# Lab

# Software Installation for the Virtual Internet Lab

This document walks you through the software installation for the virtual labs. The installation consists of

- VirtualBox a hypervisor for running virtual machines (GNS3 VM runs on Virtual Box) (If you already have VirtualBox installed or if you have VMware installed, you may skip this part of the installation process.);
- 2. GNS3 a tool for network configuration of virtual network devices;
- 3. GNS3 VM a virtual machine that supports virtual devices in GNS3;
- 4. (Mac only) Wireshark a protocol analyzer.

The software installation must be completed before commencing with Lab 1. All software is available for free without cost.

Software versions: GNS3 2.2.x, VirtualBox 6.1, Wireshark 2.2.x (Windows), Wireshark 2.2.x (Mac)

System Requirements

- Windows 10 with an Internet connection
- Mac OS X 10.15 or above with an Internet connection
- minimum 4GB memory, 8 GB or more is recommended

#### YouTube Videos

The software installation and setup described in this document is available in YouTube videos:

- Windows: <u>https://youtu.be/0jRwq68-acU</u>
- Mac: <u>https://youtu.be/oQwkQC7vH5k</u>

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# **Installation and Configuration of VirtualBox and GNS3**

The following instructions guide you through the installation and configuration of the GNS3 network simulation software. In GNS3, routers and PCs are run on virtual machines. The virtual machines are controlled by the virtualization tool VirtualBox.

## Task 1. Installation of VirtualBox

Step 1: Download <u>VirtualBox</u> (Version 6.1 or higher) for your operating system (Windows, Mac OS X) from

https://www.virtualbox.org/wiki/Downloads

**Step 1:** Install the downloaded software using the default settings. Upon successful installation, you should see the window in Figure 1. Close the window.



Figure 1. VirtualBox application.

**Step 2:** Open the "File" menu and select "Host Network Manager." This opens a window as shown in Figure 2.

📰 Host Network Manager				×
Network				
Create Remove Properties				
Name	IPv4 Address/Mask	IPv6 Address/Mask	DHCP S	erver
VirtualBox Host-Only Ethernet Adapter	192.168.56.1/24		🗹 Enab	le
			Clo	se

Figure 2. Host Network Manager.

- **Step 3:** If you see an entry for "VirtualBox Host-only Ethernet Adapter" displayed, proceed to the next step. Otherwise, create a Host-only network by pressing "Create" button in the menu. Make sure that "DHCP Server" is enabled in the checkbox.
- Step 4: Next, select the *Properties* icon in the Host Network Manager. In the *Adapter* tab, the IPv4 address should be set to 192.168.56.1, and the IPv4 Network Mask netmask should be set to 255.255.255.0 as shown in Figure 3.

Host Network Manager -								
<u>N</u> etwork								
Create Remove Prop	perties							
Name	^	IPv4 Address/Mask	IPv6 Address/Mask	DHCP Server				
VirtualBox Host-Only Et	hernet Adapter	192.168.56.1/24		🗹 Enable				
Adapter DHCP Serve	er							
Configure Adapter Au	utomatically							
Configure Adapter Magneter Magneter Magneter Magnetic Magneti	anually							
IPv4 Address:	192.168.56.1							
IPv4 Network Mask:	255.255.255.0							
IPv6 Address:	fe80::8d7c:5252:33b4:5aa8	1						
IPv6 Prefix Length:	64							
Reset			Apply	Close				

Figure 3. Host Network Manager (Adapter).

**Step 5:** Then, select the *DHCP Server* tab and verify that "Enable Server" is enabled. The displayed IP addresses should be as shown in Figure 4 and as listed her:

Server Address:	192.168.56.100
Server Mask:	255.255.255.0
Lower Address Bound:	192.168.56.101
Upper Address Bound:	192.168.56.254

Host Network Manager – 🗆 🗙									
Network									
Create Remove Properties									
Name		IPv4 Address/Mask	IPv6 Address/Mask	DHCP Server					
VirtualBox Host-Only Ether	net Adapter	192.168.56.1/24		🗹 Enable					
Adapter DHCP Server									
Server Address:	192.168.56.100								
Server Mask:	255.255.255.0								
Lower Address Bound:	192.168.56.101								
Upper Address Bound: 192.168.56.254									
r servicing the network associated with this host-only adapter.									
Reset Apply Close									

Figure 4. Host Network Manager (DHCP Server).

**Step 6:** Install the VirtualBox Extension Pack, which provides support for USB devices, shared folders, as well as copy/paste between virtual machines and your PC. In a web browser go to

https://www.virtualbox.org/wiki/Downloads

and find the entry "VirtualBox 6.1.6 Oracle VM VirtualBox Extension Pack". Select "All supported platforms" to start the download of the software.

**Step 7:** When the software is downloaded, selecting "Open" starts the installation and displays a window as shown in Figure 5.



Figure 5. Install VirtualBox Extension Pack.

Step 8: Quit VirtualBox by selecting "File→Exit"

# Task 2. Installation of GNS3

- **Step 1:** Go to the GNS3 website at <u>https://www.gns3.com/software</u> and select "Download." You need to create an account to download the software. Create your own personal account.
- Step 2: Download the appropriate version for your computer (MacOS, Windows). Once the download is complete, the window in Figure 6 is displayed and the setup GNS3 starts. Click "Next" a few times, unless you want to change the setup of the software.



Figure 6. Setup of GNS3.

**Step 3: (Windows only)** As part of the setup, a window for the WinPcap Setup Wizard as shown in Figure 7 is displayed. Click "Next" and follow the instructions with the default settings.



Figure 7. WinPcap Setup window.

**Step 4: (Windows only)** When the Npcap Setup window appears as shown in Figure 8, select "Install" with the default settings, and follow the instructions.

🌍 Npcap 0.9990 Setup				-		×
NMAP.ORG	Installation Opt Please review th 0.9990	ions e following optic	ons before i	nstalling	Npcap	
Legacy loopback sup	port for Nmap 7.80	and older. Not	needed for	Wiresh	ark.)	
Restrict Npcap drive	r's access to Admini	strators only				
Support raw 802.11	traffic (and monitor	mode) for wire	less adapte	rs		
Install Nocap in WinF	cap API-compatible	Mode (WinPcar	o will be unir	nstalled	)	
	· · ·				·	
Nullsoft Install System v2.51 -						
		< Back	Insta		Cano	el
		( Each	1.10.00		Contro	

Figure 8. Npcap Setup window.

**Step 5: (Windows only)** Next, the installation of GNS3 commences. The installation takes a few minutes and asks to agree to the license agreement.

- When asked for an email, you may type a bogus email address.
- Select "No" when prompted for the free license of the "Solarwinds Standard Toolset."

**Step 6:** Once the installation is complete, GNS3 starts automatically and presents the window shown in Figure 9, as well as the GNS Setup window shown in Figure 10. Select "Cancel" to close the window.

**Step 7:** Close GNS3 by selecting "File $\rightarrow$ Quit" in the GNS3 application window.

🛞 GNS3															-		×
<u>F</u> ile <u>E</u> di	it <u>V</u> iew Contro	Node	Annotate	<u>T</u> ools	<u>H</u> elp												
		a c b	- >			C			$\bigcirc$	and a	5	•	Q	0			
													Tc     Ni	opology Summary ode Cor	nsole		
	Please create a project Servers Summary Caldene CPU 23.4%, RAM 73										M 73.3%	ØX					
5	I												•				
	Console GNS3 manageme Running GNS3 ve Copyright (c) 200 Use Help -> GNS =>	ent console. ersion 2.2.7 o 16-2020 GNS3 3 Doctor to d	n Windows 3 Technolog letect comn	; (64-bit) w gies. non issues.	ith Pytho	n 3.6.8 Qt 5.1	12.1 and Py	Qt 5.12.									

## Figure 9. GNS3 application window.

Setup Wizard ?	×
Server Please choose how would like to run your GNS3 network simulations. The GNS3 V option is strongly recommended on Windows and Mac OS X.	м
Run appliances in a virtual machine	
Requires to download and install the GNS3 VM (available for free)	
Run appliances on my local computer	
A limited number of appliances like the Cisco IOS routers <= C7200 can be run	
Run appliances on a remote server (advanced usage)	
The server will be on a remote computer and can be shared with multiple users	
✓ Don't show this again	
Next > C	ancel

Figure 10. GNS3 Setup Wizard.

# Task 3. Download and install GNS3 VM

GNS3 VM is a virtual machine that accelerates the execution of routers and hosts in GNS3. The following instructions install GNS3 VM on VirtualBox. Since the size of GNS3 VM is > 500 MB, the download may take some time.

Step 1: In a web browser go to

#### https://www.gns3.com/software/download-vm

On the web page, shown in Figure 11, click on the "Download" button for VirtualBox. When asked, click "Save" to start the download.



Figure 11. Webpage for downloading GNS3 VM.

**Step 2:** Once the download is complete, go to the *Downloads* folder on your computer. You will find a ZIP file "GNS3.VM.VirtualBox.2.2.7.zip".

The label "2.2.7" in the ZIP file represents a version number. When you download the virtual machine, the version number may be different. This is not an issue, as long as the version number matches that of the downloaded GNS3 application.

In Windows: When you click on the ZIP file in the Downloads folder, the file explorer opens the "Compressed Folder Tools" view, which shows an "Extract All" button. The folder now displays the file "GNS3 VM.ovf." Select "Extract All." This starts VirtualBox and displays the "Appliance Settings" windows shown in Figure 12. In this window, select "Import" to start the import of GNS3 VM.

? ×

Import Virtual Appliance

#### Appliance settings

These are the virtual machines contained in the appliance and the suggested settings of the imported VirtualBox machines. You can change many of the properties shown by double-clicking on the items and disable others using the check boxes below.

Virtual System 1			^			
😽 Name		GNS3 VM				
旹 Guest OS Ty	/pe	💕 Ubuntu (64-bit)				
CPU		1				
RAM		2048 MB				
🕪 Sound Card		ICH AC97				
📑 Network Adapter		Intel PRO/1000 MT Desktop (82540EM)				
📑 Network Adapter		Intel PRO/1000 MT Desktop (82540EM)	~			
Machine Base Folder:	C:\Users\userr	ame\VirtualBox VMs	~			
MAC Address Policy:	Include only N	AT network adapter MAC addresses	•			
Additional Options: 🗹 Import hard drives as VDI						
Appliance is not signed						
		Restore Defaults Import Cancel				

Figure 12. Appliance setting window for importing GNS3 VM.

**Step 3:** Once the import of the GNS3 VM is complete, VirtualBox displays a window as seen in Figure 13.

휳 Oracle VM VirtualBox Manager	- 🗆 X					
<u>F</u> ile <u>M</u> achine <u>H</u> elp						
Tools	New Settings Discard Start					
GNS3 VM U Powered Off	General     Preview       Name:     GNS3 VM       Operating System:     Ubuntu (64-bit)					
	System Base Memory: 2048 MB Boot Order: Hard Disk, Optical Acceleration: VT-x/AND-V, Nested Paging, PAE/NX, KVM Paravirtualization					
	📃 Display					
	Video Memory: S MB Graphics Controller: VBoxVGA Remote Desktop Server Port: 5903 Recording: Disabled					
	Storage					
	Controller: IDE Controller IDE Primary Master: GNS3 VM-disk001.vdi (Normal, 19.53 GB) Controller: SATA Controller SATA Port 2: GNS3 VM-disk002.vdi (Normal, 488.28 GB)					
	խ Audio					
	Host Driver: Windows DirectSound Controller: ICH AC97					
	🚽 Network					
	Adapter 1: Intel PRO/1000 MT Desktop (Host-only Adapter, 'vboxnet0') Adapter 2: Intel PRO/1000 MT Desktop (NAT)					
	🖉 USB					
	Disabled					
	Shared folders					
	None					

Figure 13. VirtualBox Manager after importing the GNS3 VM.

- **Step 4:** Select the GNS3 VM on the left-hand side, then select "Settings" in the top of the window, and then click on "Network" in the popup window. You now see the window in Figure 14.
- **Step 5:** The window in Figure 14 shows the network configuration for "Adapter 1." Make sure that "Enable Network Adapter" is checked and that the "Attached to" field shows "Host-only Adapter."

Then click on "Advanced" to obtain the window shown in Figure 15.

**Important:** In the field "Promiscuous Mode" change the selection from "Deny" (indicated by a red arrow) to "Allow All."

😳 GNS3 VM - Settings		?	×
General	Network		
System	Adapter <u>1</u> Adapter <u>2</u> Adapter <u>3</u> Adapter <u>4</u>		
Display	Enable Network Adapter		
Storage	Attached to: Host-only Adapter *		
Audio	Name: VirtualBox Host-Only Ethernet Adapter Advanced		•
Network			
Serial Ports			
彦 USB			
Shared Folders			
User Interface			
	ОК	Can	cel

Figure 14. Network Settings of GNS3 VM (Adapter 1).

😳 GNS3 VM - Settings			?	×
General	Network			
System	Adapter <u>1</u> Adapter <u>2</u>	Adapter <u>3</u> Adapter <u>4</u>		
Display	Enable Network Adapt	er		
Storage	Attached to:	Host-only Adapter 🔹		
Audia	<u>N</u> ame:	VirtualBox Host-Only Ethernet Adapter		•
Audio	✓ Advanced			
Network	Adapter Type:	Intel PRO/1000 MT Desktop (82540EM)		•
Serial Ports	Promiscuous Mode:	Deny		•
USB	MAC Address:	080027FDC002		<b>S</b>
		Cable Connected		
Shared Folders		Port Forwarding		
User Interface				
		ОК	Car	icel

Figure 15. Network Settings of GNS3 VM (Adapter 1, Advanced).

Step 6: Continuing with the window in Figure 15, select the tab for "Adapter 2" to obtain the window in Figure 16. Make sure that "Enable Network Adapter" is checked and that the "Attached to" field shows "NAT."

😳 GNS3 VM - Settings	;		?	×
General	Network			
System	Adapter <u>1</u> Adapter <u>2</u>	Adapter <u>3</u> Adapter <u>4</u>		
Display	Enable Network Adapt	er		
Storage	<u>Attached to:</u>	NAT *		_
Audio	<u>N</u> ame: ▼ Advanced			*
Network	Adapter <u>T</u> ype:	Intel PRO/1000 MT Desktop (82540EM)		•
Serial Ports	Promiscuous Mode:	Deny		τ.
USB	MAC Address:	0800272B6ACF		S
Shared Folders		Cable Connected <u>P</u> ort Forwarding		
		ОК	Car	ncel

Figure 16. Network Settings of GNS3 VM (Adapter 2).

- **Step 7:** Click "OK" to confirm the configuration of the GNS3 VM. This completes the installation of GNS3 VM for use by the GNS3 application.
- Step 8: In the VirtualBox window, select "File→Exit."

#### **Task 4. Configuration of GNS3**

The last task of the software installation is the configuration of the GNS3 application so that it can access the installed GNS3 VM. For reasons not fully understood, the configuration is sometimes not successful even when all pieces are in place. Restarting the applications and/or the installation of the VM generally resolves arising issues.

- **Step 1:** Start GNS3 (installed in Task 2) and select "Help→Setup Wizard".
- Step 2: The first window of the Setup Wizard is shown Figure 10. Proceed with the default selection "Run applications in a virtual machine" and click "Next".
- Step 3: Select the setting 192.168.56.1 for "Host binding" and click "Next" as shown in Figure 17 below. (On a Mac, if 192.168.56.1 is not shown, select 127.0.0.1 instead.)

🛞 Setup Wizard	i	?	×
Local server Please co	configuration figure the following GNS3 local server settings		
Server path:	C:\Program Files\GNS3\gns3server.EXE	Brow	se
Host binding:	192.168.56.1		•
Port:	3080 TCP		-
	< <u>Back</u> <u>Next</u> >	Can	cel

Figure 17. GNS3 Local server configuration.

Step 4: The software will proceed with some installation. In the process, you may see an error message, which you may ignore. Eventually, you see a window as shown in Figure 18, telling you that connection to the local server has succeeded. Select "Next."

😢 Setup Wizard	?	×
Local server status Validation of the configuration for the local server		
Connection to the local GNS3 server has been successful!	Canc	rel
Figure 18. GNS3 Local server stat	us.	

**Step 5:** You now get a warning message as shown in Figure 19, which you can safely ignore. Click OK to proceed to the next screen.



Figure 19. Warning message during GNS3 setup.

Step 6: The next window that is displayed, shown in Figure 20 is for the setup of GNS3 VM. Select the box "VirtualBox" as shown in the figure. After a short time, you should see that the filed "VM Name" shows GNS3 VM as in the figure. If this is not the case, click on the "Refresh" button. Once GNS3 VM is displayed, click "Next".

Setup Wizard	?
GNS3 VM In order to run the GNS3 VM you must first have VMware or VirtualBox installed and the GNS3 software.	/M.ova imported with one of these
Virtualization software: • VMware (recommended) • VirtualBox If you don't have the GNS3 Virtual Machine you can <u>download it here</u> . And import the VM in the virtualization software and hit refresh.	SAVE 20% GNS3 Exclusive BUY NOW
VM name:	
VM name: GNS3 VM	▼ Refresh
VM name: GNS3 VM VCPU cores:	▼ <u>R</u> efresh
VM name: GNS3 VM vCPU cores: 1	• <u>R</u> efresh
VM name: GNS3 VM vCPU cores: 1 RAM size:	Refresh
VM name: GNS3 VM vCPU cores: 1 RAM size: 2048 MB	<u>R</u> efresh
VM name: GNS3 VM vCPU cores: 1 RAM size: 2048 MB	▼ <u>R</u> efresh

Figure 20. Configuration of GNS3 VM.

Step 7: Next, the window in Figure 21 displays that the configuration is complete. Click on "Finish."

			•
Summary The server to	he has been configured, please see the summary of the settings be	alow	
The server cy	in this been configured, pieace see the summary of the seatings be		
Server type:	GNS3 Virtual Machine		
VM engine:	Virtualbox		
VM name:	GNS3 VM		
VM vCPUs:	1		
VM RAM:	2048 MB		

Figure 21. Summary of GNS3 VM configuration.

**Step 8:** When the configuration of GNS3 is complete, the virtual machine GNS3 VM will boot up. Once the boot is completed, you see a window as shown in Figure 22.



#### Auto capture keyboard (for all VirtualBox virtual machines)

If you click inside the window of the GNS3 VM (Figure 22), the control of the mouse and the keyboard is transferred to the virtual machine. When you type on the keyboard, the input will go to virtual machine, and when you move the mouse, it will only move within the boundaries of the window of the virtual machine.

When this is enabled, the arrow in the lower right corner of the window in Figure 11 (showing a downward pointing arrow) turns green.

To transfer the control of keyboard and mouse back to the host computer, press the right control key (Right Ctrl) on your keyboard. This is of course a problem when your keyboard does not have two control keys. On Windows computers, Ctrl+ALT+DEL followed by selecting "Cancel" also transfers control to the host.

🕎 GNS3 VM [Runni	ng] - Oracle VM VirtualBox 🛛 🗆 🖾	
File Machine View Input Devices Help		
GNS3 2.0.3 You have the <b>Auto capture keyboard</b> option turned on. This will cause the Virtual Machine to automatically <b>capture</b> 🛞 🕅 -		
The Virtual Machine r	eports that the guest OS does not support mouse pointer integration in the current video $@$ 😡	
	GNS3 version: 2.0.3 VM version: 0.10.14 KVM support available: False IP: 192.168.56.101 To log in using SSH: ssh gns30192.168.56.101 Password: gns3 Images and projects are located in /opt/gns3 Release channel: 2.0 <pre></pre>	
	😰 🗗 🧰 🖉 🚱 😯 Right Control 💡	

Figure 22. GNS3 VM running.

Step 9: In the main window of the GNS3 application, the status of GNS3 VM is displayed in the pane "Servers Summary" (see Figure 16). If the GNS3 VM is running properly the status indicator should be green.



Windows users are done! For Mac users, there is an additional task (Task 5).

#### Task 5. (Mac only) Download and install Wireshark

On Mac systems, there is an additional task to install the Wireshark protocol analyzer.

If you are running Windows, Wireshark is installed as part of the GNS3 installation. Skip Task 5!

Step 1: In a web browser go to

#### https://www.wireshark.org

On the web page, shown in Figure 23, select "macOS Intel 64-bit.dmg" and start the download.

- **Step 10:** Once the download is complete, go to the *Downloads* folder and open the downloaded file.
- **Step 11:** When you see the window shown in Figure 24, drag the Wireshark icon (blue shark fin) to the application folder. Wait until Wireshark is copied to the Application folder.
- **Step 12:** To test the installation, go to the Application folder and find the Wireshark icon. Doubleclick to start Wireshark. Select "Wireshark→Quit Wireshark" to close the application.



Figure 23. Webpage for downloading Wireshark.



Figure 12. Installation of Wireshark (Mac only).

Now you are ready to move on to Lab 1!