THE UNIVERSITY OF DODOMA



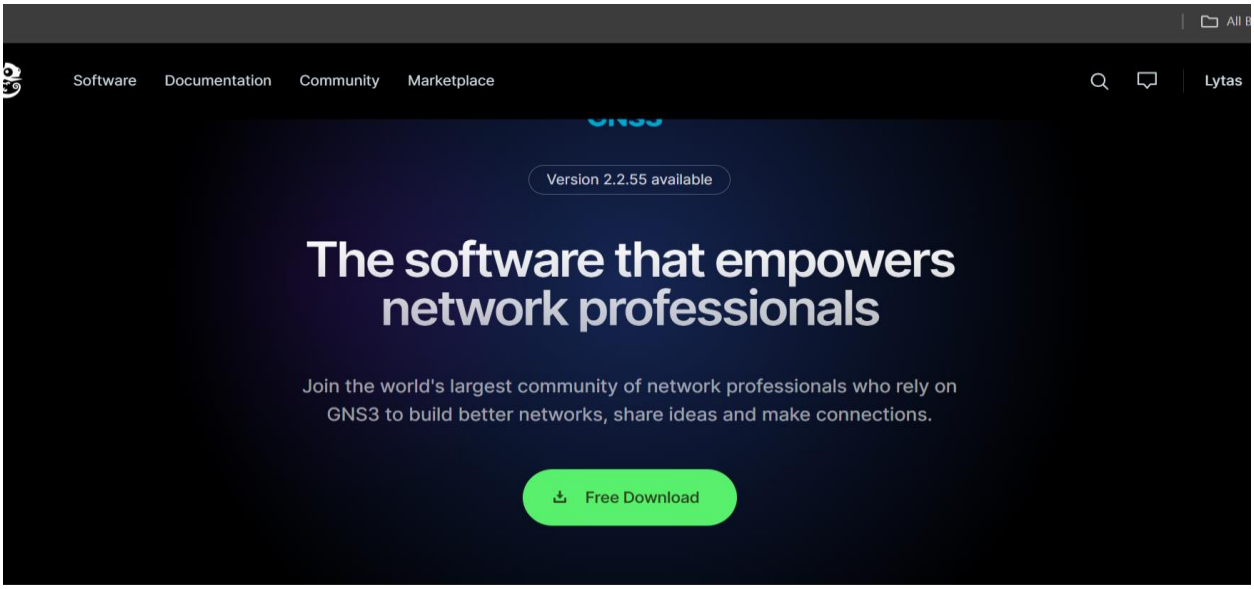
COLLEGE OF INFORMATICS AND VIRTUAL EDUCATION(CIVE)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(CSE)
COURSE NAME: SOFTWARE DEFINED NETWORKS: CG 311

SN	NAMES	REGISTRATION NUMBER	PROGRAMME
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3.	EVES VITUS SYLVESTER	T23-03-11142	BSC. CNISE

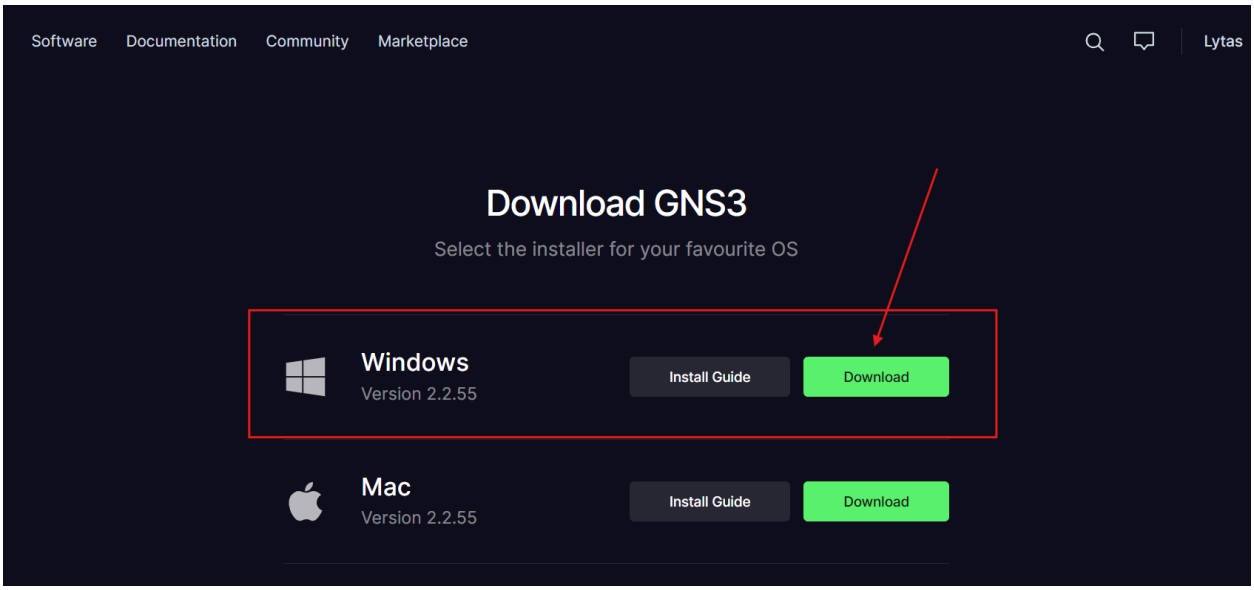
Part 1: Detailed Step-by-Step GNS3 Installation Guide

Step 1: Download GNS3 GUI

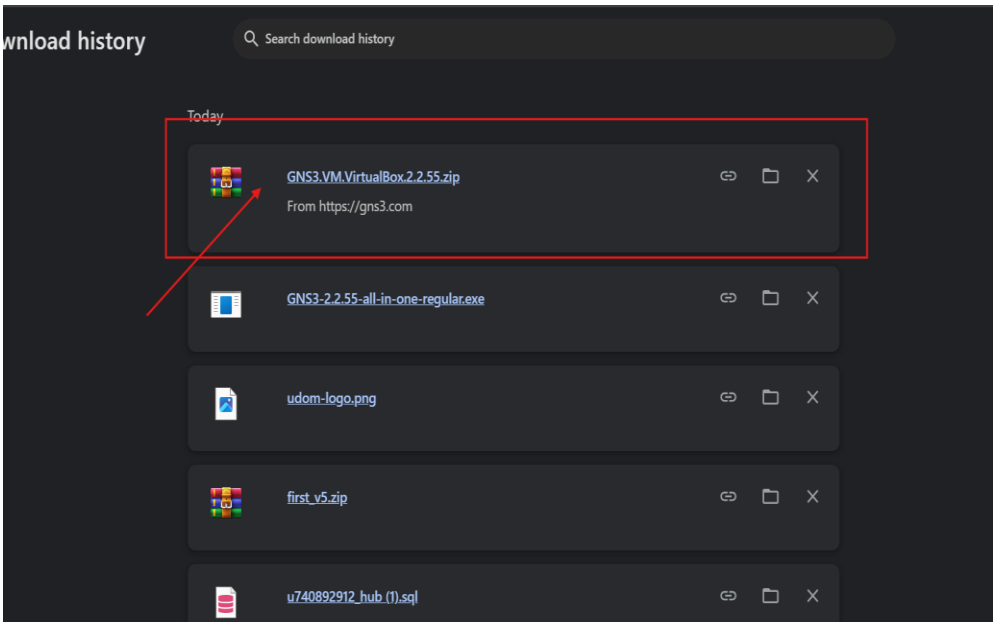
1. **Visit the GNS3 website:**
    i. Open your browser and go to: https://www.gns3.com/



2. **Go to the download section:**
    i. Click on the **Download** button in the top menu.
    ii. Or, go directly to: https://www.gns3.com/software/download

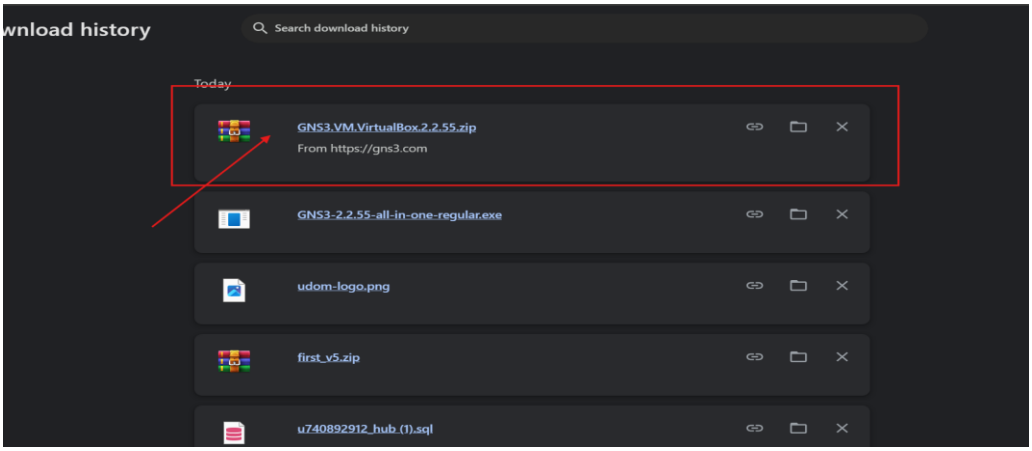


3. **Choose your operating system:**
    i. For Windows, click **"Download GNS3 for Windows"**.
4. **Select the installer:**
    i. Choose the **"All-in-one installer"** for beginners (includes all dependencies).
    ii. Save the installer to your **Downloads** folder.



Step 2: Download GNS3 VM

1. **Go to the VM download page:**
    i. Visit: https://www.gns3.com/software/download-vm
    ii. Download the GNS3 VM (.ova file).



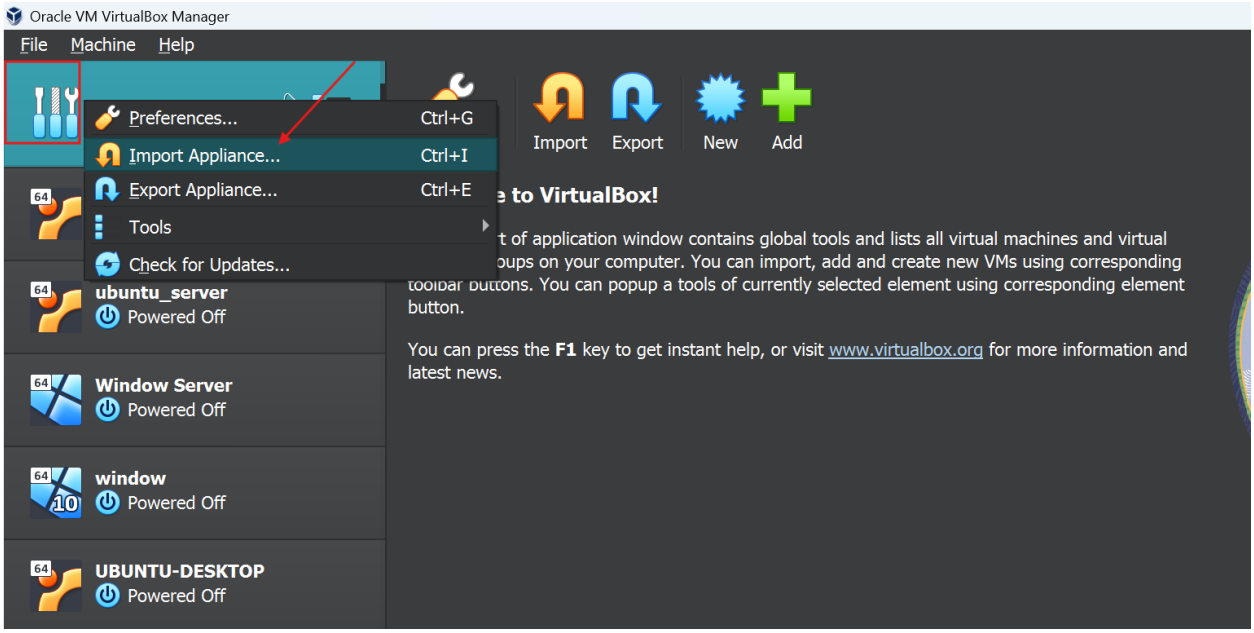
Step 3: Install Virtualization Software (If Not Installed)

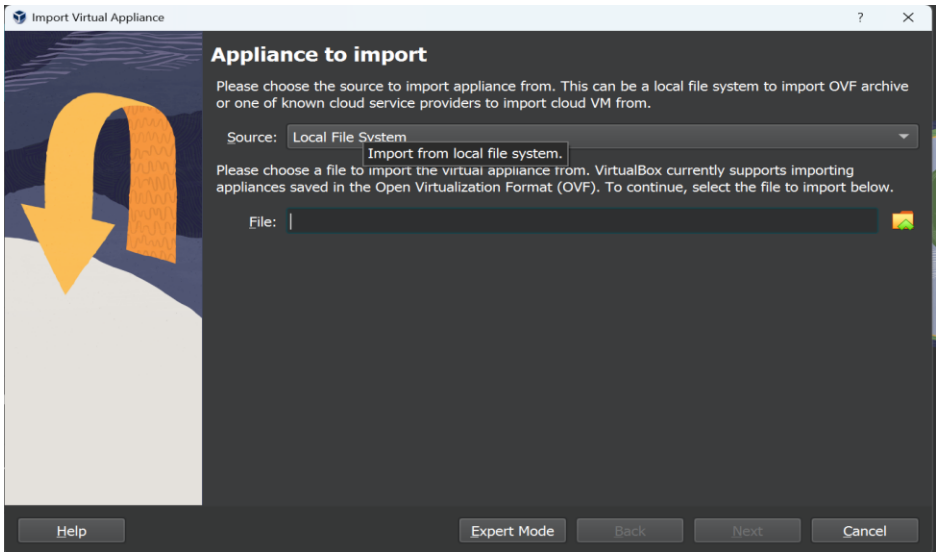
i. If you don't already have VirtualBox or VMware installed, download and install **Oracle VirtualBox** (recommended) from virtualbox.org.

Step 4: Import GNS3 VM into Virtualization Software

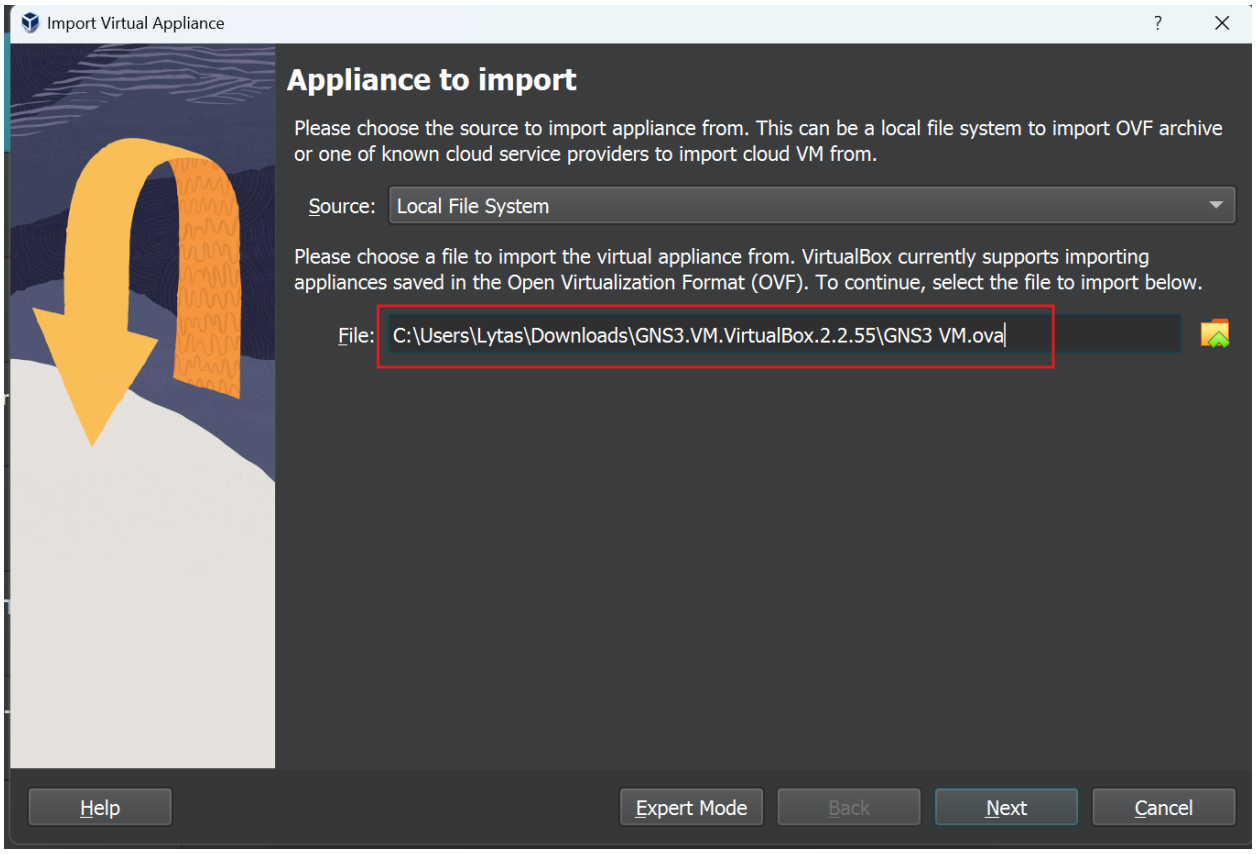
For VirtualBox:

1. Open **VirtualBox**.
2. Click **File → Import Appliance**.
3. Browse to the downloaded .ova file.





4. Click **Next**, then **Import**.



5. Wait for the import to complete.

Step 5: Configure GNS3 VM Settings

Before starting the VM, adjust these settings:

1. **Increase memory (RAM):**
    i. Right-click GNS3 VM → **Settings**.
    ii. Go to **Memory**.
    iii. Set to **at least 4096 MB (4 GB)** if possible.
    iv. Minimum: **2048 MB (2 GB)**.
2. **Configure network adapter:**

i. Go to **Network Adapter**.

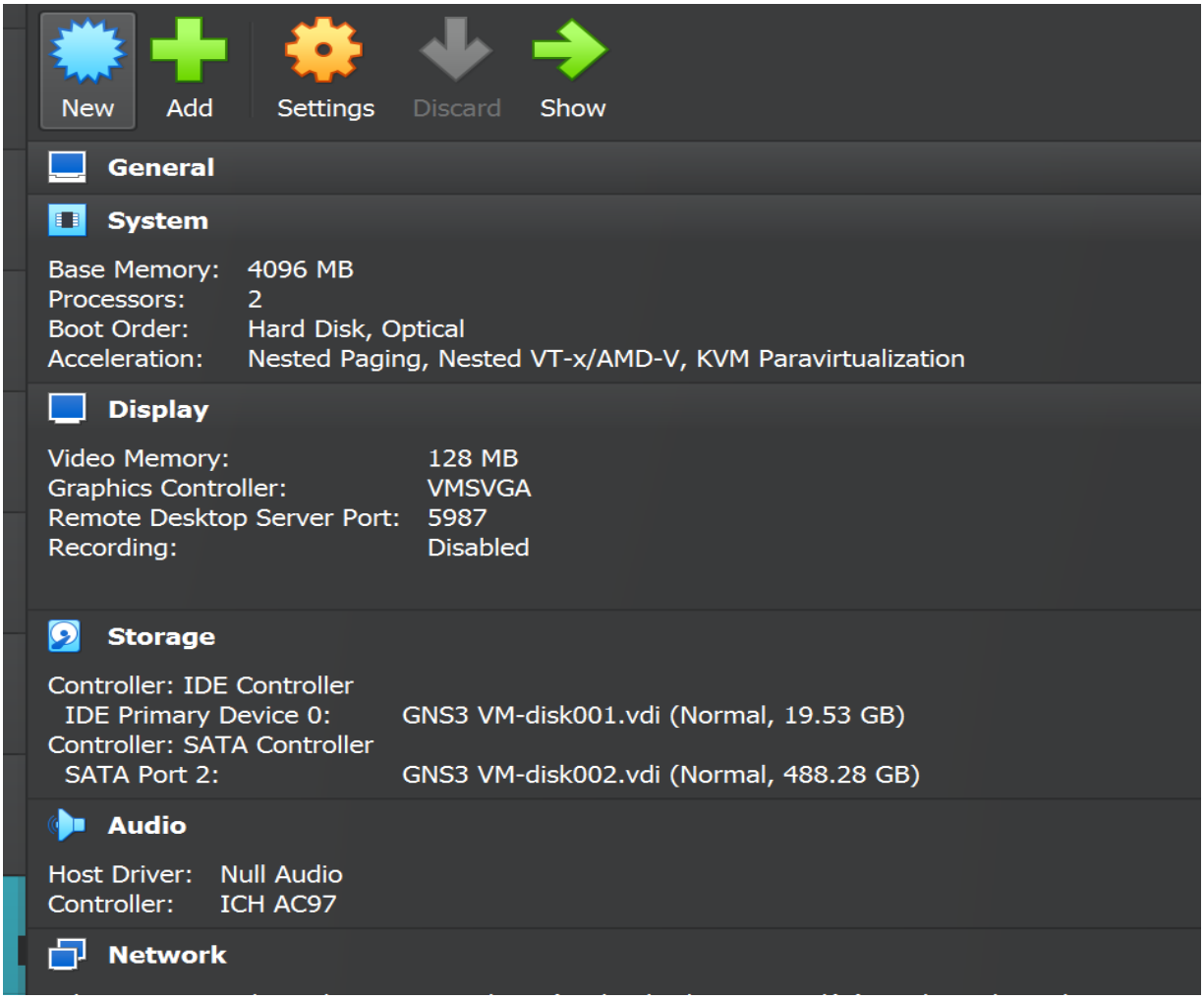
ii. Set to **NAT** or **Bridged** mode.

iii. Ensure **"Cable Connected"** is checked.

3. **Allocate CPU cores:**

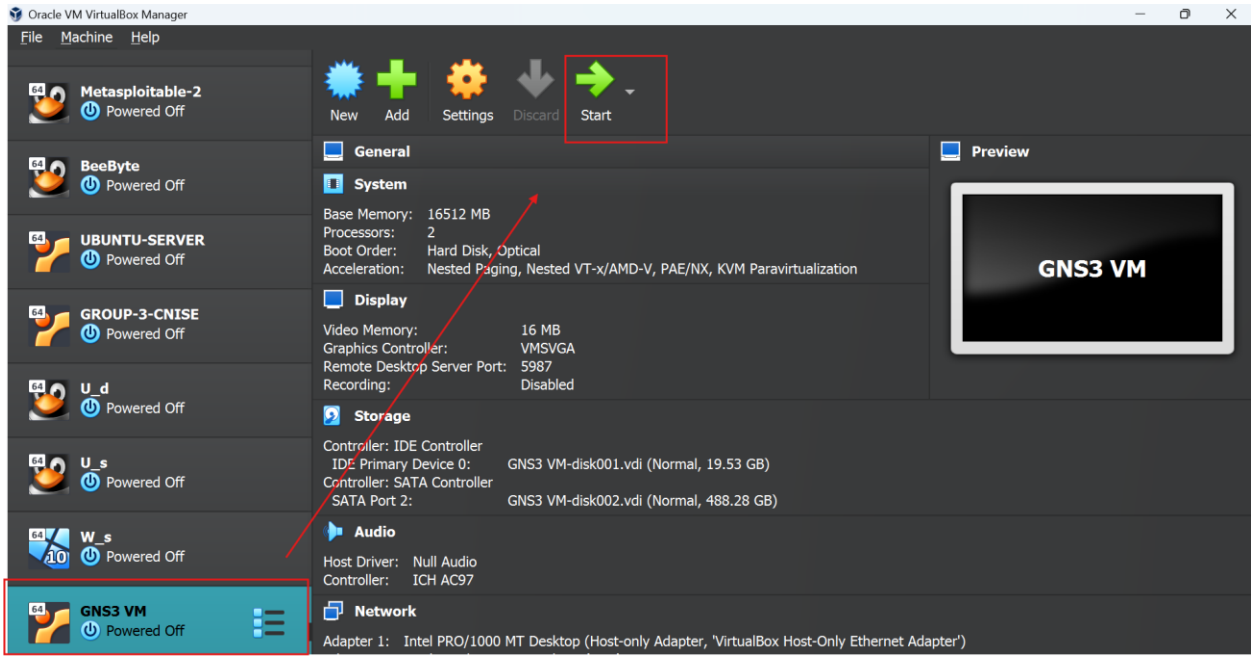
i. Go to **Processors**.

ii. Allocate **2–4 CPU cores** if available.

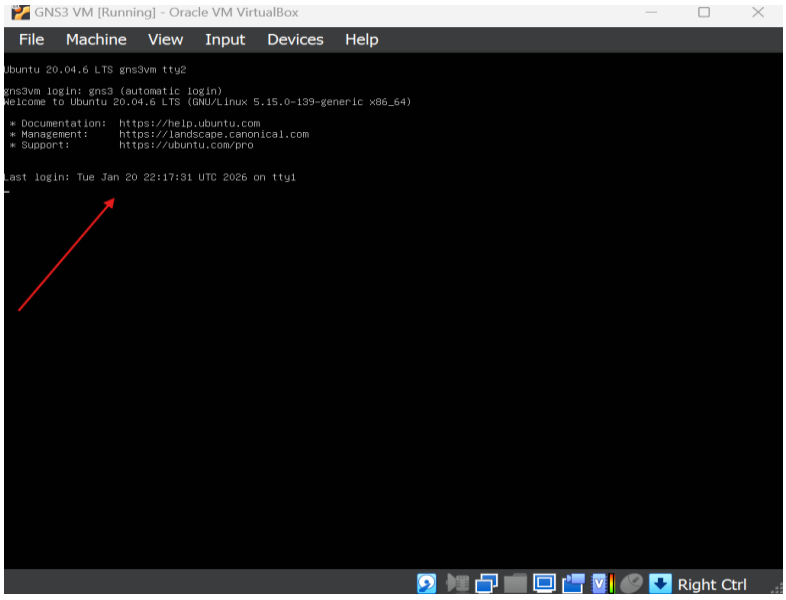


Step 6: Start GNS3 VM

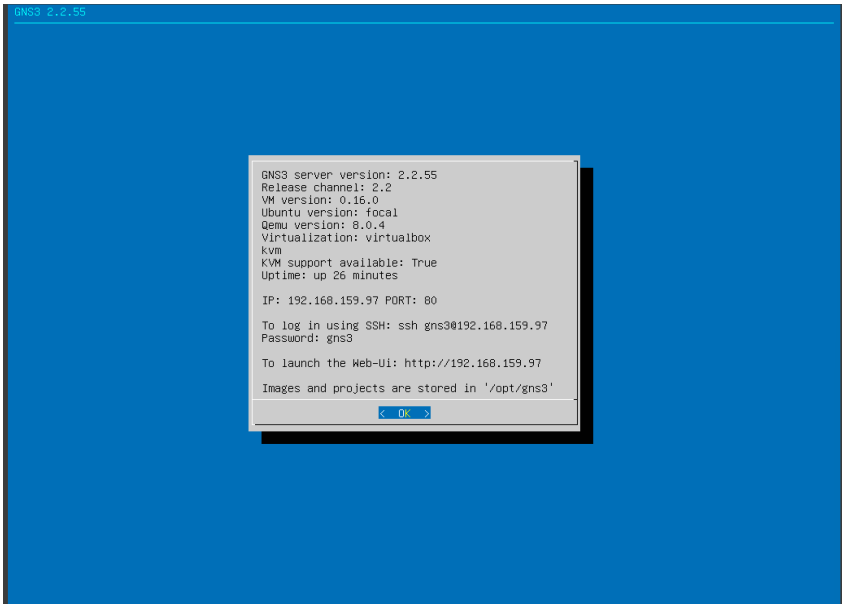
1. **Power on the VM:**
    i. Click **Start**.



2. **Wait for boot sequence:**
    i. You'll see the Linux (Ubuntu-based) boot process.
    ii. Wait until the login screen or desktop appears.
    iii. **Do not log in** — GNS3 GUI will connect automatically.

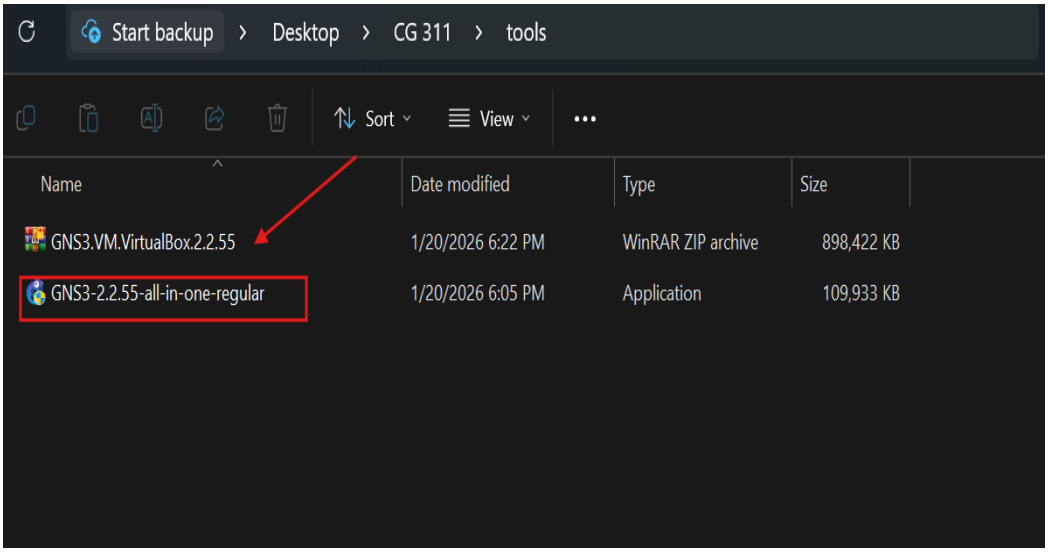


3. **Note the IP address:**
    i. The VM will display its IP address on screen.
    ii. Usually something like 192.168.159.97



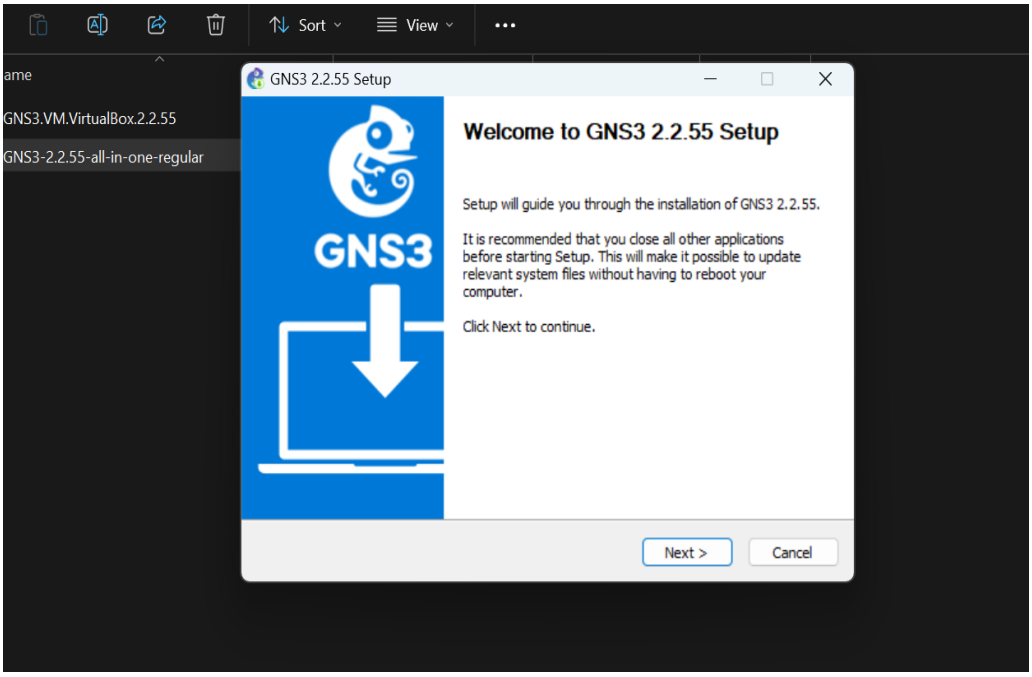
Step 7: Install GNS3 GUI

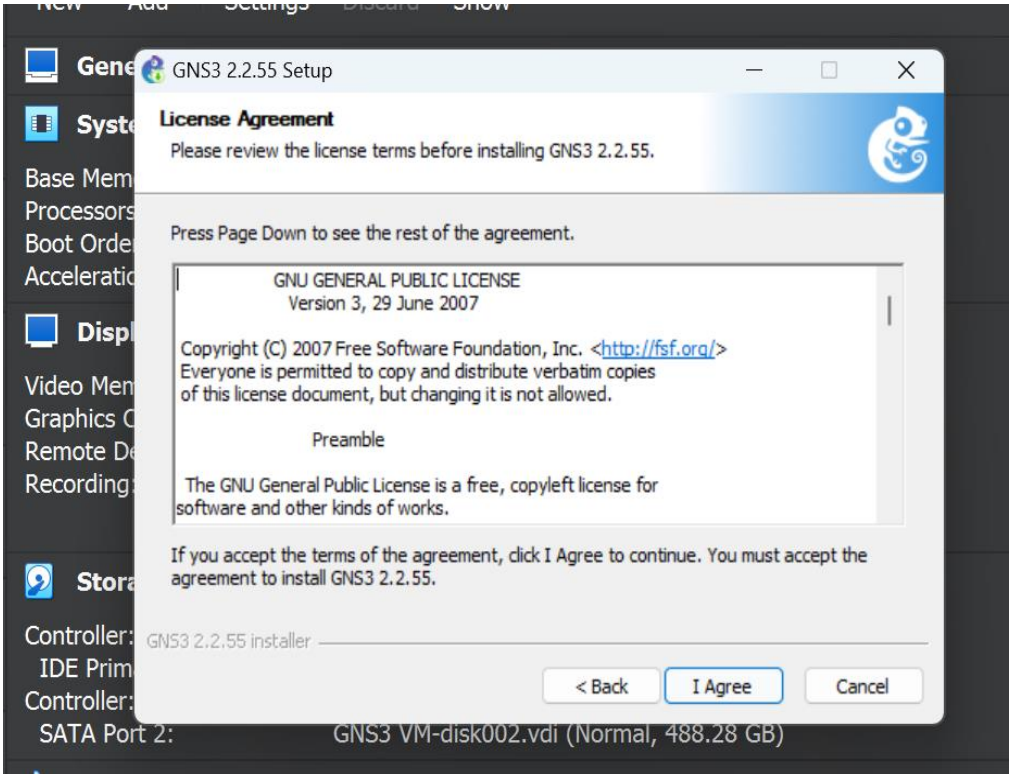
1. **Run the installer:**
    i. Locate the GNS3 installer downloaded in Step 1.
    ii. Double-click to run.
    iii. Accept any security warnings.



2. **Follow the installation wizard:**

   i. Accept the license agreement.

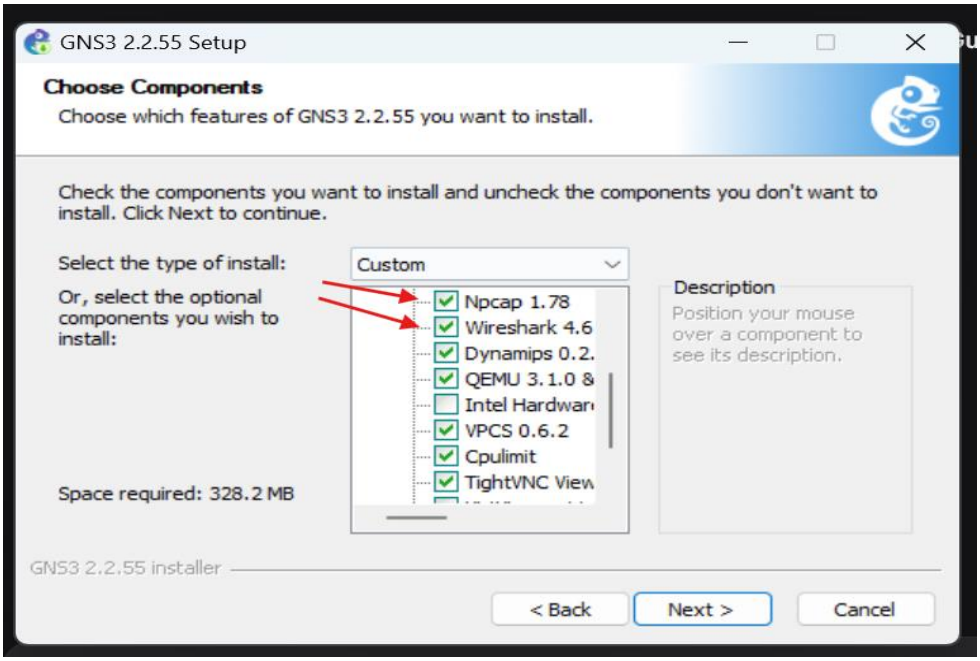




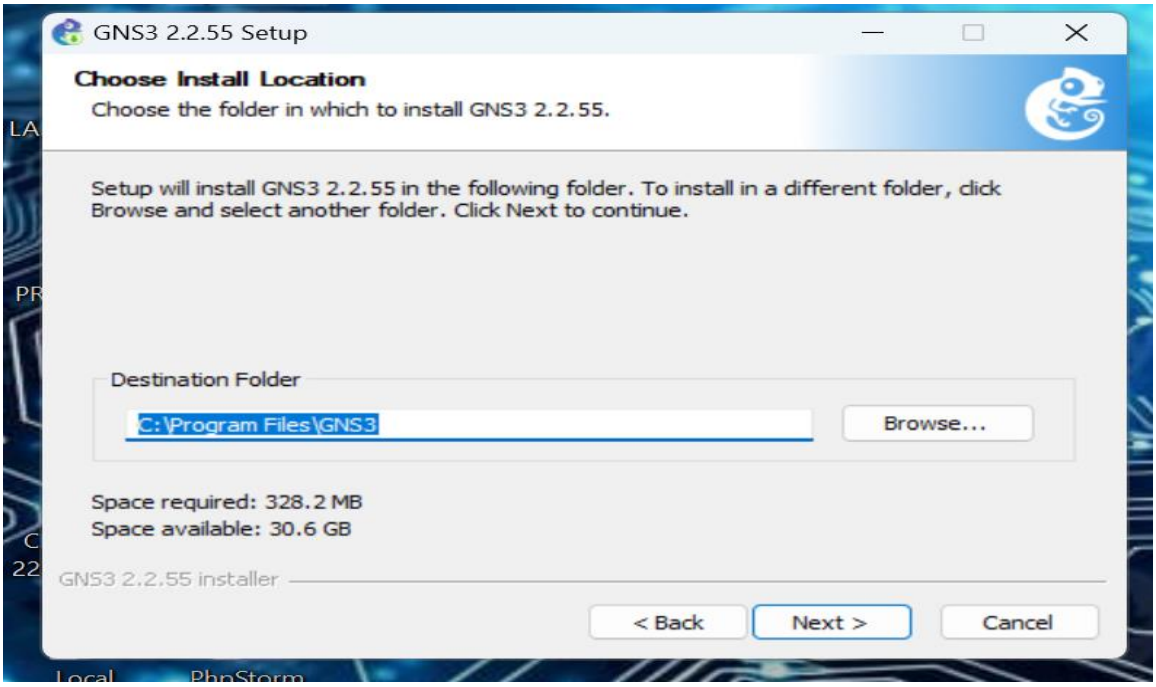
   ii. Choose **Standard Installation**.

iii. **CRITICAL:** Check both options:

- ✓ **Install Npcap**
- ✓ **Install Wireshark**

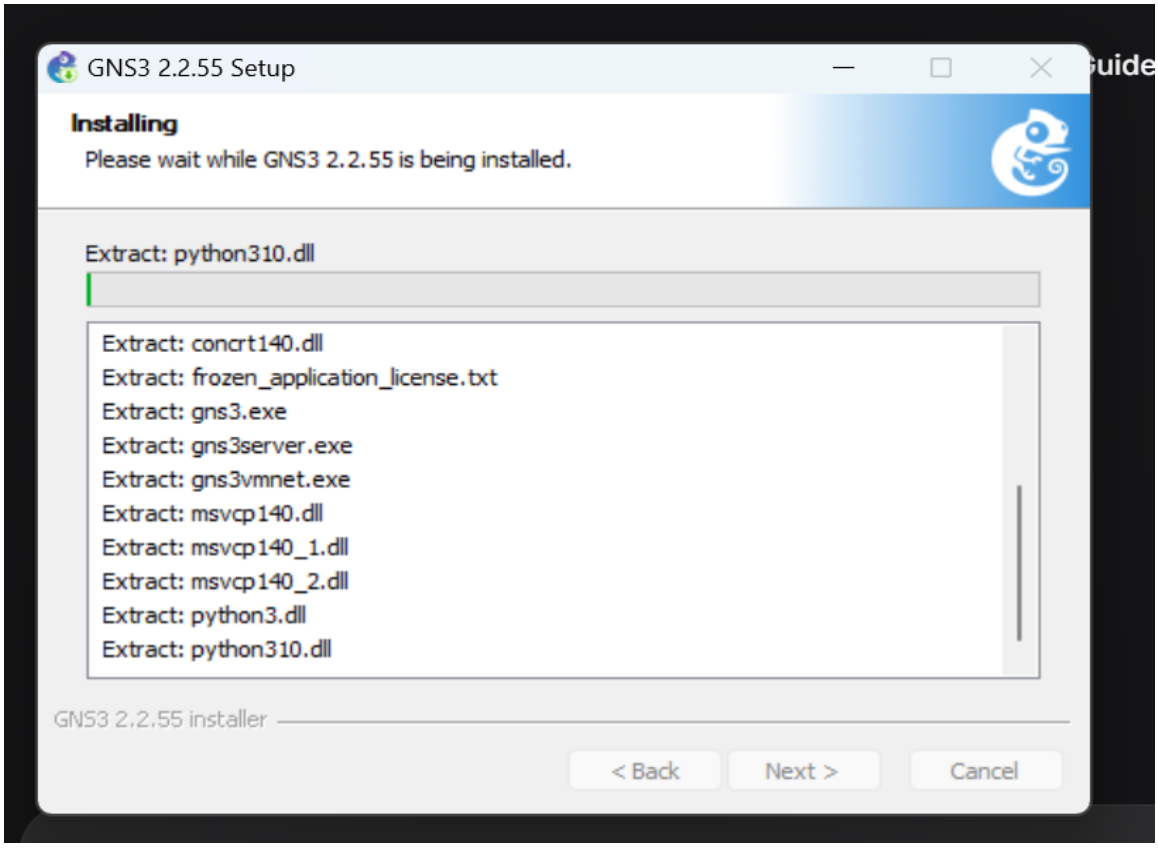


iv. Choose installation directory (default is fine).

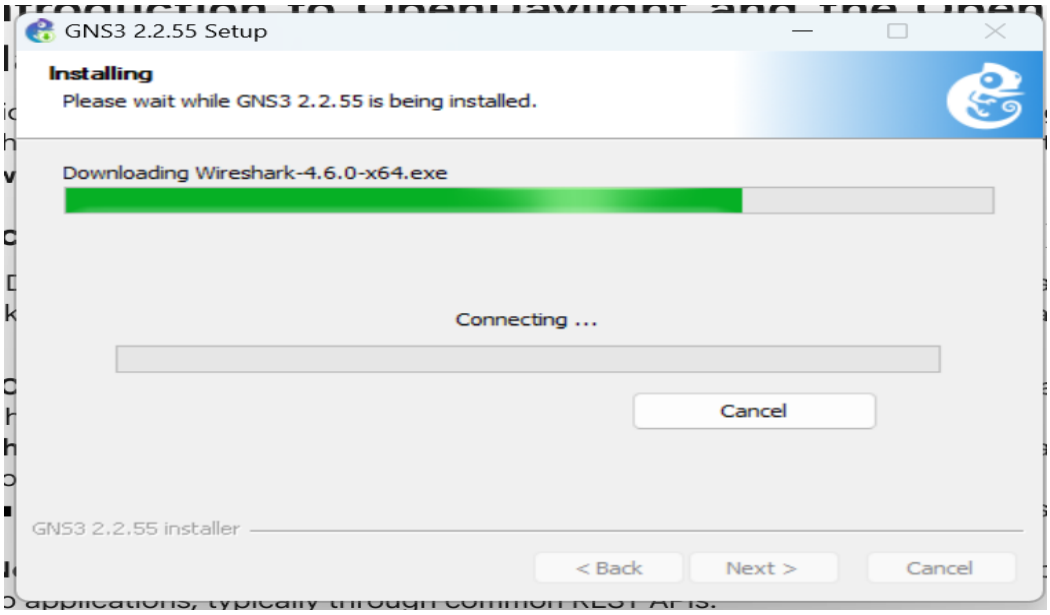


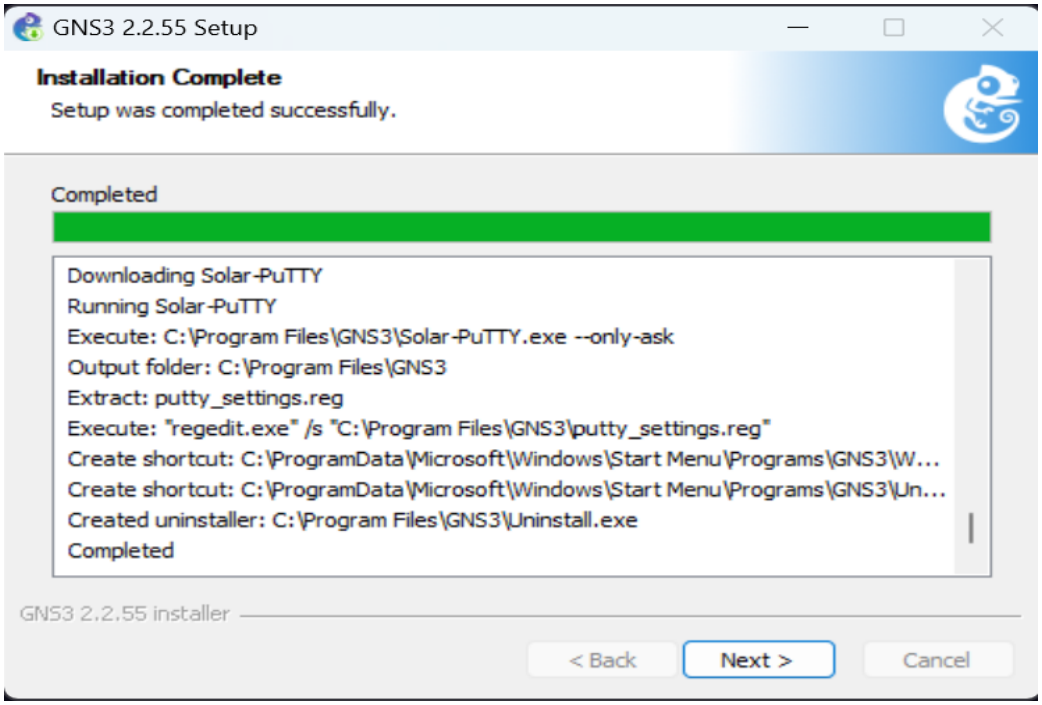
3. **Complete installation:**

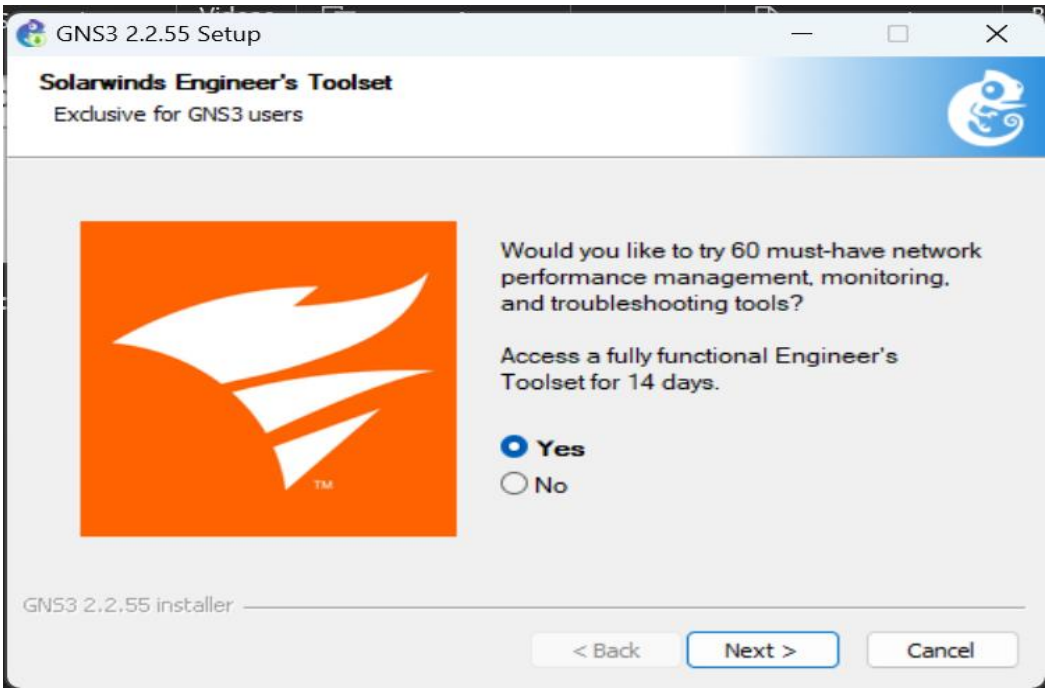
   i. Wait for installation to finish (5–10 minutes).



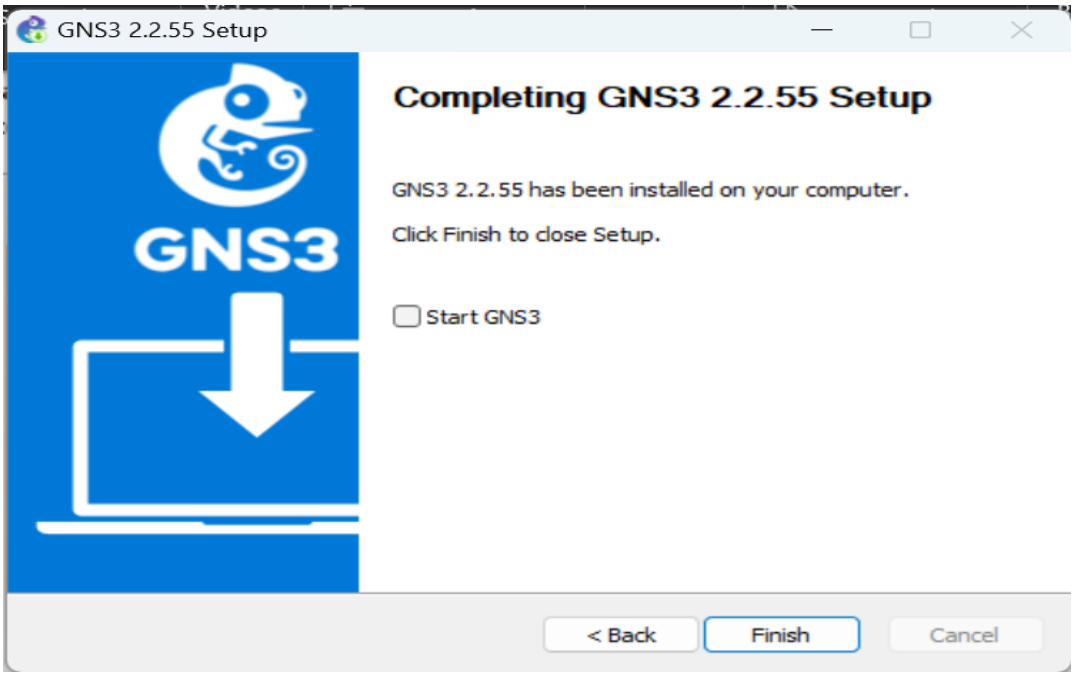
   ii. Click **Finish**.




GNS3 2.2.55 Setup
Installation Complete
Setup was completed successfully.
Completed
Downloading Solar-PuTTY
Running Solar-PuTTY
Execute: C:\Program Files\GNS3\Solar-PuTTY.exe --only-ask
Output folder: C:\Program Files\GNS3
Extract: putty_settings.reg
Execute: "regedit.exe" /s "C:\Program Files\GNS3\putty_settings.reg"
Create shortcut: C:\ProgramData\Microsoft\Windows\Start Menu\Programs\GNS3\W...
Create shortcut: C:\ProgramData\Microsoft\Windows\Start Menu\Programs\GNS3\Un...
Created uninstaller: C:\Program Files\GNS3\Uninstall.exe
Completed
GNS3 2.2.55 installer
< Back
Next >
Cancel


GNS3 2.2.55 Setup
Solarwinds Engineer's Toolset
Exclusive for GNS3 users
Would you like to try 60 must-have network performance management, monitoring, and troubleshooting tools?
Access a fully functional Engineer's Toolset for 14 days.
Yes
No
GNS3 2.2.55 installer
< Back
Next >
Cancel

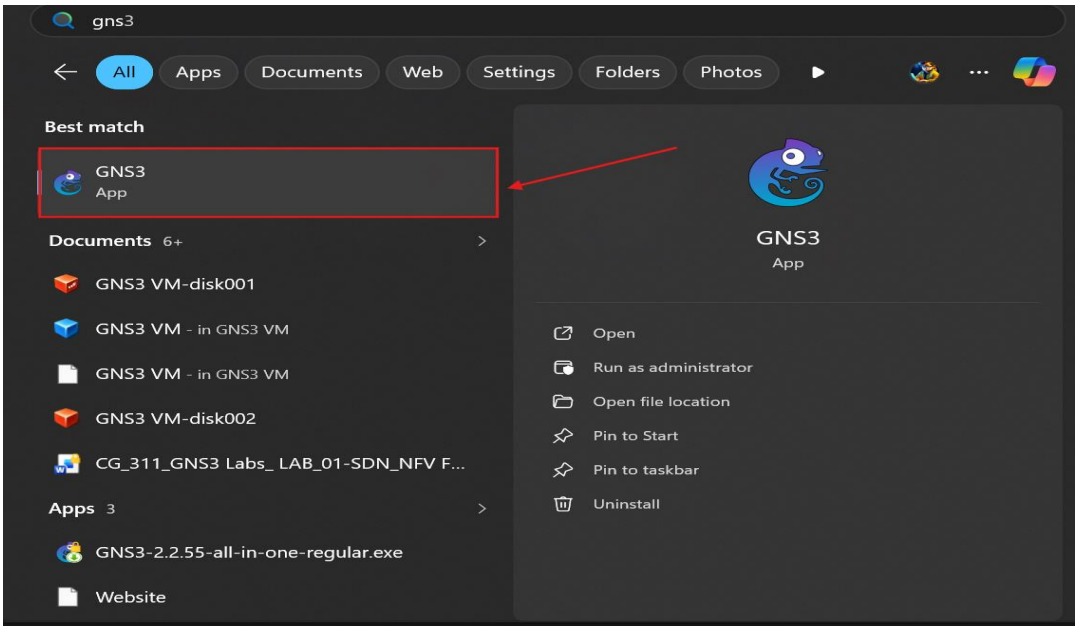
iii. **Do not launch GNS3 yet.**



Step 8: Initial GNS3 Setup Wizard

1. **Launch GNS3 for the first time:**

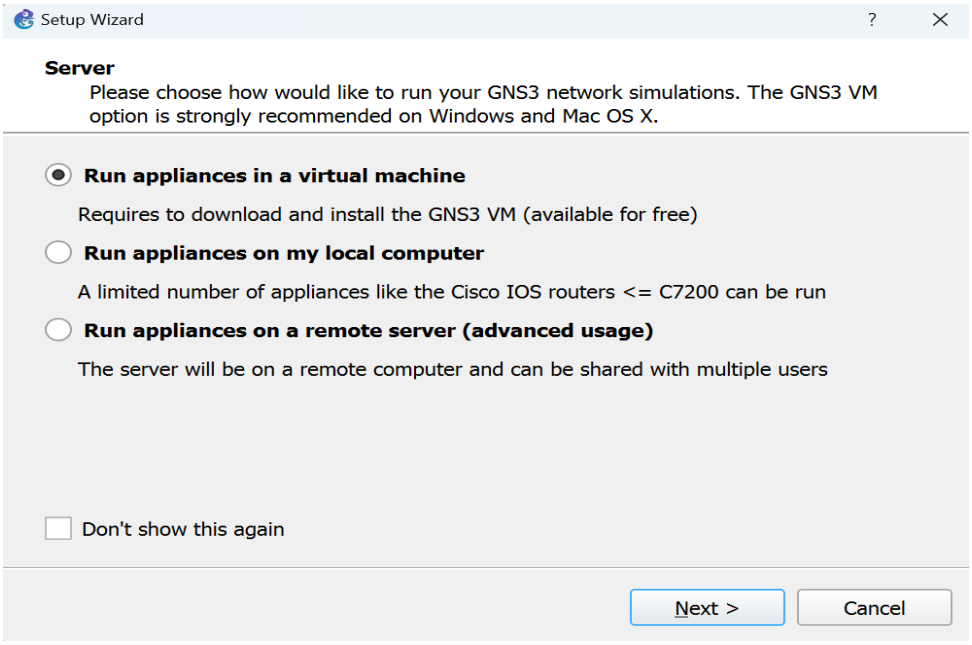
   i. Find GNS3 in your Start Menu / Applications.



   ii. Double-click to launch.

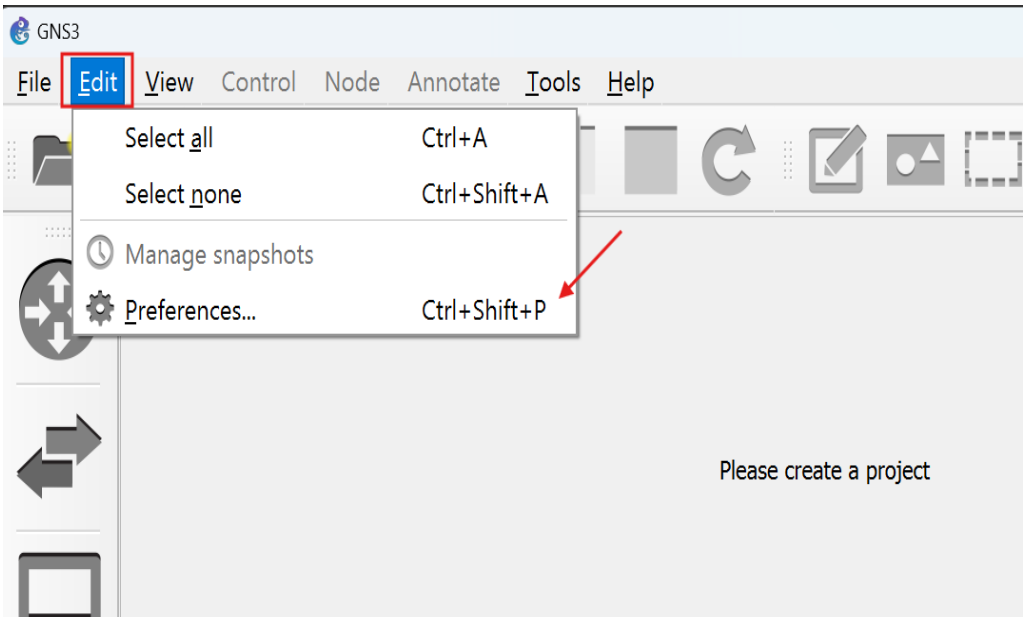
2. **Cancel the Setup Wizard:**

   i. Since your VM is already running, you don't need the wizard.



Step 9: Manually Configure GNS3 to Connect to Your VM

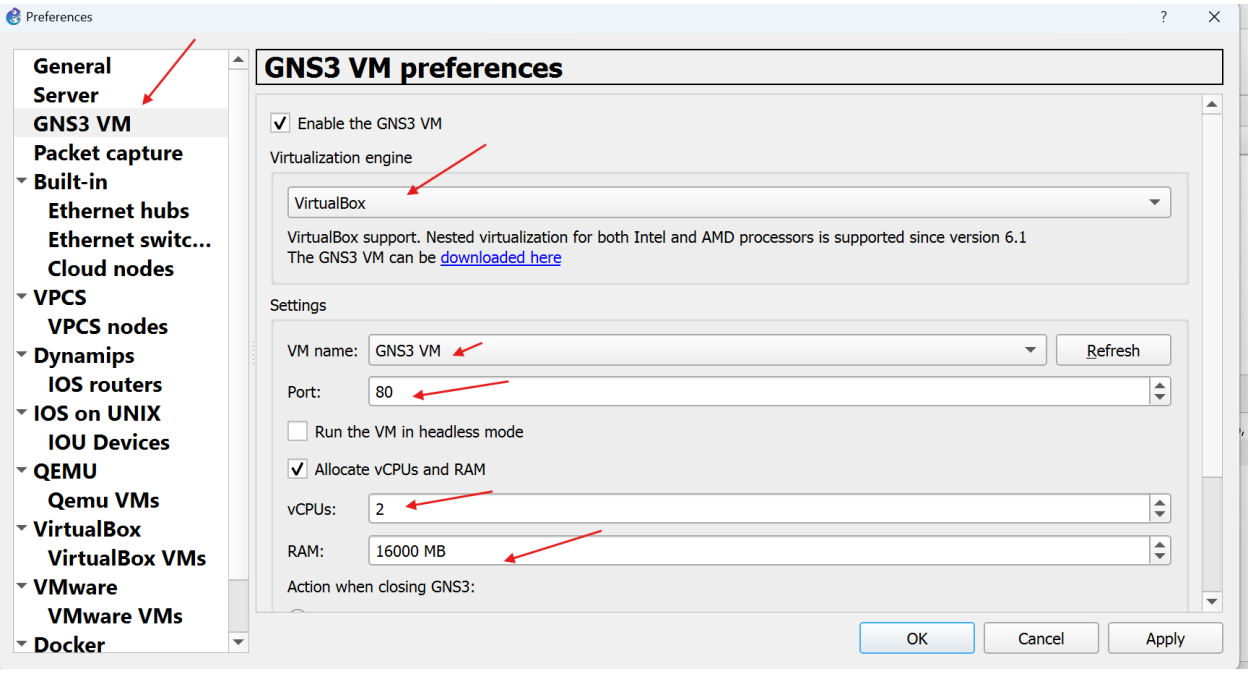
1. In the GNS3 main window, go to: **Edit → Preferences**.

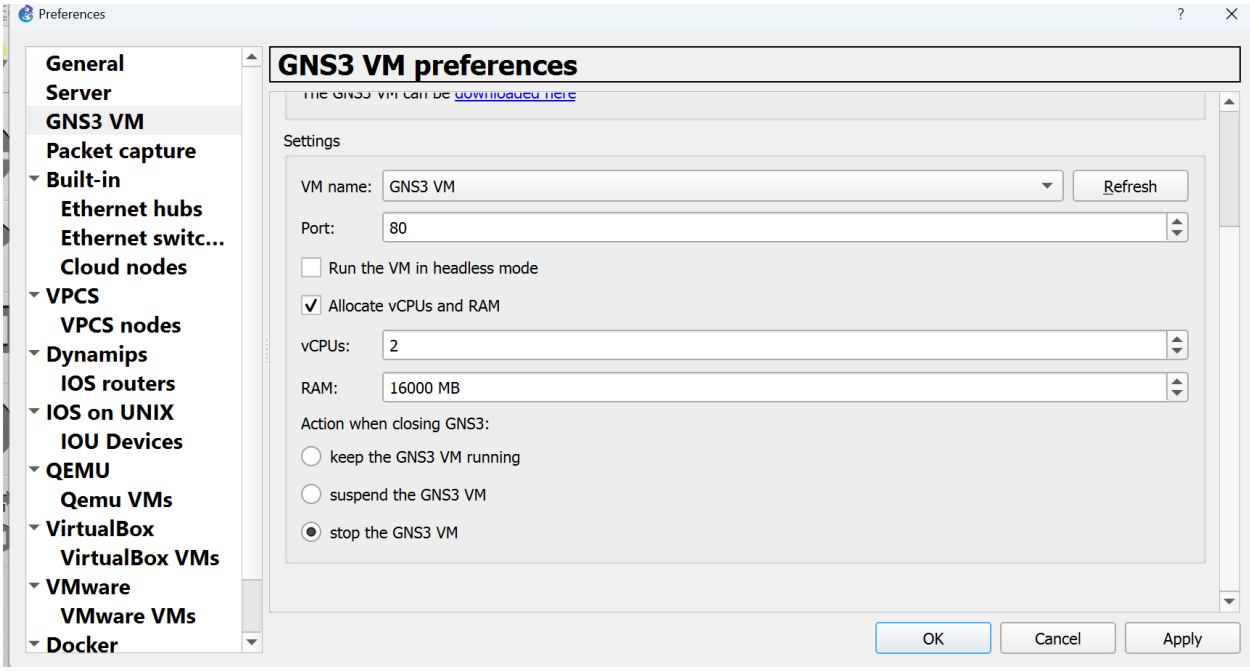


2. **Configure server settings:**

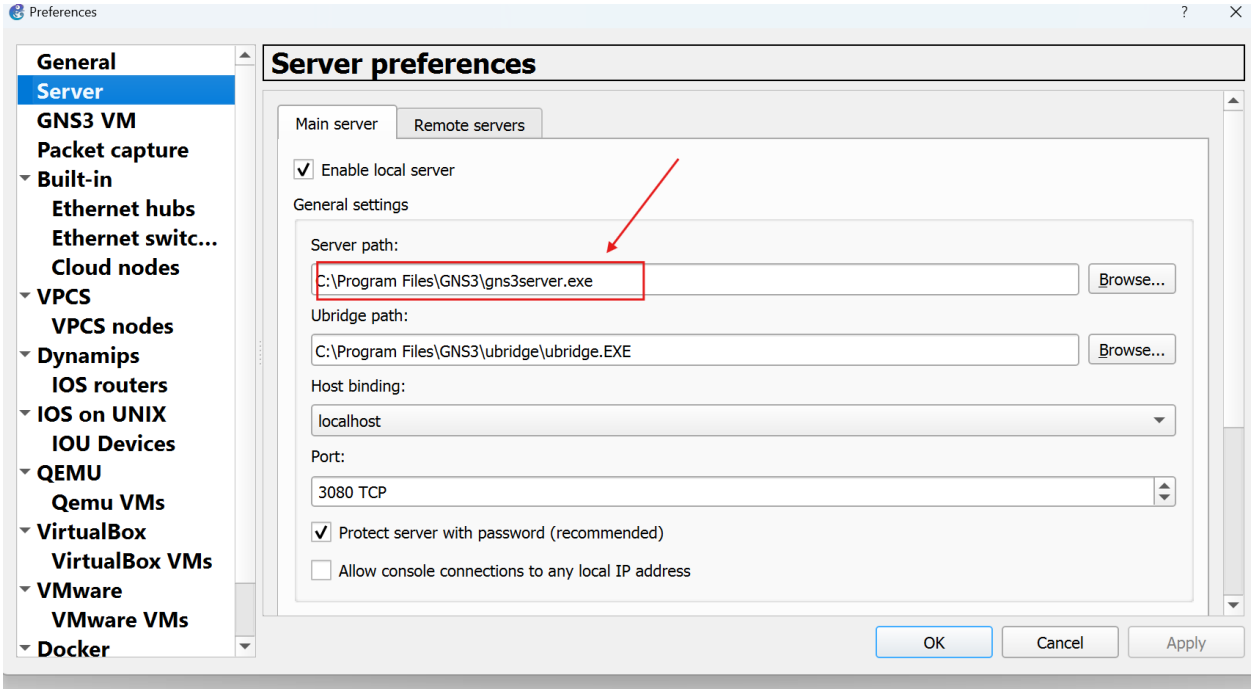
   i. Under **Server** section:

   - ✓ **VM list**: "GNS3 VM" (should auto-appear).
   - ✓ Click **Refresh** — it should detect your VM automatically.



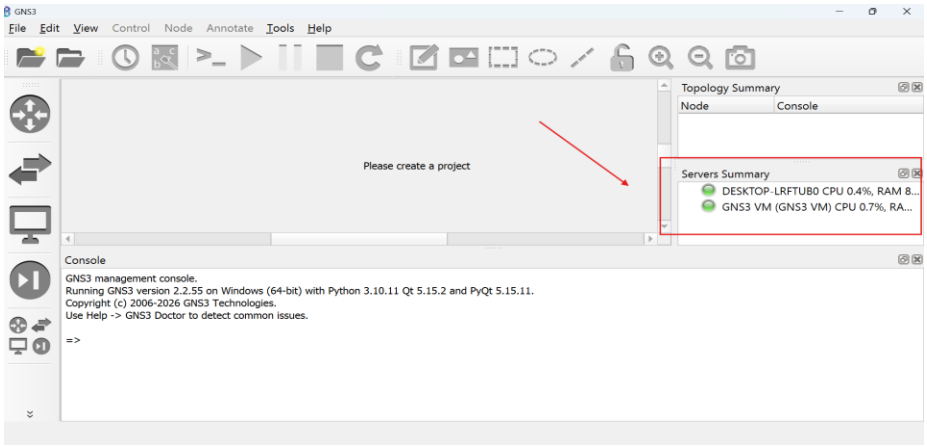


3. **Apply the settings:**
    i. Click **Apply**, then **OK**.
4. **Also check server configuration:**
    i. Go to **Edit → Preferences → Server**.



    ii. Ensure the server is set to **localhost** or the correct VM IP.

5. **Finalize:**
    i. Click **Apply**, then **OK** again.



You're now ready to use GNS3 with your VM!
You can start creating network topologies and adding devices.

Lab 1: Basic Topology Construction and Packet Analysis

Objective

To familiarize students with the GNS3 workspace, the deployment of virtual nodes, and the use of Wireshark to observe data plane traffic.

1. Scenario Logic

In this introductory lab, you will move away from the classical network appliance approach—which requires physical installations and instead build a basic virtualized connection between two end-user hosts using a standard Ethernet switch.

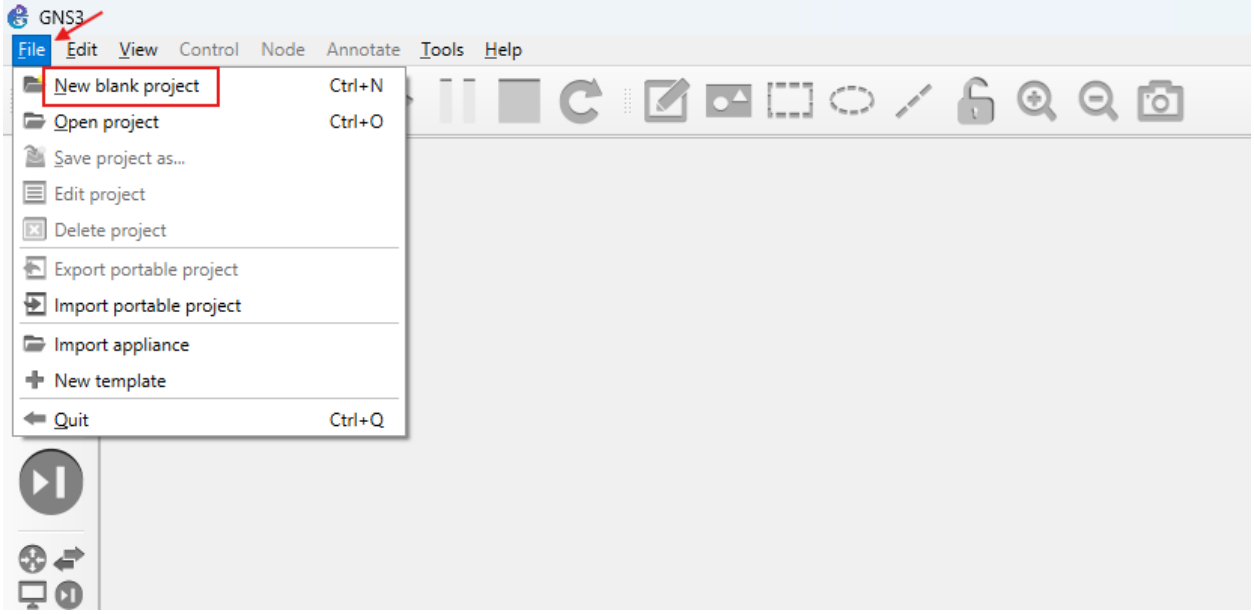
2. Topology Requirements

1. **Nodes:**
    - ✓ 2 × VPCS (Virtual PC Simulator)
    - ✓ 1 × GNS3 Built-in Ethernet Switch
2. **Connections:** Use the **"Add a Link"** tool to connect the VPCs to the switch ports.

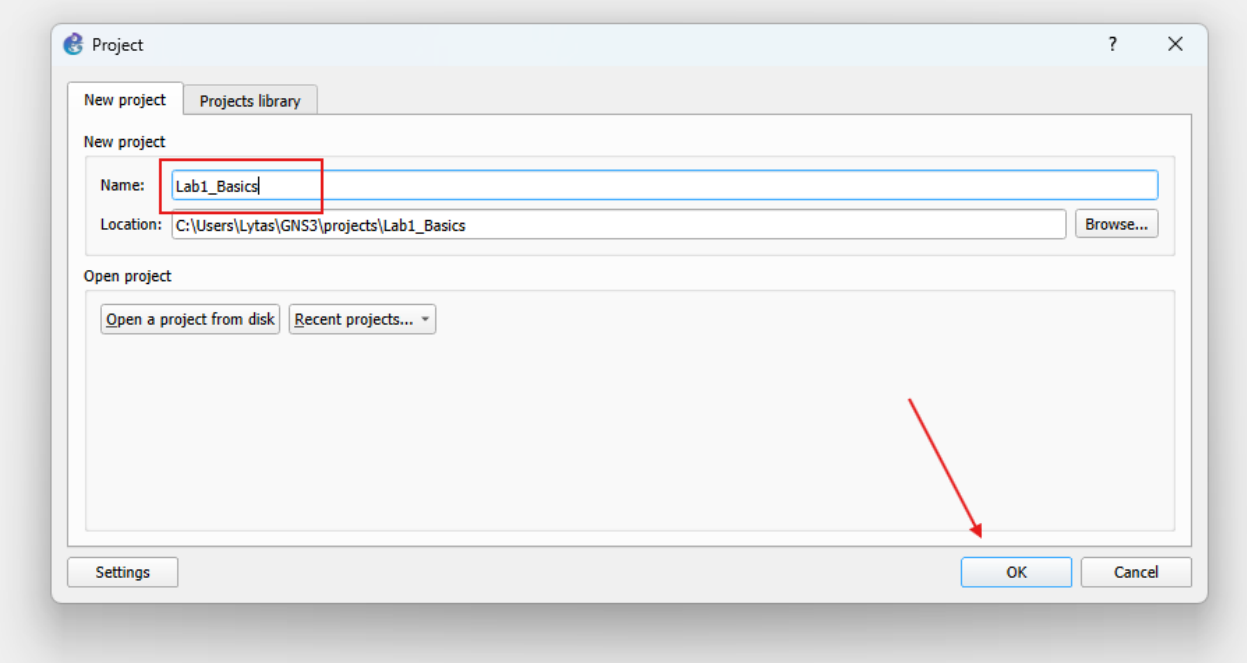
3. Procedure

Step 1: Create a New Project

1. Open GNS3.

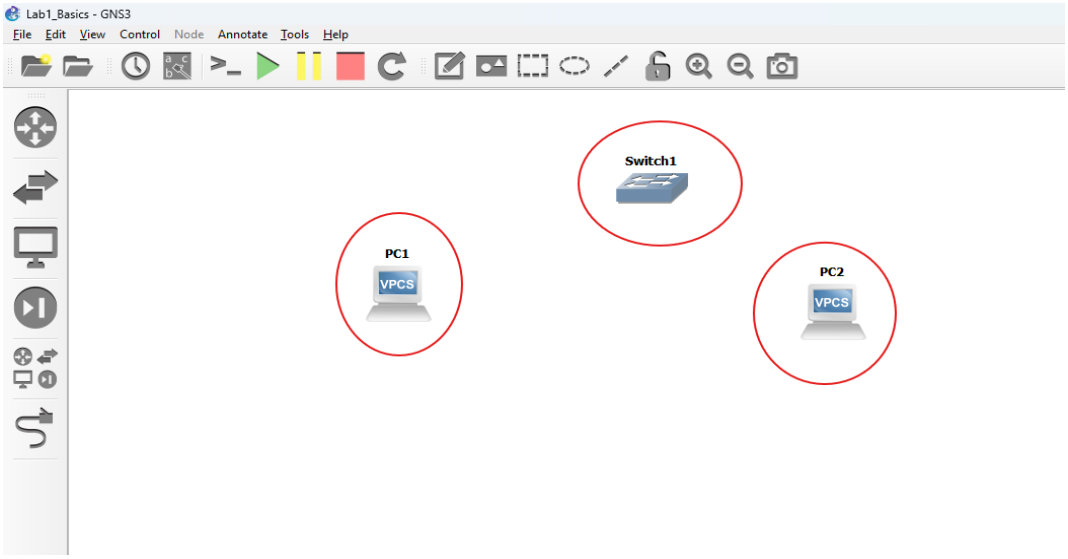


2. Create a new project titled:
   Lab1_Basics



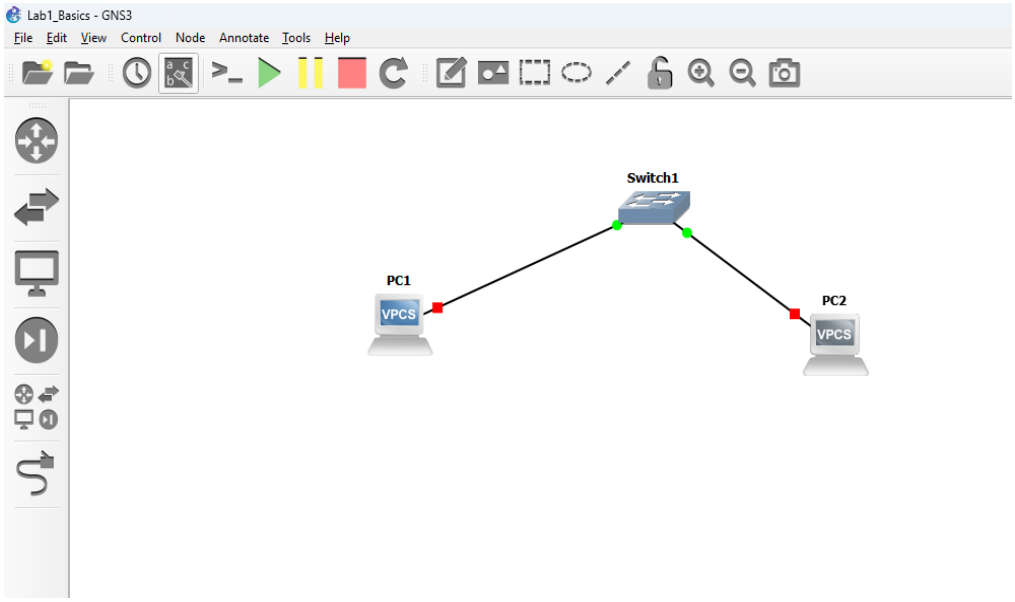
Step 2: Deploy Nodes

1. From the left sidebar (Device Toolbar), drag and drop:
    - ✓ **2 × VPCS** (Virtual PC Simulator)
    - ✓ **1 × Ethernet Switch** (GNS3 built-in switch)
2. Arrange them clearly on the workspace.

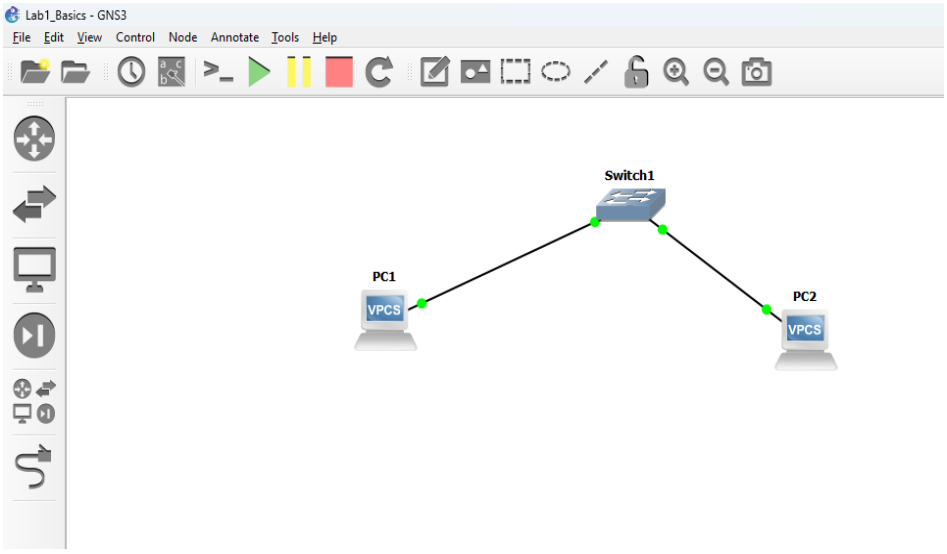


Step 3: Establish Logical Connectivity

1. Click the **"Add a Link"** tool (cable icon).
2. Connect:
   - ✓ **PC1 (Eth0) → Switch1 (Port 1)**
   - ✓ **PC2 (Eth0) → Switch1 (Port 2)**



3. Ensure links show as green (active).

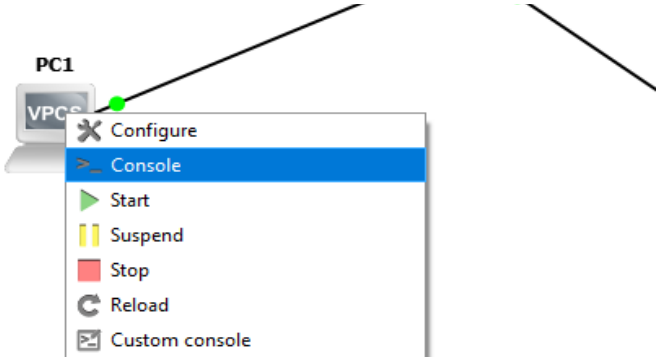


Right-click on each pc and click start option. The color of the link will change from red to green(active)

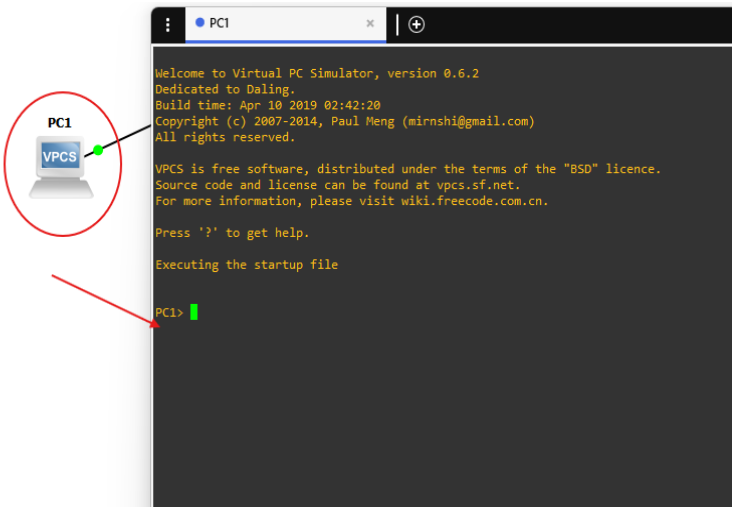
Step 4: Configure IP Addresses

1. **For PC1:**

   Right-click **PC1 → Console**



   Type this command ip 192.168.1.1 255.255.255.0

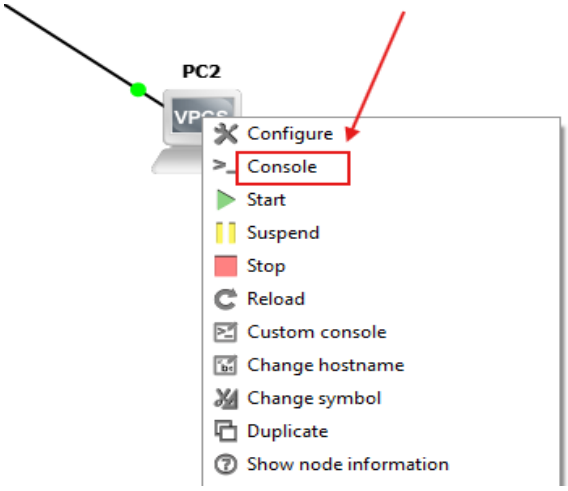




   there after Press Enter.

2. **For PC2:**

   ✓ Right-click **PC2 → Console**



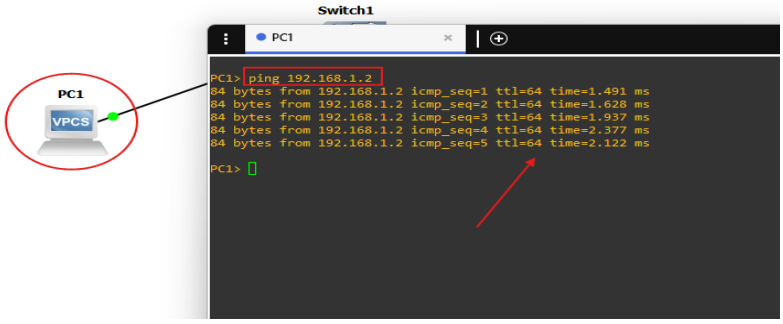
   ✓ Type: ip 192.168.1.2 255.255.255.0



   ✓ Press Enter.

Step 5: Verify Connectivity

1. In the **PC1 console**, type: ping 192.168.1.2



2. Observe the replies.

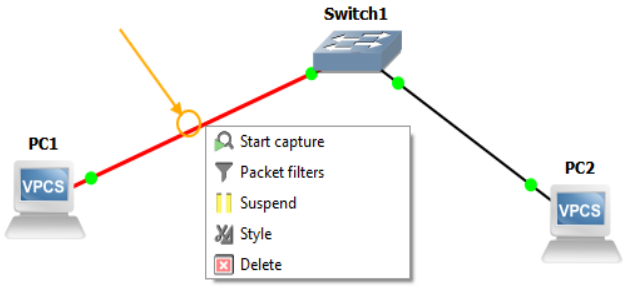
```
PC1> ping 192.168.1.2
84 bytes from 192.168.1.2 icmp_seq=1 ttl=64 time=1.491 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=64 time=1.628 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=64 time=1.937 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=64 time=2.377 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=64 time=2.122 ms
```

This confirms that pc1 is connected to the switch.

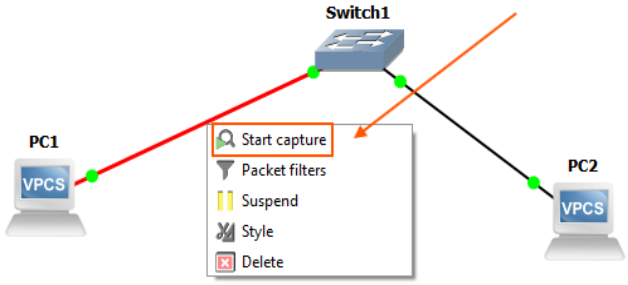
4. Technical Analysis: The Virtual Tap

Packet Capture with Wireshark

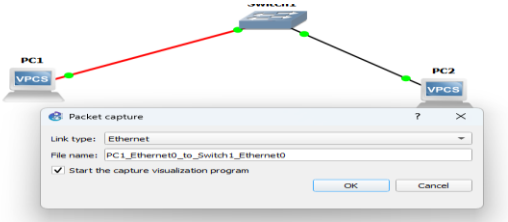
1. Right-click on the link between **PC1** and **Switch1**.

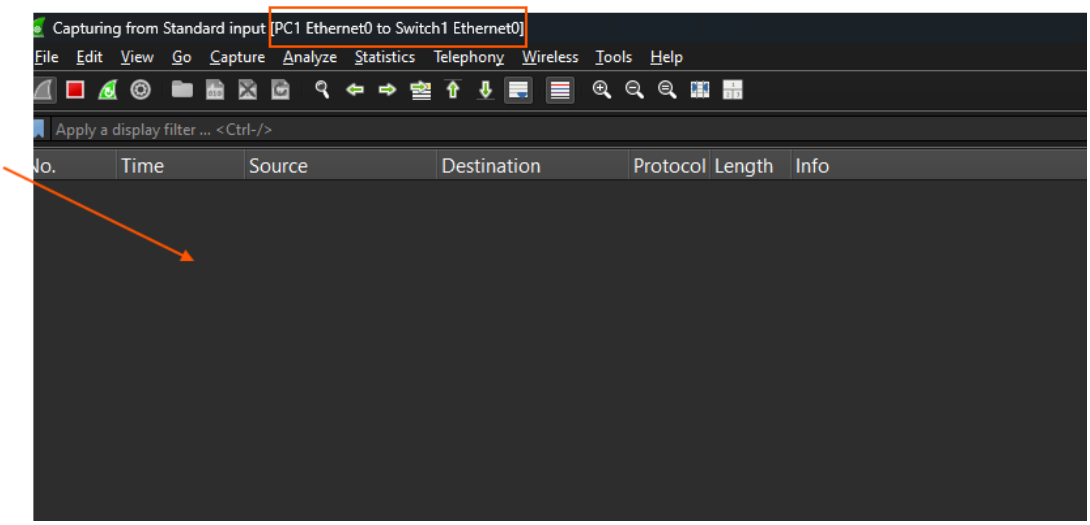


2. Select **"Start Capture."**



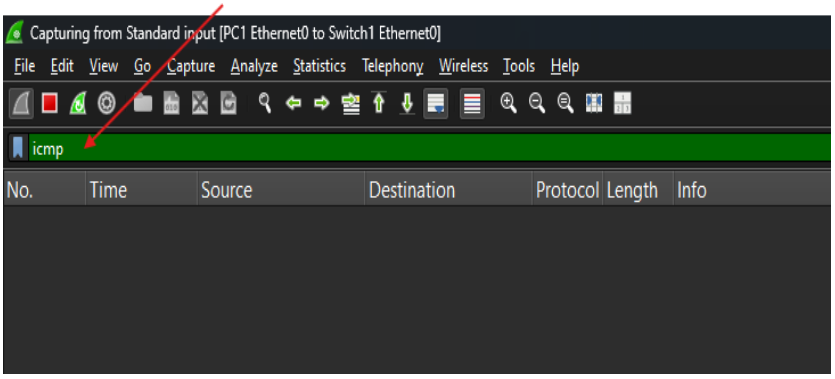
3. **Wireshark** will open automatically.



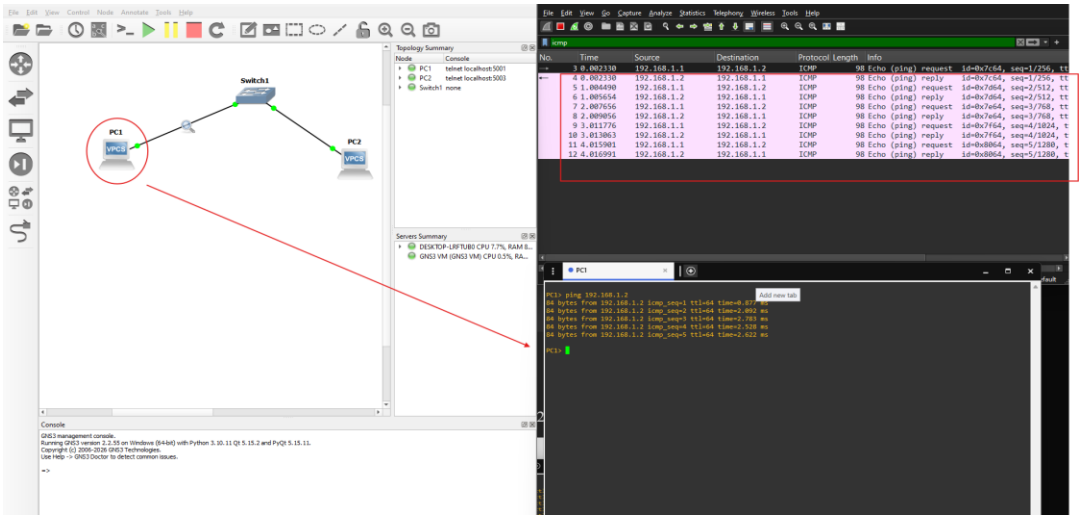


Observations

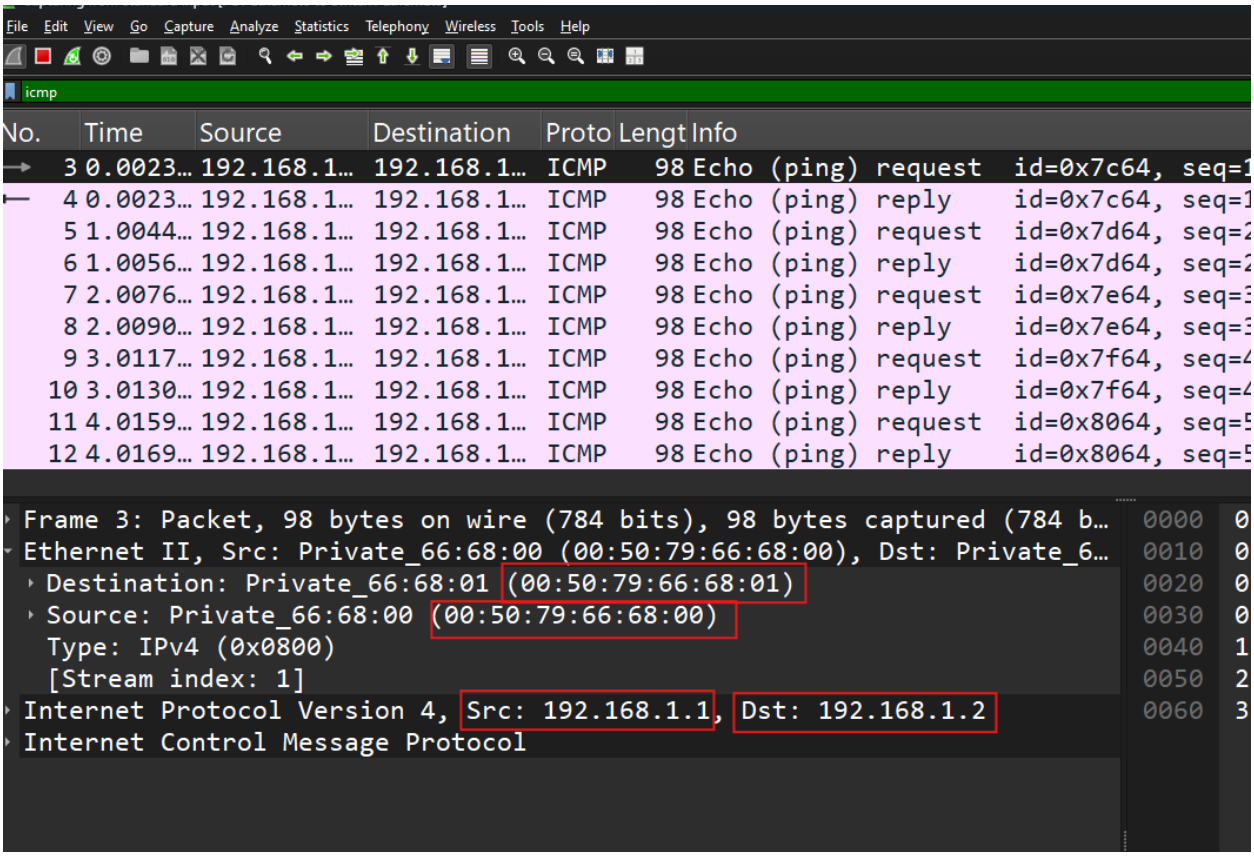
i. Filter for **ICMP** in Wireshark.



ii. Observe **ICMP Echo Request** and **ICMP Echo Reply** packets.



iii. Note source/destination IPs and MAC addresses.



Source ip	Destination ip	Source mac	Destination mac
192.168.1.1	192.168.1.2	00:50:79:66:68:00	00:50:79:66:68:01

NFV Perspective

This mirroring of traffic to Wireshark is a fundamental precursor to the **Virtual Tap** concept used in IDS/IPS deployments in virtualized environments.

Lab 1 Assessment Questions

Question 1

Explain how the GNS3 VM acts as the NFV Infrastructure (NFVI) in this setup.

Answer:
The GNS3 VM provides the virtualized compute, storage, and networking resources required to run network functions (such as VPCS and virtual switches) in software. It abstracts underlying physical hardware, allowing network topologies to be deployed and managed programmatically-core to the NFVI layer in an NFV architecture.

Question 2

In a physical network, what hardware would replace the "Start Capture" software feature?

Answer:
In a physical network, the equivalent functionality would be provided by:

i. A **Network TAP (Test Access Point)** or

ii. A **SPAN port (Switch Port Analyzer)** on a network switch.

These devices duplicate traffic from one or more ports to a monitoring port, where a physical packet analyzer (or laptop with Wireshark) is connected.

Lab Completion Checklist

I. Project created: Lab1_Basics

II. VPCS and switch deployed and connected

III. IP addresses configured

IV. Ping successful

V. Wireshark capture performed

VI. Assessment questions answered