

Planning RouterOS Networks with GNS3

By: Michael Omondi

Name: Michael Omondi

Preferred Name: **Mike**

8+ years in the IT industry.

Introduced to Mikrotik in 2014

Areas of interest:

- ✓ ISP Solutions
- ✓ Wireless Services
- ✓ Network Security

Certifications

- ✓ Mikrotik:- MTCNA, MTCRE, MTCWE & MTCTCE,
- ✓ Other Vendors:- Cisco, CompTIA, Vmware, Solarwinds, Ubiquiti, Cyberoam

We are an IT company

- Training
- Consultancy
- Design, deployment and management of computer networks
- Server deployment and management
- Cloud services (storage, backup & archiving, web & application hosting etc.), Data Center Virtualization and many more.
- For more about us, please visit <http://lockstepit.com>

Provide adequate knowledge to
make you comfortable running
RouterOS in GNS3

- **In 2015, Mikrotik released a virtual RouterOS instance for x86_64 architecture.**
- **They called it Cloud Hosted Router (CHR)**
- **Designed for virtualized environments.**

- Currently there are 4 levels of licensing.
 - a) Free- 1Mbps interface speed
 - b) P1- 1Gbps
 - c) P10- 10Gbps
 - d) P-Unlimited

- **Training classes**
- **Exam preparation**
- **Testing configuration before deployment**
- **Production**

- **Graphical Network Simulator**
- **Originally developed to emulate Cisco's IOS**
- **It's capabilities have been extended beyond just Ciscos' IOS**
- **For this Lab setup version 1.5.2 of GNS3 installation and its Virtual Machine counterpart will be used.**

- **Quick Emulator**
- **Developed to virtualize x86_64 architectures in Linux**
- **REMEMBER: RouterOS is a Linux**
- **To successfully build a virtual RouterOS Lab we will enlist QEMU version 2.5.0**

- **64bit CPU with virtualization support**
- **128 MB or more RAM for the CHR instance**
- **128 MB disk space for the CHR virtual hard drive**

CHR has been tested on the following platforms:

- **VirtualBox 5 on Linux and OS X**
- **VMWare Fusion 7 and 8 on OS X**
- **Qemu 2.4.0.1 on OS X**
- **Hyper-V on Windows Server 2012 (*Only Generation 1 Hyper-V virtual machine is supported at the moment*)**

GNS3 can run on Windows, Linux and OSX

For my Presentation, I have used;

Processor: Intel Core i5 2.50GHz

RAM: 8GB

OS: Windows 10 Pro

Hypervisor: VMware Workstation 12 Pro

- **Download GNS3 from her:**
<https://gns3.com/software/download>
- **NB: sign in is required or create an account**




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Download

Download GNS3

Select the installer for your favourite OS




Windows

Version 1.5.2

[DOWNLOAD](#)

[Install Guide for Windows](#)




Linux

Version 1.5.2

[DOWNLOAD](#)

[Install Guide for Linux](#)



Mac

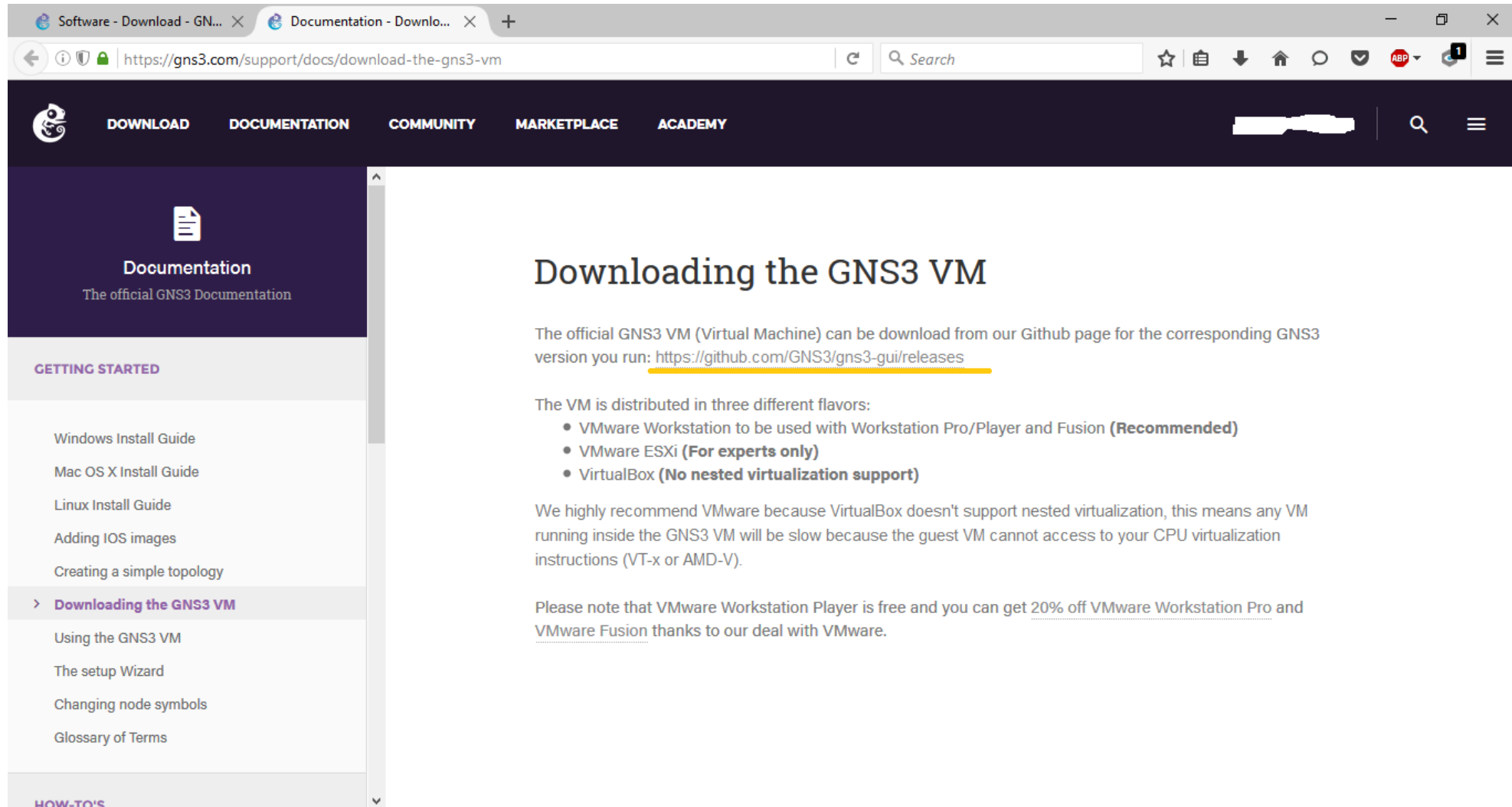
Version 1.5.2

[DOWNLOAD](#)

[Install Guide for Mac](#)

[Download the GNS3 VM](#) **Click Here**

GNS3 is a Free and Open Source software under GPL v3 licensing



The screenshot shows a web browser window with the URL <https://gns3.com/support/docs/download-the-gns3-vm>. The page features a dark navigation bar with links for DOWNLOAD, DOCUMENTATION, COMMUNITY, MARKETPLACE, and ACADEMY. A sidebar on the left is titled "Documentation" and lists various guides, with "Downloading the GNS3 VM" selected. The main content area has the heading "Downloading the GNS3 VM" and provides instructions on where to download the VM from (GitHub) and lists three supported virtualization flavors: VMware Workstation (recommended), VMware ESXi (for experts only), and VirtualBox (no nested virtualization support). It also includes a note about the VMware Workstation Pro discount.

Software - Download - GN... x Documentation - Downlo... x +

https://gns3.com/support/docs/download-the-gns3-vm

SEARCH

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DOWNLOAD DOCUMENTATION COMMUNITY MARKETPLACE ACADEMY

Documentation
The official GNS3 Documentation

GETTING STARTED

- Windows Install Guide
- Mac OS X Install Guide
- Linux Install Guide
- Adding IOS images
- Creating a simple topology
- > **Downloading the GNS3 VM**
- Using the GNS3 VM
- The setup Wizard
- Changing node symbols
- Glossary of Terms

HOW-TO'S

Downloading the GNS3 VM

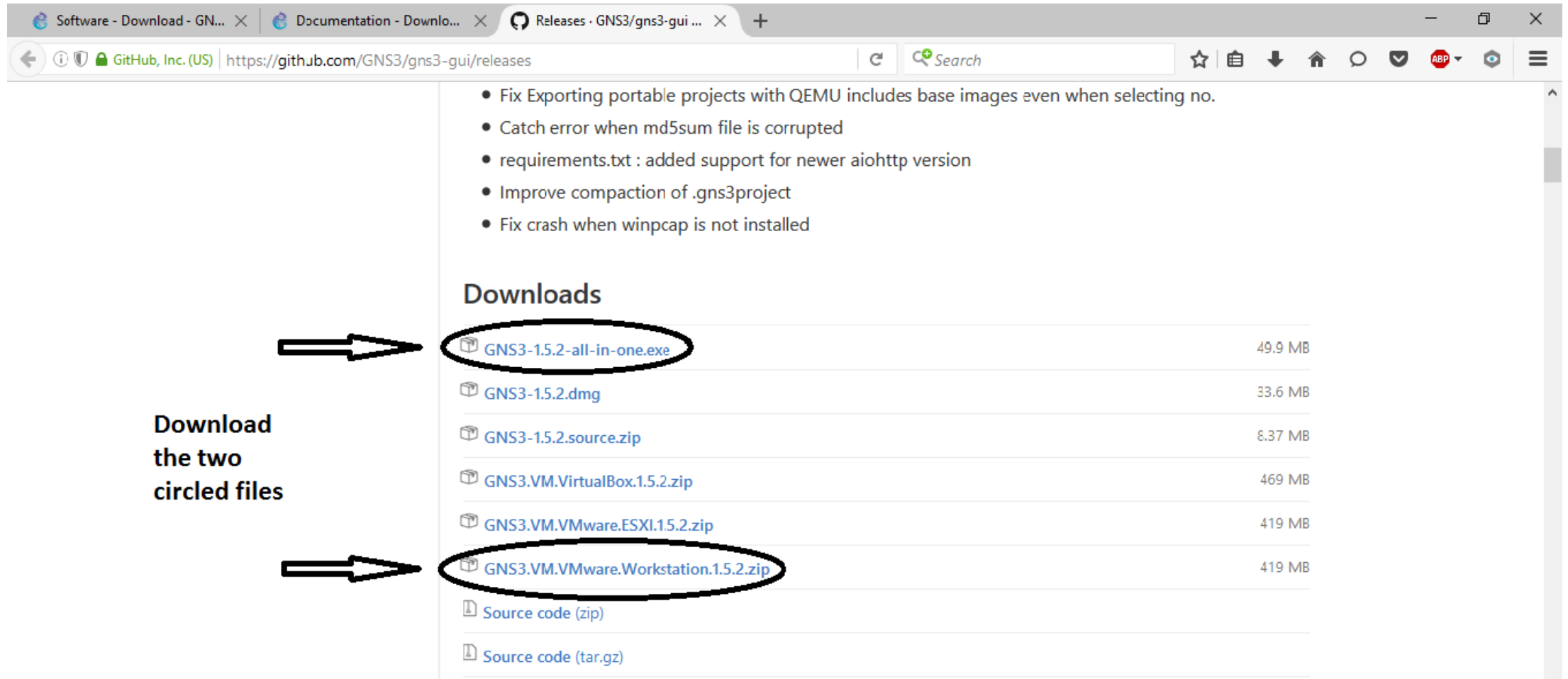
The official GNS3 VM (Virtual Machine) can be download from our Github page for the corresponding GNS3 version you run: <https://github.com/GNS3/gns3-gui/releases>

The VM is distributed in three different flavors:

- VMware Workstation to be used with Workstation Pro/Player and Fusion (**Recommended**)
- VMware ESXi (**For experts only**)
- VirtualBox (**No nested virtualization support**)

We highly recommend VMware because VirtualBox doesn't support nested virtualization, this means any VM running inside the GNS3 VM will be slow because the guest VM cannot access to your CPU virtualization instructions (VT-x or AMD-V).

Please note that VMware Workstation Player is free and you can get 20% off VMware Workstation Pro and VMware Fusion thanks to our deal with VMware.











Software - Download - GN... × Documentation - Downlo... × Releases · GNS3/gns3-gui ... × +

GitHub, Inc. (US) | <https://github.com/GNS3/gns3-gui/releases> Search

- Fix Exporting portable projects with QEMU includes base images even when selecting no.
- Catch error when md5sum file is corrupted
- requirements.txt : added support for newer aiohttp version
- Improve compaction of .gns3project
- Fix crash when winpcap is not installed

Downloads

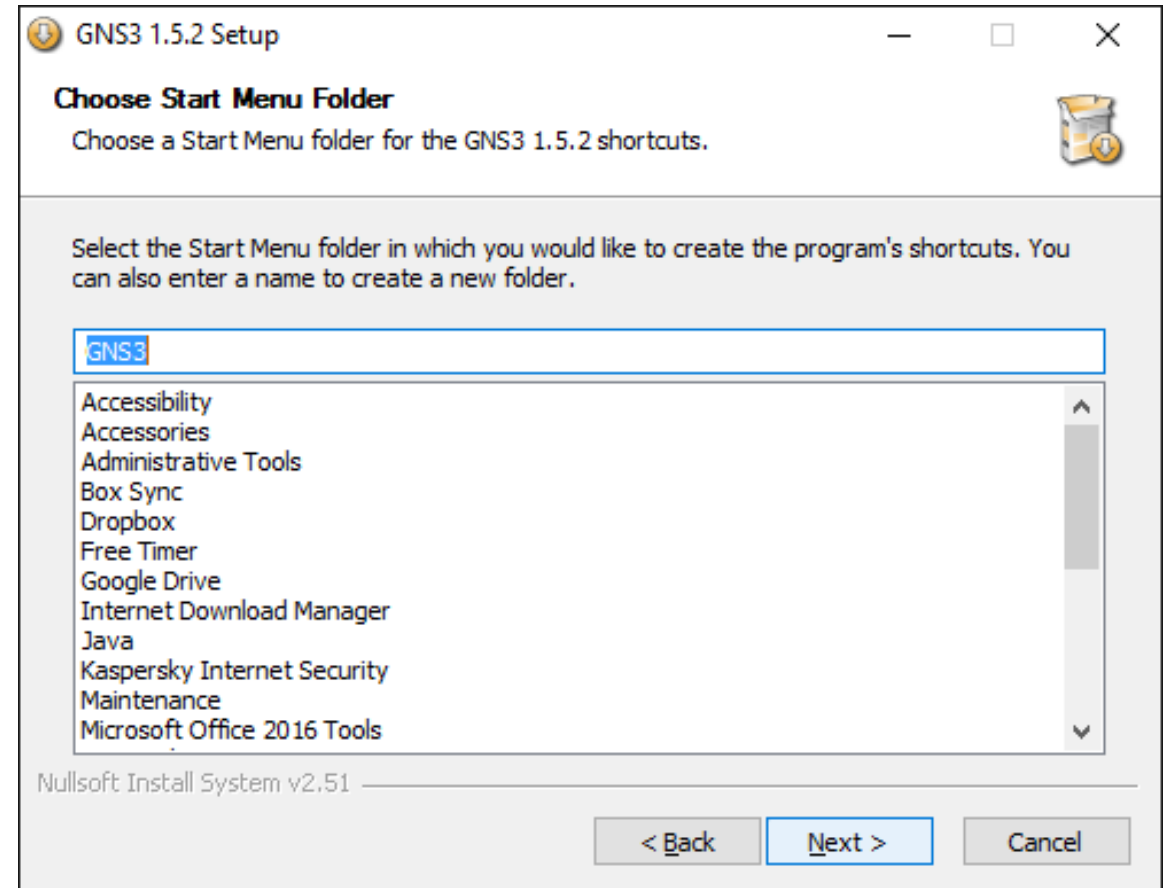
 GNS3-1.5.2-all-in-one.exe	49.9 MB
 GNS3-1.5.2.dmg	33.6 MB
 GNS3-1.5.2.source.zip	8.37 MB
 GNS3.VM.VirtualBox.1.5.2.zip	469 MB
 GNS3.VM.VMware.ESXI.1.5.2.zip	419 MB
 GNS3.VM.VMware.Workstation.1.5.2.zip	419 MB
 Source code (zip)	
 Source code (tar.gz)	

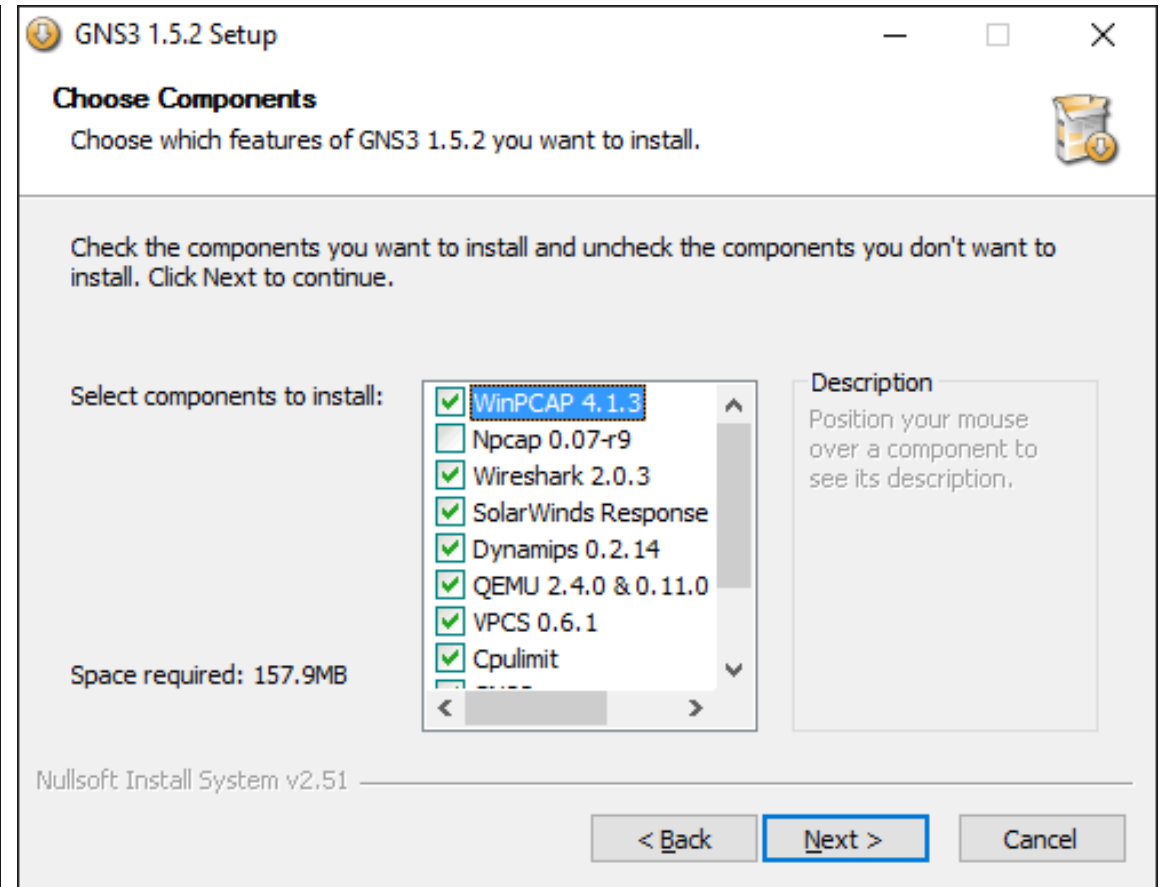
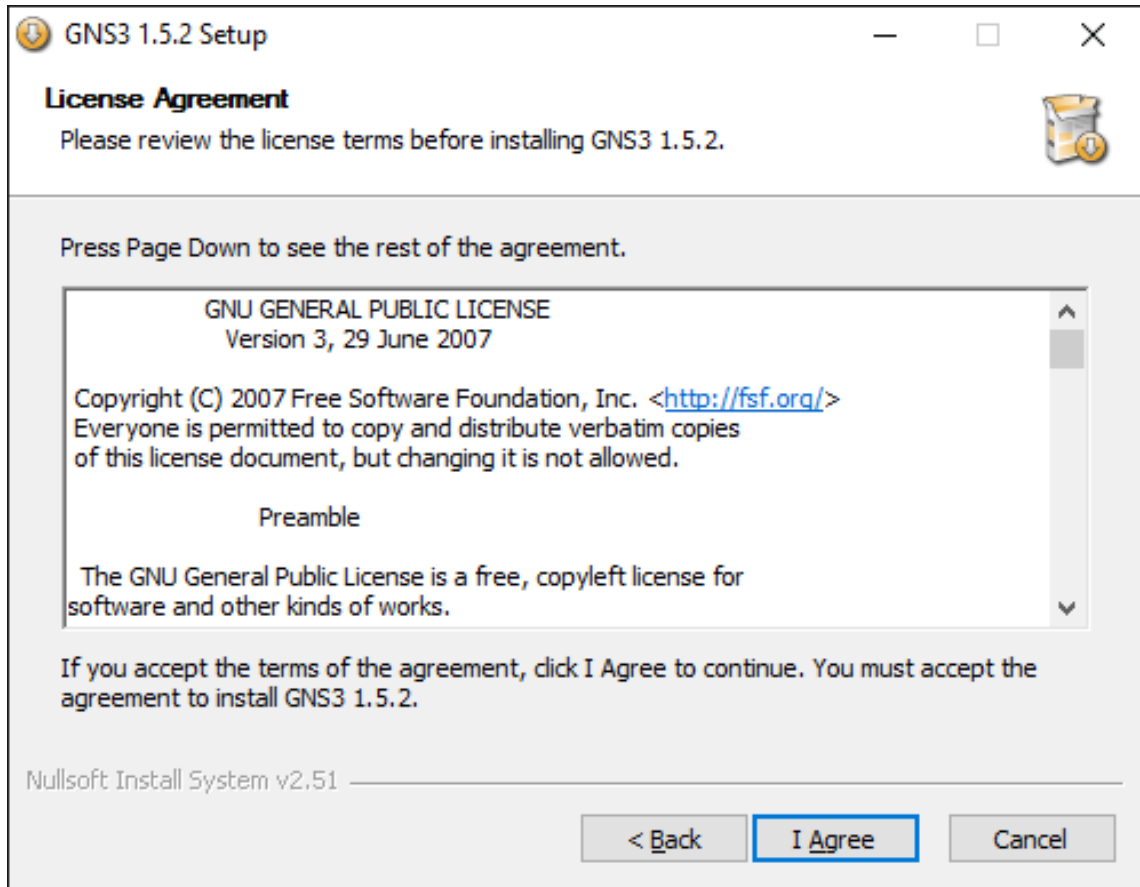
Download the two circled files

Once the download is finished;

Run the .exe file, follow the prompts.

NB: you need to be connected to the internet as the installation will download additional files





Once the installation is finished;

Extract the zipped VM (OVA) file

Import it into VMware

NB: you can use VMware player (free) or VMware workstation (license required).

We will use VMware Workstation 12 Pro.

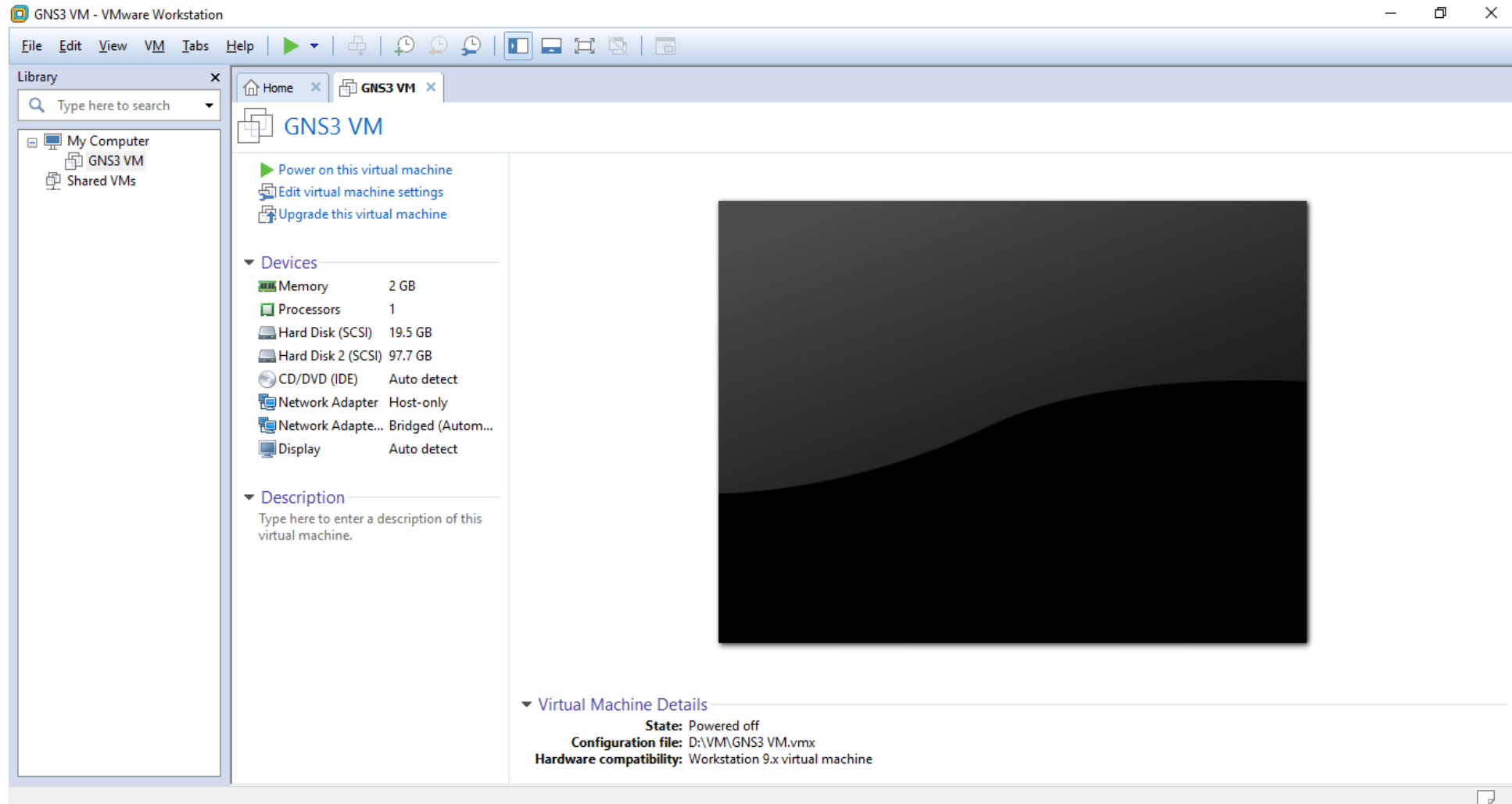


Import Virtual Machine ✕

Store the new Virtual Machine
Provide a name and local storage path for the new virtual machine.

Name for the new virtual machine:

Storage path for the new virtual machine:



The Next thing is;

Download CHR from here:

<http://www.mikrotik.com/download>

NB: The file format to be downloaded depends on the hypervisor.

For our case we will download the VHDX file.

Time to put the pieces together.

Open GNS3

Configure GNS3 to use the GNS3 VM

Setup Wizard

Server
Please choose a server type to run your GNS3 network simulations. The GNS3 VM is strongly recommended on Windows and Mac OS X.

Local GNS3 VM
 Local server

Don't show this again


Next > Cancel

Setup Wizard

GNS3 VM
In order to run the GNS3 VM you must first have VMware or VirtualBox installed and the GNS3 VM.ova imported in one of these.

Virtualization software:

VMware (recommended)
 VirtualBox



The GNS3 VM can [downloaded here](#).
Import the VM in your virtualization software and hit refresh.

VM name:

GNS3 VM

vCPU cores:

2

RAM size:

4048 MB

< Back Next > Cancel

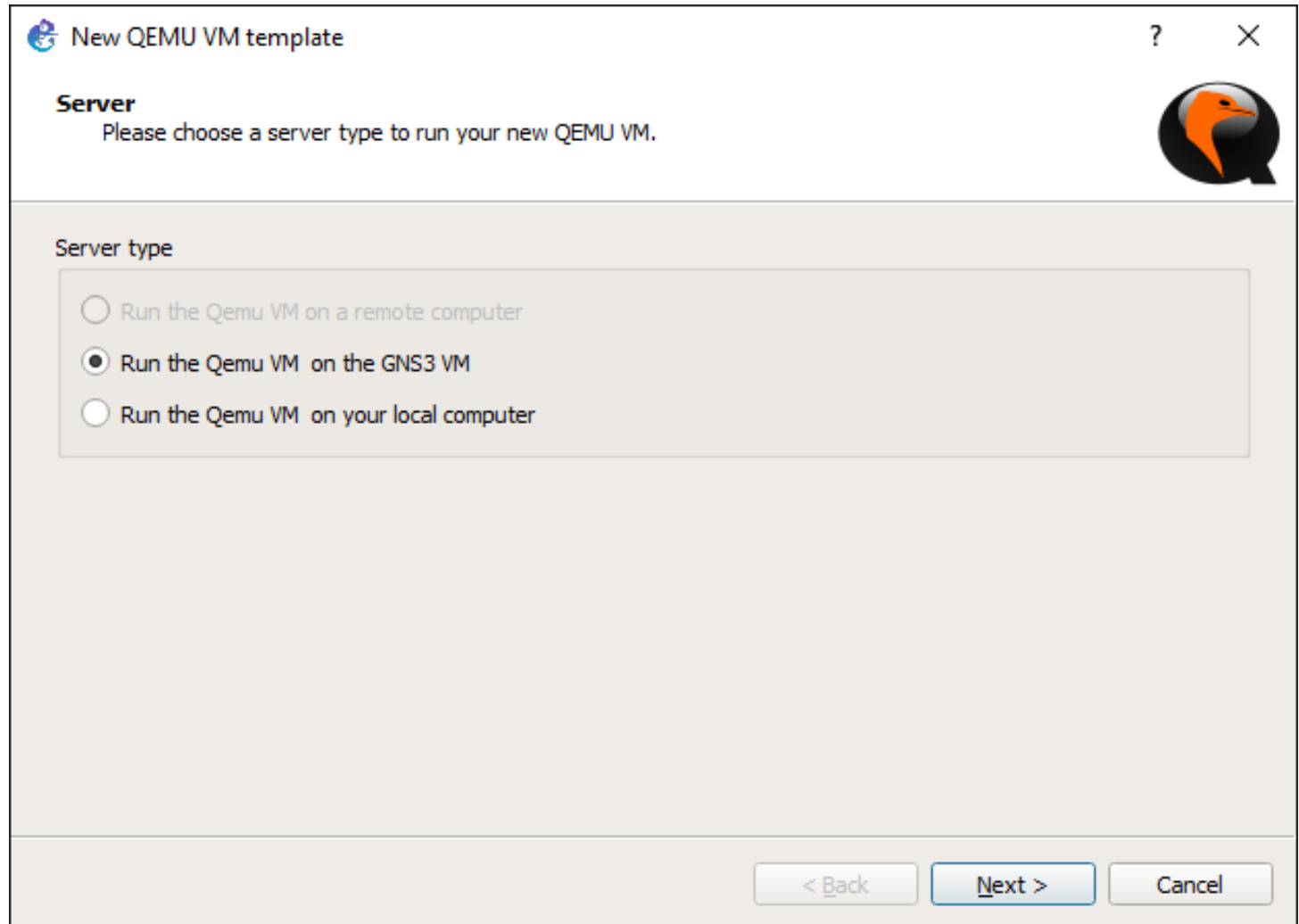
Setup Wizard

Add virtual machines
Now that you have configured the server type you can choose to add one or more virtual machines (VMs) of different types.

- Add an IOS router using a real IOS image (supported by Dynamips)
- Add an IOU (IOS on UNIX) device using a L3 or L2 IOU image
- Add a Qemu virtual machine
- Add a VirtualBox virtual machine
- Add a VMware virtual machine
- Add a Docker container

< Back Finish Cancel

Select “Run Qemu VM
on the GNS3 VM”



The screenshot shows a dialog box titled "New QEMU VM template" with a help icon and a close button in the top right corner. Below the title bar, the word "Server" is displayed, followed by the instruction "Please choose a server type to run your new QEMU VM." and a QEMU logo. The main area is titled "Server type" and contains three radio button options: "Run the Qemu VM on a remote computer", "Run the Qemu VM on the GNS3 VM" (which is selected), and "Run the Qemu VM on your local computer". At the bottom of the dialog, there are three buttons: "< Back", "Next >", and "Cancel".

**Give Your VM a
name**

New QEMU VM template

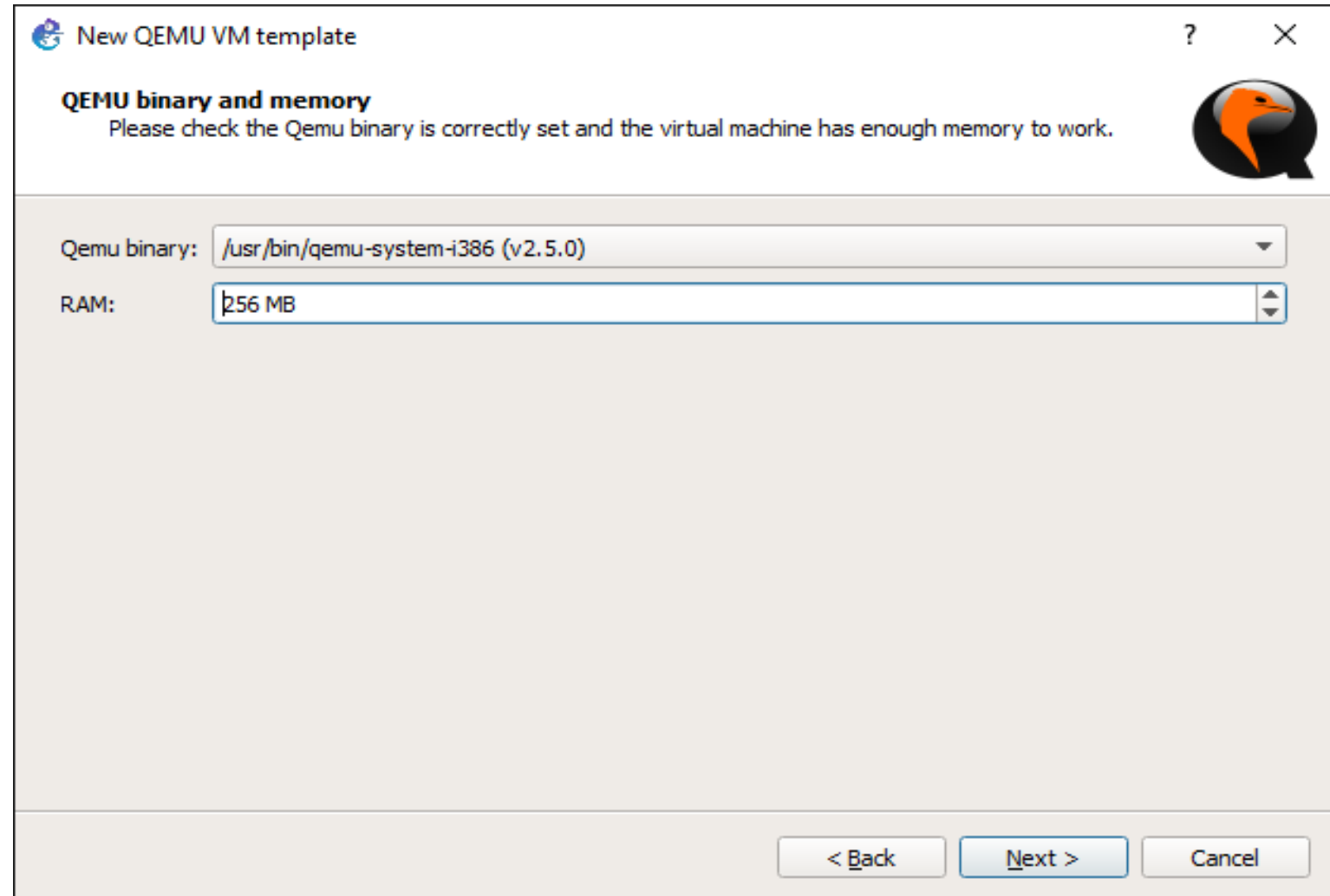
QEMU VM name
Please choose a descriptive name for your new QEMU virtual machine.

Name:

This is a legacy ASA VM

< Back Next > Cancel

- **Select the Qemu binary & location**
- **Set the Memory**



New QEMU VM template

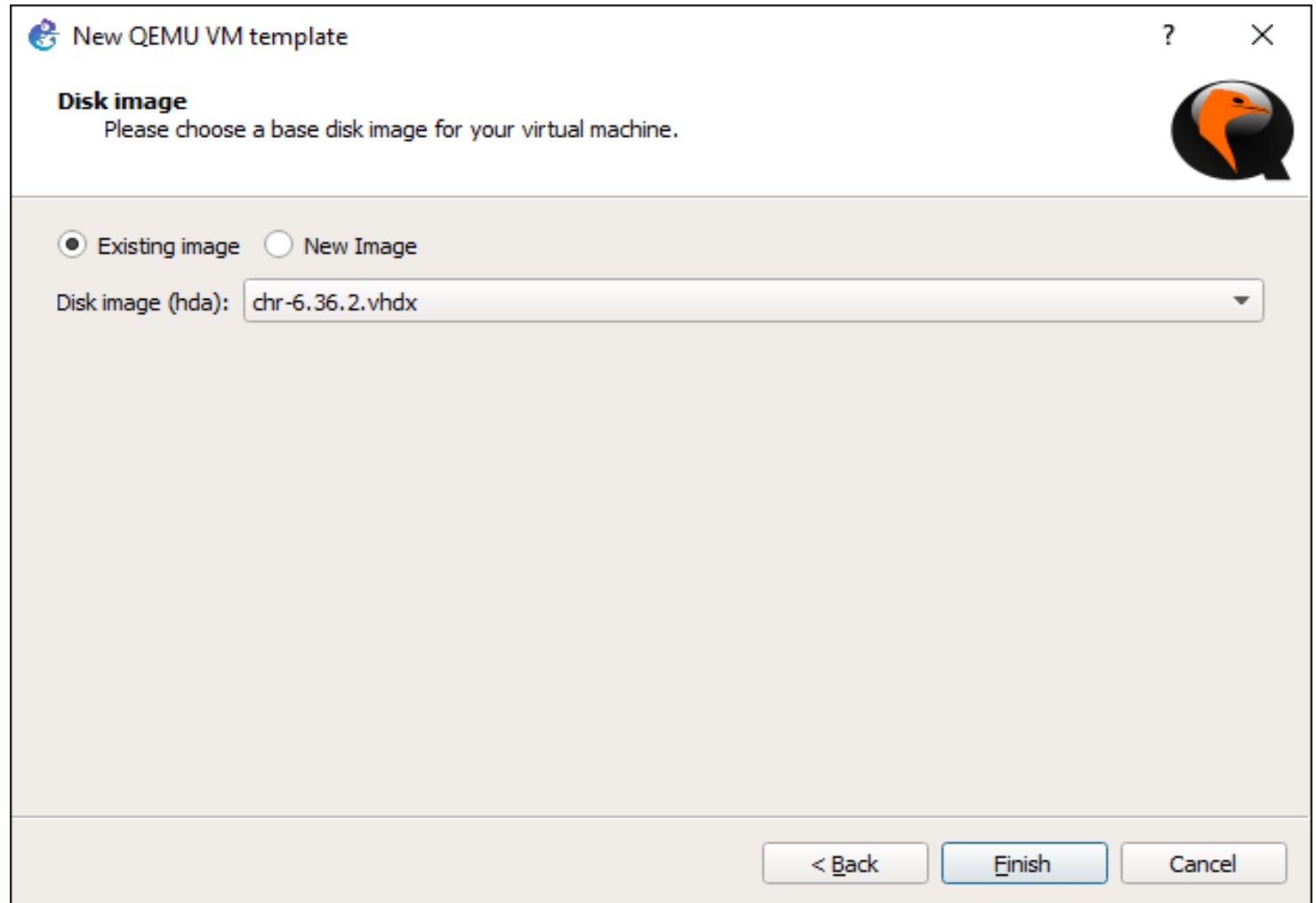
QEMU binary and memory
Please check the Qemu binary is correctly set and the virtual machine has enough memory to work.

Qemu binary: /usr/bin/qemu-system-i386 (v2.5.0)

RAM: 256 MB

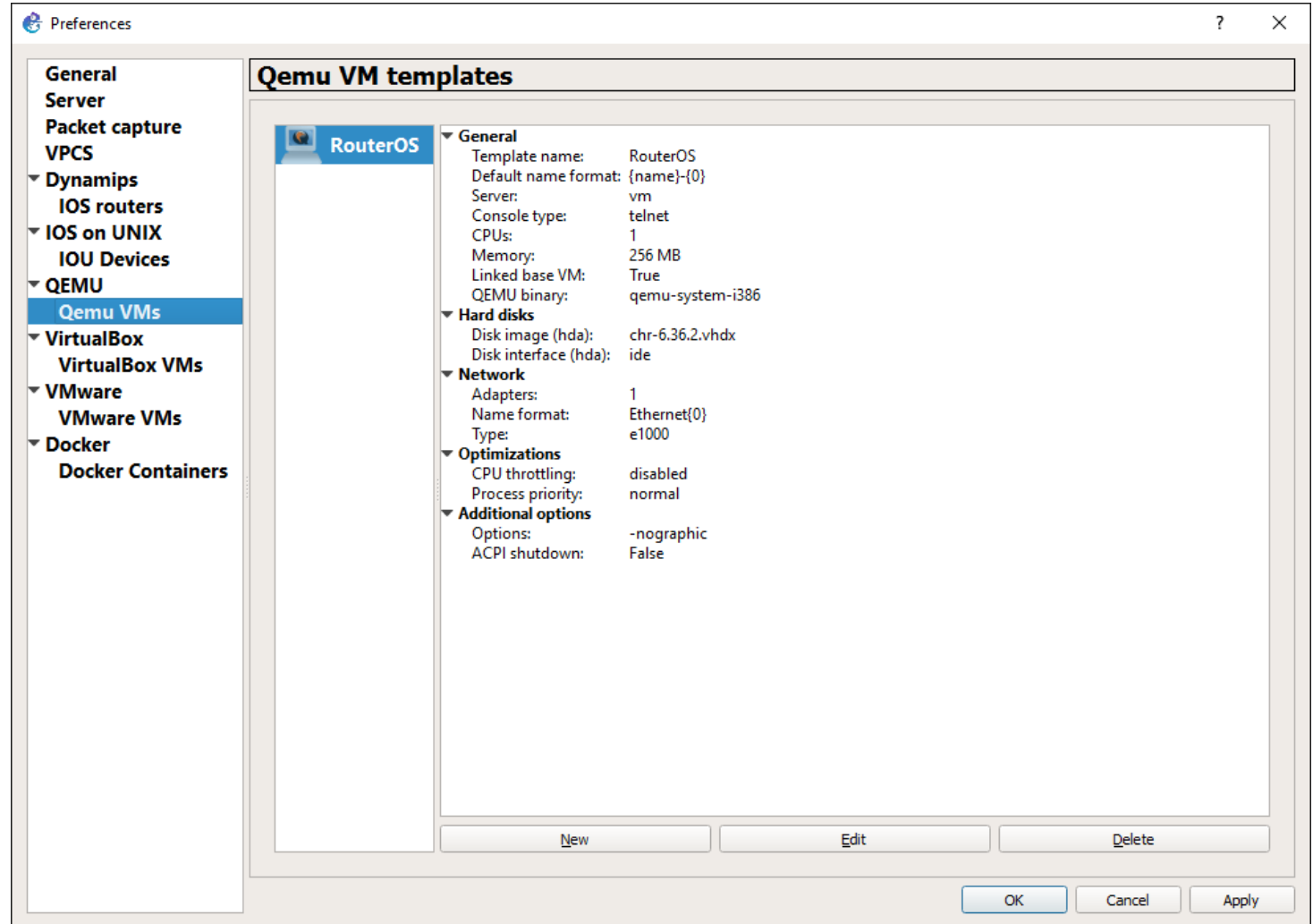
< Back Next > Cancel

- Select “existing image”
- Browse to the location of your VHDX and select

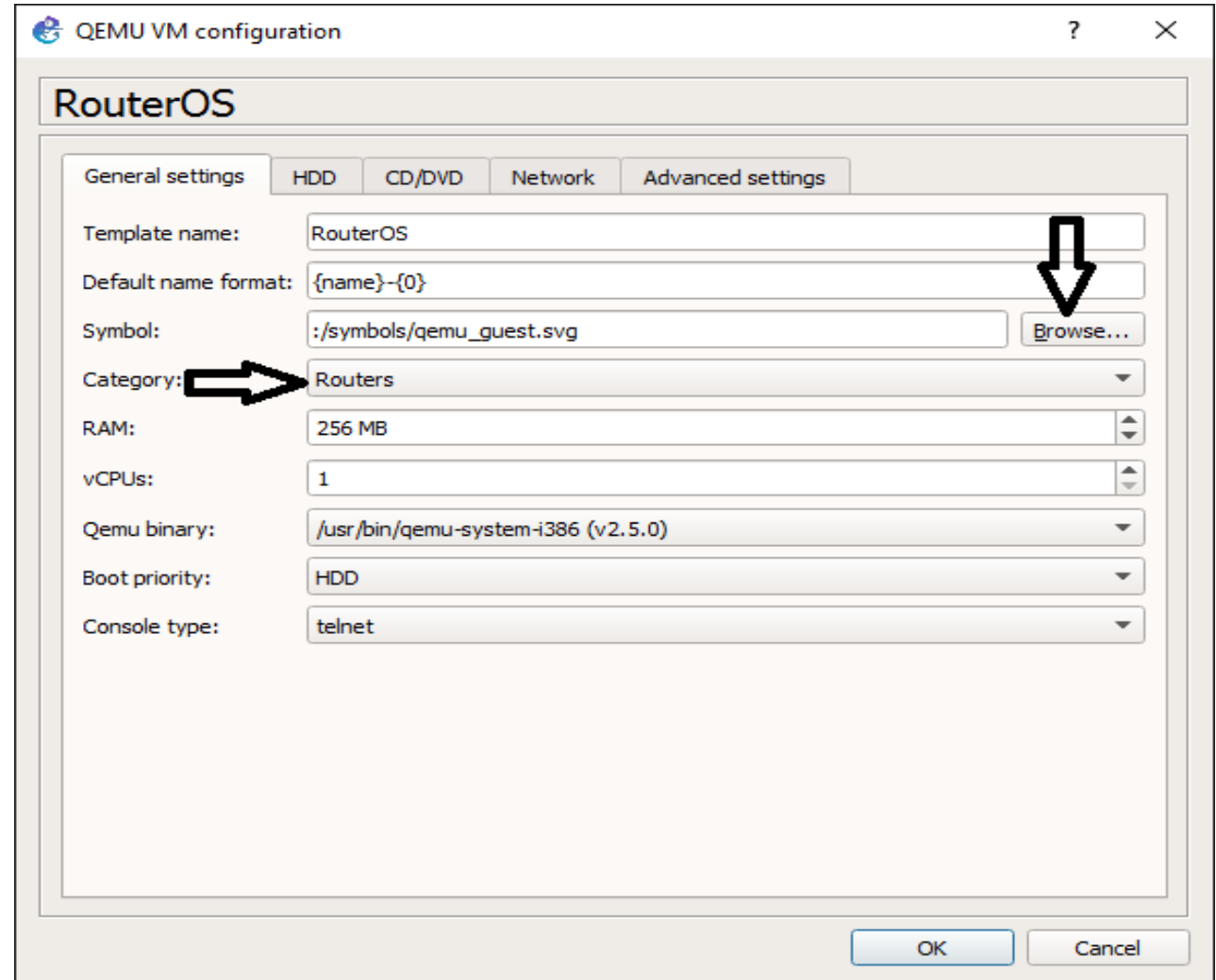


The screenshot shows a dialog box titled "New QEMU VM template" with a close button (X) and a help button (?). The main heading is "Disk image" with the instruction "Please choose a base disk image for your virtual machine." Below this, there are two radio buttons: "Existing image" (which is selected) and "New Image". Underneath, there is a text field labeled "Disk image (hda):" containing the text "chr-6.36.2.vhdx". At the bottom right, there are three buttons: "< Back", "Finish", and "Cancel".

**Qemu VM template is
now set and ready for use**



- Click 'Edit' then general tab
- Change category to 'Routers'
- Change Symbol to that of a router



QEMU VM configuration

RouterOS

General settings | HDD | CD/DVD | Network | Advanced settings

Template name: RouterOS

Default name format: {name}-{0}

Symbol: Browse...

Category: **Routers**

RAM: 256 MB

vCPUs: 1

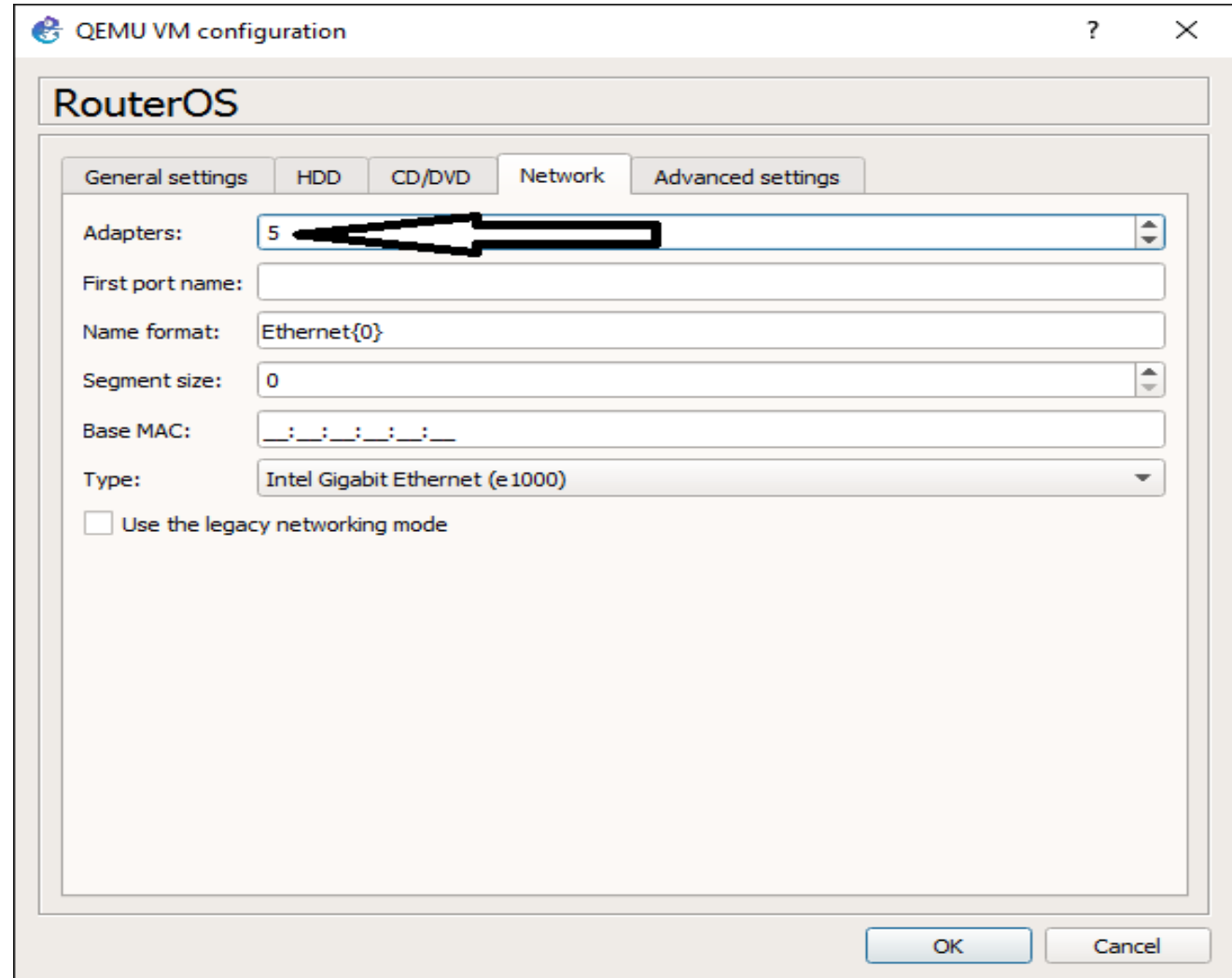
Qemu binary: /usr/bin/qemu-system-i386 (v2.5.0)

Boot priority: HDD

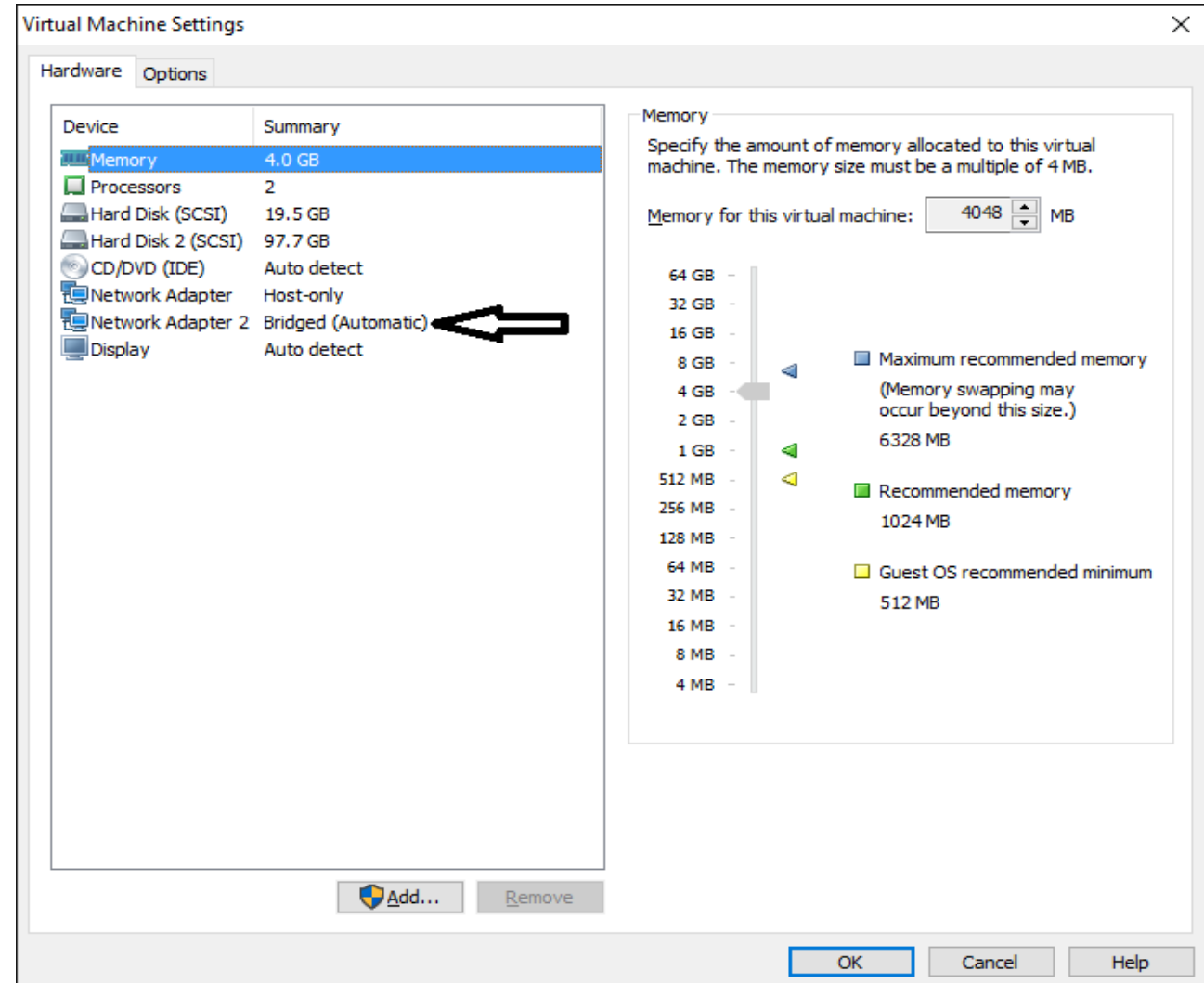
Console type: telnet

OK Cancel

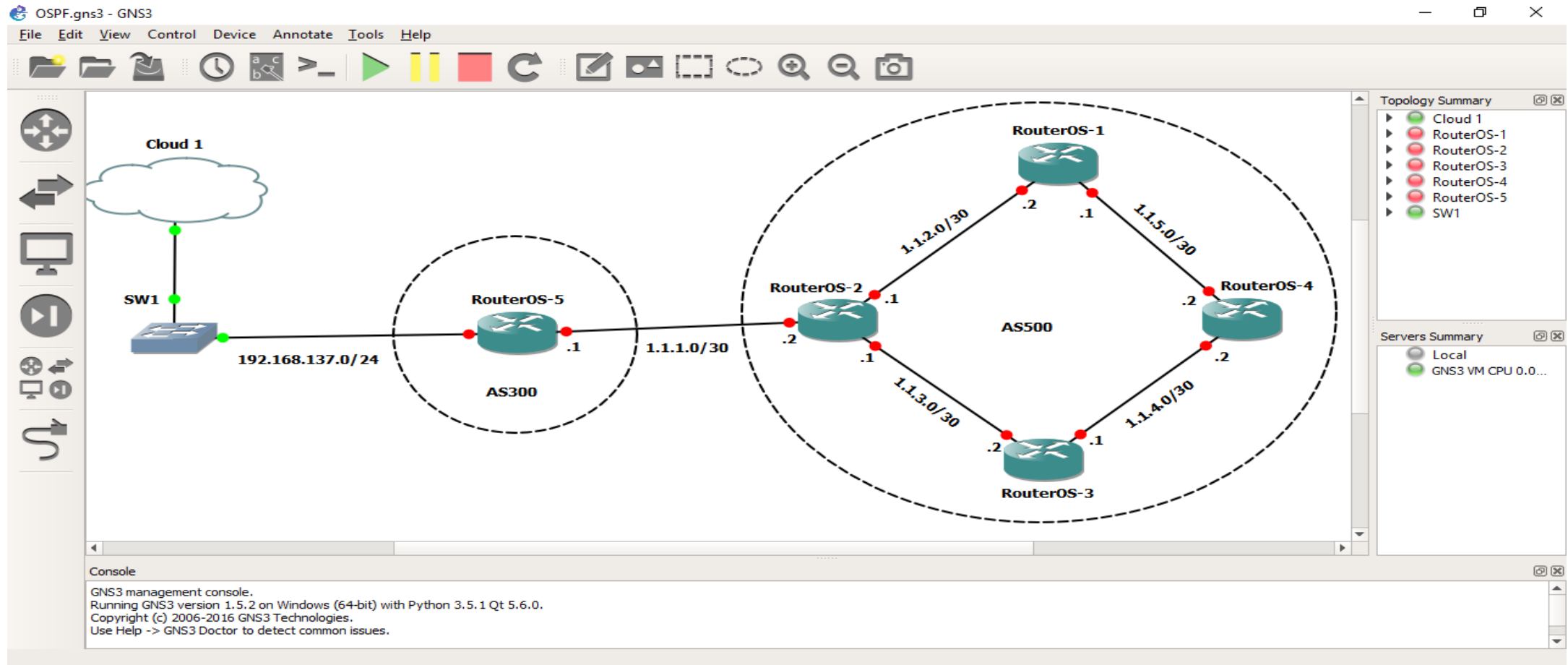
**Navigate to Network tab,
Under 'Adapters' Specify
number of interfaces in
the VM**



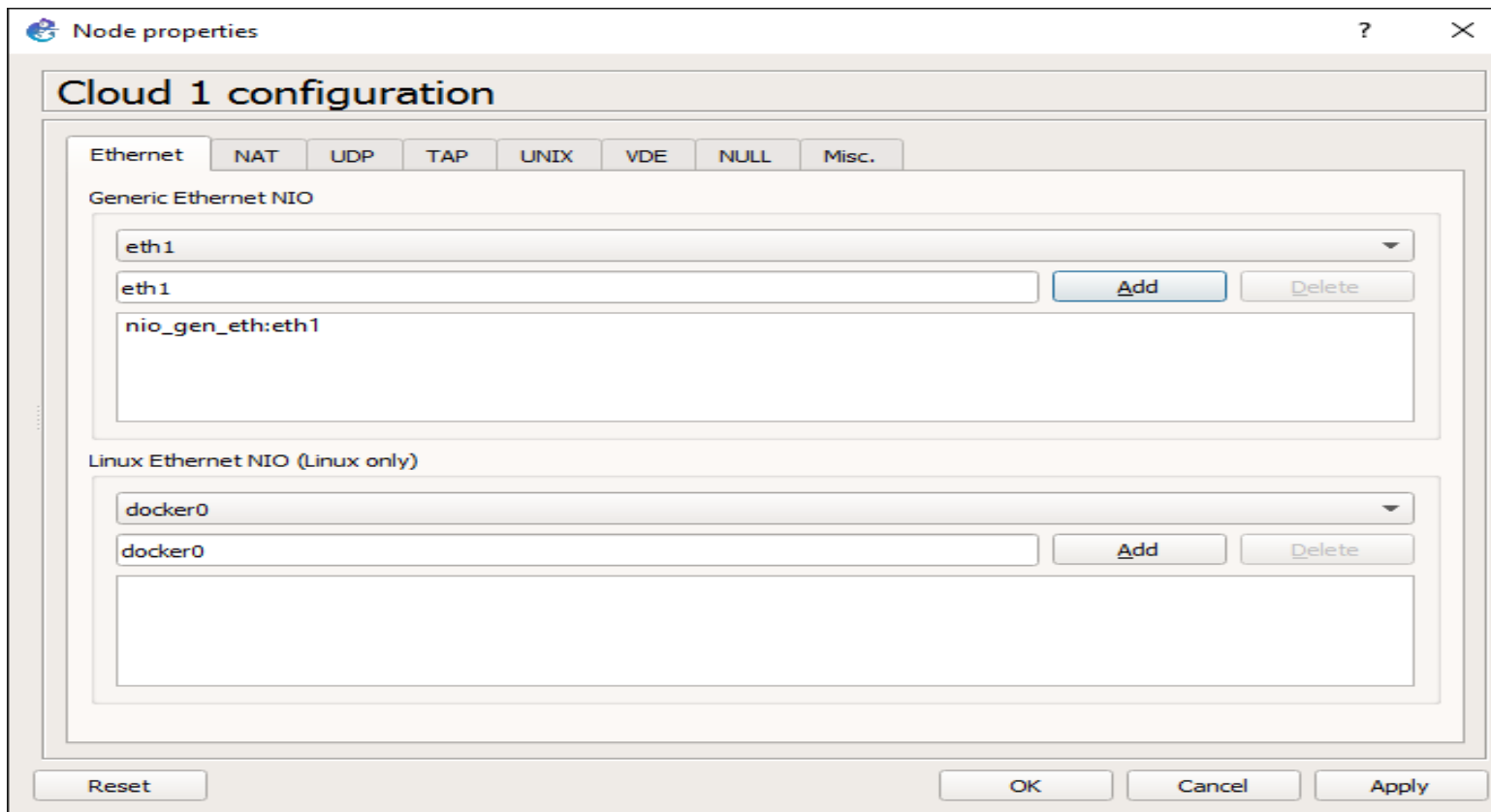
**To allow VMs external access,
Configure GNS3 VM second network adapter to 'bridge mode'**



Drag RouterOS to the blank canvas to set up your desired network



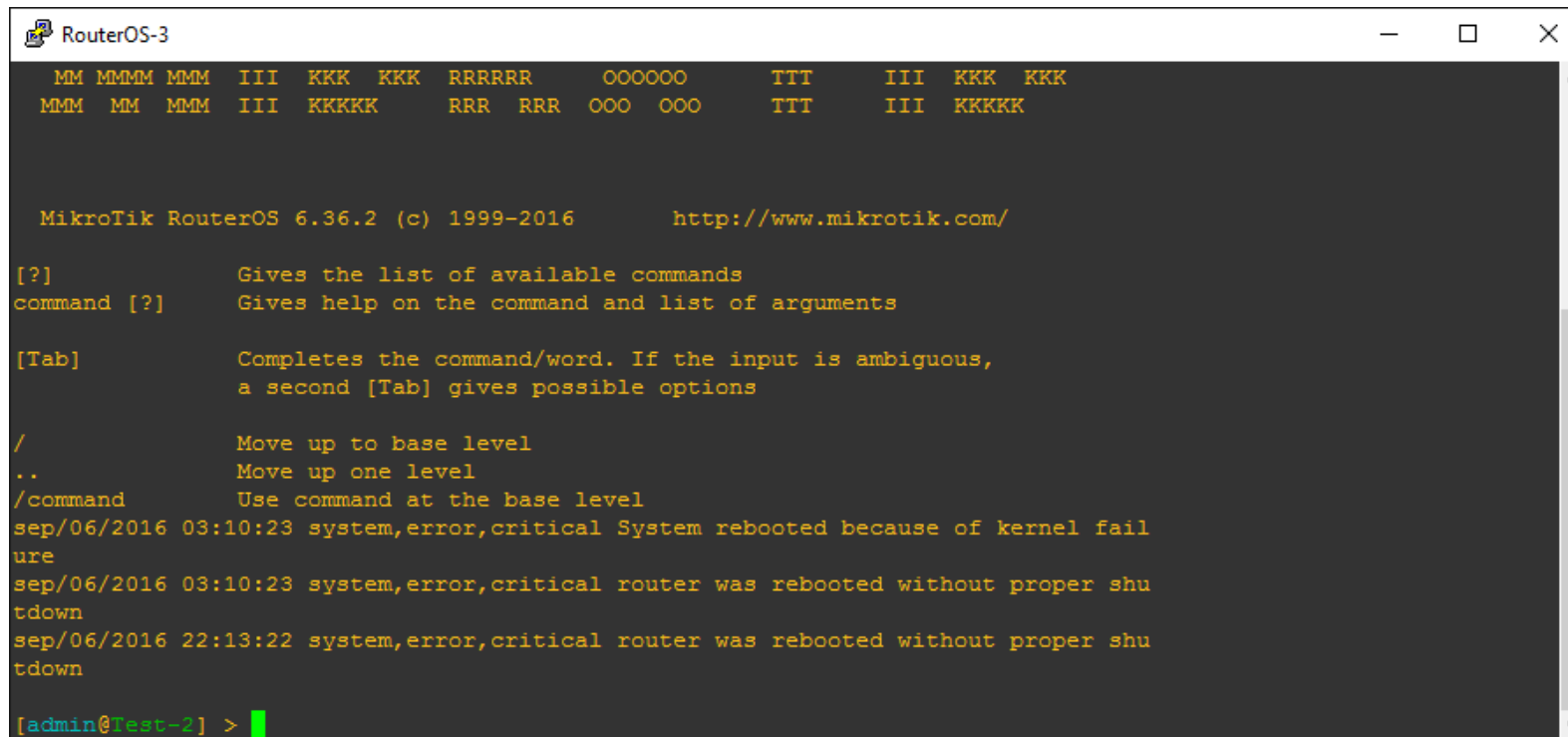
Use the Cloud to connect your VMs to external resources



Power up your routers by right-clicking each and selecting 'start'

Or power all at once with green 'start' button at the top.

Console in by right-clicking and select 'console'



```
RouterOS-3
MM MMMM MMM III KKK KKK RRRRRR OOOOOO TTT III KKK KKK
MMM MM MMM III KKKKK RRR RRR OOO OOO TTT III KKKKK

MikroTik RouterOS 6.36.2 (c) 1999-2016 http://www.mikrotik.com/

[?] Gives the list of available commands
command [?] Gives help on the command and list of arguments

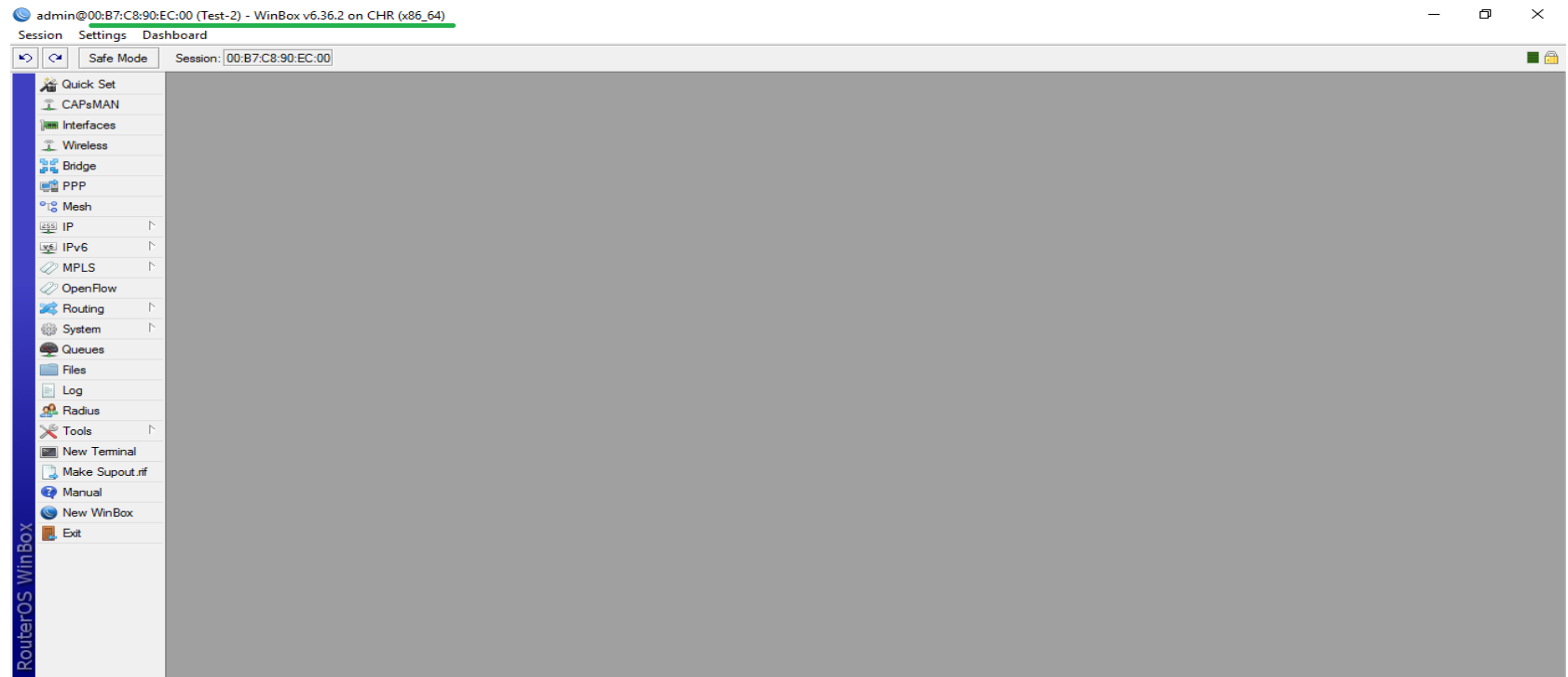
[Tab] Completes the command/word. If the input is ambiguous,
a second [Tab] gives possible options

/ Move up to base level
.. Move up one level
/command Use command at the base level
sep/06/2016 03:10:23 system,error,critical System rebooted because of kernel fail
ure
sep/06/2016 03:10:23 system,error,critical router was rebooted without proper shu
tdown
sep/06/2016 22:13:22 system,error,critical router was rebooted without proper shu
tdown

[admin@Test-2] >
```

At this point, the router can be configured using Winbox.

`/tool romon set enabled=yes`

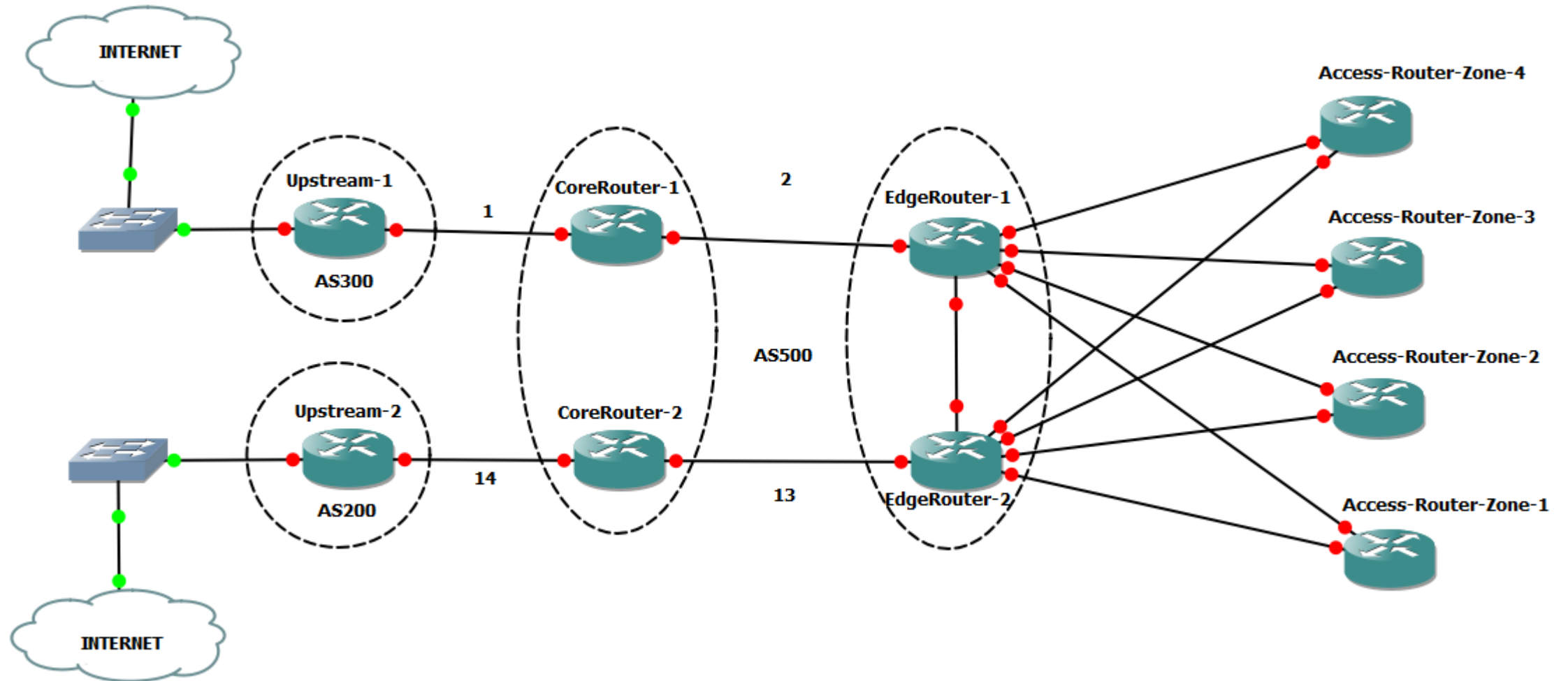




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Staying in Sync

Application (in my Case)

- **Consulting for a small WISP that wanted to scale up**
- **Need for uptime/HA with BGP**
- **Faster convergence with OSPF**
- **Improved Network Security**



Properties X

```
[admin@CoreRouter-1] > /routing bgp instance set default as=500 redistribute-static=no
```

```
[admin@CoreRouter-1] > /routing bgp peer add remote-address=41.217.X.Y remote-as=200
```

```
[admin@CoreRouter-1] > /routing bgp instance set default redistribute-static=yes
```

NOTE: Swap IP address and AS Number with the correct ones for each of the Core Routers and the Upstream Routers.

```
[admin@EdgeRouter-1] /routing ospf instance> add name=default  
  
[admin@EdgeRouter-1] /routing ospf instance> set 0 router-id=1.1.1.1  
  
[admin@EdgeRouter-1] /interface bridge> add name=loopback  
  
[admin@EdgeRouter-1] > ip address add address=X.X.X.X/32 interface=loopback  
  
[admin@EdgeRouter-1] /routing ospf network> add network=Y.Y.Y.0/22 area=backbone
```

NOTE: Swap Router ID, Network statements, Loopback IP Address with the correct ones for each of the participating routers.



Session Settings Dashboard

Safe Mode Session:

Uptime: 3d 08:00:42 Memory: 104.7 MiB Time: 07:57:58 CPU: 4%

Firewall

Filter Rules NAT Mangle Raw Service Ports Connections Address Lists Layer7 Protocols

Find

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Inter...	Out. Int...	Bytes	Packets
::: Add Spammers to the list for 1 day											
0	add...	forward			6 (tcp)		25,587,1...			0 B	0
::: Avoid spammers action											
1	drop	forward			6 (tcp)		25,587,1...			0 B	0
::: Add Spammers to the list for 1 day											
2	add...	output			6 (tcp)		25,587,1...			0 B	0
::: Avoid spammers action											
3	drop	output			6 (tcp)		25,587,1...			0 B	0
4 X	drop	forward								1896.4 KB	23 000
::: block torrent dns											
5 X	drop	forward			17 (u...		53			1430.3 KB	20 259
6	drop	input			6 (tcp)		53			168 B	4
7	drop	input			17 (u...		53			2439 B	37
8	drop	input			17 (u...		5060			87.8 KB	204
9	drop	forward			17 (u...		5060			720.5 KB	1 660
10	drop	forward								2536.5 KB	56 649
11	drop	input								0 B	0
12	drop	forward			1 (c...					113.9 KB	1 822
13	drop	input			1 (c...					0 B	0
::: drop invalid connections											
14	drop	forward			6 (tcp)					3704.8 KB	71 165
::: allow already established connections											
15 X	acc...	forward								0 B	0
16	add...	input			6 (tcp)					0 B	0
17	tarpit	input			6 (tcp)					0 B	0
::: SYN Flood protect											
18 X	jump	forward			6 (tcp)					0 B	0
19 X	drop	SYN-Protect			6 (tcp)					0 B	0
20	drop	input			17 (u...					12.5 MiB	138 904
21	drop	input	0.0.0.0	255.255.25...						0 B	0

22 items

- **GNS3 is bundled with useful tools such as;**
 - *VPCS (Virtual PC Simulator)- This is a simple network testing tool that has essential commands like traceroute, ping, arp built in.*
 - *Wireshark: A powerful protocol analyzer that can be used to capture and analyze packets*

Q. How do we move from simulation to production Or to another platform?

- ***GNS3 stores all project files under one folder which is movable to another computer. RouterOS template image file (.img) should also be copied together with the project itself and placed into 'GNS3/images' folder on target machine.***
- ***Qemu stores images in qcow2 (copy-on-write) format. These images can be run separately from GNS3.***
- ***If in production environment different hypervisor is used, qcow2 image can be converted to various formats using 'qemu-img convert' command***

- Training –Almost as realistic as building a mock network with real equipment
- Network Validation –Allows you test network designs and changes before they are applied to a production network
- Reduces downtime
- Increases ROI

- **CHR is a fully functional RouterOS**
- **Any descent computer that supports virtualization can be used for Lab scenario**
- **GNS3 Lab configurations can be migrated to other systems or production.**
- **Wireshark and other tools are bundled with GNS3 for testing and analysis**
- **The uses are only limited by your imagination**

The End



Thank You!



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