



Installation of GNS3 & vTestbed setup for SONiC

Revision History

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Introduction

Graphical Network Simulator-3 (shortened to GNS3) is a network software emulator first released in 2008. It allows the combination of virtual and real devices to simulate complex networks. It uses Dynamips emulation software to simulate Cisco IOS. GNS3 is used by many large companies including Exxon, Walmart, AT&T, and NASA, and is also famous for preparing network professional certification exams.



This testing guide explains the step-by-step procedure of GNS3 installation on Ubuntu 22.04 using CLI and then setting up a virtual TestBed for SONiC

Installation Procedure

GNS3 version 2.2.x is compatible with Ubuntu 20.04 | 22.04. For more information on the latest version of GNS3, one can visit this [link](#). First, we have to update and upgrade the packages of the system.

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ sudo apt update
[sudo] password for bushra:
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Hit:2 https://download.docker.com/linux/ubuntu jammy InRelease
Hit:3 http://packages.osrfoundation.org/gazebo/ubuntu-stable jammy InRelease
Hit:4 http://pk.archive.ubuntu.com/ubuntu jammy InRelease
Hit:5 https://dl.google.com/linux/chrome/deb stable InRelease
Hit:6 http://packages.ros.org/ros2/ubuntu jammy InRelease
Hit:7 https://ppa.launchpadcontent.net/danielrichter2007/grub-customizer/ubuntu
jammy InRelease
Get:8 http://pk.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Hit:9 https://ppa.launchpadcontent.net/gns3/ppa/ubuntu jammy InRelease
Get:10 http://pk.archive.ubuntu.com/ubuntu jammy-backports InRelease [107 kB]
```

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ sudo apt upgrade
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 libllvm13
Use 'sudo apt autoremove' to remove them.
Get more security updates through Ubuntu Pro with 'esm-apps' enabled:
  libpostproc-dev libjs-jquery-ui libopenexr-dev libavdevice58 libopenexr25
  libpostproc55 libswscale-dev libavdevice-dev libavcodec58 libavutil56
  libswscale5 libavutil-dev libswresample3 libavfilter-dev libavformat58
```

Step-1

GNS3 packages are available on gns3 ppa repository. Add the repository by running this command:

- `sudo add-apt-repository ppa:gns3/ppa`

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ sudo add-apt-repository ppa:gns3/ppa
[sudo] password for bushra:
Repository: 'deb https://ppa.launchpadcontent.net/gns3/ppa/ubuntu/ jammy 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.^CAborted.
```

Step-2

Update the system package list by running this command again:

- `sudo apt update`

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ sudo apt update
Hit:1 http://packages.ros.org/ros2/ubuntu jammy InRelease
Hit:2 http://pk.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:4 http://pk.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Hit:5 https://download.docker.com/linux/ubuntu jammy InRelease
Hit:6 http://packages.osrfoundation.org/gazebo/ubuntu-stable jammy InRelease
Hit:7 https://ppa.launchpadcontent.net/danielrichter2007/grub-customizer/ubuntu
jammy InRelease
Get:8 http://pk.archive.ubuntu.com/ubuntu jammy-backports InRelease [107 kB]
Hit:9 https://ppa.launchpadcontent.net/gns3/ppa/ubuntu jammy InRelease
Hit:10 https://dl.google.com/linux/chrome/deb stable InRelease
Fetched 336 kB in 2s (148 kB/s)
```

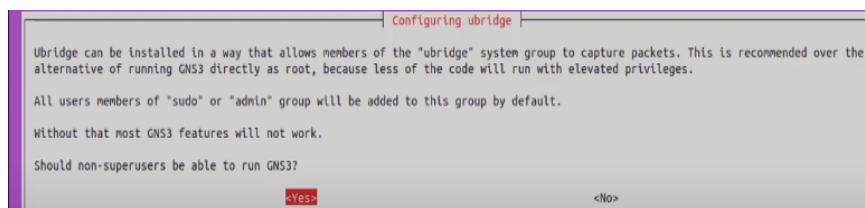
Step-3

Now, install GNS3 server by running the following command:

- `sudo apt-get install gns3-server gns3-gui`

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ sudo apt-get install gns3-server gns3-gui
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
gns3-gui is already the newest version (2.2.38-jammy1).
gns3-server is already the newest version (2.2.38-jammy1).
The following packages were automatically installed and are no longer required:
 libflashrom1 libftdi1-2 libllvm13
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 24 not upgraded.
```

A window will pop-up after installation called “Configuring ubridge”. Select “yes” from the options:



```
Configuring ubridge

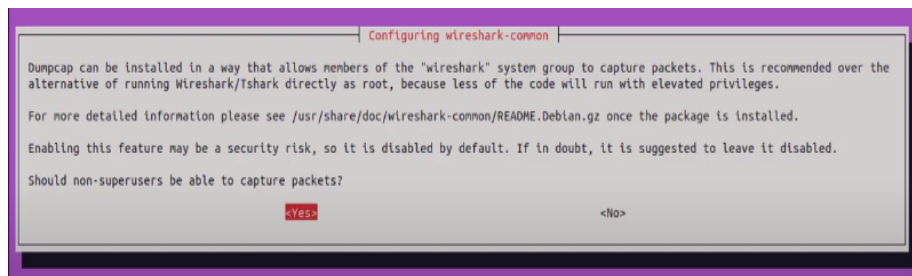
Ubridge can be installed in a way that allows members of the "ubridge" system group to capture packets. This is recommended over the
alternative of running GNS3 directly as root, because less of the code will run with elevated privileges.

All users members of "sudo" or "admin" group will be added to this group by default.

Without that most GNS3 features will not work.

Should non-superusers be able to run GNS3?
<Yes> <No>
```

Another window will pop up named “Configuring Wireshark-common”. Click “yes” again:



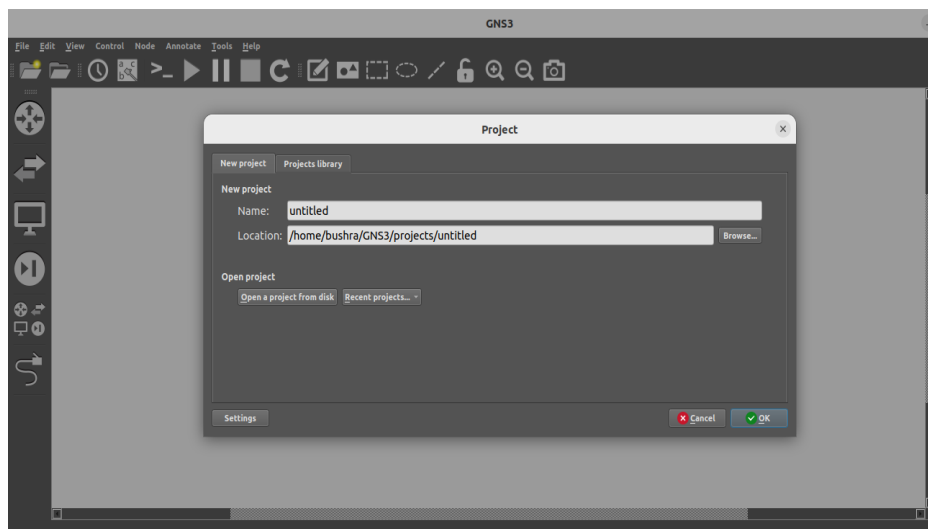
Step-4

Now run GNS3 on your computer by running this command on the terminal:

- gns3

```
bushra@bushra-HP-Laptop-15-da2xxx:~$ gns3
2023-03-24 10:38:37 INFO root:126 Log level: INFO
2023-03-24 10:38:37 INFO main:263 GNS3 GUI version 2.2.38
2023-03-24 10:38:37 INFO main:264 Copyright (c) 2007-2023 GNS3 Technologies Inc.
2023-03-24 10:38:37 INFO main:265 Application started with /usr/bin/gns3
```

Following window of GNS3 will pop up:



The installation of GNS3 has been completed successfully, which means we're now one step closer to setting up our testbed.

Testbed Setup

To deploy any topology, we will need a testbed that will set up the perfect environment where we can deploy our topologies. Now testbeds are of two types i.e., physical and virtual, depending on our availability of resources (switches, hosts, servers). If we have the required devices available for our topology, then we can go with a physical testbed otherwise we will opt for the virtual one.

Virtual Switch Testbed

SONiC (Software for Open Networking in the Cloud) is a free and open-source network operating system (OS) based on Linux that runs on switches from multiple vendors and ASICs and uses a key-value database (Redis). To prepare the testbed, we need the following things:

1. GNS3 Software
2. Device image for GNS3
3. SONiC image (.img file)

If GNS3 software is already installed and running without issues, skip step one and proceed to the next step, which involves acquiring the necessary device images for use in GNS3.

Device Image for GNS3

To deploy a SONiC image in GNS3, we need a device image. To download that image, go to the link given [here](#) and make “.sh” file.

After downloading, some changings are required to make it compatible with GNS3. For Ubuntu, make it executable by “right-click>properties>permissions>allow executing file as program” and then execute it by using command “./<filename>”

Note: Before downloading gns3a file, it must be noted that “.sh” and “sonic-vs.img” files must be present in the same directory.

Basic	Permissions	Open With
Owner:	Me	
Access:	Read and write	
Group:	humza-vm	
Access:	Read and write	
Others		
Access:	Read and write	
Execute:	<input checked="" type="checkbox"/> Allow executing file as program	
Security context:	unknown	

SONiC image for GNS3

To download the SONiC image (.img file) for GNS3, the procedure is given below:

- Open the web browser and type “SONiC- Build Azure pipelines” in the search bar.
- Click the first [link](#).

SONiC Image Azure Pipelines				
Seq.	Platform	BranchName	DefinitionId	Builds
1	barefoot	master	146	Build History
2	barefoot	202205	146	Build History
3	barefoot	202111	146	Build History

- To download the latest vs image, check available images on the website, confirm the recent build date (e.g., 202205), and click "Build History" to proceed.

61	vs	master	142	Azure.sonic-buildimage.official.vs	Build History
62	vs	202205	142	Azure.sonic-buildimage.official.vs	Build History
63	vs	202111	142	Azure.sonic-buildimage.official.vs	Build History

- It displays a list of different versions of the “vs” images. Select the most recent one and verify the "Result" column which shows "succeeded". Then click "Artifacts" to Proceed further.

BuildId	BuildNumber	BranchName	BuildName	Result	StartTime	FinishTime	Commit	BuildLink	Artifacts
244167	20230331.4	202205	Azure.sonic-buildimage.official.vs	succeeded	2023-03-31T08:17:34	2023-03-31T13:35:40	1cf4c84c43	Build Link	Artifacts
243523	20230330.4	202205	Azure.sonic-buildimage.official.vs	succeeded	2023-03-30T08:14:47	2023-03-30T13:26:30	f620052715	Build Link	Artifacts
242856	20230329.4	202205	Azure.sonic-buildimage.official.vs	succeeded	2023-03-29T08:21:23	2023-03-29T13:37:47	f620052715	Build Link	Artifacts

- Once you click on the "Artifacts" button, a new tab will open displaying “sonic-buildimage.vs” file. Click on it.

Seq.	ArtifactId	Name
1	409595	sonic-buildimage.vs

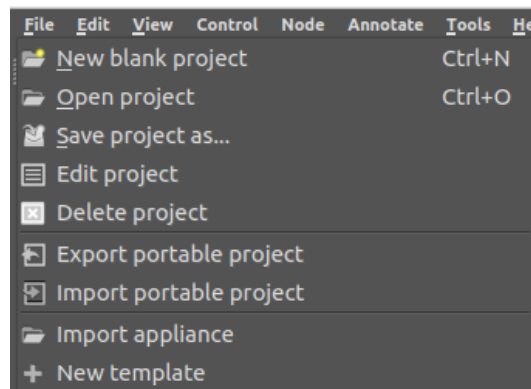
- Locate the "target/sonic-vs.img.gz" option in the new tab. Click on the corresponding button to initiate the download process.

1188	target/sonic-vs.bin	955834258	file
1189	target/sonic-vs.img.gz	967951500	file
1190	target/sonic-vs.img.gz.log	803606	file

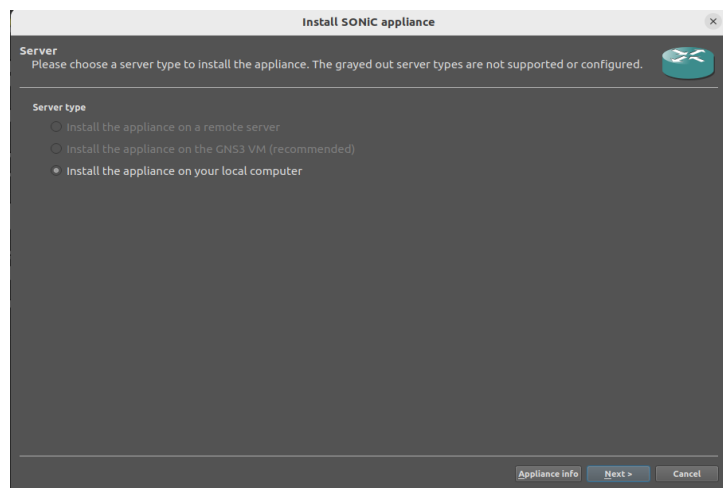
Importing GNS3 device image

To import the device and SONiC image in GNS3 after creating a project, follow the path given below:

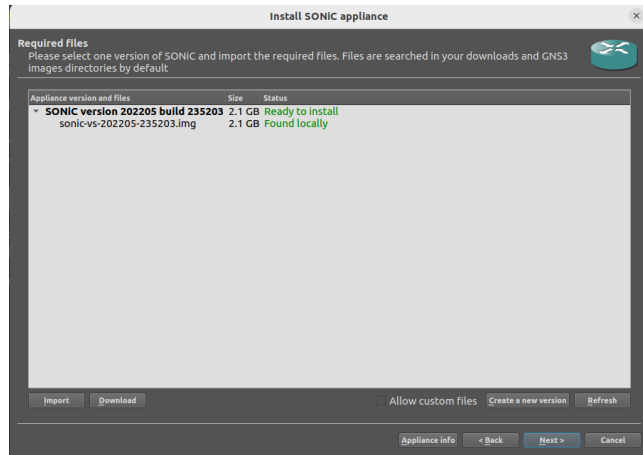
- file>import appliance



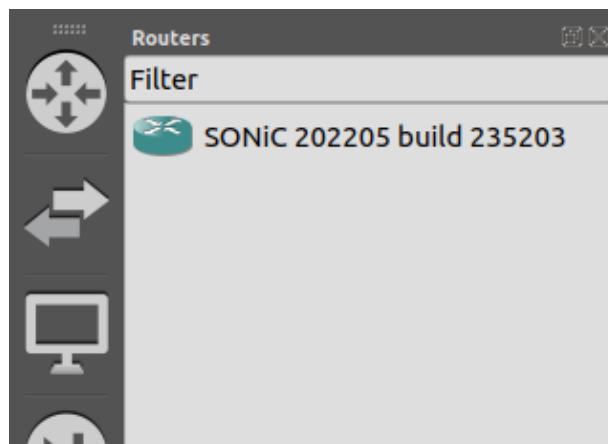
- After that, a pop-up menu will open, Click on "Install the appliance on your local computer".



- Now click on the “Next” button.



- Looking at the GNS3 interface, we can see that a new device in the section of “Routers” with the name “SONiC 202205 build 235203” has been added to the left side of the screen.



Finally, when the device image is imported, one can use GNS3 to draw different topologies.

- Drag and drop the router. Run the device by pressing the green “Start” button on the top bar. By clicking on the SONiC router, the following window will pop up:

```
SONIC202205-1
[ 25.851525] rc.local[356]: + [ -d /host/old_config ]
[ 25.892289] rc.local[356]: + [ -f /host/minigraph.xml ]
[ 25.924531] rc.local[356]: + [ -n ]
[ 25.949044] rc.local[356]: + touch /tmp/pending_config_initialization
[ 25.990182] rc.local[356]: + touch /tmp/notify_firstboot_to_platform
[ 26.020322] rc.local[356]: + [ ! -d /host/reboot-cause/platform ]
[ 26.058212] rc.local[356]: + mkdir -p /host/reboot-cause/platform
[ 26.090182] rc.local[356]: + [ -d /host/image-202205.250942-c55a5a94e/platfor
m/x86_64-kvm_x86_64-r0 ]
[ 26.138449] rc.local[356]: + sync
[ 26.170367] rc.local[356]: + [ -n x86_64-kvm_x86_64-r0 ]
[ 26.197798] rc.local[356]: + [ -n ]
[ 26.218196] rc.local[356]: + mkdir -p /var/platform
[ 26.244888] rc.local[356]: + [ -f /etc/default/kdump-tools ]
[ 26.281524] rc.local[356]: + sed -i -e s/PLATFORM_/x86_64-kvm_x86_64-r0/g
/etc/default/kdump-tools
[ 26.332529] rc.local[356]: + firsttime_exit
[ 26.353820] rc.local[356]: + rm -rf /host/image-202205.250942-c55a5a94e/platf
orm/firsttime
[ 26.401934] rc.local[356]: + exit 0
Debian GNU/Linux 11 sonic ttyS0
sonic login: [ ]
```

- Enter the following credentials to have access to the SONiC switch/router.

sonic login: admin

Password: YourPaSsWoRd

```
SONIC202205-1
Debian GNU/Linux 11 sonic ttyS0
sonic login: admin
Password:
Login incorrect
sonic login: admin
Password:
Linux sonic 5.10.0-18-2-amd64 #1 SMP Debian 5.10.140-1 (2022-09-02) x86_64
You are on

SONiC

-- Software for Open Networking in the Cloud --

Unauthorized access and/or use are prohibited.
All access and/or use are subject to monitoring.

Help: https://sonic-net.github.io/SONiC/
admin@sonic:~$ [ ]
```

Port Breakout

In SONiC, the ports are structured in groups of four, such as Ethernet0, Ethernet4, Ethernet8, and so on. When connecting switches in GNS3, a menu appears allowing users to select the desired port. If Ethernet1 is chosen in GNS3, it corresponds to using Ethernet4 in the SONiC CLI. Similarly, selecting Ethernet2 in GNS3 corresponds to using Ethernet8 in the SONiC CLI.

Interface	Lanes	Speed	MTU	FEC	Alias	Vlan	Oper
Ethernet0	25,26,27,28	40G	9100	N/A	fortyGigE0/0	routed	down
Ethernet4	29,30,31,32	40G	9100	N/A	fortyGigE0/4	routed	down
Ethernet8	33,34,35,36	40G	9100	N/A	fortyGigE0/8	routed	down
Ethernet12	37,38,39,40	40G	9100	N/A	fortyGigE0/12	routed	down
Ethernet16	45,46,47,48	40G	9100	N/A	fortyGigE0/16	routed	down
Ethernet20	41,42,43,44	40G	9100	N/A	fortyGigE0/20	routed	down
Ethernet24	1,2,3,4	40G	9100	N/A	fortyGigE0/24	routed	down

FRR Split Mode Configuration

It is normal behaviour of SONiC that after rebooting the switch or reloading the config_db all configurations go back to default for FRR. To avoid this add this to config_db in "DEVICE_METADATA":

- **"docker_routing_config_mode": "split",**

```
"DEVICE_METADATA": {
  "localhost": {
    "bgp_asn": "65100",
    "buffer_model": "traditional",
    "default_bgp_status": "up",
    "default_pfcwd_status": "disable",
    "docker_routing_config_mode": "split",
    "hostname": "sonic",
    "hwsku": "Force10-S6000",
    "mac": "0c:a4:8f:41:00:00",
    "platform": "x86_64-kvm_x86_64-r0",
    "synchronous_mode": "enable",
    "type": "LeafRouter"
  }
}
```

References

- <https://www.youtube.com/watch?v=PBdHzJOi1Tc>
- <https://www.sysnettechsolutions.com/en/what-is-gns3/>
- https://en.wikipedia.org/wiki/Graphical_Network_Simulator-3
- <https://sonic-build.azurewebsites.net/ui/sonic/pipelines>
- <https://www.n-study.com/en/how-to-use-gns3/using-gns3-appliance/#:~:text=What%20is%20GNS3%20Appliances%3F,device%20you%20wish%20to%20emulate.>