

# **Corporate Network**

**Environment Setup up (Ubuntu host machine,  
GNS3, Appliances (OVS, Cisco, Linux)**

**6<sup>th</sup> Semester Project**

**RAIMAL RAJA 2K23/BLCS/49**

**HAROON 2K23/BLCS/38**

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# Ubuntu: Set up host machine on hardware

We used Ubuntu Linux for best practice, because it is more familiar with GN3 appliance like open v switch (OVS), Routers,

## STEP – 1: Download Image (version 24.4.3 LTS)

Download Ubuntu distro ISO image from its official website, using link given below

<https://ubuntu.com/download/desktop>

## STEP - 2: make pen drive bootable

1. Download tool for booting USB (any latest version)  
Link: <https://rufus.ie/downloads/>
2. Take a 16GB portable pen drive and make it bootable  
Tutorial link: <https://youtu.be/gvm0blOBRCM>

## STEP – 3: Turn off secure boot

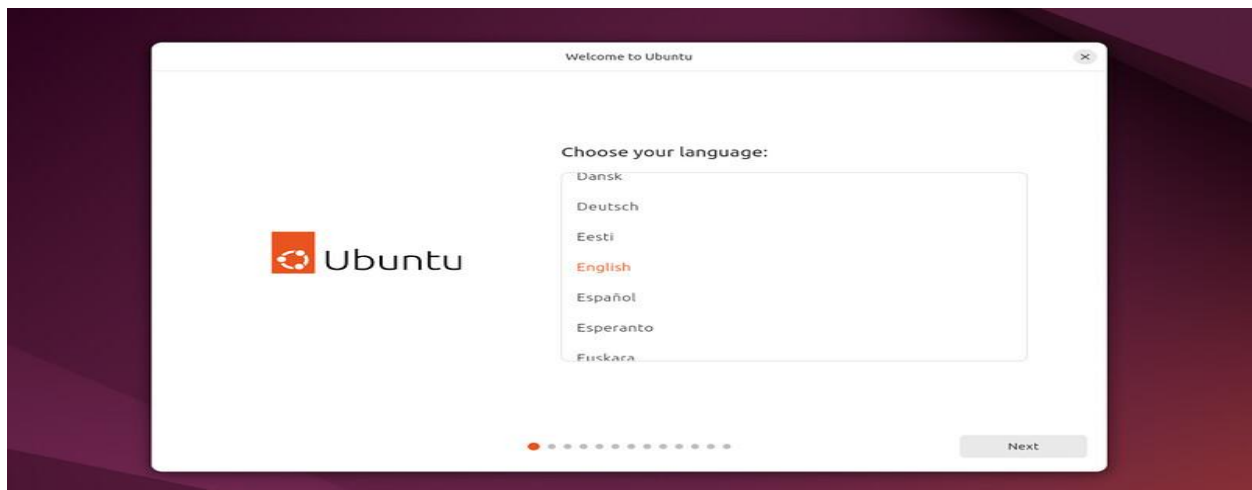
You may need to turn off Secure Boot while booting Linux primarily because some Linux distributions, custom kernels, or third-party drivers are not digitally signed with the keys recognized by your computer's firmware.

Search your device model on google check BIOS function key, then restart your machine and then press function key to get into bios and then turn off secure boot mode, and then start your machine again press boot, select bootable pen drive.

Further Steps for installation

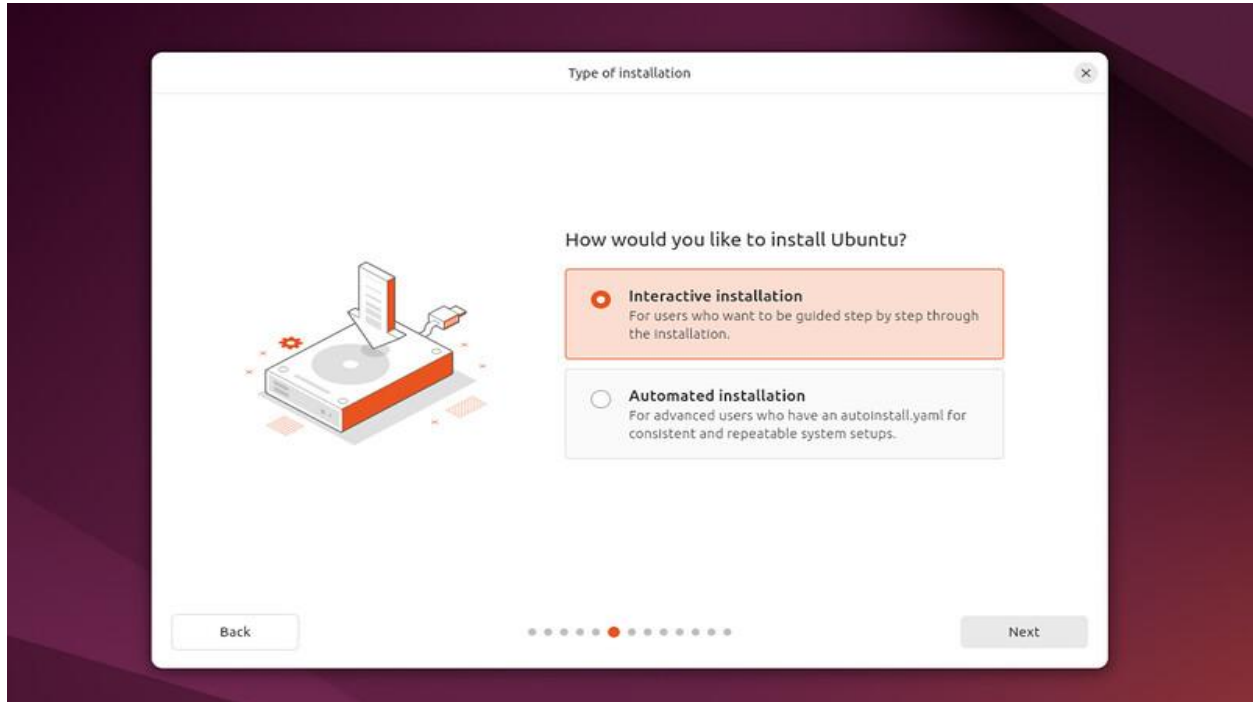
## Step – 4: Boot from USB flash drive

Select system language e.g. English

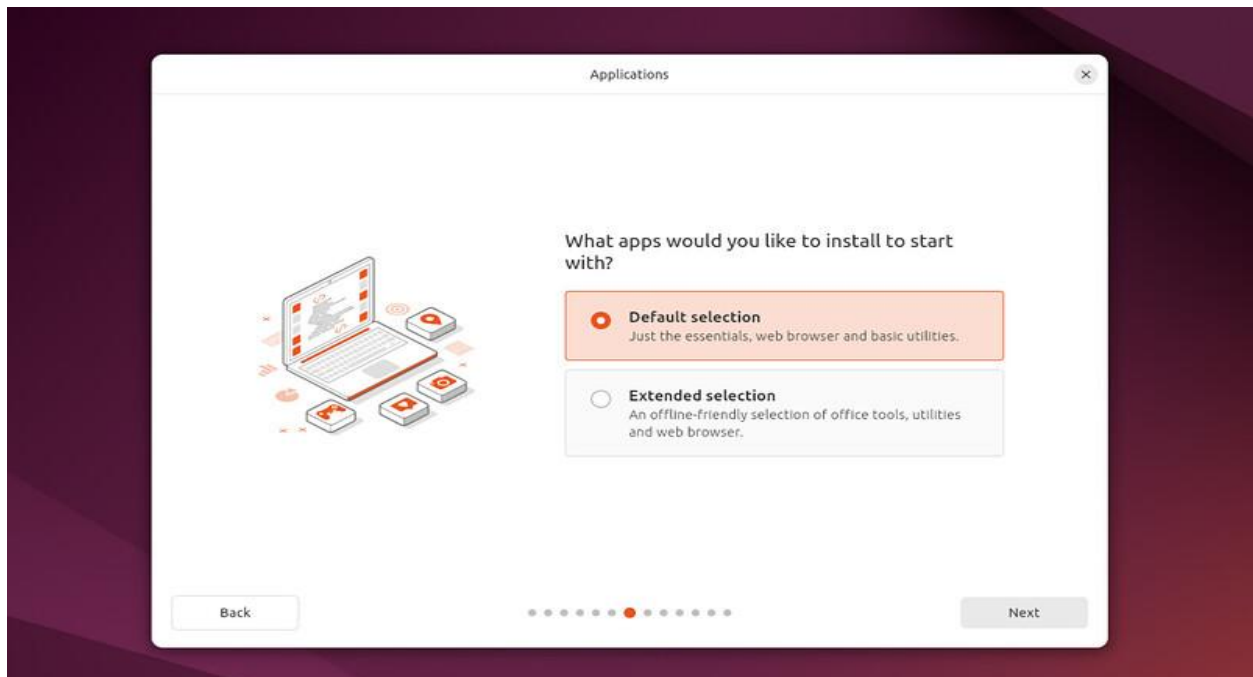


## Step – 5: Installation setup

Chose Interactive installation

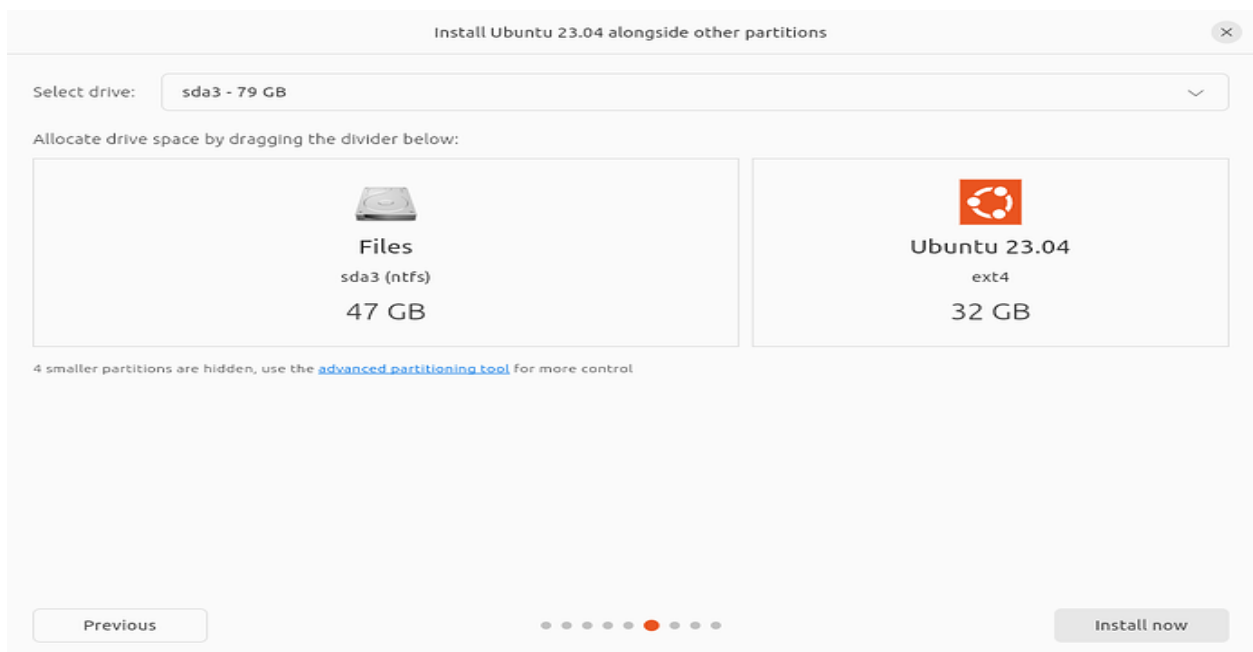
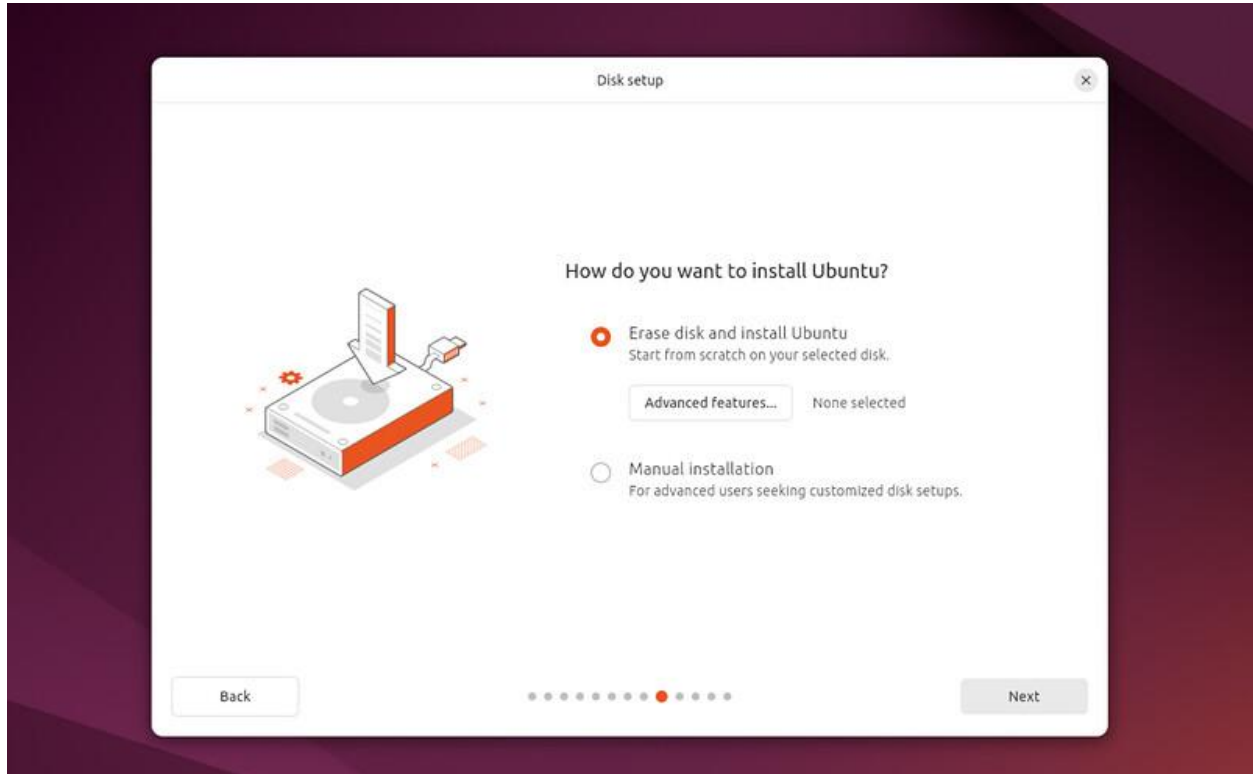


Go with default selection



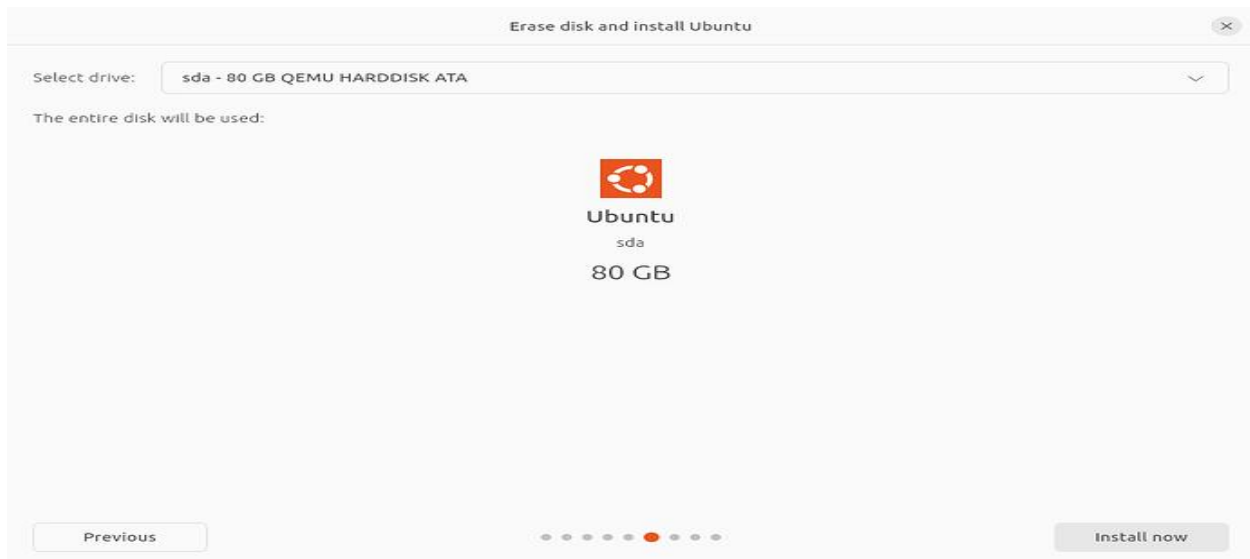
## Step – 6: Select disk partition

This screen allows you to configure your installation. If you would like Ubuntu to be the only operating system on your hard drive, select Erase disk and install Ubuntu.



## Erase disk and install Ubuntu

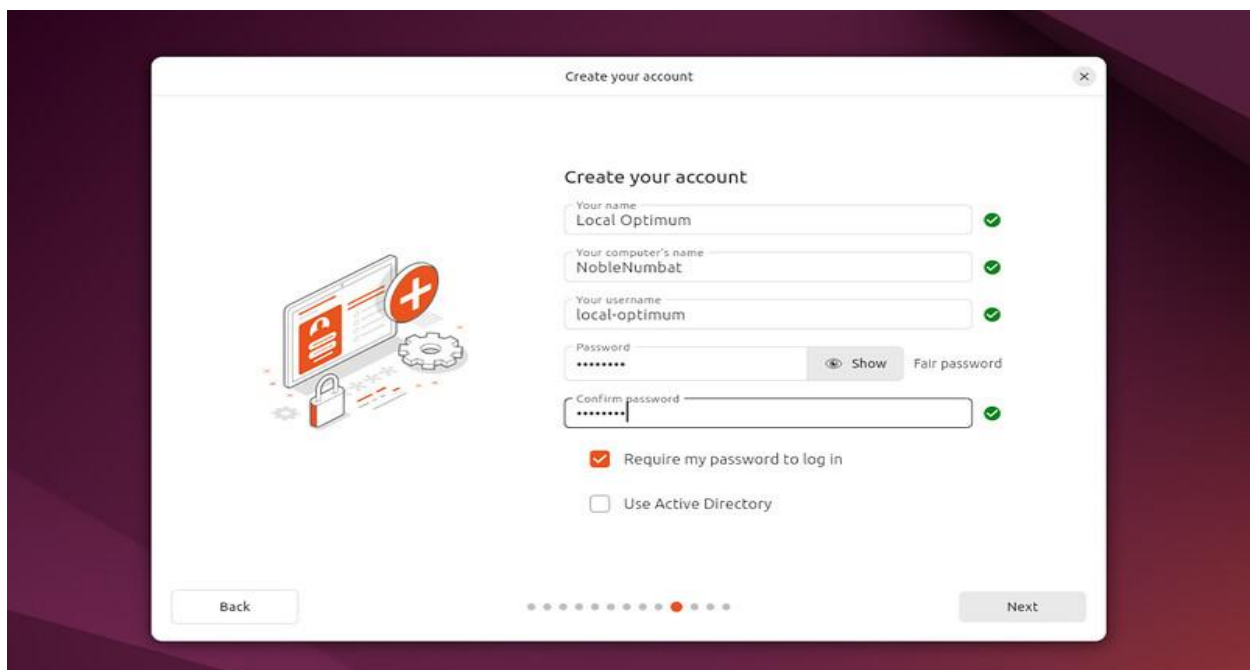
If you select this option Ubuntu will take up the entire disk space on the selected drive.



If your PC has multiple hard drives, then this option allows you to install Ubuntu alongside an existing OS as long as they each have their own drive. Take care to ensure that you are selecting the right drive in this instance!

## Step – 7: Create Your Login Details

On this screen, you will be prompted to enter your name and the name of your computer as it will appear on the network. Finally, you will create a username and a strong password.



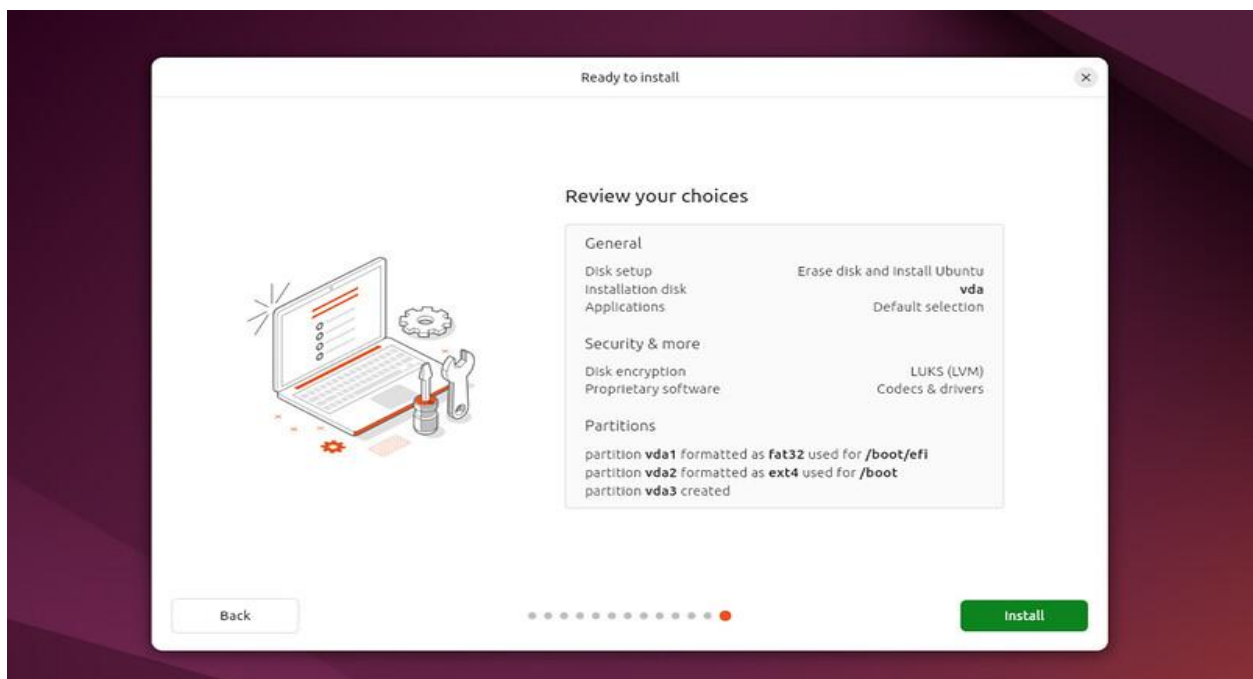
## Step – 8: Choose your Location

Select your location and time zone from the map screen and click Continue. This information will be detected automatically if you are connected to the internet



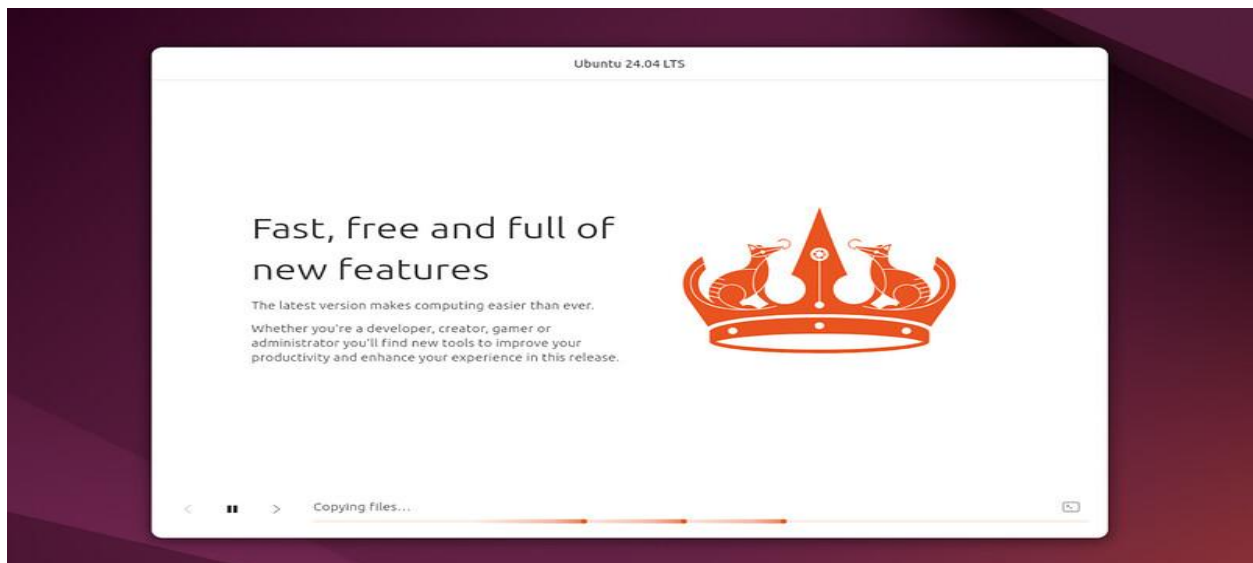
## Step – 9: Ready to install

Clicking Next will take you to a summary of your installation configuration to give you a chance to confirm your setup before clicking Install.



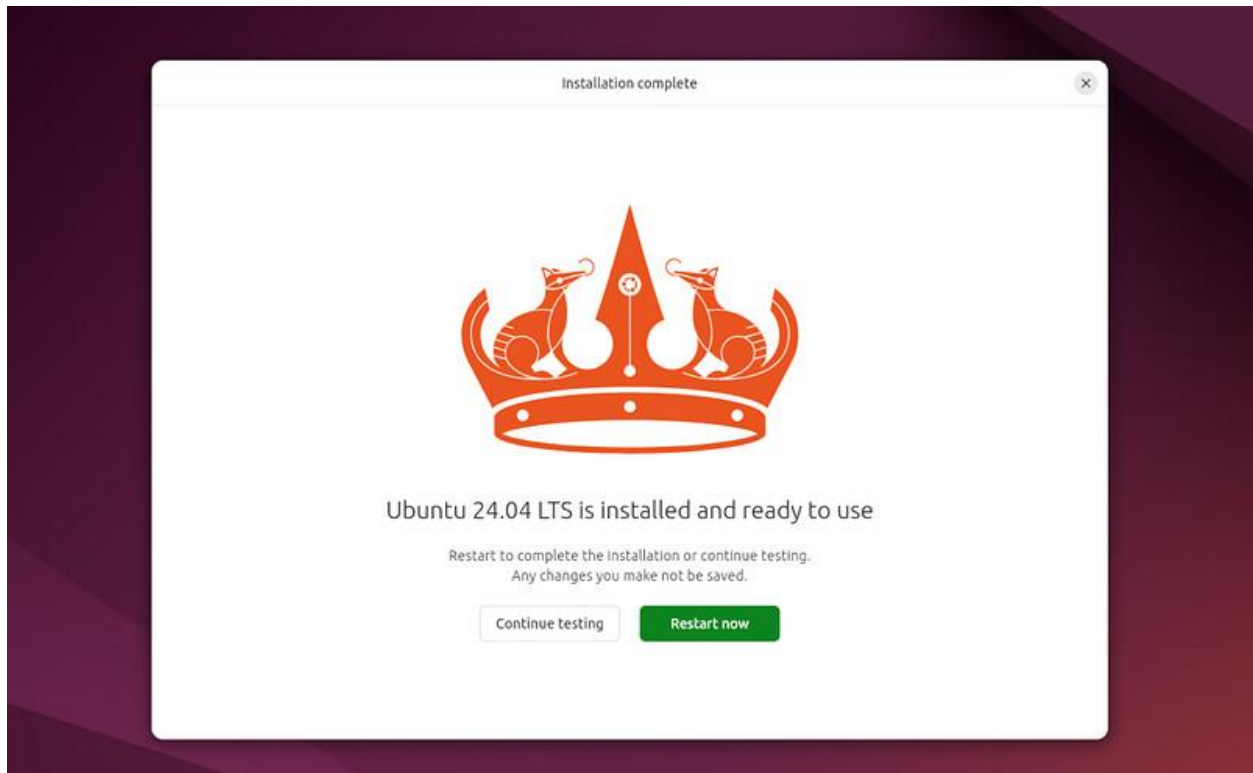
## Step – 10: Complete the Installation

Sit back and enjoy the slideshow as Ubuntu installs in the background.



Once the installation has completed, you will be prompted to restart your machine.

Click **Restart Now**.





## Step – 11: Don't forget to Update

Open terminal and then run these two commands one by one to update and upgrade ubuntu

1 - *sudo apt update*

2 - *sudo apt upgrade*

Here you have completed your setting up your host machine for GNS3 and GN3 VM

# Install GNS and GNS VM on host operating system

What is GNS3?

A free, open-source software tool that allows users to design, emulate, and simulate computer networks in a virtual environment. The software that empowers network professionals.

## GNS3 installations

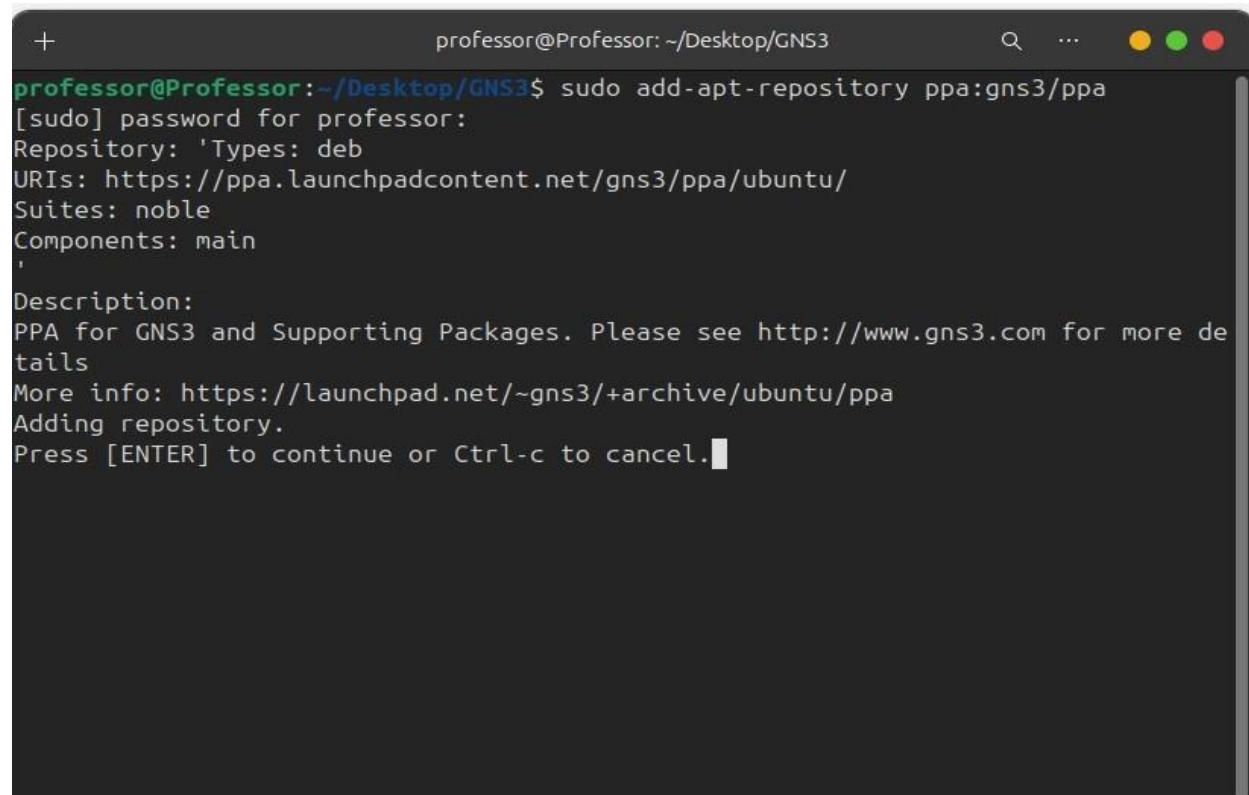
Step – 1 Download it from its official website, download Ubuntu Linux. latest version at this time Version 2.2.54, you must install same version to avoid unexpected issues and problems,

Link: <https://docs.gns3.com/docs/getting-started/installation/linux/>

This link will redirect you to gns3 installation commands, copy all commands one by one and paste it in terminal. Run only Ubuntu-based distributions (64-bit only) commands, do not run Debian based distros or other

Copy the command below, and hit ENTER, it will ask you to enter root password, enter it, and then hit ENTER

**Command – 1: `sudo add-apt-repository ppa:gns3/ppa`**

A terminal window titled 'professor@Professor: ~/Desktop/GNS3' showing the execution of the command 'sudo add-apt-repository ppa:gns3/ppa'. The terminal output includes the password prompt, repository details (Types: deb, URIs: https://ppa.launchpadcontent.net/gns3/ppa/ubuntu/, Suites: noble, Components: main), a description of the PPA for GNS3 and Supporting Packages, and a prompt to press [ENTER] to continue or Ctrl-c to cancel.

```
professor@Professor: ~/Desktop/GNS3$ sudo add-apt-repository ppa:gns3/ppa
[sudo] password for professor:
Repository: 'Types: deb
URIs: https://ppa.launchpadcontent.net/gns3/ppa/ubuntu/
Suites: noble
Components: main
'
Description:
PPA for GNS3 and Supporting Packages. Please see http://www.gns3.com for more de
tails
More info: https://launchpad.net/~gns3/+archive/ubuntu/ppa
Adding repository.
Press [ENTER] to continue or Ctrl-c to cancel.
```

After running this command, this will ask you again to continue this process. Say yes, hit ENTER (for yes)

Then run second command, to make sure everything is listed and working correctly.

#### Command – 2: **sudo apt update**

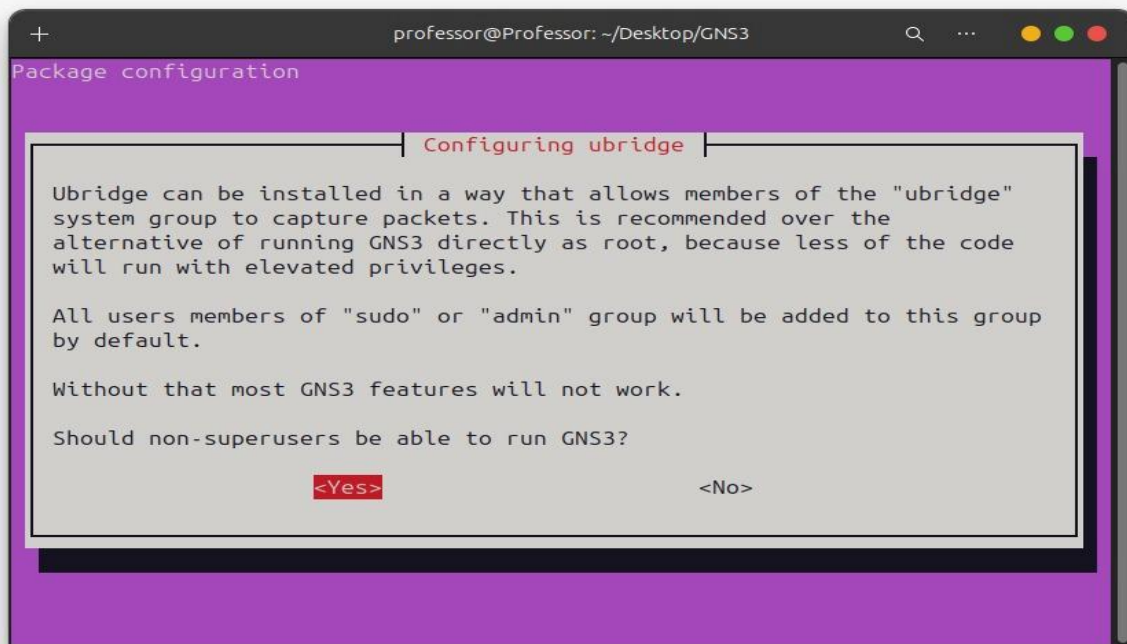
Then run third command to install GNS3 GUI, it's about 166MB, make sure you have additional 683MB, it will ask to prerequisites, enter 'Y' and hit ENTER.

#### Command – 3: **sudo apt install gns3-gui gns3-server**

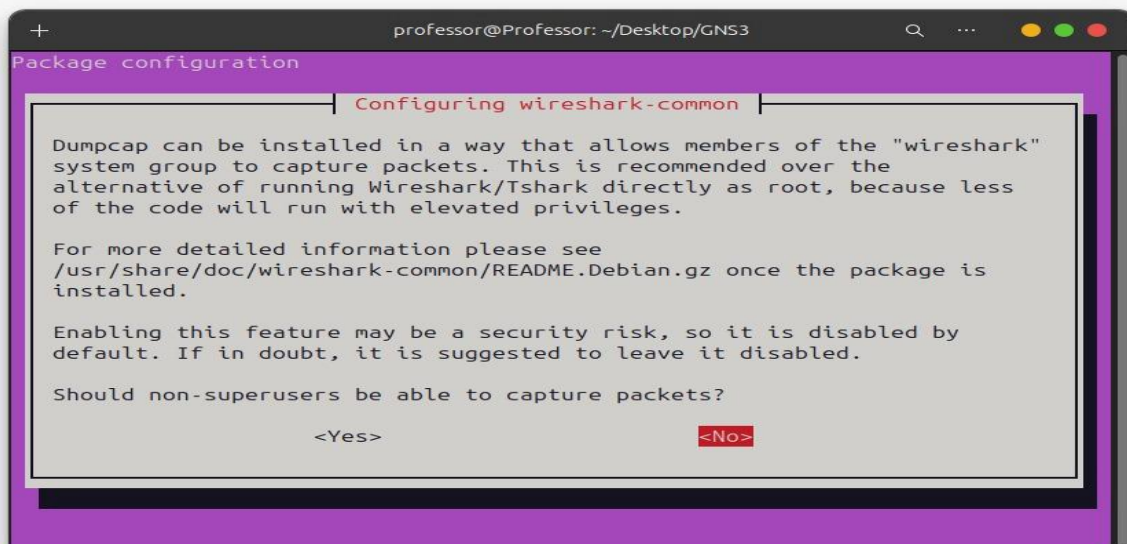
```
professor@Professor: ~/Desktop/GNS3
professor@Professor:~/Desktop/GNS3$ sudo apt install gns3-gui gns3-server
[sudo] password for professor:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libgit2-1.7 libhttp-parser2.9 libllvm17t64 libllvm19 libssh2-1t64
  libstd-rust-1.75 libstd-rust-dev
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  cpu-checker cpulimit dmeventd dynamips i965-va-driver intel-media-va-driver
  ipxe-qemu ipxe-qemu-256k-compatible-efi-roms libaacs0 libaio1t64 libavcodec60
  libavformat60 libavutil58 libb2-1 libbcg729-0 libbdplus0 libbluray2
  libboost-iostreams1.83.0 libboost-thread1.83.0 libcacard0 libchromaprint1
  libcjson1 libcodec2-1.2 libdavid7 libdaxctl1 libdevmapper-event1.02.1
  libdouble-conversion3 libfdt1 libgme0 libgsm1 libhwy1t64 libigdgmm12
  libiscsi7 libjack-jackd2-0 libjxl0.7 liblua5.2-0 liblvm2cmd2.03
  libmbedcrypto7t64 libmd4c0 libminizip1t64 libndctl6 libnhttp3-3 libnorm1t64
```

```
professor@Professor: ~/Desktop/GNS3
librdmacm1t64 librist4 libSDL2-2.0-0 libshine3 libslirp0 libsmi2t64
libsnappy1v5 libsodium23 libsoxr0 libspandsp2t64 libspice-server1
libsrt1.5-gnutls libssh-gcrypt-4 libsvtav1enc1d1 libswresample4 libswscale7
libtk8.6 libtpms0 libts0t64 libudfread0 liburing2 libusbredirparser1t64
libva-drm2 libva-x11-2 libva2 libvdpau1 libvirglrenderer1 libvirt-clients
libvirt-daemon libvirt-daemon-config-network libvirt-daemon-config-nwfilter
libvirt-daemon-driver-qemu libvirt-daemon-system
libvirt-daemon-system-systemd libvirt-l10n libvirt0 libvncclient1
libvncserver1 libvpl2 libwireshark-data libwireshark17t64 libwiretap14t64
libwsutil15t64 libx264-164 libx265-199 libxcb-xinerama0 libxcb-xinput0
libxvidcore4 libyajl2 libzmq5 libzvb-common libzvb10t64 lvm2 mdevctl
mesa-va-drivers mesa-vdpau-drivers msr-tools mtools ocl-icd-libopencl1 ovmf
python3-pyqt5 python3-pyqt5.qtsvg python3-pyqt5.qtwebsockets
python3-pyqt5.sip qemu-block-extra qemu-system-common qemu-system-data
qemu-system-gui qemu-system-modules-opengl qemu-system-modules-spice
qemu-system-x86 qemu-utils qt5-gtk-platformtheme qt6-gtk-platformtheme
qt6-qpa-plugins qt6-translations-l10n qt6-wayland qttranslations5-l10n
qwayland5 seabios swtpm swtpm-tools systemd-container
thin-provisioning-tools tk tk8.6 ubridge va-driver-all vdpau-driver-all vpcs
wireshark wireshark-common wmlctrl x11vnc xvfb
0 upgraded, 188 newly installed, 0 to remove and 1 not upgraded.
Need to get 51.7 MB/166 MB of archives.
After this operation, 683 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

After installing GNS3 from internet then a pop up will appear on your terminal window, it asks if non-superusers (like users in sudo or admin groups) should be able to run **GNS3** and **capture packets**. Choosing **Yes** is the **security-recommended option** because it prevents GNS3 from running with full root privileges.



Then another pop up will appear, keep default (no) but I will recommend you choose yes and hit ENTER. This asks if **non-superusers** should be able to run **Wireshark/Tshark** to **capture network packets** by adding them to the wireshark group.



You have installed GNS3 GUI successfully

**Note: do not open GNS3 GUI, install GNS3 VM first.**

## Install VMware workstation Pro:

Why VMware Workstation Pro?

The GNS3 GUI is a lightweight tool for design. The GNS3 VM is a powerful server needed to run complex, resource-intensive virtual devices (like modern Cisco images) efficiently and stably using technologies like KVM. And for installation and to setup up GNS3 VM, we need virtual environments /hypervisor. In this case I am using VMware Workstation Pro 25H2.

Download it from its official website

Link: <https://www.vmware.com/products/desktop-hypervisor/workstation-and-fusion>

Rename this file as VMwarePro.double. (VMware image file you have downloaded)

Here are steps to install Ubuntu after downloading successfully,

## Step – 1: open terminal in the root directory where VMware Workstation Pro .double file exists. Run these two commands

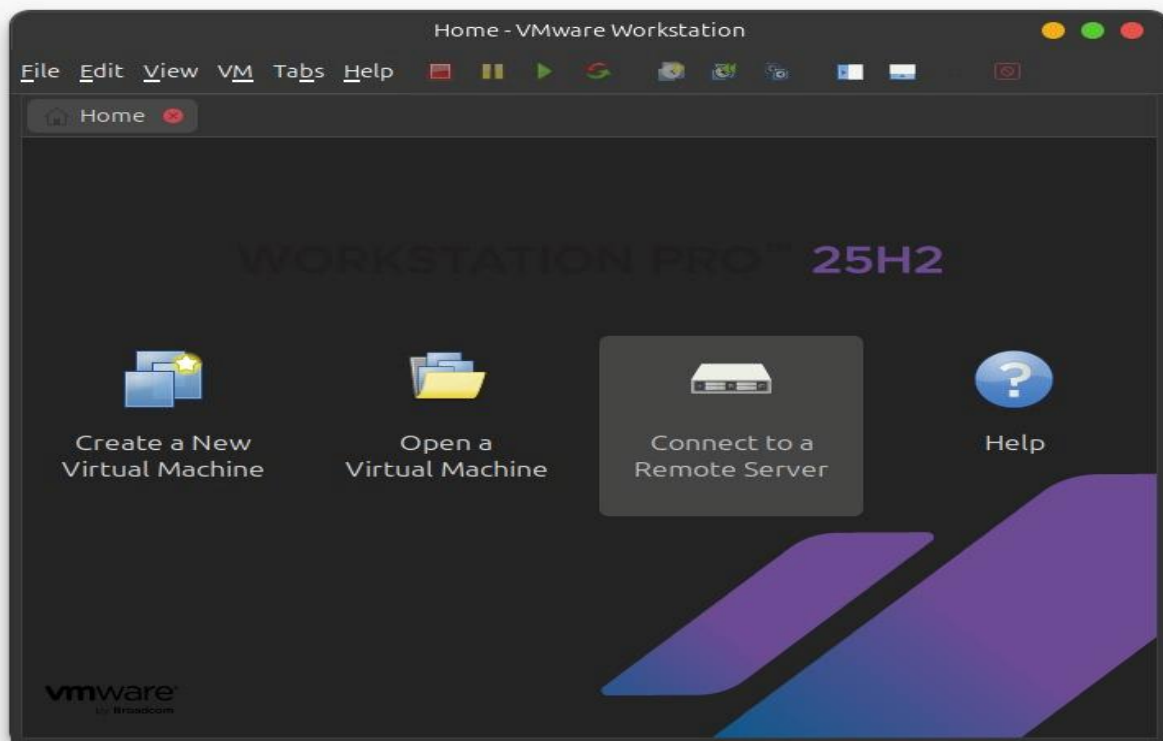
Run this command to make script executable binary

**Command – 1: `chmod +x VMwarePro.double`**

Then command below to install

**Command – 2: `sudo ./VmwarePro.double`**

VMware Workstation Pro installed successfully. Restart your machine and continuously press F1, then find VTx or Virtualizations, press ENTER and enable it. And then start machine normally.





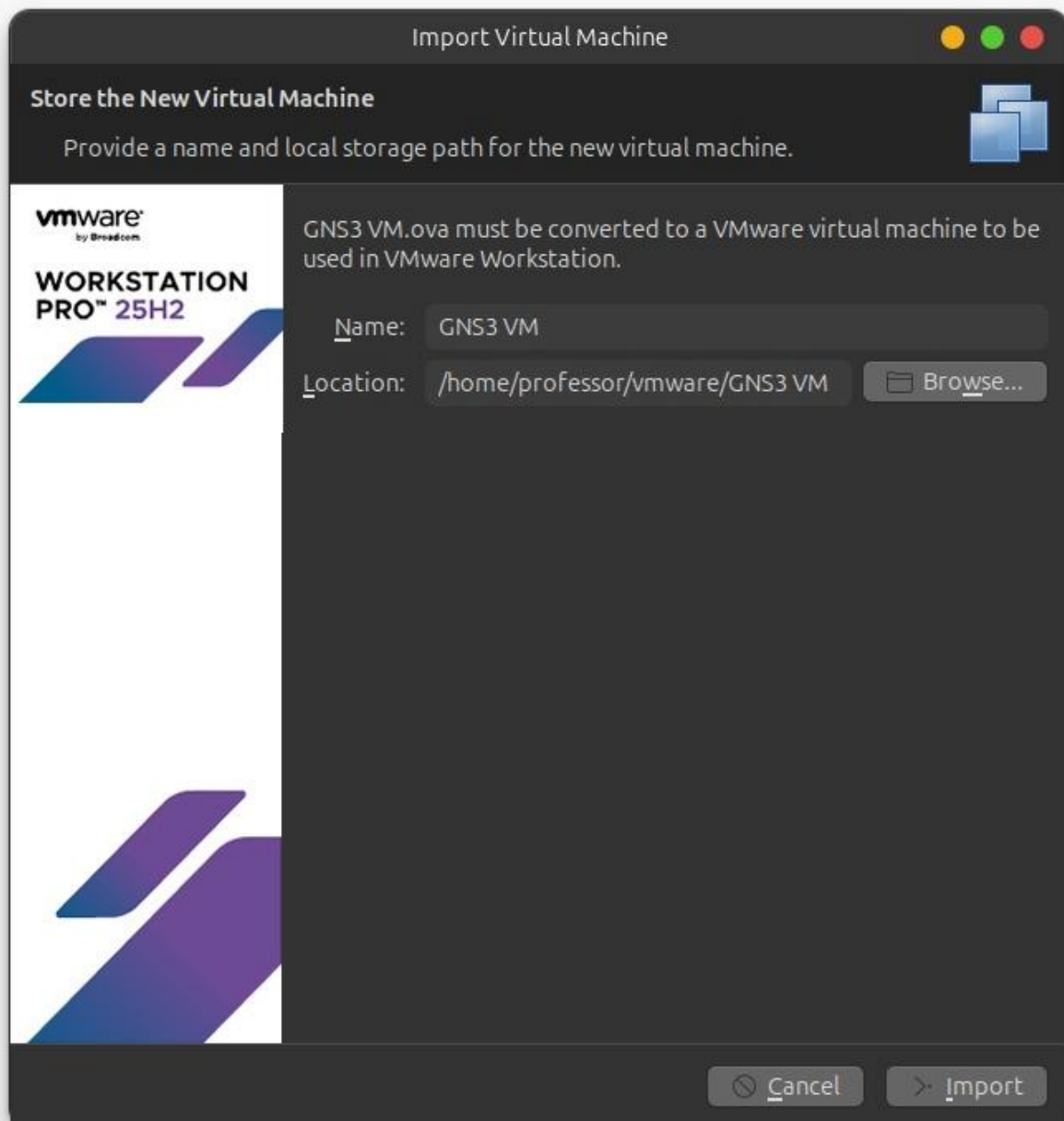
## GNS3 VM

### Step – 2: Download GNS3 VM from its official website

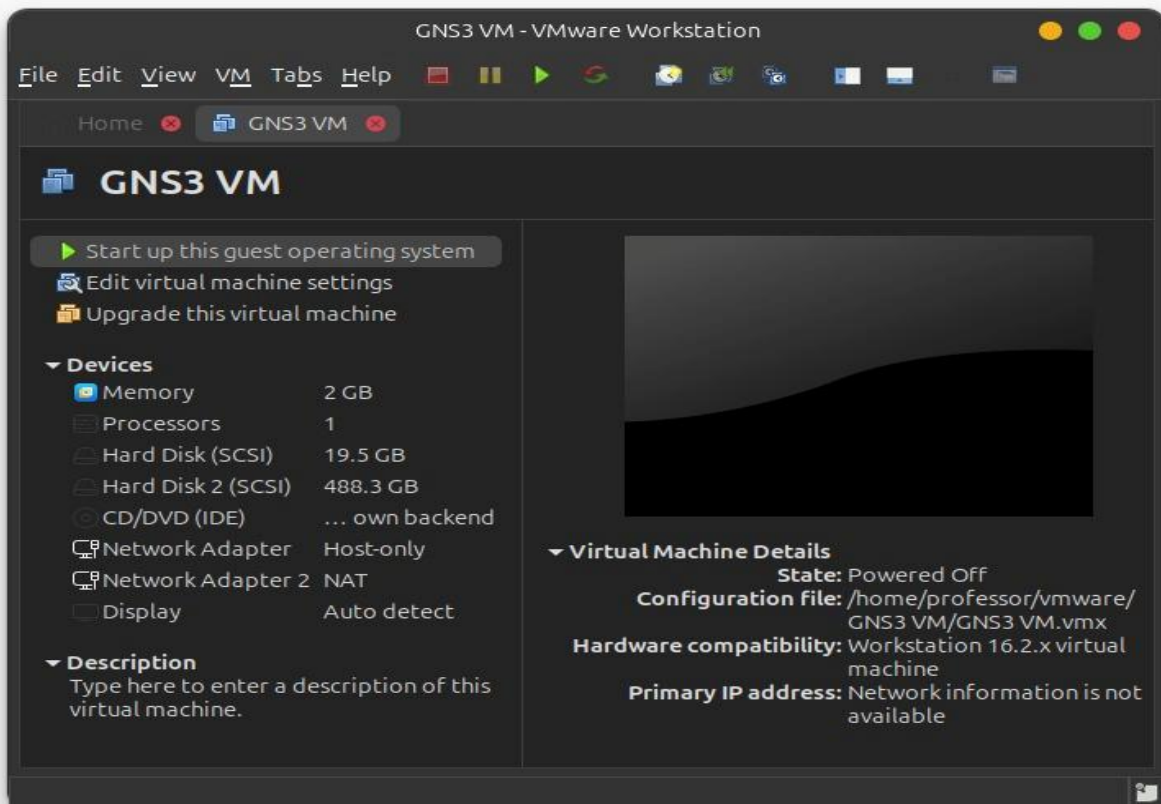
Link: <https://gns3.com/software/download-vm>

When you download GNS3 VM successfully, open VMware Workstation Pro 25H2, if you haven't opened.

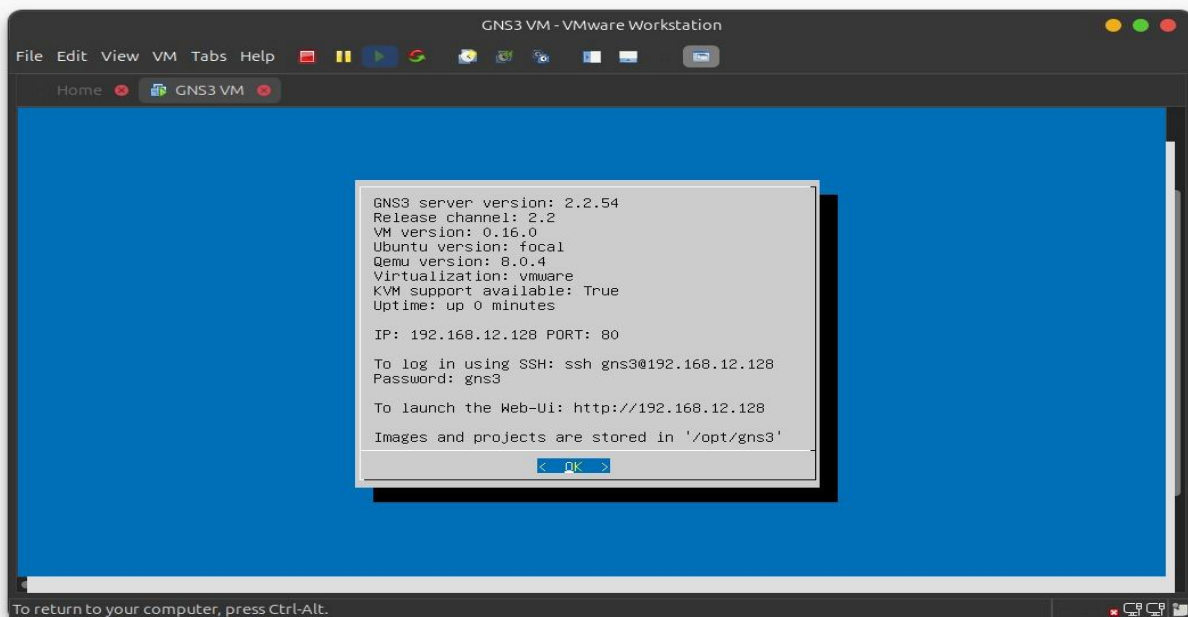
Click on **File** tab on left top corner, File>Open, Then Select GNS VM, and import it



After importing, VMware will look like this on click 'Start up the guest operating system' and run the virtual machine

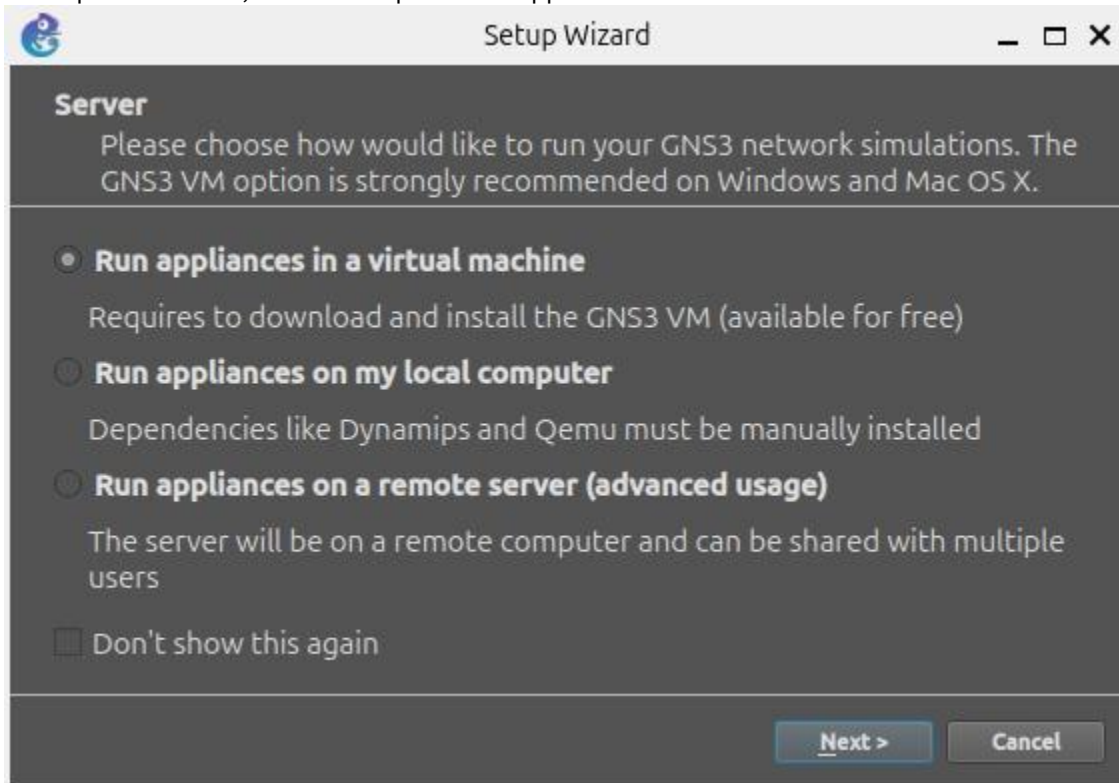


GNS3 VM is successfully configured

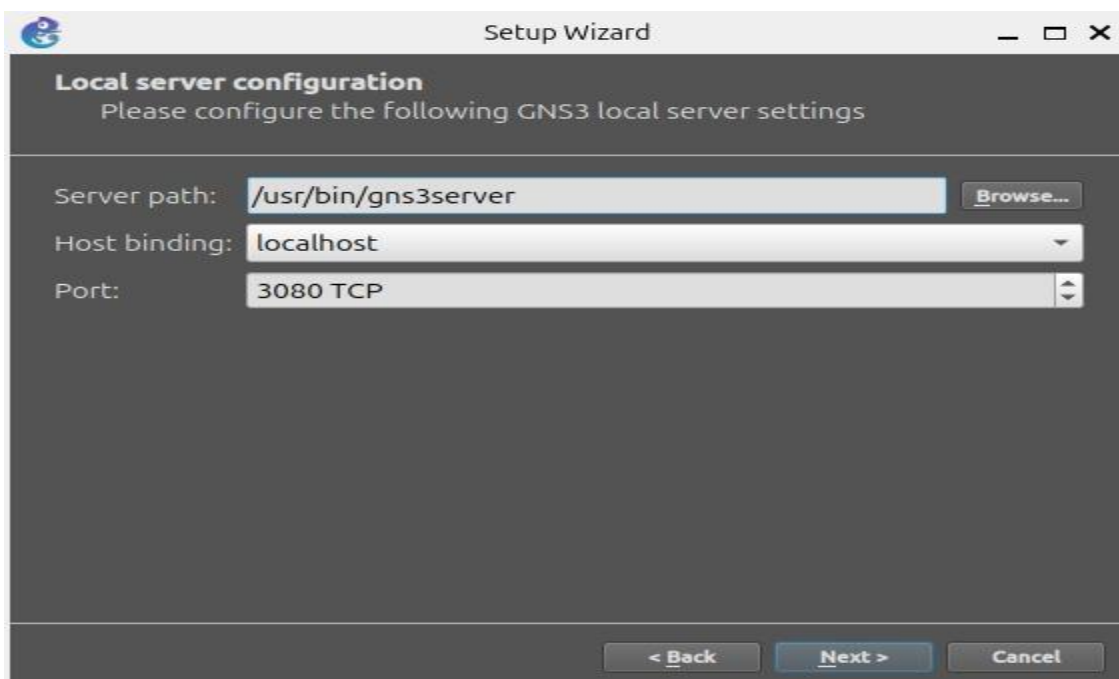


## Step – 3: connect both GNS3 GUI and GNS3 VM

Now open GNS3 GUI, select first option 'Run appliances in a virtual machine'

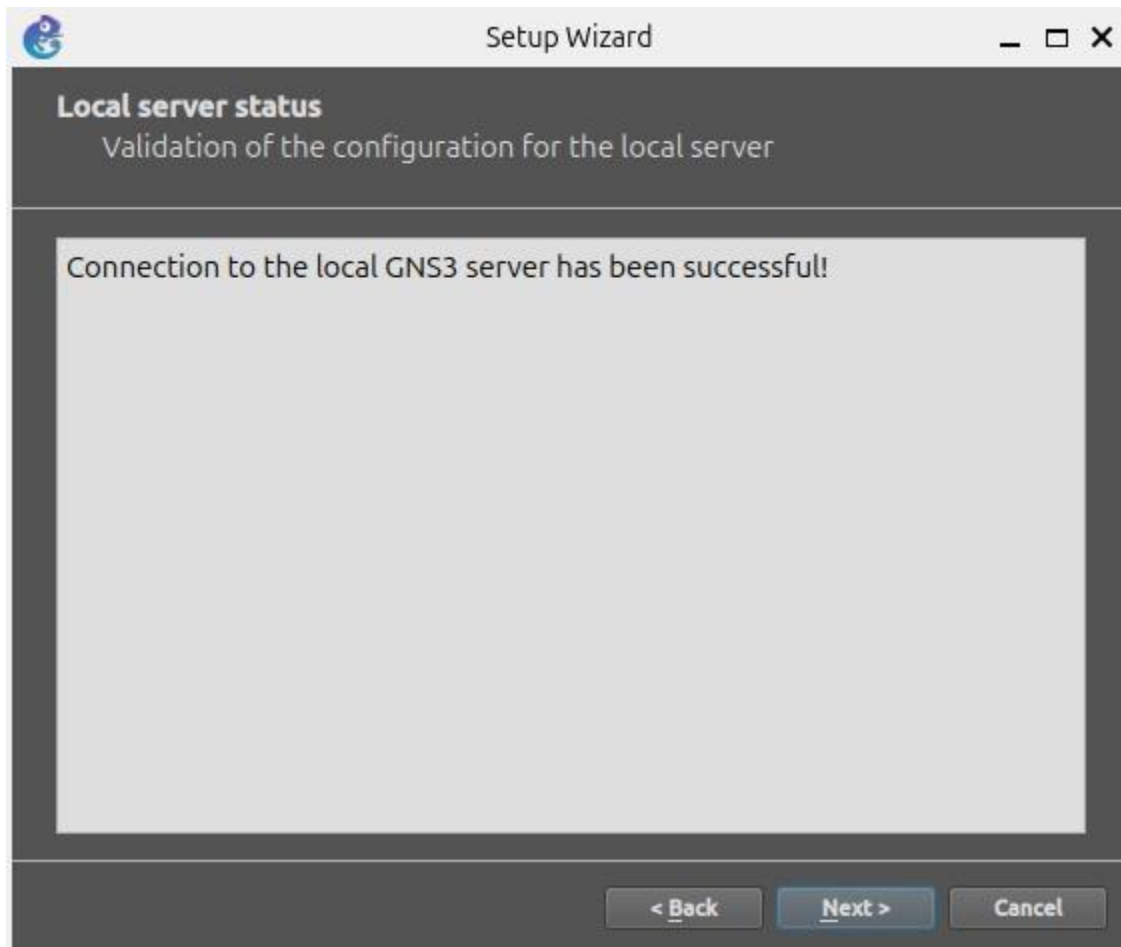


Keep it as default, press Next





It shows successful message.



If you are having few further steps on your machine, then keep them default press 'Next' and finish it.

## Final Step (Optional Step. it wouldn't affect your project if you skip this)

Now final step is to finish environments setup. Multi-session managers like Solor-PuTTY, Solar-PuTTY is basically a **multi-session SSH/Telnet manager**, a popular **terminal emulator** (like PuTTY) that GNS3 uses by default on **Windows**, *not Ubuntu*. It helps you **console** into virtual network devices, but you can install alternative like terminator or remmina. Installing terminator is much easier than remmina

Open terminal and run these two commands

Command – 1: `sudo apt update && sudo apt upgrade -y`

Command – 2: `sudo apt install terminator -y`

Now do some changes in GNS3 Gui, open GN3 Gui and make sure GN3 VM must be running.

**GNS3** → **Preferences** → **General** → **Console** > click on edit > choose **Terminator**. Save the changes, you are done!

## Appliances: Installing appliances on GNS3 (OVS, Cisco Routers)

### 1 - Open vSwitch

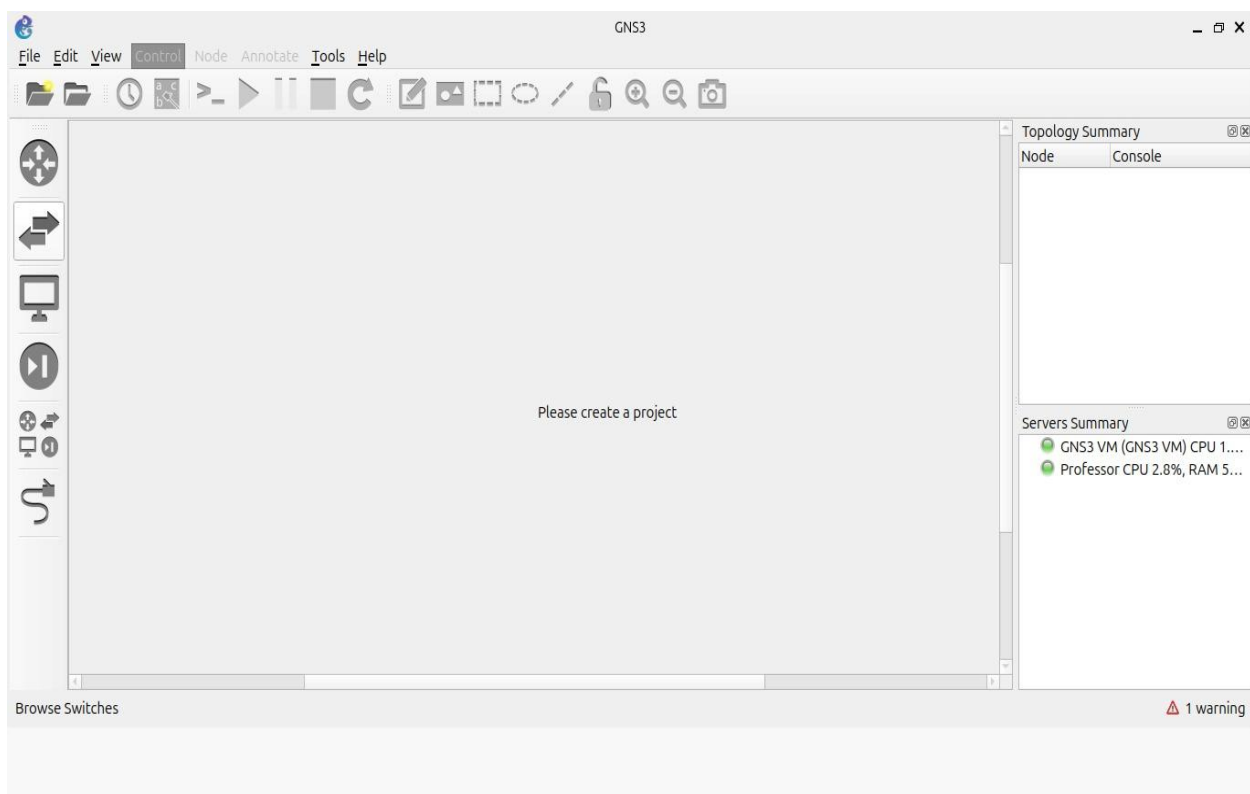
Open vSwitch (OVS) is a specialized switch, you can configure it as a Router. It is an open-source, multilayer virtual switch that enables network automation, monitoring, and management across virtualized environments and physical networks.

### How to install GN3VM?

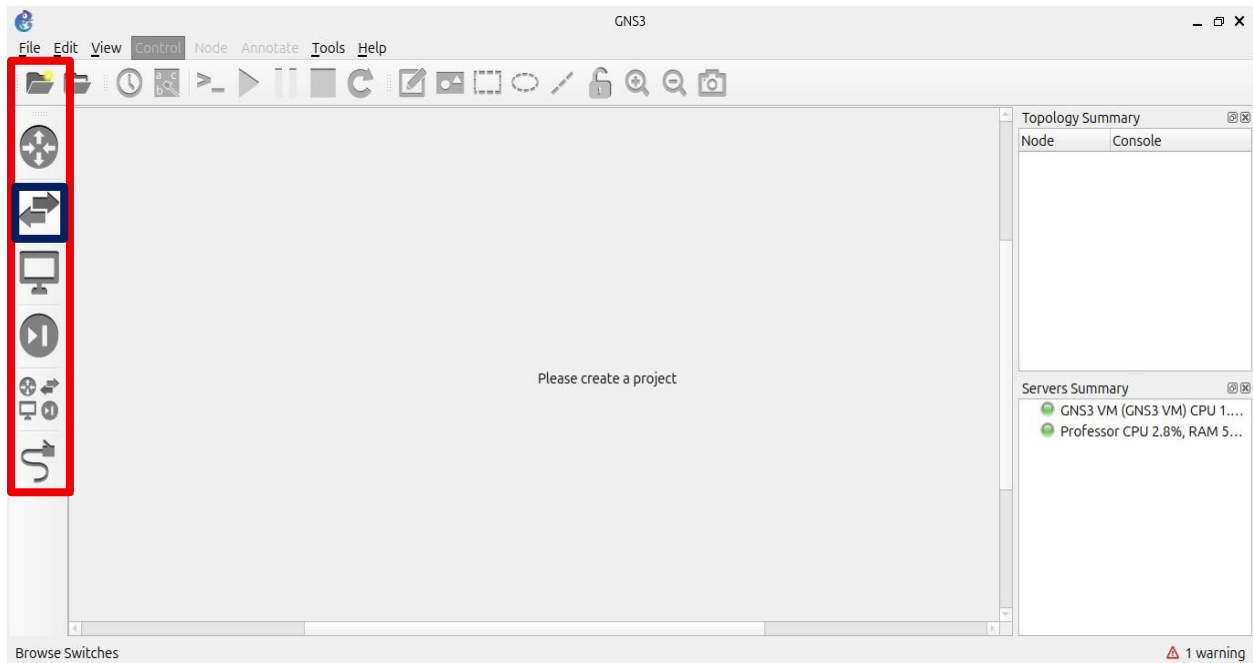
Open your GNS3 GUI the VM will automatically started if you have configured it correctly as guided

Open GN3 GUI > inside on the left side icons column click on **Browse Switches** > **New Template** select first option “Install an appliance from the GNS3 server (recommended)” > **switches** > **Open vSwitch** > Select first option “install the appliance on the GNS3 VM (recommended)” > FINISHED

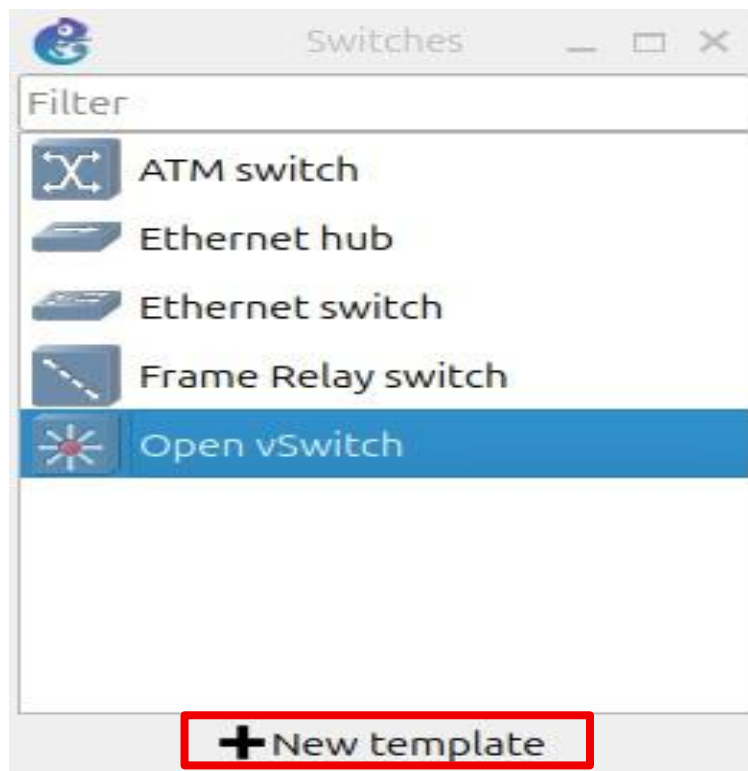
### Step – 1: Open GNS3 GUI



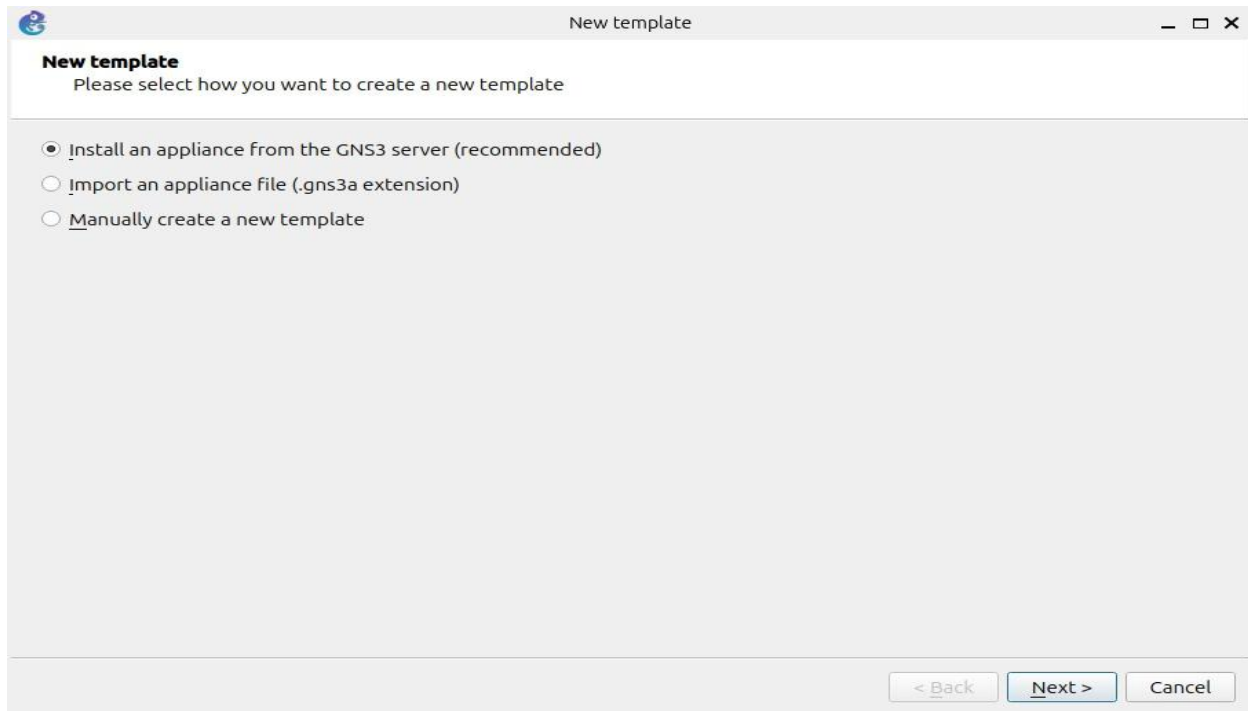
## Step – 2: Browse Switches



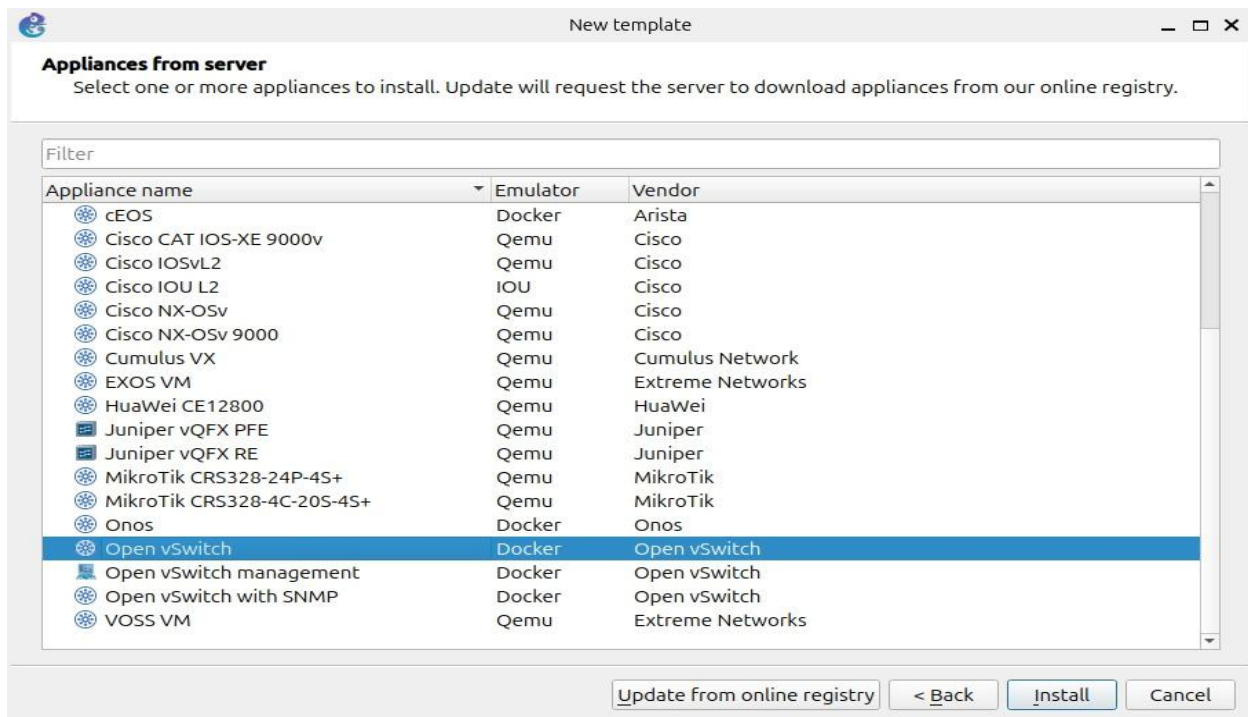
## Step – 3: New Templates



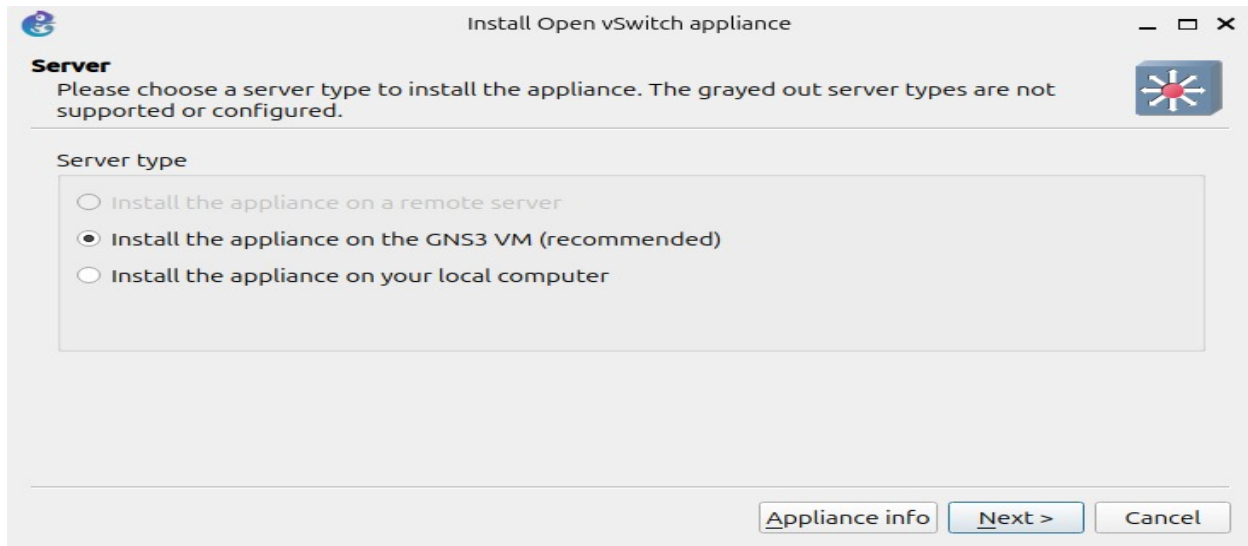
## Step – 4: Install an appliance from the GNS3 server (recommended)



## Step – 5: Switches > Open vSwitch



## Step 6: Final step, installing it in VM



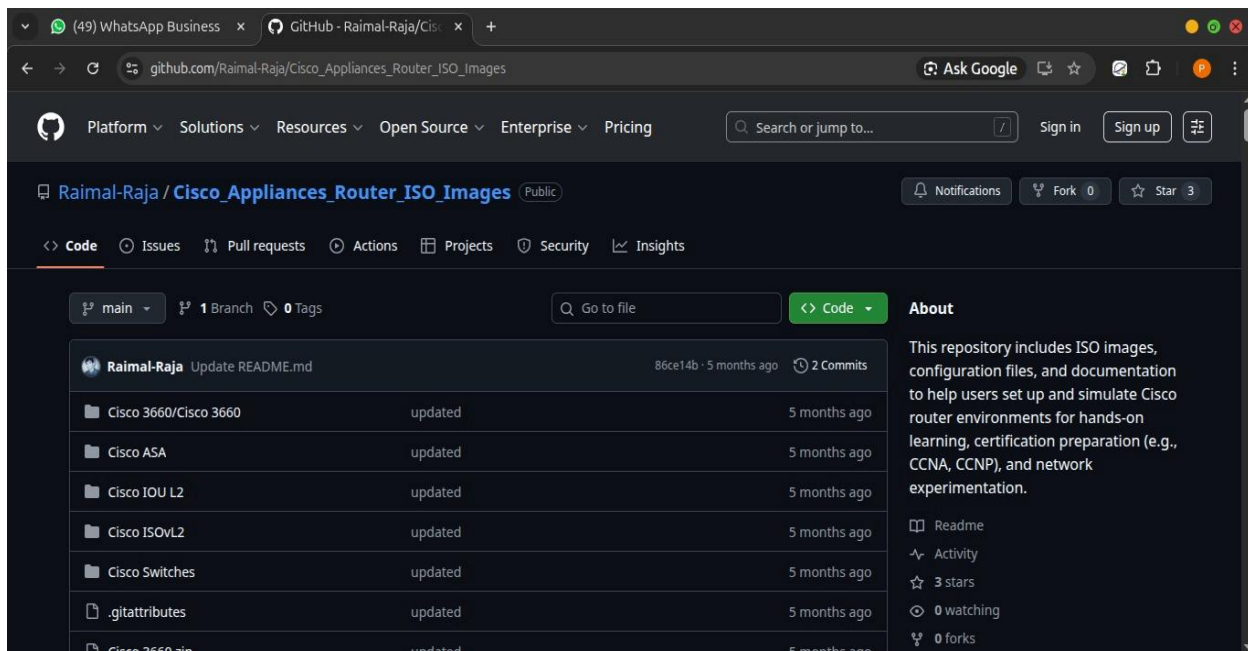
## 2 – Cisco Router

Cisco Routers have variety of models; we are not going to use cisco router in project but if you want to test it you can download, import and install it same way.

In GN3, when you must work with Cisco Routers, you need to buy virtual routers from Cisco Appliance Official website and download it's ISO image and then need to import in GNS3 and select model of image and Router in GNS3.

You can download Cisco free appliances from my GitHub repository

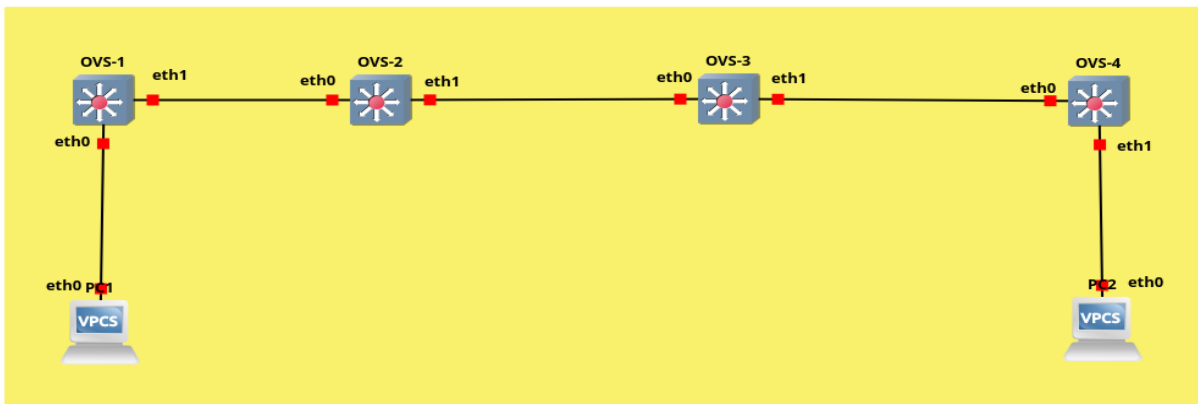
Link: [https://github.com/Raimal-Raja/Cisco\\_Appliances\\_Router\\_ISO\\_Images](https://github.com/Raimal-Raja/Cisco_Appliances_Router_ISO_Images)



# Project: Create Topology (OVS + VPCs), Configure and Implement Static Routing

## Create Topology (devices: 4 OVS and VPCs)

Open GNS3 GUI, create new project file and drag 4 open vswitches, and 2 vpcs, connect it in series (bus topology)



## IP Table

Device	Interface	IP Address	Subnet
VPC1	eth0	10.0.1.2/24	10.0.1.0/24
OVS1	eth0	10.0.1.1/24	10.0.1.0/24
OVS1	eth1	10.0.2.1/24	10.0.2.0/24
OVS2	eth0	10.0.2.2/24	10.0.2.0/24
OVS2	eth1	10.0.3.1/24	10.0.3.0/24
OVS3	eth0	10.0.3.2/24	10.0.3.0/24
OVS3	eth1	10.0.4.1/24	10.0.4.0/24
OVS4	eth0	10.0.4.2/24	10.0.4.0/24
OVS4	eth1	10.0.5.1/24	10.0.5.0/24
VPC2	eth0	10.0.5.2/24	10.0.5.0/24

## Configure and Implement Static Routing

Step – 1: Firstly, clean and clear all the running services, routing, remove bridges.

### Step 1: Clean Configuration on ALL OVS Devices

Run these commands on **OVS1, OVS2, OVS3, and OVS4**:

```
bash

# Stop services
rc-service networking stop 2>/dev/null

# Remove all existing bridges
for br in $(ovs-vsctl list-br); do
    ovs-vsctl del-br $br
done

# Clear all IP addresses from interfaces
ip addr flush dev eth0
ip addr flush dev eth1

# Enable IP forwarding
echo 1 > /proc/sys/net/ipv4/ip_forward
sysctl -w net.ipv4.ip_forward=1

# Make IP forwarding persistent
echo "net.ipv4.ip_forward=1" >> /etc/sysctl.conf
```

Step – 2: Configure all OVS using these commands (example; configure OVS1)

```
# Configure IP addresses
ip addr add 10.0.1.1/24 dev eth0
ip addr add 10.0.2.1/24 dev eth1

# Bring interfaces up
ip link set eth0 up
ip link set eth1 up

# Add static routes
ip route add 10.0.3.0/24 via 10.0.2.2
ip route add 10.0.4.0/24 via 10.0.2.2
ip route add 10.0.5.0/24 via 10.0.2.2

# Verify
ip addr show
ip route show
```

### Step – 3: Configure VPCs (e.g. configure vpc1)

```
bash
ip 10.0.5.2/24 10.0.5.1
save
```

### Step – 4: Testing from VPCs

#### From VPC1:

```
bash

# Test connectivity to all devices
ping 10.0.1.1 -c 4      # OVS1
ping 10.0.2.1 -c 4      # OVS1 eth1
ping 10.0.2.2 -c 4      # OVS2
ping 10.0.3.1 -c 4      # OVS2 eth1
ping 10.0.3.2 -c 4      # OVS3
ping 10.0.4.1 -c 4      # OVS3 eth1
ping 10.0.4.2 -c 4      # OVS4
ping 10.0.5.1 -c 4      # OVS4 eth1
ping 10.0.5.2 -c 4      # VPC2
```

#### From VPC2:

```
bash

# Test connectivity back to VPC1
ping 10.0.5.1 -c 4      # OVS4
ping 10.0.4.2 -c 4      # OVS4 eth0
ping 10.0.1.2 -c 4      # VPC1
```

### Step – 5: Verify routing on each OVS

```
# On any OVS device
ip route show
ip addr show

# Check forwarding
cat /proc/sys/net/ipv4/ip_forward # Should show 1
```



## Step 2: Download and Setup the Application

```
bash
```

```
# Create directory for the application
```

```
mkdir -p ~/gns3-acl-manager
```

```
cd ~/gns3-acl-manager
```

```
# Save the Python script
```

```
nano gns3_acl_manager.py
```

(Paste python code here)

```
# Make it executable
```

```
chmod +x gns3_acl_manager.py
```