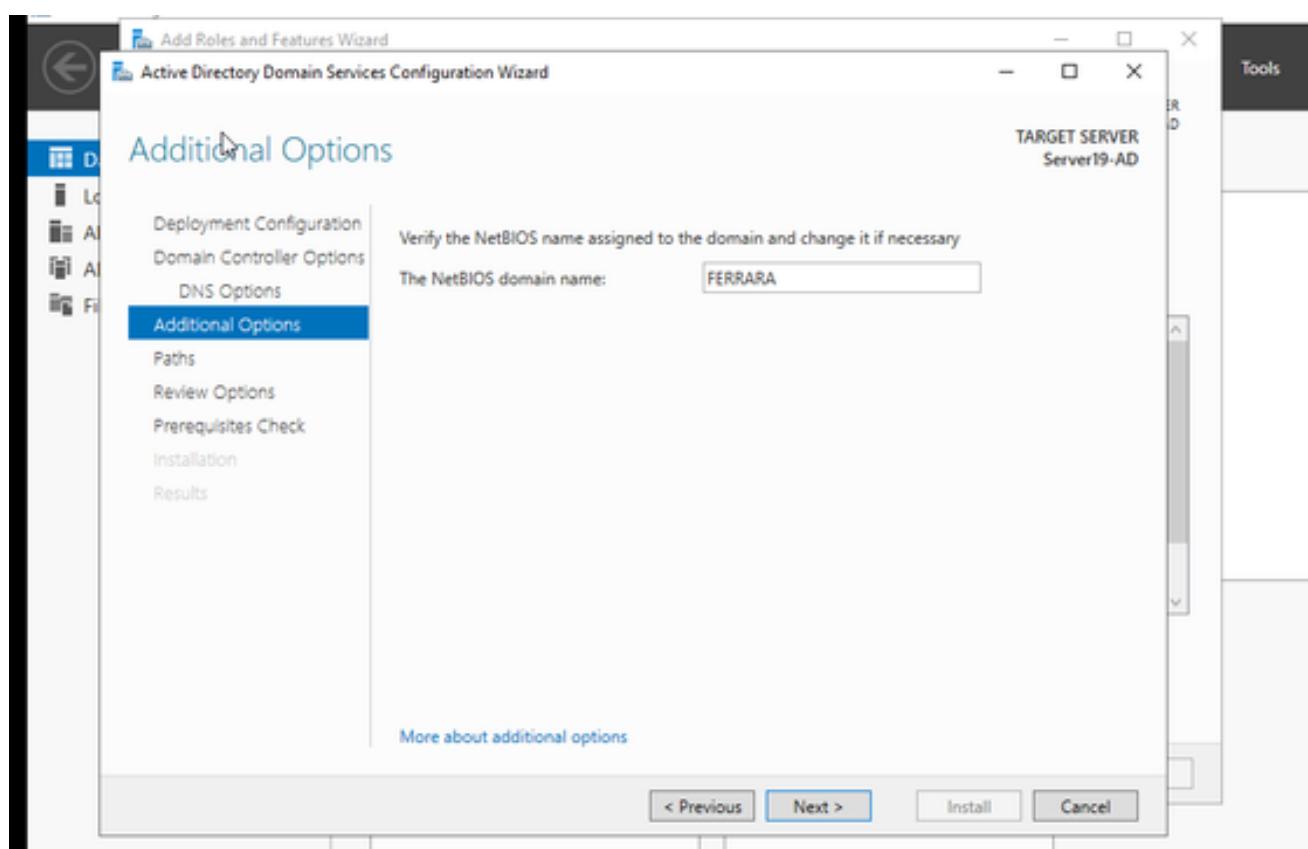
I selected “Add a new forest” and added root domain name → “Next”



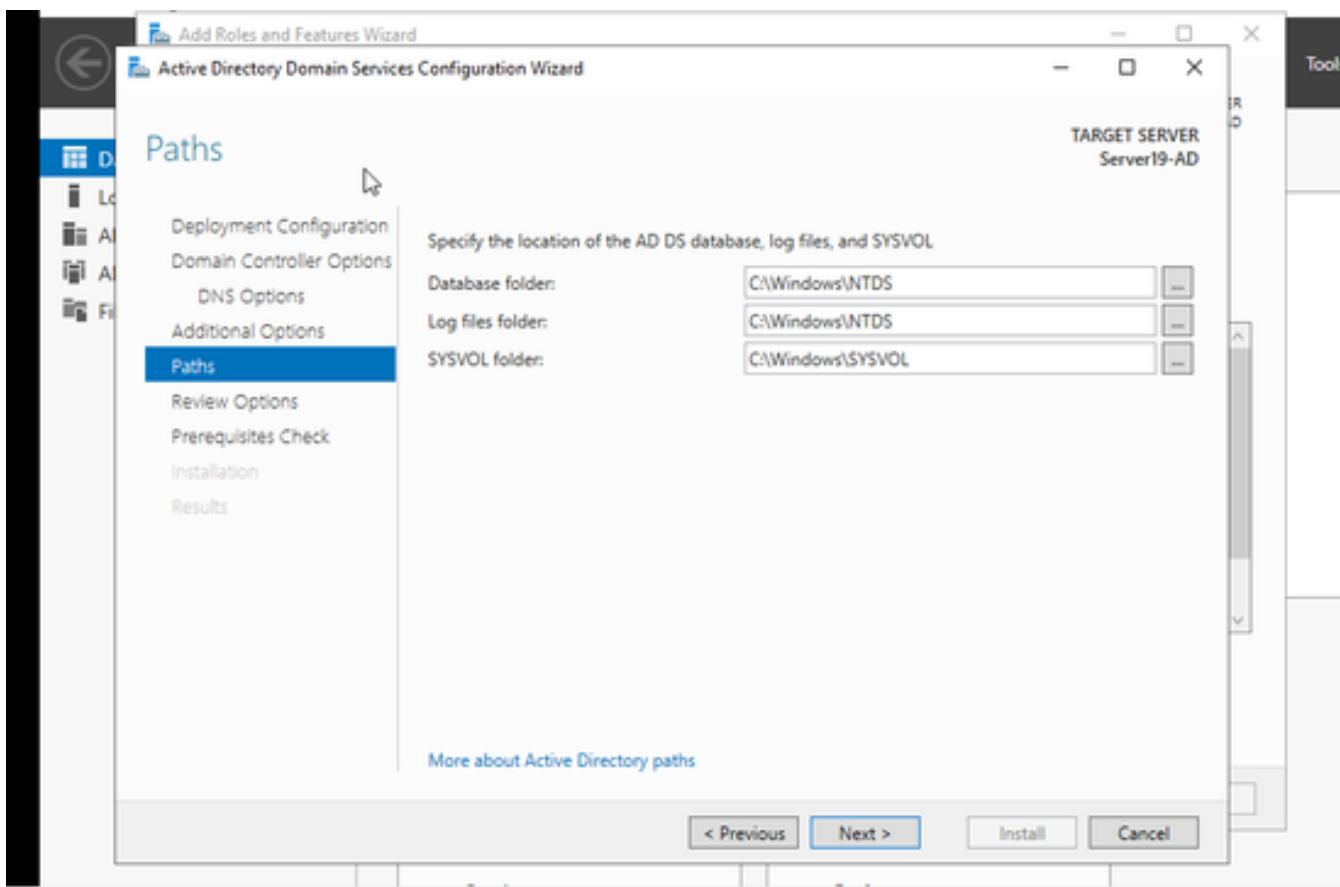
I added password and clicked “Next”



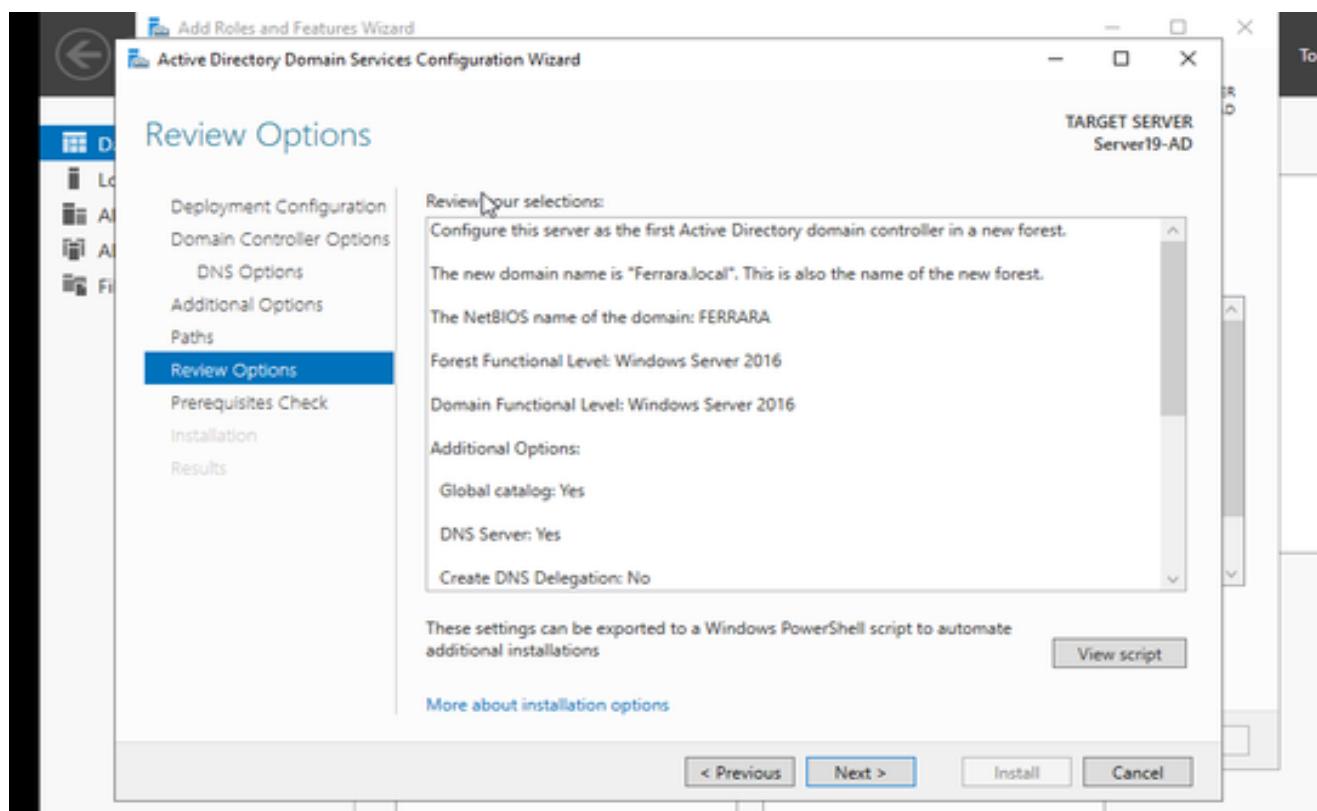
I clicked "Next"



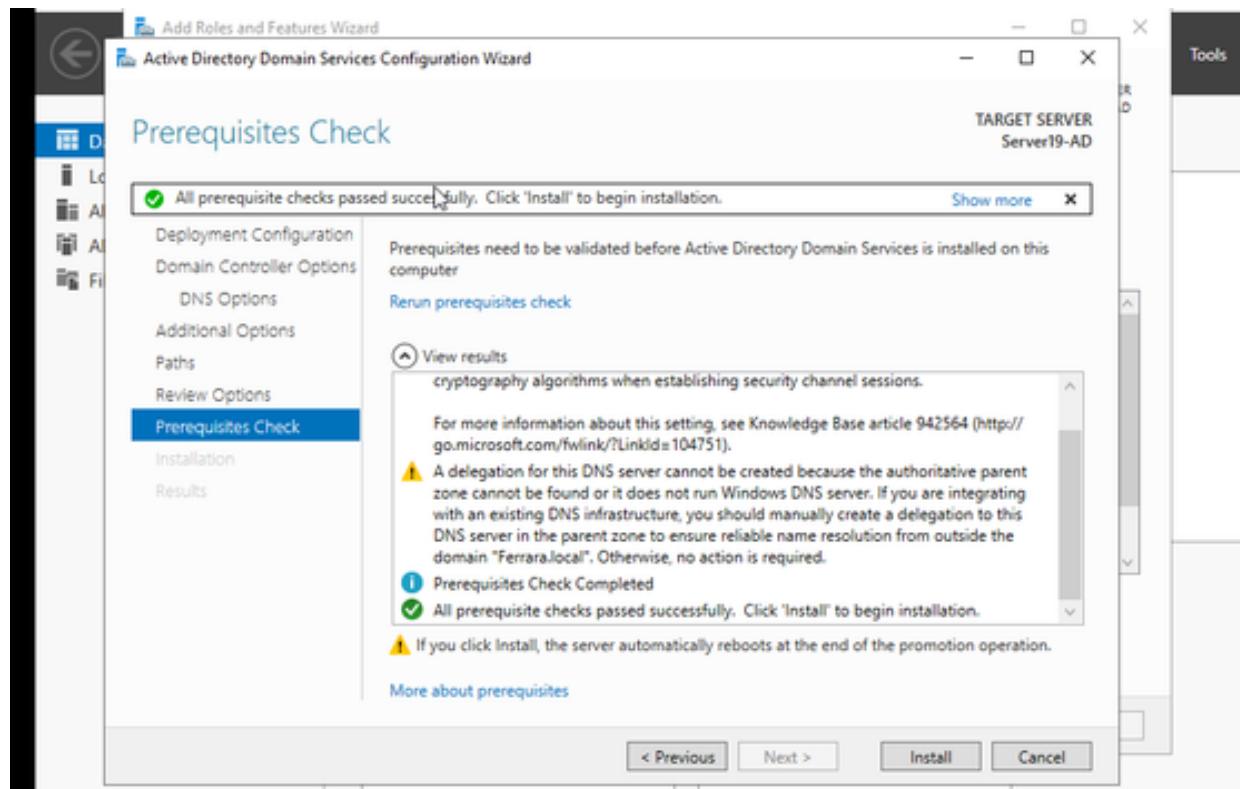
I clicked “Next” again



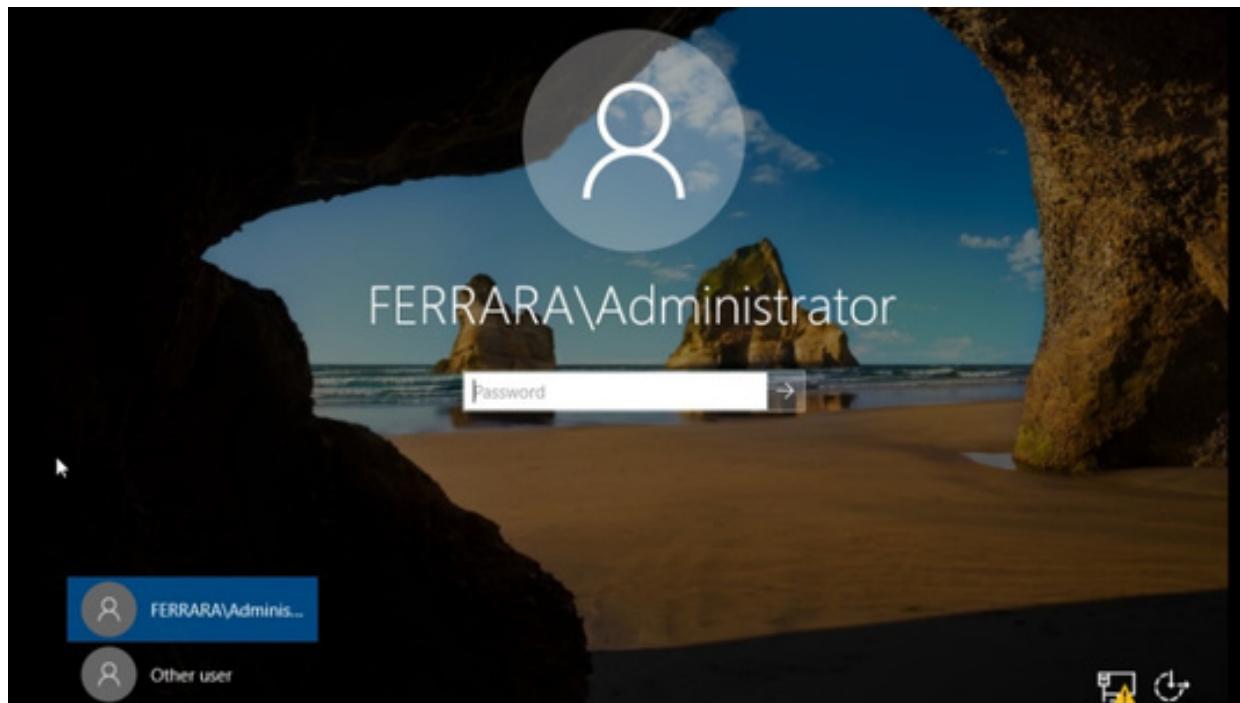
I clicked “Next”



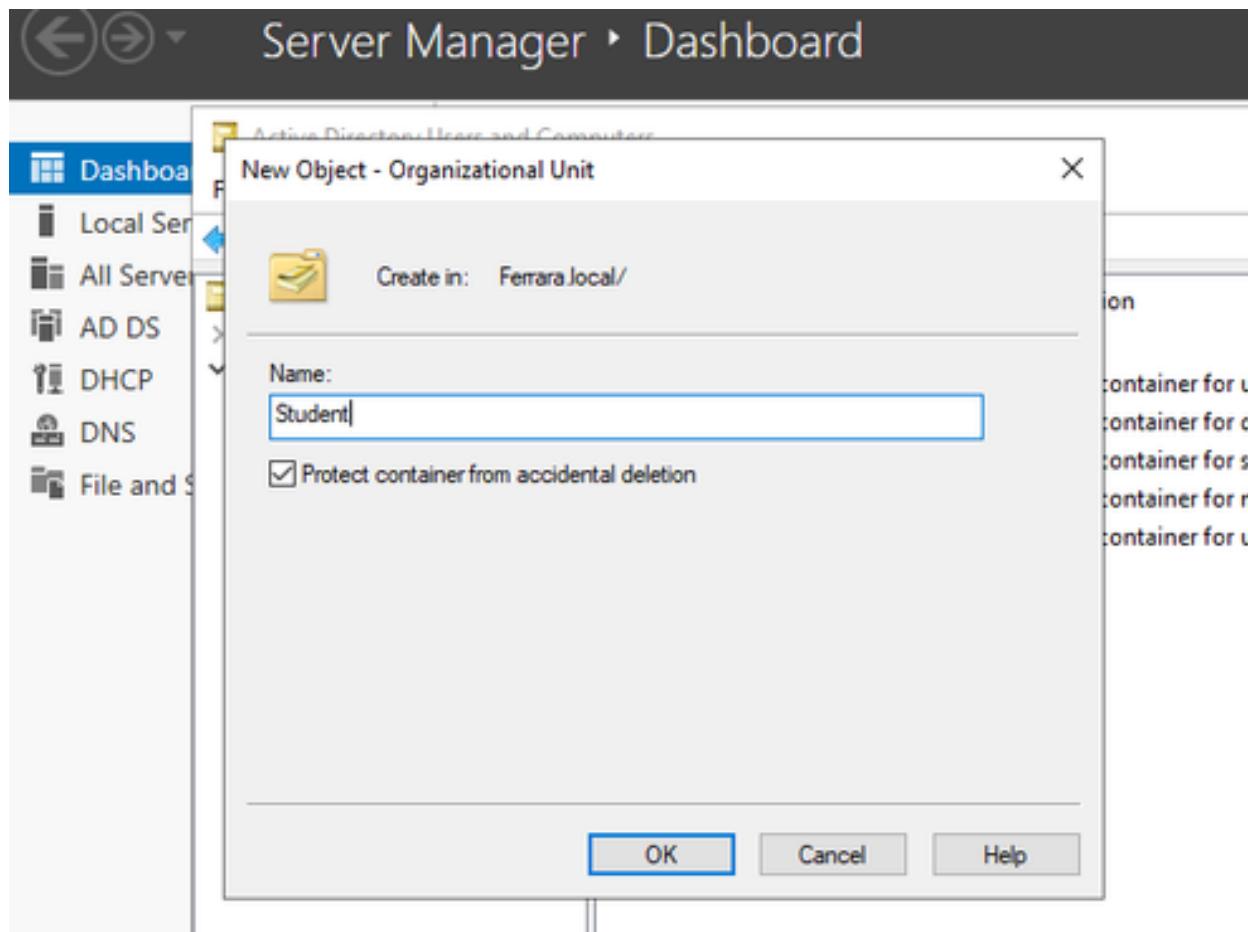
"Next"



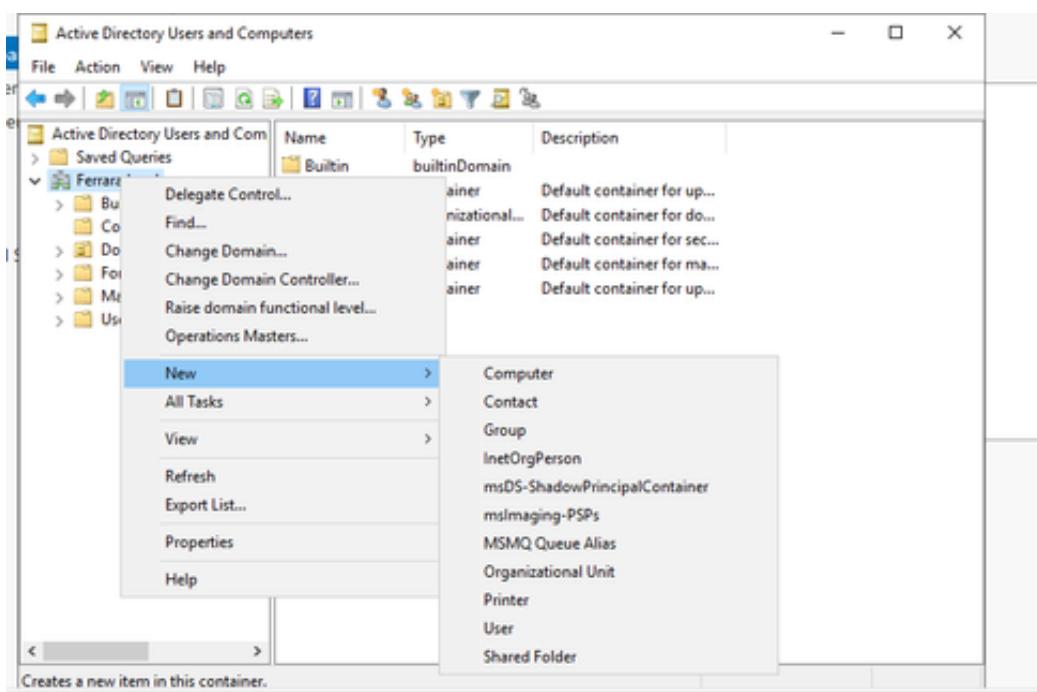
I clicked "Install"



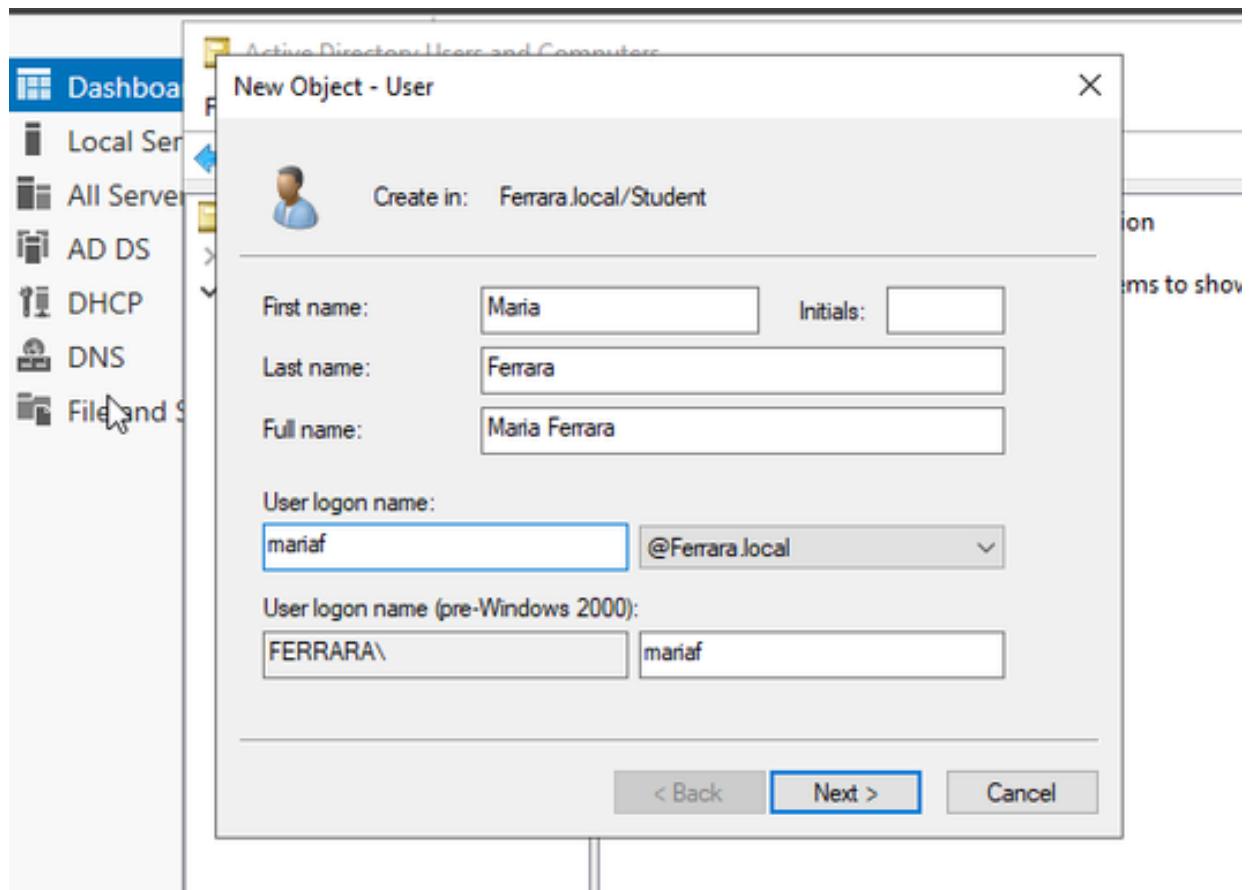
After clicking "Install" VMware restarted



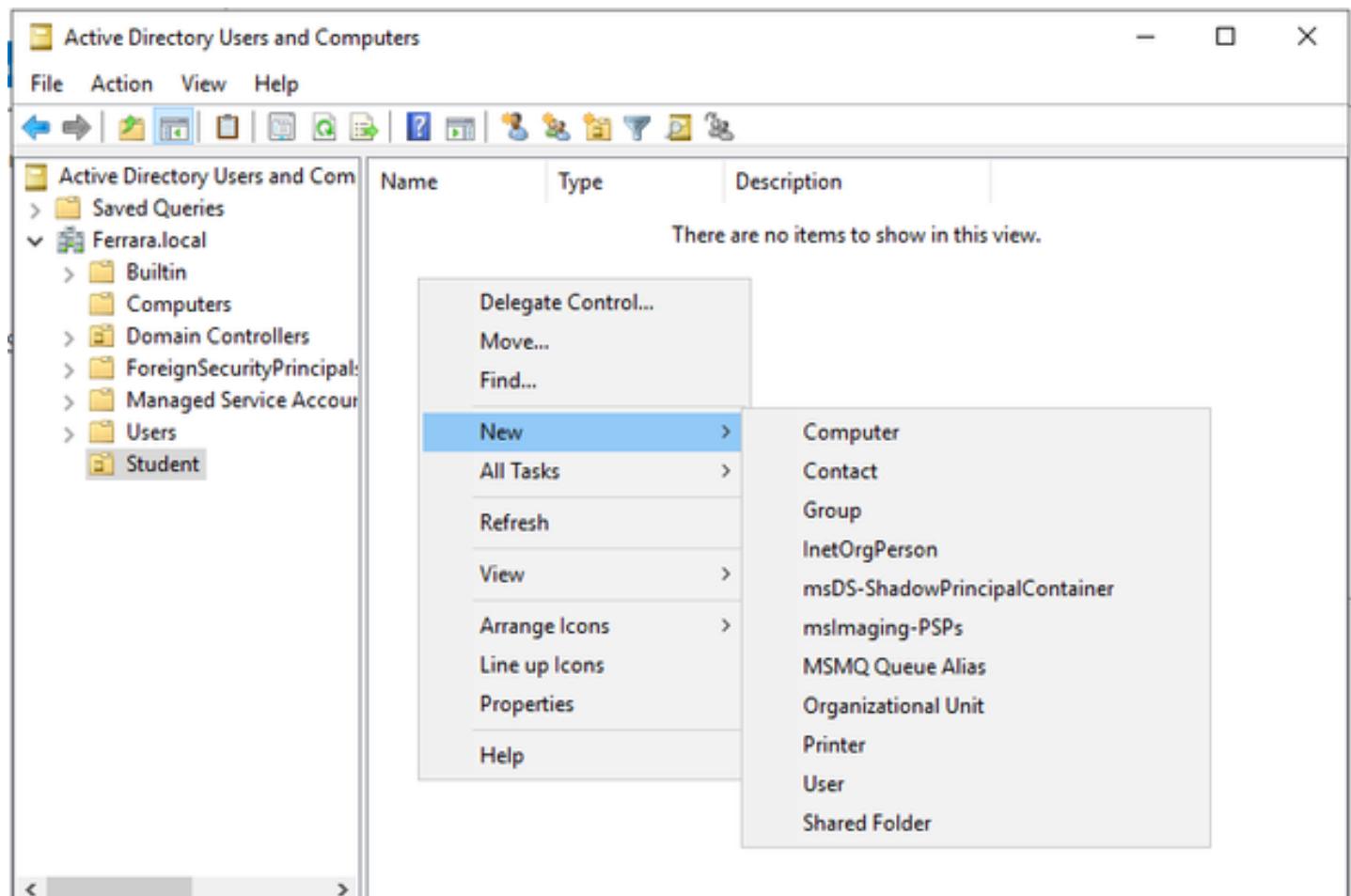
After VMWare restarted I went to Tools-> Active Directory Users and Computers ->right clicked ->next -> Organisational unit



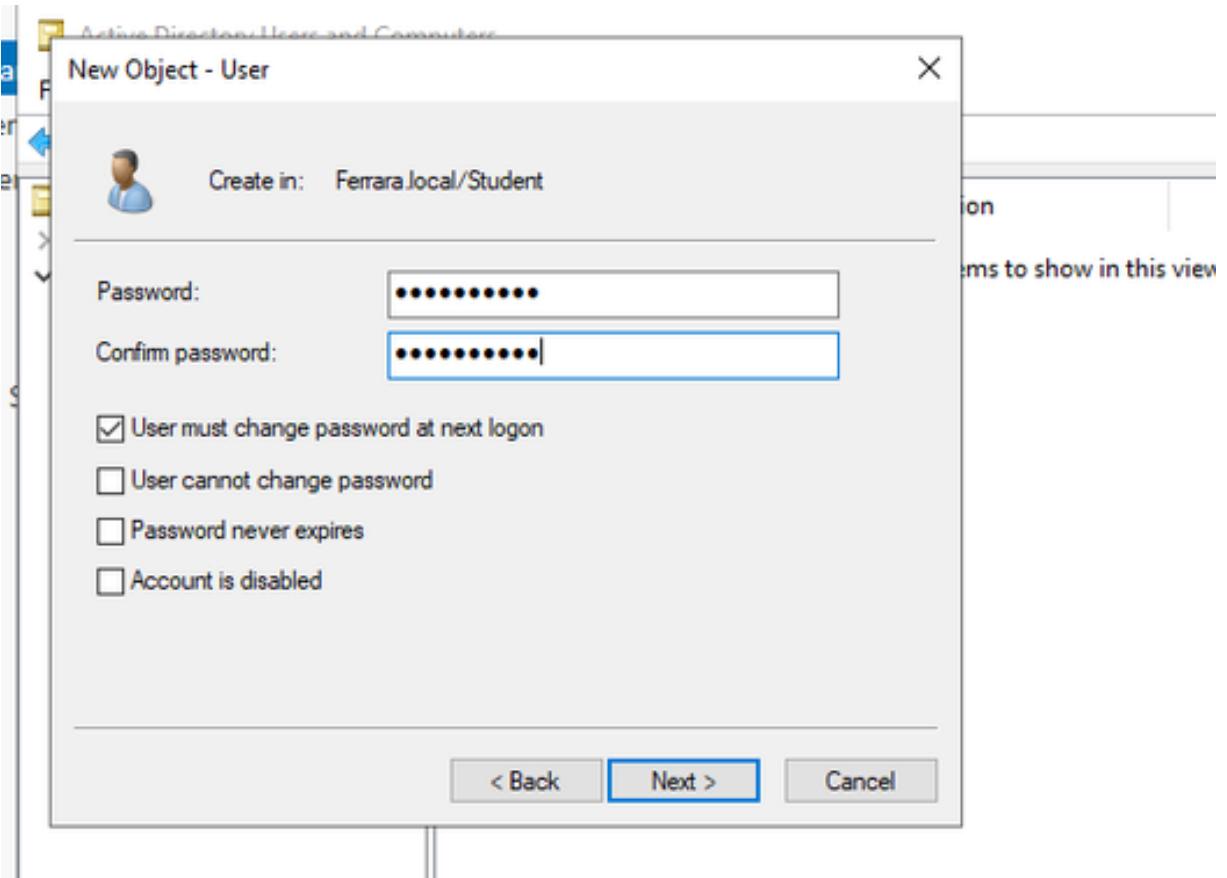
Added name and clicked OK



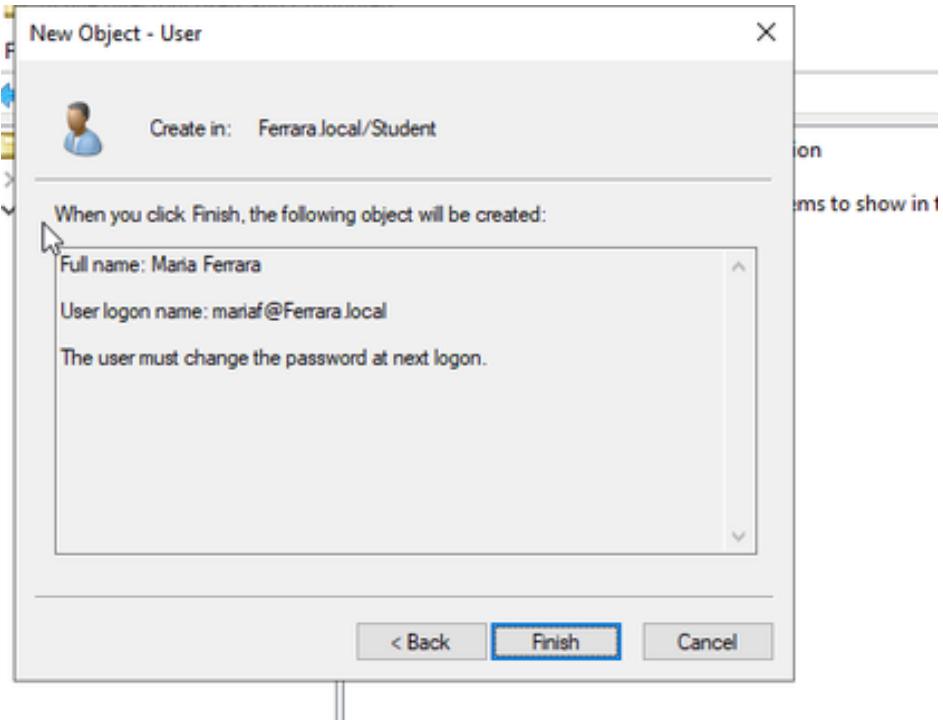
Then I right clicked -> New-> User



Added new user's details -> Next

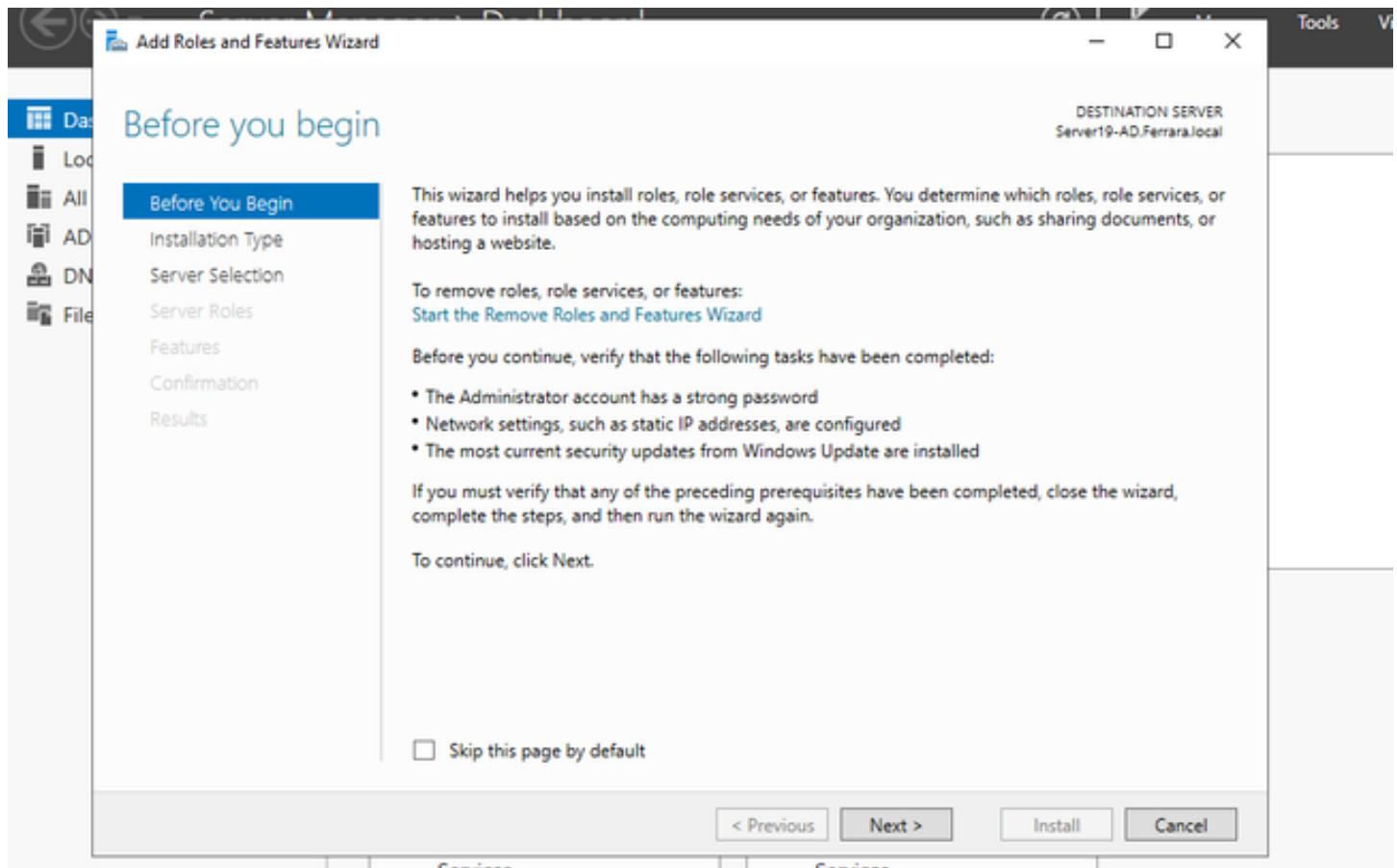


Added password ->Next

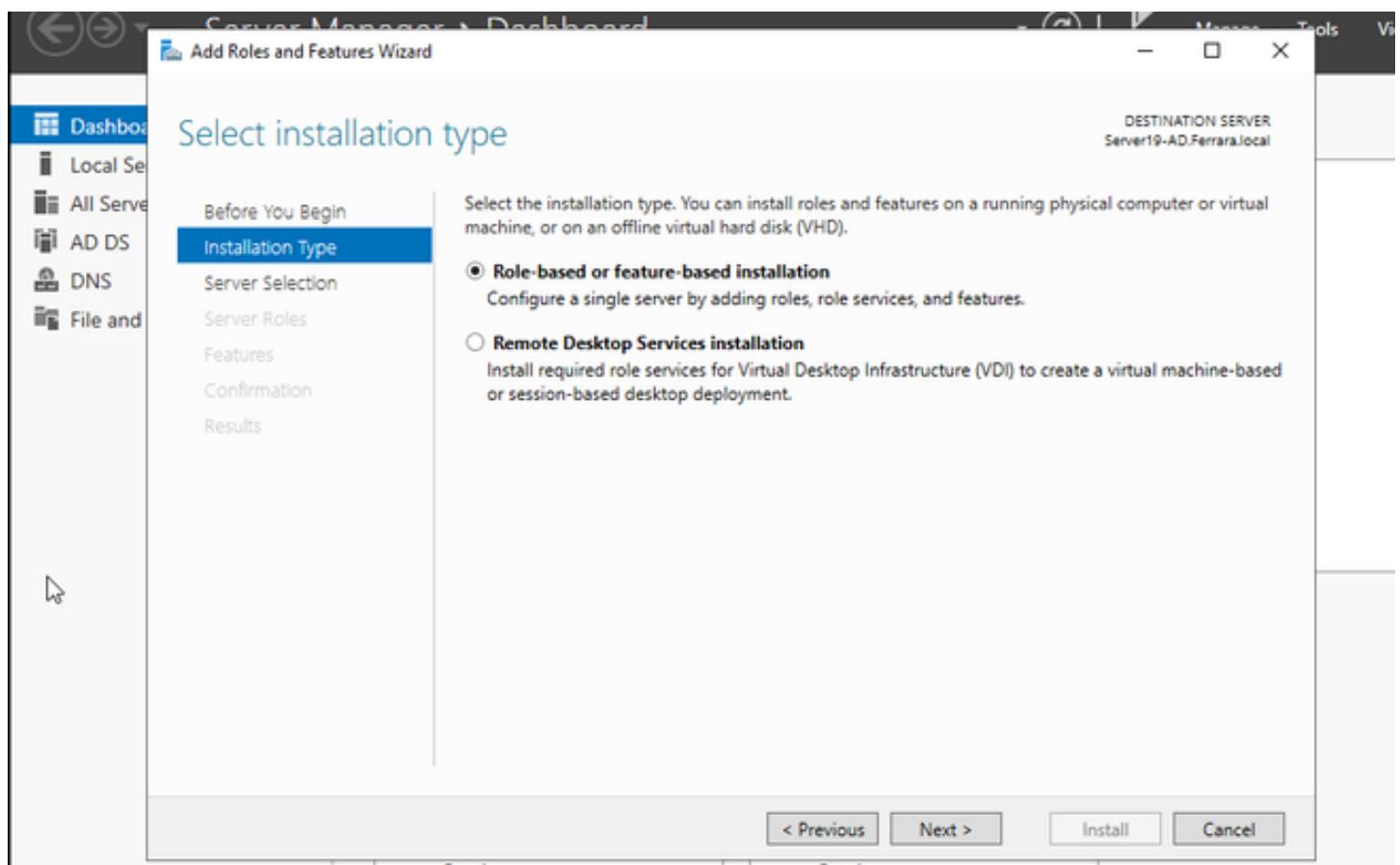


I clicked finish

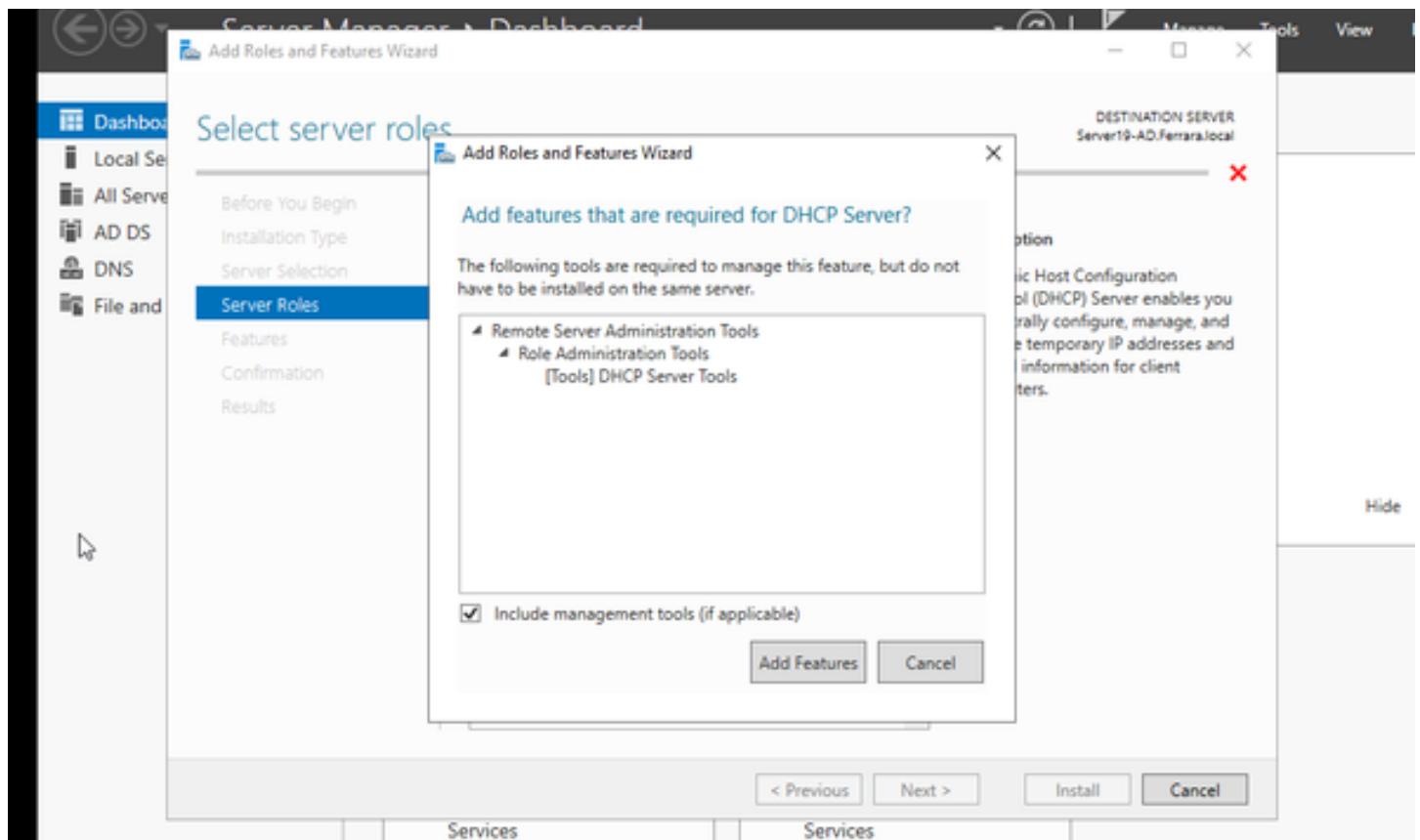
Stage 5 – DHCP Implementation



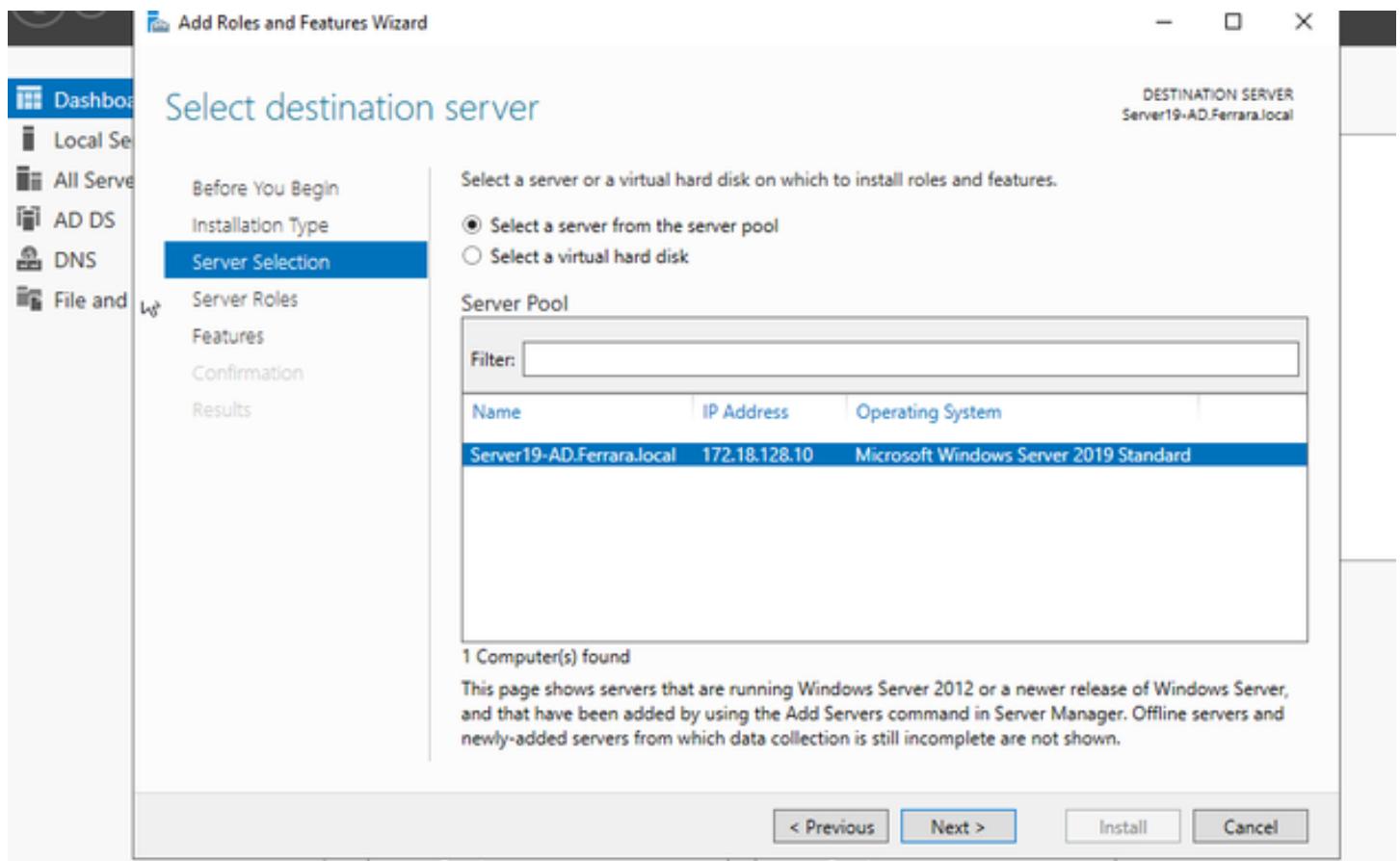
Then I went back to Server Manager → Dashboard → Add roles and features wizard → "Next"



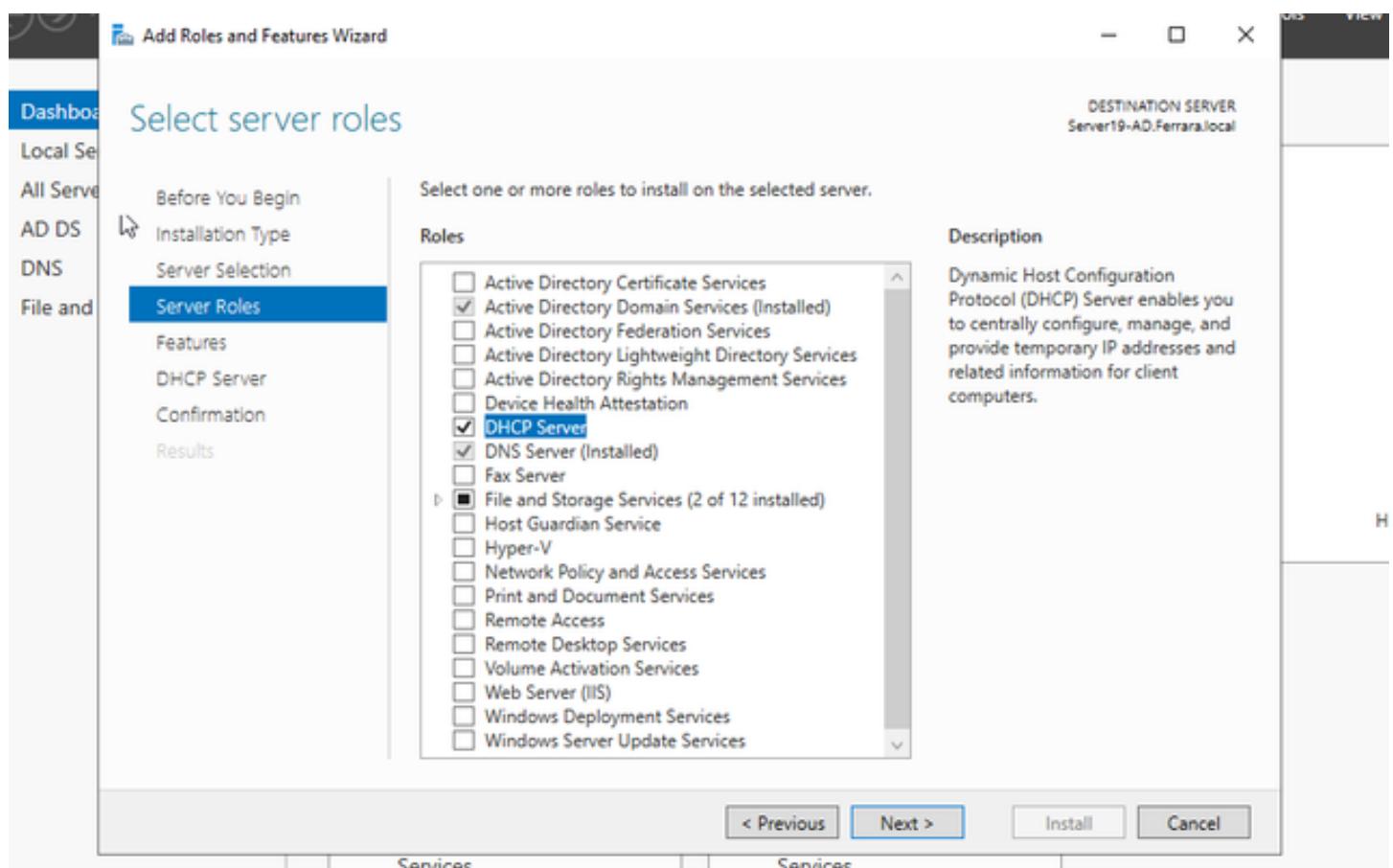
"Next"



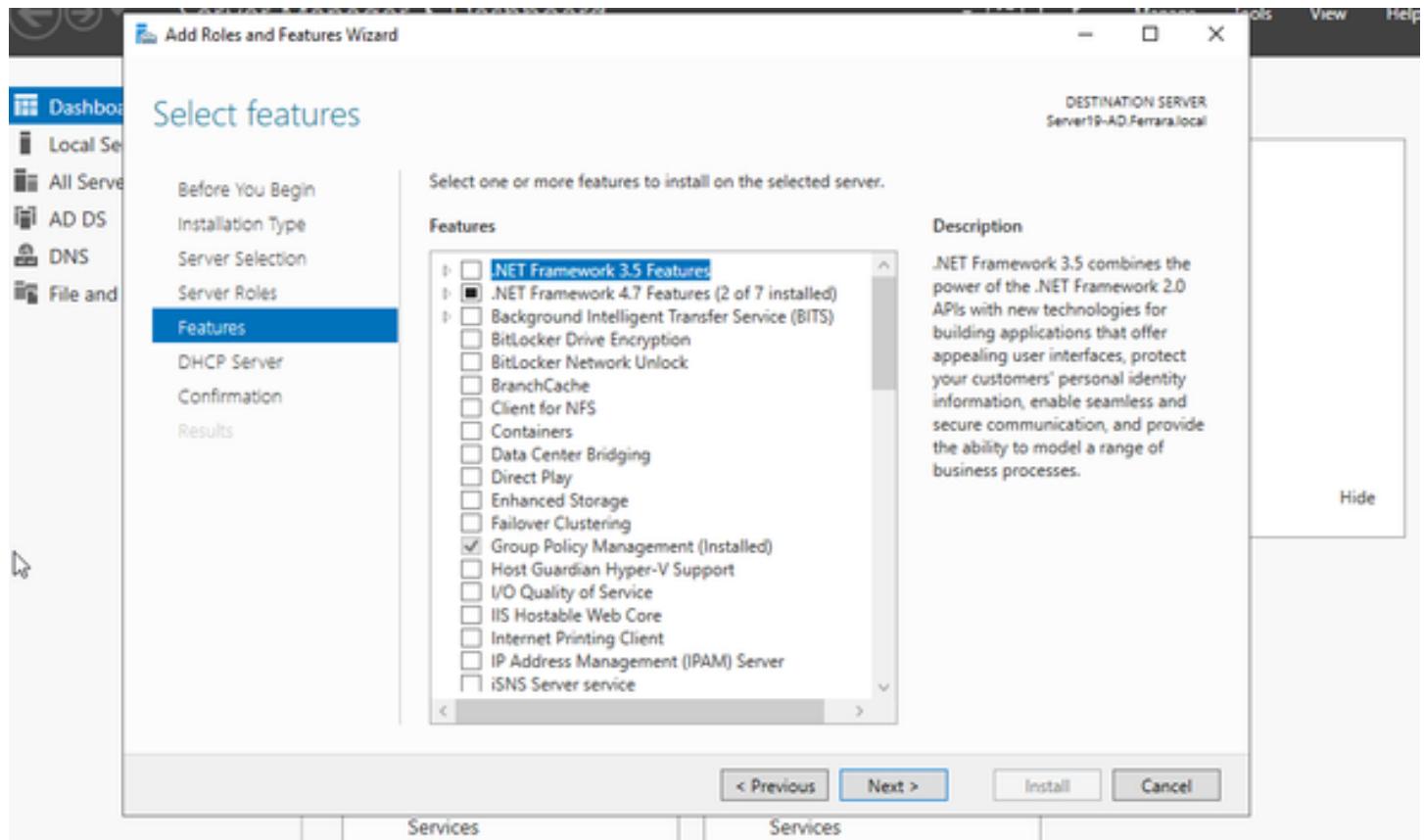
"Next"



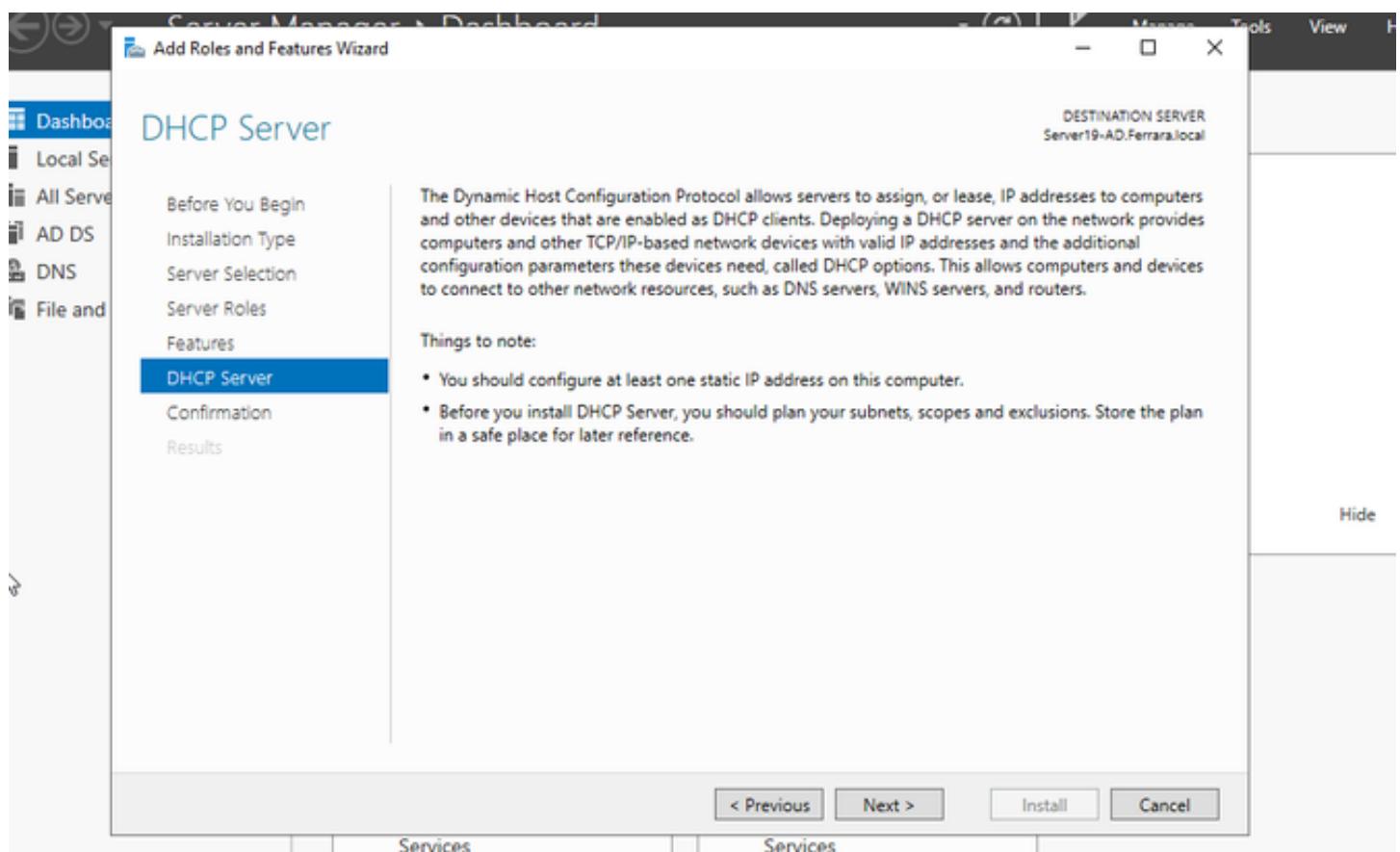
I clicked "DHCP Server" from the features option list and clicked on "Add Features"



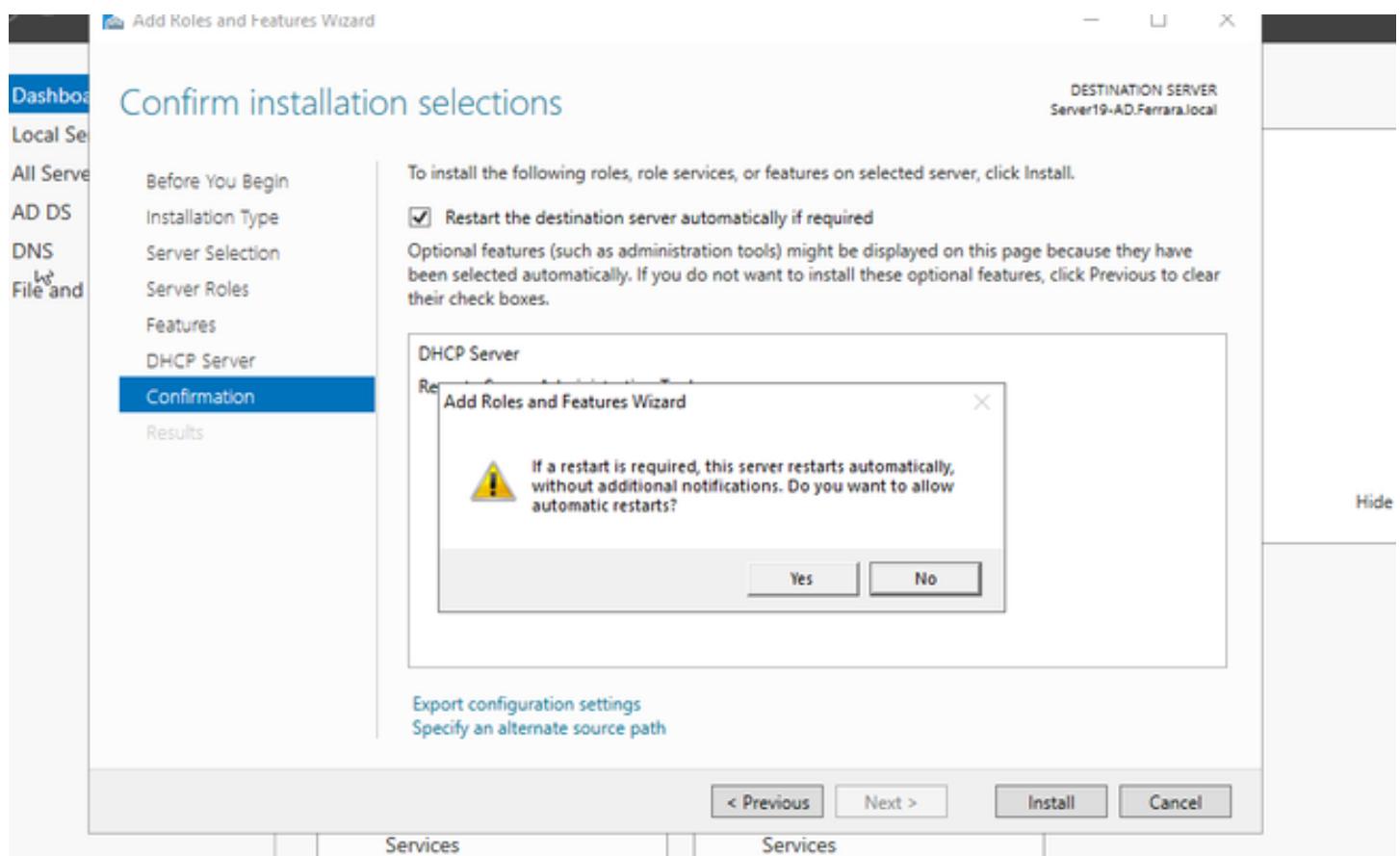
Then I clicked "Next"



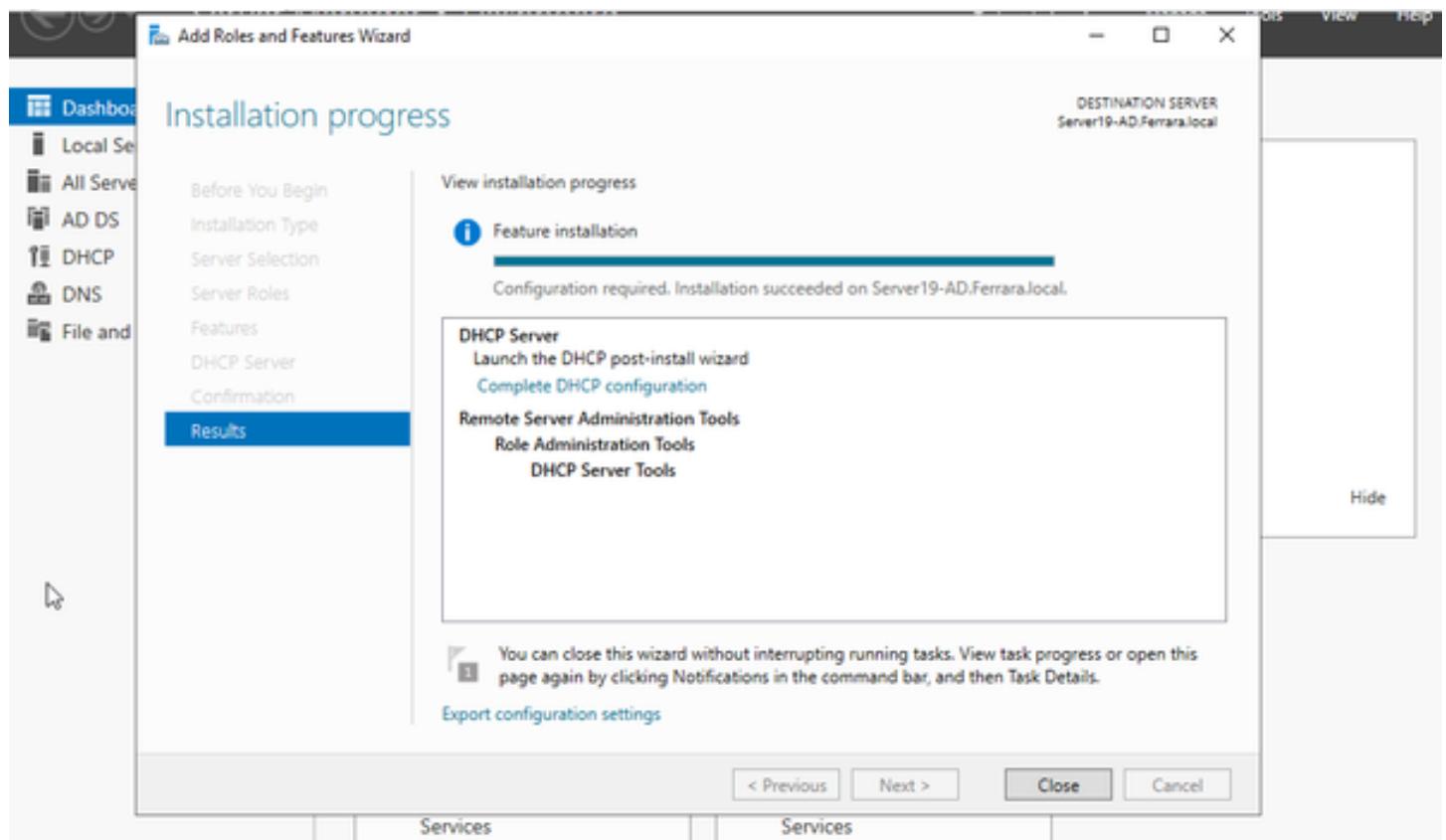
I clicked "Next" again



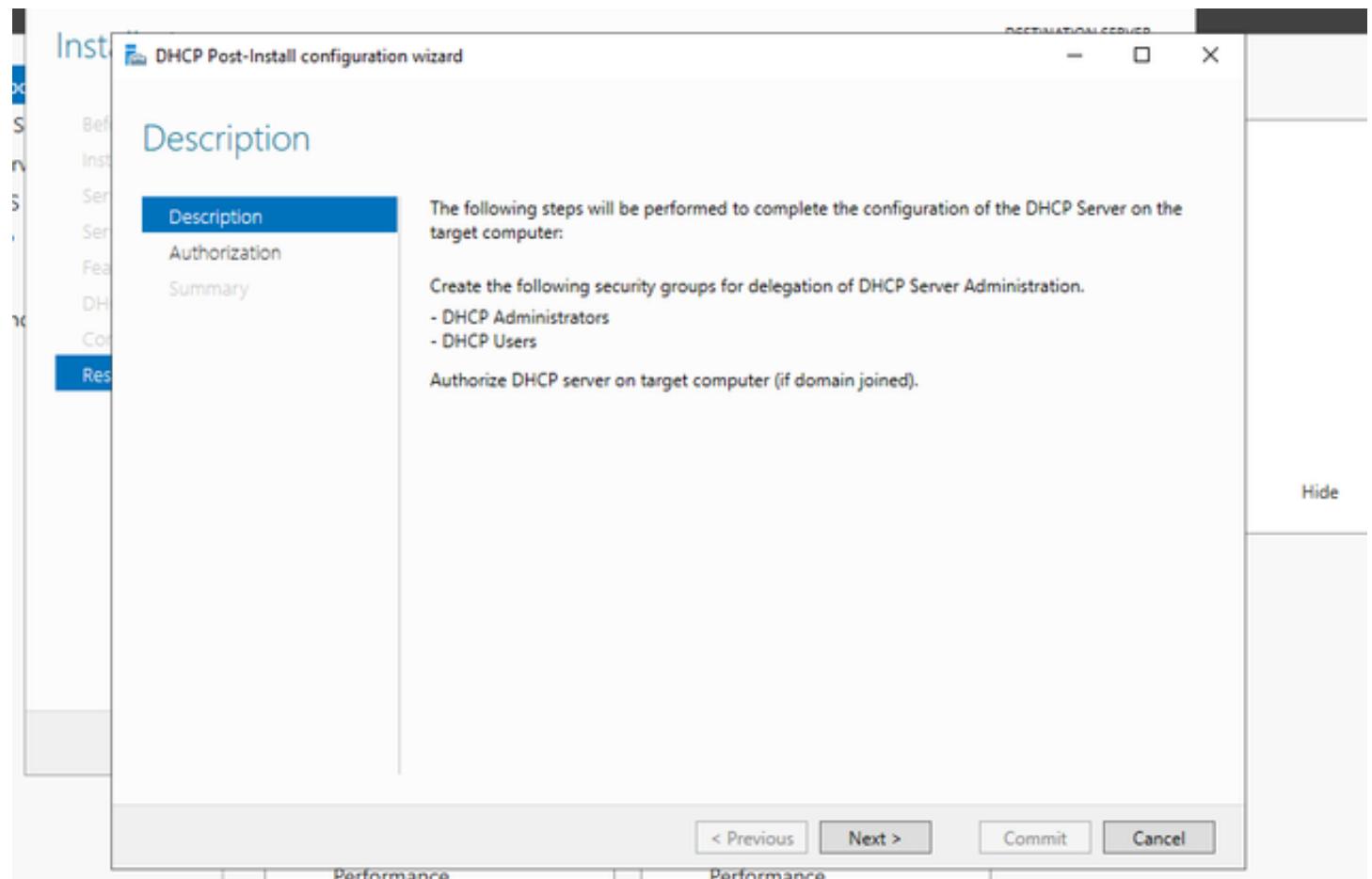
"Next"



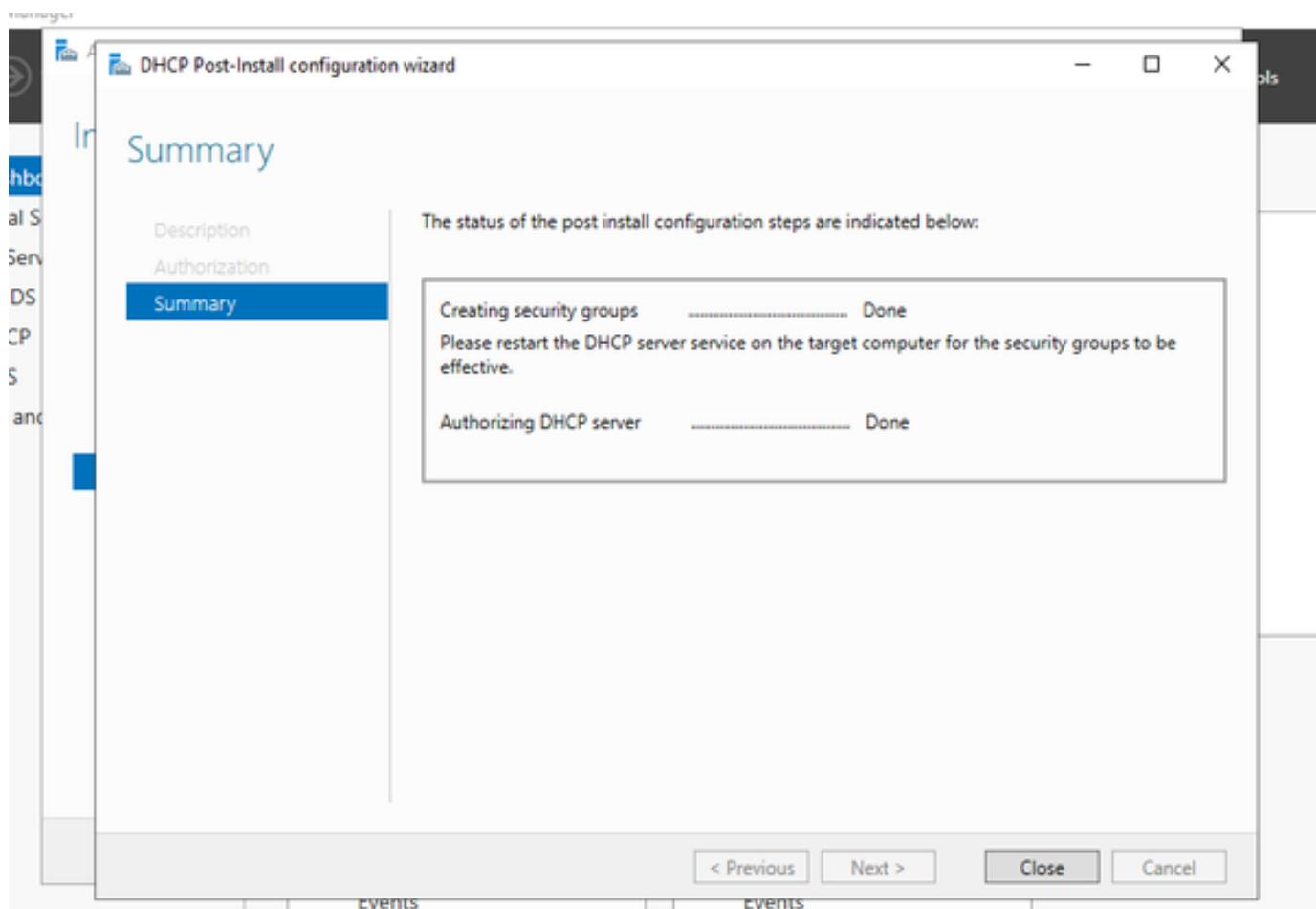
Then I clicked "Restart the destination server automatically if required" -> "Yes" -> "Install"



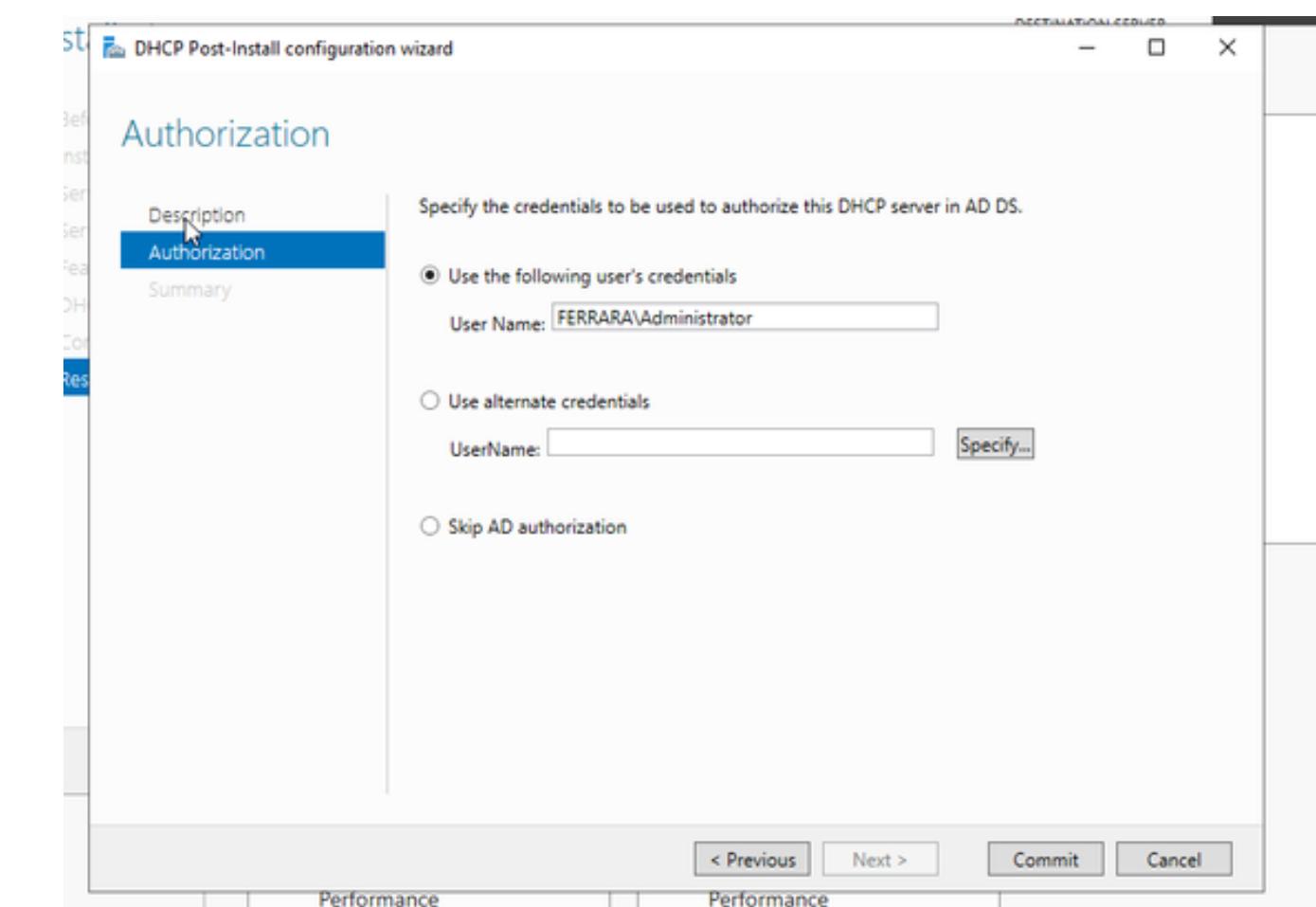
After feature installation completed I clicked “complete DHCP configuration”



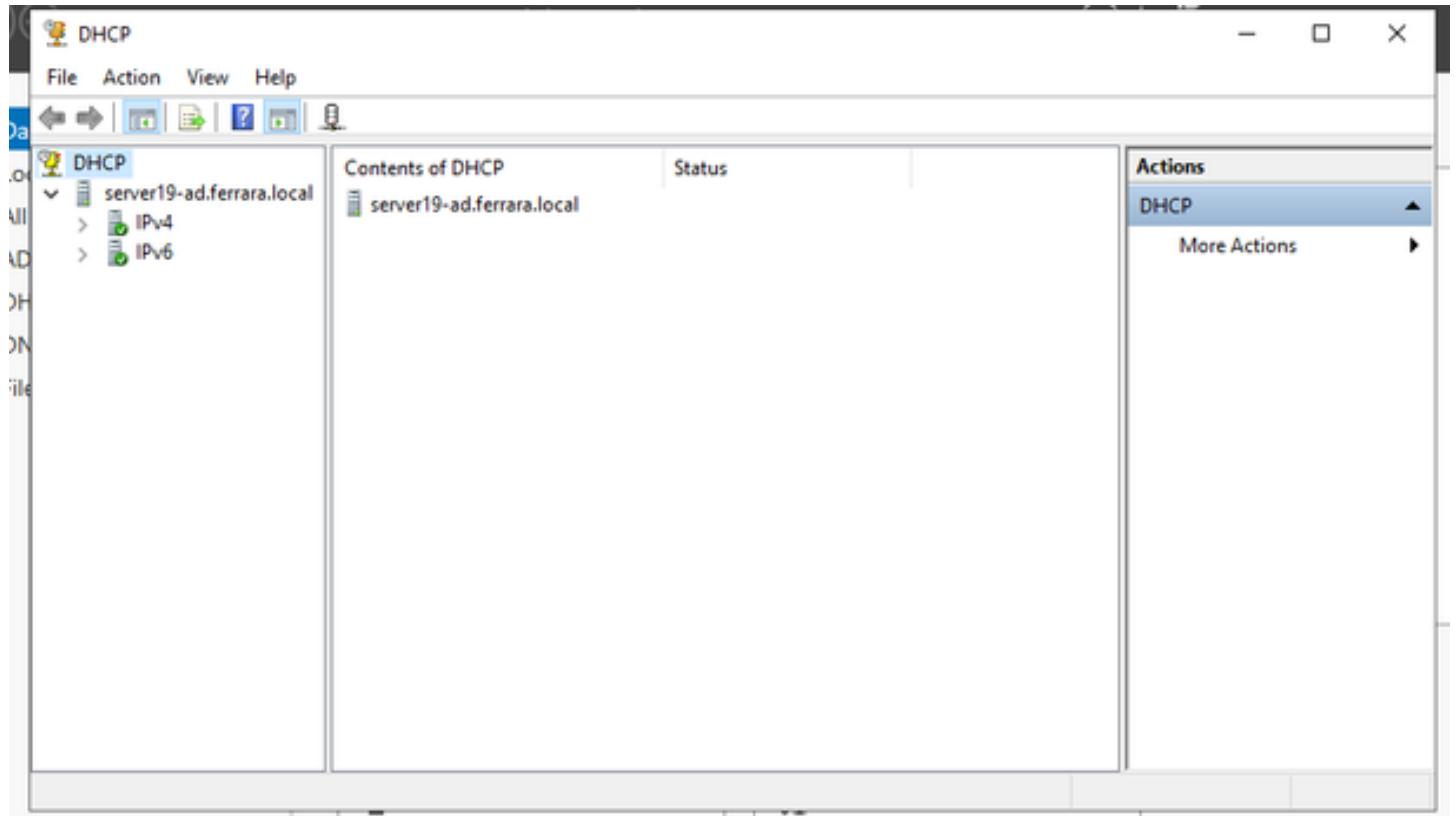
I clicked “Next”



I clicked "Commit"



Clicked “Close”



I clicked “Close” again

## Installation progress

DESTINATION SERVER  
Server19-AD.Ferrara.local

- Before You Begin
- Installation Type
- Server Selection
- Server Roles
- Features
- DHCP Server
- Confirmation
- Results**

View installation progress

**i Feature installation**

Configuration required. Installation succeeded on Server19-AD.Ferrara.local.

**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 page again by clicking Notifications in the command bar, and then Task Details.[Export configuration settings](#)

&lt; Previous

Next &gt;

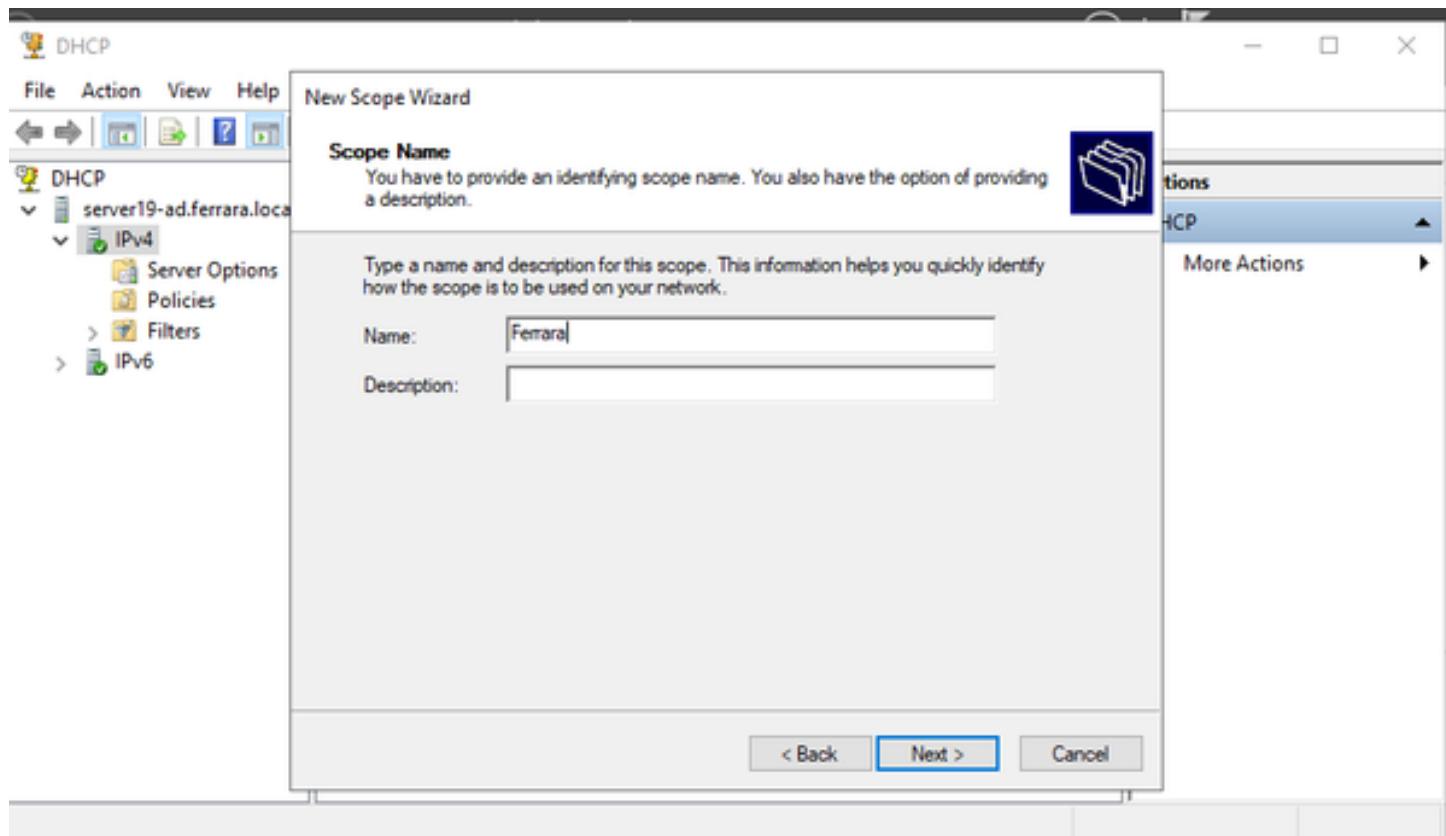
**Close**

Cancel

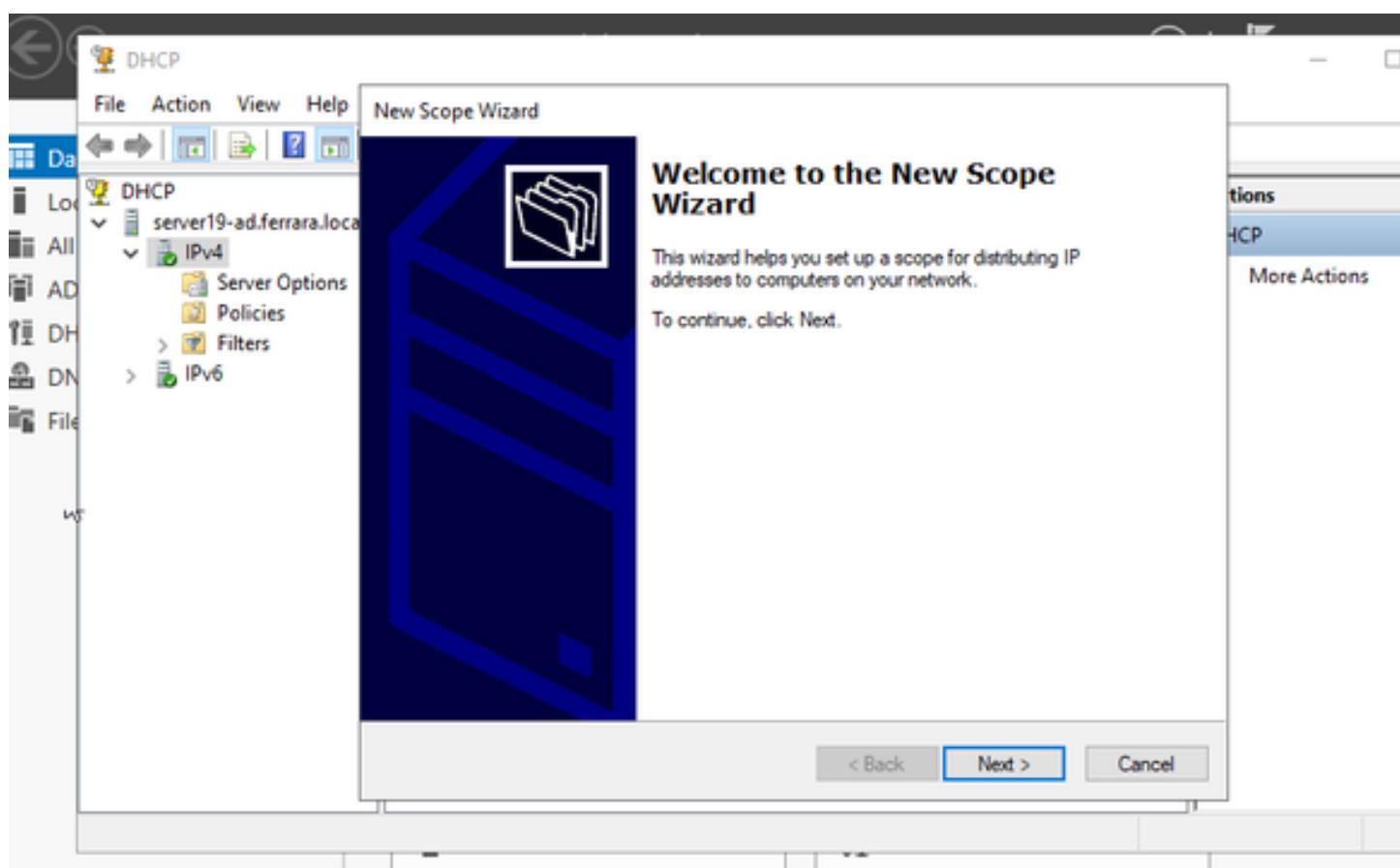
Events

Events

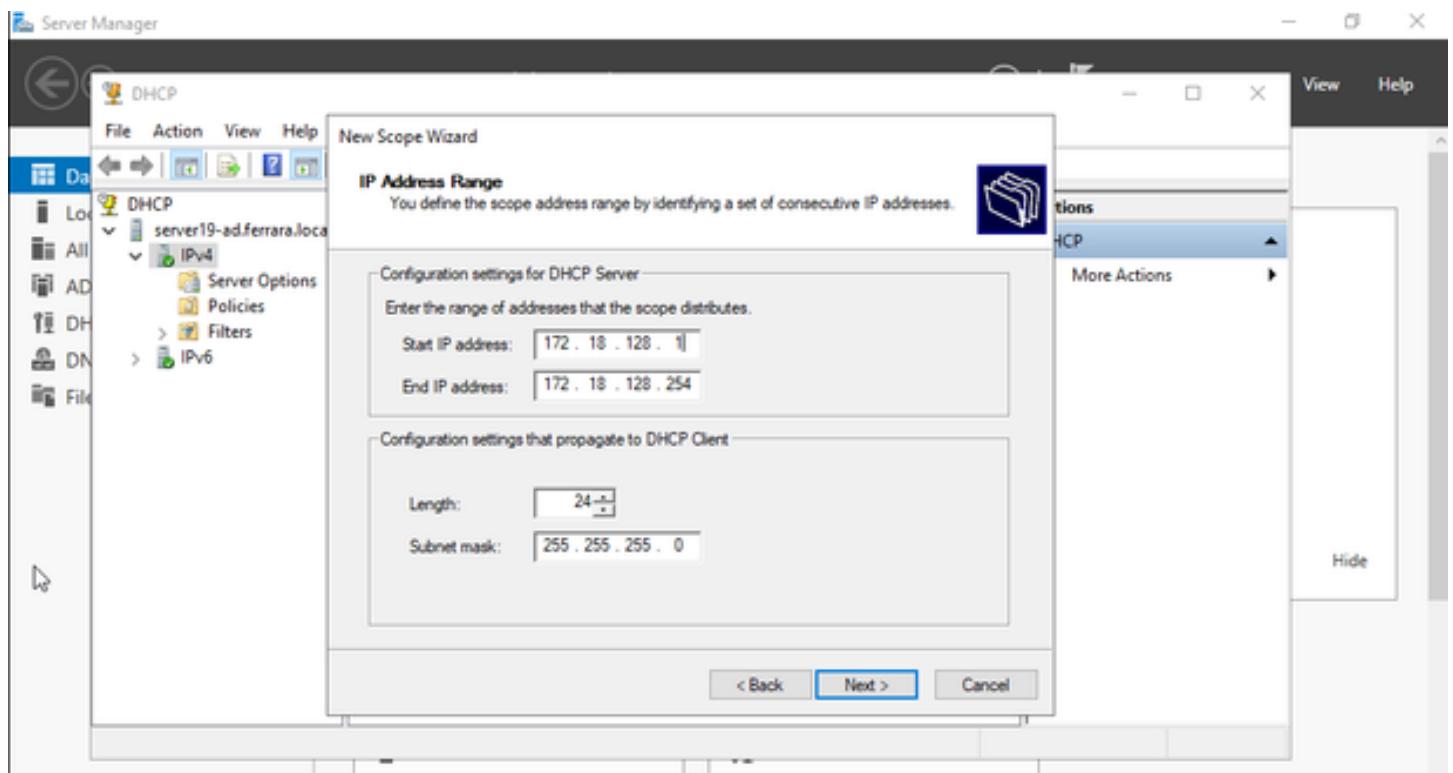
I clicked on "Tools" -&gt; "DHCP"



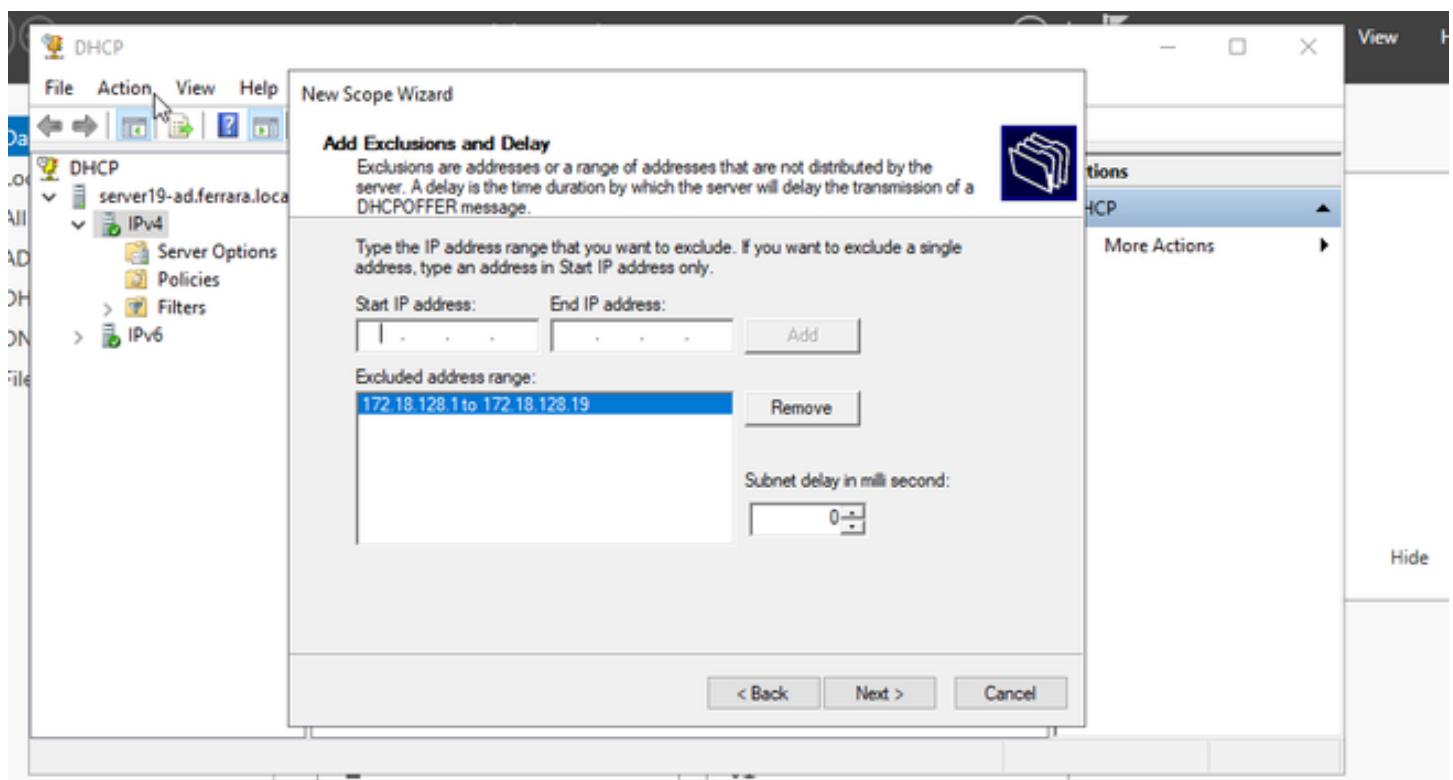
Then I right clicked on IPv4 and selected “New Scope” -> “Next”



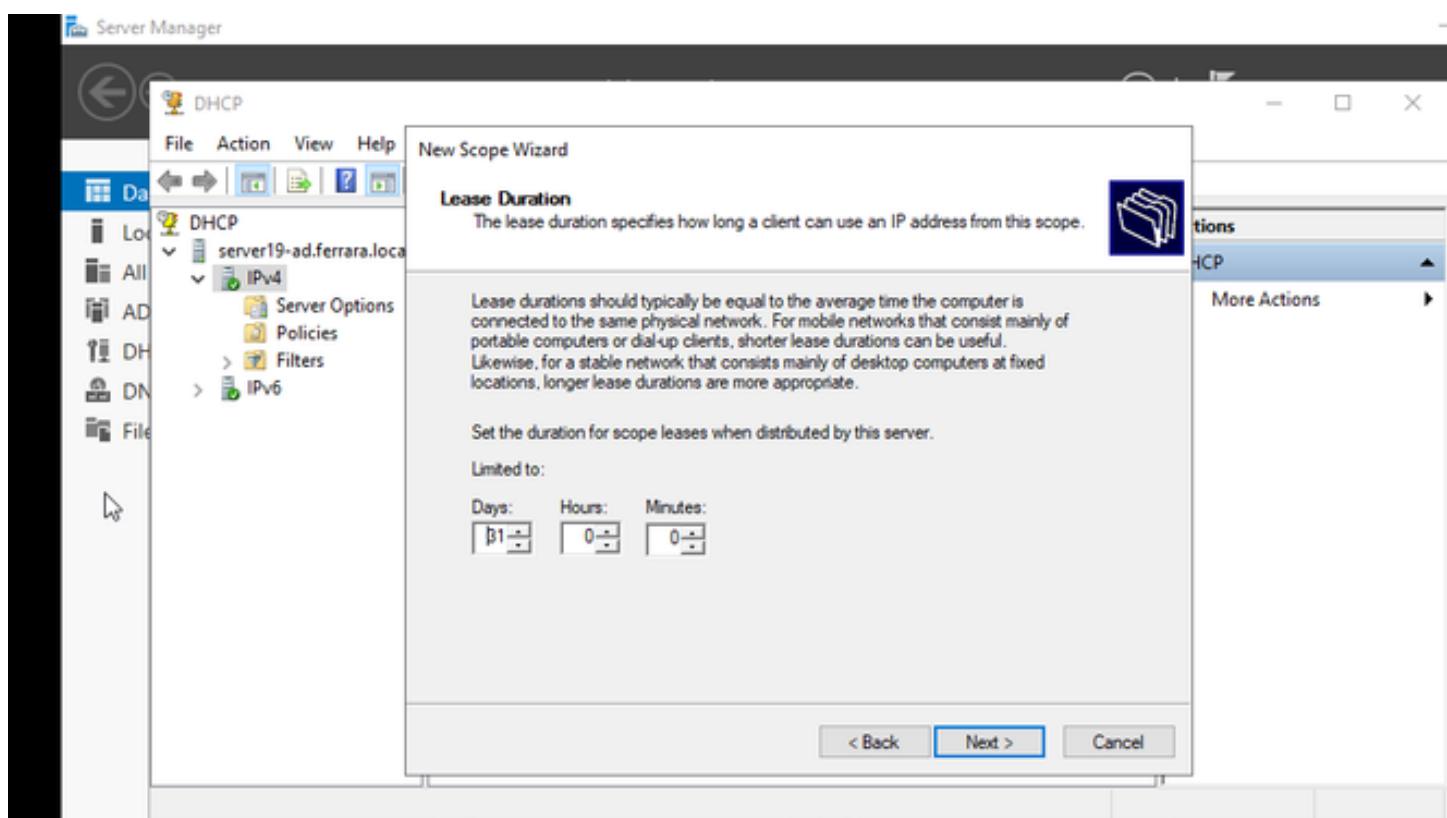
Added new scope name and clicked “Next”



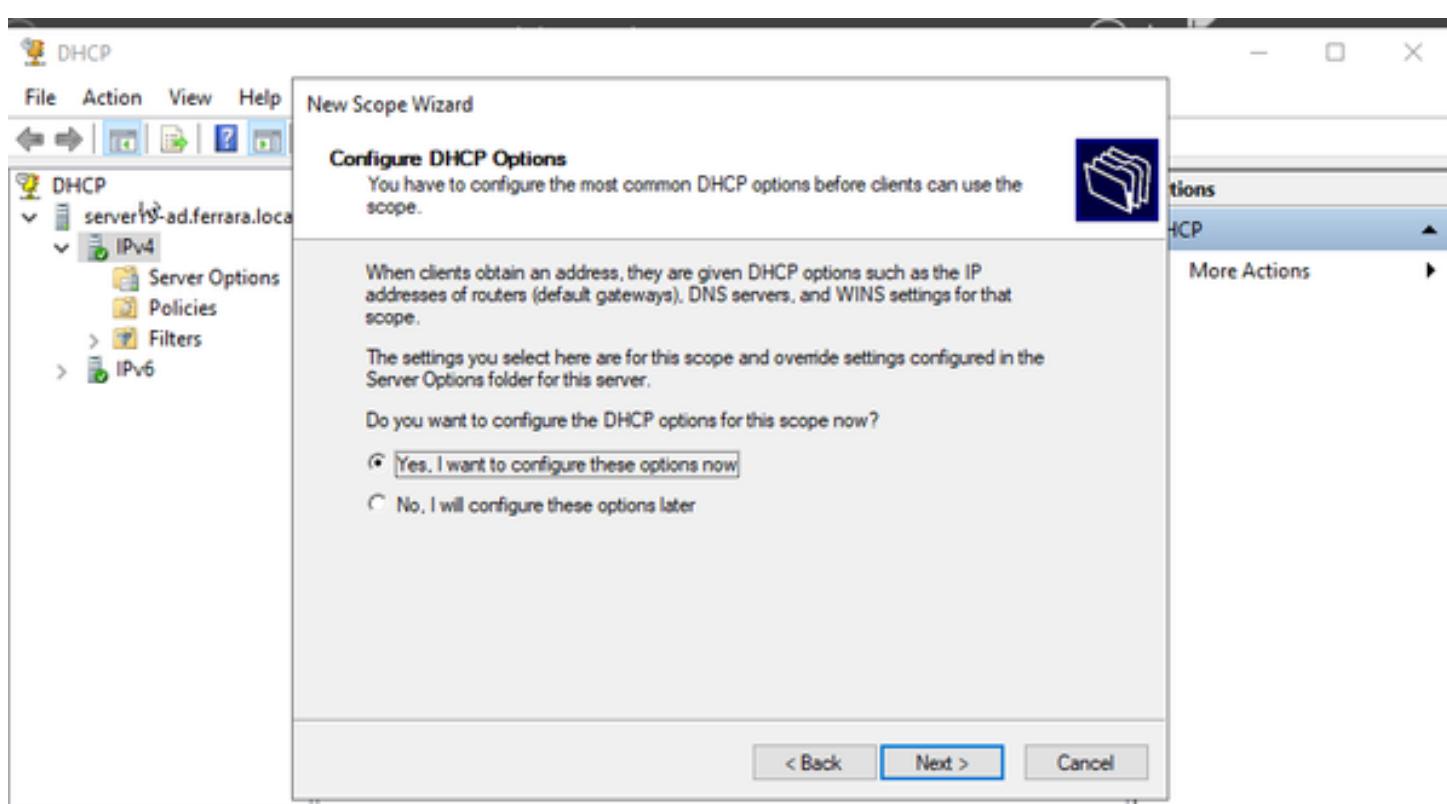
I added the IP addresses range for the 1st subnet of the network (IT) -> "Next"



I added exclusion for reserved addresses in 1st subnet -> "Next" (first 19 addresses are now reserved static IP addresses)



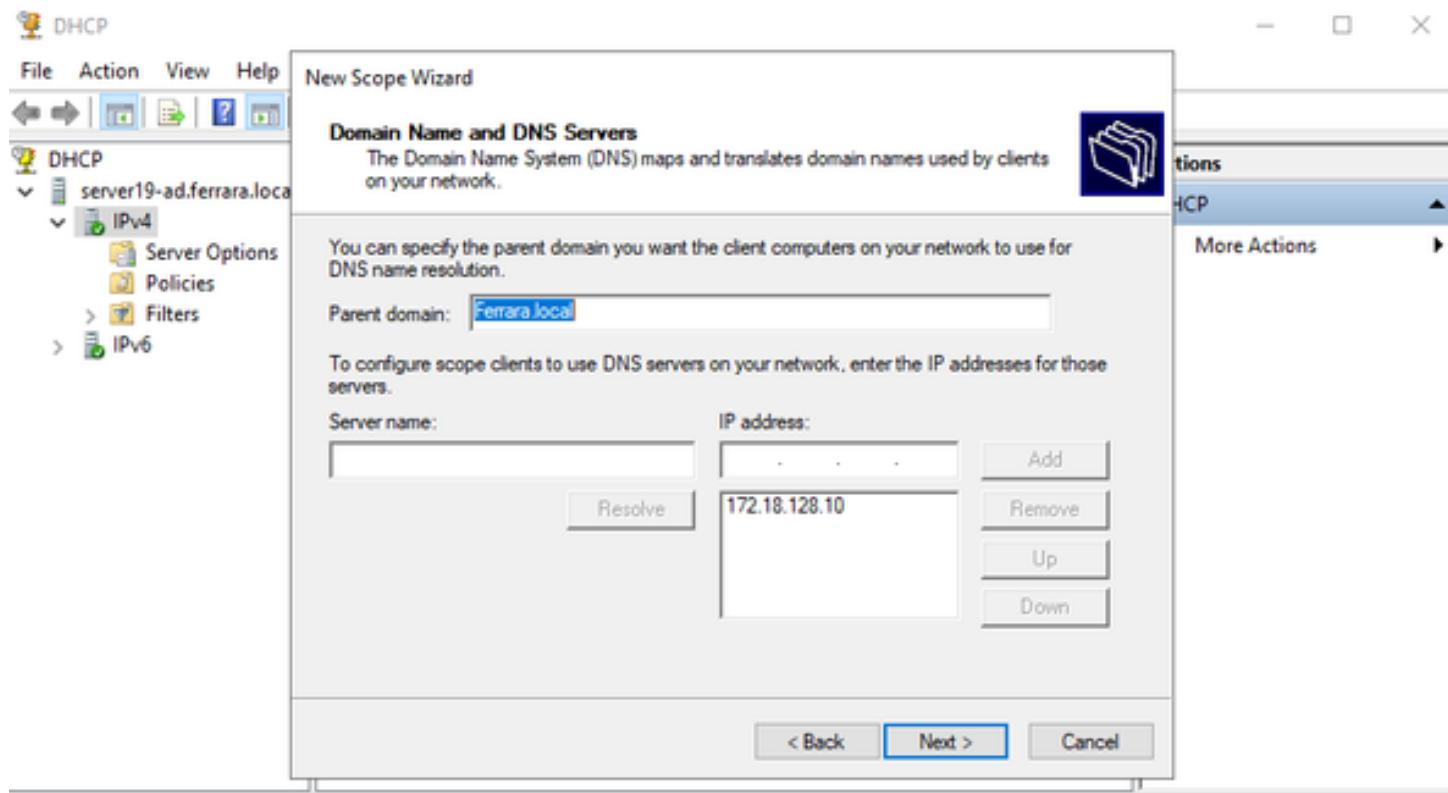
Added lease days 31-> "Next"



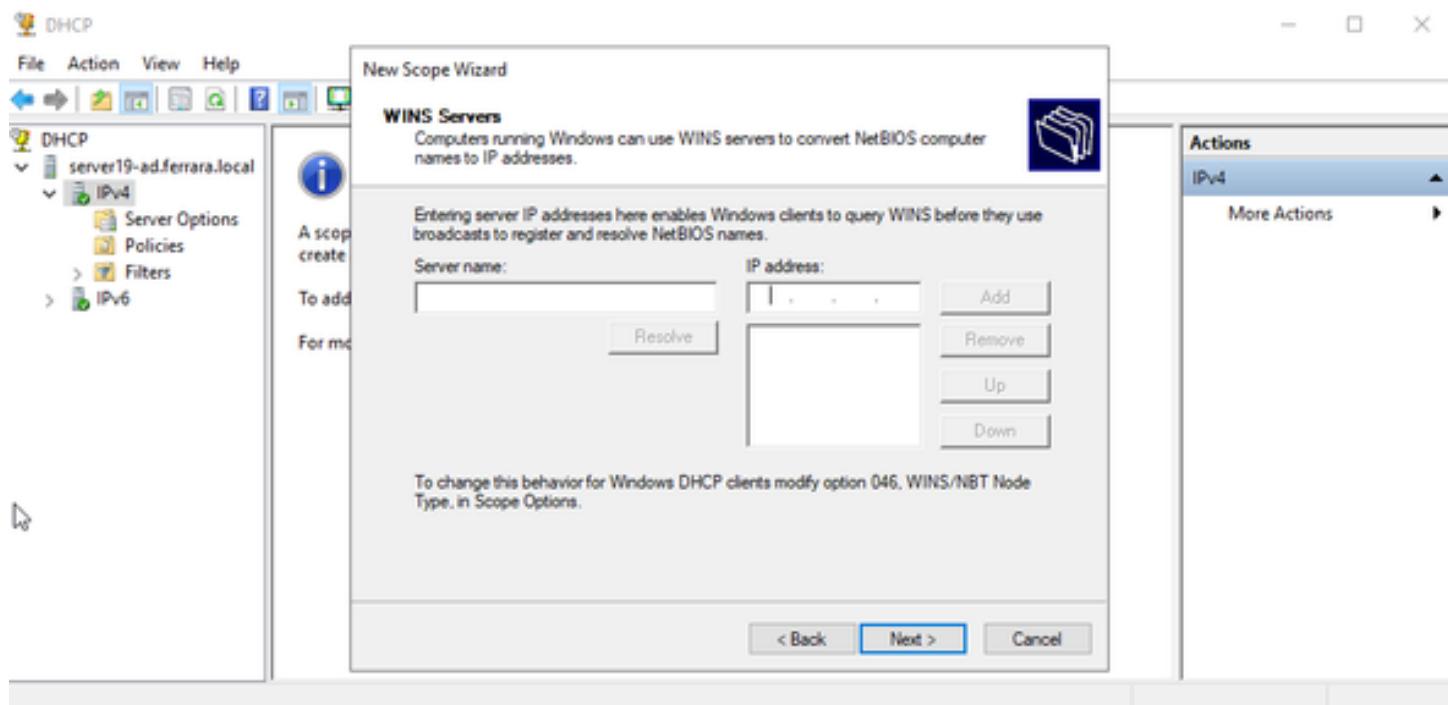
Clicked “Next”



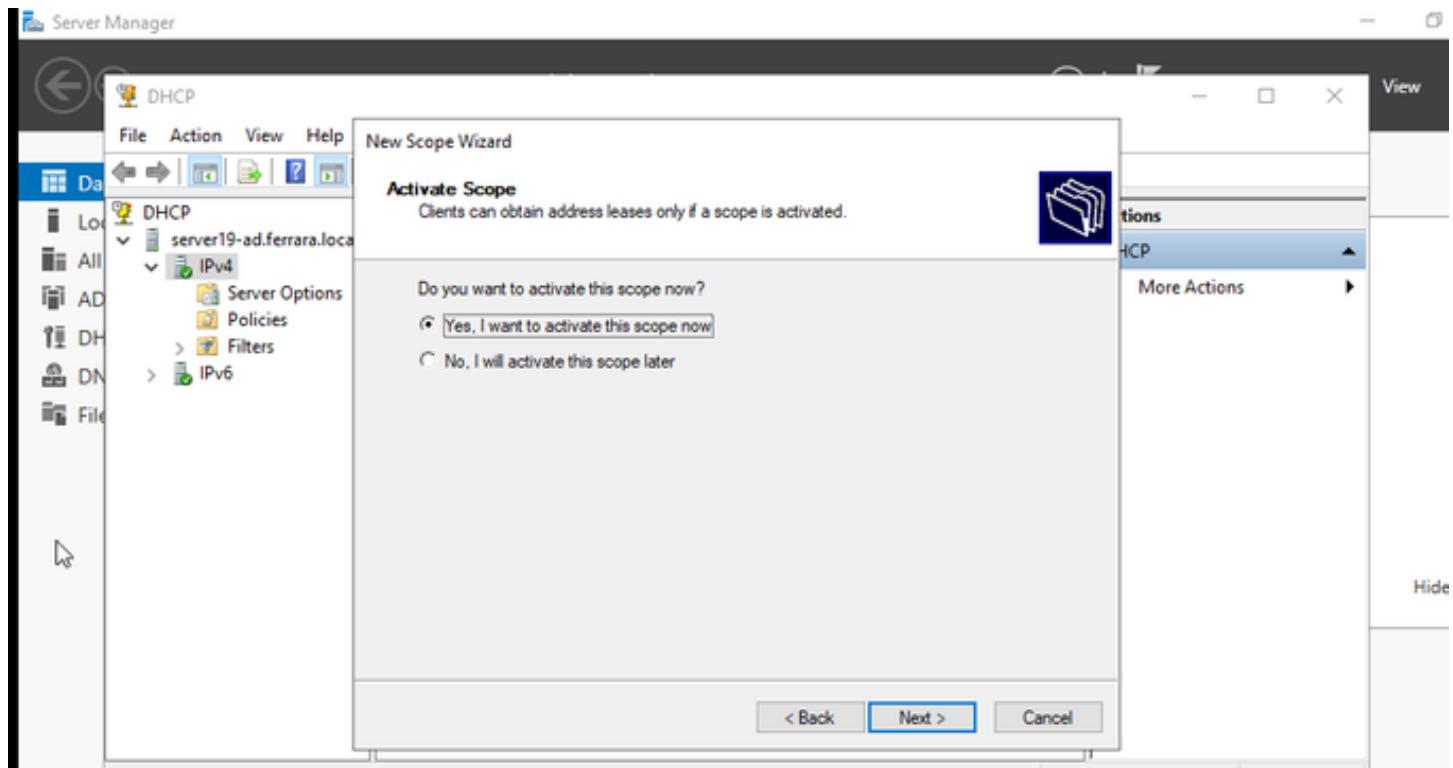
I added IP address for router and clicked “Next”



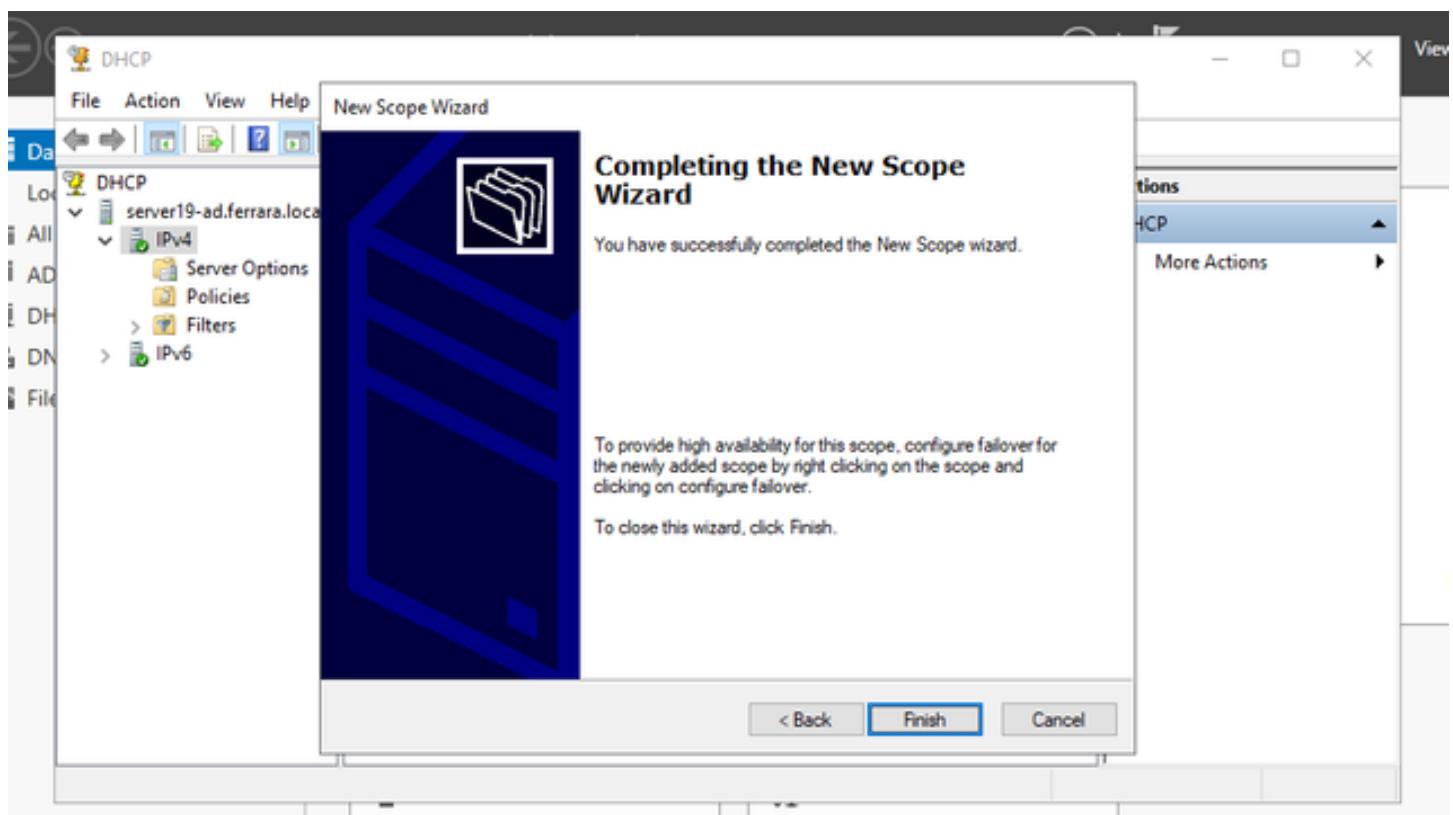
"Next"



clicked "Next"

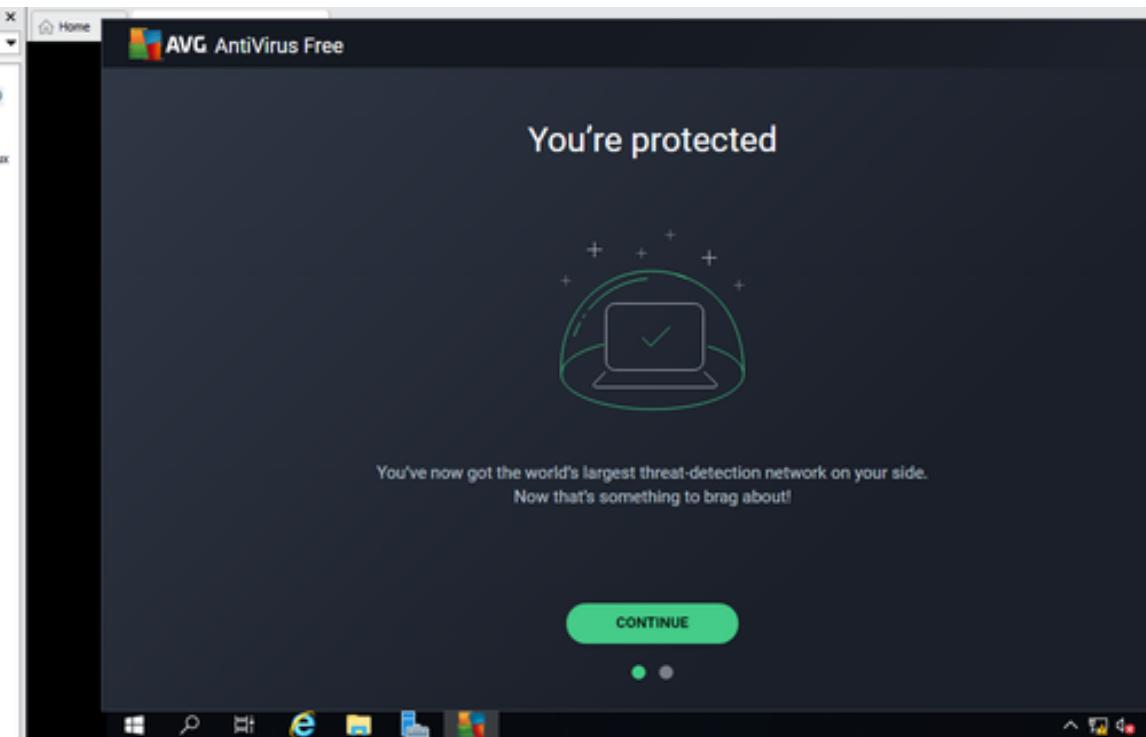


Clicked on "Next"



Clicked on “Finish”

## Stage 6 – Antivirus installation



## Stage 8 – Testing functionality of stages 4–7

```
Command Prompt
Microsoft Windows [Version 10.0.17763.107]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Admin>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . : Ferrara.local
Link-local IPv6 Address . . . . . : fe80::5a9:b7a9:6339:93bf%14
IPv4 Address . . . . . : 172.18.128.20
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 172.18.128.1

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . : 

C:\Users\Admin>
```

On Windows10 -> cmd -> ipconfig

```
Command Prompt
C:\Users\Admin>ipconfig /all

Windows IP Configuration

Host Name . . . . . : DESKTOP-JM3MRDR
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : Ferrara.local

Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . . . . . : Ferrara.local
Description . . . . . : Intel(R) 82574L Gigabit Network Connection
Physical Address. . . . . : 00-0C-29-43-E3-57
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::5a9:b7a9:6339:93bf%14(Preferred)
IPv4 Address. . . . . : 172.18.128.20(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : 15 December 2020 21:09:55
Lease Expires . . . . . : 15 January 2021 21:11:37
Default Gateway . . . . . : 172.18.128.1
DHCP Server . . . . . : 172.18.128.10
DHCPv6 IAID . . . . . : 117443625
DHCPv6 Client DUID. . . . . : 00-01-00-01-27-6A-D9-C3-00-0C-29-43-E3-57
DNS Servers . . . . . : 172.18.128.10
NetBIOS over Tcpip. . . . . : Enabled
```

Windows10-> cmd -> ipconfig /all

```
Command Prompt
Default Gateway . . . . . : 172.18.128.1
DHCP Server . . . . . : 172.18.128.10
DHCPv6 IAID . . . . . : 117443625
DHCPv6 Client DUID. . . . . : 00-01-00-01-27-6A-D9-C3-00-0C-29-43-E3-57
DNS Servers . . . . . : 172.18.128.10
NetBIOS over Tcpip. . . . . : Enabled

Ethernet adapter Bluetooth Network Connection:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Description . . . . . : Bluetooth Device (Personal Area Network)
Physical Address. . . . . : F4-8C-50-A4-84-67
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes

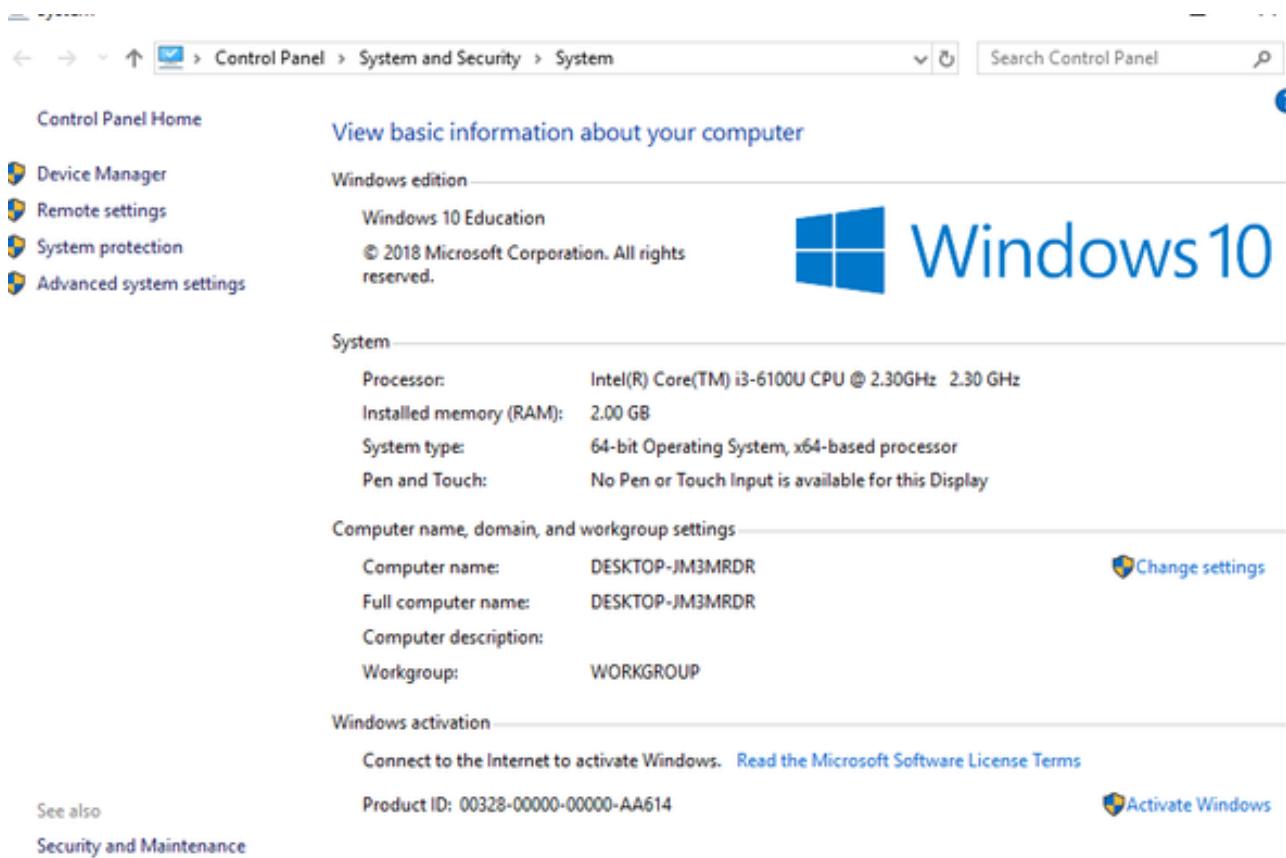
C:\Users\Admin>ping ferrara.local

Pinging ferrara.local [172.18.128.10] with 32 bytes of data:
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128

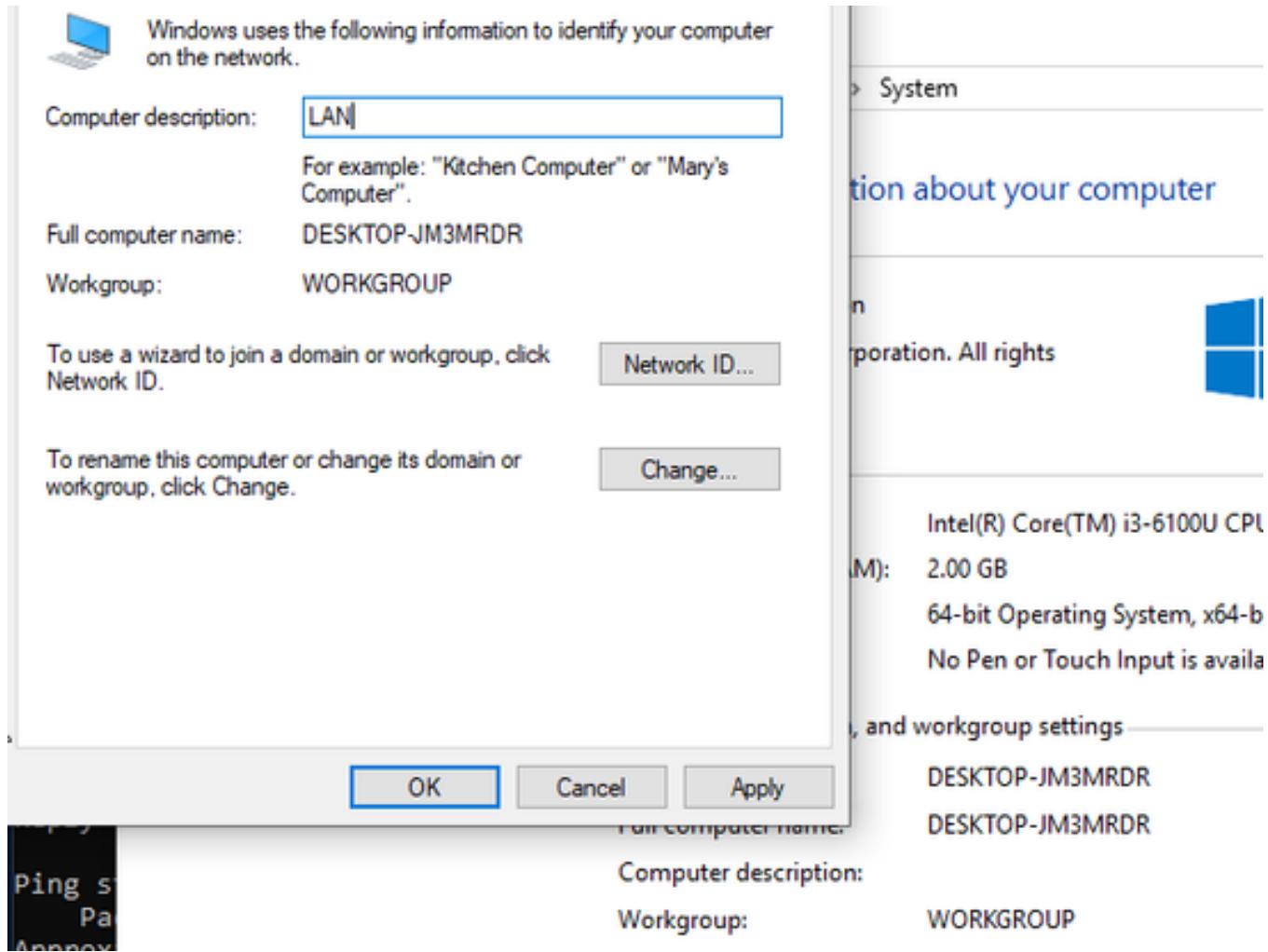
Ping statistics for 172.18.128.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\Admin>
```

On windows10 cmd -> I pinged ferrara.local



I went to control panel-> Systems and security -> change settings



Then I clicked Network ID

Is your company network on a domain?

- My company uses a network with a domain
- My company uses a network without a domain

Next

Cancel

clicked next

Select the option that describes your network

- This computer is part of a business network; I use it to connect to other computers at work
- This is a home computer; it's not part of a business network.

Next

Cancel

clicked next

You will need the following information

- Your user name
- Your password
- Your user account domain name

You might also need:

- Your computer name
- Your computer domain name

If you don't have this information, contact your network administrator.

Next

Cancel

clicked next

Type your user name, password, and domain name for your domain account

User name:

Admin

Password:

\*\*\*\*\*

Domain name:

FERRARA.LOCAL

Next

Cancel

I created user and clicked next

## Type the computer name and computer domain name

Windows cannot find an account for your computer in the FERRARA.LOCAL domain. (Your computer domain can be different from your user account domain.)

Computer name:

DESKTOP01

Computer domain:

FERRARA.LOCAL

Next

Cancel

Changed name and clicked next

Type th

Windows  
computer

Computer

Computer

### Domain User Name and Password

X

Type the name and password of an account with permission to join the domain.

User name:

Password:

Domain:

OK

Cancel

Next

Cancel

joined domain clicked okay

Sys

Co

### Join a Domain or Workgroup

X

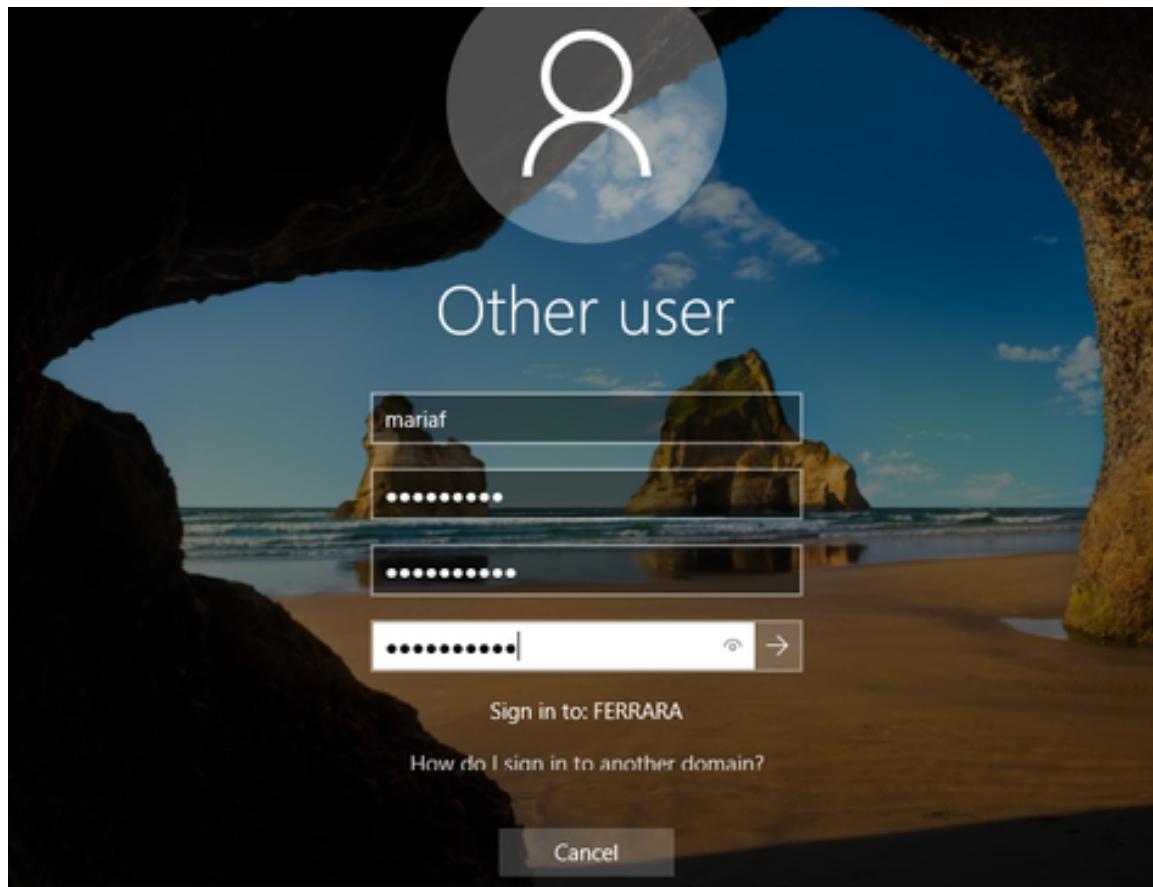
You must restart your computer to apply these changes

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

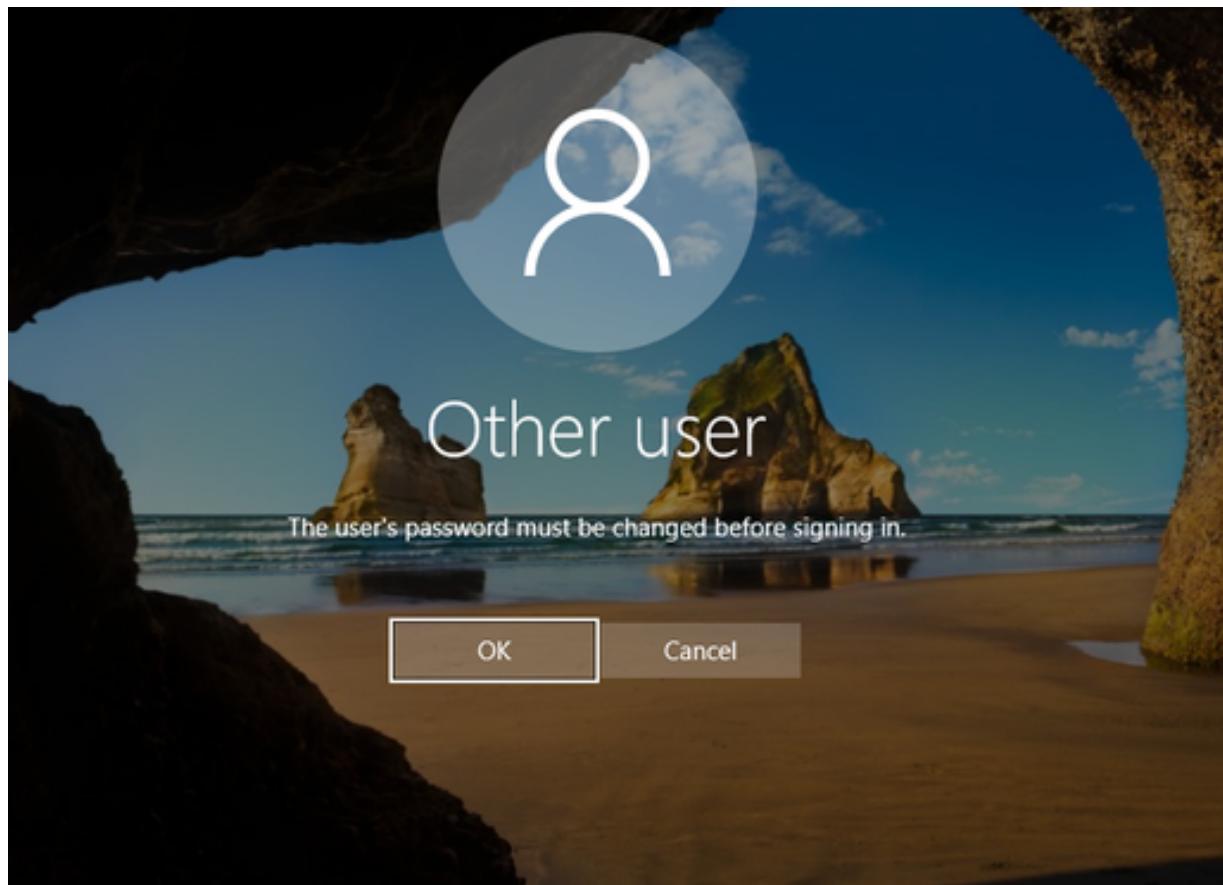
Finish

Cancel

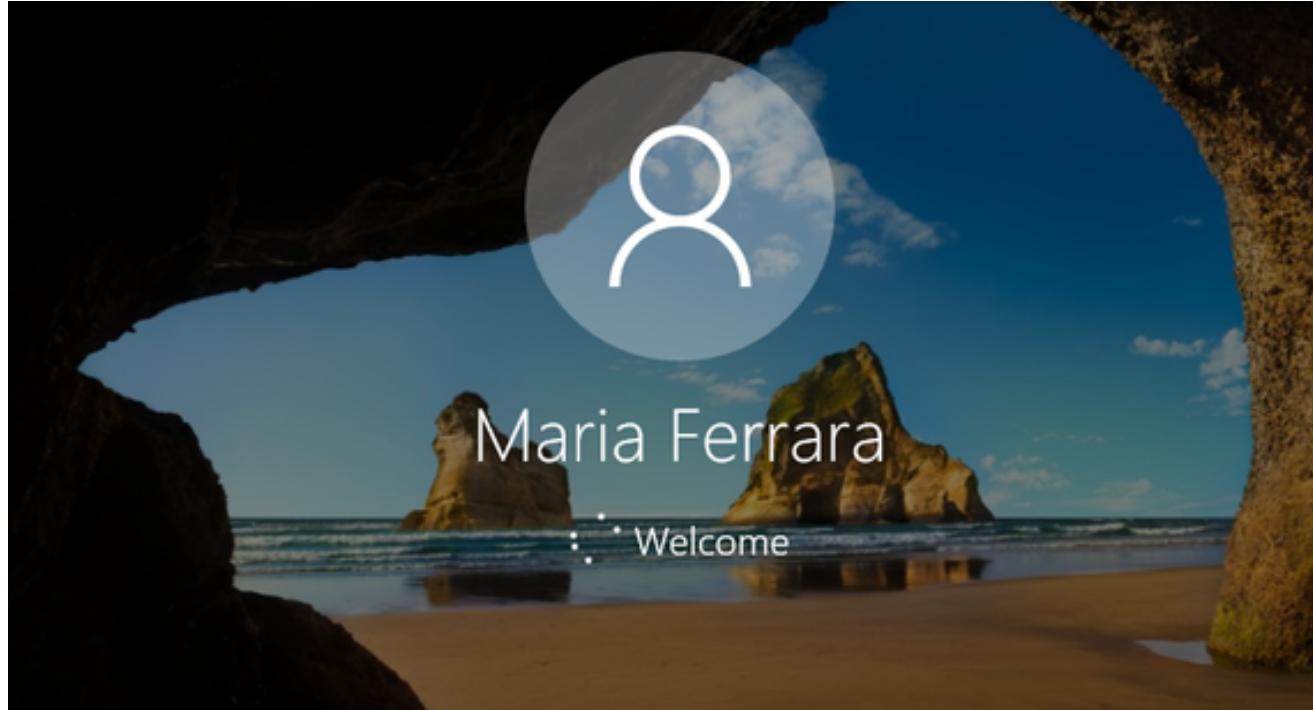
pressed finished then restart now



Logged in with existing user's login details



## Changed details



## User joined domain

On windows10 -> cmd -> I used "ipconfig /release" and "ipconfig /renew commands"

```
Command Prompt
Ping statistics for 172.18.128.10:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Users\mariaf>ipconfig /renew
Windows IP Configuration

Ethernet adapter Ethernet0:

  Connection-specific DNS Suffix  . : Ferrara.local
  Link-local IPv6 Address . . . . . : fe80::5a9:b7a9:6339:93bf%14
  IPv4 Address. . . . . : 172.18.128.20
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 172.18.128.1

C:\Users\mariaf>ping 172.18.128.10

Pinging 172.18.128.10 with 32 bytes of data:
Reply from 172.18.128.10: bytes=32 time<1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128

Ping statistics for 172.18.128.10:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\mariaf>
```

Then I used pinged 172.18.128.10

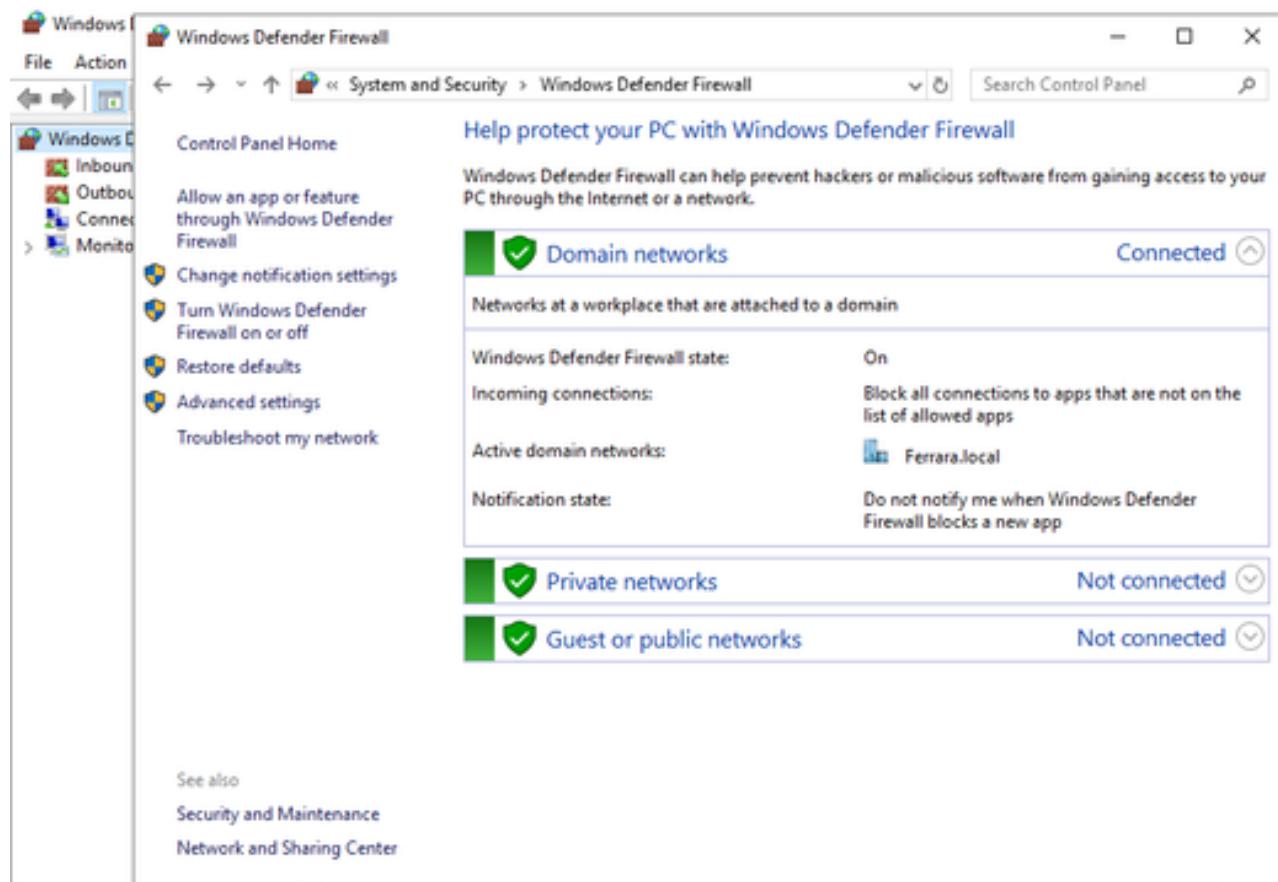
```
C:\Users\mariaf>ping SERVER19-AD

Pinging Server19-AD.Ferrara.local [172.18.128.10] with 32 bytes of data:
Reply from 172.18.128.10: bytes=32 time<1ms TTL=128

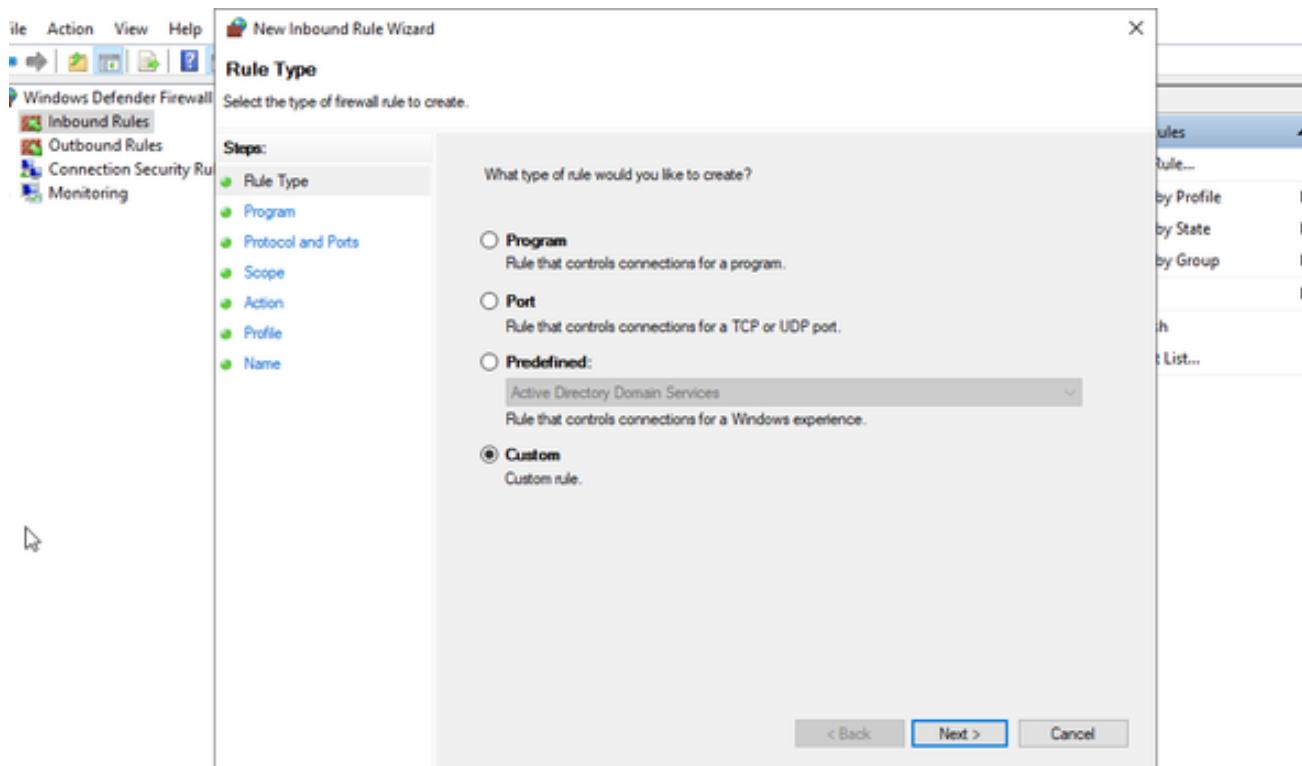
Ping statistics for 172.18.128.10:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\mariaf>
```

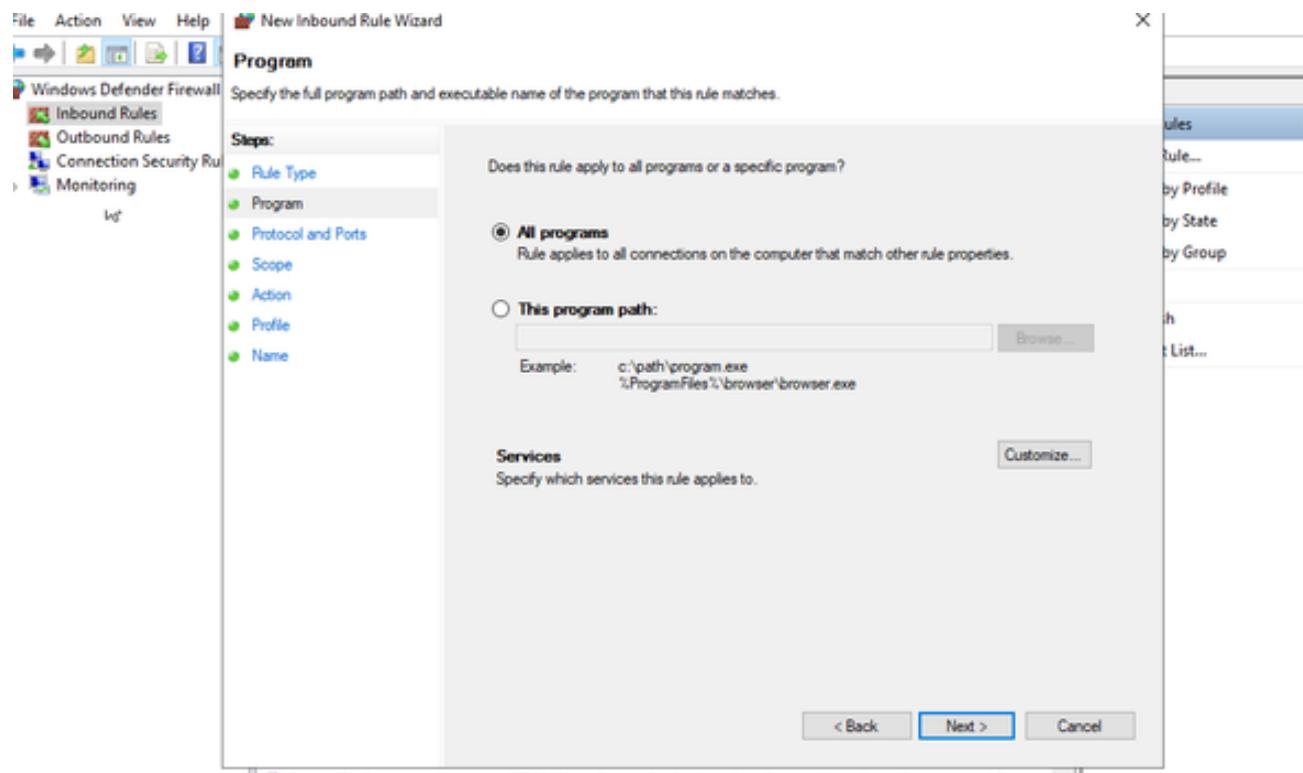
## Stage 7 – Firewall configuration



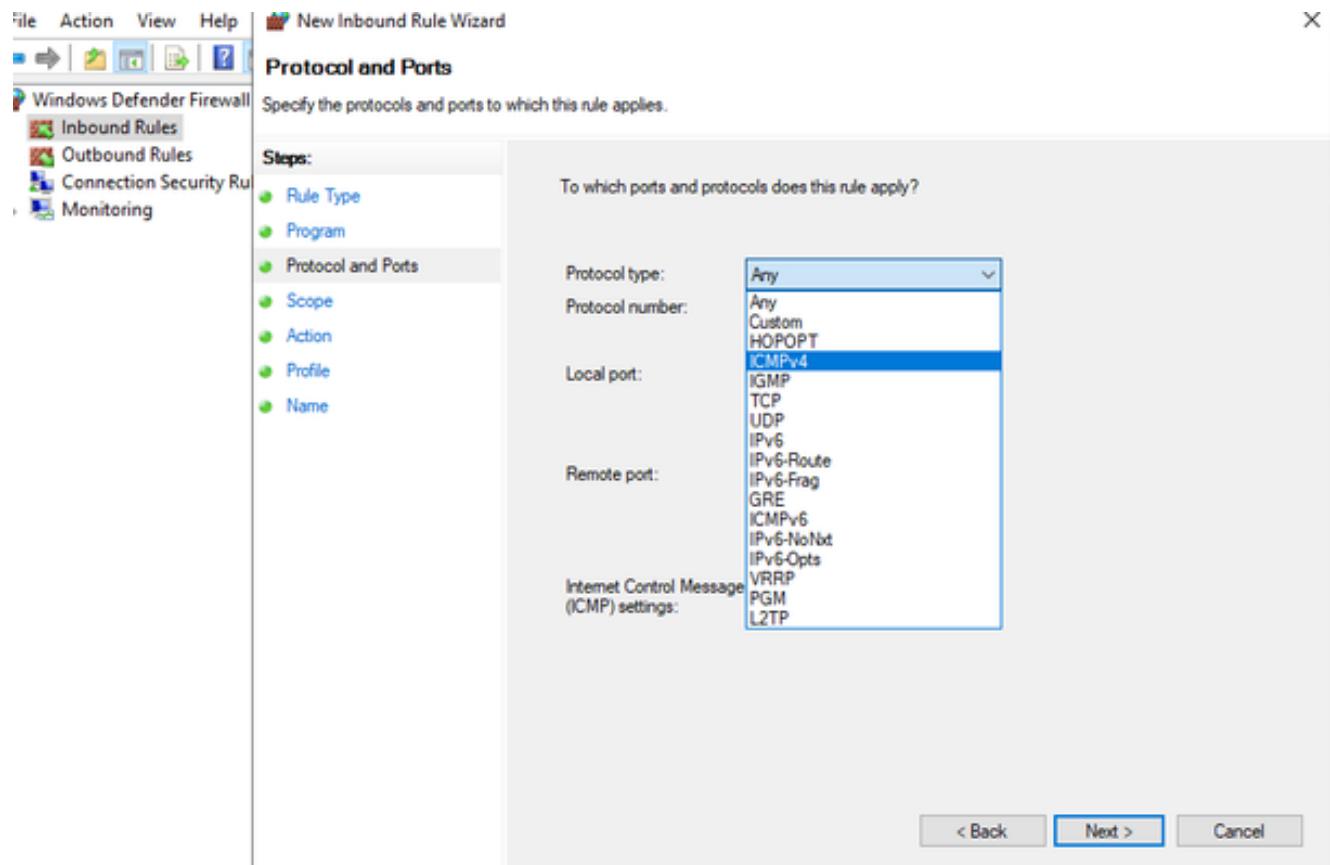
Control panel → systems and security → windows defender firewall → clicked advanced setting



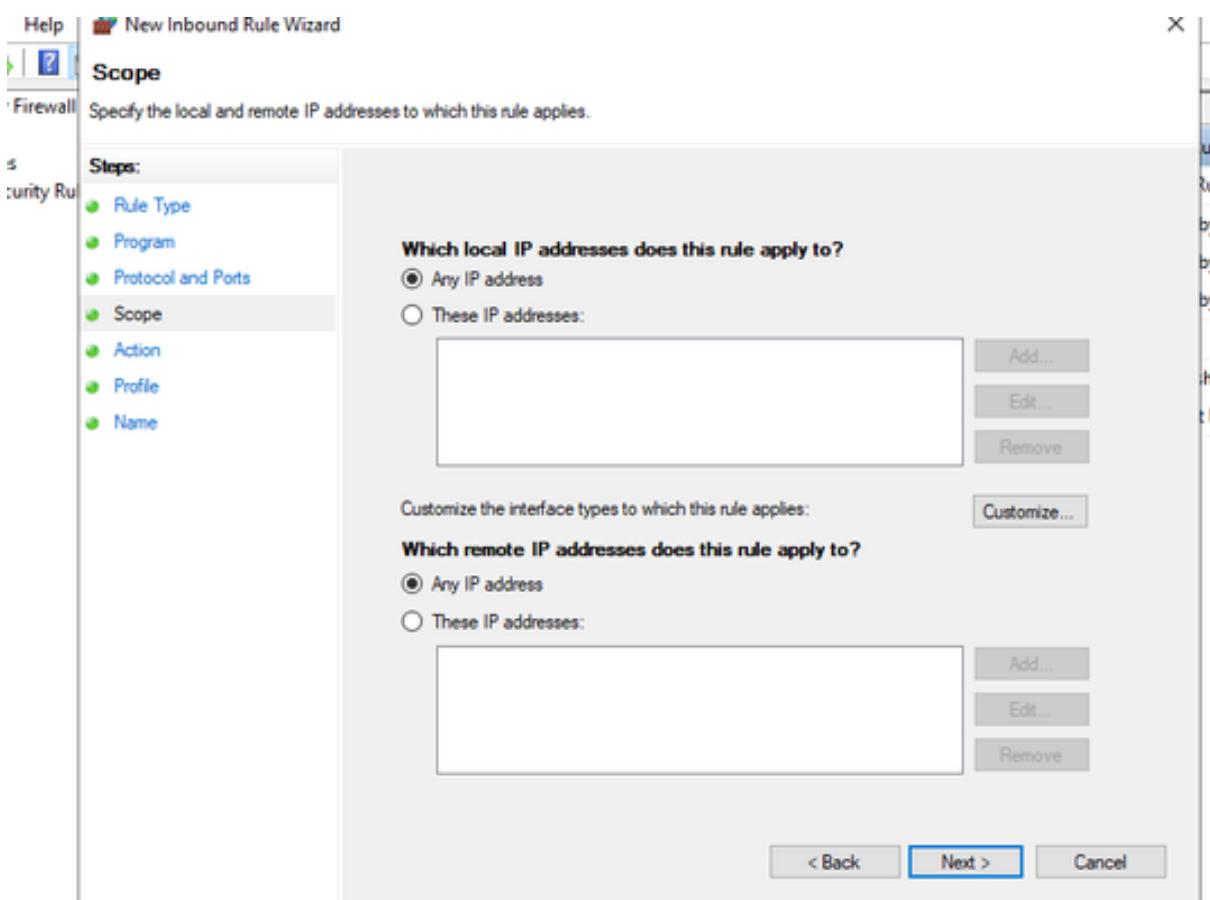
In inbound rule → clicked new rule → custom rule → next



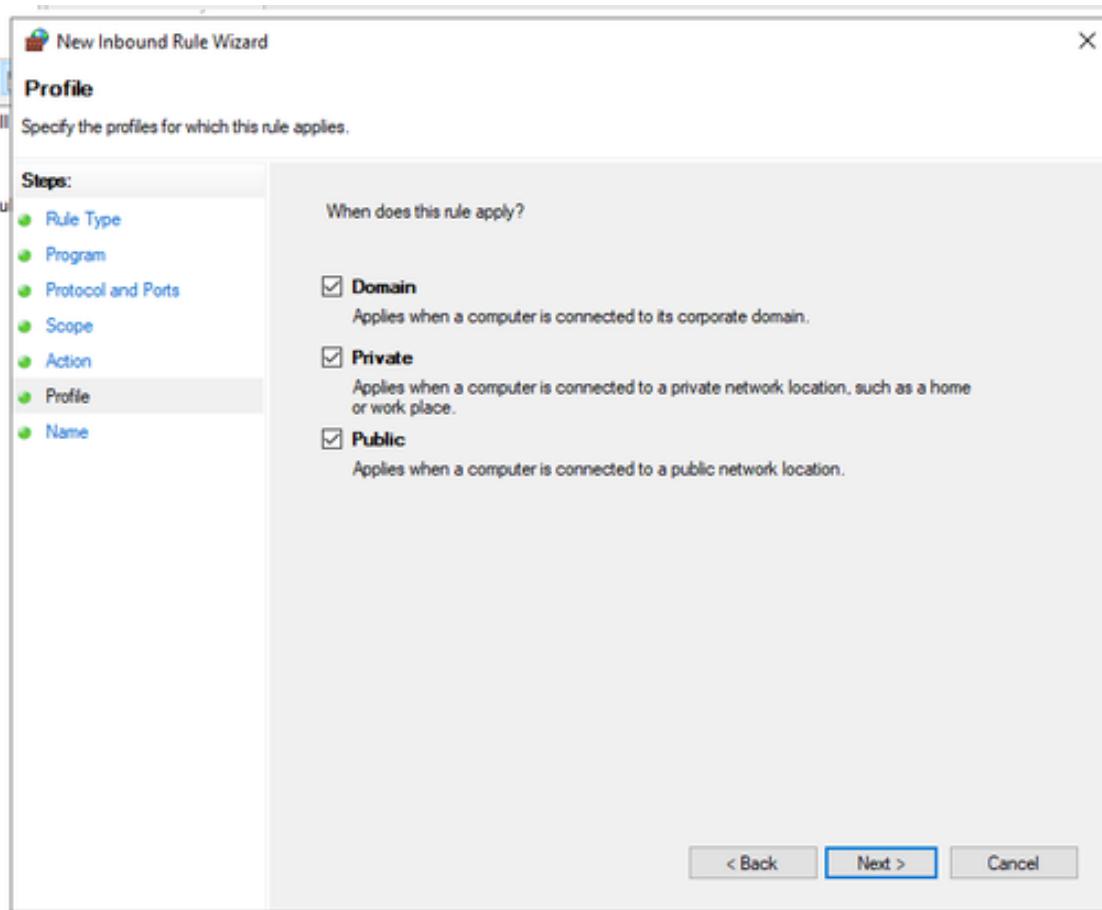
Clicked next



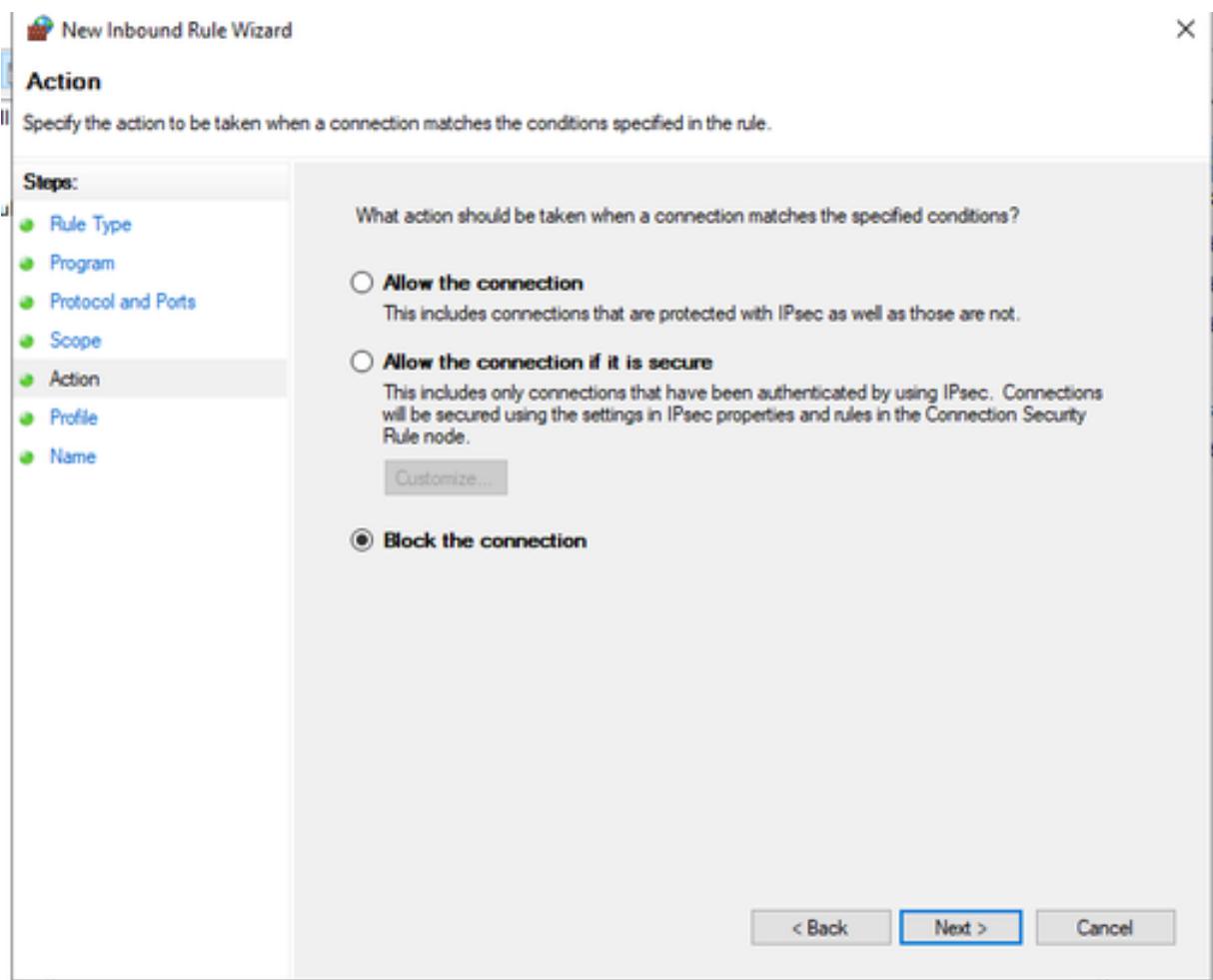
Chose ICMPv4 under protocol type -> clicked next



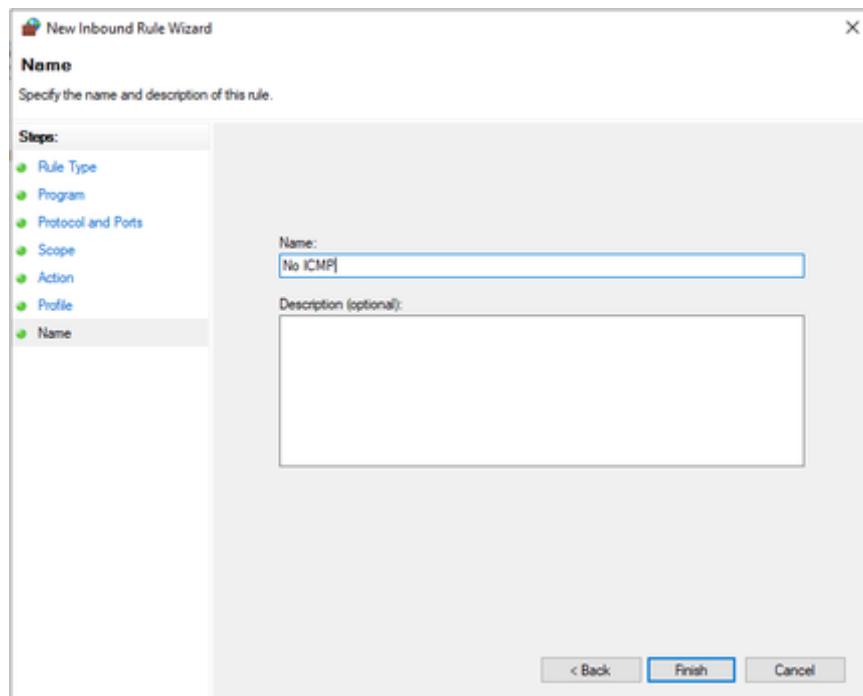
Clicked next



Selected Block the connection and next



Clicked next



Named rule and clicked finish

```
C:\Users\mariaf>ping SERVER19-AD

Pinging Server19-AD.Ferrara.local [172.18.128.10] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 172.18.128.10:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Users\mariaf>
```

After creating firewall rule I tried to ping server to check

| Name       | Group        | Profile                        | Enabled | Action |       |
|------------|--------------|--------------------------------|---------|--------|-------|
| No ICMP    | Disable Rule | All                            | Yes     | Block  |       |
| Active Dir | Cut          | Active Directory Domain Ser... | All     | Yes    | Allow |
| Active Dir | Copy         | Active Directory Domain Ser... | All     | Yes    | Allow |
| Active Dir | Delete       | Active Directory Domain Ser... | All     | Yes    | Allow |
| Active Dir | Properties   | Active Directory Domain Ser... | All     | Yes    | Allow |
| Active Dir | Help         | Active Directory Domain Ser... | All     | Yes    | Allow |
| Active Dir |              | Active Directory Domain Ser... | All     | Yes    | Allow |

Disabled rule to test outcome

```
C:\Users\mariaf>ping SERVER19-AD

Pinging Server19-AD.Ferrara.local [172.18.128.10] with 32 bytes of data:
Reply from 172.18.128.10: bytes=32 time<1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128

Ping statistics for 172.18.128.10:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\mariaf>
```

ping result when firewall rule is disabled

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.17763.1]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>ping 172.18.128.10

Pinging 172.18.128.10 with 32 bytes of data:
Reply from 172.18.128.10: bytes=32 time<1ms TTL=128

Ping statistics for 172.18.128.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Administrator>
```

Ping result from server to host would still work as firewall rule was created in inbound therefore sever can ping but incoming pings have been blocked by firewall.

```
C:\Users\mariaf>ping SERVER19-AD -t

Pinging Server19-AD.Ferrara.local [172.18.128.10] with 32 bytes of data:
Request timed out.
Reply from 172.18.128.10: bytes=32 time=1ms TTL=128
Request timed out.
Request timed out.
Request timed out.
```

Host cannot ping server with firewall rule enabled- by disabling firewall rule host starts to ping sever again.