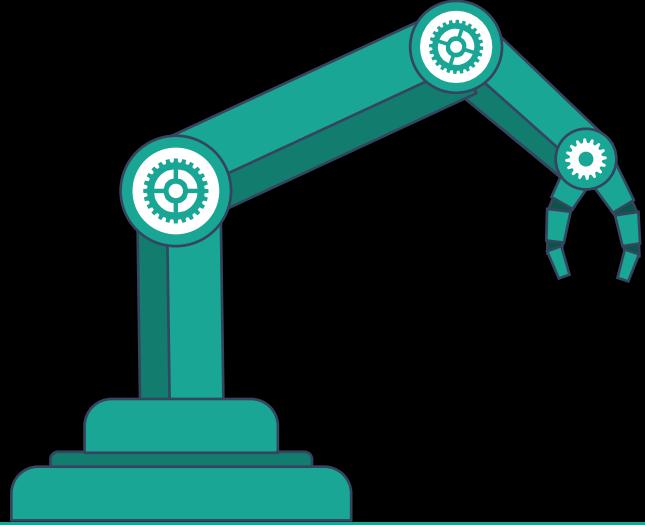
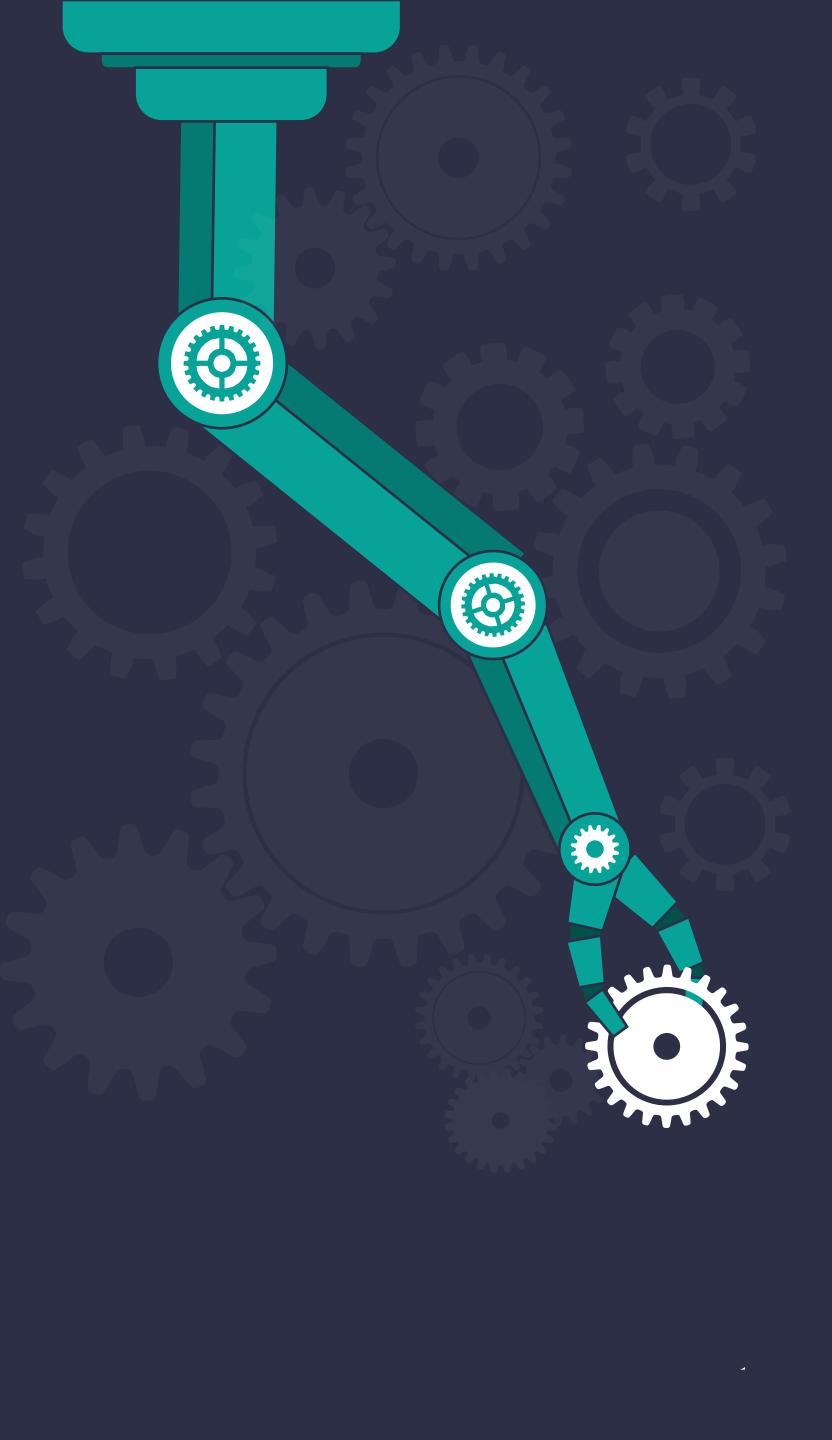


# ALGORITMIKA



# Installing and configuring DNS, DHCP, Domain Controller on Ubuntu Server

Student: Amil Jamilov  
Instructor: Ulvu Feyziyev



# Plan:

01

Installing Ubuntu Server,  
Initial network settings

02

DNS, DHCP, NAT installation, adjustment

03

Domain Controller installation, adjustment

04

NFS Server, GNOME Desktop Environment,  
Docker Container Platform



# Ubuntu



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ubuntu server **download**

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## Get Ubuntu Server

### Option 1: Manual server installation

USB or DVD image based physical install

- ✓ OS security guaranteed until April 2027
- ✓ Extended security maintenance until April 2032
- ✓ Commercial support for enterprise customers

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Read the Ubuntu Server 22.04 LTS release notes >

Option 1 - Manual server installation Option 2 - Instant Ubuntu VMs Option 3 - Automated server provisioning

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<https://ubuntu.com/download/server#download-content> Ubuntu Server 22.10



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# Get Ubuntu Server

## Option 1: Manual server installation

USB or DVD [image based physical install](#)

- OS security guaranteed until April 2027
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- Commercial support for enterprise customers



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## Alternative releases

Ubuntu Server 22.10



File Machine Help



Tools

 New  
 Add  
 Settings  
 Discard  
 Start Ubuntu Server \_ project Clone (Snapshot 2)  
Running Ubuntu Server \_ project  
Powered Off Ubuntu-Personal \_ 2  
Running Ubuntu-Personal (Initial State)  
Powered Off Ubuntu Server WebServer  
Powered Off kali-linux-2022.4-virtualbox-amd64 (snap 1)  
Powered Off

General

? X

Name and Operating System

Name: **UbuntuServer-Project** ✓

Folder: C:\Users\User\VirtualBox VMs

ISO Image: C:\Users\User\Downloads\ubuntu-22.04.1-live-server-amd64.iso  
C:\Users\User\Downloads\ubuntu-22.04.1-live-server-amd64.iso  
Other...

Type: C:\Users\User\Downloads\ubuntu-22.04.1-live-server-amd64.iso  
C:\Users\User\Desktop\ISO Files\ubuntu-22.10-desktop-amd64.iso  
C:/Users/User/Desktop/ISO Files/Win10\_21H2\_English\_x64.iso  
C:/Users/User/Downloads/en-us\_windows\_server\_2019\_updated\_aug\_2021\_x64\_dvd\_a6431a28.iso  
C:/Users/User/Desktop/server/Windows SRV 2019.iso

Version:

Unattended Install

Hardware

Hard Disk

Help Guided Mode Back Finish Cancel

Preview



File Machine Help



Tools

 Ubuntu Server \_ project Clone (Snapshot 2)  
Running Ubuntu Server \_ project  
Powered Off Ubuntu-Personal \_ 2  
Running Ubuntu-Personal (Initial State)  
Powered Off Ubuntu Server WebServer  
Powered Off kali-linux-2022.4-virtualbox-amd64 (snap 1)  
Powered Off

New   Add   Settings   Discard   Start

General

?

X

### Create Virtual Machine

Name and Operating System

Unattended Install

Hardware

Base Memory: 3054 MB

Processors: 4

1 CPU

12 CPUs

Enable EFI (special OSes only)

Hard Disk

Help

Guided Mode

Back

Finish

Cancel

Preview



File Machine Help



Tools

 New  
 Add  
 Settings  
 Discard  
 Start Ubuntu Server \_ project Clone (Snapshot 2)  
Running Ubuntu Server \_ project  
Powered Off Ubuntu-Personal \_ 2  
Running Ubuntu-Personal (Initial State)  
Powered Off Ubuntu Server WebServer  
Powered Off kali-linux-2022.4-virtualbox-amd64 (snap 1)  
Powered Off

General

### Create Virtual Machine

Name and Operating System

Unattended Install

Hardware

Hard Disk

Create a Virtual Hard Disk Now

Hard Disk File Location and Size

C:\Users\User\VirtualBox VMs\UbuntuServer-Project\UbuntuServer-Project.vdi

4.00 MB      2.00 TB      50.00 GB

Hard Disk File Type and Variant

VDI (VirtualBox Disk Image)

Pre-allocate Full Size

Split into 2GB parts

Use an Existing Virtual Hard Disk File

Ubuntu-Personal\_1.vdi (Normal, 50.00 GB)

Do Not Add a Virtual Hard Disk

Help      Guided Mode      Back      Finish      Cancel

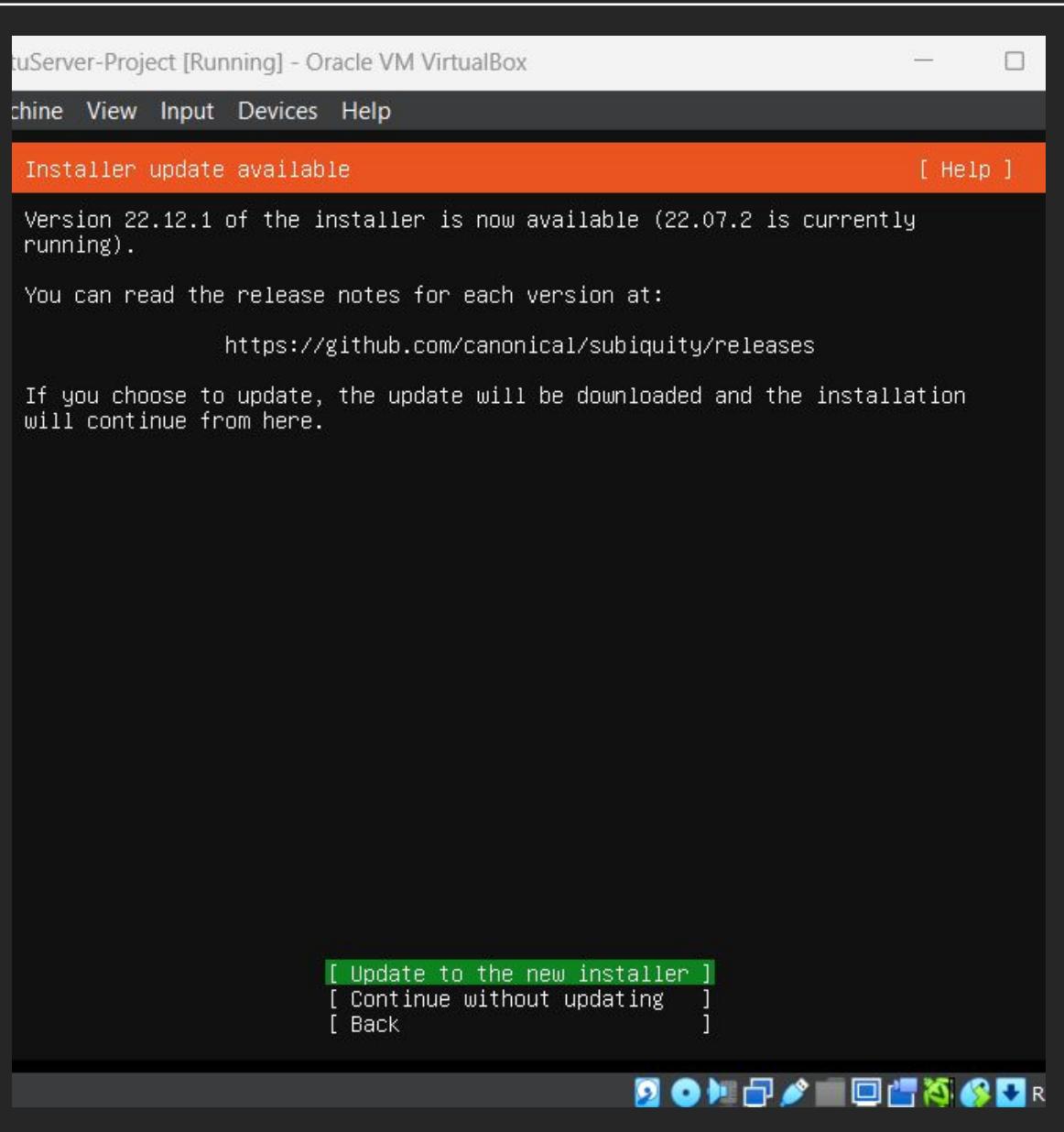
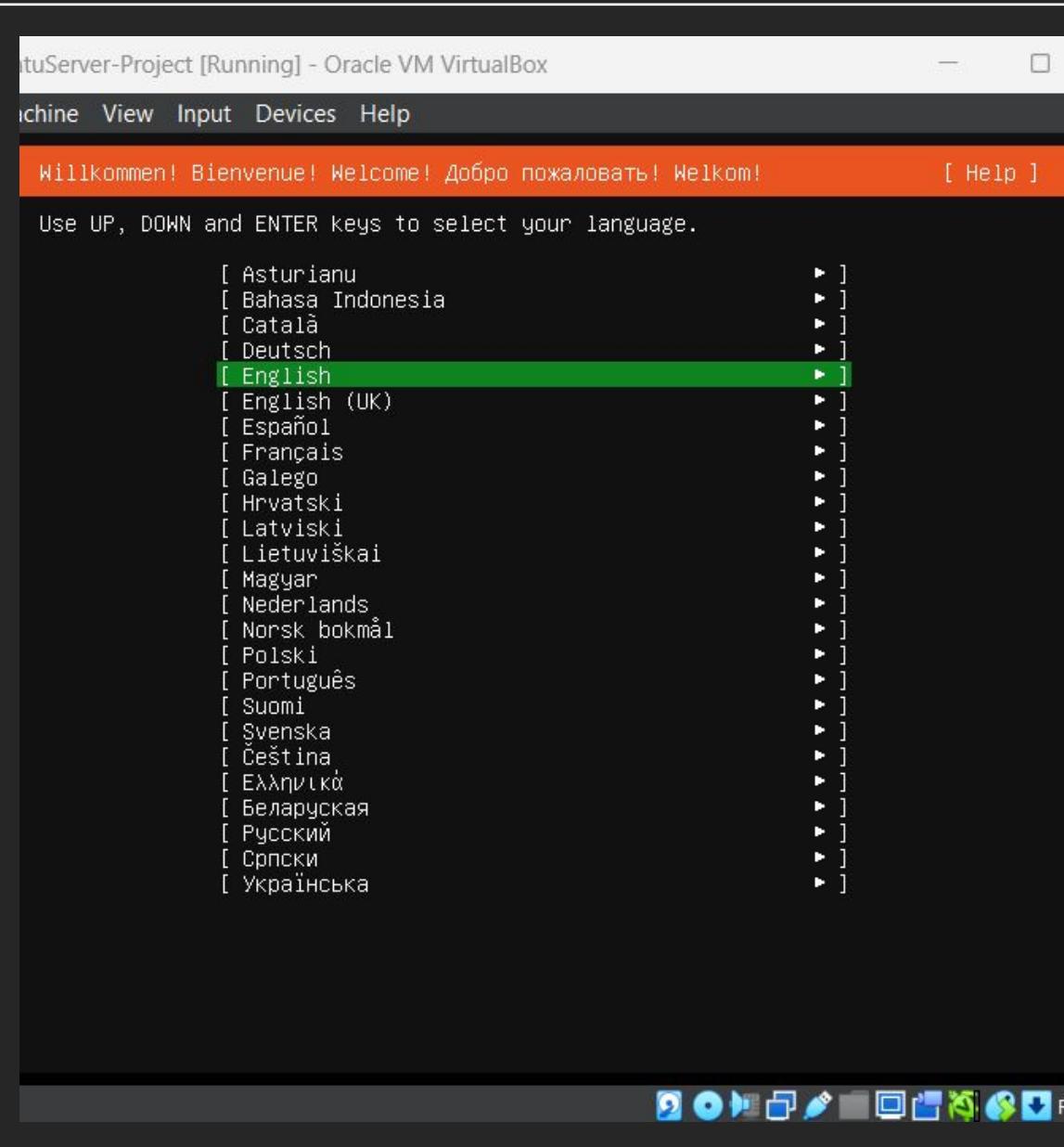
Preview

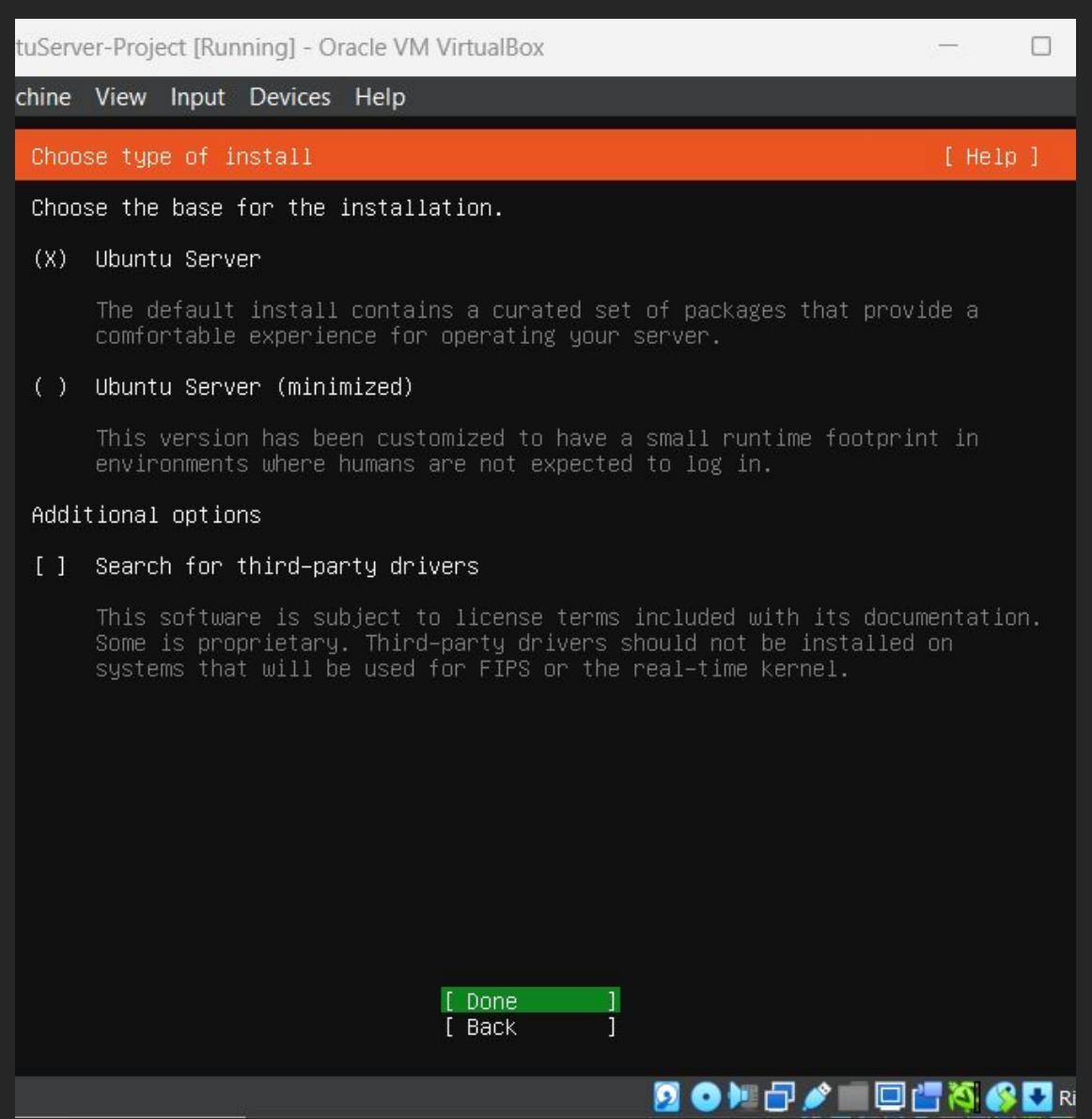
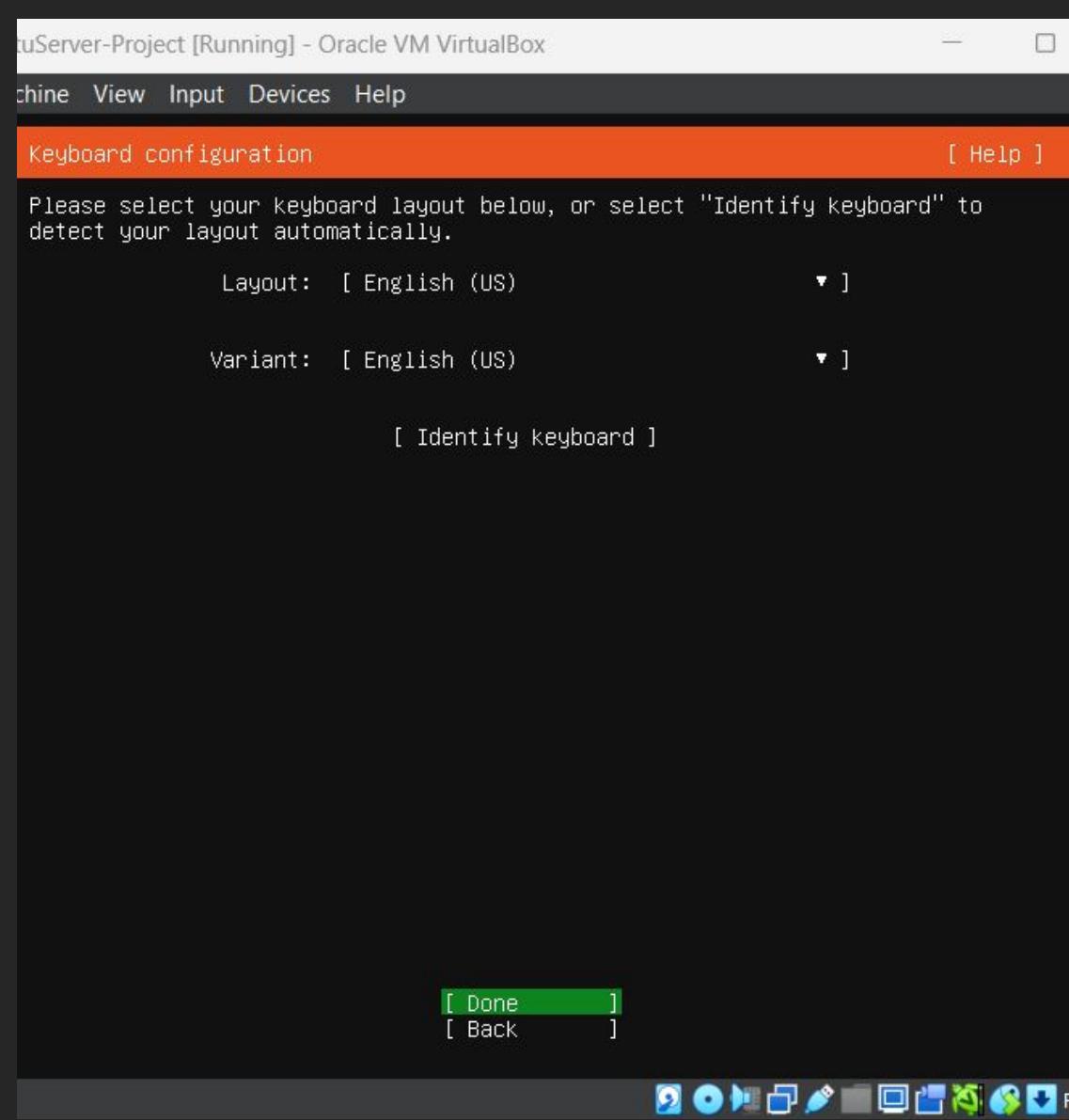
Ubuntu Server \_ project

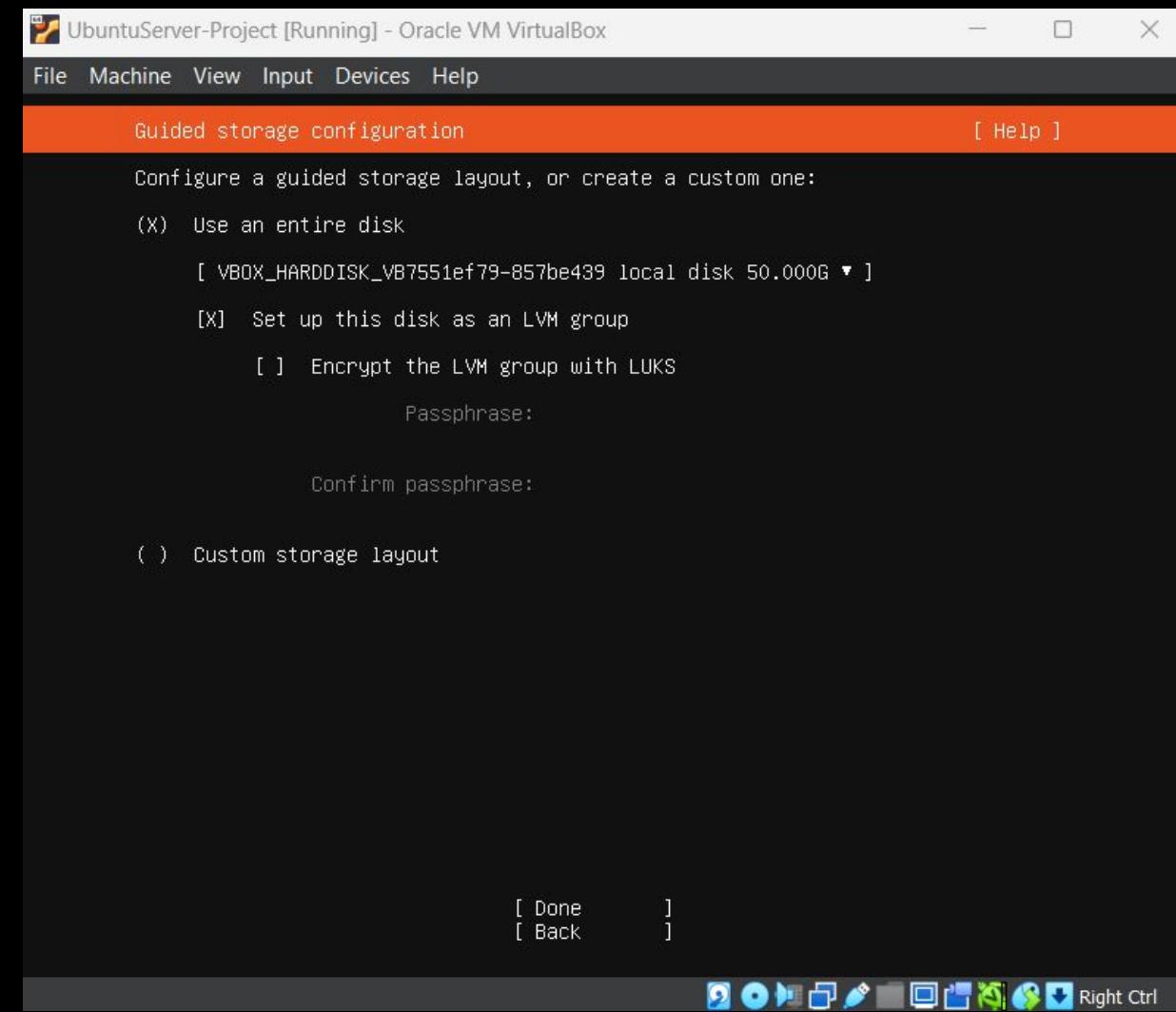
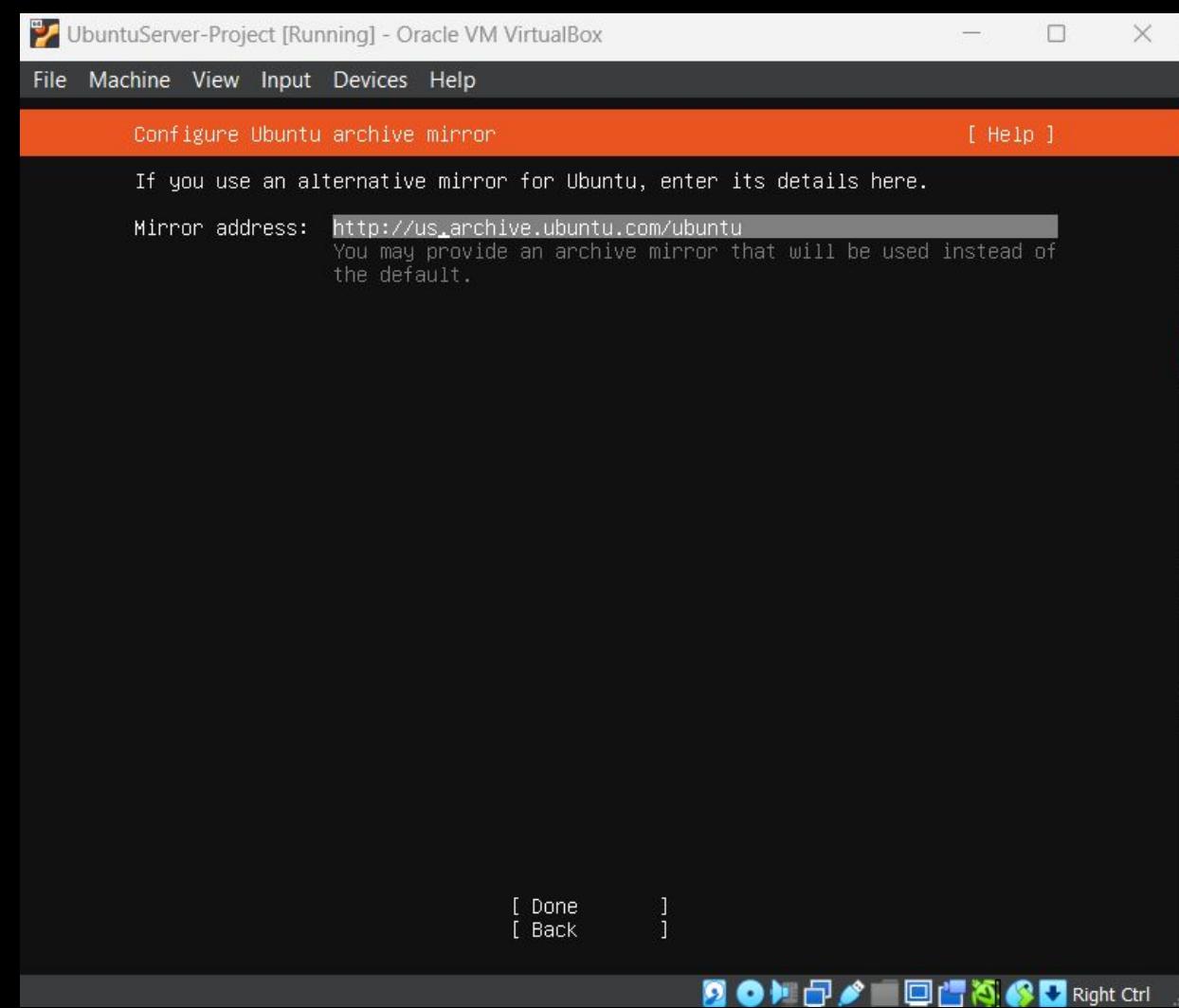
UbuntuServer-Project [Running] - Oracle VM VirtualBox

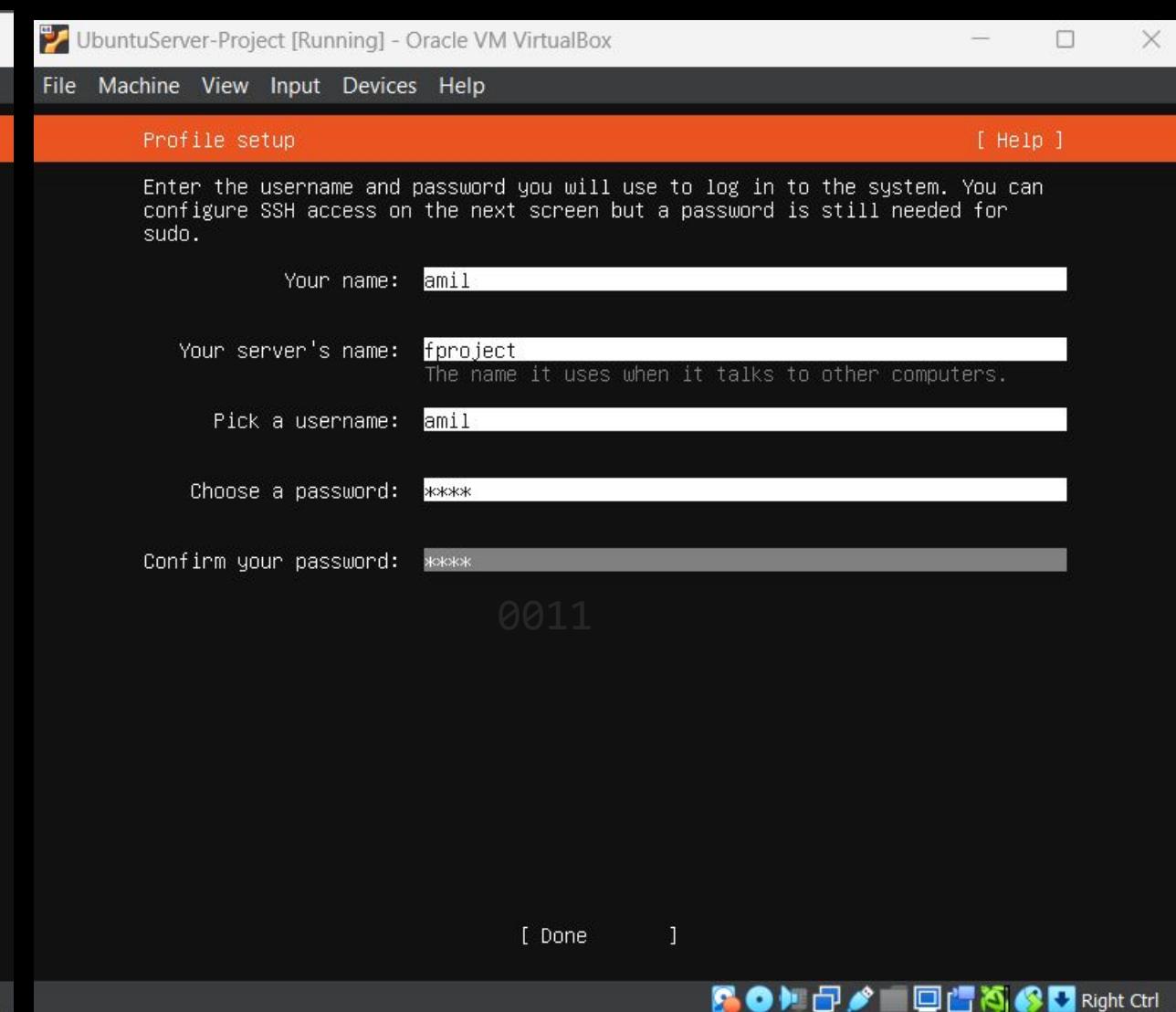
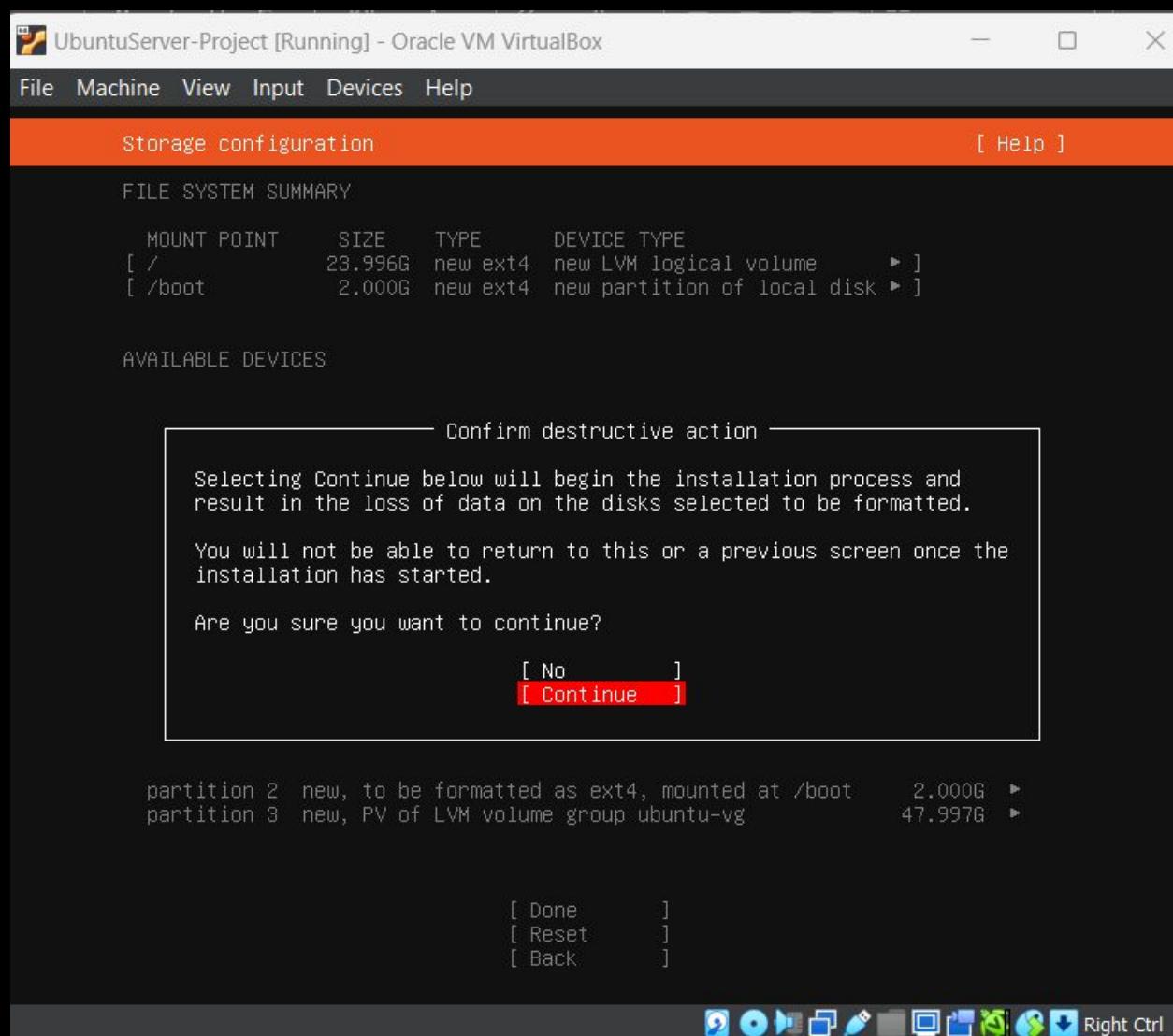
File Machine View Input Devices Help

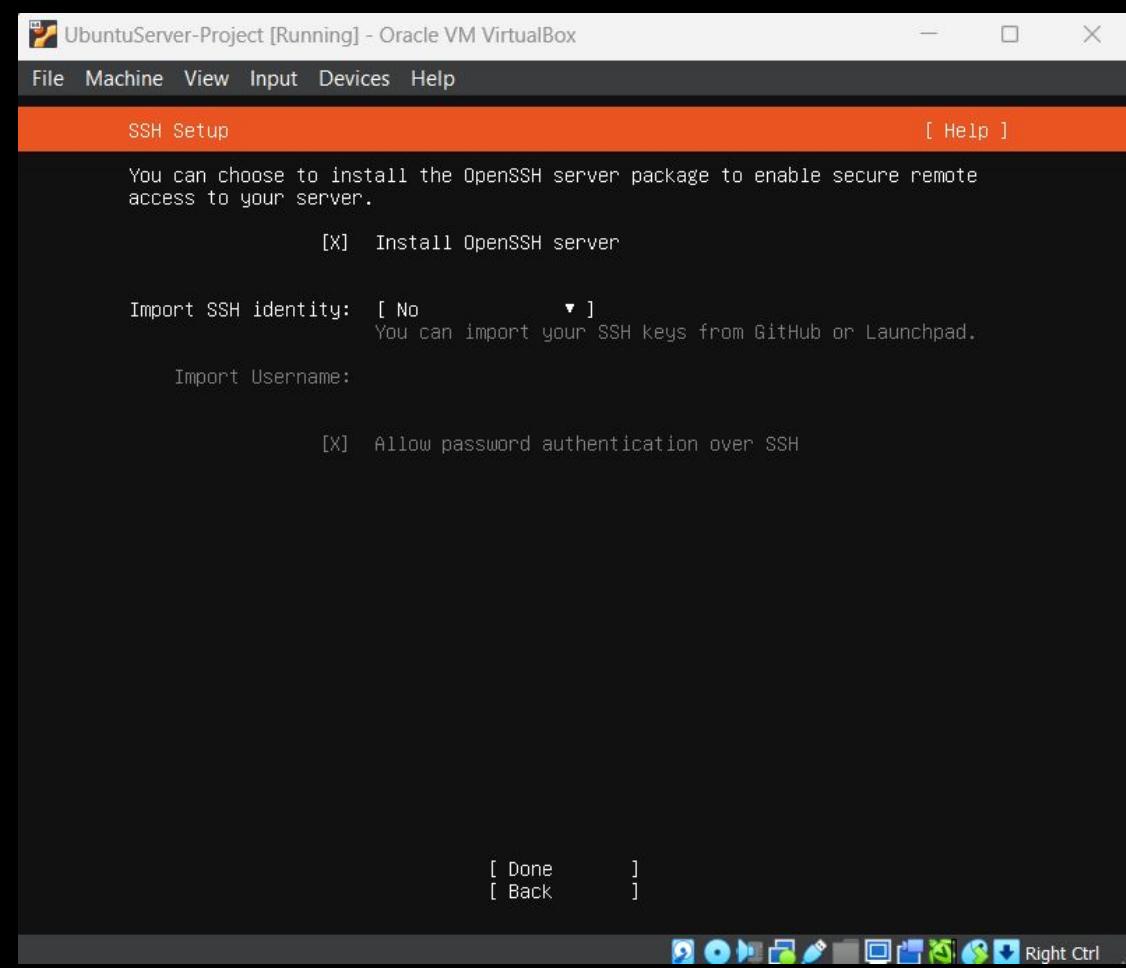
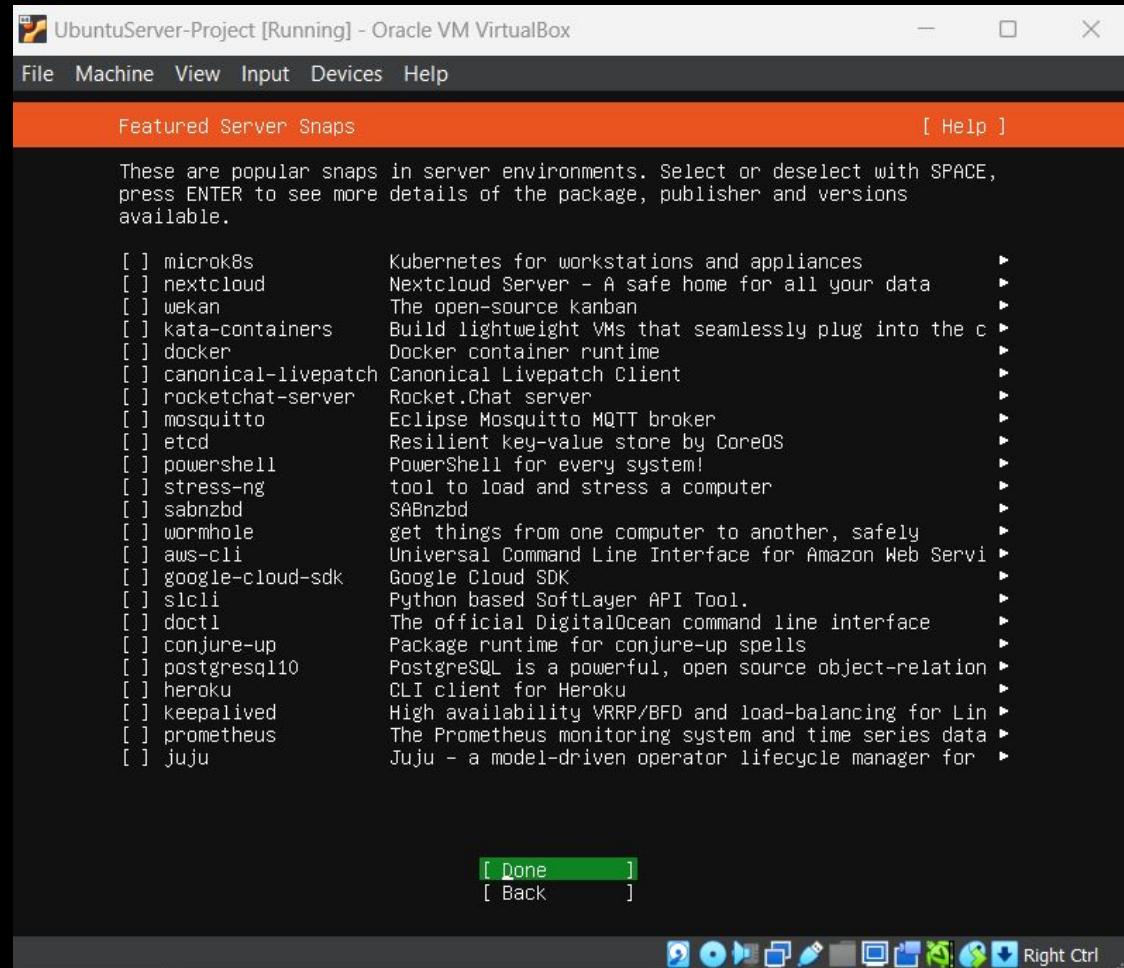
```
[ OK ] Reached target Remote File Systems.
[ OK ] Finished Availability of block devices.
[ OK ] Listening on Socket activation for snappy daemon.
[ OK ] Reached target Socket Units.
[ OK ] Reached target Basic System.
  Starting LSB: automatic crash report generation...
  Starting casper-md5check Verify Live ISO checksums...
[ OK ] Started Regular background program processing daemon.
[ OK ] Started D-Bus System Message Bus.
[ OK ] Started Save initial kernel messages after boot.
  Starting Remove Stale Online ext4 Metadata Check Snapshots...
[ OK ] Reached target Login Prompts.
[ OK ] Started irqbalance daemon.
  Starting Dispatcher daemon for systemd-networkd...
  Starting Authorization Manager...
  Starting Pollinate to seed the pseudo random number generator...
  Starting System Logging Service...
[ OK ] Reached target Preparation for Logins.
  Starting Snap Daemon...
  Starting User Login Management...
  Starting Permit User Sessions...
  Starting Disk Manager...
[ OK ] Finished Permit User Sessions.
  Starting Hold until boot process finishes up...
  Starting Terminate Plymouth Boot Screen...
[ OK ] Finished Hold until boot process finishes up.
  Starting Set console scheme...
[ OK ] Finished Terminate Plymouth Boot Screen.
[ OK ] Started System Logging Service
```













UbuntuServer-Project [Running] - Oracle VM VirtualBox



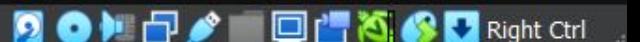
File Machine View Input Devices Help

Install complete!

[ Help ]

```
curtin command install
configuring installed system
  running 'mount --bind /cdrom /target/cdrom'
  running 'curtin in-target -- setupcon --save-only'
    curtin command in-target
running 'curtin curthooks'
  curtin command curthooks
    configuring apt
    configuring apt
    installing missing packages
    configuring iscsi service
    configuring raid (mdadm) service
    installing kernel
    setting up swap
    apply networking config
    writing etc/fstab
    configuring multipath
    updating packages on target system
    configuring pollinate user-agent on target
    updating initramfs configuration
    configuring target system bootloader
    installing grub to target devices
final system configuration
  configuring cloud-init
  calculating extra packages to install
  installing openssh-server
    curtin command system-install
downloading and installing security updates
  curtin command in-target \
```

[ View full log ]  
[ Cancel update and reboot ]



UbuntuServer-Project [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Install complete!

```
running 'curtin in-target -- setupcon --save-only'
  curtin command in-target
running 'curtin curthooks'
  curtin command curthooks
    configuring apt configuring apt
    installing missing packages
  configuring iscsi service
  configuring raid (mdadm) service
  installing kernel
  setting up swap
  apply networking config
  writing etc/fstab
  configuring multipath
  updating packages on target system
  configuring pollinate user-agent on target
  updating initramfs configuration
  configuring target system bootloader
  installing grub to target devices
final system configuration
  configuring cloud-init
  calculating extra packages to install
  installing openssh-server
    curtin command system-install
  downloading and installing security updates
    curtin command in-target
  restoring apt configuration
    curtin command in-target
subiquity/Late/run
```

[ View full log ]

[ Reboot Now ]

Right Ctrl

UbuntuServer-Project [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
OK ] Unmounted /rofs.
OK ] Unmounted /run/credentials/systemd-sysusers.service.
OK ] Unmounted /run/snapd/ns/1xd.mnt.
OK ] Unmounted Mount unit for core20, revision 1587.
OK ] Unmounted Mount unit for 1xd, revision 22923.
OK ] Unmounted Mount unit for snapd, revision 16292.
OK ] Unmounted /tmp/tmp6_8h33af/ubuntu-server-minimal.squashfs.dir.
OK ] Unmounted /tmp/tmp6_8h33af/ubuntu-server-minimal.ubuntu-server.squashfs.dir.
OK ] Unmounted /tmp/tmpxbj8hoz1/root.dir.
OK ] Unmounted /tmp/tmpxbj8hoz1/ubuntu-server-minimal.squashfs.dir.
OK ] Unmounted /tmp/tmpxbj8hoz1/ubuntu-server-minimal.ubuntu-server.squashfs.dir.
  Unmounting /run/snapd/ns...
OK ] Unmounted /run/snapd/ns.
OK ] Unmounted Mount unit for subiquity, revision 3698.
OK ] Unmounted Mount unit for subiquity, revision 4229.
OK ] Unmounted /target/boot.
  Unmounting /target...
OK ] Unmounted /tmp/tmp6_8h33af/root.dir.
  Unmounting /tmp...
OK ] Unmounted /tmp.
OK ] Stopped target Swaps.
OK ] Unmounted /target.
OK ] Stopped target Preparation for Local File Systems.
OK ] Reached target Unmount All Filesystems.
  Stopping Monitoring of LVM2 mirrors,...c. using dmeventd or progress polling...
  Stopping Device-Mapper Multipath Device Controller...
OK ] Stopped Create Static Device Nodes in /dev.
OK ] Stopped Create System Users.
OK ] Stopped Device-Mapper Multipath Device Controller.
OK ] Stopped Remount Root and Kernel File Systems.
OK ] Stopped Monitoring of LVM2 mirrors, ...etc. using dmeventd or progress polling.
OK ] Reached target System Shutdown.
  Starting Shuts down the "live" preinstalled system cleanly...
lease remove the installation medium, then press ENTER:
  Unmounting /cdrom...
FAILED] Failed unmounting /cdrom.
```

Right Ctrl

# System is ready!

```
UbuntuServer-Project [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
:35:24 +0000. Datasource DataSourceNone. Up 35.54 seconds
[ 35.560467] cloud-init[1408]: 2022-12-24 09:35:24,460 - cc_final_message.py[WARNINg]: Used fallback datasource
[ OK ] Finished Execute cloud user/final scripts.
[ OK ] Reached target Cloud-init target.

fproject login: amil
Password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-56-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 System information as of Sat Dec 24 09:36:49 AM UTC 2022

 System load:  0.7919921875   Processes:           136
 Usage of /:   23.7% of 23.45GB  Users logged in:      0
 Memory usage: 7%                  IPv4 address for enp0s3: 10.0.2.15
 Swap usage:   0%

55 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

amil@fproject:~$ _
```



Network setup, connecting to the server via SSH

```
UbuntuServer-Project [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
amil0@fproject:~$ ls /etc/netplan/
00-installer-config.yaml
amil0@fproject:~$ sudo nano /etc/netplan/00-installer-config.yaml
```

```
UbuntuServer-Project [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
GNU nano 6.2 /etc/netplan/00-installer-config.yaml
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      dhcp4: true
  version: 2
```

[ Read 8 lines ] [ ^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo  
^X Exit ^R Read File ^Y Replace ^U Paste ^J Justify ^I Go To Line M-E Redo ]

# Some changes are being made to the network

172.16.0.0 - 172.31.255.255 B sınıf şəbəkələr qrupundan

172.16.0.40 /22 static ip verilir.

Alt şəbəkə olaraq -- 255.255.252.0 (22) verilir.  
(subnet)

DNS üçün

- 192.168.1.254
- 8.8.8.8

```
GNU nano 6.2                               /etc/netplan/00-installer-config.yaml *
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      addresses:
        - 172.16.0.40/22
      gateway4: 192.168.1.254
      nameservers:
        addresses:
          - 192.168.1.254
          - 8.8.8.8
        search: []
        optional: true
    enp0s8:
      dhcp4: true
      version: 2
```

^G Help  
^X Exit

^O Write Out  
^R Read File

^W Where Is  
^Y Replace

^K Cut  
^U Paste

^T Execute  
^J Justify

^C Location M-U Undo  
^/ Go To Line M-E Redo

```
~$ sudo netplan --debug generate
```

```
amil@fproject:~$ sudo netplan --debug generate
[sudo] password for amil:
DEBUG:command generate: running ['/lib/netplan/generate']
** (generate:1376): DEBUG: 20:47:31.747: starting new processing pass

** (generate:1376): WARNING **: 20:47:31.747: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (generate:1376): DEBUG: 20:47:31.747: We have some netdefs, pass them through a final round of validation
** (generate:1376): DEBUG: 20:47:31.747: enp0s8: setting default backend to 1
** (generate:1376): DEBUG: 20:47:31.747: Configuration is valid
** (generate:1376): DEBUG: 20:47:31.747: enp0s3: setting default backend to 1
** (generate:1376): DEBUG: 20:47:31.747: Configuration is valid
** (generate:1376): DEBUG: 20:47:31.747: Generating output files..
** (generate:1376): DEBUG: 20:47:31.748: openvswitch: definition enp0s3 is not for us (backend 1)
** (generate:1376): DEBUG: 20:47:31.748: NetworkManager: definition enp0s3 is not for us (backend 1)
** (generate:1376): DEBUG: 20:47:31.748: openvswitch: definition enp0s8 is not for us (backend 1)
** (generate:1376): DEBUG: 20:47:31.748: NetworkManager: definition enp0s8 is not for us (backend 1)
amil@fproject:~$
```

```
~$ sudo netplan --debug apply
```

```
** (process:1382): DEBUG: 20:48:05.951: We have some netdefs, pass them through a final round of validation
** (process:1382): DEBUG: 20:48:05.951: enp0s8: setting default backend to 1
** (process:1382): DEBUG: 20:48:05.951: Configuration is valid
** (process:1382): DEBUG: 20:48:05.951: enp0s3: setting default backend to 1
** (process:1382): DEBUG: 20:48:05.951: Configuration is valid
DEBUG:Merged config:
b''
DEBUG:Link changes: {}
DEBUG:netplan triggering .link rules for lo
DEBUG:netplan triggering .link rules for enp0s3
DEBUG:netplan triggering .link rules for enp0s8
** (process:1382): DEBUG: 20:48:06.178: starting new processing pass

** (process:1382): WARNING **: 20:48:06.178: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:1382): DEBUG: 20:48:06.178: We have some netdefs, pass them through a final round of validation
** (process:1382): DEBUG: 20:48:06.178: enp0s8: setting default backend to 1
** (process:1382): DEBUG: 20:48:06.178: Configuration is valid
** (process:1382): DEBUG: 20:48:06.178: enp0s3: setting default backend to 1
** (process:1382): DEBUG: 20:48:06.178: Configuration is valid
** (process:1382): DEBUG: 20:48:06.178: starting new processing pass

** (process:1382): WARNING **: 20:48:06.178: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:1382): DEBUG: 20:48:06.178: We have some netdefs, pass them through a final round of validation
** (process:1382): DEBUG: 20:48:06.178: enp0s8: setting default backend to 1
** (process:1382): DEBUG: 20:48:06.178: Configuration is valid
** (process:1382): DEBUG: 20:48:06.178: enp0s3: setting default backend to 1
** (process:1382): DEBUG: 20:48:06.178: Configuration is valid
DEBUG:Merged config:
b''
amil@fproject:~$
```

```
~$ ip a
```

```
amil@fproject:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:de:86:66 brd ff:ff:ff:ff:ff:ff
        inet 172.16.0.40/22 brd 172.16.3.255 scope global enp0s3
            valid_lft forever preferred_lft forever
        inet6 fe80::a00:27ff:fedc:8666/64 scope link
            valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:dd:89:43 brd ff:ff:ff:ff:ff:ff
        inet 10.0.3.15/24 metric 100 brd 10.0.3.255 scope global dynamic enp0s8
            valid_lft 86239sec preferred_lft 86239sec
        inet6 fe80::a00:27ff:fedd:8943/64 scope link
            valid_lft forever preferred_lft forever
amil@fproject:~$ _
```

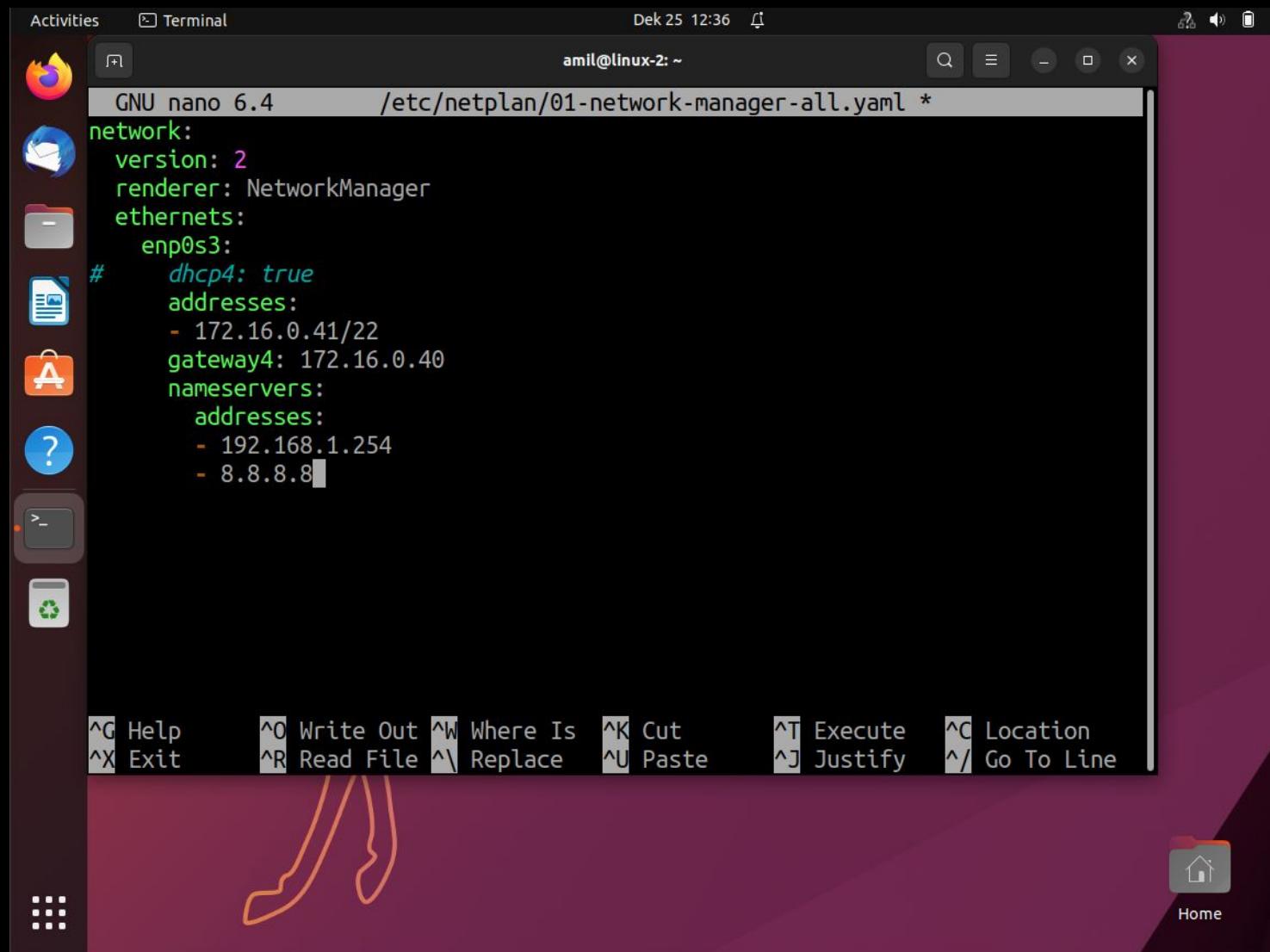
```
~$ ping google.com -c 4
```

```
amil@fproject:~$ ping google.com -c 4
PING google.com (172.217.17.142) 56(84) bytes of data.
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=2 ttl=115 time=72.6 ms
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=3 ttl=115 time=73.8 ms
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=4 ttl=115 time=56.1 ms

--- google.com ping statistics ---
4 packets transmitted, 3 received, 25% packet loss, time 3011ms
rtt min/avg/max/mdev = 56.137/67.509/73.819/8.057 ms
amil@fproject:~$
```

## Network configuration process in Ubuntu Desktop

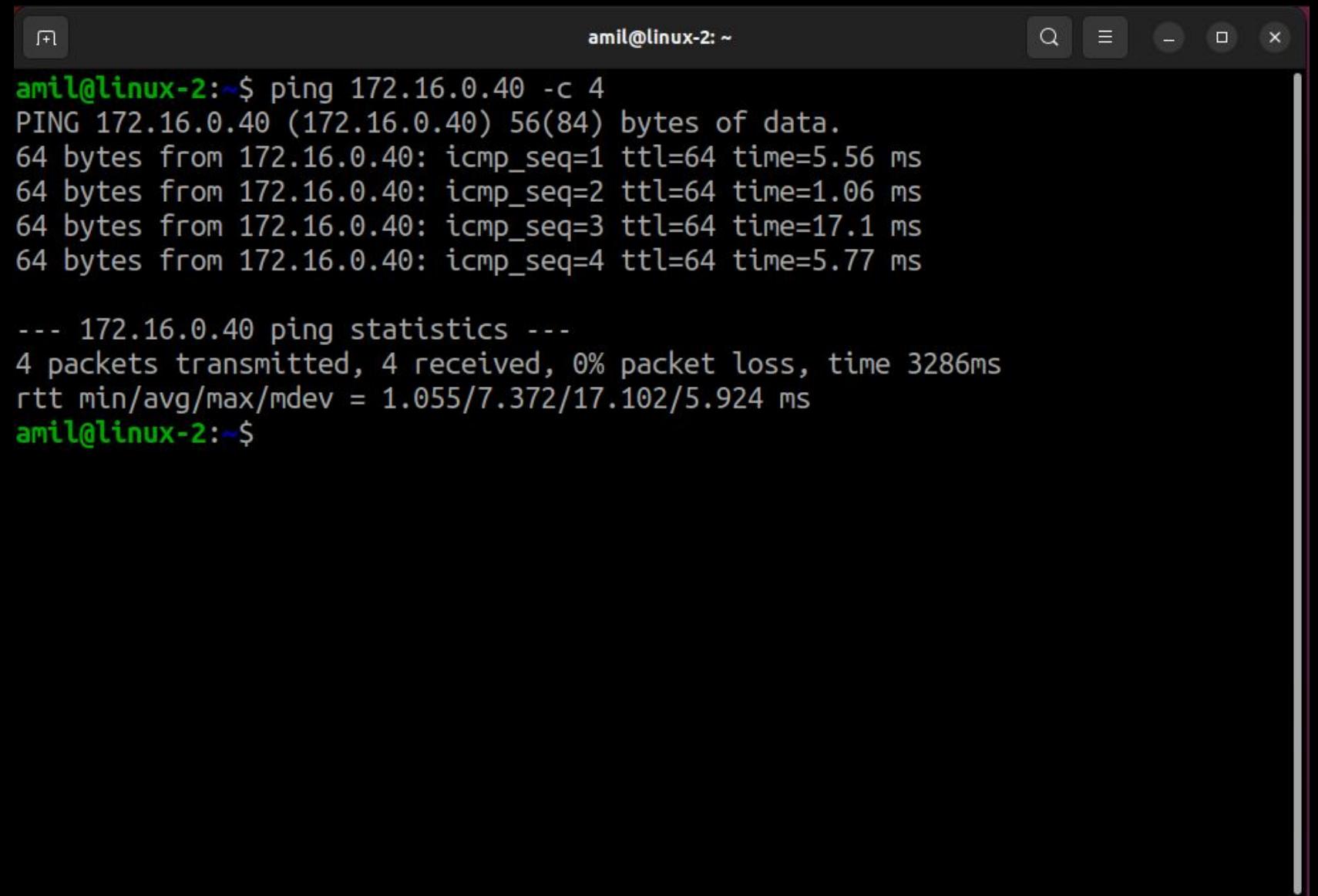
```
~$ sudo nano /etc/netplan/01-network-manager-all.yaml
```



```
GNU nano 6.4      /etc/netplan/01-network-manager-all.yaml *
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      #      dhcp4: true
      addresses:
        - 172.16.0.41/22
      gateway4: 172.16.0.40
      nameservers:
        addresses:
          - 192.168.1.254
          - 8.8.8.8
```

The screenshot shows a terminal window titled "Terminal" running on an Ubuntu desktop environment. The window title bar includes the date and time ("Dek 25 12:36") and the user's name ("amil@linux-2: ~"). The terminal is displaying the contents of the file "/etc/netplan/01-network-manager-all.yaml". The configuration file defines a network interface "enp0s3" with an IP address of "172.16.0.41/22" and a gateway of "172.16.0.40". It also specifies nameservers with addresses "192.168.1.254" and "8.8.8.8". The terminal window has a dark theme and includes standard nano key bindings at the bottom.

```
~$ ping 172.16.0.40 -c 4
```



A screenshot of a terminal window titled "amil@linux-2: ~". The window contains the following text:

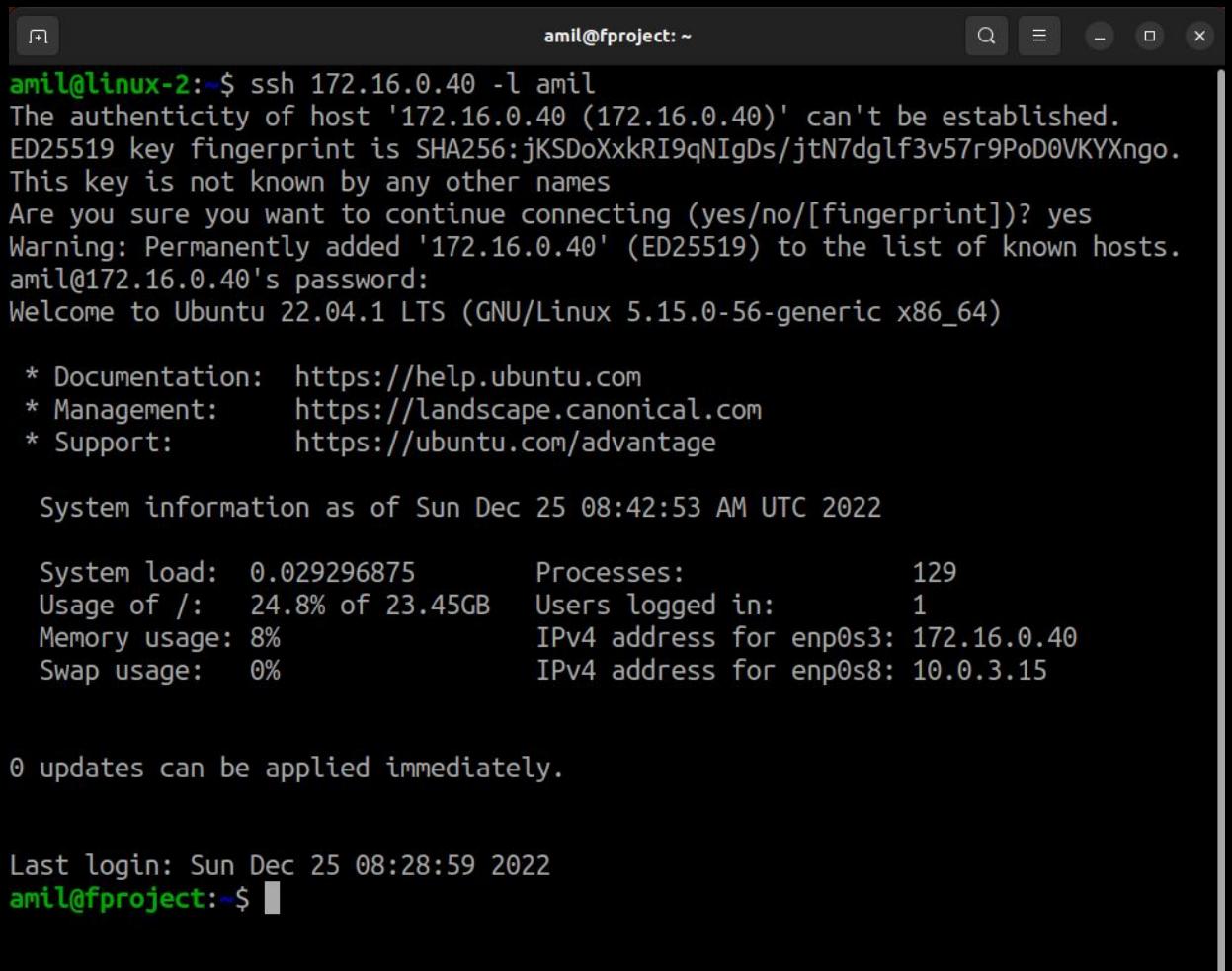
```
amil@linux-2:~$ ping 172.16.0.40 -c 4
PING 172.16.0.40 (172.16.0.40) 56(84) bytes of data.
64 bytes from 172.16.0.40: icmp_seq=1 ttl=64 time=5.56 ms
64 bytes from 172.16.0.40: icmp_seq=2 ttl=64 time=1.06 ms
64 bytes from 172.16.0.40: icmp_seq=3 ttl=64 time=17.1 ms
64 bytes from 172.16.0.40: icmp_seq=4 ttl=64 time=5.77 ms

--- 172.16.0.40 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3286ms
rtt min/avg/max/mdev = 1.055/7.372/17.102/5.924 ms
amil@linux-2:~$
```

```
~$ ssh 172.16.0.40 -l amil
```

Are you sure you want to continue connecting (yes/no/[fingerprint])? yes

amil@172.16.0.40's password: 0011



```
amil@fproject:~
```

```
amil@linux-2:~$ ssh 172.16.0.40 -l amil
The authenticity of host '172.16.0.40 (172.16.0.40)' can't be established.
ED25519 key fingerprint is SHA256:jKSDoXxkRI9qNIgDs/jtN7dglf3v57r9PoD0VKYXngo.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '172.16.0.40' (ED25519) to the list of known hosts.
amil@172.16.0.40's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-56-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

 System information as of Sun Dec 25 08:42:53 AM UTC 2022

 System load:  0.029296875      Processes:          129
 Usage of /:   24.8% of 23.45GB   Users logged in:   1
 Memory usage: 8%
 Swap usage:   0%                  IPv4 address for enp0s3: 172.16.0.40
                                         IPv4 address for enp0s8: 10.0.3.15

0 updates can be applied immediately.

Last login: Sun Dec 25 08:28:59 2022
amil@fproject:~$
```

```
amil@fproject:~$ hostname
```

```
fproject
```

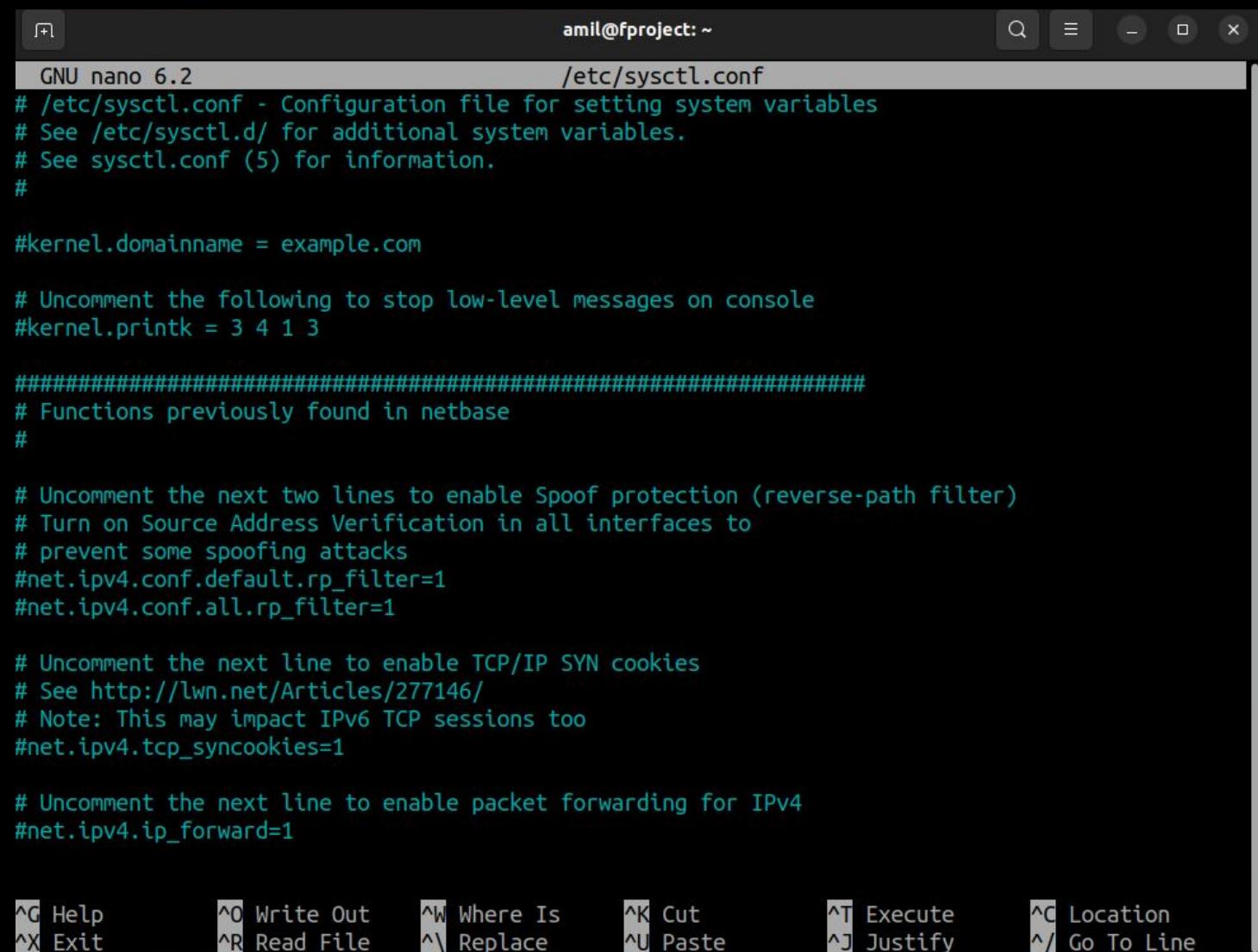
```
amil@fproject:~$
```



# Installing Ubuntu Server for NAT

## 1) Using the sysctl tool

```
$ sudo nano /etc/sysctl.conf
```



The screenshot shows a terminal window titled "GNU nano 6.2" with the file "/etc/sysctl.conf" open. The file contains configuration settings for system variables. The terminal window has a dark theme with light-colored text. The status bar at the bottom shows keyboard shortcuts for various functions like Help, Exit, Write Out, Read File, Where Is, Replace, Cut, Paste, Execute, Justify, Location, and Go To Line.

```
GNU nano 6.2 /etc/sysctl.conf
# /etc/sysctl.conf - Configuration file for setting system variables
# See /etc/sysctl.d/ for additional system variables.
# See sysctl.conf (5) for information.
#
#kernel.domainname = example.com

# Uncomment the following to stop low-level messages on console
#kernel.printk = 3 4 1 3

#####
# Functions previously found in netbase
#
# Uncomment the next two lines to enable Spoof protection (reverse-path filter)
# Turn on Source Address Verification in all interfaces to
# prevent some spoofing attacks
#net.ipv4.conf.default.rp_filter=1
#net.ipv4.conf.all.rp_filter=1

# Uncomment the next line to enable TCP/IP SYN cookies
# See http://lwn.net/Articles/277146/
# Note: This may impact IPv6 TCP sessions too
#net.ipv4.tcp_syncookies=1

# Uncomment the next line to enable packet forwarding for IPv4
#net.ipv4.ip_forward=1
```

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute  
^X Exit ^R Read File ^A Replace ^U Paste ^J Justify ^C Location  
^/ Go To Line

amil@fproject: ~

GNU nano 6.2 /etc/sysctl.conf \*

```
# /etc/sysctl.conf - Configuration file for setting system variables
# See /etc/sysctl.d/ for additional system variables.
# See sysctl.conf (5) for information.
#
#kernel.domainname = example.com

# Uncomment the following to stop low-level messages on console
#kernel.printk = 3 4 1 3

#####
# Functions previously found in netbase
#
# Uncomment the next two lines to enable Spoof protection (reverse-path filter)
# Turn on Source Address Verification in all interfaces to
# prevent some spoofing attacks
#net.ipv4.conf.default.rp_filter=1
#net.ipv4.conf.all.rp_filter=1

# Uncomment the next line to enable TCP/IP SYN cookies
# See http://lwn.net/Articles/277146/
# Note: This may impact IPv6 TCP sessions too
#net.ipv4.tcp_syncookies=1

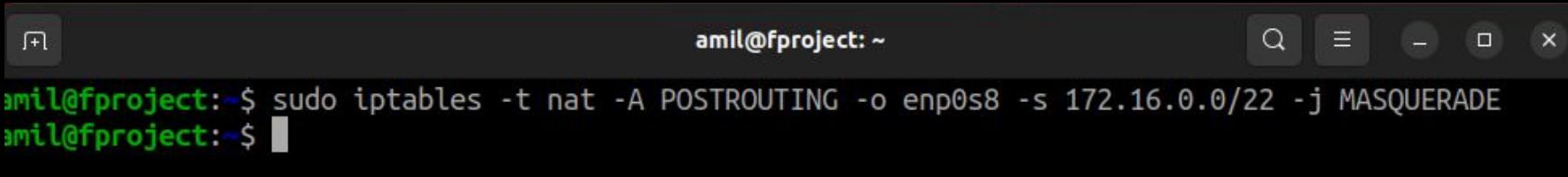
# Uncomment the next line to enable packet forwarding for IPv4
net.ipv4.ip_forward=1
```

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location  
^X Exit ^R Read File ^A Replace ^U Paste ^J Justify ^/ Go To Line

amil@fproject:~\$ sudo sysctl -p /etc/sysctl.conf  
net.ipv4.ip\_forward = 1  
amil@fproject:~\$

## 2) Applying the iptables tool

```
$ sudo iptables -t nat -A POSTROUTING -o enp0s8 -s 172.16.0.0/22 -j MASQUERADE
```



```
amil@fproject:~$ sudo iptables -t nat -A POSTROUTING -o enp0s8 -s 172.16.0.0/22 -j MASQUERADE  
amil@fproject:~$
```

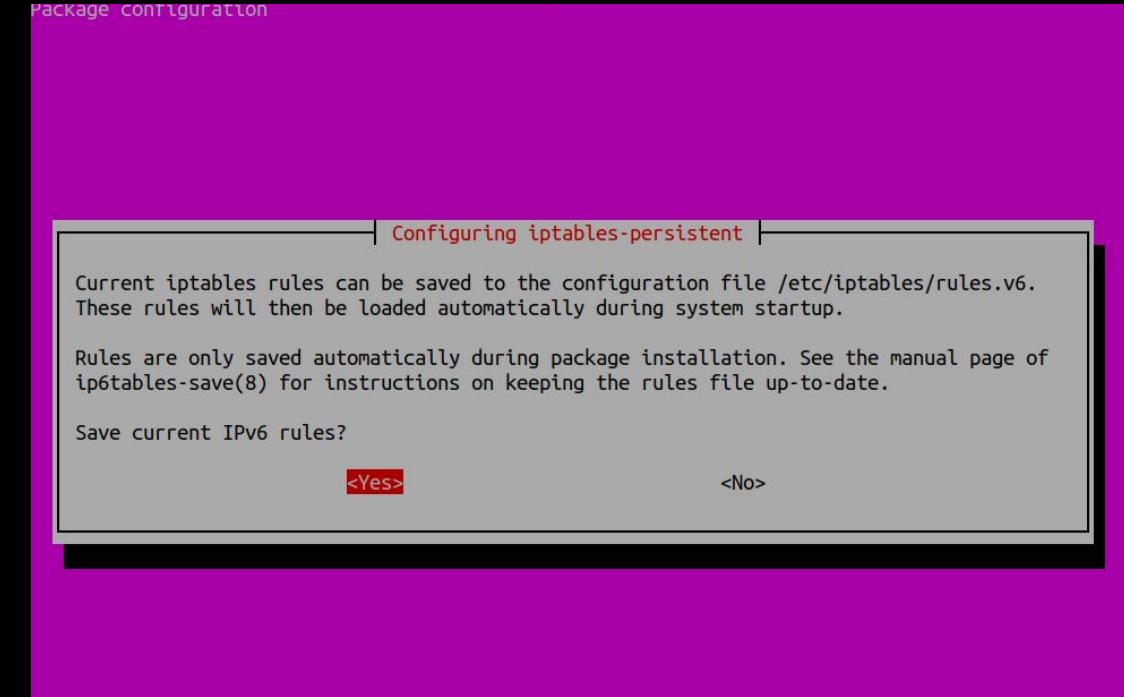
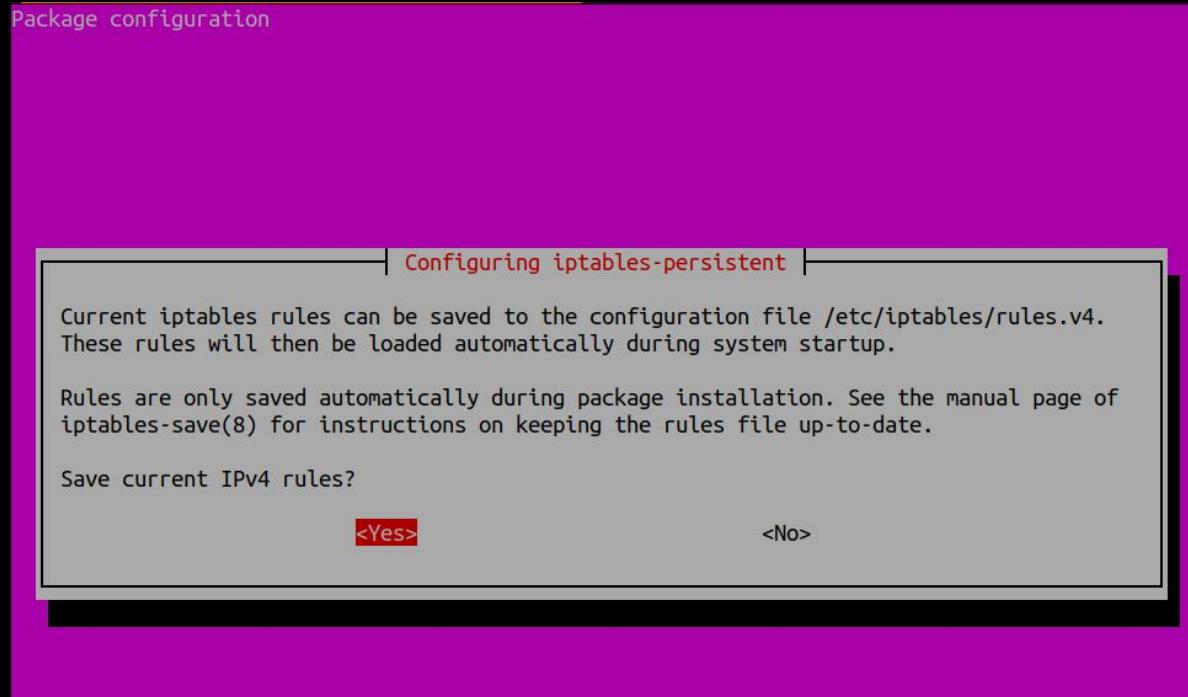
NAT funksiyasını Desktop Ubuntuda yoxlayaq :

```
$ ping google.com -c 4
```

```
amil@linux-2:~$ ping google.com -c 4  
PING google.com (142.251.140.78) 56(84) bytes of data.  
64 bytes from sof04s06-in-f14.1e100.net (142.251.140.78): icmp_seq=1 ttl=114 time=104 ms  
64 bytes from sof04s06-in-f14.1e100.net (142.251.140.78): icmp_seq=2 ttl=114 time=124 ms  
64 bytes from sof04s06-in-f14.1e100.net (142.251.140.78): icmp_seq=3 ttl=114 time=82.2 ms  
64 bytes from sof04s06-in-f14.1e100.net (142.251.140.78): icmp_seq=4 ttl=114 time=80.2 ms  
  
--- google.com ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 4760ms  
rtt min/avg/max/mdev = 80.193/97.446/123.677/17.719 ms  
amil@linux-2:~$
```

- Operation to save the given settings on the server

- \$ sudo apt install iptables-persistent



```
amil@fproject:~ amil@linux-2:~
```

Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  netfilter-persistent  
The following NEW packages will be installed:  
  iptables-persistent netfilter-persistent  
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.  
Need to get 13.9 kB of archives.  
After this operation, 93.2 kB of additional disk space will be used.  
Do you want to continue? [Y/n] Y  
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/universe amd64 netfilter-persistent all 1.0.16 [7440 B]  
Get:2 http://us.archive.ubuntu.com/ubuntu jammy/universe amd64 iptables-persistent all 1.0.16 [6488 B]  
Fetched 13.9 kB in 6s (2157 B/s)  
Preconfiguring packages ...  
Selecting previously unselected package netfilter-persistent.  
(Reading database ... 73800 files and directories currently installed.)  
Preparing to unpack .../netfilter-persistent\_1.0.16\_all.deb ...  
Unpacking netfilter-persistent (1.0.16) ...  
Selecting previously unselected package iptables-persistent.  
Preparing to unpack .../iptables-persistent\_1.0.16\_all.deb ...  
Unpacking iptables-persistent (1.0.16) ...  
Setting up netfilter-persistent (1.0.16) ...  
Created symlink /etc/systemd/system/multi-user.target.wants/netfilter-persistent.service → /lib/systemd/system/netfilter-persistent.service.  
Setting up iptables-persistent (1.0.16) ...  
update-alternatives: using /lib/systemd/system/netfilter-persistent.service to provide /lib/systemd/system/iptables.service (iptables.service) in auto mode  
Processing triggers for man-db (2.10.2-1) ...  
Scanning processes...  
Scanning linux images...  
  
Running kernel seems to be up-to-date.  
  
No services need to be restarted.  
  
No containers need to be restarted.  
  
No user sessions are running outdated binaries.  
  
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
amil@fproject:~\$

```
amil@fproject: ~
amil@fproject: ~
amil@linux-2: ~

amil@fproject:~$ sudo reboot
Connection to 172.16.0.40 closed by remote host.
Connection to 172.16.0.40 closed.
amil@linux-2:~$ ssh 172.16.0.40 -l amil
amil@172.16.0.40's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-56-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

System information as of Sun Dec 25 09:16:42 AM UTC 2022

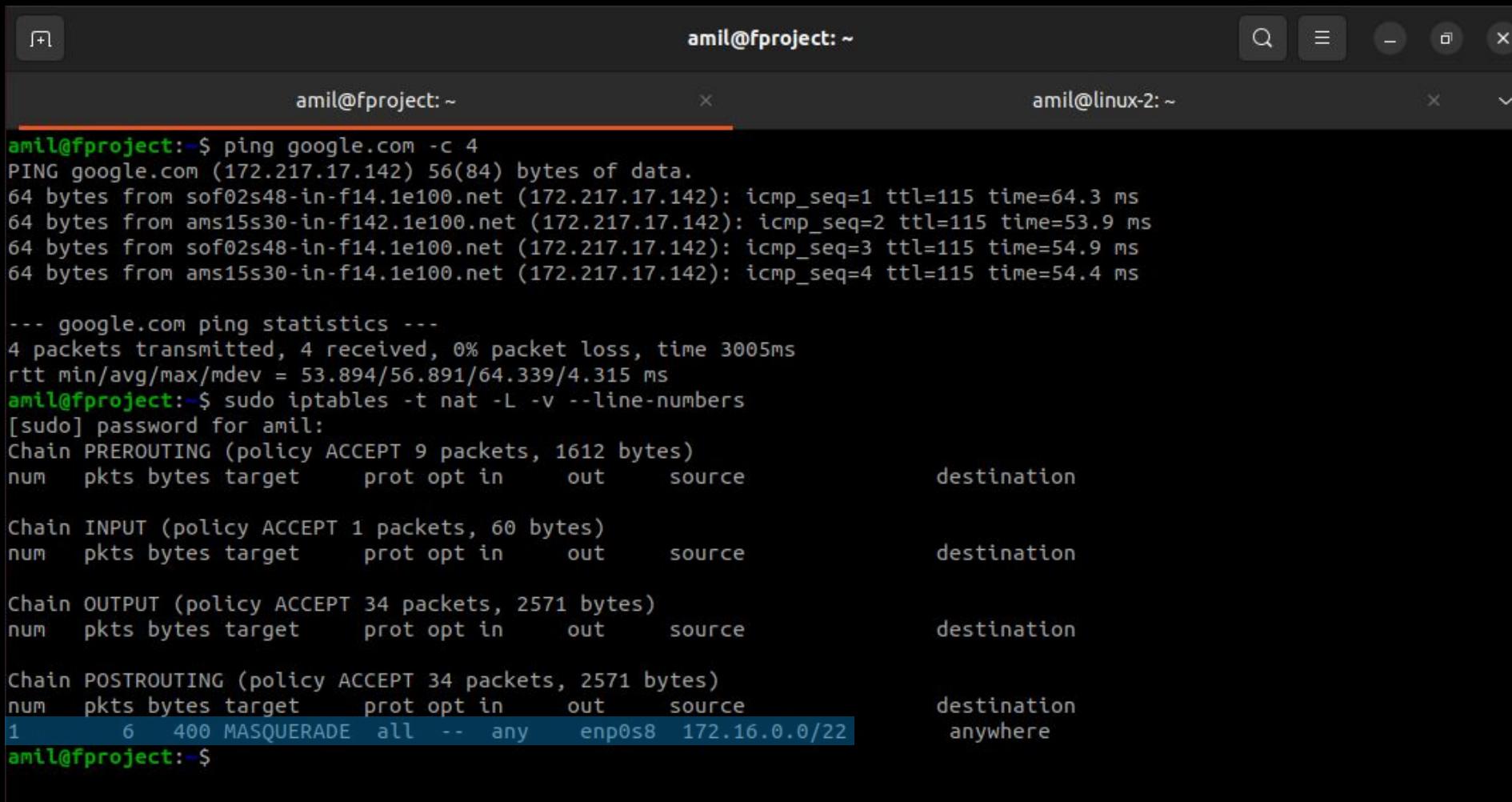
System load:  0.13671875      Processes:           137
Usage of /:   24.8% of 23.45GB  Users logged in:    0
Memory usage: 7%
Swap usage:   0%              IPv4 address for enp0s3: 172.16.0.40
                             IPv4 address for enp0s8: 10.0.3.15

0 updates can be applied immediately.

Last login: Sun Dec 25 08:42:54 2022 from 172.16.0.41
amil@fproject:~$
```

```
amil@fproject:~$ ping google.com -c 4
PING google.com (172.217.17.142) 56(84) bytes of data.
64 bytes from sof02s48-in-f14.1e100.net (172.217.17.142): icmp_seq=1 ttl=115 time=64.3 ms
64 bytes from ams15s30-in-f142.1e100.net (172.217.17.142): icmp_seq=2 ttl=115 time=53.9 ms
64 bytes from sof02s48-in-f14.1e100.net (172.217.17.142): icmp_seq=3 ttl=115 time=54.9 ms
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=4 ttl=115 time=54.4 ms
--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 53.894/56.891/64.339/4.315 ms
amil@fproject:~$
```

```
$ sudo iptables -t nat -L -v --line-numbers
```



```
amil@fproject:~$ ping google.com -c 4
PING google.com (172.217.17.142) 56(84) bytes of data.
64 bytes from sof02s48-in-f14.1e100.net (172.217.17.142): icmp_seq=1 ttl=115 time=64.3 ms
64 bytes from ams15s30-in-f142.1e100.net (172.217.17.142): icmp_seq=2 ttl=115 time=53.9 ms
64 bytes from sof02s48-in-f14.1e100.net (172.217.17.142): icmp_seq=3 ttl=115 time=54.9 ms
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=4 ttl=115 time=54.4 ms

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 53.894/56.891/64.339/4.315 ms
amil@fproject:~$ sudo iptables -t nat -L -v --line-numbers
[sudo] password for amil:
Chain PREROUTING (policy ACCEPT 9 packets, 1612 bytes)
num  pkts bytes target     prot opt in     out      source          destination
Chain INPUT (policy ACCEPT 1 packets, 60 bytes)
num  pkts bytes target     prot opt in     out      source          destination
Chain OUTPUT (policy ACCEPT 34 packets, 2571 bytes)
num  pkts bytes target     prot opt in     out      source          destination
Chain POSTROUTING (policy ACCEPT 34 packets, 2571 bytes)
num  pkts bytes target     prot opt in     out      source          destination
1      6    400 MASQUERADE  all    --  any    enp0s8  172.16.0.0/22      anywhere
amil@fproject:~$
```

### 3) Applying the Traceroute tool

In Ubuntu Desktop we check:

```
$ sudo apt install traceroute
```

```
amil@linux-2:~$ sudo apt install traceroute
[sudo] password for amil:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
traceroute is already the newest version (1:2.1.0-3).
0 upgraded, 0 newly installed, 0 to remove and 19 not upgraded.
amil@linux-2:~$
```

```
$ sudo traceroute -I youtube.com
```

```
amil@linux-2:~$ sudo traceroute -I youtube.com
traceroute to youtube.com (216.58.212.46), 30 hops max, 60 byte packets
 1 _gateway (172.16.0.40)  3.149 ms  3.016 ms  2.746 ms
 2 10.0.3.2 (10.0.3.2)  5.068 ms * *
 3 192.168.1.254 (192.168.1.254)  101.876 ms  101.791 ms  101.707 ms
 4 100.64.0.1 (100.64.0.1)  101.218 ms *  120.311 ms
 5 172.16.12.61 (172.16.12.61)  120.208 ms  119.887 ms  119.796 ms
 6 94.20.50.145 (94.20.50.145)  119.702 ms  42.110 ms *
 7 * * *
 8 * * *
 9 * * *
10 * * *
11 * sof04s02-in-f14.1e100.net (216.58.212.46)  76.837 ms  76.627 ms
amil@linux-2:~$
```

# Initial configuration of DNS for Ubuntu Server



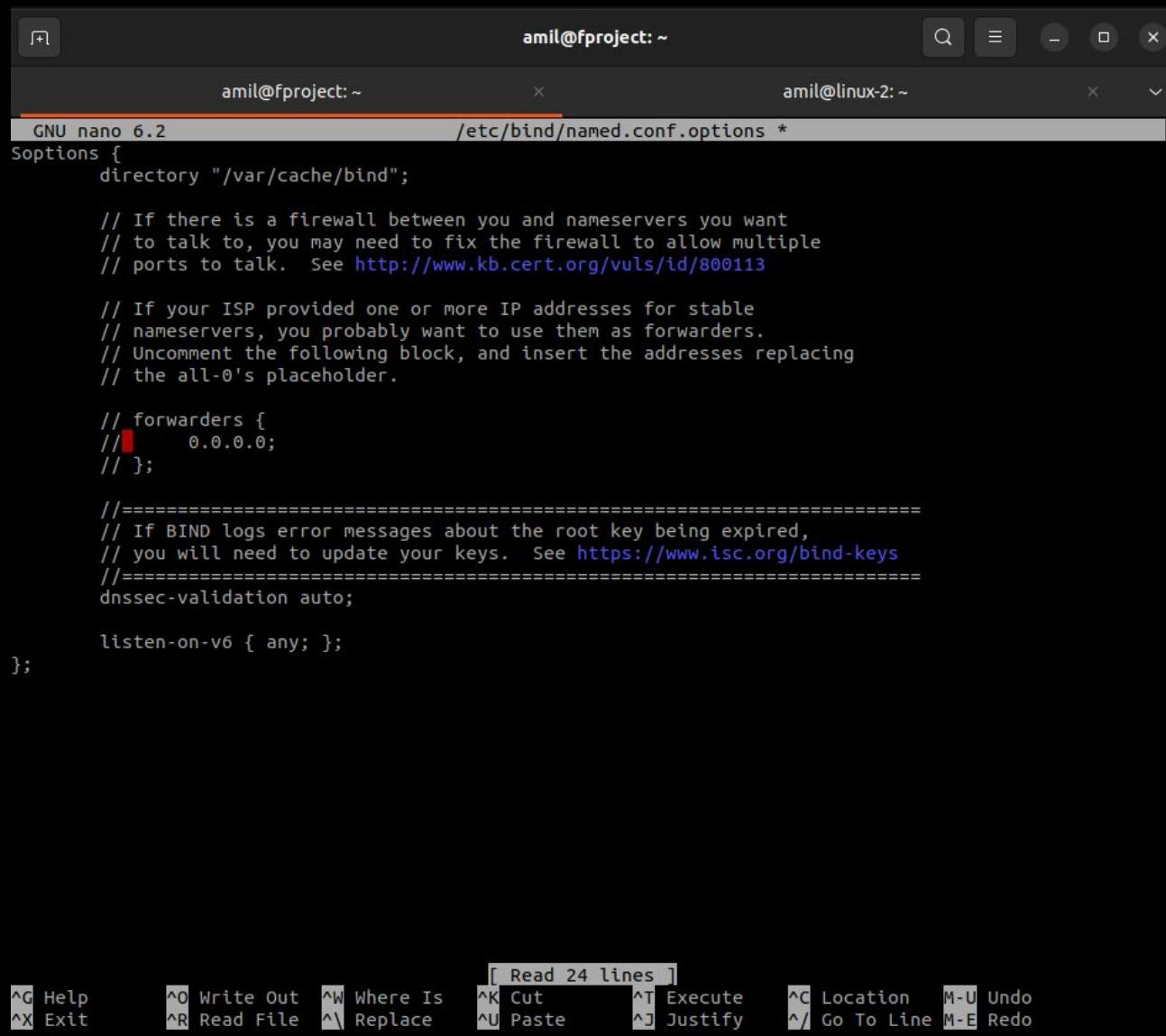
Bind9 - DNS server installation

```
$ sudo apt install bind9 -y
```

A screenshot of a terminal window titled "amil@fproject: ~". The window shows the command \$ sudo apt install bind9 -y being run, followed by the output of the package manager. The output details the installation of bind9 and its dependencies, including bind9-utils, dns-root-data, and bind9-doc. It shows the download of files from the Ubuntu archive, the unpacking of deb packages, and the configuration of the system to start the bind9 service at boot. A progress bar at the bottom indicates the task is at 92% completion.

```
The following additional packages will be installed:  
  bind9-utils dns-root-data  
Suggested packages:  
  bind-doc resolvconf  
The following NEW packages will be installed:  
  bind9 bind9-utils dns-root-data  
0 upgraded, 3 newly installed, 0 to remove and 0 not upgraded.  
Need to get 406 kB of archives.  
After this operation, 1556 kB of additional disk space will be used.  
Get:1 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 bind9-utils amd64 1:9.18.1-1ubuntu1.2 [150 kB]  
Get:2 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 dns-root-data all 2021011101 [5256 B]  
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 bind9 amd64 1:9.18.1-1ubuntu1.2 [251 kB]  
Fetched 406 kB in 13s (30.5 kB/s)  
Selecting previously unselected package bind9-utils.  
(Reading database ... 73822 files and directories currently installed.)  
Preparing to unpack .../bind9-utils_1%3a9.18.1-1ubuntu1.2_amd64.deb ...  
Unpacking bind9-utils (1:9.18.1-1ubuntu1.2) ...  
Selecting previously unselected package dns-root-data.  
Preparing to unpack .../dns-root-data_2021011101_all.deb ...  
Unpacking dns-root-data (2021011101) ...  
Selecting previously unselected package bind9.  
Preparing to unpack .../bind9_1%3a9.18.1-1ubuntu1.2_amd64.deb ...  
Unpacking bind9 (1:9.18.1-1ubuntu1.2) ...  
Setting up dns-root-data (2021011101) ...  
Setting up bind9-utils (1:9.18.1-1ubuntu1.2) ...  
Setting up bind9 (1:9.18.1-1ubuntu1.2) ...  
Adding group 'bind' (GID 119) ...  
Done.  
Adding system user 'bind' (UID 114) ...  
Adding new user 'bind' (UID 114) with group 'bind' ...  
Not creating home directory `/var/cache/bind'.  
wrote key file "/etc/bind/rndc.key"  
named-resolvconf.service is a disabled or a static unit, not starting it.  
Created symlink /etc/systemd/system/bind9.service → /lib/systemd/system/named.service.  
Created symlink /etc/systemd/system/multi-user.target.wants/named.service → /lib/systemd/system/named.service.  
Processing triggers for man-db (2.10.2-1) ...  
[ Progress: [ 92%] [########################################.....]
```

```
$ sudo nano /etc/bind/named.conf.options
```



The screenshot shows a terminal window titled "amil@fproject: ~" with two tabs open. The active tab is titled "/etc/bind/named.conf.options \*". The file contains BIND configuration options, including a "options" block with a "directory" directive and comments about firewalls and forwarders. It also includes sections for DNSSEC validation and IPv6 listening.

```
GNU nano 6.2          /etc/bind/named.conf.options *
options {
    directory "/var/cache/bind";

    // If there is a firewall between you and nameservers you want
    // to talk to, you may need to fix the firewall to allow multiple
    // ports to talk. See http://www.kb.cert.org/vuls/id/800113

    // If your ISP provided one or more IP addresses for stable
    // nameservers, you probably want to use them as forwarders.
    // Uncomment the following block, and insert the addresses replacing
    // the all-0's placeholder.

    // forwarders {
    //   0.0.0.0;
    // };

    =====
    // If BIND logs error messages about the root key being expired,
    // you will need to update your keys. See https://www.isc.org/bind-keys
    =====
    dnssec-validation auto;

    listen-on-v6 { any; };
};
```

At the bottom of the terminal window, there is a menu bar with various keyboard shortcuts for navigating and editing the file.

^G Help	^O Write Out	^W Where Is	[ Read 24 lines ]			
^X Exit	^R Read File	^  Replace	^K Cut	^T Execute	^C Location	M-U Undo
			^U Paste	^J Justify	^/ Go To Line	M-E Redo

amil@fproject: ~

amil@fproject: ~

amil@linux-2: ~

GNU nano 6.2 /etc/bind/named.conf.options \*

```
options {
    directory "/var/cache/bind";
    listen-on {
        172.16.0.0/22;
        127.0.0.0/8;
    };

    forwarders {
        192.168.1.254;
        8.8.8.8;
    };

    dnssec-validation auto;
    auth-nxdomain no;
    listen-on-v6 { none; };
};
```

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo  
^X Exit ^R Read File ^V Replace ^U Paste ^J Justify ^L Go To Line M-E Redo

```
amil@fproject:~$ sudo systemctl restart bind9
amil@fproject:~$ nslookup google.com
Server:          127.0.0.53
Address:         127.0.0.53#53

Non-authoritative answer:
Name:  google.com
Address: 172.217.17.142
Name:  google.com
Address: 2a00:1450:4017:811::200e

amil@fproject:~$
```

```
amil@fproject:~$ ping google.com -c 4
PING google.com (172.217.17.142) 56(84) bytes of data.
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=3 ttl=115 time=106 ms
64 bytes from ams15s30-in-f14.1e100.net (172.217.17.142): icmp_seq=4 ttl=115 time=56.3 ms

--- google.com ping statistics ---
4 packets transmitted, 2 received, 50% packet loss, time 3050ms
rtt min/avg/max/mdev = 56.295/81.105/105.915/24.810 ms
amil@fproject:~$ ping google.com -c 4
PING google.com (172.217.17.142) 56(84) bytes of data.
64 bytes from ams15s30-in-f142.1e100.net (172.217.17.142): icmp_seq=1 ttl=115 time=58.9 ms
64 bytes from ams15s30-in-f142.1e100.net (172.217.17.142): icmp_seq=2 ttl=115 time=55.9 ms
64 bytes from ams15s30-in-f142.1e100.net (172.217.17.142): icmp_seq=3 ttl=115 time=53.7 ms
64 bytes from sof02s48-in-f14.1e100.net (172.217.17.142): icmp_seq=4 ttl=115 time=54.8 ms

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3072ms
rtt min/avg/max/mdev = 53.670/55.801/58.897/1.950 ms
amil@fproject:~$ █
```

## DNS server setup for Ubuntu Desktop

```
amil@linux-2:~$ sudo ls /etc/netplan/  
[sudo] password for amil:  
01-network-manager-all.yaml  
amil@linux-2:~$
```

```
:~$ sudo nano /etc/netplan/01-network-manager-all.yaml
```

```
network:  
  version: 2  
  renderer: NetworkManager  
  ethernets:  
    enp0s3:  
      #      dhcp4: true  
      addresses:  
      - 172.16.0.41/22  
      gateway4: 172.16.0.40  
      nameservers:  
        addresses:  
        - 192.168.1.254  
        - 8.8.8.8
```

amil@linux-2: ~

amil@fproject: ~

amil@linux-2: ~

```
GNU nano 6.4          /etc/netplan/01-network-manager-all.yaml *
```

```
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      dhcp4: true
      addresses:
        - 172.16.0.41/22
      gateway4: 172.16.0.40
      nameservers:
        addresses:
          - 192.168.1.254
          - 8.8.8.8
          - 172.16.0.40
```

^G Help  
^X Exit

^O Write Out  
^R Read File

^W Where Is  
^\\ Replace

^K Cut  
^U Paste

^T Execute  
^J Justify

^C Location  
^/ Go To Line

M-U Undo  
M-E Redo

```
:-$ sudo netplan --debug generate
```

```
amil@fproject:~
```

```
amil@linux-2:~
```

```
amil@linux-2:~
```

```
amil@linux-2: $ sudo ls /etc/netplan/
[sudo] password for amil:
01-network-manager-all.yaml
amil@linux-2: $ sudo nano /etc/netplan/01-network-manager-all.yaml
amil@linux-2: $ sudo netplan --debug generate
DEBUG:command generate: running ['/lib/netplan/generate']
** (generate:7241): DEBUG: 14:10:49.607: starting new processing pass
** (generate:7241): WARNING **: 14:10:49.607: `gateway4` has been deprecated, use default routes instead
.
See the 'Default routes' section of the documentation for more details.
** (generate:7241): DEBUG: 14:10:49.608: We have some netdefs, pass them through a final round of validation
** (generate:7241): DEBUG: 14:10:49.608: enp0s3: setting default backend to 2
** (generate:7241): DEBUG: 14:10:49.608: Configuration is valid
** (generate:7241): DEBUG: 14:10:49.612: Generating output files..
** (generate:7241): DEBUG: 14:10:49.612: networkd: definition enp0s3 is not for us (backend 2)
** (generate:7241): DEBUG: 14:10:49.612: openvswitch: definition enp0s3 is not for us (backend 2)
amil@linux-2: $
```

```
$ sudo netplan --debug apply
```

```
amil@fproject:~
```

```
amil@linux-2:~
```

```
amil@linux-2:~
```

```
** (generate:7274): DEBUG: 14:11:22.128: We have some netdefs, pass them through a final round of validation
** (generate:7274): DEBUG: 14:11:22.128: enp0s3: setting default backend to 2
** (generate:7274): DEBUG: 14:11:22.128: Configuration is valid
** (generate:7274): DEBUG: 14:11:22.129: Generating output files..
** (generate:7274): DEBUG: 14:11:22.129: networkd: definition enp0s3 is not for us (backend 2)
** (generate:7274): DEBUG: 14:11:22.129: openvswitch: definition enp0s3 is not for us (backend 2)
DEBUG:netplan generated networkd configuration exists
DEBUG:netplan generated NM configuration changed, restarting NM
** (process:7272): DEBUG: 14:11:23.830: starting new processing pass
** (process:7272): WARNING **: 14:11:23.831: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:7272): DEBUG: 14:11:23.831: We have some netdefs, pass them through a final round of validation
** (process:7272): DEBUG: 14:11:23.831: enp0s3: setting default backend to 2
** (process:7272): DEBUG: 14:11:23.831: Configuration is valid
DEBUG:Merged config:
b''
DEBUG:Link changes: {}
DEBUG:netplan triggering .link rules for lo
DEBUG:netplan triggering .link rules for enp0s3
** (process:7272): DEBUG: 14:11:24.277: starting new processing pass
** (process:7272): WARNING **: 14:11:24.280: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:7272): DEBUG: 14:11:24.294: We have some netdefs, pass them through a final round of validation
** (process:7272): DEBUG: 14:11:24.294: enp0s3: setting default backend to 2
** (process:7272): DEBUG: 14:11:24.294: Configuration is valid
** (process:7272): DEBUG: 14:11:24.295: starting new processing pass
** (process:7272): WARNING **: 14:11:24.295: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:7272): DEBUG: 14:11:24.295: We have some netdefs, pass them through a final round of validation
** (process:7272): DEBUG: 14:11:24.295: enp0s3: setting default backend to 2
** (process:7272): DEBUG: 14:11:24.295: Configuration is valid
DEBUG:Merged config:
b''
amil@linux-2: $
```

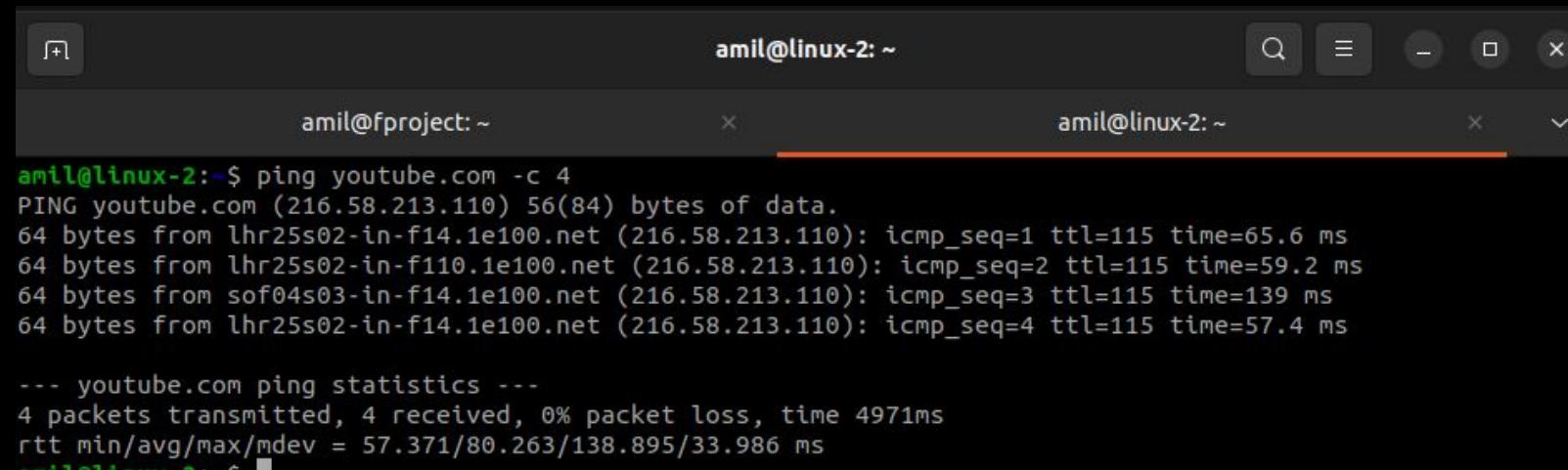
```
amil@linux-2:~$ nslookup google.com
```

```
Server:      127.0.0.53  
Address:    127.0.0.53#53
```

```
Non-authoritative answer:
```

```
Name:  google.com  
Address: 216.58.213.110  
Name:  google.com  
Address: 2a00:1450:4017:80c::200e
```

```
amil@linux-2:~$
```



```
amil@fproject:~  
amil@linux-2:~  
  
amil@linux-2:~$ ping youtube.com -c 4  
PING youtube.com (216.58.213.110) 56(84) bytes of data.  
64 bytes from lhr25s02-in-f14.1e100.net (216.58.213.110): icmp_seq=1 ttl=115 time=65.6 ms  
64 bytes from lhr25s02-in-f110.1e100.net (216.58.213.110): icmp_seq=2 ttl=115 time=59.2 ms  
64 bytes from sof04s03-in-f14.1e100.net (216.58.213.110): icmp_seq=3 ttl=115 time=139 ms  
64 bytes from lhr25s02-in-f14.1e100.net (216.58.213.110): icmp_seq=4 ttl=115 time=57.4 ms  
  
--- youtube.com ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 4971ms  
rtt min/avg/max/mdev = 57.371/80.263/138.895/33.986 ms  
amil@linux-2:~$
```

```
amil@fproject:~$ ping youtube.com -c 4  
PING youtube.com (142.251.140.46) 56(84) bytes of data.  
64 bytes from sof04s05-in-f14.1e100.net (142.251.140.46): icmp_seq=1 ttl=116 time=79.2 ms  
64 bytes from sof04s05-in-f14.1e100.net (142.251.140.46): icmp_seq=2 ttl=116 time=80.6 ms  
64 bytes from sof04s05-in-f14.1e100.net (142.251.140.46): icmp_seq=3 ttl=116 time=78.9 ms  
64 bytes from sof04s05-in-f14.1e100.net (142.251.140.46): icmp_seq=4 ttl=116 time=78.8 ms  
  
--- youtube.com ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3072ms  
rtt min/avg/max/mdev = 78.793/79.371/80.633/0.740 ms  
amil@fproject:~$
```

# Configuring a DHCP server for Ubuntu Desktop

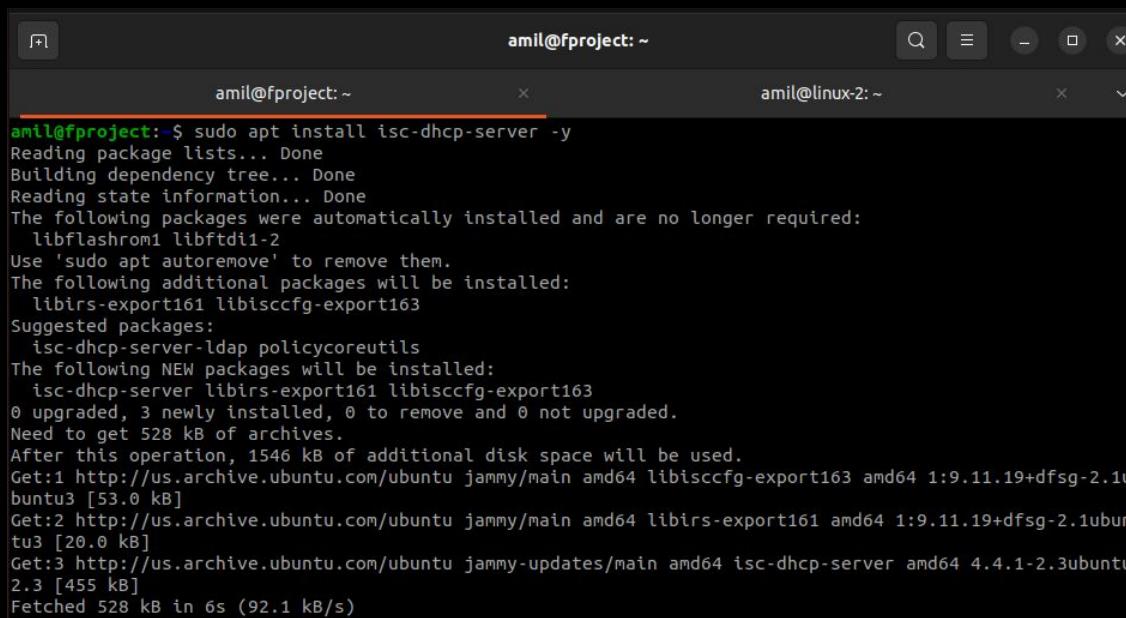
## 1) Defining the network configuration

172.16.1.50 - 172.16.1.249

172.16.2.50 - 172.16.2.249

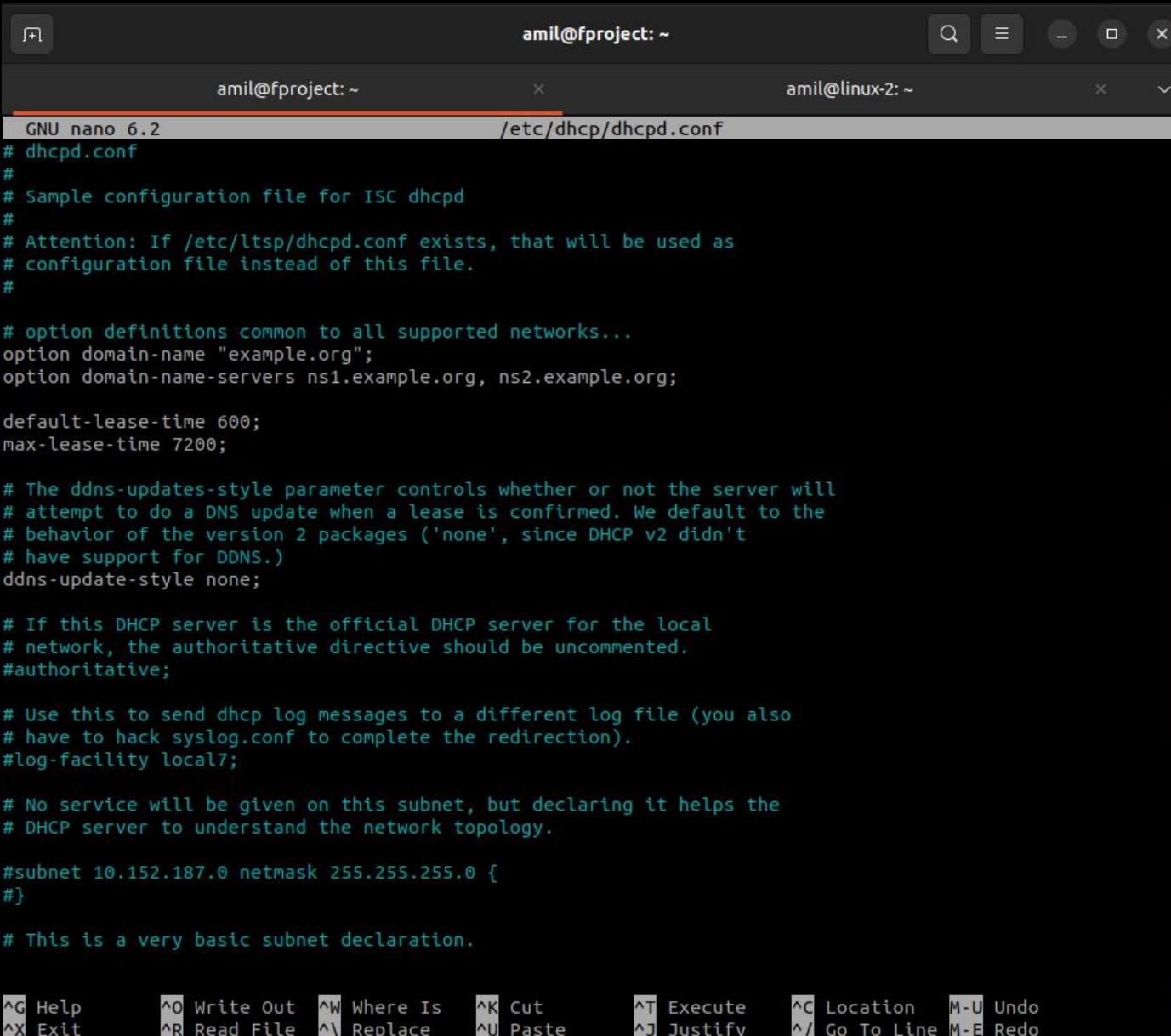
172.16.3.50 - 172.16.3.249

## 2) `$ sudo apt install isc-dhcp-server -y`



```
amil@fproject:~$ sudo apt install isc-dhcp-server -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  libirs-export161 libisccfg-export163
Suggested packages:
  isc-dhcp-server-ldap policycoreutils
The following NEW packages will be installed:
  isc-dhcp-server libirs-export161 libisccfg-export163
0 upgraded, 3 newly installed, 0 to remove and 0 not upgraded.
Need to get 528 kB of archives.
After this operation, 1546 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libiscfg-export163 amd64 1:9.11.19+dfsg-2.1ubuntu3 [53.0 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libirs-export161 amd64 1:9.11.19+dfsg-2.1ubuntu3 [20.0 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 isc-dhcp-server amd64 4.4.1-2.3ubuntu2.3 [455 kB]
Fetched 528 kB in 6s (92.1 kB/s)
```

3) \$ sudo nano /etc/dhcp/dhcpd.conf



The screenshot shows a terminal window with two tabs. The active tab is titled 'amil@fproject: ~' and contains the configuration file for ISC DHCP. The file includes comments about the configuration file, lease times, ddns-update-style, authoritative status, log facility, subnet declarations, and a basic subnet declaration.

```
amil@fproject: ~
amil@fproject: ~
amil@linux-2: ~

GNU nano 6.2
/etc/dhcp/dhcpd.conf
#
# Sample configuration file for ISC dhcpcd
#
# Attention: If /etc/ltsp/dhcpd.conf exists, that will be used as
# configuration file instead of this file.
#
# option definitions common to all supported networks...
option domain-name "example.org";
option domain-name-servers ns1.example.org, ns2.example.org;

default-lease-time 600;
max-lease-time 7200;

# The ddns-updates-style parameter controls whether or not the server will
# attempt to do a DNS update when a lease is confirmed. We default to the
# behavior of the version 2 packages ('none', since DHCP v2 didn't
# have support for DDNS.)
ddns-update-style none;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
#authoritative;

# Use this to send dhcp log messages to a different log file (you also
# have to hack syslog.conf to complete the redirection).
#log-facility local7;

# No service will be given on this subnet, but declaring it helps the
# DHCP server to understand the network topology.

#subnet 10.152.187.0 netmask 255.255.255.0 {
#}

# This is a very basic subnet declaration.
```

At the bottom of the terminal window, there is a menu bar with various keyboard shortcuts for the nano editor, including Help, Write Out, Where Is, Cut, Execute, Location, Undo, Exit, Read File, Replace, Paste, Justify, Go To Line, and Redo.

amil@fproject: ~

amil@fproject: ~

amil@linux-2: ~

GNU nano 6.2

```
authoritative;
subnet 172.16.0.0 netmask 255.255.252.0 {
    option subnet-mask 255.255.252.0;
    option broadcast-address 172.16.3.255;
    option routers 172.16.0.40;
    option domain-name "fproject.local";
    option domain-name-servers 172.16.0.40;
    pool {
        max-lease-time 604800;
        range 172.16.1.50 172.16.1.249;
        range 172.16.2.50 172.16.2.249;
        range 172.16.3.50 172.16.3.249;
    }
}
```

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo  
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line M-E Redo

4) -\$ sudo systemctl restart isc-dhcp-server

```
amil@fproject:~$ sudo systemctl restart isc-dhcp-server
amil@fproject:~$
```

5) -\$ sudo systemctl status isc-dhcp-server

```
amil@fproject:~$ sudo systemctl status isc-dhcp-server
● isc-dhcp-server.service - ISC DHCP IPv4 server
  Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor preset: enabled)
  Active: active (running) since Sun 2022-12-25 10:42:05 UTC; 3s ago
    Docs: man:dhcpd(8)
 Main PID: 2081 (dhcpd)
   Tasks: 4 (limit: 3421)
  Memory: 4.6M
     CPU: 79ms
    CGroup: /system.slice/isc-dhcp-server.service
            └─2081 dhcpcd -user dhcpcd -group dhcpcd -f -4 -pf /run/dhcp-server/dhcpcd.pid -cf /etc/dhcp/d>

Dec 25 10:42:05 fproject dhcpcd[2081]:      in your dhcpcd.conf file for the network segment
Dec 25 10:42:05 fproject dhcpcd[2081]:      to which interface enp0s8 is attached. **
Dec 25 10:42:05 fproject dhcpcd[2081]:
Dec 25 10:42:05 fproject dhcpcd[2081]: Listening on LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:42:05 fproject sh[2081]: Listening on LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:42:05 fproject sh[2081]: Sending on   LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:42:05 fproject sh[2081]: Sending on   Socket/fallback/fallback-net
Dec 25 10:42:05 fproject dhcpcd[2081]: Sending on   LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:42:05 fproject dhcpcd[2081]: Sending on   Socket/fallback/fallback-net
Dec 25 10:42:05 fproject dhcpcd[2081]: Server starting service.
lines 1-21/21 (END)
```

## Obtaining an IP address for Ubuntu Desktop:

- \$ sudo nano /etc/netplan/01-network-manager-all.yaml

```
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      #      dhcp4: true
      addresses:
        - 172.16.0.41/22
      gateway4: 172.16.0.40
      nameservers:
        addresses:
          #      - 192.168.1.254
          #      - 8.8.8.8
          - 172.16.0.40
```



```
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      dhcp4: true
      addresses:
        #      - 172.16.0.41/22
        #      gateway4: 172.16.0.40
        #      nameservers:
        #        addresses:
        #          #      - 192.168.1.254
        #          #      - 8.8.8.8
        #          - 172.16.0.40
```

```
- $ sudo netplan --debug generate
- $ sudo netplan --debug apply
```

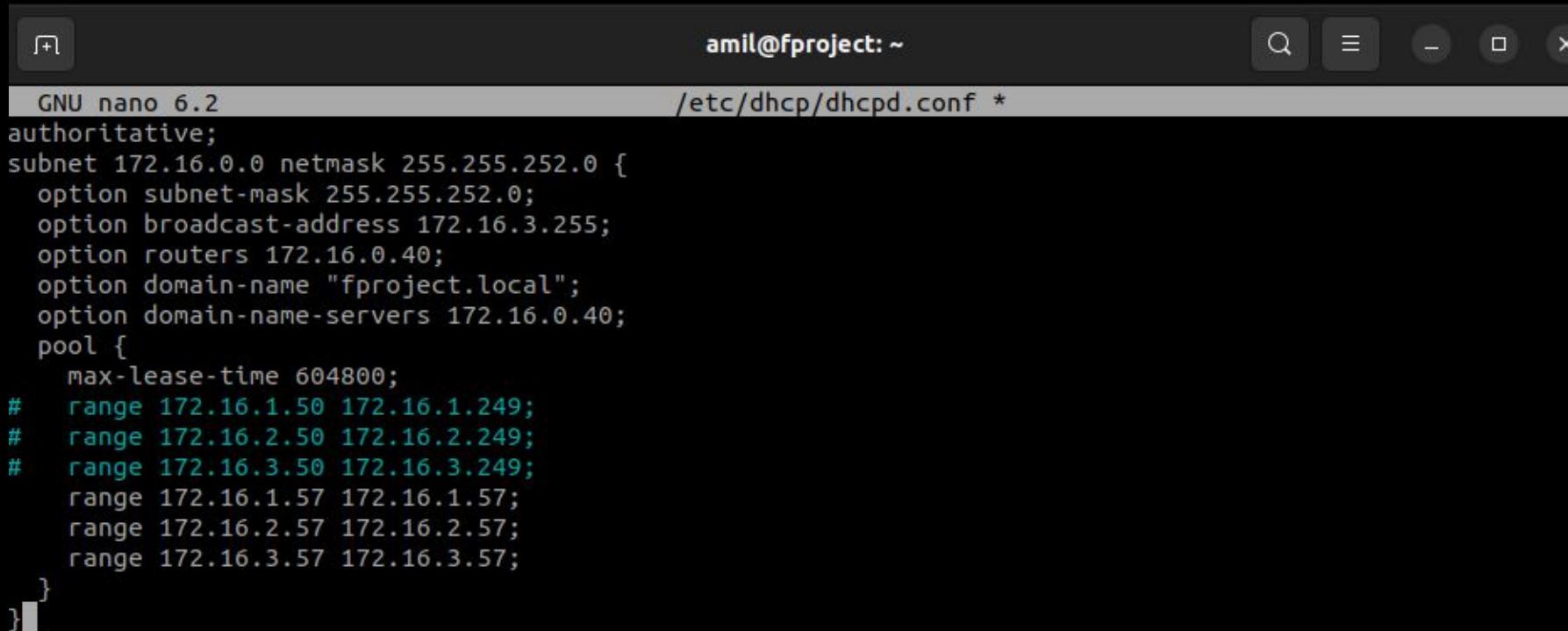
```
amil@linux-2:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:7e:a0:17 brd ff:ff:ff:ff:ff:ff
        inet 172.16.1.50/22 brd 172.16.3.255 scope global dynamic noprefixroute enp0s3
            valid_lft 43126sec preferred_lft 43126sec
        inet6 fe80::a00:27ff:fe7e:a017/64 scope link
            valid_lft forever preferred_lft forever
amil@linux-2:~$
```

```
amil@linux-2:~$ ping learn.algoritmika.org -c 4
PING learn.algoritmika.org (178.248.235.86) 56(84) bytes of data.
64 bytes from 178.248.235.86 (178.248.235.86): icmp_seq=1 ttl=54 time=86.2 ms
64 bytes from 178.248.235.86 (178.248.235.86): icmp_seq=2 ttl=54 time=39.2 ms
64 bytes from 178.248.235.86 (178.248.235.86): icmp_seq=3 ttl=54 time=81.7 ms
64 bytes from 178.248.235.86 (178.248.235.86): icmp_seq=4 ttl=54 time=40.4 ms

--- learn.algoritmika.org ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3255ms
rtt min/avg/max/mdev = 39.213/61.892/86.236/22.156 ms
amil@linux-2:~$
```

## Testing the performance of ranges on the DHCP server

```
$ sudo nano /etc/dhcp/dhcpd.conf
```



The screenshot shows a terminal window titled "amil@fproject: ~" running the "nano" text editor. The file being edited is "/etc/dhcp/dhcpd.conf". The content of the file is as follows:

```
GNU nano 6.2                               /etc/dhcp/dhcpd.conf *
authoritative;
subnet 172.16.0.0 netmask 255.255.252.0 {
    option subnet-mask 255.255.252.0;
    option broadcast-address 172.16.3.255;
    option routers 172.16.0.40;
    option domain-name "fproject.local";
    option domain-name-servers 172.16.0.40;
    pool {
        max-lease-time 604800;
#       range 172.16.1.50 172.16.1.249;
#       range 172.16.2.50 172.16.2.249;
#       range 172.16.3.50 172.16.3.249;
        range 172.16.1.57 172.16.1.57;
        range 172.16.2.57 172.16.2.57;
        range 172.16.3.57 172.16.3.57;
    }
}
```

```
amil@fproject:~$ sudo systemctl restart isc-dhcp-server
amil@fproject:~$ sudo systemctl status isc-dhcp-server
● isc-dhcp-server.service - ISC DHCP IPv4 server
  Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor preset: enabled)
  Active: active (running) since Sun 2022-12-25 10:56:33 UTC; 3s ago
    Docs: man:dhcpd(8)
 Main PID: 2250 (dhcpd)
   Tasks: 4 (limit: 3421)
  Memory: 4.5M
     CPU: 45ms
    CGroup: /system.slice/isc-dhcp-server.service
            └─2250 dhcpcd -user dhcpcd -group dhcpcd -f -4 -pf /run/dhcp-server/dhcpcd.pid -cf /etc/dhcp/d>

Dec 25 10:56:33 fproject dhcpcd[2250]:      in your dhcpcd.conf file for the network segment
Dec 25 10:56:33 fproject dhcpcd[2250]:      to which interface enp0s8 is attached. **
Dec 25 10:56:33 fproject dhcpcd[2250]:
Dec 25 10:56:33 fproject dhcpcd[2250]: Listening on LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:56:33 fproject sh[2250]: Listening on LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:56:33 fproject sh[2250]: Sending on   LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:56:33 fproject sh[2250]: Sending on   Socket/fallback/fallback-net
Dec 25 10:56:33 fproject dhcpcd[2250]: Sending on   LPF/enp0s3/08:00:27:de:86:66/172.16.0.0/22
Dec 25 10:56:33 fproject dhcpcd[2250]: Sending on   Socket/fallback/fallback-net
Dec 25 10:56:33 fproject dhcpcd[2250]: Server starting service.
lines 1-21/21 (END)
```

```
amil@linux-2:~$ sudo dhclient -r  
[sudo] password for amil:  
amil@linux-2:~$ sudo dhclient  
amil@linux-2:~$
```

```
amil@linux-2:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000  
    link/ether 08:00:27:7e:a0:17 brd ff:ff:ff:ff:ff:ff  
    inet 172.16.1.57/22 brd 172.16.3.255 scope global dynamic enp0s3  
        valid_lft 43173sec preferred_lft 43173sec  
    inet6 fe80::a00:27ff:fe7e:a017/64 scope link  
        valid_lft forever preferred_lft forever  
amil@linux-2:~$
```

To restore the system to its previous state, the changes made during the process are reverted to their previous state.

```
amil@linux-2:~$ sudo dhclient -r
[sudo] password for amil:
amil@linux-2:~$ sudo dhclient
amil@linux-2:~$
```

---

```
amil@linux-2:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:7e:a0:17 brd ff:ff:ff:ff:ff:ff
    inet 172.16.1.50/22 brd 172.16.3.255 scope global dynamic noprefixroute enp0s3
        valid_lft 42971sec preferred_lft 42971sec
    inet6 fe80::a00:27ff:fe7e:a017/64 scope link
        valid_lft forever preferred_lft forever
amil@linux-2:~$
```

# Storage of IP addresses

\$ sudo less /var/lib/dhcp/dhcpd.leases

```
# The format of this file is documented in the dhcpcd.leases(5) manual page.
# This lease file was written by isc-dhcp-4.4.1

# authoring-byte-order entry is generated, DO NOT DELETE
authoring-byte-order little-endian;

lease 172.16.1.57 {
    starts 0 2022/12/25 11:11:57;
    ends 0 2022/12/25 23:11:57;
    tstp 0 2022/12/25 23:11:57;
    cltt 0 2022/12/25 11:11:57;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 08:00:27:7e:a0:17;
    client-hostname "linux-2";
}
server-duid "\000\001\000\001+:\345\010\000'\336\206f";

lease 172.16.1.50 {
    starts 0 2022/12/25 11:14:59;
    ends 0 2022/12/25 23:14:59;
    cltt 0 2022/12/25 11:14:59;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 08:00:27:7e:a0:17;
    uid "\001\010\000'~\240\027";
    client-hostname "linux-2";
}
~
```

amil@linux-2:

```
-$ sudo nano /etc/dhcp/dhcpd.conf
```

```
authoritative;
subnet 172.16.0.0 netmask 255.255.252.0 {
    option subnet-mask 255.255.252.0;
    option broadcast-address 172.16.3.255;
    option routers 172.16.0.40;
    option domain-name "fproject.local";
    option domain-name-servers 172.16.0.40;
    pool {
        max-lease-time 604800;
        range 172.16.1.50 172.16.1.249;
        range 172.16.2.50 172.16.2.249;
        range 172.16.3.50 172.16.3.249;
    }
}
```

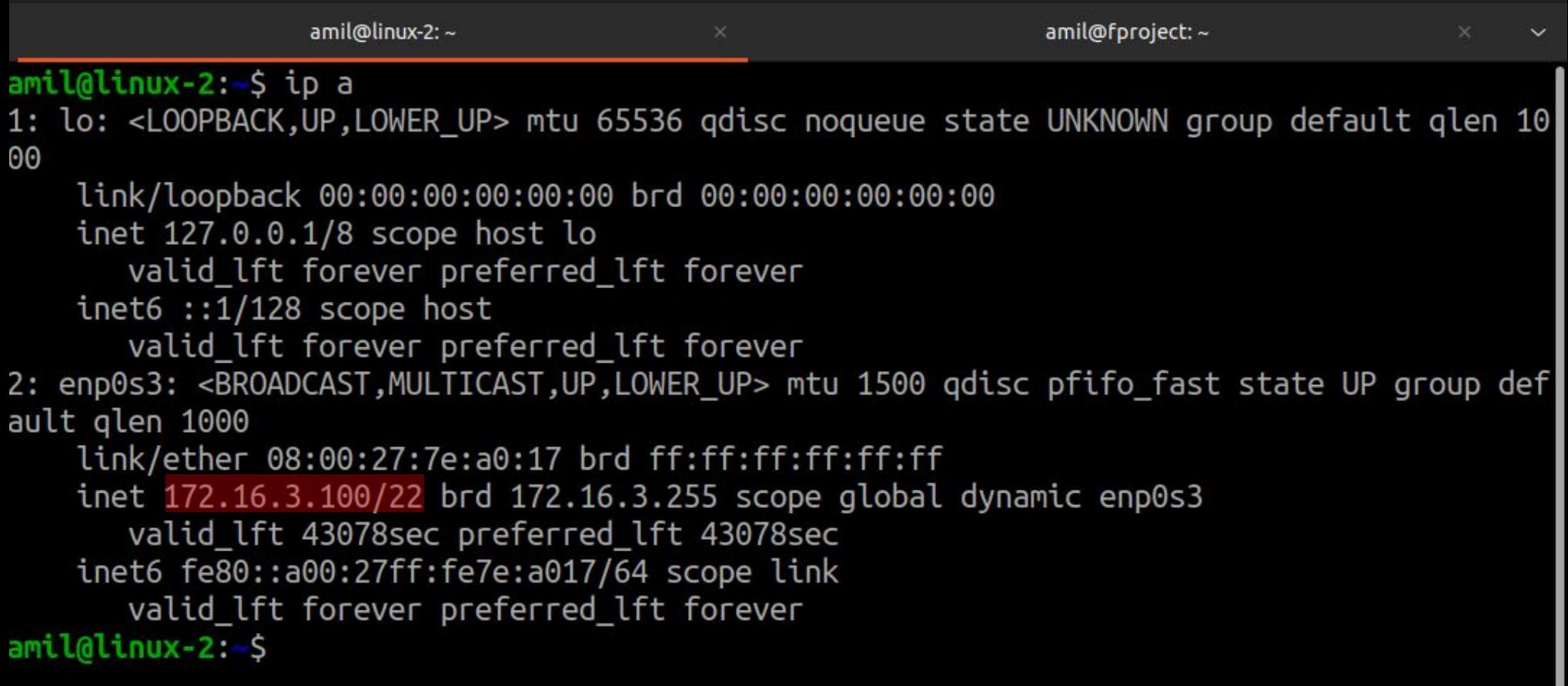
IP address reserved by the DHCP server for the device's MAC address.

The screenshot shows a terminal window with two tabs. The left tab is titled "amil@linux-2: ~" and contains the command "GNU nano 6.2". The right tab is titled "amil@fproject: ~" and contains the path "/etc/dhcp/dhcpd.conf". The content of the /etc/dhcp/dhcpd.conf file is as follows:

```
authoritative;
subnet 172.16.0.0 netmask 255.255.252.0 {
    option subnet-mask 255.255.252.0;
    option broadcast-address 172.16.3.255;
    option routers 172.16.0.40;
    option domain-name "fproject.local";
    option domain-name-servers 172.16.0.40;
    pool {
        max-lease-time 604800;
        range 172.16.1.50 172.16.1.249;
        range 172.16.2.50 172.16.2.249;
        range 172.16.3.50 172.16.3.249;
    }
}

host linux-2 {
    hardware ethernet 08:00:27:7e:a0:17;
    fixed-address 172.16.3.100;
}
```

```
amil@linux-2:~$ sudo dhclient -r
[sudo] password for amil:
amil@linux-2:~$ sudo dhclient
amil@linux-2:~$
```



```
amil@linux-2:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:7e:a0:17 brd ff:ff:ff:ff:ff:ff
    inet 172.16.3.100/22 brd 172.16.3.255 scope global dynamic enp0s3
        valid_lft 43078sec preferred_lft 43078sec
    inet6 fe80::a00:27ff:fe7e:a017/64 scope link
        valid_lft forever preferred_lft forever
amil@linux-2:~$
```

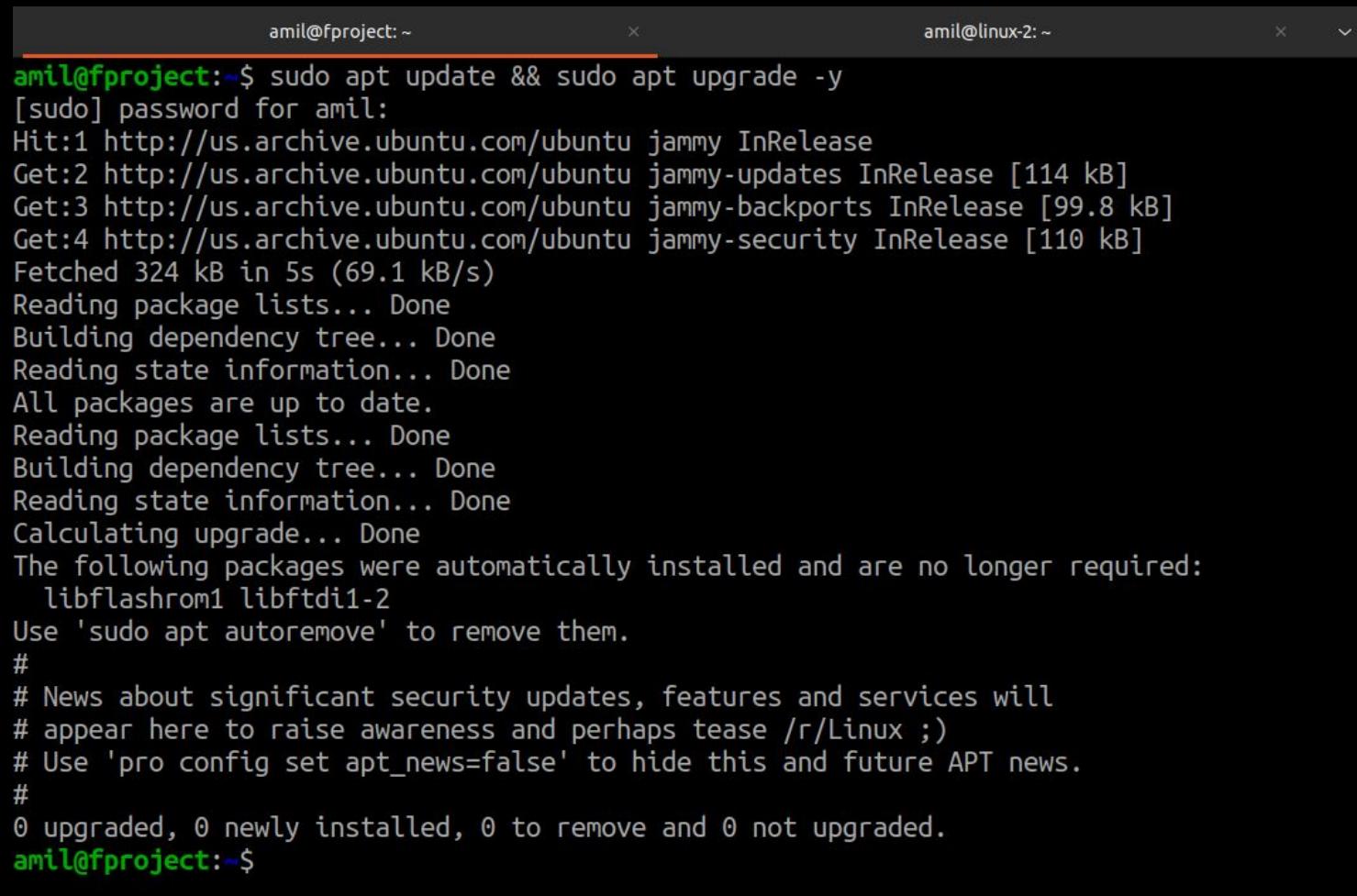
```
amil@fproject: ~          amil@linux-2: ~
amil@linux-2:~$ traceroute -I learn.algoritmika.org
You do not have enough privileges to use this traceroute method.
socket: Operation not permitted
amil@linux-2:~$ sudo traceroute -I learn.algoritmika.org
[sudo] password for amil:
traceroute to learn.algoritmika.org (178.248.235.86), 30 hops max, 60 byte packets
 1 _gateway (172.16.0.40)  1.869 ms  1.845 ms  2.640 ms
 2 10.0.3.2 (10.0.3.2)  3.270 ms * *
 3 * * *
 4 * 100.64.0.1 (100.64.0.1)  144.524 ms  145.703 ms
 5 172.16.12.61 (172.16.12.61)  164.877 ms  164.789 ms  164.694 ms
 6 94.20.50.145 (94.20.50.145)  164.606 ms * *
 7 10.50.10.38 (10.50.10.38)  118.464 ms  118.382 ms  118.299 ms
 8 * 188.43.209.206 (188.43.209.206)  68.599 ms  67.947 ms
 9 * * *
10 HLL-gw.transtelecom.net (188.43.15.237)  46.333 ms  46.243 ms  46.684 ms
11 * 178.248.235.86 (178.248.235.86)  38.906 ms  40.629 ms
amil@linux-2:~$
```



# Installing Samba Domain Controller on Ubuntu Server

# 1) Updating the system, changing the name of the server, configuring the /etc/hosts file

```
~$ sudo apt update && sudo apt upgrade -y
```



The screenshot shows two terminal windows side-by-side. The left window is titled 'amil@fproject: ~' and the right window is titled 'amil@linux-2: ~'. Both windows display the command 'sudo apt update && sudo apt upgrade -y' followed by its execution output.

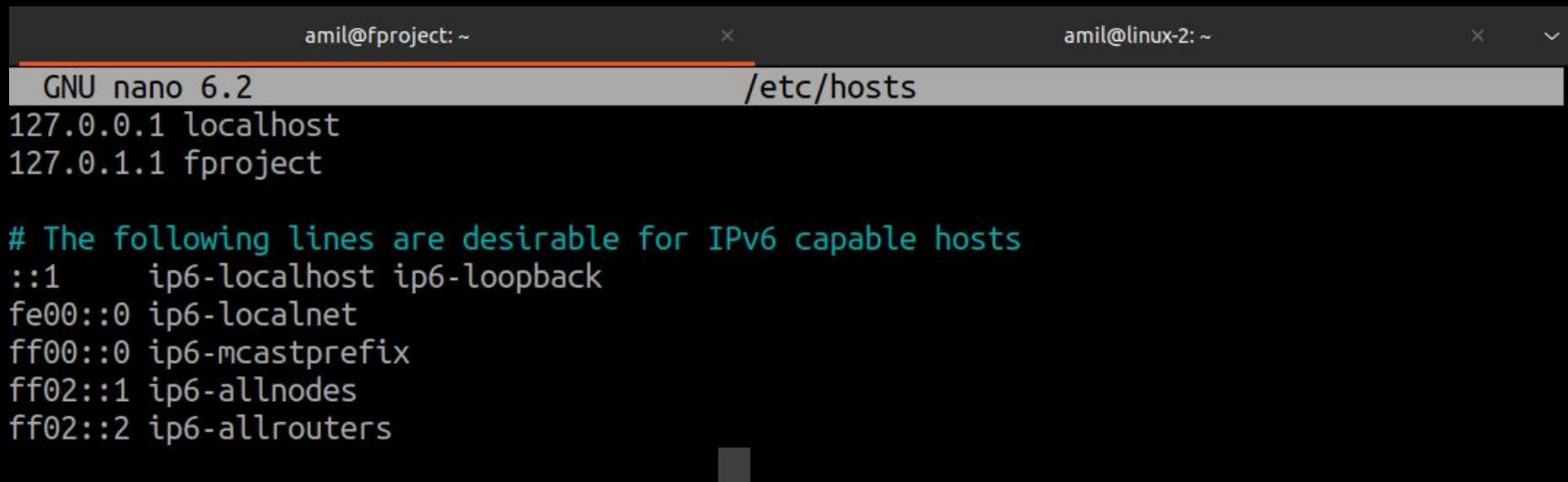
```
amil@fproject:~$ sudo apt update && sudo apt upgrade -y
[sudo] password for amil:
Hit:1 http://us.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Fetched 324 kB in 5s (69.1 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2
Use 'sudo apt autoremove' to remove them.
#
# News about significant security updates, features and services will
# appear here to raise awareness and perhaps tease /r/Linux ;)
# Use 'pro config set apt_news=false' to hide this and future APT news.
#
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
amil@fproject:~$
```

```
amil@fproject:~$ hostnamectl
Static hostname: fproject
  Icon name: computer-vm
  Chassis: vm
Machine ID: 5c3021f28f064978a4b3a8bb84059c7b
  Boot ID: b0ea199f2a054fcab04406d6b343826d
Virtualization: oracle
Operating System: Ubuntu 22.04.1 LTS
  Kernel: Linux 5.15.0-56-generic
Architecture: x86-64
Hardware Vendor: innotek GmbH
Hardware Model: VirtualBox
amil@fproject:~$
```

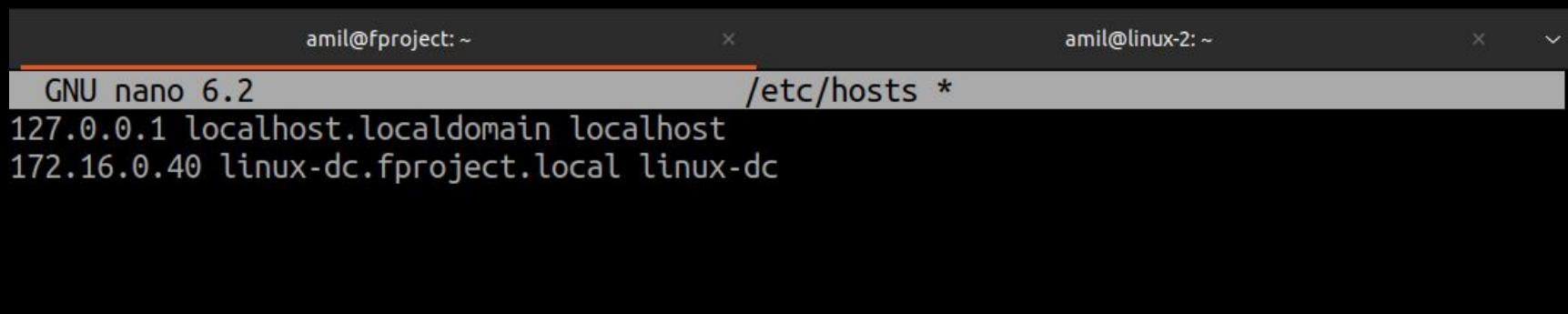
```
~$ sudo hostnamectl set-hostname linux-dc
```

```
amil@fproject:~$ sudo hostnamectl set-hostname linux-dc
[sudo] password for amil:
amil@fproject:~$ hostnamectl
Static hostname: linux-dc
  Icon name: computer-vm
  Chassis: vm
Machine ID: 5c3021f28f064978a4b3a8bb84059c7b
  Boot ID: b0ea199f2a054fcab04406d6b343826d
Virtualization: oracle
Operating System: Ubuntu 22.04.1 LTS
  Kernel: Linux 5.15.0-56-generic
Architecture: x86-64
Hardware Vendor: innotek GmbH
Hardware Model: VirtualBox
amil@fproject:~$
```

```
$ sudo nano /etc/hosts
```

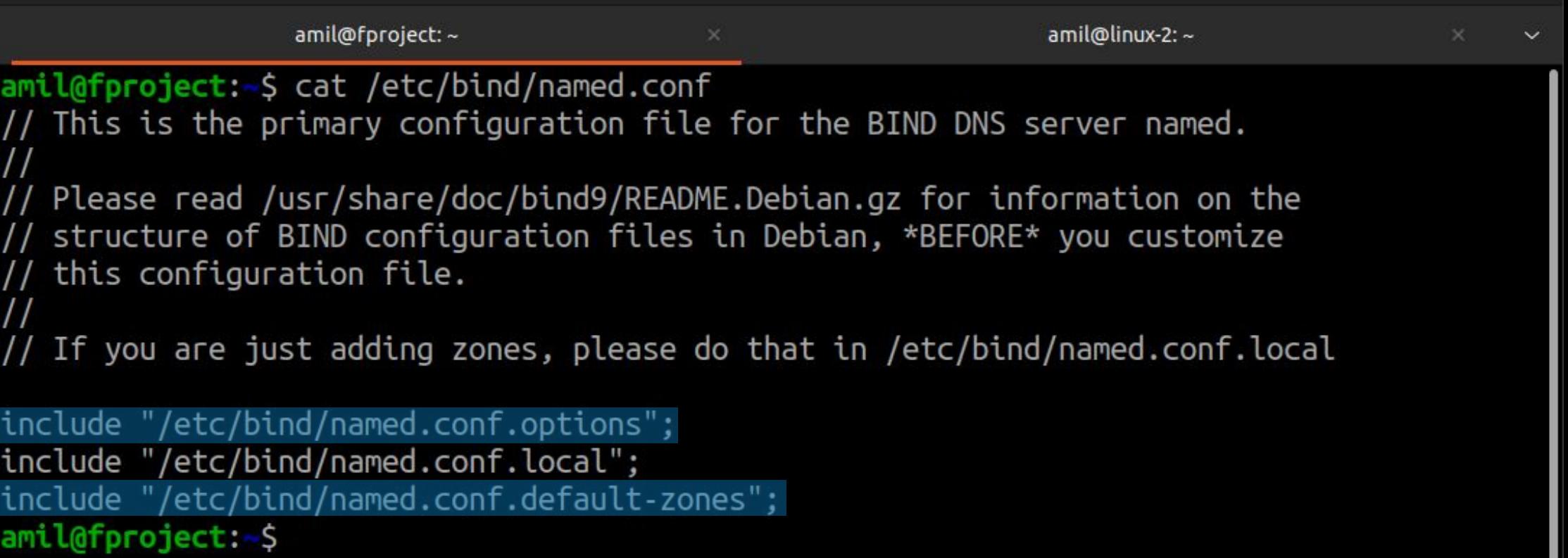


```
amil@fproject: ~          /etc/hosts  
GNU nano 6.2  
127.0.0.1 localhost  
127.0.1.1 fproject  
  
# The following lines are desirable for IPv6 capable hosts  
::1      ip6-localhost ip6-loopback  
fe00::0  ip6-localnet  
ff00::0  ip6-mcastprefix  
ff02::1  ip6-allnodes  
ff02::2  ip6-allrouters
```



```
amil@fproject: ~          /etc/hosts *  
GNU nano 6.2  
127.0.0.1 localhost.localdomain localhost  
172.16.0.40 linux-dc.fproject.local linux-dc
```

## 2) Setting the Bind9 DNS server to work with the domain controller



The screenshot shows a terminal window with two tabs. The active tab, highlighted with a red border, is titled 'amil@fproject:~' and contains the command 'cat /etc/bind/named.conf'. The output of this command is displayed below:

```
amil@fproject:~$ cat /etc/bind/named.conf
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
amil@fproject:~$
```

```
~$ sudo cp /etc/bind/named.conf.options{,.orig}
```

```
amil@fproject:~$ sudo cp /etc/bind/named.conf.options{,.orig}
```

```
amil@fproject:~$ ls /etc/bind
```

bind.keys	db.255	named.conf	named.conf.options	zones.rfc1918
db.0	db.empty	named.conf.default-zones	named.conf.options.orig	
db.127	db.local	named.conf.local	rndc.key	

```
amil@fproject:~$
```

```
~$ sudo nano /etc/bind/named.conf.options
```

The screenshot shows a terminal window titled "GNU nano 6.2" with the file "/etc/bind/named.conf.options" open. The file contains the following configuration:

```
options {
    directory "/var/cache/bind";
    listen-on {
        172.16.0.0/22;
        127.0.0.0/8;
    };

    forwarders {
        192.168.1.254;
        8.8.8.8;
    };

    dnssec-validation auto;
    auth-nxdomain no;
    listen-on-v6 { none; };
};
```

amil@fproject: ~

amil@linux-2: ~

```
GNU nano 6.2                               /etc/bind/named.conf.options *

options {
    auth-nxdomain yes;
    directory "/var/cache/bind";
    notify no;
    empty-zones-enable no;
    tkey-gssapi-keytab "/var/lib/samba/private/dns.keytab";
    minimal-responses yes;

    allow-query {
        127.0.0.1;
        172.16.0.0/22;
    };

    allow-recursion {
        127.0.0.1;
        172.16.0.0/22;
    };

    forwarders {
        192.168.1.254;
        8.8.8.8;
    };

    allow-transfer {
        none;
    };
};
```

^G Help  
^X Exit

^O Write Out  
^R Read File

^W Where Is  
^\\ Replace

^K Cut  
^U Paste

^T Execute  
^J Justify

^C Location  
^/ Go To Line

M-U Undo  
M-E Redo

```
$ sudo cp /etc/bind/named.conf.default-zones{,.orig}
```

```
amil@fproject:~$ sudo cp /etc/bind/named.conf.default-zones{,.orig}
```

```
amil@fproject:~$ ls /etc/bind
```

```
bind.keys  db.255  named.conf          named.conf.local      rndc.key  
db.0       db.empty named.conf.default-zones  named.conf.options  zones.rfc1918  
db.127     db.local named.conf.default-zones.orig  named.conf.options.orig
```

```
amil@fproject:~$
```

```
$ sudo nano /etc/bind/named.conf.default-zones
```

The screenshot shows a terminal window titled "amil@fproject: ~" with the command "sudo nano /etc/bind/named.conf.default-zones" running. The file content is displayed in the nano editor, which has a black background with white text. The file contains configuration for a DNS server, defining zones for root servers, localhost, and several standard address spaces (127.in-addr.arpa, 0.in-addr.arpa, 255.in-addr.arpa). The nano interface includes standard keyboard shortcuts at the bottom.

```
GNU nano 6.2 /etc/bind/named.conf.default-zones
// prime the server with knowledge of the root servers
zone "." {
    type hint;
    file "/usr/share/dns/root.hints";
};

// be authoritative for the localhost forward and reverse zones, and for
// broadcast zones as per RFC 1912

zone "localhost" {
    type master;
    file "/etc/bind/db.local";
};

zone "127.in-addr.arpa" {
    type master;
    file "/etc/bind/db.127";
};

zone "0.in-addr.arpa" {
    type master;
    file "/etc/bind/db.0";
};

zone "255.in-addr.arpa" {
    type master;
    file "/etc/bind/db.255";
};
```

[ Read 30 lines ]

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo  
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line M-E Redo

amil@fproject: ~ x amil@linux-2: ~ x

GNU nano 6.2 /etc/bind/named.conf.default-zones \*

```
zone "." {
    type hint;
    file "named.root";
};

zone "localhost" {
    type master;
    file "/master/localhost.zone";
};

zone "0.0.127.in-addr.arpa" {
    type master;
    file "/master/0.0.127.zone";
};
```

# Disabling systemd-resolved service for DNS to work properly

```
amil@fproject:~$ sudo systemctl stop systemd-resolved
amil@fproject:~$ sudo systemctl disable systemd-resolved.service
Removed /etc/systemd/system/dbus-org.freedesktop.resolve1.service.
Removed /etc/systemd/system/multi-user.target.wants/systemd-resolved.service.
amil@fproject:~$ sudo rm /etc/resolv.conf
amil@fproject:~$
```

```
$ sudo nano /etc/resolv.conf
```

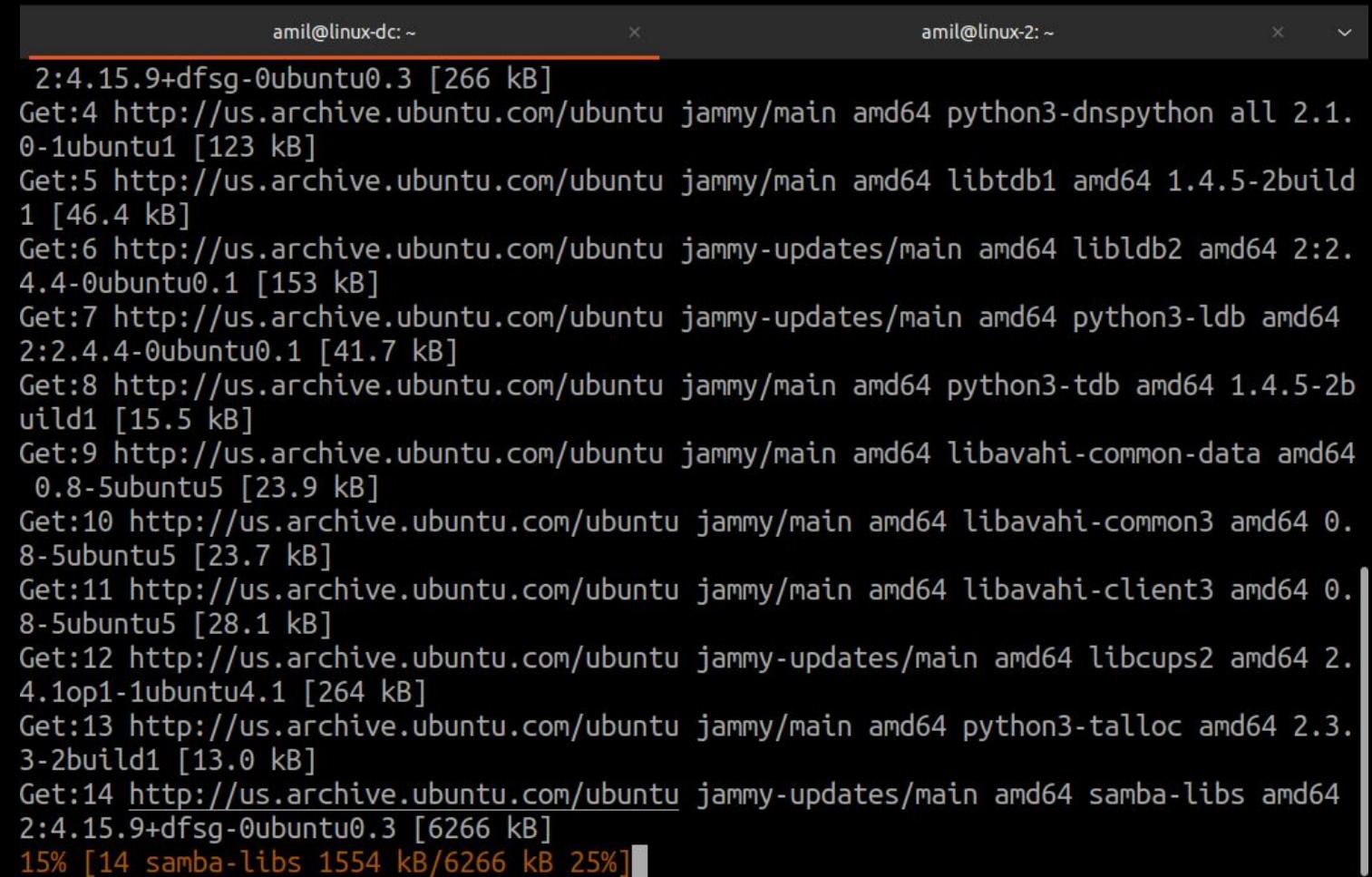
The screenshot shows a terminal window with two tabs. The left tab is titled 'amil@fproject: ~' and the right tab is titled 'amil@linux-2: ~'. Both tabs have an 'X' button in the top right corner. The title bar of the window has a red horizontal bar. The main area of the terminal shows the contents of the /etc/resolv.conf file:

```
GNU nano 6.2
/etc/resolv.conf *
nameserver 8.8.8.8
search fproject.local
```

System initialization for Samba Domain Controller is complete.

# Installing and configuring the Domain Controller

```
$ sudo apt -y install samba krb5-config winbind smbclient krb5-user
```



The screenshot shows a terminal window with two tabs. The active tab, titled 'amil@linux-dc: ~', displays the output of an 'apt-get update' command. The output lists several packages being downloaded from 'http://us.archive.ubuntu.com/ubuntu' and 'http://us.archive.ubuntu.com/ubuntu jammy-updates/main'. The packages include samba, krb5-config, winbind, smbclient, and krb5-user. The progress bar at the bottom indicates that 15% of the download has been completed, with a total size of 1554 kB and a speed of 6266 kB/s. The second tab, titled 'amil@linux-2: ~', is visible in the background.

```
2:4.15.9+dfsg-0ubuntu0.3 [266 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 python3-dnspython all 2.1.
0-1ubuntu1 [123 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libtdb1 amd64 1.4.5-2build
1 [46.4 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 libldb2 amd64 2:2.
4.4-0ubuntu0.1 [153 kB]
Get:7 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 python3-ldb amd64
2:2.4.4-0ubuntu0.1 [41.7 kB]
Get:8 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 python3-tdb amd64 1.4.5-2b
uild1 [15.5 kB]
Get:9 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libavahi-common-data amd64
0.8-5ubuntu5 [23.9 kB]
Get:10 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libavahi-common3 amd64 0.
8-5ubuntu5 [23.7 kB]
Get:11 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libavahi-client3 amd64 0.
8-5ubuntu5 [28.1 kB]
Get:12 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 libcups2 amd64 2.
4.1op1-1ubuntu4.1 [264 kB]
Get:13 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 python3-talloc amd64 2.3.
3-2build1 [13.0 kB]
Get:14 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 samba-libs amd64
2:4.15.9+dfsg-0ubuntu0.3 [6266 kB]
15% [14 samba-libs 1554 kB/6266 kB 25%]
```

amil@linux-dc: ~

amil@linux-2: ~

## Package configuration

### Configuring Kerberos Authentication

When users attempt to use Kerberos and specify a principal or user name without specifying what administrative Kerberos realm that principal belongs to, the system appends the default realm. The default realm may also be used as the realm of a Kerberos service running on the local machine. Often, the default realm is the uppercase version of the local DNS domain.

Default Kerberos version 5 realm:

FPROJECT.LOCAL

<0k>

amil@linux-dc: ~

Package configuration

amil@linux-2: ~

**Configuring Kerberos Authentication**  
Enter the hostnames of Kerberos servers in the FPROJECT.LOCAL Kerberos realm separated by spaces.

Kerberos servers for your realm:

<0k>

**Configuring Kerberos Authentication**  
Enter the hostnames of Kerberos servers in the FPROJECT.LOCAL Kerberos realm separated by spaces.

Kerberos servers for your realm:

linux-dc.fproject.local

<0k>

amil@linux-dc: ~

amil@linux-2: ~

Package configuration

**Configuring Kerberos Authentication**

Enter the hostname of the administrative (password changing) server for the FPROJECT.LOCAL Kerberos realm.

Administrative server for your Kerberos realm:

<0k>

**Configuring Kerberos Authentication**

Enter the hostname of the administrative (password changing) server for the FPROJECT.LOCAL Kerberos realm.

Administrative server for your Kerberos realm:

linux-dc.fproject.local

<0k>

```
amil@linux-dc:~          amil@linux-2:~  
/usr/bin/deb-systemd-helper: error: systemctl preset failed on samba-ad-dc.service: No such file or directory  
Created symlink /etc/systemd/system/multi-user.target.wants/smbd.service → /lib/systemd/system/smbd.service.  
samba-ad-dc.service is a disabled or a static unit, not starting it.  
Setting up winbind (2:4.15.9+dfsg-0ubuntu0.3) ...  
mkdir: created directory '/var/lib/samba/winbindd_privileged'  
changed group of '/var/lib/samba/winbindd_privileged' from root to winbindd_priv  
mode of '/var/lib/samba/winbindd_privileged' changed from 0755 (rwxr-xr-x) to 0750 (rwxr-x---)  
Created symlink /etc/systemd/system/multi-user.target.wants/winbind.service → /lib/systemd/system/winbind.service.  
Processing triggers for man-db (2.10.2-1) ...  
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...  
Processing triggers for ufw (0.36.1-4build1) ...  
Scanning processes...  
Scanning linux images...  
  
Running kernel seems to be up-to-date.  
  
No services need to be restarted.  
  
No containers need to be restarted.  
  
No user sessions are running outdated binaries.  
  
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
amil@linux-dc:~$
```

- Renaming the Samba configuration file

```
~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$
```

- Domain Controller initialization

```
~$ sudo samba-tool domain provision --use-rfc2307 --interactive
```

- Realm parametrinin yoxlanılması:

```
amil@linux-dc:~$ sudo samba-tool domain provision --use-rfc2307 --interactive  
Realm [FPROJECT.LOCAL]:
```

- Domain parametrinin yoxlanılması:

```
amil@linux-dc:~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$ sudo samba-tool domain provision --use-rfc2307 --interactive  
Realm [FPROJECT.LOCAL]:  
Domain [FPROJECT]:
```

- Checking the Server Role setting:

```
amil@linux-dc:~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$ sudo samba-tool domain provision --use-rfc2307 --interactive  
Realm [FPROJECT.LOCAL]:  
Domain [FPROJECT]:  
Server Role (dc, member, standalone) [dc]:
```

- DNS backend parameter check: BIND9\_DLZ must be entered

```
amil@linux-dc:~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$ sudo samba-tool domain provision --use-rfc2307 --interactive  
Realm [FPROJECT.LOCAL]:  
Domain [FPROJECT]:  
Server Role (dc, member, standalone) [dc]:  
DNS backend (SAMBA_INTERNAL, BIND9_FLATFILE, BIND9_DLZ, NONE) [SAMBA_INTERNAL]: BIND9_DLZ
```

- Password for Domain Administrator is entered: s.Up.1md\_

```
amil@linux-dc:~$ sudo mv /etc/samba/smb.conf /etc/samba/smb.conf.orig  
amil@linux-dc:~$ sudo samba-tool domain provision --use-rfc2307 --interactive  
Realm [FPROJECT.LOCAL]:  
Domain [FPROJECT]:  
Server Role (dc, member, standalone) [dc]:  
DNS backend (SAMBA_INTERNAL, BIND9_FLATFILE, BIND9_DLZ, NONE) [SAMBA_INTERNAL]: BIND9_DLZ  
Administrator password: █
```

amil@linux-dc: ~

```
INFO 2022-12-25 14:15:19,018 pid:2732 /usr/lib/python3/dist-packages/samba/provision/sambadns.py #1336: and /var/lib/samba/bind-dns/named.txt for further documentation required for secure DNS updates
INFO 2022-12-25 14:15:19,115 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #2012: Setting up sam.ldb rootDSE marking as synchronized
INFO 2022-12-25 14:15:19,151 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #2017: Fixing provision GUIDs
INFO 2022-12-25 14:15:19,835 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #2348: A Kerberos configuration suitable for Samba AD has been generated at /var/lib/samba/private/krb5.conf
INFO 2022-12-25 14:15:19,836 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #2350: Merge the contents of this file with your system krb5.conf or replace it with this one.
Do not create a symlink!
INFO 2022-12-25 14:15:19,958 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #2082: Setting up fake yp server settings
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #487: Once the above files are installed, your Samba AD server will be ready to use
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #492: Server Role: active directory domain controller
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #493: Hostname: linux-dc
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #494: NetBIOS Domain: FPROJECT
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #495: DNS Domain: fproject.local
INFO 2022-12-25 14:15:20,112 pid:2732 /usr/lib/python3/dist-packages/samba/provision/__init__.py #496: DOMAIN SID: S-1-5-21-280813283-2307820831-3506324483
```

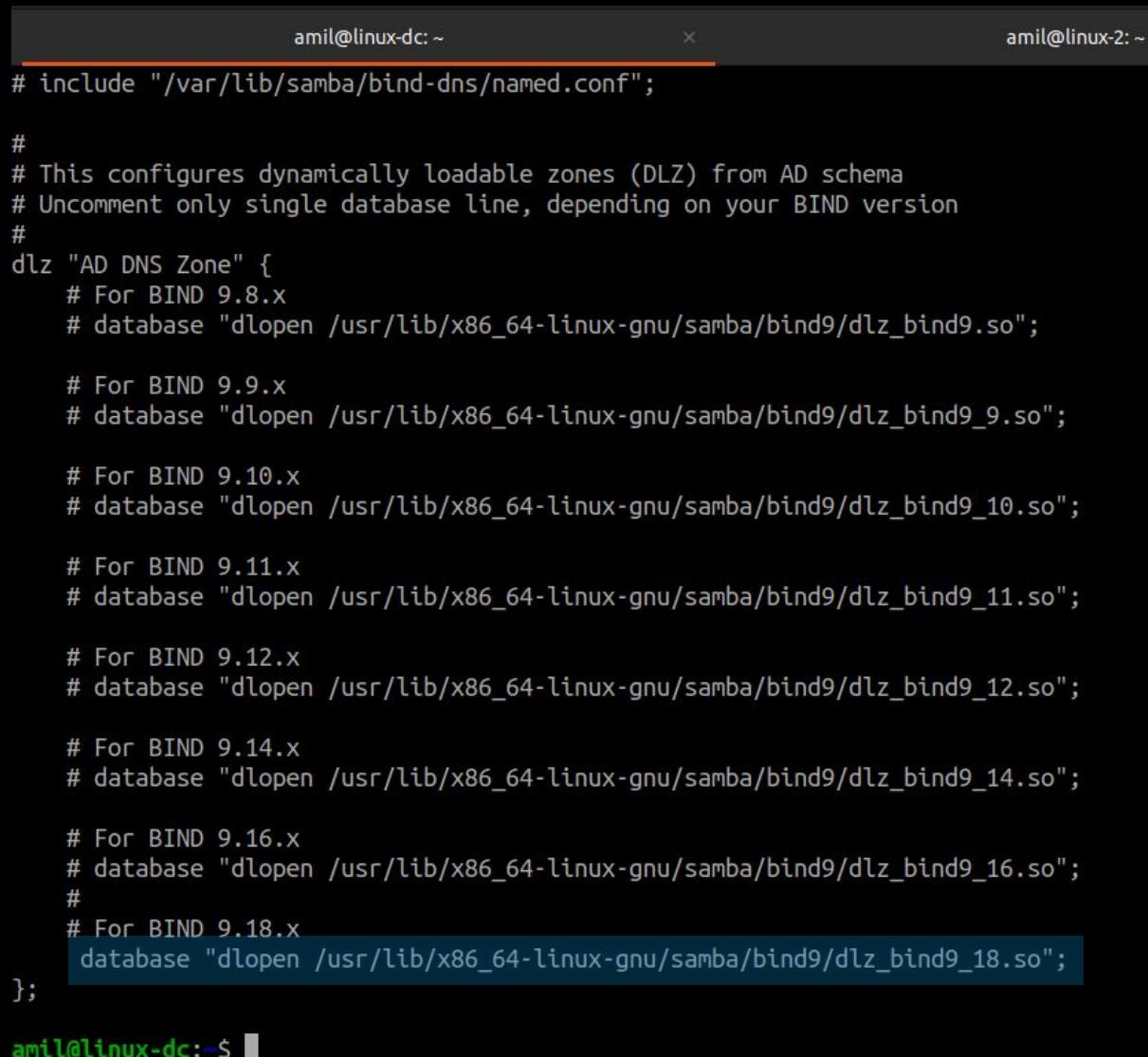
amil@linux-dc:~\$

amil@linux-2: ~

```
amil@linux-dc:~$ named -v
BIND 9.18.1-1ubuntu1.2-Ubuntu (Stable Release) <id:>
amil@linux-dc:~$
```

Checking samba version for Bind9:

```
$ sudo cat /var/lib/samba/bind-dns/named.conf
```



```
# include "/var/lib/samba/bind-dns/named.conf";

#
# This configures dynamically loadable zones (DLZ) from AD schema
# Uncomment only single database line, depending on your BIND version
#
dlz "AD DNS Zone" {
    # For BIND 9.8.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9.so";

    # For BIND 9.9.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_9.so";

    # For BIND 9.10.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_10.so";

    # For BIND 9.11.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_11.so";

    # For BIND 9.12.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_12.so";

    # For BIND 9.14.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_14.so";

    # For BIND 9.16.x
    # database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_16.so";
    #
    # For BIND 9.18.x
    database "dlopen /usr/lib/x86_64-linux-gnu/samba/bind9/dlz_bind9_18.so";
};
```

```
$ sudo nano /etc/bind/named.conf
```

The screenshot shows two terminal windows side-by-side. Both windows have a title bar with the user 'amil' and host 'linux'. The left window shows the command 'sudo nano /etc/bind/named.conf' at the prompt. The right window shows the contents of the named.conf file.

The file content is as follows:

```
GNU nano 6.2                               /etc/bind/named.conf *
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
```

At the bottom of the screen, there is a menu bar with various keyboard shortcuts for the nano editor, including Help, Write Out, Where Is, Cut, Paste, Execute, Location, Undo, Exit, Read File, Replace, Justify, Go To Line, and Redo.

amil@linux-dc: ~ amil@linux-2: ~

```
GNU nano 6.2 /etc/bind/named.conf *
// This is the primary configuration file for the BIND DNS server named.
//
// Please read /usr/share/doc/bind9/README.Debian.gz for information on the
// structure of BIND configuration files in Debian, *BEFORE* you customize
// this configuration file.
//
// If you are just adding zones, please do that in /etc/bind/named.conf.local

include "/etc/bind/named.conf.options";
include "/etc/bind/named.conf.local";
include "/etc/bind/named.conf.default-zones";
include "/var/lib/samba/bind-dns/named.conf";
```

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo  
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line M-E Redo

## Checking rights:

```
amil@linux-dc:~$ ls -l /var/lib/samba/private/dns.keytab
-rw-r----- 2 root bind 520 Dec 25 14:15 /var/lib/samba/private/dns.keytab
amil@linux-dc:~$
```

```
amil@linux-dc:~$ ls -l /var/lib/samba/
total 1408
drwxr-xr-x  4 root root          4096 Dec 25 14:00 DriverStore
-rw-----  1 root root        421888 Dec 25 14:00 account_policy.tdb
drwxrwx---  3 root bind          4096 Dec 25 14:15 bind-dns
-rw-----  1 root root          696 Dec 25 14:00 group_mapping.tdb
drwxr-xr-x 12 root root          4096 Dec 25 14:00 printers
drwxr-xr-x  5 root root          4096 Dec 25 14:15 private
-rw-----  1 root root      528384 Dec 25 14:00 registry.tdb
-rw-----  1 root root      421888 Dec 25 14:00 share_info.tdb
drwxrwx---+ 3 root      3000000  4096 Dec 25 14:15 sysvol
drwxrwx--T  2 root sambashare    4096 Dec 25 14:00 usershares
-rw-----  1 root root      32768 Dec 25 14:00 winbindd_cache.tdb
drwxr-x---  2 root winbindd_priv   4096 Dec 25 14:00 winbindd_privileged
```

```
amil@linux-dc:~$ ls -l /etc/krb5.conf
-rw-r--r-- 1 root root 2893 Dec 25 14:00 /etc/krb5.conf
amil@linux-dc:~$ sudo chown root:bind /etc/krb5.conf
amil@linux-dc:~$ ls -l /etc/krb5.conf
-rw-r--r-- 1 root bind 2893 Dec 25 14:00 /etc/krb5.conf
amil@linux-dc:~$
```

Downloading a list of root DNS servers:

```
amil@linux-dc:~$ sudo wget -q -O /var/cache/bind/named.root http://www.internic.net/zones/named.root  
amil@linux-dc:~$
```

Changing the permissions of the `Named.root` file:

```
amil@linux-dc:~$ sudo chown root:bind /var/cache/bind/named.root  
amil@linux-dc:~$ sudo chmod 640 /var/cache/bind/named.root  
amil@linux-dc:~$ ls /var/cache/bind/named.root  
/var/cache/bind/named.root  
amil@linux-dc:~$ ls -l /var/cache/bind/named.root  
-rw-r----- 1 root bind 3314 Dec 25 06:46 /var/cache/bind/named.root  
amil@linux-dc:~$ █
```

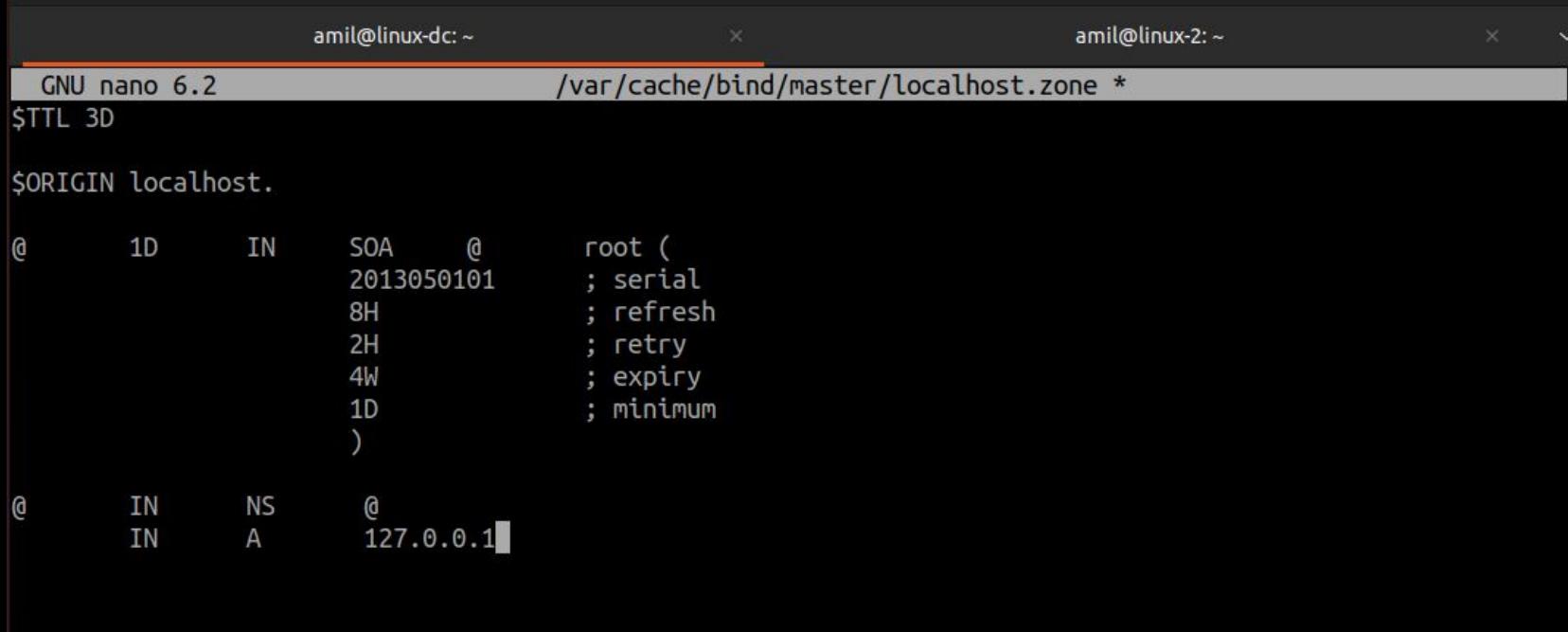
# Creation of Direct and Reverse viewing zones

Creating a master folder:

```
$ sudo mkdir /var/cache/bind/master  
$ sudo chown bind:bind /var/cache/bind/master
```

Creating a Live View Zone:

```
$ sudo nano /var/cache/bind/master/localhost.zone
```



The screenshot shows a terminal window with two tabs. The active tab is titled 'localhost.zone \*' and contains the following BIND zone configuration:

```
GNU nano 6.2                               /var/cache/bind/master/localhost.zone *
$TTL 3D

$ORIGIN localhost.

@      1D      IN      SOA      @      root (
        2013050101      ; serial
        8H              ; refresh
        2H              ; retry
        4W              ; expiry
        1D              ; minimum
)

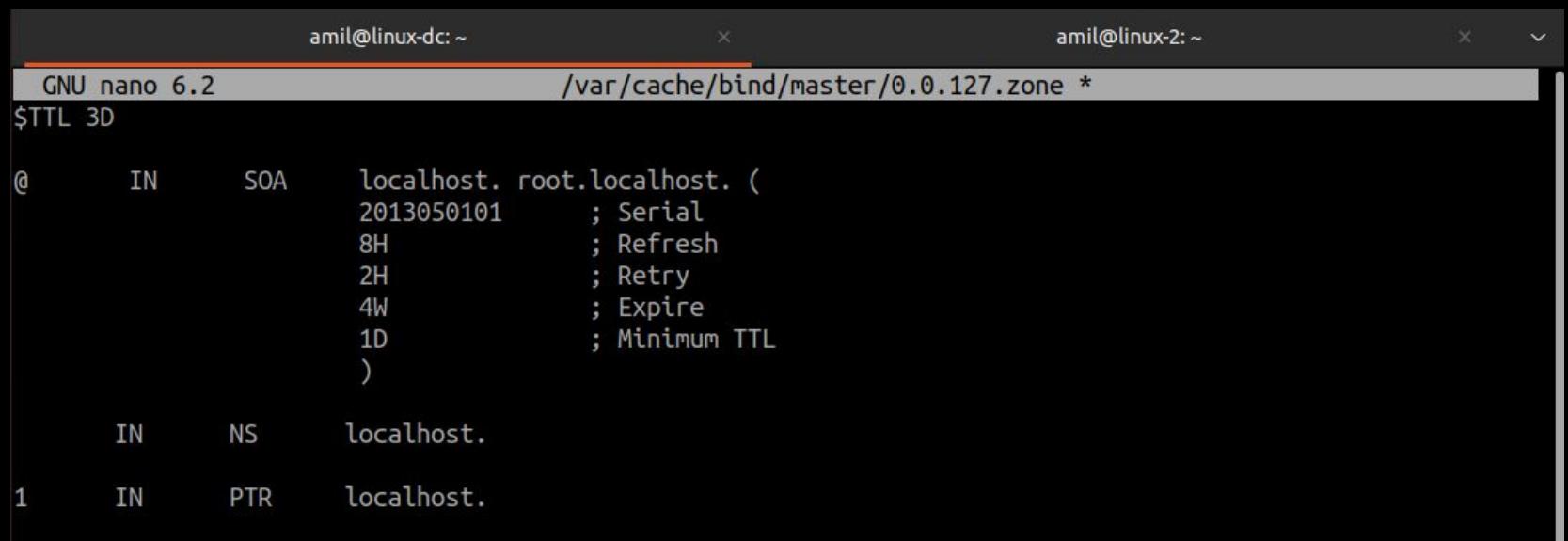
@      IN      NS      @
IN      A      127.0.0.1
```

## Changing zone rights:

```
amil@linux-dc:~$ ls -l /var/cache/bind/master
total 4
-rw-r--r-- 1 root root 402 Dec 25 14:47 localhost.zone
amil@linux-dc:~$ sudo chown bind:bind /var/cache/bind/master/localhost.zone
amil@linux-dc:~$ ls -l /var/cache/bind/master
total 4
-rw-r--r-- 1 bind bind 402 Dec 25 14:47 localhost.zone
amil@linux-dc:~$ sudo chmod 640 /var/cache/bind/master/localhost.zone
amil@linux-dc:~$ ls -l /var/cache/bind/master
total 4
-rw-r----- 1 bind bind 402 Dec 25 14:47 localhost.zone
amil@linux-dc:~$
```

## Creating a counter view zone:

```
$ sudo nano /var/cache/bind/master/0.0.127.zone
```



The screenshot shows a terminal window with two tabs. The active tab is titled "amil@linux-dc: ~" and contains the command "sudo nano /var/cache/bind/master/0.0.127.zone". The nano editor interface is visible, showing the contents of the zone file. The second tab, "amil@linux-2: ~", is visible in the background.

```
amil@linux-dc:~$ sudo nano /var/cache/bind/master/0.0.127.zone
GNU nano 6.2                               /var/cache/bind/master/0.0.127.zone *
$TTL 3D

@      IN      SOA    localhost. root.localhost. (
                      2013050101      ; Serial
                      8H              ; Refresh
                      2H              ; Retry
                      4W              ; Expire
                      1D              ; Minimum TTL
)

@      IN      NS     localhost.

1      IN      PTR    localhost.
```

Changing zone rights:

```
amil@linux-dc:~$ sudo chown bind:bind /var/cache/bind/master/0.0.127.zone
amil@linux-dc:~$ sudo chmod 640 /var/cache/bind/master/0.0.127.zone
amil@linux-dc:~$ ls -l /var/cache/bind/master/0.0.127.zone
-rw-r----- 1 bind bind 408 Dec 25 14:54 /var/cache/bind/master/0.0.127.zone
amil@linux-dc:~$ █
```

Checking the DNS server configuration:

```
amil@linux-dc:~$ sudo named-checkconf
amil@linux-dc:~$ █
```

Restarting the DNS-server Bind9:

```
amil@linux-dc:~$ sudo systemctl restart bind9
amil@linux-dc:~$ █
```

## Final inspection of zones:

The image shows two terminal windows side-by-side. Both windows have a dark background and white text. The window on the left is titled 'amil@linux-dc: ~' and the window on the right is titled 'amil@linux-2: ~'. Both windows contain the same command-line session.

```
amil@linux-dc:~$ host -t A localhost 127.0.0.1
Using domain server:
Name: 127.0.0.1
Address: 127.0.0.1#53
Aliases:

localhost has address 127.0.0.1
amil@linux-dc:~$ host -t PTR 127.0.0.1 127.0.0.1
Using domain server:
Name: 127.0.0.1
Address: 127.0.0.1#53
Aliases:

1.0.0.127.in-addr.arpa domain name pointer localhost.
amil@linux-dc:~$
```

## Starting Samba and adjusting the network configuration

To configure the operation:

```
amil@linux-dc:~$ sudo systemctl stop smbd nmbd winbind
amil@linux-dc:~$ sudo systemctl disable smbd nmbd winbind
Synchronizing state of smbd.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install disable smbd
Synchronizing state of nmbd.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install disable nmbd
Synchronizing state of winbind.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install disable winbind
Removed /etc/systemd/system/multi-user.target.wants/smbd.service.
Removed /etc/systemd/system/multi-user.target.wants/nmbd.service.
Removed /etc/systemd/system/multi-user.target.wants/winbind.service.
amil@linux-dc:~$ sudo systemctl mask smbd nmbd winbind
Created symlink /etc/systemd/system/smbd.service → /dev/null.
Created symlink /etc/systemd/system/nmbd.service → /dev/null.
Created symlink /etc/systemd/system/winbind.service → /dev/null.
amil@linux-dc:~$ sudo systemctl unmask samba-ad-dc
Removed /etc/systemd/system/samba-ad-dc.service.
amil@linux-dc:~$
```

```
amil@linux-dc:~$ sudo systemctl start samba-ad-dc
amil@linux-dc:~$ sudo systemctl enable samba-ad-dc
Synchronizing state of samba-ad-dc.service with SysV service script with /lib/systemd/systemd-sysv-install
.
Executing: /lib/systemd/systemd-sysv-install enable samba-ad-dc
```

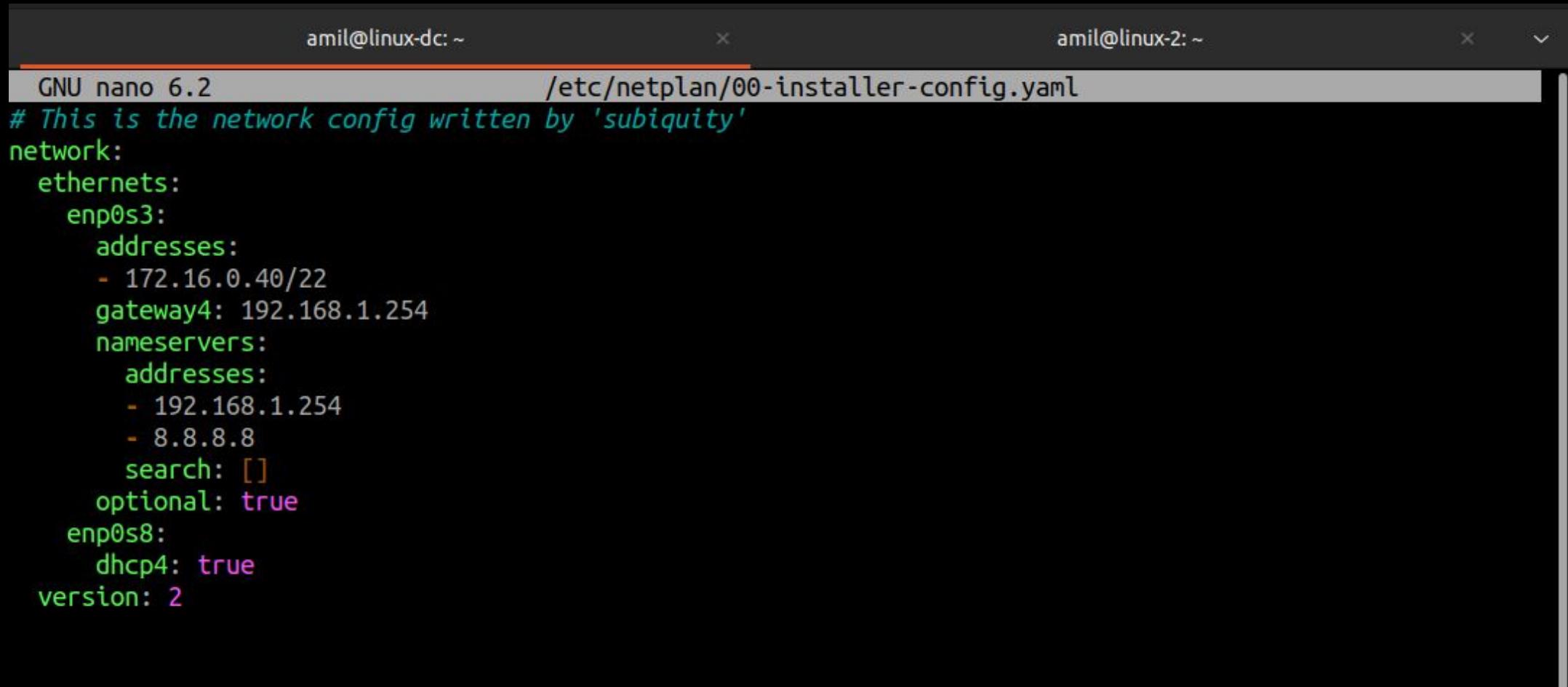
Finally, checking the status of samba-ad-dc: `sudo systemctl status samba-ad-dc`

```
● samba-ad-dc.service - Samba AD Daemon
   Loaded: loaded (/lib/systemd/system/samba-ad-dc.service; enabled; vendor preset: enabled)
   Active: active (running) since Sun 2022-12-25 15:21:31 UTC; 1min 16s ago
     Docs: man:samba(8)
           man:samba(7)
           man:smb.conf(5)
   Main PID: 3488 (samba)
      Status: "samba: ready to serve connections..."
        Tasks: 58 (limit: 3421)
       Memory: 187.4M
          CPU: 7.429s
         CGroup: /system.slice/samba-ad-dc.service
                 └─3488 "samba: root process" " "
                  ├─3489 "samba: tfork waiter process(3490)" " "
                  ├─3490 "samba: task[s3fs] pre-fork master" " "
                  ├─3491 "samba: tfork waiter process(3494)" " "
                  ├─3492 "samba: tfork waiter process(3493)" " "
                  ├─3493 /usr/sbin/smbd -D "--option=server role check:inhibit=yes" --foreground ""
                  ├─3494 "samba: task[rpc] pre-fork master" " "
                  ├─3495 "samba: tfork waiter process(3496)" " "
                  ├─3496 "samba: task[nbt] pre-fork master" " "
                  ├─3497 "samba: tfork waiter process(3499)" " "
                  ├─3498 "samba: tfork waiter process(3500)" " "
                  ├─3499 "samba: task[rpc] pre-forked worker(0)" " "
                  ├─3500 "samba: task[wrepl] pre-fork master" " "
                  ├─3501 "samba: tfork waiter process(3504)" " "
                  ├─3502 "samba: tfork waiter process(3503)" " "
                  ├─3503 "samba: task[rpc] pre-forked worker(1)" " "
                  ├─3504 "samba: task[ldap] pre-fork master" " "
                  ├─3505 "samba: tfork waiter process(3507)" " "
                  ├─3506 "samba: tfork waiter process(3508)" " "
                  ├─3507 "samba: task[cldap] pre-fork master" " "

```

## Network adjustment:

```
$ sudo nano /etc/netplan/00-installer-config.yaml
```



The screenshot shows a terminal window with two tabs. The left tab is titled 'amil@linux-dc: ~' and the right tab is titled 'amil@linux-2: ~'. Both tabs have an 'x' button in the top right corner. The title bar of the window also displays 'GNU nano 6.2' and the file path '/etc/netplan/00-installer-config.yaml'. The content of the file is a YAML configuration for the network. It includes a header note, a 'network:' section with an 'ethernets:' block for 'enp0s3' (with an IP of 172.16.0.40/22), a 'gateway4:' entry (192.168.1.254), a 'nameservers:' block (with addresses 192.168.1.254 and 8.8.8.8, and an empty 'search' list), an 'optional: true' entry, an 'enp0s8:' block (with 'dhcp4: true'), and a 'version: 2' entry.

```
amil@linux-dc: ~          amil@linux-2: ~
GNU nano 6.2              /etc/netplan/00-installer-config.yaml
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      addresses:
        - 172.16.0.40/22
      gateway4: 192.168.1.254
      nameservers:
        addresses:
          - 192.168.1.254
          - 8.8.8.8
        search: []
      optional: true
    enp0s8:
      dhcp4: true
  version: 2
```

```
amil@linux-dc:~          amil@linux-2:~  
GNU nano 6.2              /etc/netplan/00-installer-config.yaml *  
# This is the network config written by 'subiquity'  
network:  
  ethernets:  
    enp0s3:  
      addresses:  
        - 172.16.0.40/22  
      gateway4: 192.168.1.254  
      nameservers:  
        addresses:  
          - 172.16.0.40  
        search: [fproject.local]  
      optional: true  
    enp0s8:  
      dhcp4: true  
  version: 2
```

```
$ sudo netplan --debug generate
```

```
amil@linux-dc:~$ sudo netplan --debug generate
DEBUG:command generate: running ['/lib/netplan/generate']
** (generate:3807): DEBUG: 15:29:28.075: starting new processing pass

** (generate:3807): WARNING **: 15:29:28.075: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (generate:3807): DEBUG: 15:29:28.075: We have some netdefs, pass them through a final round of validation
on
** (generate:3807): DEBUG: 15:29:28.075: enp0s8: setting default backend to 1
** (generate:3807): DEBUG: 15:29:28.075: Configuration is valid
** (generate:3807): DEBUG: 15:29:28.075: enp0s3: setting default backend to 1
** (generate:3807): DEBUG: 15:29:28.075: Configuration is valid
** (generate:3807): DEBUG: 15:29:28.075: Generating output files..
** (generate:3807): DEBUG: 15:29:28.076: openvswitch: definition enp0s3 is not for us (backend 1)
** (generate:3807): DEBUG: 15:29:28.076: NetworkManager: definition enp0s3 is not for us (backend 1)
** (generate:3807): DEBUG: 15:29:28.076: openvswitch: definition enp0s8 is not for us (backend 1)
** (generate:3807): DEBUG: 15:29:28.076: NetworkManager: definition enp0s8 is not for us (backend 1)
amil@linux-dc:~$
```

```
$ sudo netplan --debug apply
```

```
** (process:3812): DEBUG: 15:30:19.138: enp0s8: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.138: Configuration is valid
** (process:3812): DEBUG: 15:30:19.138: enp0s3: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.138: Configuration is valid
DEBUG:Merged config:
b''
DEBUG:Link changes: {}
DEBUG:netplan triggering .link rules for lo
DEBUG:netplan triggering .link rules for enp0s3
DEBUG:netplan triggering .link rules for enp0s8
** (process:3812): DEBUG: 15:30:19.640: starting new processing pass

** (process:3812): WARNING **: 15:30:19.640: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:3812): DEBUG: 15:30:19.640: We have some netdefs, pass them through a final round of validation
on
** (process:3812): DEBUG: 15:30:19.640: enp0s8: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.640: Configuration is valid
** (process:3812): DEBUG: 15:30:19.640: enp0s3: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.640: Configuration is valid
** (process:3812): DEBUG: 15:30:19.641: starting new processing pass

** (process:3812): WARNING **: 15:30:19.641: `gateway4` has been deprecated, use default routes instead.
See the 'Default routes' section of the documentation for more details.
** (process:3812): DEBUG: 15:30:19.641: We have some netdefs, pass them through a final round of validation
on
** (process:3812): DEBUG: 15:30:19.642: enp0s8: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.642: Configuration is valid
** (process:3812): DEBUG: 15:30:19.642: enp0s3: setting default backend to 1
** (process:3812): DEBUG: 15:30:19.642: Configuration is valid
DEBUG:Merged config:
b''
amil@linux-dc:~$
```

```
$ sudo nano /etc/resolv.conf
```

```
amil@linux-dc: ~          amil@linux-2: ~  
GNU nano 6.2                /etc/resolv.conf  
nameserver 8.8.8.8  
search fproject.local
```



```
amil@linux-dc: ~          amil@linux-2: ~  
GNU nano 6.2                /etc/resolv.conf *  
nameserver 172.16.0.40  
search fproject.local
```

Copying the Kerberos setup:

```
amil@linux-dc: ~          amil@linux-2: ~  
amil@linux-dc:~$ sudo cp /var/lib/samba/private/krb5.conf /etc/  
amil@linux-dc:~$
```

## Checking the configuration:

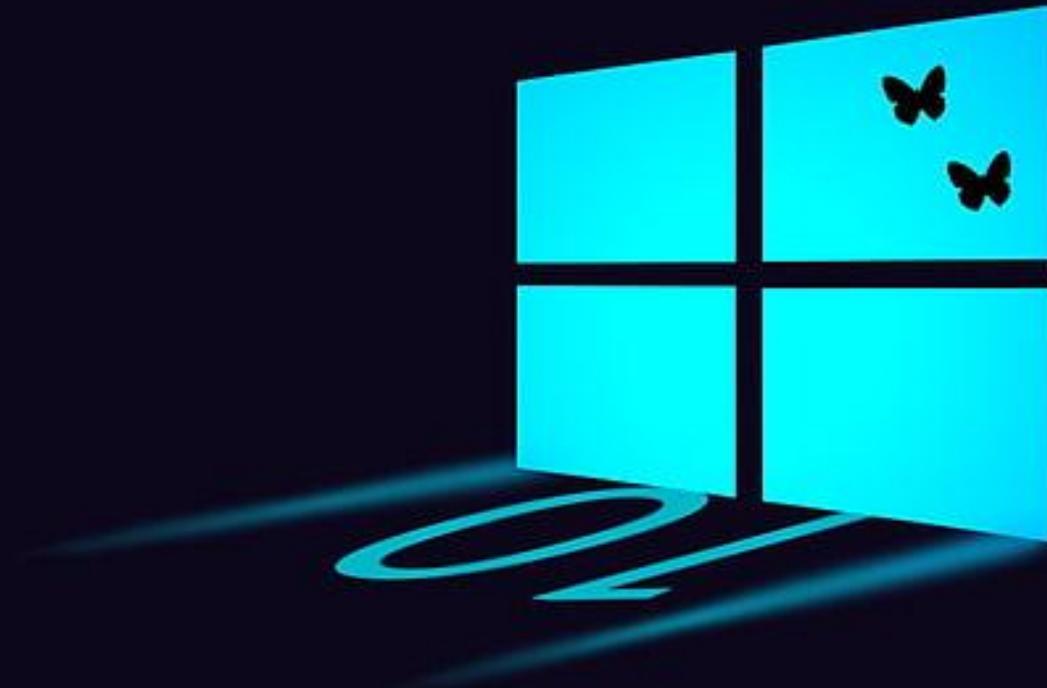
```
amil@linux-dc:~$ smbclient -L localhost -U%
Sharename          Type      Comment
-----            ----
sysvol            Disk
netlogon          Disk
IPC$              IPC       IPC Service (Samba 4.15.9-Ubuntu)
SMB1 disabled -- no workgroup available
amil@linux-dc:~$ smbclient //localhost/netlogon -UAdministrator -c 'ls'
Password for [FPROJECT\Administrator]:
.
.
.
D      0  Sun Dec 25 14:15:11 2022
D      0  Sun Dec 25 14:15:15 2022

        24590672 blocks of size 1024. 17016524 blocks available
amil@linux-dc:~$ host -t SRV _ldap._tcp.fproject.local
_ldap._tcp.fproject.local has SRV record 0 100 389 linux-dc.fproject.local.
```

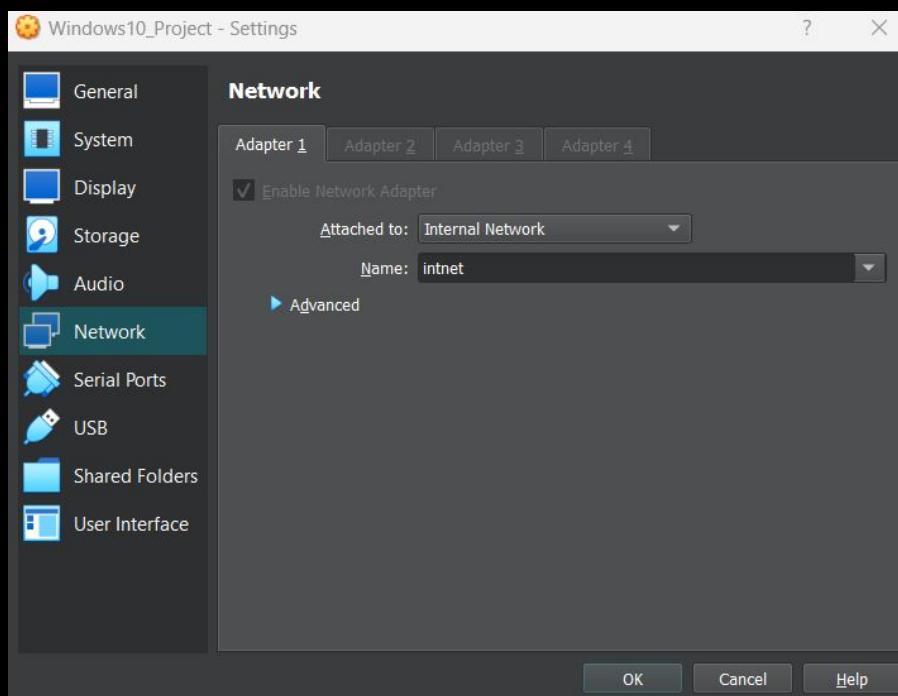
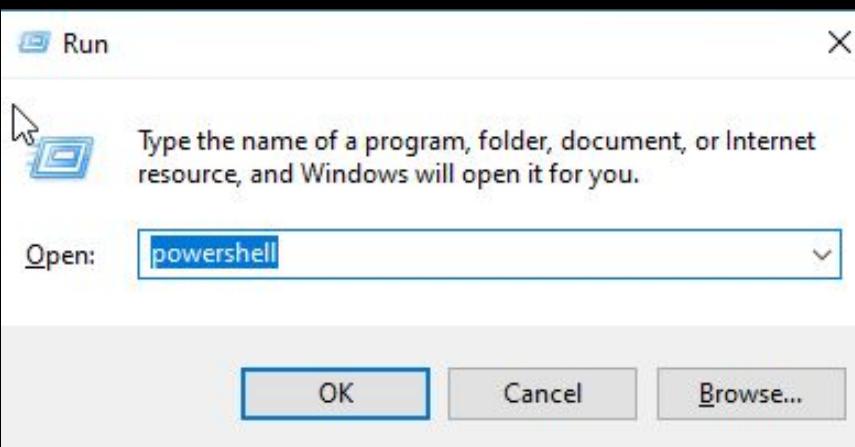
```
amil@linux-dc:~$ host -t SRV _kerberos._udp.fproject.local
_kerberos._udp.fproject.local has SRV record 0 100 88 linux-dc.fproject.local.
amil@linux-dc:~$ host -t A linux-dc.fproject.local
linux-dc.fproject.local has address 10.0.3.15
linux-dc.fproject.local has address 172.16.0.40
amil@linux-dc:~$ kinit administrator
Password for administrator@FPROJECT.LOCAL:
Warning: Your password will expire in 41 days on Sun Feb  5 14:15:16 2023
amil@linux-dc:~$ klist
Ticket cache: FILE:/tmp/krb5cc_1000
Default principal: administrator@FPROJECT.LOCAL

Valid starting     Expires            Service principal
12/25/22 15:40:35  12/26/22 01:40:35  krbtgt/FPROJECT.LOCAL@FPROJECT.LOCAL
                  renew until 12/26/22 15:40:21
amil@linux-dc:~$
```

# Joining a Domain Controller in Windows 10



## Checking network settings:



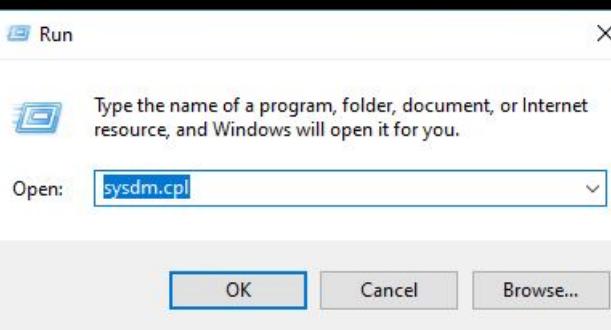
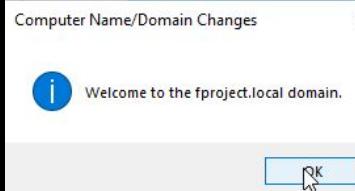
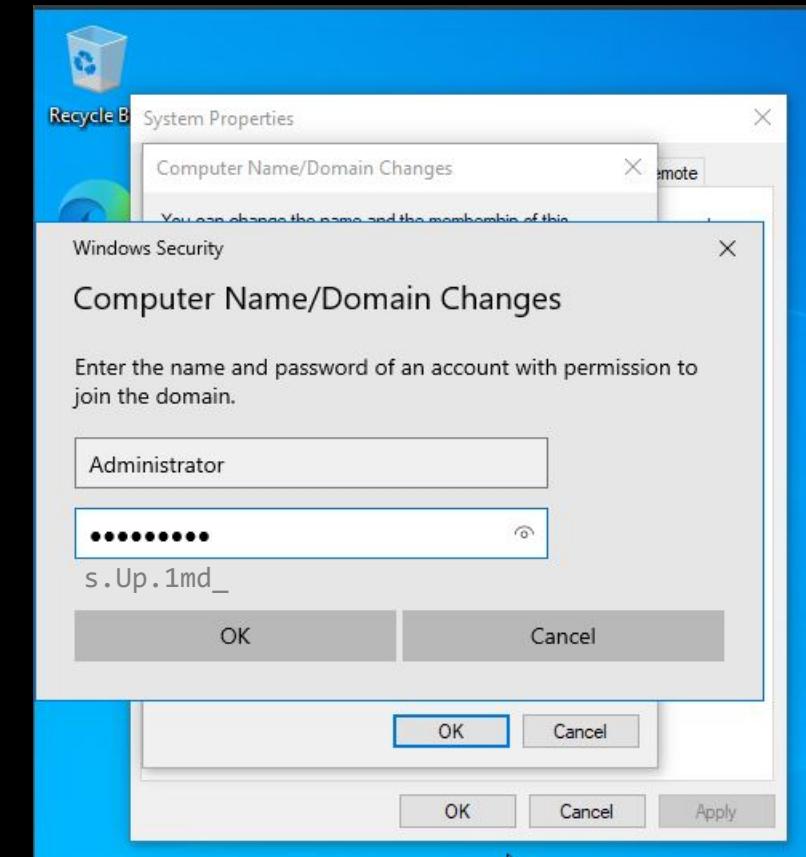
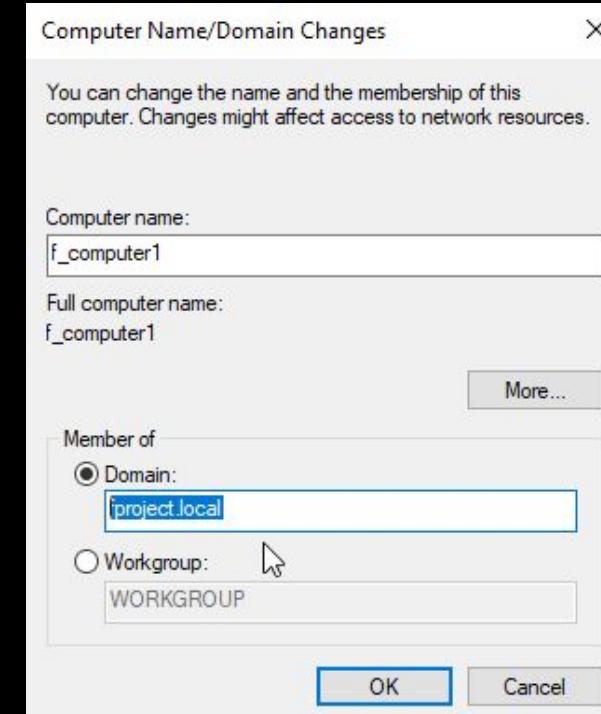
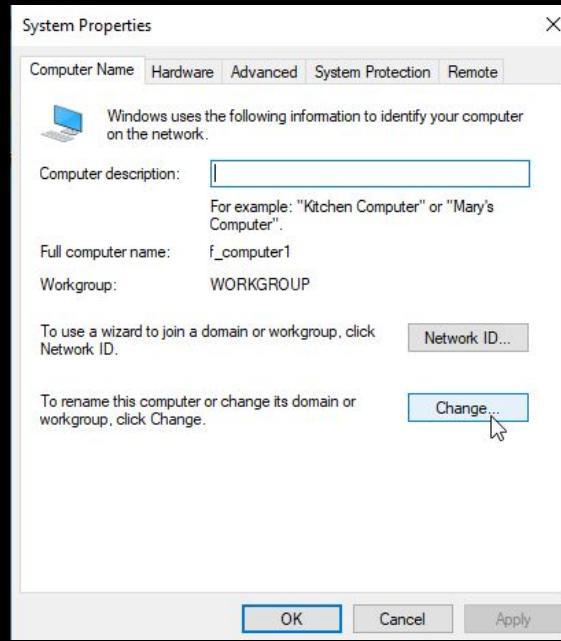
> Get-NetIPConfiguration

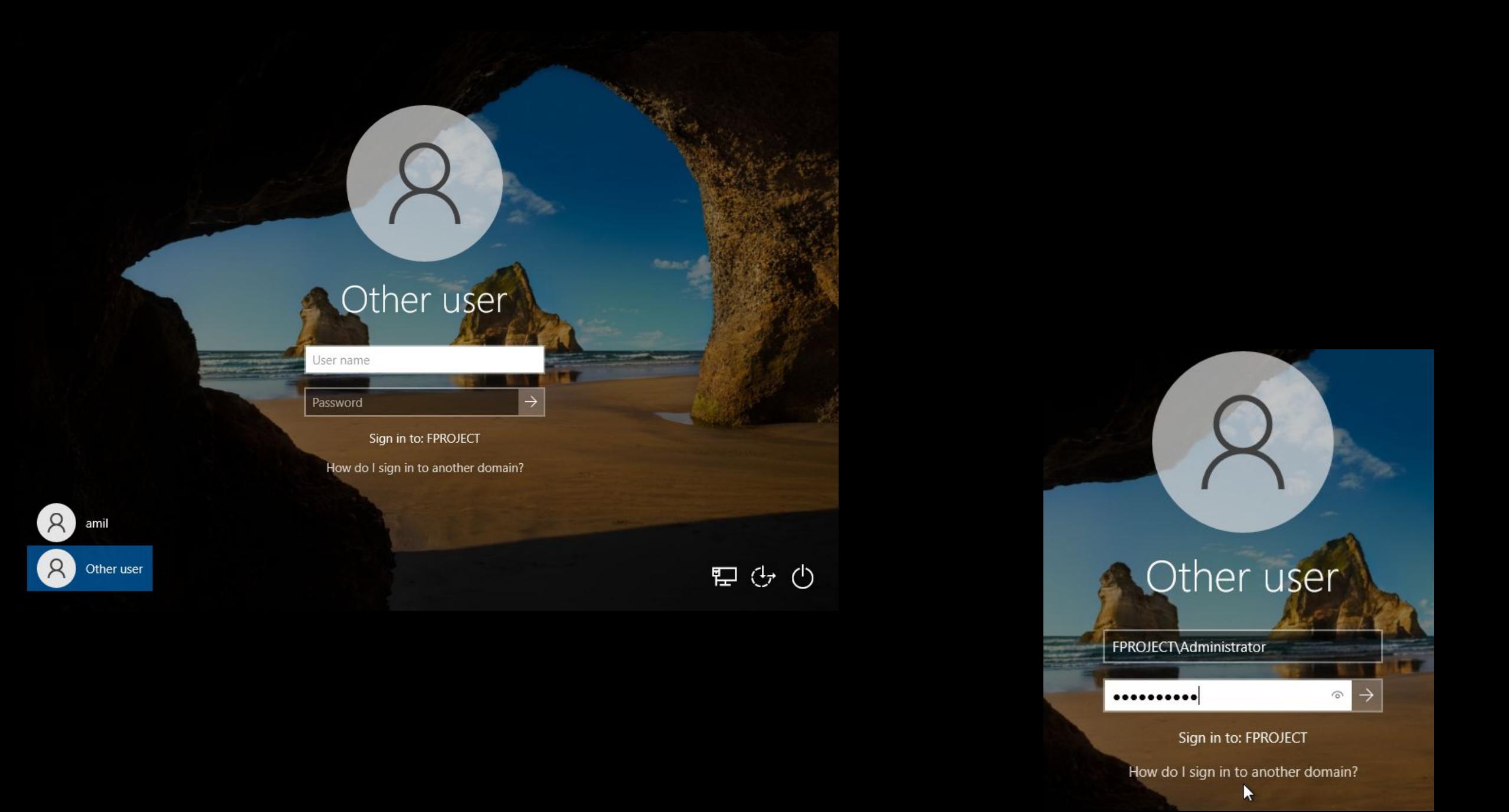
```
PS C:\Users\amil> Get-NetIPConfiguration
```

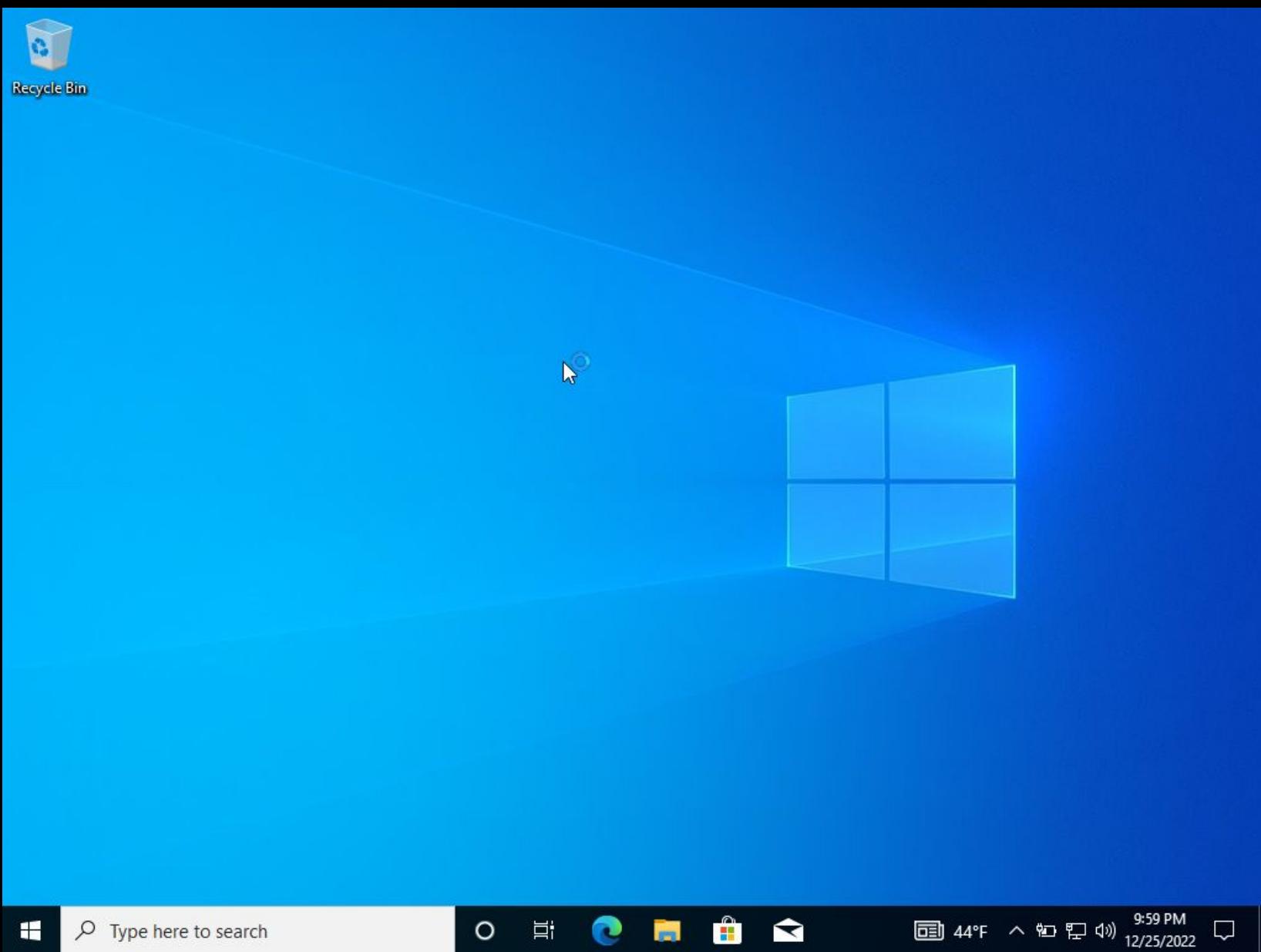
```
InterfaceAlias      : Ethernet
InterfaceIndex     : 5
InterfaceDescription: Intel(R) PRO/1000 MT Desktop Adapter
NetProfile.Name    : Network 2
IPv4Address        : 172.16.0.42
IPv6DefaultGateway :
IPv4DefaultGateway : 172.16.0.40
DNSServer          : 172.16.0.40
```

```
PS C:\Users\amil>
```

# Join the domain

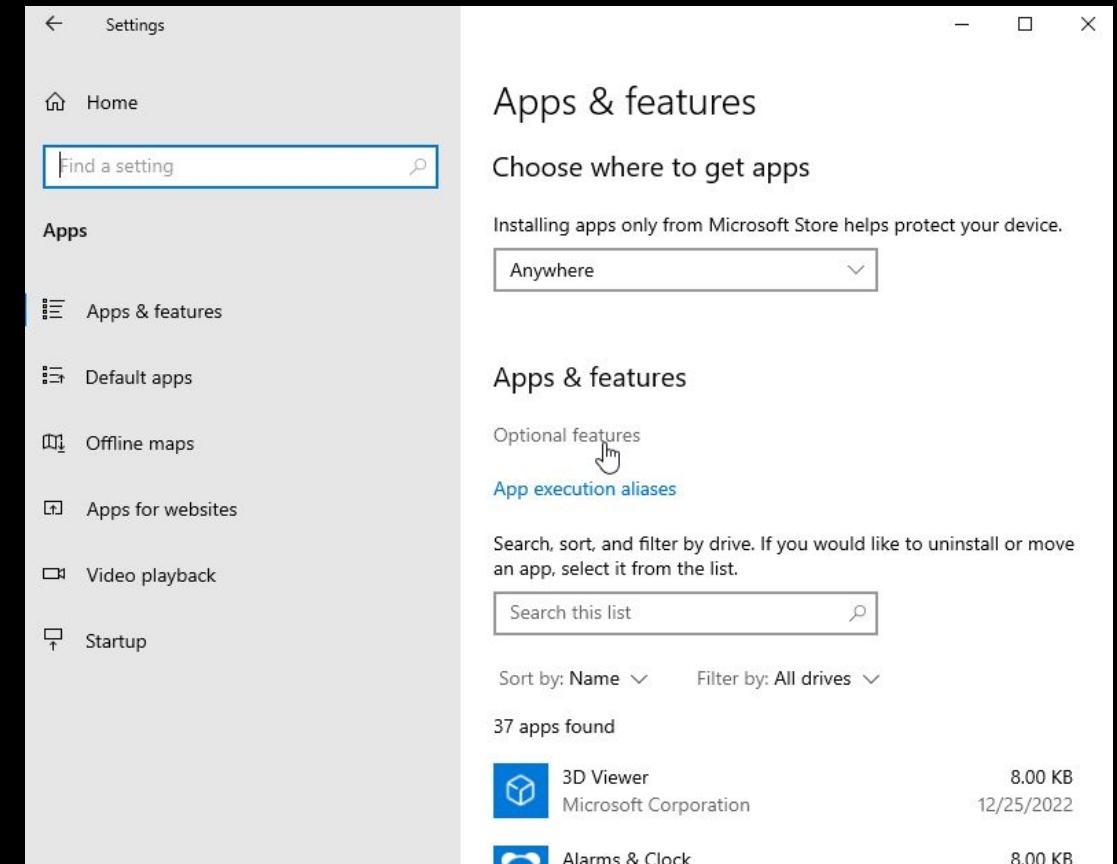
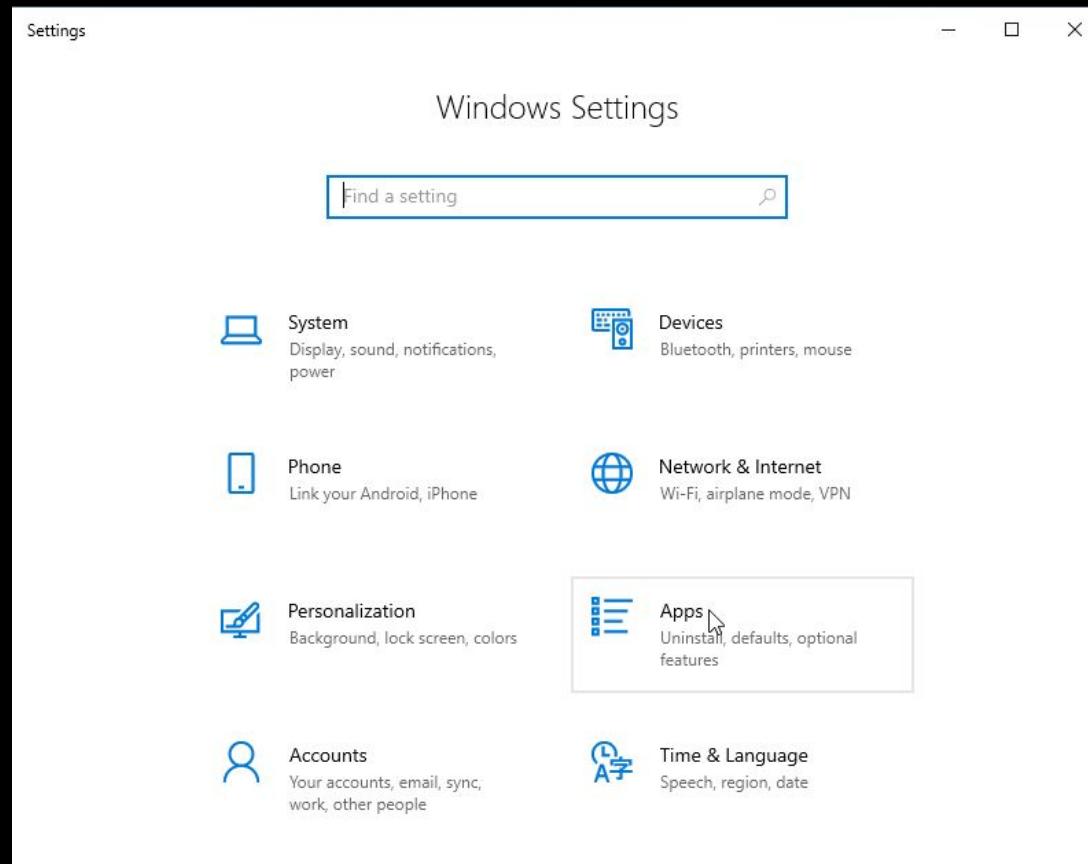






# Installation of RSAT

## RSAT - Remote Servers Administration Tools



## Optional features



Add a feature



[See optional feature history](#)

### Installed features

Find an installed optional feature



Sort by: Name ▾



Internet Explorer 11

3.20 MB



Math Recognizer

33.3 MB



Microsoft Paint

6.68 MB



Microsoft Quick Assist

2.89 MB

← Settings

## Add an optional feature

Optional

rsat

Sort by: Name ▾

<input checked="" type="checkbox"/>		RSAT: Active Directory Domain Services and Lightweight Directory Services Tools	4.98 MB
<input type="checkbox"/>		RSAT: BitLocker Drive Encryption Administration Utilities	41.9 KB
<input type="checkbox"/>		RSAT: DHCP Server Tools	1.57 MB
<input checked="" type="checkbox"/>		RSAT: DNS Server Tools	1.27 MB
<input type="checkbox"/>		RSAT: Data Center Bridging LLDP Tools	22.8 KB
<input type="checkbox"/>		RSAT: Failover Clustering Tools	9.41 MB
<input type="checkbox"/>		RSAT: File Services Tools	5.07 MB
<input checked="" type="checkbox"/>		RSAT: Group Policy Management Tools	4.07 MB

Install (3) Cancel

See optional feature history

Optional features

- + Add a feature
- See optional feature history

Installed features

Find an installed option

Sort by: Name ▾

	Internet Explorer
	Math Recognizer
	Microsoft Paint
	Microsoft Quick Access
	Notepad
	OpenSSH Client

Type here to search

10:39 PM 44°F 12/25/2022

Latest actions

	RSAT: Group Policy Management Tools	Installing
	RSAT: Active Directory Domain Services and Lightweight Directory Services Tools	Installed
	RSAT: DNS Server Tools	Installing

See optional feature history

# Active Directory Users and Computers

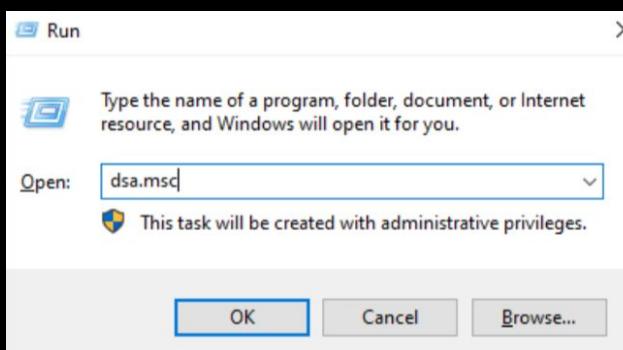
File Action View Help



## Active Directory Users and Computers

- > Saved Queries
- > fproject.local

Name	Type	Description
Saved Queries		Folder to store your favo...
fproject.local	Domain	



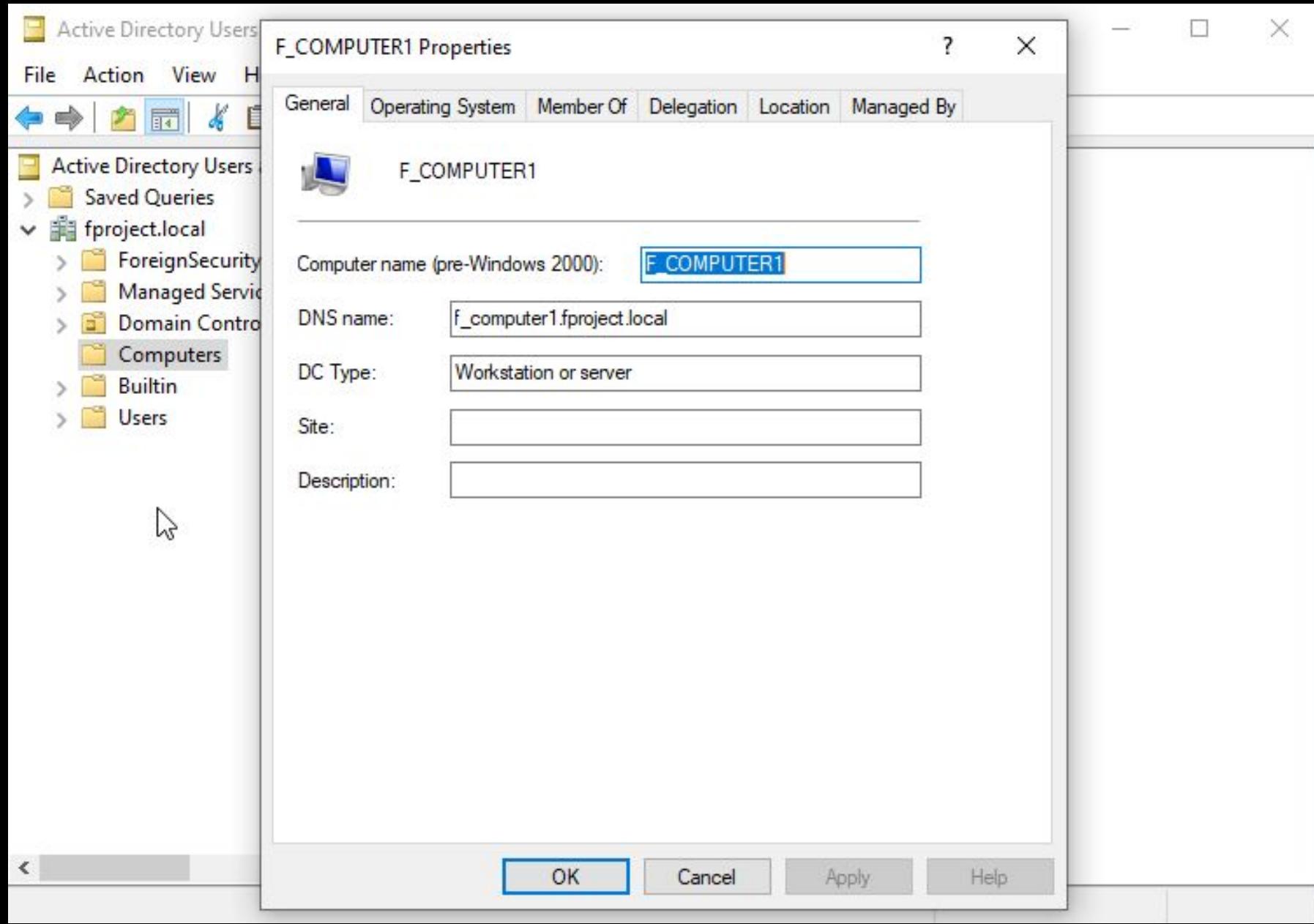
# Active Directory Users and Computers

File Action View Help



- Active Directory Users and Com
- > Saved Queries
- ✓ fproject.local
  - > ForeignSecurityPrincipal:
  - > Managed Service Accour
  - > Domain Controllers
    - > Computers
    - > Builtli
    - > Users

Name	Type	Description
F_COMPUTE...	Computer	

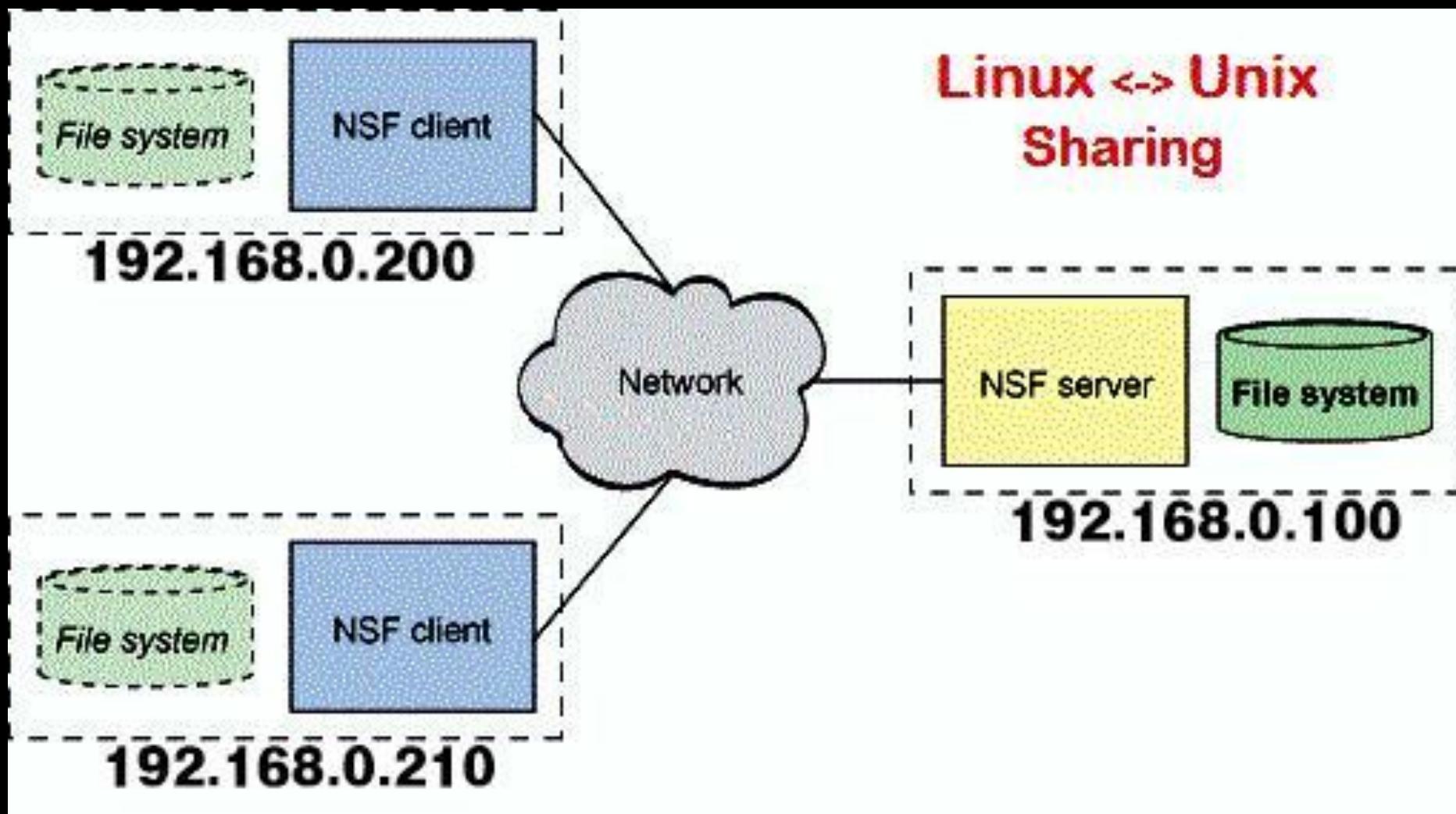


# NFS

NETWORK FILE SYSTEM



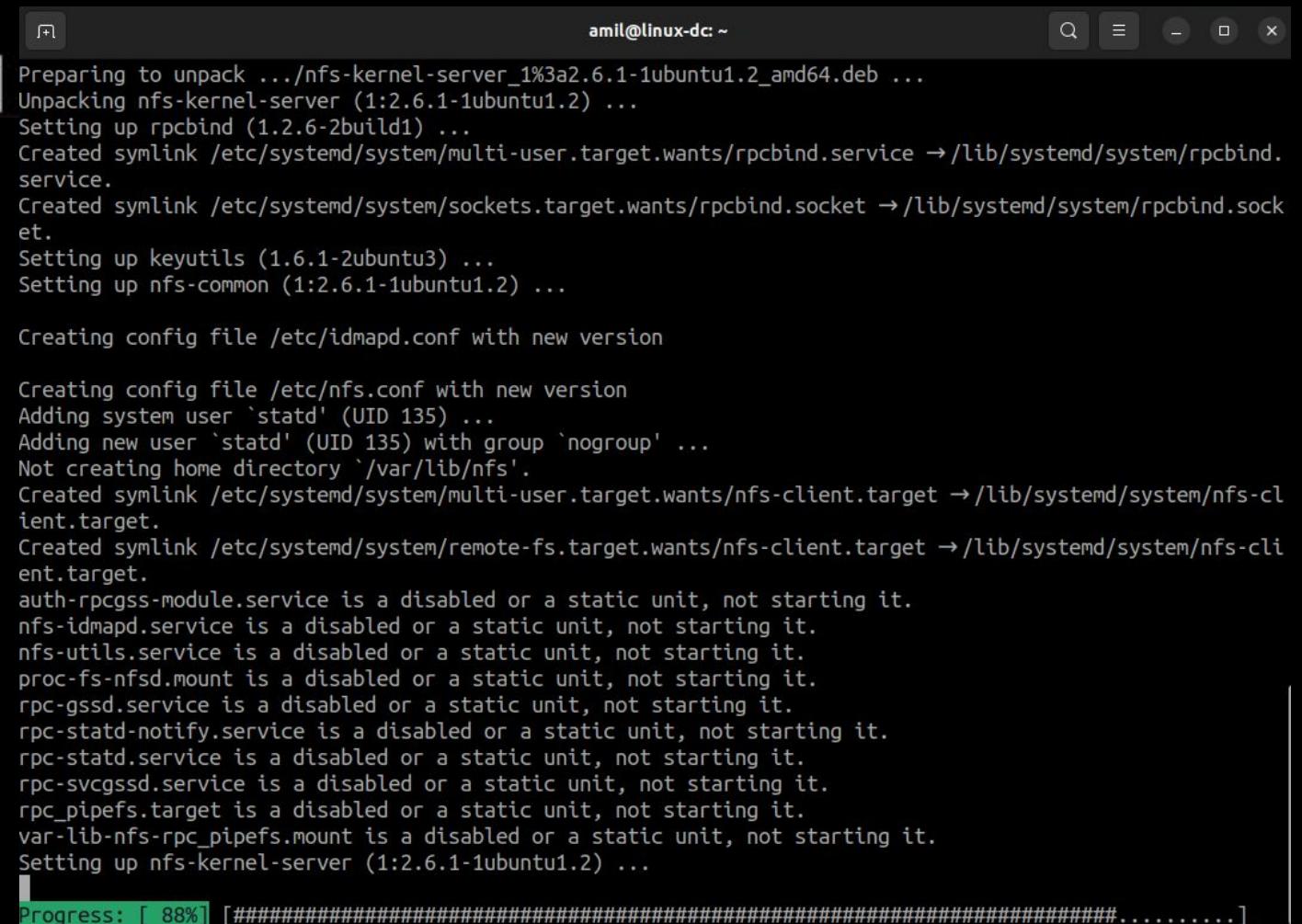
## **Linux <>> Unix Sharing**



# Setting up an NFS Server

```
~$ sudo apt update
```

```
~$ sudo apt install nfs-kernel-server
```



A terminal window titled 'amil@linux-dc: ~' showing the output of the 'apt install nfs-kernel-server' command. The window has standard Linux window controls at the top right. The terminal shows the progress of the package unpacking and configuration, including the creation of symlinks, configuration files, and system users. It also lists various services that are disabled or static units.

```
Preparing to unpack .../nfs-kernel-server_1%3a2.6.1-1ubuntu1.2_amd64.deb ...
Unpacking nfs-kernel-server (1:2.6.1-1ubuntu1.2) ...
Setting up rpcbind (1.2.6-2build1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/rpcbind.service → /lib/systemd/system/rpcbind.service.
Created symlink /etc/systemd/system/sockets.target.wants/rpcbind.socket → /lib/systemd/system/rpcbind.socket.
Setting up keyutils (1.6.1-2ubuntu3) ...
Setting up nfs-common (1:2.6.1-1ubuntu1.2) ...

Creating config file /etc/idmapd.conf with new version

Creating config file /etc/nfs.conf with new version
Adding system user `statd' (UID 135) ...
Adding new user `statd' (UID 135) with group `nogroup' ...
Not creating home directory `/var/lib/nfs'.
Created symlink /etc/systemd/system/multi-user.target.wants/nfs-client.target → /lib/systemd/system/nfs-client.target.
Created symlink /etc/systemd/system/remote-fs.target.wants/nfs-client.target → /lib/systemd/system/nfs-client.target.
auth-rpcgss-module.service is a disabled or a static unit, not starting it.
nfs-idmapd.service is a disabled or a static unit, not starting it.
nfs-utils.service is a disabled or a static unit, not starting it.
proc-fs-nfsd.mount is a disabled or a static unit, not starting it.
rpc-gssd.service is a disabled or a static unit, not starting it.
rpc-statd-notify.service is a disabled or a static unit, not starting it.
rpc-statd.service is a disabled or a static unit, not starting it.
rpc-svcgssd.service is a disabled or a static unit, not starting it.
rpc_pipeefs.target is a disabled or a static unit, not starting it.
var-lib-nfs-rpc_pipeefs.mount is a disabled or a static unit, not starting it.
Setting up nfs-kernel-server (1:2.6.1-1ubuntu1.2) ...

Progress: [ 88%] [#####
.....]
```

NFSv2 server is not supported:

```
amil@linux-dc:~$ sudo cat /proc/fs/nfsd/versions
-2 +3 +4 +4.1 +4.2
```

```
~$ systemctl enable nfs-kernel-server
```

```
amil@linux-dc:~$ systemctl enable nfs-kernel-server
Synchronizing state of nfs-kernel-server.service with SysV service scr
ipt with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable nfs-kernel-server
amil@linux-dc:~$ █
```

```
~$ sudo systemctl status nfs-kernel-server
```

```
amil@linux-dc:~$ sudo systemctl status nfs-kernel-server
● nfs-server.service - NFS server and services
  Loaded: loaded (/lib/systemd/system/nfs-server.service; enabled;>
  Drop-In: /run/systemd/generator/nfs-server.service.d
            └─order-with-mounts.conf
  Active: active (exited) since Mon 2022-12-26 21:14:13 UTC; 8min >
    Main PID: 3192 (code=exited, status=0/SUCCESS)
      CPU: 55ms
```

```
Dec 26 21:14:13 linux-dc systemd[1]: Starting NFS server and services>
Dec 26 21:14:13 linux-dc exportfs[3191]: exportfs: /etc/exports [1]: >
Dec 26 21:14:13 linux-dc exportfs[3191]:   Assuming default behaviour>
Dec 26 21:14:13 linux-dc exportfs[3191]:   NOTE: this default has cha>
Dec 26 21:14:13 linux-dc systemd[1]: Finished NFS server and services.
[lines 1-13/13 (END)]
```

```
~$ sudo vi /etc/exports
```

**rw** – read / write

**no\_root\_squash** – "not crushing" the root authority of the host user

```
amil@linux-dc: ~
# /etc/exports: the access control list for filesystems which may be exported
#                                     to NFS clients. See exports(5).
#
# Example for NFSv2 and NFSv3:
# /srv/homes      hostname1(rw,sync,no_subtree_check) hostname2(ro,sync,no_subtree_check)
#
# Example for NFSv4:
# /srv/nfs4      gss/krb5i(rw,sync,fsid=0,crossmnt,no_subtree_check)
# /srv/nfs4/homes gss/krb5i(rw,sync,no_subtree_check)
#
~
```

```
amil@linux-dc: /home
GNU nano 6.2          /etc/exports *
# /etc/exports: the access control list for filesystems which may be >
#                                     to NFS clients. See exports(5).
#
# Example for NFSv2 and NFSv3:
# /srv/homes      hostname1(rw,sync,no_subtree_check) hostname2(ro,s>
#
/home/nfsshare 172.16.0.41/22(rw,sync,no_root_squash)

# Example for NFSv4:
# /srv/nfs4      gss/krb5i(rw,sync,fsid=0,crossmnt,no_subtree_check)
# /srv/nfs4/homes gss/krb5i(rw,sync,no_subtree_check)
#
```

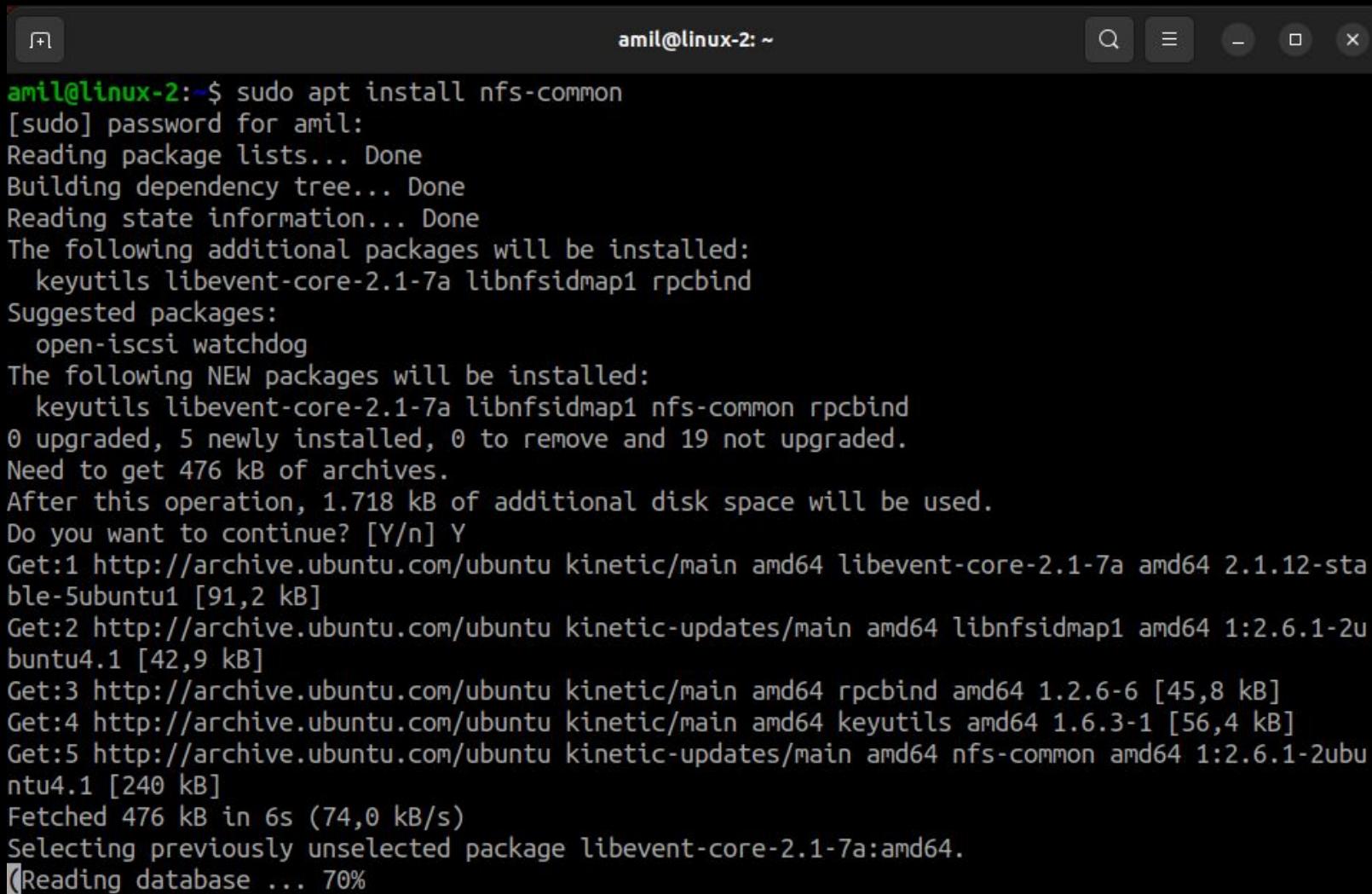
```
$ sudo mkdir /home/nfsshare
$ sudo chmod 777 -R nfsshare
```

```
amil@linux-dc:/home$ sudo systemctl restart nfs-server
amil@linux-dc:/home$ sudo systemctl status nfs-server
● nfs-server.service - NFS server and services
   Loaded: loaded (/lib/systemd/system/nfs-server.service; enabled;)
   Active: active (exited) since Mon 2022-12-26 21:14:13 UTC; 14s ago
     Process: 3191 ExecStartPre=/usr/sbin/exportfs -r (code=exited, st>
     Process: 3192 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0>
    Main PID: 3192 (code=exited, status=0/SUCCESS)
       CPU: 55ms

Dec 26 21:14:13 linux-dc systemd[1]: Starting NFS server and services...
Dec 26 21:14:13 linux-dc exportfs[3191]: exportfs: /etc/exports [1]: >
Dec 26 21:14:13 linux-dc exportfs[3191]: Assuming default behaviour...
Dec 26 21:14:13 linux-dc exportfs[3191]: NOTE: this default has cha...
Dec 26 21:14:13 linux-dc systemd[1]: Finished NFS server and services.
lines 1-13/13 (END)
```

# Setting up the NFS Client

```
- $ sudo apt install nfs-common
```



The screenshot shows a terminal window with a dark background and light-colored text. The title bar reads "amil@linux-2: ~". The terminal displays the command "sudo apt install nfs-common" followed by its execution output. The output includes package lists, dependency resolution, state information, additional packages to be installed (keyutils, libevent-core, libnfsidmap1, rpcbind), suggested packages (open-iscsi, watchdog), and NEW packages to be installed (keyutils, libevent-core, libnfsidmap1, nfs-common, rpcbind). It also shows upgrade counts, disk space requirements, and download details from the archive. The terminal ends with a progress bar at 70%.

```
amil@linux-2:~$ sudo apt install nfs-common
[sudo] password for amil:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  keyutils libevent-core-2.1-7a libnfsidmap1 rpcbind
Suggested packages:
  open-iscsi watchdog
The following NEW packages will be installed:
  keyutils libevent-core-2.1-7a libnfsidmap1 nfs-common rpcbind
0 upgraded, 5 newly installed, 0 to remove and 19 not upgraded.
Need to get 476 kB of archives.
After this operation, 1.718 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu kinetic/main amd64 libevent-core-2.1-7a amd64 2.1.12-stable-5ubuntu1 [91,2 kB]
Get:2 http://archive.ubuntu.com/ubuntu kinetic-updates/main amd64 libnfsidmap1 amd64 1:2.6.1-2ubuntu4.1 [42,9 kB]
Get:3 http://archive.ubuntu.com/ubuntu kinetic/main amd64 rpcbind amd64 1.2.6-6 [45,8 kB]
Get:4 http://archive.ubuntu.com/ubuntu kinetic/main amd64 keyutils amd64 1.6.3-1 [56,4 kB]
Get:5 http://archive.ubuntu.com/ubuntu kinetic-updates/main amd64 nfs-common amd64 1:2.6.1-2ubuntu4.1 [240 kB]
Fetched 476 kB in 6s (74,0 kB/s)
Selecting previously unselected package libevent-core-2.1-7a:amd64.
(Reading database ... 70%
```

```
$ sudo mkdir /nfs  
$ sudo mount 172.16.0.40:/home/nfsshare /nfs
```

```
amil@linux-2:~$ df -hT  
Filesystem          Type  Size  Used   Avail Use% Mounted on  
tmpfs              tmpfs  340M  2,9M  338M  1% /run  
/dev/sda3           ext4   49G   15G   32G  31% /  
tmpfs              tmpfs  1,7G    0   1,7G  0% /dev/shm  
tmpfs              tmpfs  5,0M  4,0K  5,0M  1% /run/lock  
/dev/sda2           vfat   512M  5,3M  507M  2% /boot/efi  
tmpfs              tmpfs  340M  2,4M  338M  1% /run/user/1000  
172.16.0.40:/home/nfsshare nfs4   24G  9,2G  14G  42% /nfs  
amil@linux-2:~$
```

Əlaqə uğurla yaradılmışdır.

## Not testing the system:

Client tərəfdə **testFile** yaradılır:

```
amil@linux-2:~$ sudo touch /nfs/testFile.txt
```

Checking on the server:

```
amil@linux-dc:/home$ ls  
amil nfsshare  
amil@linux-dc:/home$
```

```
amil@linux-dc:/home$ ls nfsshare  
testFile.txt  
amil@linux-dc:/home$
```

# Gnome Desktop Environment

```
amil@linux-dc:~$ sudo apt -y install ubuntu-desktop_
```

```
systemd-oomd thunderbird thunderbird-gnome-support totem totem-common totem-plugins tracker
tracker-extract tracker-miner-fs transmission-common transmission-gtk
ubuntu-advantage-desktop-daemon ubuntu-desktop ubuntu-desktop-minimal ubuntu-docs ubuntu-mono
ubuntu-release-upgrader-gtk ubuntu-report ubuntu-session ubuntu-settings ubuntu-wallpapers
ubuntu-wallpapers-jammy uno-libs-private unzip update-inetd update-manager update-notifier ure
usb-creator-common usb-creator-gtk wamerican whoopsie whoopsie-preferences wireless-tools
x11-apps x11-common x11-session-utils x11-utils x11-xkb-utils x11-xserver-utils xbitmaps xbrlapi
xcursor-themes xcvt xdg-dbus-proxy xdg-desktop-portal xdg-desktop-portal-gnome
xdg-desktop-portal-gtk xdg-user-dirs-gtk xdg-utils xfonts-base xfonts-encodings xfonts-scalable
xfonts-utils xinit xinput xml-core xorg xorg-docs-core xserver-common xserver-xephyr
xserver-xorg xserver-xorg-core xserver-xorg-input-all xserver-xorg-input-libinput
xserver-xorg-input-wacom xserver-xorg-legacy xserver-xorg-video-all xserver-xorg-video-amdgpu
xserver-xorg-video-ati xserver-xorg-video-fbdev xserver-xorg-video-intel
xserver-xorg-video-nouveau xserver-xorg-video-qxl xserver-xorg-video-radeon
xserver-xorg-video-vesa xserver-xorg-video-vmware xwayland yaru-theme-gnome-shell yaru-theme-gtk
yaru-theme-icon yaru-theme-sound yelp yelp-xsl zenity zenity-common zip
0 upgraded, 1102 newly installed, 0 to remove and 0 not upgraded.
Need to get 635 MB of archives.
After this operation, 2,153 MB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 acpid amd64 1:2.0.33-1ubuntu1 [35.8 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libavahi-core7 amd64 0.8-5ubuntu5 [90.7 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libdaemon0 amd64 0.14-7.1ubuntu3 [14.1 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 avahi-daemon amd64 0.8-5ubuntu5 [69.6 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 ssl-cert all 1.1.2 [17.4 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libpaper1 amd64 1.1.28build2 [13.8 kB]
Get:7 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libproxy1v5 amd64 0.4.17-2 [51.9 kB]
Get:8 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 glib-networking-common all 2.72.0-1 [3,718 kB]
Get:9 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 glib-networking-services amd64 2.72.0-1 [9,982 kB]
Get:10 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 libdconf1 amd64 0.40.0-3 [40.5 kB]
Get:11 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 dconf-service amd64 0.40.0-3 [28.5 kB]
Get:12 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 dconf-gsettings-backend amd64 0.40.0-3 [22.8 kB]
0% [12 dconf-gsettings-backend 1,236 B/22.8 KB 5%]
```

```
[ OK ] Stopped target Host and Network Name Lookups.
[ OK ] Stopped target System Time Set.
  Stopping BIND Domain Name Server...
[ OK ] Stopped Hold until boot process finishes up.
  Starting Tell Plymouth To Jump To initramfs...
  Stopping Authorization Manager...
[ OK ] Stopped Authorization Manager.
[ OK ] Stopped Samba AD Daemon.
[ OK ] Finished Tell Plymouth To Jump To initramfs.
[ OK ] Stopped Make remote CUPS printers available locally.
[ OK ] Stopped LSB: automatic crash report generation.
[ OK ] Stopped Session 7 of User amil.
  Stopping Avahi mDNS/DNS-SD Stack...
  Stopping CUPS Scheduler...
  Stopping User Login Management...
  Stopping User Manager for UID 1000...
[ OK ] Stopped CUPS Scheduler.
[ OK ] Stopped User Manager for UID 1000.
[ OK ] Stopped Avahi mDNS/DNS-SD Stack.
  Stopping Userspace Out-Of-Memory (OOM) Killer...
  Stopping User Runtime Directory /run/user/1000...
[ OK ] Stopped User Login Management.
[ OK ] Stopped Userspace Out-Of-Memory (OOM) Killer.
[ OK ] Unmounted /run/user/1000.
[ OK ] Stopped User Runtime Directory /run/user/1000.
[ OK ] Removed slice User Slice of UID 1000.
  Stopping Permit User Sessions...
[ OK ] Stopped Permit User Sessions.
[ OK ] Stopped target User and Group Name Lookups.
[ OK ] Stopped target Remote File Systems.
[ OK ] Stopped target Preparation for Remote File Systems.
[ OK ] Stopped BIND Domain Name Server.
[ OK ] Unmounted /run/docker/netns/c5da58b0038b.
[ OK ] Unmounted /var/lib/docker/overlay2/6..8bac1005b52f1e0977939ed94501a998/merged.
[ OK ] Stopped Create final runtime dir for shutdown pivot root.
[*ok*] A stop job is running for Docker Application Container Engine (6s / no limit)

[ OK ] Unmounting /run/credentials/systemd-sysusers.service...
[ OK ] Unmounting /run/snapd/ns/1xd.mnt...
[ OK ] Unmounting Mount unit for core20, revision 1587...
[ OK ] Unmounting Mount unit for core20, revision 1738...
[ OK ] Unmounting Mount unit for lxd, revision 22923...
[ OK ] Unmounting Mount unit for lxd, revision 23541...
[ OK ] Unmounting Mount unit for snapd, revision 17883...

[ OK ] Stopped Load Kernel Modules.
[ OK ] Unmounted /boot.
[ OK ] Unmounted /run/credentials/systemd-sysusers.service.
[ OK ] Unmounted Mount unit for core20, revision 1587.
[ OK ] Unmounted Mount unit for core20, revision 1738.
[ OK ] Unmounted Mount unit for lxd, revision 22923.
[ OK ] Unmounted Mount unit for lxd, revision 23541.
[ OK ] Unmounted Mount unit for snapd, revision 17883.
[ OK ] Stopped File System Check on /dev/di..id/35e8fc22-254d-4361-a80f-e831b1c607d2.
[ OK ] Removed slice Slice /system/systemd-fsck.
[ OK ] Unmounted /run/snapd/ns/1xd.mnt.
  Unmounting /run/snapd/ns...
[ OK ] Unmounted /run/snapd/ns.
[ OK ] Stopped target Preparation for Local File Systems.
[ OK ] Stopped target Swaps.
  Deactivating swap /swap.img...
  Stopping Monitoring of LVM2 mirrors,...c. using dmeventd or progress polling...
  Stopping Device-Mapper Multipath Device Controller...
[ OK ] Stopped Create Static Device Nodes in /dev.
[ OK ] Stopped Create System Users.
[ OK ] Deactivated swap /swap.img.
[ OK ] Reached target Unmount All Filesystems.
[ OK ] Stopped Device-Mapper Multipath Device Controller.
[ OK ] Stopped Monitoring of LVM2 mirrors, ...etc. using dmeventd or progress polling.
[ OK ] Stopped Remount Root and Kernel File Systems.
[ OK ] Reached target System Shutdown.
[ OK ] Reached target Late Shutdown Services.
[ OK ] Finished System Reboot.
[ OK ] Reached target System Reboot.
```

Dec 26 15:12

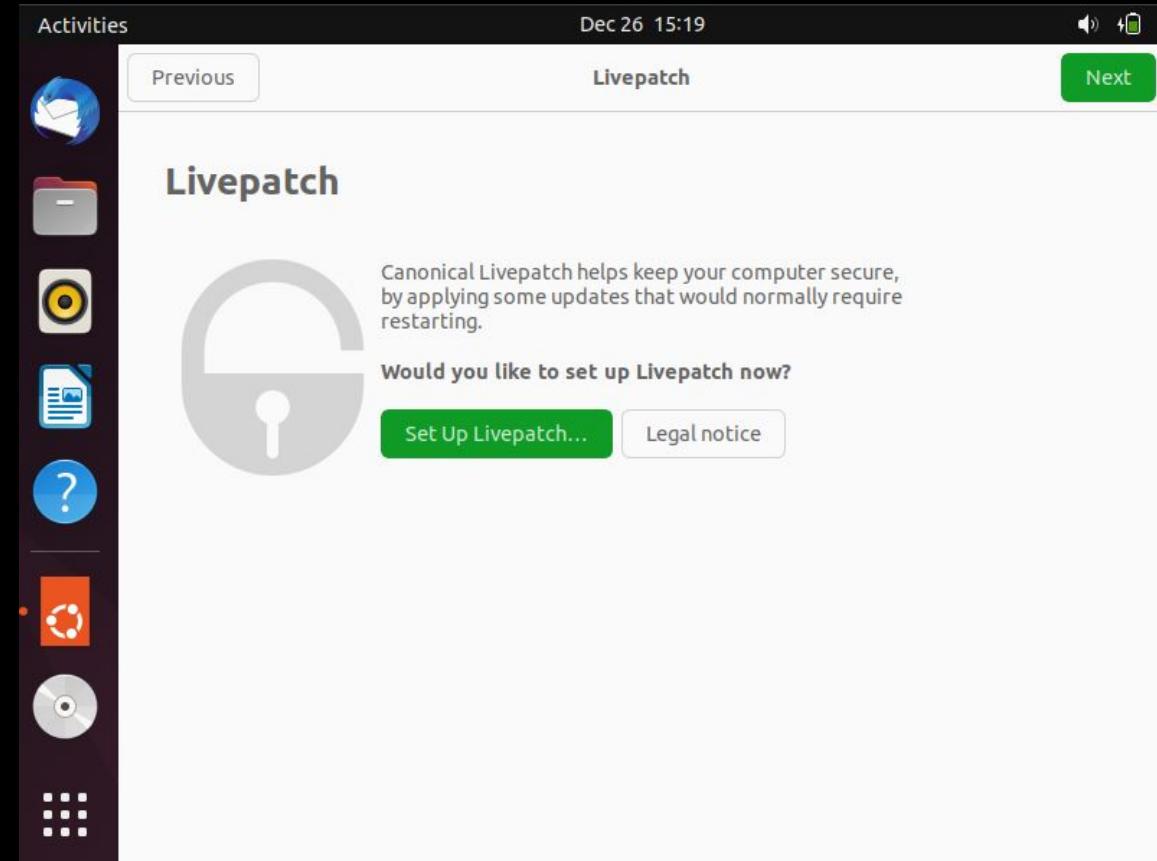
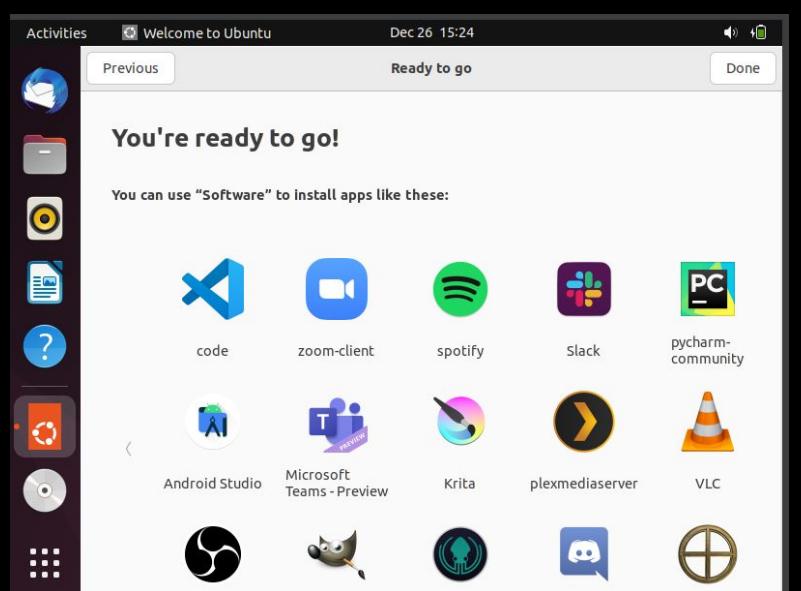
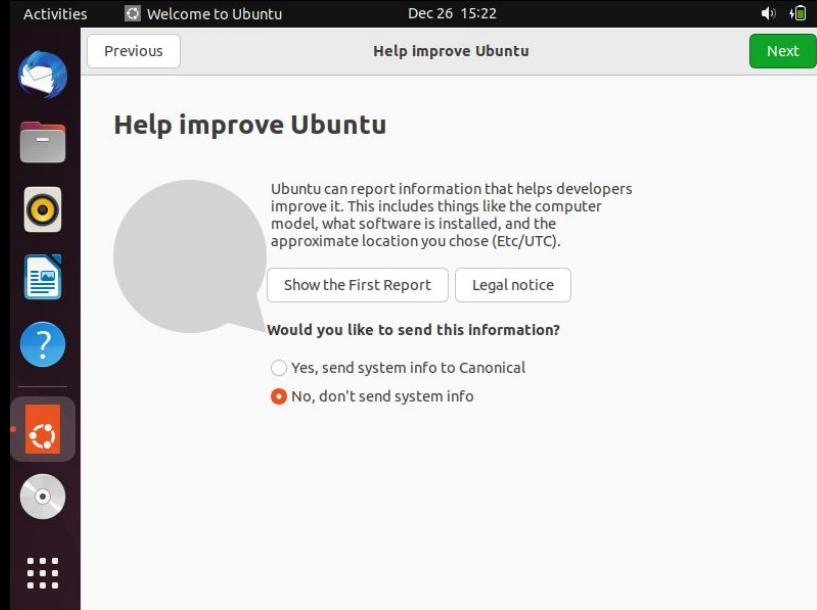


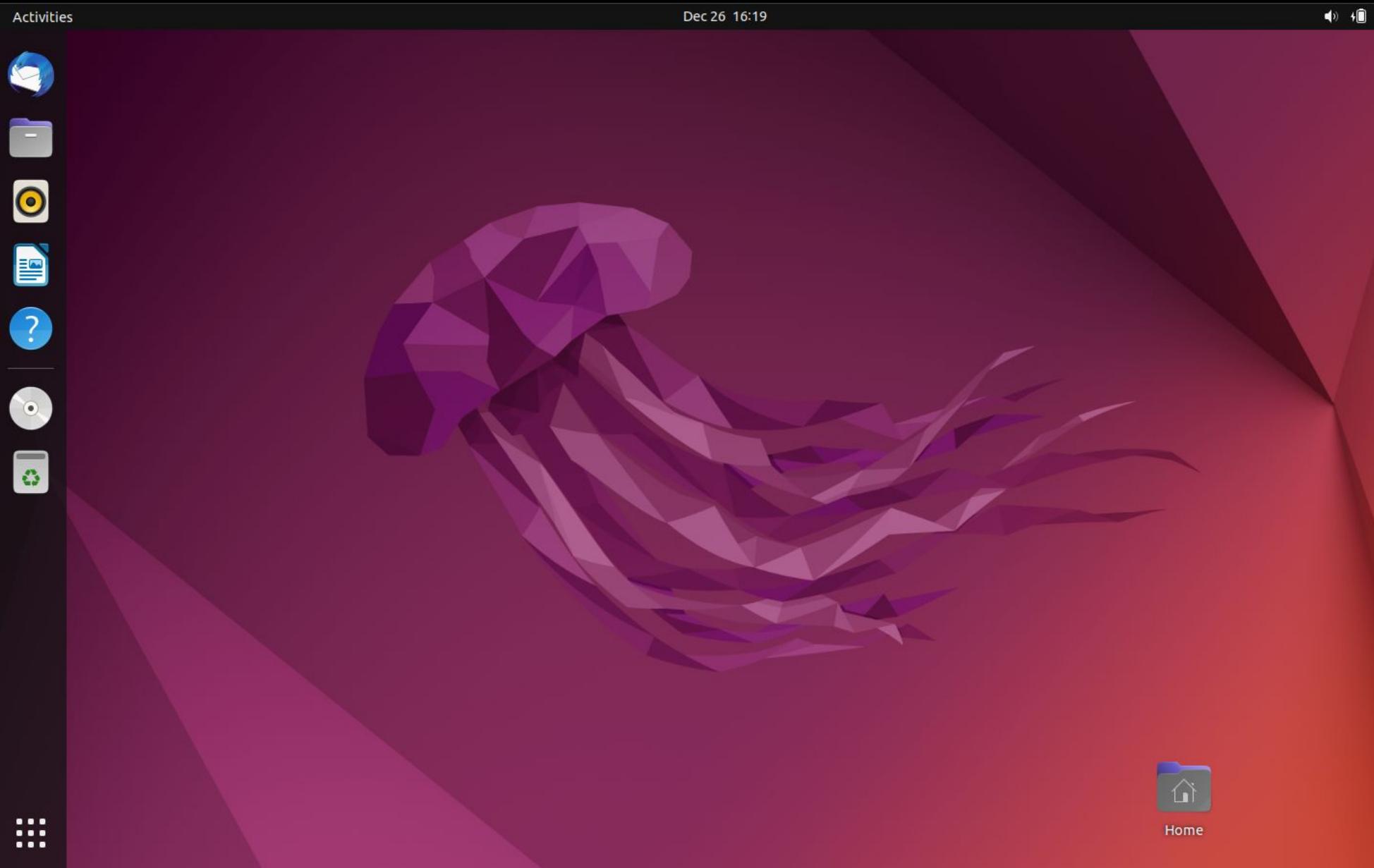
amil

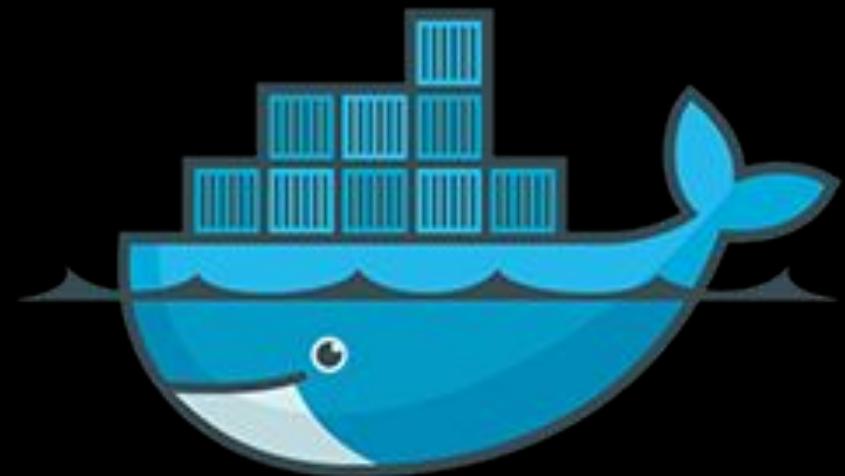
Not listed?



Ubuntu







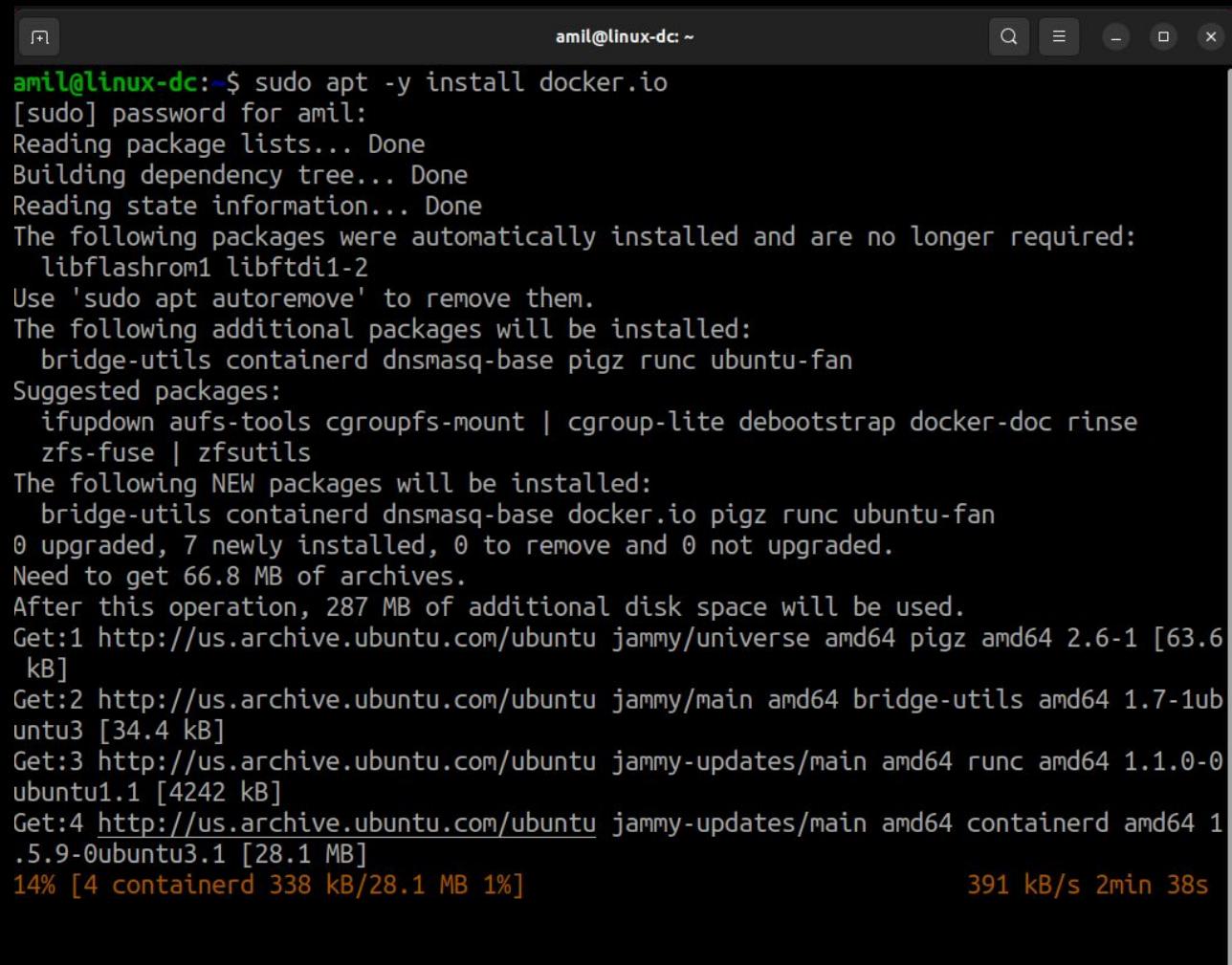
docker

Installation, configuration of the Docker Container platform  
on Ubuntu Server

# Installing Docker, an OS-Level Virtualization Tool that automates the deployment of applications inside containers

## [1] Downloading Docker

```
$ sudo apt -y install docker.io
```



The screenshot shows a terminal window with a dark background and light-colored text. The title bar reads "amil@linux-dc: ~". The command entered was "\$ sudo apt -y install docker.io". The terminal displays the standard output of an apt-get update and install process, including dependency resolution, package lists, and download progress. It shows that 0 upgraded, 7 newly installed, and 0 to remove and 0 not upgraded packages were handled. The total size of the download is 287 MB, and it is progressing at 391 kB/s over 2 minutes and 38 seconds.

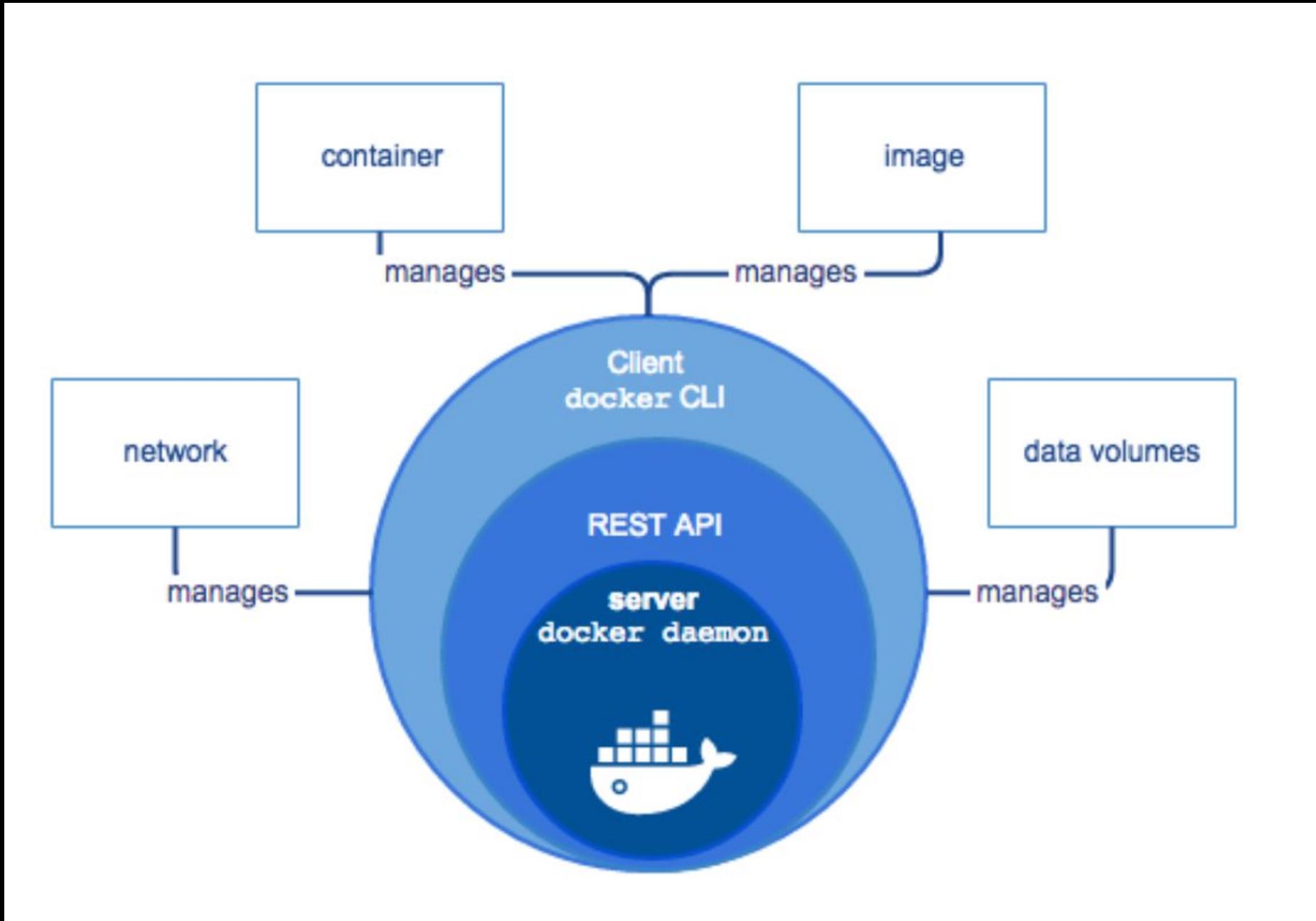
```
amil@linux-dc:~$ sudo apt -y install docker.io
[sudo] password for amil:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libflashrom1 libftdi1-2
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  bridge-utils containerd dnsmasq-base pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-doc rinse
  zfs-fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dnsmasq-base docker.io pigz runc ubuntu-fan
0 upgraded, 7 newly installed, 0 to remove and 0 not upgraded.
Need to get 66.8 MB of archives.
After this operation, 287 MB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu jammy/universe amd64 pigz amd64 2.6-1 [63.6 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu jammy/main amd64 bridge-utils amd64 1.7-1ubuntu3 [34.4 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 runc amd64 1.1.0-0ubuntu1.1 [4242 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 containerd amd64 1.5.9-0ubuntu3.1 [28.1 MB]
14% [4 containerd 338 kB/28.1 MB 1%]
391 kB/s 2min 38s
```

```
amil@linux-dc:~$ sudo docker version
Client:
  Version:          20.10.12
  API version:     1.41
  Go version:      go1.17.3
  Git commit:      20.10.12-0ubuntu4
  Built:           Mon Mar  7 17:10:06 2022
  OS/Arch:         linux/amd64
  Context:         default
  Experimental:   true

Server:
  Engine:
    Version:          20.10.12
    API version:     1.41 (minimum version 1.12)
    Go version:      go1.17.3
    Git commit:      20.10.12-0ubuntu4
    Built:           Mon Mar  7 15:57:50 2022
    OS/Arch:         linux/amd64
    Experimental:   false
  containerd:
    Version:          1.5.9-0ubuntu3.1
    GitCommit:
  runc:
    Version:          1.1.0-0ubuntu1.1
    GitCommit:
  docker-init:
    Version:          0.19.0
    GitCommit:
amil@linux-dc:~$
```

```
amil@linux-dc:~$ docker version
Client:
  Version:          20.10.12
  API version:     1.41
  Go version:      go1.17.3
  Git commit:      20.10.12-0ubuntu4
  Built:           Mon Mar  7 17:10:06 2022
  OS/Arch:         linux/amd64
  Context:         default
  Experimental:   true
```

Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get "http://%2Fvar%2Frun%2Fdocker.sock/v1.24/version": dial unix /var/run/docker.sock: connect: permission denied



[2] Downloading the official image

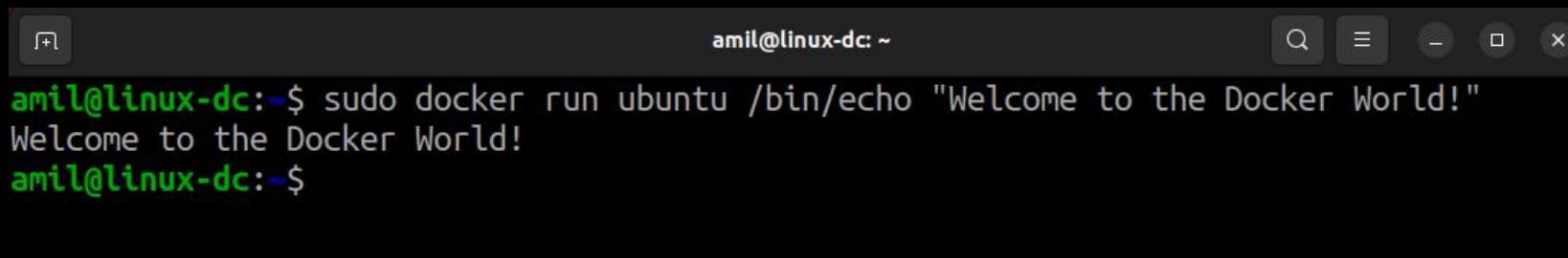
Container creation

Removing the words [Welcome to Docker World] inside the container

```
~$ sudo docker pull ubuntu
```

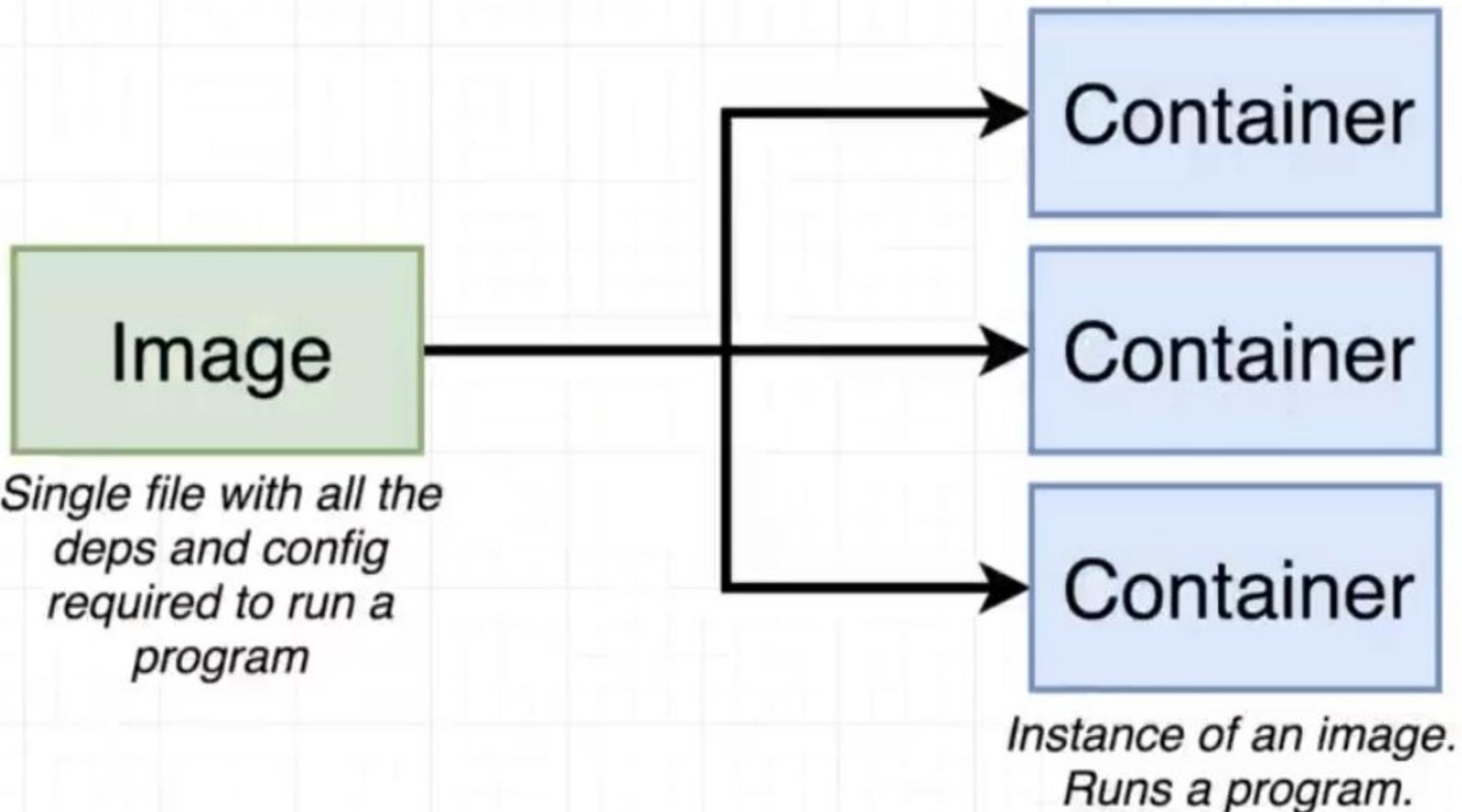
```
amil@linux-dc:~$ sudo docker pull ubuntu
Using default tag: latest
latest: Pulling from library/ubuntu
6e3729cf69e0: Pull complete
Digest: sha256:27cb6e6cce575a4698b66f5de06c7ecd61589132d5a91d098f7f3f9285415a9
Status: Downloaded newer image for ubuntu:latest
docker.io/library/ubuntu:latest
amil@linux-dc:~$
```

```
~$ sudo docker run ubuntu /bin/echo "Welcome to the Docker World!"
```



A screenshot of a terminal window titled 'amil@linux-dc: ~'. The window contains the following text:

```
amil@linux-dc:~$ sudo docker run ubuntu /bin/echo "Welcome to the Docker World!"
Welcome to the Docker World!
amil@linux-dc:~$
```



[3] Connect to an interactive session of the container.  
(Container process terminates if we exit the container session)

```
amil@linux-dc:~$ sudo docker run -it ubuntu /bin/bash
root@ac1b00fc95e2:/#
```

```
amil@linux-dc:~$ sudo docker run -it ubuntu /bin/bash
root@ac1b00fc95e2:/# uname -a
Linux ac1b00fc95e2 5.15.0-56-generic #62-Ubuntu SMP Tue Nov 22 19:54:14 UTC 2022 x86_
64 x86_64 x86_64 GNU/Linux
root@ac1b00fc95e2:/#
```

Kernel name – **Linux**.

Host node name – **ac1b00fc95e2**.

Kernel release – **5.15.0-56-generic**.

Kernel version and build time – **#62-Ubuntu SMP Tue Nov 22 19:54:14 UTC 2022**.

**x86\_64 x86\_64 x86\_64** – Processor type, hardware platform and architecture of processor.

**GNU/Linux** – Operating system name.

```
amil@linux-dc:~$ sudo docker run -it ubuntu /bin/bash
root@ac1b00fc95e2:/# uname -a
Linux ac1b00fc95e2 5.15.0-56-generic #62-Ubuntu SMP Tue Nov 22 19:54:14 UTC 2022 x86_
64 x86_64 x86_64 GNU/Linux
root@ac1b00fc95e2:/# exit
exit
amil@linux-dc:~$
```

Exit the container, provided the outgoing process is saved

```
amil@linux-dc:~$ sudo docker run -it ubuntu /bin/bash
root@01b10e5d1b78:/# █ (Ctrl+p) + (Ctrl+q)
```

```
amil@linux-dc:~$ sudo docker run -it ubuntu /bin/bash
root@01b10e5d1b78:/# amil@linux-dc:~$ sudo docker ps
CONTAINER ID   IMAGE      COMMAND      CREATED          STATUS          PORTS
NAMES
01b10e5d1b78   ubuntu     "/bin/bash"   About a minute ago   Up About a minute
    dreamy_ganguly
amil@linux-dc:~$
```

```
amil@linux-dc:~$ sudo docker kill 01b10e5d1b78
01b10e5d1b78
amil@linux-dc:~$ sudo docker ps
CONTAINER ID   IMAGE      COMMAND      CREATED          STATUS          PORTS      NAMES
amil@linux-dc:~$ █
```

## Adding the Container images we created

For example, by installing Nginx, the official image is downloaded and added as a new image for the container. A container is created each time a docker run command is executed, so the most recently executed container is added as follows.

```
[1] amil@linux-dc:~$ sudo docker images
[sudo] password for amil:
REPOSITORY      TAG      IMAGE ID      CREATED      SIZE
ubuntu          latest    6b7dfa7e8fdb    2 weeks ago   77.8MB

[2] Konteynerin işe salınması ve nginx quraşdırılması
$ sudo docker run ubuntu /bin/bash -c "apt-get update; apt-get -y install nginx"
```

Problem: Sistem Xeta verir

```
amil@linux-dc: ~          amil@linux-2: ~
Ign:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Ign:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Ign:2 http://archive.ubuntu.com/ubuntu jammy InRelease
Ign:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Ign:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Ign:1 http://security.ubuntu.com/ubuntu jammy-security InRelease
Ign:2 http://archive.ubuntu.com/ubuntu jammy InRelease
Ign:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Ign:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Ign:1 http://security.ubuntu.com/ubuntu jammy-security InRelease
Err:2 http://archive.ubuntu.com/ubuntu jammy InRelease
  Could not resolve 'archive.ubuntu.com'
Err:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
  Could not resolve 'archive.ubuntu.com'
Err:1 http://security.ubuntu.com/ubuntu jammy-security InRelease
  Could not resolve 'security.ubuntu.com'
Err:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
  Could not resolve 'archive.ubuntu.com'
Reading package lists...
W: Failed to fetch http://archive.ubuntu.com/ubuntu/dists/jammy/InRelease  Could not resolve 'archive.ubuntu.com'
W: Failed to fetch http://archive.ubuntu.com/ubuntu/dists/jammy-updates/InRelease  Could not resolve 'archive.ubuntu.com'
W: Failed to fetch http://archive.ubuntu.com/ubuntu/dists/jammy-backports/InRelease  Could not resolve 'archive.ubuntu.com'
W: Failed to fetch http://security.ubuntu.com/ubuntu/dists/jammy-security/InRelease  Could not resolve 'security.ubuntu.com'
W: Some index files failed to download. They have been ignored, or old ones used instead.
E: Unable to locate package nginx
Reading package lists...
Building dependency tree...
Reading state information...
amil@linux-dc:~$
```

```
amil@linux-dc:~$ sudo docker run busybox nslookup google.com
```

```
Server: 172.16.0.40  
Address: 172.16.0.40:53
```

```
** server can't find google.com: REFUSED
```

```
** server can't find google.com: REFUSED
```

```
amil@linux-dc:~$ sudo docker run busybox nslookup fproject.local
```

```
Server: 172.16.0.40  
Address: 172.16.0.40:53
```

```
Name: fproject.local
```

```
Address: 172.17.0.1
```

```
Name: fproject.local
```

```
Address: 10.0.3.15
```

```
Name: fproject.local
```

```
Address: 172.16.0.40
```

```
$ sudo nano /etc/resolv.conf
```

```
amil@linux-dc:~$
```

```
GNU nano 6.2 /etc/resolv.conf *  
nameserver 8.8.8.8  
#nameserver 172.16.0.40  
search fproject.local
```

```
amil@linux-dc:~$ sudo docker run ubuntu /bin/bash -c "apt-get update; apt-get -y install nginx"
Get:1 http://archive.ubuntu.com/ubuntu jammy InRelease [270 kB]
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:5 http://archive.ubuntu.com/ubuntu jammy/main amd64 Packages [1792 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy/multiverse amd64 Packages [266 kB]
Get:7 http://archive.ubuntu.com/ubuntu jammy/restricted amd64 Packages [164 kB]
Get:8 http://archive.ubuntu.com/ubuntu jammy/universe amd64 Packages [17.5 MB]
Get:9 http://security.ubuntu.com/ubuntu jammy-security/restricted amd64 Packages [593 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [641 kB]
Get:11 http://archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 Packages [8150 B]
Get:12 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [970 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [972 kB]
Get:14 http://archive.ubuntu.com/ubuntu jammy-backports/universe amd64 Packages [7278 B]
Get:15 http://archive.ubuntu.com/ubuntu jammy-backports/main amd64 Packages [3520 B]
Get:16 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [667 kB]
Get:17 http://security.ubuntu.com/ubuntu jammy-security/multiverse amd64 Packages [4732 B]
Get:18 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [781 kB]
```

```
amil@linux-dc:~$ sudo docker ps -a | head -2
CONTAINER ID        IMAGE       COMMAND                  CREATED             STATUS              PORTS          NAMES
89b091ab93f5        ubuntu      "/bin/bash -c 'apt-g..."   About a minute ago   Exited (0) 19 seconds ago

```

```
amil@linux-dc:~$ sudo docker images
REPOSITORY          TAG           IMAGE ID            CREATED            SIZE
busybox              latest        827365c7baf1    3 days ago        4.86MB
ubuntu               latest        6b7dfa7e8fdb    2 weeks ago       77.8MB
```

```
amil@linux-dc:~$ sudo docker commit 89b091ab93f5 fproject/ubuntu-nginx
sha256:d643bbf02cc243095b3cee5a2d3fcc53bec1b2f31ff29d7aae751f003d32adc
```

```
amil@linux-dc:~$ sudo docker images
REPOSITORY          TAG           IMAGE ID            CREATED            SIZE
fproject/ubuntu-nginx  latest        d643bbf02cc2    15 seconds ago   174MB
busybox              latest        827365c7baf1    3 days ago        4.86MB
ubuntu               latest        6b7dfa7e8fdb    2 weeks ago       77.8MB
amil@linux-dc:~$ █
```

Let's create a container from the new image and run the [which] command to make sure nginx is available:

```
amil@linux-dc:~$ sudo docker run fproject/ubuntu-nginx /usr/bin/which nginx  
/usr/sbin/nginx  
amil@linux-dc:~$ █
```

Həqiqətən də:

```
amil@linux-dc:~$ sudo docker run fproject/ubuntu-nginx /bin/bash -c "ls /usr/sbin/ | grep nginx"  
nginx  
amil@linux-dc:~$ █
```

# Access to Container Services

Accessing services such as HTTP or SSH running as a daemon in containers:

start a Container and also run Nginx

map the port of Host and the port of Container with [-p xxx:xxx]

```
amil@linux-dc:~$ sudo docker run -t -d -p 8081:80 fproject/ubuntu-nginx /usr/sbin/nginx -g "daemon off;"  
9aaf924b7e4f201ffef6ddc859067ae5fb410b2396f9791fc01412ee499ca10
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
9aaf924b7e4f	fproject/ubuntu-nginx	/usr/sbin/nginx -g ..."	8 minutes ago	Up 7 minutes	0.0.0.0:8081->80/tcp, :::8081->80/tcp	practical_kare

create a test page

```
amil@linux-dc:~$ sudo docker exec 9aaf924b7e4f /bin/bash -c 'echo "Nginx on Docker Container" > /var/www/html/index.html'  
amil@linux-dc:~$
```

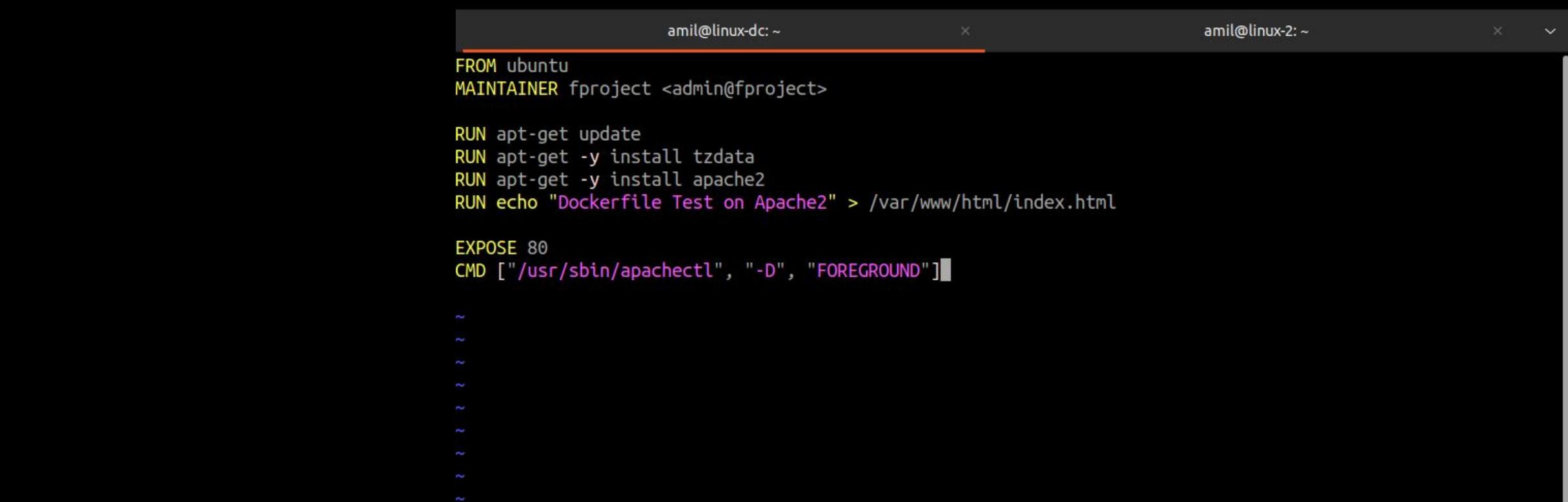
```
amil@linux-dc:~$ sudo curl localhost:8081  
Nginx on Docker Container  
amil@linux-dc:~$
```

# Using DockerFile

Dockerfile usage and automatic creation of Docker images. Implementation of configuration management.

- As an example, the implementation of the Dockerfile creation process, where Apache2 is installed and started

```
amil@linux-dc:~$ vi Dockerfile
```



The screenshot shows a terminal window with two tabs. The active tab is titled 'amil@linux-dc: ~' and contains the Dockerfile code. The other tab is titled 'amil@linux-2: ~'. The Dockerfile content is as follows:

```
FROM ubuntu
MAINTAINER fproject <admin@fproject>

RUN apt-get update
RUN apt-get -y install tzdata
RUN apt-get -y install apache2
RUN echo "Dockerfile Test on Apache2" > /var/www/html/index.html

EXPOSE 80
CMD ["/usr/sbin/apachectl", "-D", "foreground"]
```

build image ⇒ docker build -t [image name]:[tag] .

-\$ sudo docker build -t fproject/ubuntu-apache2:latest ./

The screenshot shows two terminal windows side-by-side. The left window, titled 'amil@linux-dc:~', displays the command-line output of a Docker build process. The right window, titled 'amil@linux-2:~', is empty and serves as a reference point. The terminal output includes Apache module enabling logs, system trigger processing, certificate updates, hook execution, intermediate container removal, Dockerfile steps (RUN, EXPOSE), and finally successful tagging of the image.

```
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
invoke-rc.d: could not determine current runlevel
invoke-rc.d: policy-rc.d denied execution of start.
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
Processing triggers for ca-certificates (20211016ubuntu0.22.04.1) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...
done.
Removing intermediate container d1508d4cc33c
--> aaa4b41c2dc9
Step 6/8 : RUN echo "Dockerfile Test on Apache2" > /var/www/html/index.html
--> Running in a67e6b91da48
Removing intermediate container a67e6b91da48
--> 432c4a1c07f5
Step 7/8 : EXPOSE 80
--> Running in 567ab05151a7
Removing intermediate container 567ab05151a7
--> d9024a2262bd
Step 8/8 : CMD ["/usr/sbin/apachectl", "-D", "FOREGROUND"]
--> Running in 46f5769a818b
Removing intermediate container 46f5769a818b
--> 51222f0ab750
Successfully built 51222f0ab750
Successfully tagged fproject/ubuntu-apache2:latest
amil@linux-dc:~$
```

```
amil@linux-dc:~$ sudo docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
fproject/ubuntu-apache2  latest   51222f0ab750  39 seconds ago  231MB
fproject/ubuntu-nginx    latest   d643bbf02cc2  5 hours ago   174MB
busybox              latest   827365c7baf1  3 days ago    4.86MB
ubuntu               latest   6b7dfa7e8fdb  2 weeks ago   77.8MB
amil@linux-dc:~$
```

```
amil@linux-dc:~$ sudo docker run -d -p 8080:80 fproject/ubuntu-apache2
17013569120dcfd1cde164ccaaa8755b176d43452a6784e8121c1095d4b89539
amil@linux-dc:~$
```

```
amil@linux-dc:~$ curl localhost:8080
Dockerfile Test on Apache2
amil@linux-dc:~$ █
```

# Using external memory

When containers are deleted, the data they contain is also deleted, so when needed, containers should use an external file system as persistent storage.

[1] Installing a directory into containers on Docker Host

```
root@linux-dc:/home/amil# mkdir -p /var/lib/docker/disk01
root@linux-dc:/home/amil# echo "persistent storage" >> /var/lib/docker/disk01/testfile.txt
root@linux-dc:/home/amil# docker run -it -v /var/lib/docker/disk01:/mnt ubuntu /bin/bash
```

```
root@8c4bc982d1ef:/# df -hT
```

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
overlay	overlay	24G	9.1G	14G	41%	/
tmpfs	tmpfs	64M	0	64M	0%	/dev
shm	tmpfs	64M	0	64M	0%	/dev/shm
/dev/mapper/ubuntu--vg-ubuntu--lv	ext4	24G	9.1G	14G	41%	/mnt
tmpfs	tmpfs	1.5G	0	1.5G	0%	/proc/asound
tmpfs	tmpfs	1.5G	0	1.5G	0%	/proc/acpi
tmpfs	tmpfs	1.5G	0	1.5G	0%	/proc/scsi
tmpfs	tmpfs	1.5G	0	1.5G	0%	/sys/firmware

```
root@8c4bc982d1ef:/# cat /mnt/testfile.txt
persistent storage
```

[2] It is also possible to configure external storage with the Docker Data Volume command.

**Volume [volume01] is created**

```
root@linux-dc:/home/amil# docker volume create volume01
volume01
```

**display volume list (volume list)**

```
root@linux-dc:/home/amil# docker volume ls
DRIVER      VOLUME NAME
local        volume01
```

**Showing details of [volume01].**

```
root@linux-dc:/home/amil# docker volume inspect volume01
[
  {
    "CreatedAt": "2022-12-26T17:38:24Z",
    "Driver": "local",
    "Labels": {},
    "Mountpoint": "/var/lib/docker/volumes/volume01/_data",
    "Name": "volume01",
    "Options": {},
    "Scope": "local"
  }
]
```

**Start a container with a mount between [volume01] and [/mnt] on the container**

```
root@linux-dc:/home/amil# docker run -it -v volume01:/mnt ubuntu
root@6763a510126b:#
```

```
root@6763a510126b:# df -hT /mnt
Filesystem           Type  Size  Used  Avail Use% Mounted on
/dev/mapper/ubuntu--vg-ubuntu--lv ext4  24G  9.1G  14G  41% /mnt
```

```
root@6763a510126b:# echo "Docker Volume test" > /mnt/testfile.txt
root@6763a510126b:# exit
exit
```

```
root@linux-dc:/home/amil# cat /var/lib/docker/volumes/volume01/_data/testfile.txt
Docker Volume test
```

**It is also possible to install from other containers**

```
root@linux-dc:/home/amil# docker run -v volume01:/var/volume01 ubuntu /usr/bin/cat /var/volume01/testfile.txt
Docker Volume test
```

To delete volumes, type:

```
root@linux-dc:/home/amil# docker volume rm volume01
Error response from daemon: remove volume01: volume is in use - [6763a510126bcdd393af8f98361568864bf3504698d61edc
53cc63fac7df1abe, f20a95af83a08bf607f2417622719f03c690bbb28c6b961dd722be1d2c744f08]
root@linux-dc:/home/amil#
```

If some containers are using the volume you want to delete as above, the target containers must be removed before deleting the volume.

```
root@linux-dc:/home/amil# docker rm 6763a510126bcdd393af8f98361568864bf3504698d61edc53cc63fac7df1abe
root@linux-dc:/home/amil# docker rm f20a95af83a08bf607f2417622719f03c690bbb28c6b961dd722be1d2c744f08

root@linux-dc:/home/amil# docker volume rm volume01
volume01
root@linux-dc:/home/amil#
```

# Docker Network

Displaying the network list

```
root@linux-dc:/home/amil# docker network ls
NETWORK ID      NAME        DRIVER      SCOPE
af37312bc52c    bridge      bridge      local
892e9d712a2d    host        host        local
30665f170266    network01  bridge      local
1446e936f4c8    none        null       local
```

Describing the details of [bridge].

```
/home/amil# docker network inspect bridge
```

```
{
    "Name": "bridge",
    "Id": "af37312bc52c7d10584bf863eaa6d2db696a4f340da524331d4c372d21b0ef5e",
    "Created": "2022-12-26T20:16:25.045Z",
    "Scope": "local",
    "Driver": "bridge",
    "EnableIPv6": false,
    "IPAM": {
        "Driver": "default",
        "Options": null,
        "Config": [
            {
                "Subnet": "172.17.0.0/16",
                "Gateway": "172.17.0.1"
            }
        ]
    },
    "Internal": false,
    "Attachable": false,
    "Ingress": false,
    "ConfigFrom": {
        "Network": ""
    },
    "ConfigOnly": false,
    "Containers": {
        "b796b81a89391f4b3c92e4673c5d889fbb6ea9e8c1c2fb62b7417baa522d358": {
            "Name": "cool_lichterman",
            "EndpointID": "80da6a2e3ab6d76c9f1fd16ef0a3a21097051d496218214bc712421ba444b7e5",
            "MacAddress": "02:42:ac:11:00:02",
            "IPv4Address": "172.17.0.2/16",
            "IPv6Address": ""
        }
    },
    "Options": {
        "com.docker.network.bridge.default_bridge": "true",
        "com.docker.network.bridge.enable_icc": "true",
        "com.docker.network.bridge.enable_ip_masquerade": "true",
        "com.docker.network.bridge.host_binding_ipv4": "0.0.0.0",
        "com.docker.network.bridge.name": "docker0",
        "com.docker.network.driver.mtu": "1500"
    },
    "Labels": {}
}
}
```

[bridge] is set as container network by default

```
root@linux-dc:/home/amil# docker run -it ubuntu /bin/bash  
root@b347870b222d:#
```

```
root@b347870b222d:# apt-get update
```

```
root@b347870b222d:# apt-get install iproute2
```

```
root@b347870b222d:# ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
46: eth0@if47: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default  
    link/ether 02:42:ac:11:00:03 brd ff:ff:ff:ff:ff:ff link-netnsid 0  
    inet 172.17.0.3/16 brd 172.17.255.255 scope global eth0  
        valid_lft forever preferred_lft forever
```

```
root@b347870b222d:/# apt-get install traceroute
```

```
root@b347870b222d:/# traceroute -I google.com  
traceroute to google.com (172.217.17.238), 30 hops max, 60 byte packets
```

```
1 172.17.0.1 (172.17.0.1) 0.966 ms 0.039 ms 0.013 ms  
2 10.0.3.2 (10.0.3.2) 14.023 ms 13.167 ms 11.888 ms  
3 192.168.1.254 (192.168.1.254) 26.531 ms 25.834 ms *  
4 100.80.0.1 (100.80.0.1) 41.940 ms 42.060 ms 41.342 ms  
5 172.16.12.57 (172.16.12.57) 47.497 ms 46.304 ms 45.173 ms  
6 94.20.50.145 (94.20.50.145) 44.196 ms 8.719 ms 11.298 ms  
7 10.50.10.154 (10.50.10.154) 52.970 ms 55.977 ms 55.685 ms  
8 72.14.203.212 (72.14.203.212) 61.374 ms 65.386 ms 64.938 ms  
9 108.170.250.161 (108.170.250.161) 63.519 ms 62.514 ms 61.642 ms  
10 209.85.242.141 (209.85.242.141) 60.853 ms 60.839 ms 60.731 ms  
11 sof02s41-in-f14.1e100.net (172.217.17.238) 60.325 ms 60.209 ms 55.677 ms
```

```
root@b347870b222d:/#
```

```
root@b347870b222d:/# exit  
exit  
root@linux-dc:/home/amil#
```

## Creating a new network with [network01] and subnet [192.168.41.0/24]

```
root@linux-dc:/home/amil# docker network create --subnet 192.168.41.0/24 network02  
f815280d292f2c3ee59b6e3234bbb3aca84b6c0a05857908024062e42f717e45  
root@linux-dc:/home/amil#
```

```
root@linux-dc:/home/amil# docker network ls  
NETWORK ID      NAME      DRIVER      SCOPE  
af37312bc52c    bridge    bridge      local  
892e9d712a2d    host      host       local  
30665f170266    network01 bridge      local  
f815280d292f    network02 bridge      local  
1446e936f4c8    none      null       local  
root@linux-dc:/home/amil#
```

## Running a new container with [network02]

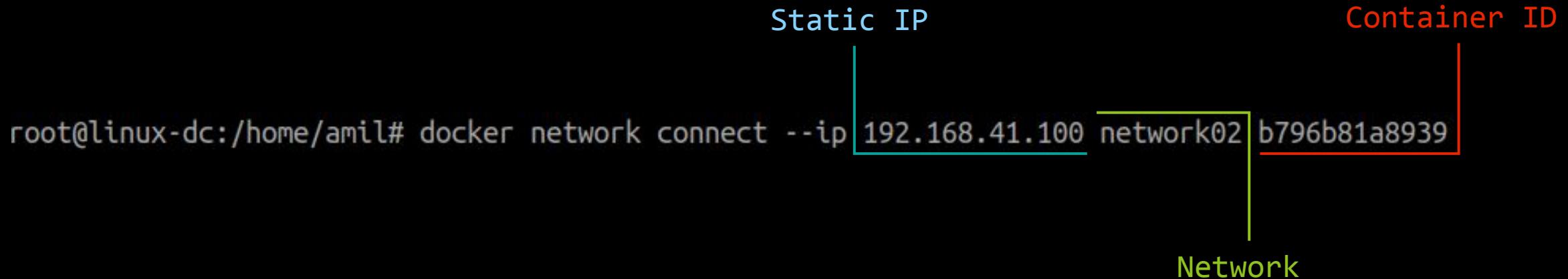
```
root@linux-dc:/home/amil# docker run --net network02 ubuntu /bin/bash -c "apt-get update; apt-get -y install iproute2; /usr/sbin/ip route"
```

The screenshot shows a terminal window with three tabs. The active tab is titled 'root@linux-dc: /home/amil'. The other two tabs are labeled 'amil@linux-dc: ~' and 'amil@linux-dc: ~'. The terminal displays the output of a Docker command to run a new container named 'network02' based on the 'ubuntu' image. The container's root shell is running a command to update the package list and install the 'iproute2' package. The output shows the installation of various dependencies and the successful execution of the 'iproute2' installation command, which outputs the IP configuration for interface 'eth0'.

```
Setting up libcap2-bin (1:2.44-1build3) ...
Setting up libmnl0:amd64 (1.0.4-3build2) ...
Setting up libxtables12:amd64 (1.8.7-1ubuntu5) ...
Setting up libmd0:amd64 (1.0.4-1build1) ...
Setting up libbsd0:amd64 (0.11.5-1) ...
Setting up libelf1:amd64 (0.186-1build1) ...
Setting up libpam-cap:amd64 (1:2.44-1build3) ...
debconf: unable to initialize frontend: Dialog
debconf: (TERM is not set, so the dialog frontend is not usable.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/ReadLine.pm in @INC (you may need to install the Term::ReadLine module) (@INC contains: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/5.34.0 /usr/local/share/perl/5.34.0 /usr/lib/x86_64-linux-gnu/perl5/5.34 /usr/share/perl5 /usr/lib/x86_64-linux-gnu/perl-base /usr/lib/x86_64-linux-gnu/perl/5.34 /usr/share/perl/5.34 /usr/local/lib/site_perl) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 7.)
debconf: falling back to frontend: Teletype
Setting up libbpf0:amd64 (1:0.5.0-1ubuntu22.04.1) ...
Setting up iproute2 (5.15.0-1ubuntu2) ...
debconf: unable to initialize frontend: Dialog
debconf: (TERM is not set, so the dialog frontend is not usable.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/ReadLine.pm in @INC (you may need to install the Term::ReadLine module) (@INC contains: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/5.34.0 /usr/local/share/perl/5.34.0 /usr/lib/x86_64-linux-gnu/perl5/5.34 /usr/share/perl5 /usr/lib/x86_64-linux-gnu/perl-base /usr/lib/x86_64-linux-gnu/perl/5.34 /usr/share/perl/5.34 /usr/local/lib/site_perl) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 7.)
debconf: falling back to frontend: Teletype
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
default via 192.168.41.1 dev eth0
192.168.41.0/24 dev eth0 proto kernel scope link src 192.168.41.2
root@linux-dc:/home/amil#
```

The process of connecting a network to a running container  
(to attach the network to existing running container, set like follows)

```
root@linux-dc:/home/amil# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
b796b81a8939 ubuntu "/bin/bash" About an hour ago Up About an hour
root@linux-dc:/home/amil#
```



## Process Error: There is no field named ip route in the system.

```
root@linux-dc:/home/amil# docker exec b796b81a8939 /usr/sbin/ip route
OCI runtime exec failed: exec failed: unable to start container process: exec: "/usr/sbin/ip": stat /usr/s
bin/ip: no such file or directory: unknown
```

```
root@linux-dc:/home/amil# docker exec b796b81a8939 apt-get update
Get:1 http://archive.ubuntu.com/ubuntu jammy InRelease [270 kB]
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:3 http://security.ubuntu.com/ubuntu jammy-security/restricted amd64 Packages [593 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:5 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy/universe amd64 Packages [17.5 MB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [781 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [667 kB]
Get:9 http://security.ubuntu.com/ubuntu jammy-security/multiverse amd64 Packages [4732 B]
Get:10 http://archive.ubuntu.com/ubuntu jammy/multiverse amd64 Packages [266 kB]
Get:11 http://archive.ubuntu.com/ubuntu jammy/main amd64 Packages [1792 kB]
Get:12 http://archive.ubuntu.com/ubuntu jammy/restricted amd64 Packages [164 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [970 kB]
Get:14 http://archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 Packages [8150 B]
Get:15 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [972 kB]
Get:16 http://archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [641 kB]
Get:17 http://archive.ubuntu.com/ubuntu jammy-backports/universe amd64 Packages [7278 B]
Get:18 http://archive.ubuntu.com/ubuntu jammy-backports/main amd64 Packages [3520 B]
Fetched 24.9 MB in 1min 10s (358 kB/s)
Reading package lists...
```

```
root@linux-dc:/home/amil# docker exec b796b81a8939 apt-get install -y iproute2
Reading package lists...
Building dependency tree...
Reading state information...
The following additional packages will be installed:
  libatm1 libbpf0 libbsd0 libcap2-bin libelf1 libmd0 libmnlo libpam-cap
  libxtables12
Suggested packages:
  iproute2-doc
The following NEW packages will be installed:
  iproute2 libatm1 libbpf0 libbsd0 libcap2-bin libelf1 libmd0 libmnlo
  libpam-cap libxtables12
0 upgraded, 10 newly installed, 0 to remove and 0 not upgraded.
Need to get 1430 kB of archives.
After this operation, 4151 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/main amd64 libelf1 amd64 0.186-1build1 [51.0 kB]
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libbpf0 amd64 1:0.5.0-1ubuntu22.04.1 [140 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy/main amd64 libmd0 amd64 1.0.4-1build1 [23.0 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy/main amd64 libbsd0 amd64 0.11.5-1 [44.8 kB]
Get:5 http://archive.ubuntu.com/ubuntu jammy/main amd64 libmnlo amd64 1.0.4-3build2 [13.2 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy/main amd64 libxtables12 amd64 1.8.7-1ubuntu5 [31.2 kB]
Get:7 http://archive.ubuntu.com/ubuntu jammy/main amd64 libcap2-bin amd64 1:2.44-1build3 [26.0 kB]
Get:8 http://archive.ubuntu.com/ubuntu jammy/main amd64 iproute2 amd64 5.15.0-1ubuntu2 [1070 kB]
Get:9 http://archive.ubuntu.com/ubuntu jammy/main amd64 libatm1 amd64 1:2.5.1-4build2 [22.8 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy/main amd64 libpam-cap amd64 1:2.44-1build3 [7932 B]
debconf: delaying package configuration, since apt-utils is not installed
Fetched 1430 kB in 4s (404 kB/s)
Selecting previously unselected package libelf1:amd64.
(Reading database ... 4395 files and directories currently installed.)
Preparing to unpack .../0-libelf1_0.186-1build1_amd64.deb ...
Unpacking libelf1:amd64 (0.186-1build1) ...
Selecting previously unselected package libbpf0:amd64.
```

After the given problem is solved, the system starts working:

```
root@linux-dc:/home/amil# docker exec b796b81a8939 /usr/sbin/ip route  
default via 172.17.0.1 dev eth0  
172.17.0.0/16 dev eth0 proto kernel scope link src 172.17.0.2  
192.168.41.0/24 dev eth1 proto kernel scope link src 192.168.41.100  
root@linux-dc:/home/amil#
```

```
root@linux-dc:/home/amil# docker exec b796b81a8939 traceroute -I google.com  
traceroute to google.com (74.125.131.113), 30 hops max, 60 byte packets  
 1  172.17.0.1 (172.17.0.1)  1.521 ms  0.036 ms  0.005 ms  
 2  10.0.3.2 (10.0.3.2)  4.648 ms  4.332 ms  4.111 ms  
 3  192.168.41.209 (192.168.41.209)  6.711 ms  5.909 ms  6.974 ms  
 4  * * *  
 5  10.64.171.14 (10.64.171.14)  50.582 ms  50.122 ms  58.543 ms  
 6  5.44.32.28 (5.44.32.28)  58.479 ms  53.900 ms  53.146 ms  
 7  109.235.192.177 (109.235.192.177)  48.922 ms  47.085 ms  46.640 ms  
 8  10.240.3.34 (10.240.3.34)  46.216 ms  45.964 ms  45.711 ms  
 9  msk-ix-gw3.google.com (195.208.208.250)  97.112 ms  95.363 ms  100.593 ms  
10  108.170.250.66 (108.170.250.66)  83.601 ms  83.332 ms  77.495 ms  
11  142.250.238.214 (142.250.238.214)  94.441 ms  94.365 ms  95.123 ms  
12  142.250.235.74 (142.250.235.74)  91.533 ms  91.475 ms  88.475 ms  
13  172.253.64.57 (172.253.64.57)  93.278 ms  152.070 ms  151.971 ms  
14  * * *  
15  * * *  
16  * * *  
17  * * *  
18  * * *  
19  * * *  
20  * * *  
21  * * *  
22  * * *  
23  lu-in-f113.1e100.net (74.125.131.113)  96.734 ms  106.365 ms  98.579 ms  
root@linux-dc:/home/amil#
```

command /usr/sbin/ip route

Checking for server:

```
amil@linux-dc:~$ /usr/sbin/ip route
default via 10.0.3.2 dev enp0s8 proto dhcp src 10.0.3.15 metric 100
10.0.3.0/24 dev enp0s8 proto kernel scope link src 10.0.3.15 metric 100
10.0.3.2 dev enp0s8 proto dhcp scope link src 10.0.3.15 metric 100
172.16.0.0/22 dev enp0s3 proto kernel scope link src 172.16.0.40
172.17.0.0/16 dev docker0 proto kernel scope link src 172.17.0.1
192.168.1.0/24 dev br-30665f170266 proto kernel scope link src 192.168.1.1 linkdown
192.168.41.0/24 dev br-f815280d292f proto kernel scope link src 192.168.41.1
192.168.41.209 via 10.0.3.2 dev enp0s8 proto dhcp src 10.0.3.15 metric 100
amil@linux-dc:~$ █
```

## Realization of the network disconnection process:

```
root@linux-dc:/home/amil# docker network disconnect network02 b796b81a8939
root@linux-dc:/home/amil# docker exec b796b81a8939 /usr/sbin/ip route
default via 172.17.0.1 dev eth0
172.17.0.0/16 dev eth0 proto kernel scope link src 172.17.0.2
root@linux-dc:/home/amil#
```



**CODE FOR FUTURE**



**Thank You**