

16.03.2024

## **Курс:**

# **Практическая работа к уроку № Lesson\_2**

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Роутер на Linux, обеспечение безопасности

## **Задание:**

Используя методичку

[/gb/methodics/linux/DmVPN.pdf](#)

И конфигурационные файлы в качестве примера

[/gb/linux/coruscant/](#)

Построить свой DmVPN

из 3-х роутеров

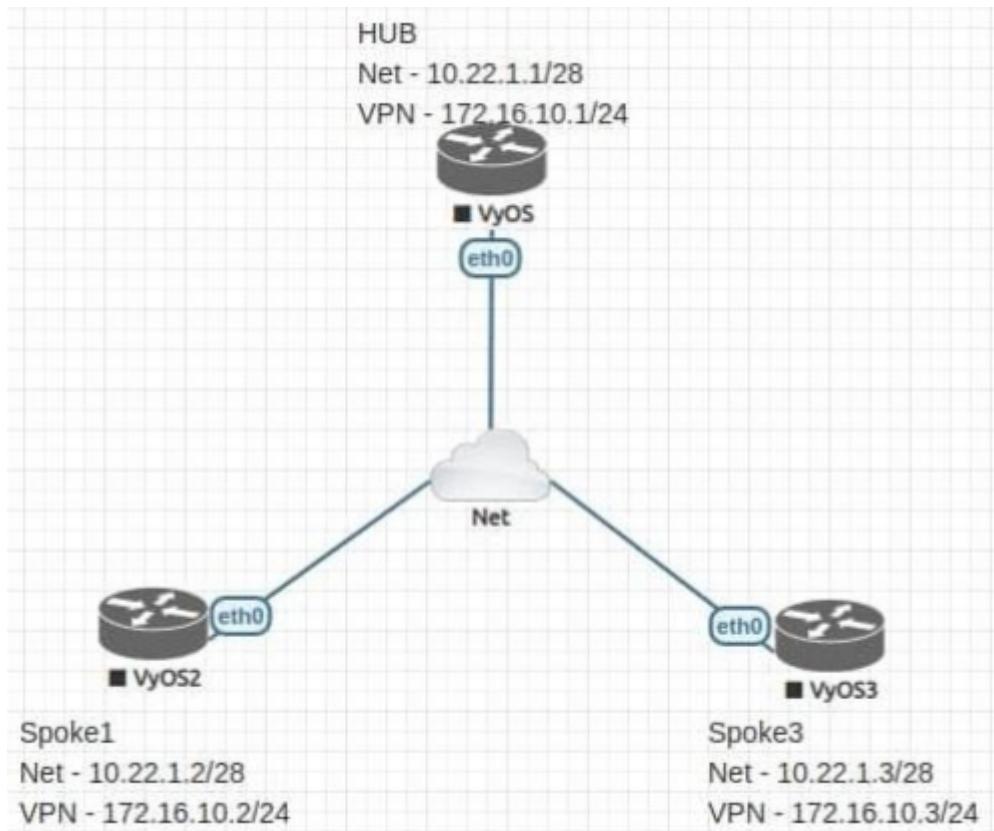
прислать скриншоты

show ip ospf database со всех роутеров

**Необходимо реализовать следующую схему на гипервизоре**

**KVM:**

VmVPN: HUB - 2 SPOKES:



Для этого понадобится **три виртуальные машины (ВМ)** под управление VyOS:

1. VyOS1 (hub): ОС Debian 10, Процессор 2, Память 512MB, Диск SCSI 2GB; Сеть NIC 2; Контроллер Virtio SCSI;
2. VyOS1 (spoke1): ОС Debian 10, Процессор 2, Память 512MB, Диск SCSI 2GB; Сеть NIC 1; Контроллер Virtio SCSI;
3. VyOS1 (spoke2): ОС Debian 10, Процессор 2, Память 512MB, Диск SCSI 2GB; Сеть NIC 1; Контроллер Virtio SCSI.

### Скачиваем:

1. Ubuntu 20.04. LTS (Focal Fossa) <https://releases.ubuntu.com/focal/>
2. Новая сеть через Менеджер виртуальных машин (QEMU/KVM)  
<https://docs.vyos.io/en/equuleus/installation/virtual/libvirt.html>  
<https://losst.pro/ustanovka-kvm-ubuntu-16-04> Debian:  
<https://wiki.debian.org/ru/KVM>
3. VyOS-1.5 (.ISO Debian) <https://vyos.net/get/> vyos/vyos (pw)  
<https://docs.vyos.io/en/equuleus/installation/virtual/index.html>  
VyOS-1.4 <https://hub.docker.com/r/vyos/image/tags>  
VyOS [Build official](#)

#### 4. Eve-NG Server (.ISO)

<https://www.eve-ng.net/index.php/download/>

[EVE-NG OVF \(.OVF\) – mirror](#)

KVM: <https://docs.vyos.io/de/latest/installation/virtual/libvirt.html>

Labs: <https://www.eve-ng.net/index.php/lab-library/multicast-labs/>

#### 5. GNS3: <https://yamadharma.github.io/ru/post/2022/05/07/gns3-appliances/>

GNS3-VyOS: <https://yamadharma.github.io/ru/course/nettech/gns3-vyos/>

#### 6. Дополнительно: пример установки Server

<http://samag.ru/archive/article/2010>

<http://samag.ru/archive/article/2054>

FRRouting <https://github.com/FRRouting/>

CISCO [DmVPN](#)

## Установка Ubuntu 20.04 и VyOS + GNS3

### Установка гипервизора (Debian / Ubuntu)

```
# New User
su -
adduser administrator

# Дать права на выполнение команд sudo
usermod -aG sudo administrator
sudo -i
reboot

ip addr
ip route

sudo nano /etc/network/interfaces
# add network interface enp0s*... allow-hotplug... iface...
sudo service networking restart

# ssh
sudo apt install ssh openssh-server
# secure
sudo nano /etc/ssh/sshd_config
Port ... new
PermitRootLogin no
AllowUsers administrator
CLIENT: ssh administrator@IP...

sudo apt update && sudo apt -y upgrade
```

```
sudo apt -y install mc wget ssh openssh-server vim-nox nano
sudo lsb_release -a
sudo apt install build-essential dkms linux-headers-$(uname -r)

# --- Network
sudo nano /etc/network/interfaces
# add network interface enp0s*... allow-hotplug... iface...
root@debserv1:~# service networking restart

# --- Установка Менеджера ВМ и VyOS по методичке DmVPN.pdf
egrep -c '(vmx|svm)' /proc/cpuinfo
# --- min 4
sudo apt install cpu-checker -y
sudo apt install libvirt-clients libvirt-daemon-system qemu-kvm
qemu-system qemu-utils bridge-utils dnsmasq virt-manager -y
sudo usermod -aG libvirt $USER
sudo usermod -aG kvm $USER
sudo reboot

systemctl status libvirtd
● libvirtd.service - Virtualization daemon
    Loaded: loaded (/lib/systemd/system/libvirtd.service;
    enabled; preset: enabled)
      Active: inactive (dead) since Mon 2024-02-26 16:53:03 MSK;
            3min 30s ago
        Duration: 2min 245ms
    TriggeredBy: ● libvirtd.socket
                  ● libvirtd-ro.socket
                  ● libvirtd-admin.socket
      Docs: man:libvirtd(8)
             https://libvirt.org
    Process: 10757 ExecStart=/usr/sbin/libvirtd $LIBVIRTD_ARGS
              (code=exited, status=0/SUCCESS)
   Main PID: 10757 (code=exited, status=0/SUCCESS)
     CPU: 157ms

administrator@debserv1:~$ sudo kvm-ok
INFO: /dev/kvm exists
KVM acceleration can be used

# List networks
ip link
1: lo: <LOOPBACK,UP,LOWER_...
```

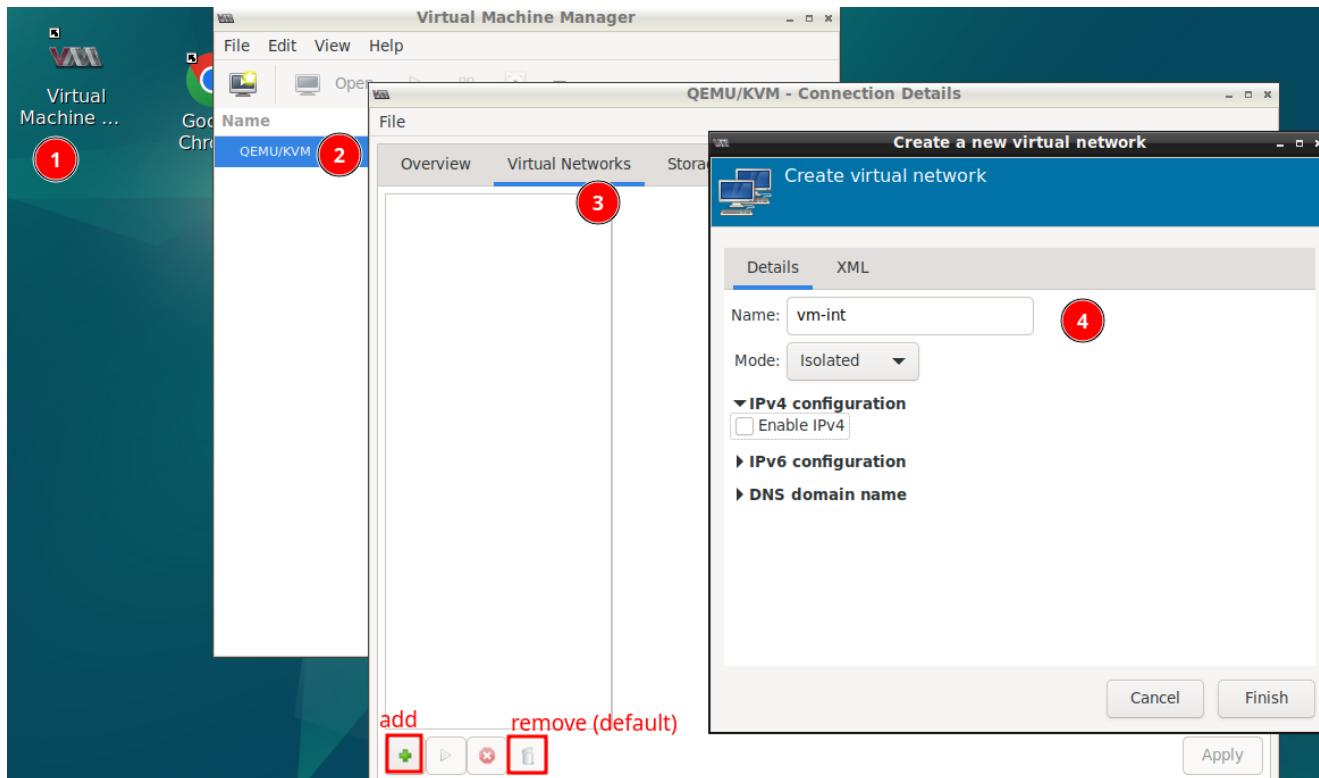
```

...
# List VM
virsh --connect qemu:///system list --all
Id      Name      State
...
...

```

## Запускаем Virt-machine VMM

Далее заходим в QEMU/KVM



Далее заходим в Виртуальные сети и создаем новую сеть *vm-int*

1. delete *default*
2. create *vm-int* (isolated) *Disable IPv4 in config*
3. create *vm-nat* (10.100.10.0 / 26)



(Add - Run - Stop - Delete)

QEMU/KVM - Connection Details

File

Overview Virtual Networks Storage

vm-int

Details XML

Name: vm-int

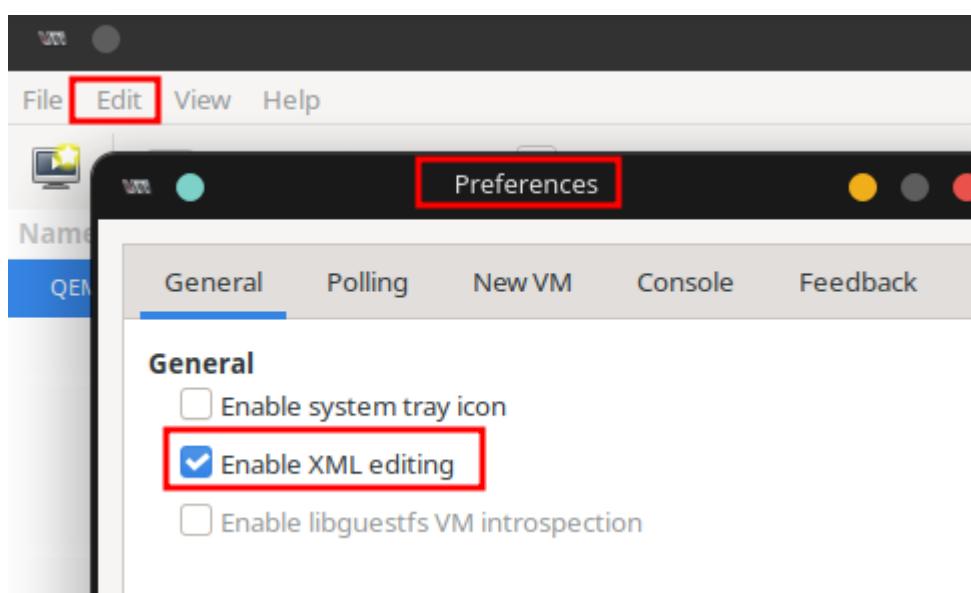
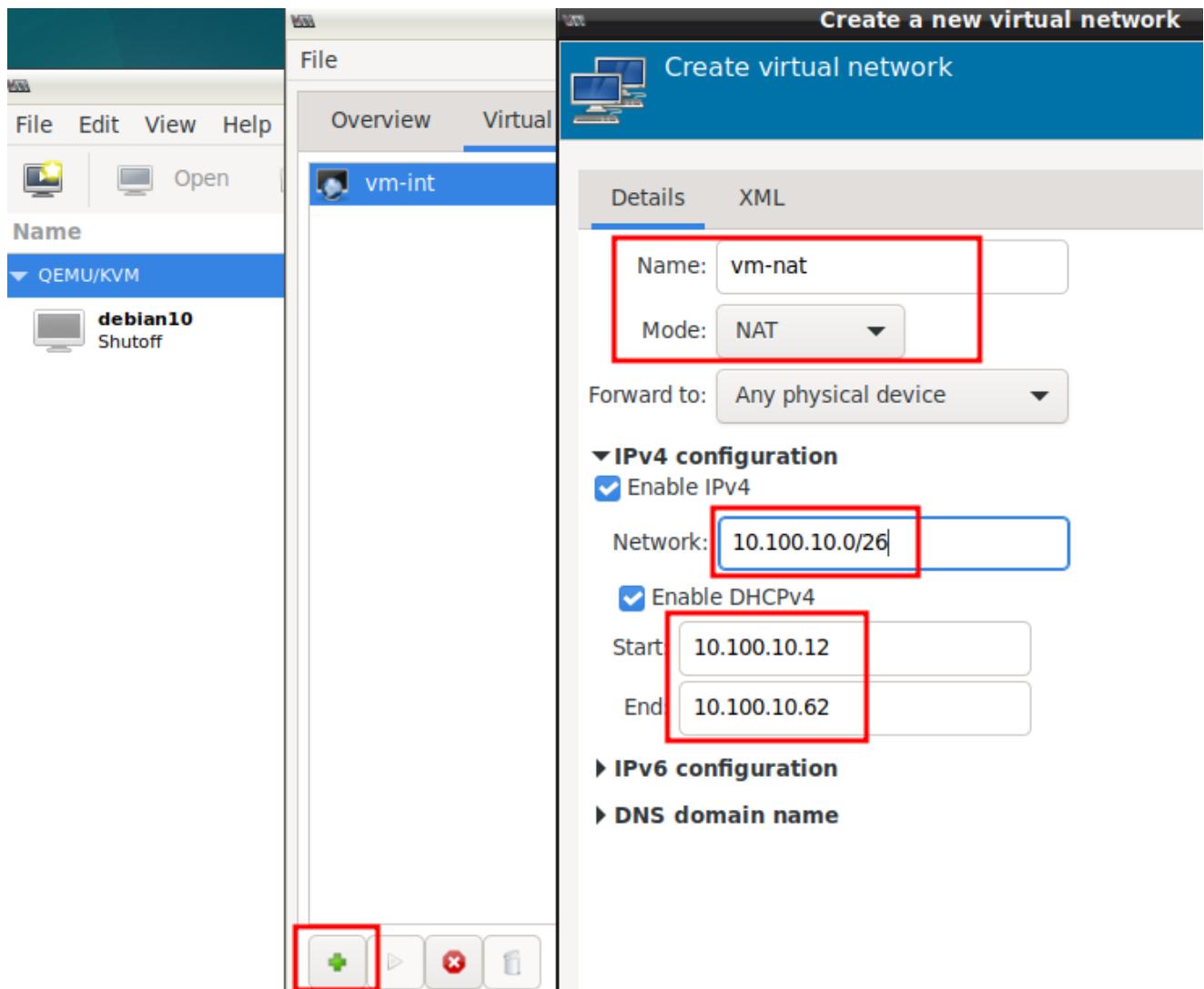
Device: virbr0

State: Active

Autostart:  On Boot

Domain: vm-int

```
<network>
  <name>vm-int</name>
  <uuid>aafa8f8f-35a7-4111-81f6-f266be18fc99</uuid>
  <bridge name="virbr0" stp="on" delay="0"/>
  <mac address="52:54:00:e6:70:86"/>
  <domain name="vm-int"/>
</network>
```



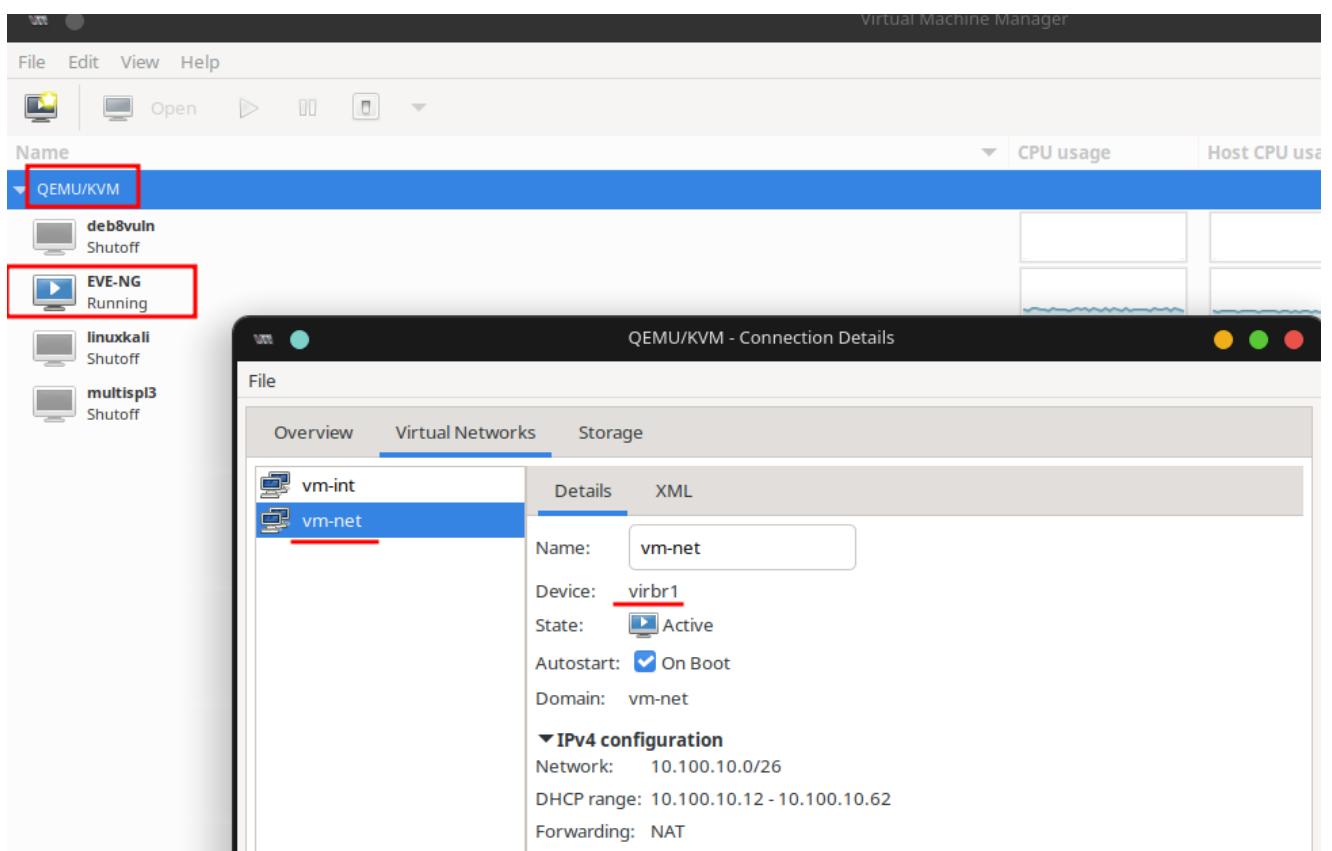
Edit XML (Enable XML editing)

```
<network>
  <name>vm-net</name>
  <uuid>af983427-4ac1-4d6f-b6e4-d086a245c466</uuid>
  <forward mode="nat">
    <nat>
```

```

<port start="1024" end="65535"/>
</nat>
</forward>
<bridge name="vm-net0" stp="on" delay="0"/>
<mac address="52:54:00:6d:94:9f"/>
<ip address="10.100.10.1" netmask="255.255.255.192">
<!-- <tftp root="/srv/tftp"/> -->
<dhcp>
  <range start="10.100.10.16" end="10.100.10.62"/>
  <bootp file="pxelinux.0" server="10.100.10.1"/>
</dhcp>
</ip>
</network>

```



```

# ---- VyOS 1.4 (.ISO Debian)
Git-hub search ...

# ---- VyOS 1.5 (.ISO Debian)
to Downloads: -0 ~/Downloads/vyos-1.5-rolling.iso
or to images: -0 /var/lib/libvirt/images/vyos-1.5-rolling.iso
# https://vyos.net/get/nightly-builds/
# https://github.com/vyos/vyos-rolling-nightly-builds/releases

```

```
# ---URL-Download: https://github.com/vyos/vyos-rolling-nightly-builds/releases/download/1.5-rolling-202403050022/vyos-1.5-rolling-.....-amd64.iso

sudo wget https://github.com/vyos/vyos-rolling-nightly-builds/releases/download/1.5-rolling-202403050022/vyos-1.5-rolling-.....-amd64.iso -O /var/lib/libvirt/images/vyos-1.5-rolling.iso

sudo ls -lh /var/lib/libvirt/images/vyos-1.5-rolling.iso
-rw-r--r-- 1 root root 444M Mar  2 05:31
/var/lib/libvirt/images/vyos-1.5-rolling.iso

# ---- Альтернативно: VyOS 1.4 (.ISO ... qcow2 ...)
# ---- Install Docker
# ---- ##### ----

https://hub.docker.com/r/vyos/image/tags
sudo apt install apt-transport-https ca-certificates curl software-properties-common
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
sudo add-apt-repository "deb [arch=amd64]
https://download.docker.com/linux/ubuntu focal stable"
apt-cache policy docker-ce
sudo apt update
sudo apt install docker-ce
sudo systemctl status docker
sudo usermod -aG docker $USER
id -nG
docker info
# Test image
docker run hello-world
soccker pull hello-world
docker image ls
# Download and run image
docker run -it ubuntu
apt update
docker search vyos-1.4
```

```

# sudo docker pull vyos/image:1.4-rolling
docker pull ringend/vyos-1_4
sudo docker run -it ringend/vyos-1_4
docker ps
docker ps -a
docker ps -l
docker stop [6d20c9361339]
docker rm [6d20c9361339]
docker inspect ringend/vyos-1_4
docker volume ls
docker image ls
...
#
# convert to ISO File
...

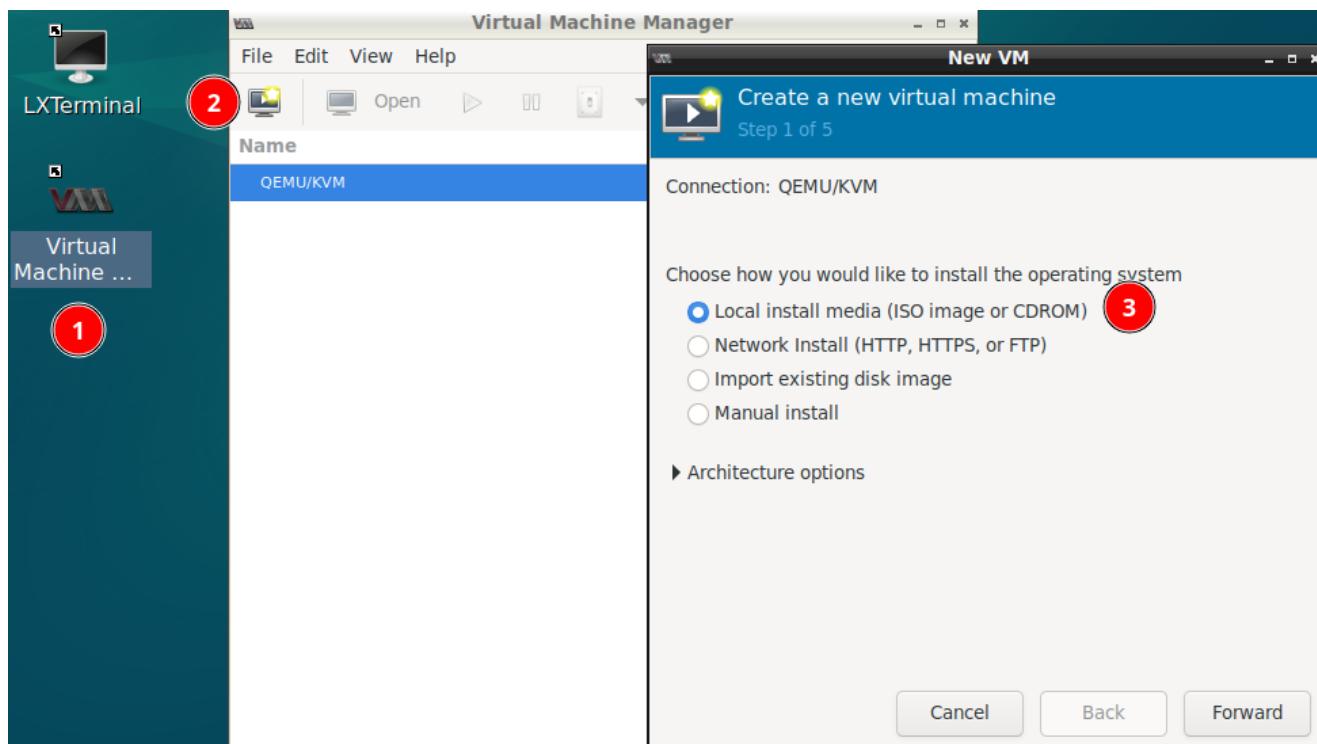
```

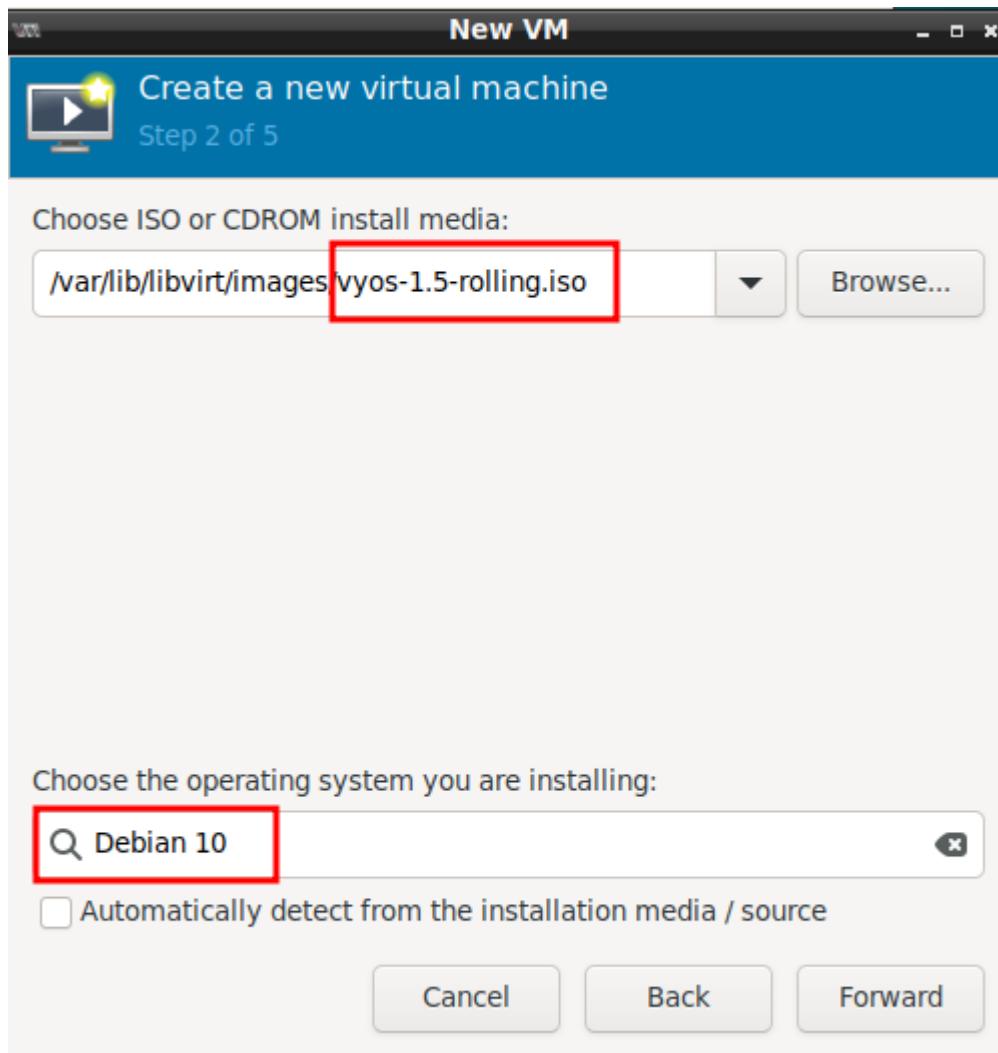
## VyOS-1.4-Rolling (Debian bookworm)

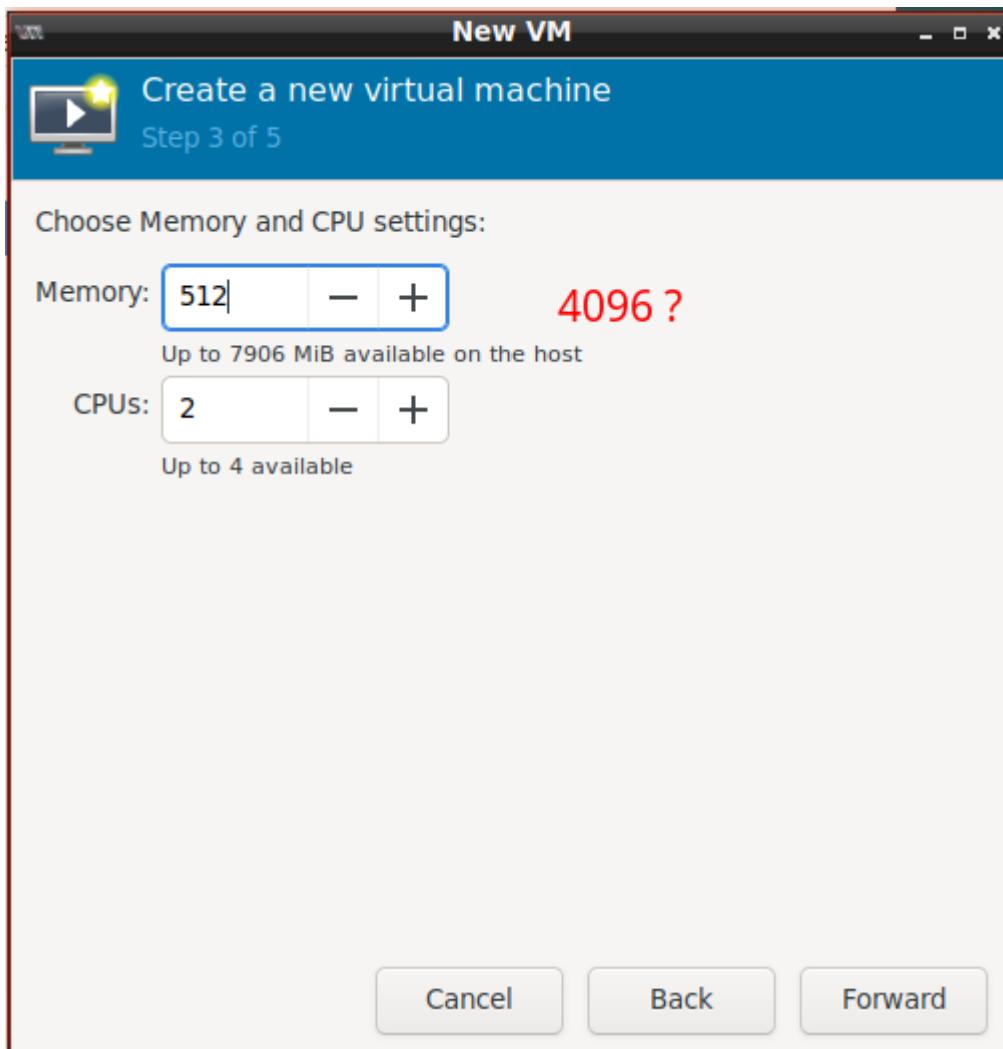
```

vyos@v-hub:~$ lsb release -a
No LSB modules are available.
Distributor ID: VyOS
Description:    VyOS 1.4-rolling-202402060302 (current)
Release:        1.4-rolling-202402060302
Codename:       bookworm
vyos@v-hub:~$ uname -a
Linux v-hub 6.6.15-amd64-vyos #1 SMP PREEMPT DYNAMIC Thu Feb  1 09:36:49 UTC 2024 x86_64 GNU/Linux

```





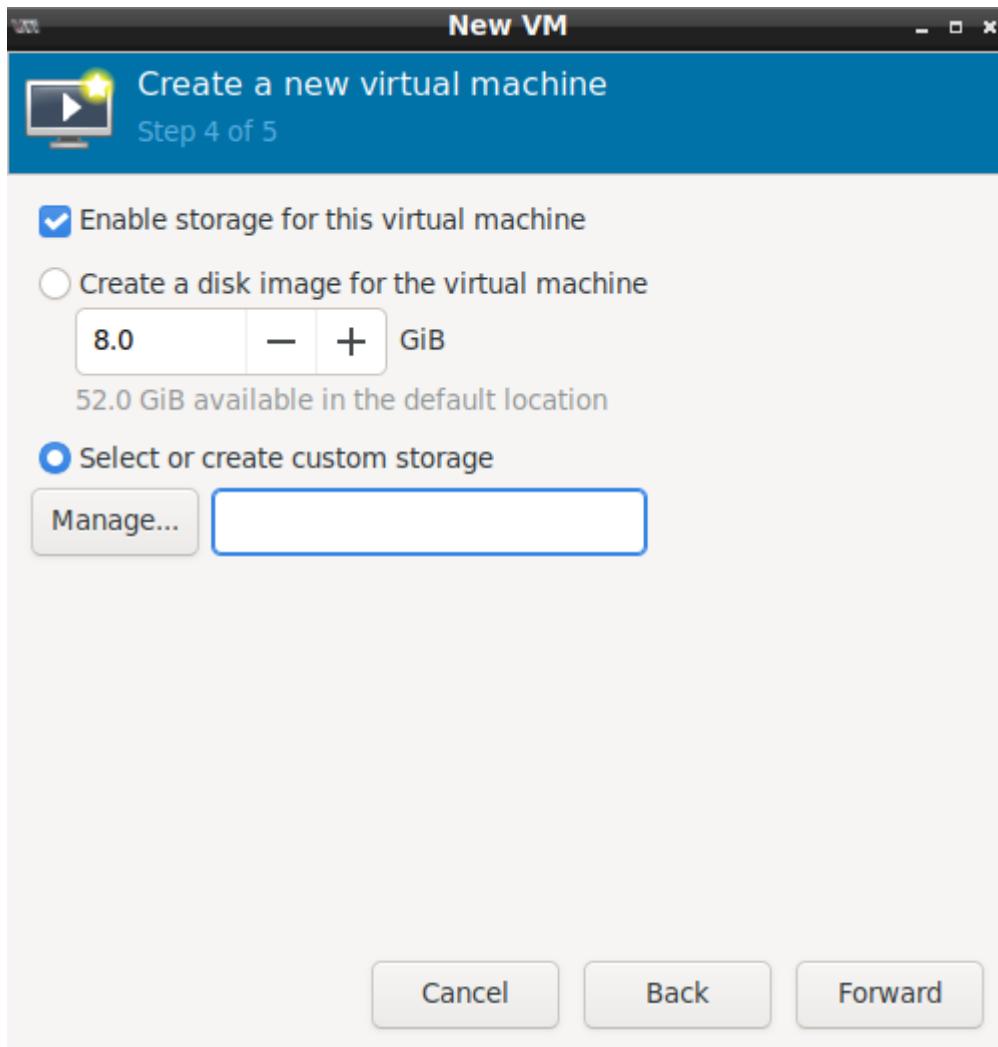


Memory: 512

CPUs: 2

Выбираем создать дополнительное пространство данных

Выбираем 'Manage'



## Создаем новый том

Locate or create storage volume

default  
Filesystem Directory

10% Size: 52.00 GiB Free / 5.82 GiB In Use  
Location: /var/lib/libvirt/images

Volumes   

Volumes	Size	Format
vyos-1.5-rolling.iso	444.00 MiB	iso

     Browse Local

Add a Storage Volume

Create storage volume

Details XML

Create a storage unit to be used directly by a virtual machine.

Name: **vyos1** .qcow2

Format: qcow2

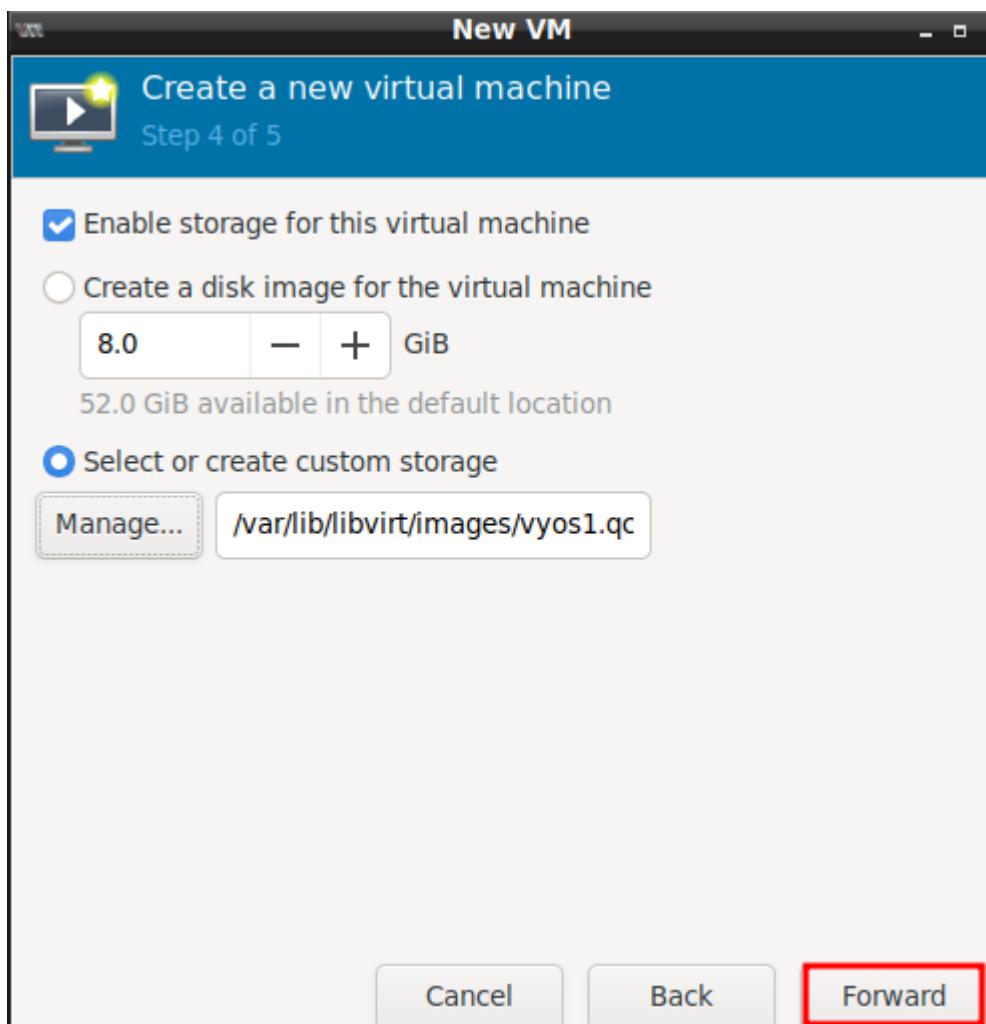
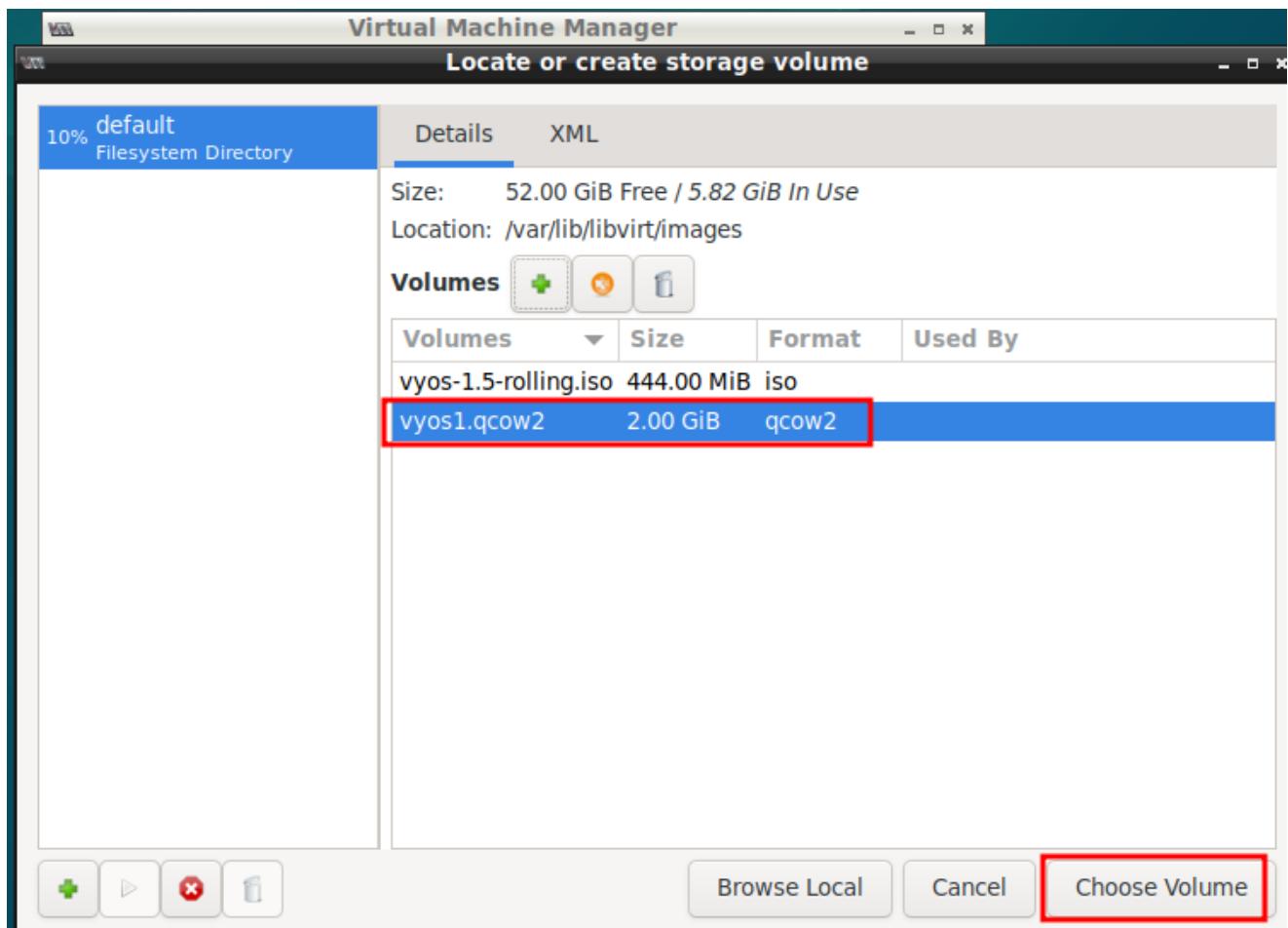
Backing store

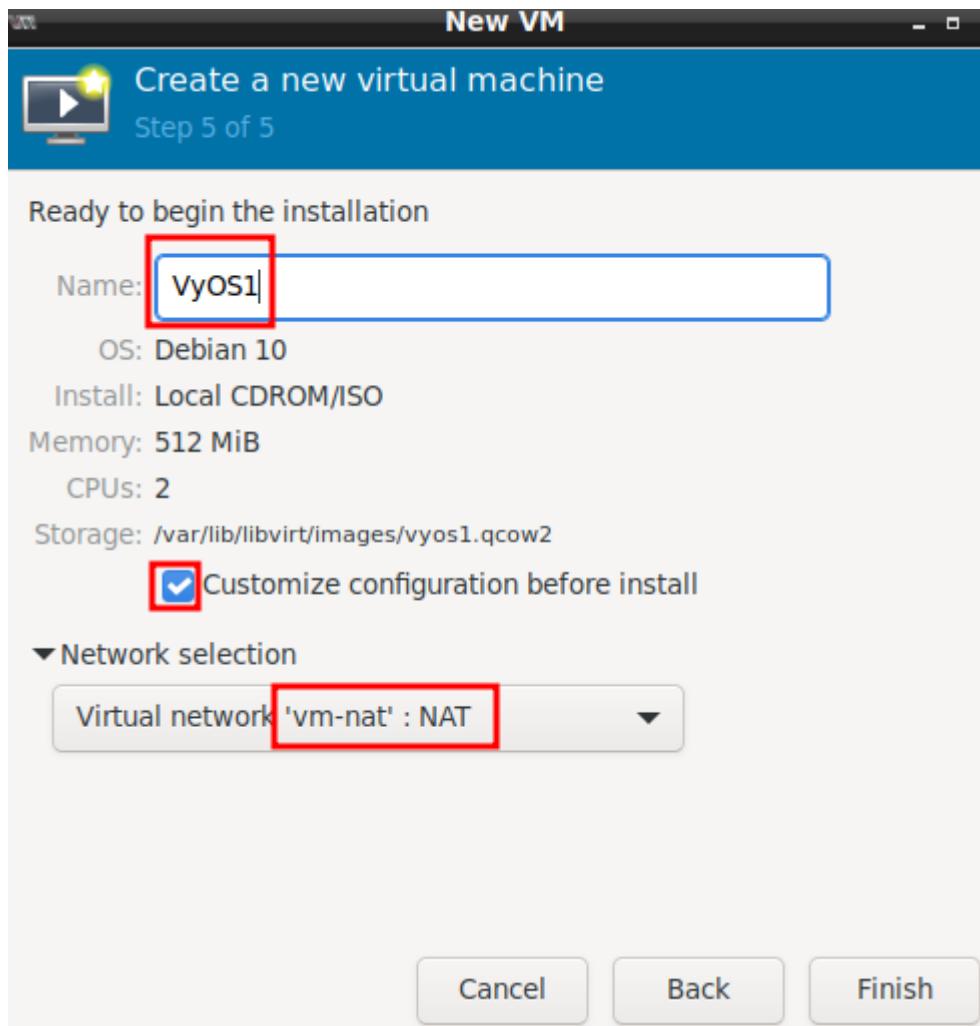
Storage Volume Quota  
default's available space: 52.00 GiB

Capacity: **2.0** GiB

Allocate entire volume now

Cancel  Fini

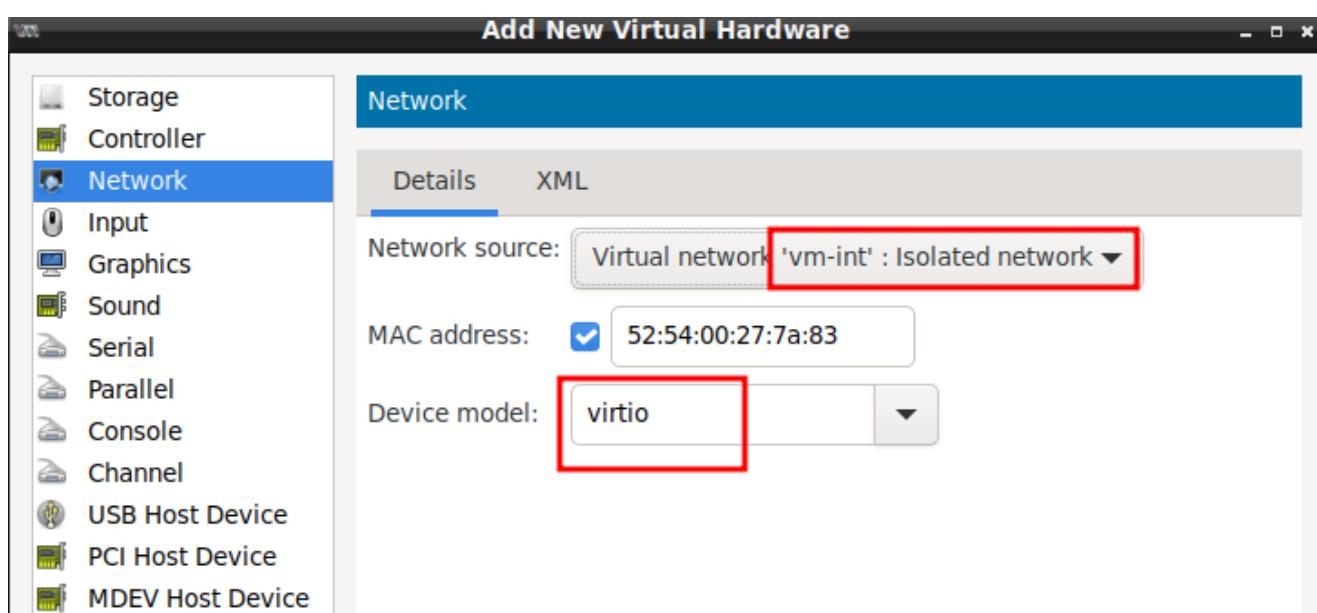
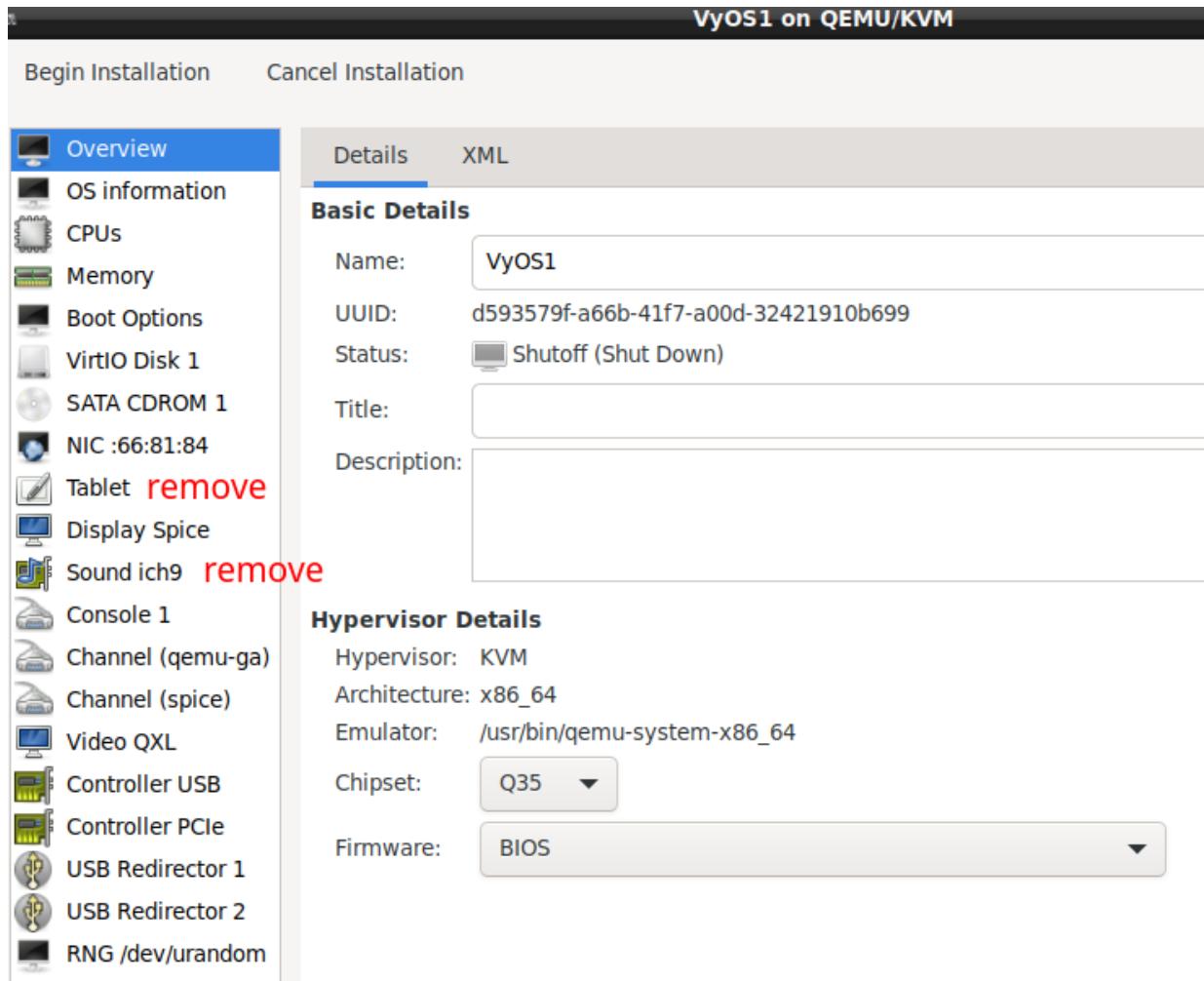


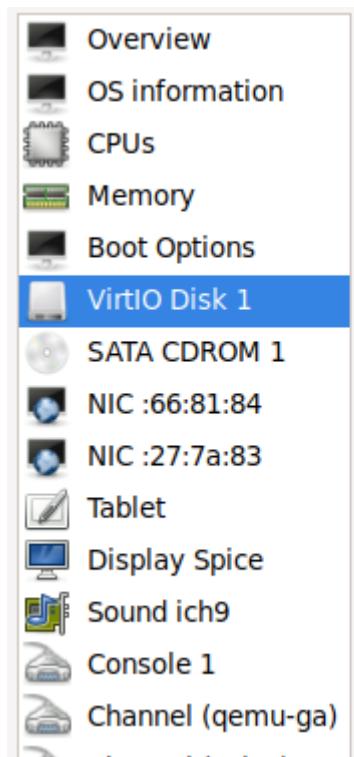


*Finish*

1. Remove: *Tablet, Sound ich9*
2. Add: *сетевой адаптер 'vm-int'*

### 3. VirtIO Disk 1: SCSI disk bus (шина SCSI)





Details XML

### Virtual Disk

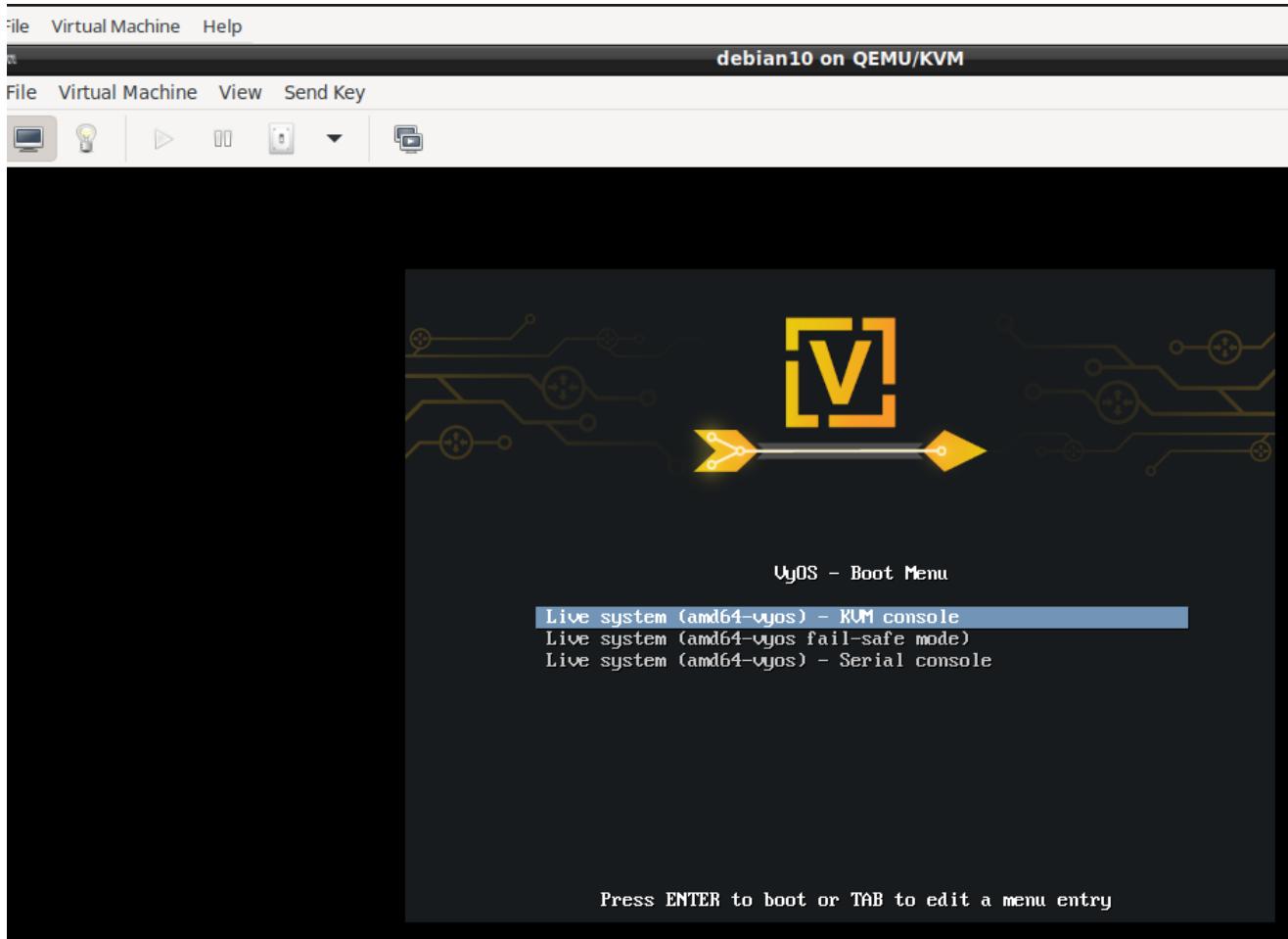
Source path: /var/lib/libvirt/images/vyos1.qcow2  
Device type: VirtIO Disk 1

Disk bus: **SCSI**

Storage size: 2.00 GiB

Advanced options

Readonly:  Shareable:   
 Serial:   
 Cache mode: Hypervisor default  
 Discard mode: Hypervisor default





```
[ OK ] Starting systemd-update-utl Record Runlevel Change in UTMP...
[ OK ] Finished systemd-update-utl - Record Runlevel Change in UTMP.
[ 68.214108] vyos-router[939]: Mounting VyOS Config...done.
[ 105.298854] vyos-router[939]: Starting VyOS router: migrate configure.
[ 106.018356] vyos-config[941]: Configuration success
```

```
Welcome to VyOS - vyos tty1
```

```
vyos login: vyos
Password: vyos
Welcome to VyOS!
```

```
└── [ ] VyOS 1.5-rolling-202403020021
    └── [ ] current
```

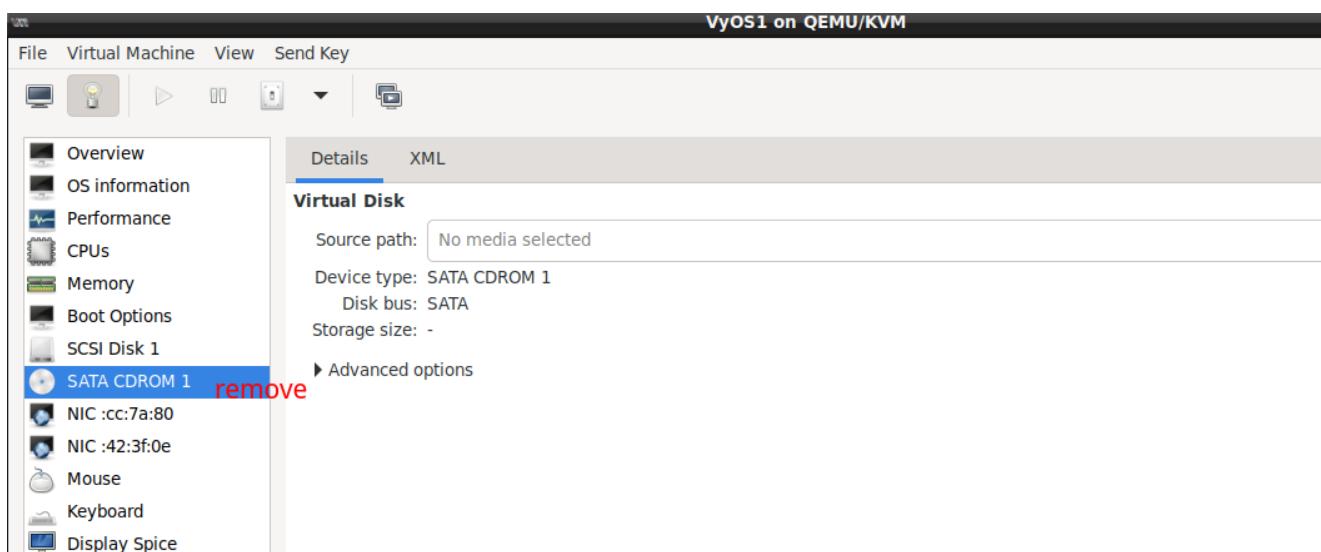
```
* Documentation: https://docs.vyos.io/en/latest
* Project news: https://blog.vyos.io
* Bug reports: https://vyos.dev
```

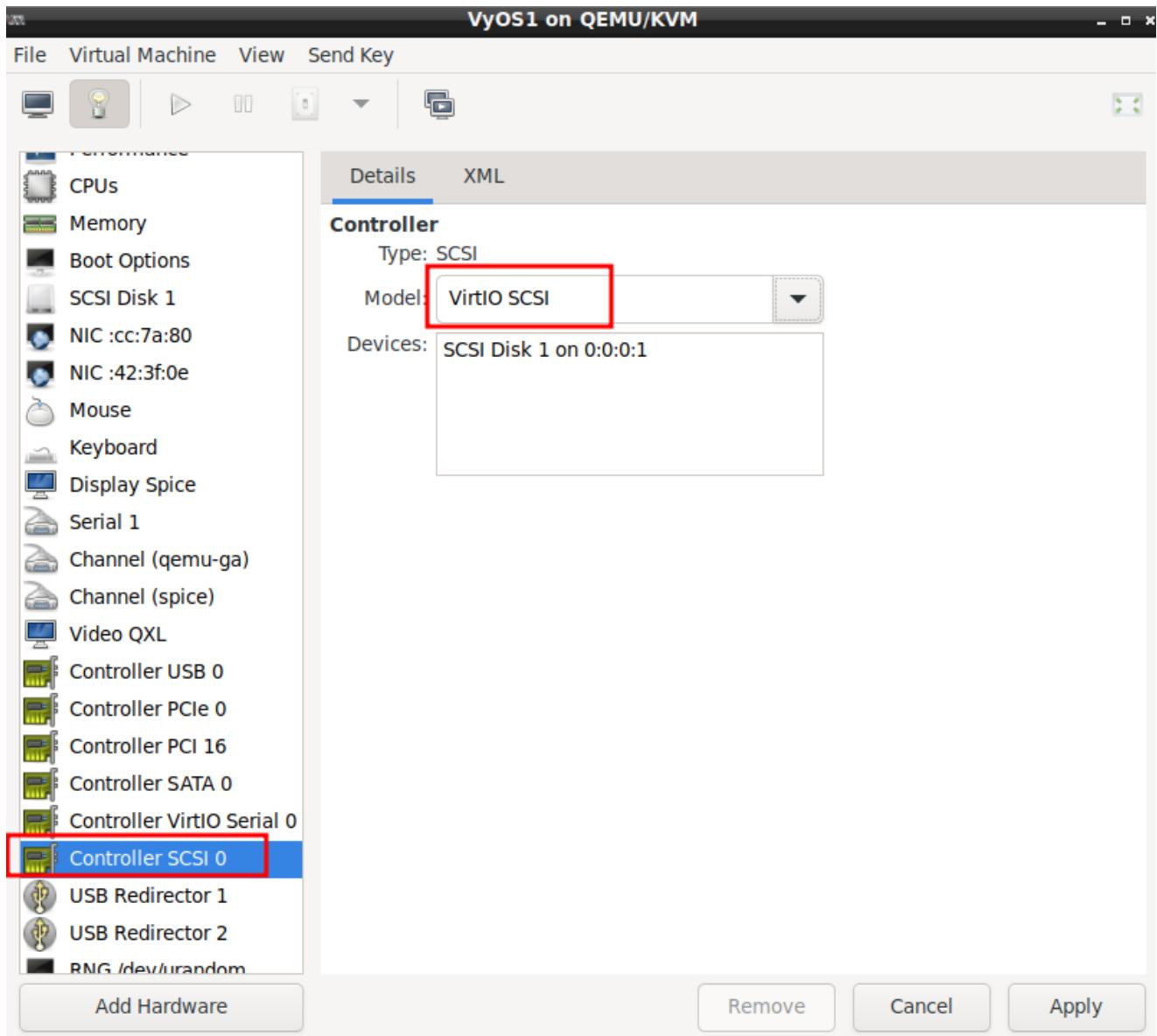
```
You can change this banner using "set system login banner post-login" command.
```

```
VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*/*copyright
vyos@vyos:~$ install image
```

```
vyos@vyos:~$ install image
Welcome to VyOS installation!
This command will install VyOS to your permanent storage.
Would you like to continue? [y/N] y
What would you like to name this image? (Default: 1.5-rolling-202403020021) 1.5-
c5
Please enter a password for the "vyos" user (Default: vyos)
What console should be used by default? (K: KVM, S: Serial, U: USB-Serial)? (Def-
ault: K)
Probing disks
1 disk(s) found
The following disks were found:
Drive: /dev/sda (2.0 GB)
Which one should be used for installation? (Default: /dev/sda)
```

```
c5
Please enter a password for the "vyos" user (Default: vyos)
What console should be used by default? (K: KVM, S: Serial, U: USB-Serial)? (Default: K)
Probing disks
1 disk(s) found
The following disks were found:
Drive: /dev/sda (2.0 GB)
Which one should be used for installation? (Default: /dev/sda)
Installation will delete all data on the drive. Continue? [y/N] y
Searching for data from previous installations
No previous installation found
Would you like to use all the free space on the drive? [Y/n] Y
Creating partition table...
Creating temporary directories
Mounting new partitions
Creating a configuration file
Copying system image files
Installing GRUB configuration files
Installing GRUB to the drive
Cleaning up
Unmounting target filesystems
^[[  Removing temporary files
The image installed successfully; please reboot now.
vyos@vyos:~$ poweroff
```





### Installation:

*install image -> poweroff -> remove cd-rom*

Создаем ВМ VyOS2 и VyOS3 по такому же принципу.

На этих двух ВМ будет использована только одна виртуальная сеть *vm-int* (isolated network)

Создаем отдельно *vyos2.qcow*, *vyos3.qcow* ...

## VyOS2 (vyos-1.4)

Virtual Machine Manager

Locate or create storage

Add a Storage Volume

Details XML

Size: 51.43 GiB Free / 6.39 GiB  
Location: /var/lib/libvirt/images

Volumes

Volumes	Size	Type
vyos-1.5-rolling.iso	444.00 MiB	iso
vyos1.qcow2	2.00 GiB	qcow2

Create storage volume

Details XML

Create a storage unit to be used directly by a virtual machine.

Name: vyos2 .qcow2

Format: qcow2

Backing store

Storage Volume Quota  
default's available space: 51.43 GiB

Capacity: 20 GiB

Allocate entire volume now

Virtual Machine Manager

New VM

Create a new virtual machine  
Step 5 of 5

Ready to begin the installation

Name: VyOS2

OS: Debian 10

Install: Local CDROM/ISO

Memory: 512 MiB

CPUs: 2

Storage: /var/lib/libvirt/images/vyos2.qcow2

Customize configuration before install

Network selection

Virtual network 'vm-int' : Isolated network

VyOS2 on QEMU/KVM

Begin Installation Cancel Installation

- Overview
- OS information
- CPUs
- Memory
- Boot Options
- VirtIO Disk 1**
- SATA CDROM 1
- NIC :75:aa:cb
- Display Spice
- Console 1
- Channel (qemu-ga)
- Channel (spice)
- Video QXL
- Controller USB
- Controller PCIe
- USB Redirector 1
- USB Redirector 2
- RNG /dev/urandom

Details XML

**Virtual Disk**

Source path: /var/lib/libvirt/images/vyos2.qcow2  
Device type: VirtIO Disk 1

Disk bus: **SCSI**

Storage size: 2.00 GiB

► Advanced options

VyOS2 on QEMU/KVM

**Begin Installation** Cancel Installation

- Overview
- OS information
- CPUs
- Memory
- Boot Options
- SCSI Disk 1**
- SATA CDROM 1
- NIC :16:04:3c

Details XML

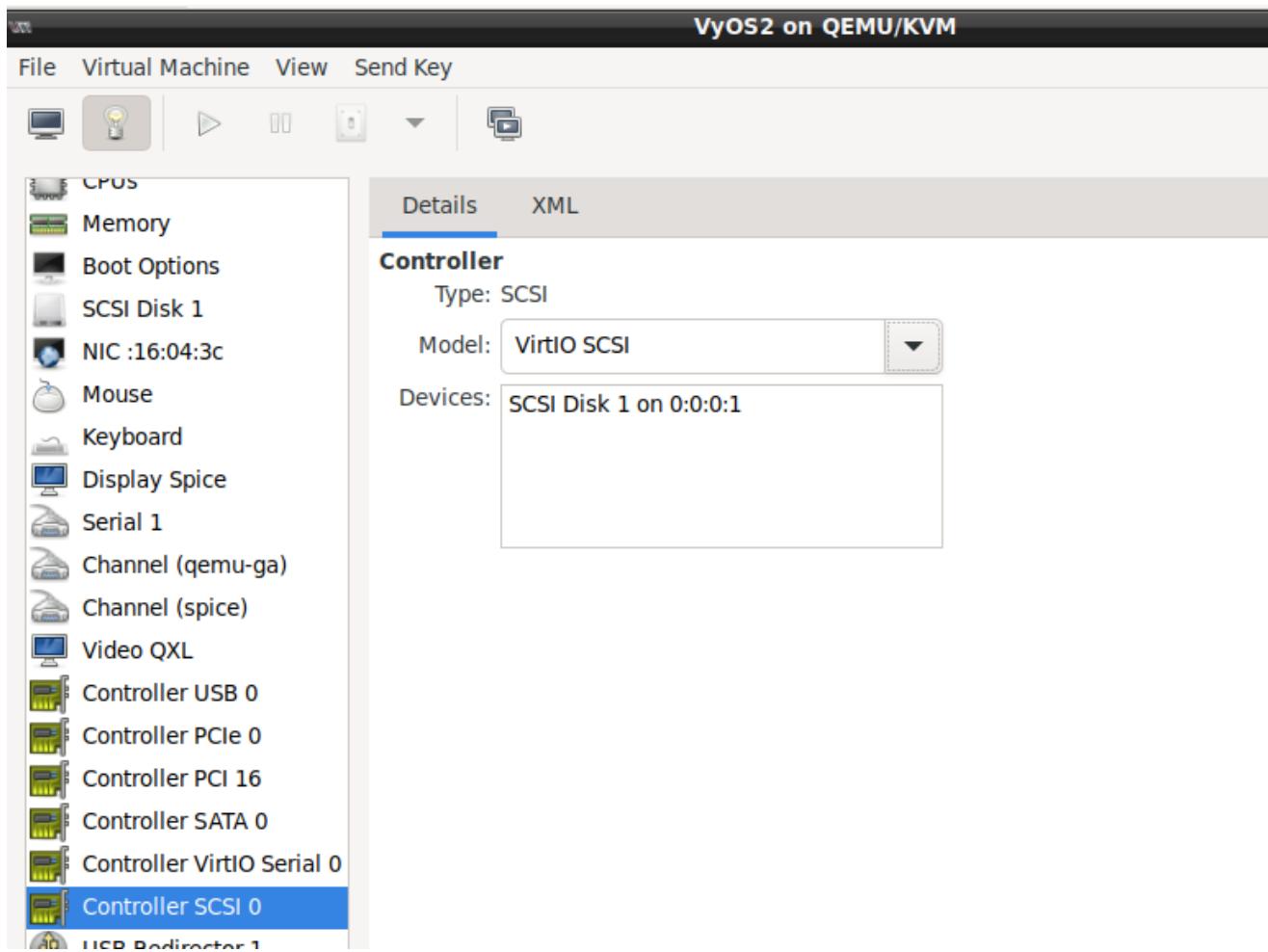
**Virtual Disk**

Source path: /var/lib/libvirt/images/vyos2.qcow2  
Device type: SCSI Disk 1

Disk bus: **SCSI**

Storage size: 2.00 GiB

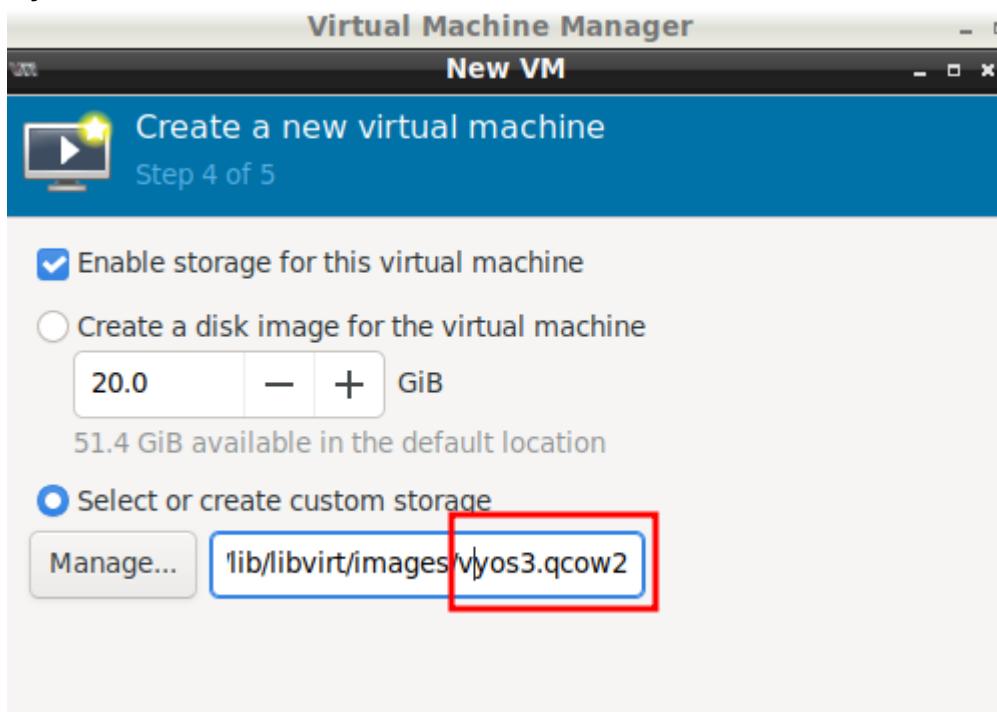
► Advanced options



*Begin Installation*

*install image -> poweroff -> remove cd-rom*

VyOS3



**Virtual Machine Manager**

**New VM**

Create a new virtual machine  
Step 5 of 5

Ready to begin the installation

Name: **VyOS3**

OS: **Debian 10**

Install: **Local CDROM/ISO**

Memory: **512 MiB**

CPUs: **2**

Storage: **/var/lib/libvirt/images/vyos3.qcow2**

Customize configuration before install

▼ Network selection

Virtual network 'vm-int' : Isolated network ▾

The screenshot shows the 'Create a new virtual machine' step of the Virtual Machine Manager wizard. It has five steps completed. The configuration includes a name 'VyOS3', operating system 'Debian 10', and various hardware settings like memory and CPUs. The storage path is specified. A checkbox for customizing configuration before install is checked. The network selection dropdown is open, showing 'Virtual network 'vm-int' : Isolated network'. This specific network option is highlighted with a red box.

VyOS3 on QEMU/KVM

Begin Installation Cancel Installation

Details XML

**Virtual Disk**

Source path: /var/lib/libvirt/images/vyos3.qcow2  
Device type: SCSI Disk 1

Disk bus: **SCSI**

Storage size: 2.00 GiB

► Advanced options

Overview OS information CPUs Memory Boot Options **SCSI Disk 1** SATA CDROM 1 NIC :57:91:c4 Display Spice Console 1 Channel (qemu-ga) Channel (spice) Video QXL Controller USB Controller PCIe USB Redirector 1 USB Redirector 2 RNG /dev/urandom

VyOS3 on QEMU/KVM

File Virtual Machine View Send Key

Overview OS information Performance CPUs Memory Boot Options SCSI Disk 1 NIC :57:91:c4 Mouse Keyboard Display Spice Serial 1 Channel (qemu-ga) Channel (spice) Video QXL Controller USB 0 Controller PCIe 0 Controller PCI 16 Controller SATA 0 Controller VirtIO Serial 0 **Controller SCSI 0**

Details XML

**Controller**

Type: SCSI

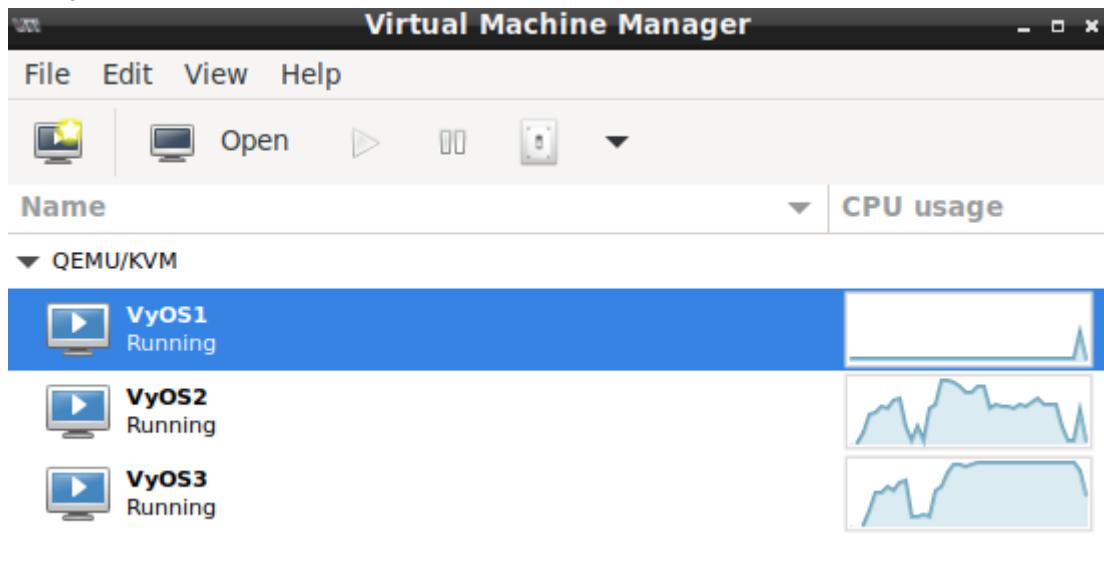
Model: **VirtIO SCSI**

Devices: **SCSI Disk 1 on 0:0:0:1**

## *Begin Installation*

*install image -> poweroff -> remove cd-rom*

Запускаем все **3 BM**



Методичка:

VPN [VyOS - Config - Guide - VPN](#)

DmVPN [VyOS - Config - Guide - VPN - DmVPN](#)

```
# User/password: vyos

# VyOS1 (HUB)
# ****
configure
compare      #...view changes...
show interfaces
set interfaces ethernet eth0 description 'net: Internet'
set interfaces ethernet eth0 address 10.100.10.5/26
set interfaces ethernet eth1 description 'net: DmVPN'
set interfaces ethernet eth1 address 10.22.10.1/29
set service ssh
set protocols static route 0.0.0.0/0 next-hop 10.100.10.1
distance 1
set system host-name v-hub
set system name-server 8.8.8.8
set system name-server 8.8.4.4
commit
save
```

```
# Смотрим все введенные команды:
```

```
run show configuration commands
```

```
vyos@vyos:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface    IP Address      MAC          URF      MTU   S/L     Description
---          ---           ---          ---       ---   ---     ---
eth0         -              52:54:00:ea:41:0d  default  1500  u/u
eth1         -              52:54:00:22:b4:0d  default  1500  u/u
lo           127.0.0.1/8    00:00:00:00:00:00  default  65536 u/u  its,
                                         ::1/128                                :copyright

vyos@vyos:~$ configure
[edit]
vyos@vyos# show interfaces
  ethernet eth0 {
    hw-id 52:54:00:ea:41:0d
  }
  ethernet eth1 {
    hw-id 52:54:00:22:b4:0d
  }
  loopback lo {
  }
[edit]
```

```
set service ntp server time2.vyos.net
set service ntp server time3.vyos.net
set service ssh
set system config-management commit-revisions '100'
set system conntrack modules ftp
set system conntrack modules h323
set system conntrack modules nfs
set system conntrack modules pptp
set system conntrack modules sip
set system conntrack modules sqlnet
set system conntrack modules tftp
set system console device ttyS0 speed '115200'
set system host-name 'v-hub'
set system login user vyos authentication encrypted-password '$6$rounds=656000$w
0z316yuqsoIpw6F$LhBHEEOfcQTdBkndgHCs9mgTtiwz/OrXF/.2HLu4nXOrpYA6YdNkB6.xMb
w09PCEGIOniBYCsxBbV91.L1Pi'
set system login user vyos authentication plaintext-password ''
set system name-server '8.8.8.8'
set system name-server '8.8.4.4'
set system syslog global facility all level 'info'
set system syslog global facility local7 level 'debug'
[edit]
```

```
set system console device ttyS0 speed '115200'
set system host-name 'v-hub'
set system login user vyos authentication encrypted-password '$6$80eKfasmxzQDXXB
H$ILm7pL/39MTPW1XzDLSOU02nmr.sZFhgIJV3ucIFSUSL1k407QT0q8EABr56WB31R3Z1ceuLvZ5DaC
tKcJURx1'
set system login user vyos authentication plaintext-password ''
set system name-server '8.8.8.8'
set system name-server '8.8.4.4'
set system ntp server time1.vyos.net
set system ntp server time2.vyos.net
set system ntp server time3.vyos.net
set system syslog global facility all level 'info'
set system syslog global facility protocols level 'debug'
[edit]
vyos@vyos#
```

```

# VyOS2
#
# *****
configure
set interfaces ethernet eth0 description 'net: DmVPN'
set interfaces ethernet eth0 address 10.22.10.2/29
set service ssh
commit
save

```

```

# ping to VyOS1
ping 10.22.10.2

```

```

vyos@vyos:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface    IP Address      MAC                      VRF     MTU   S/L   Description
---          -----
--           -
eth0          -              52:54:00:27:fe:e3    default  1500   u/u
lo            127.0.0.1/8    00:00:00:00:00:00    default  65536  u/u
               ::1/128
vyos@vyos:~$ configure
[edit]
vyos@vyos# show interfaces
  ethernet eth0 {
    hw-id 52:54:00:27:fe:e3
  }
  loopback lo {
  }
[edit]

[edit]
vyos@vyos# set interfaces ethernet eth0 description 'net: DmUPN'
[edit]
vyos@vyos# set interfaces ethernet eth0 address 10.22.10.2/29
[edit]
vyos@vyos# set service ssh
[edit]
vyos@vyos# comm
comment      commit      commit-confirm
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save

```

```

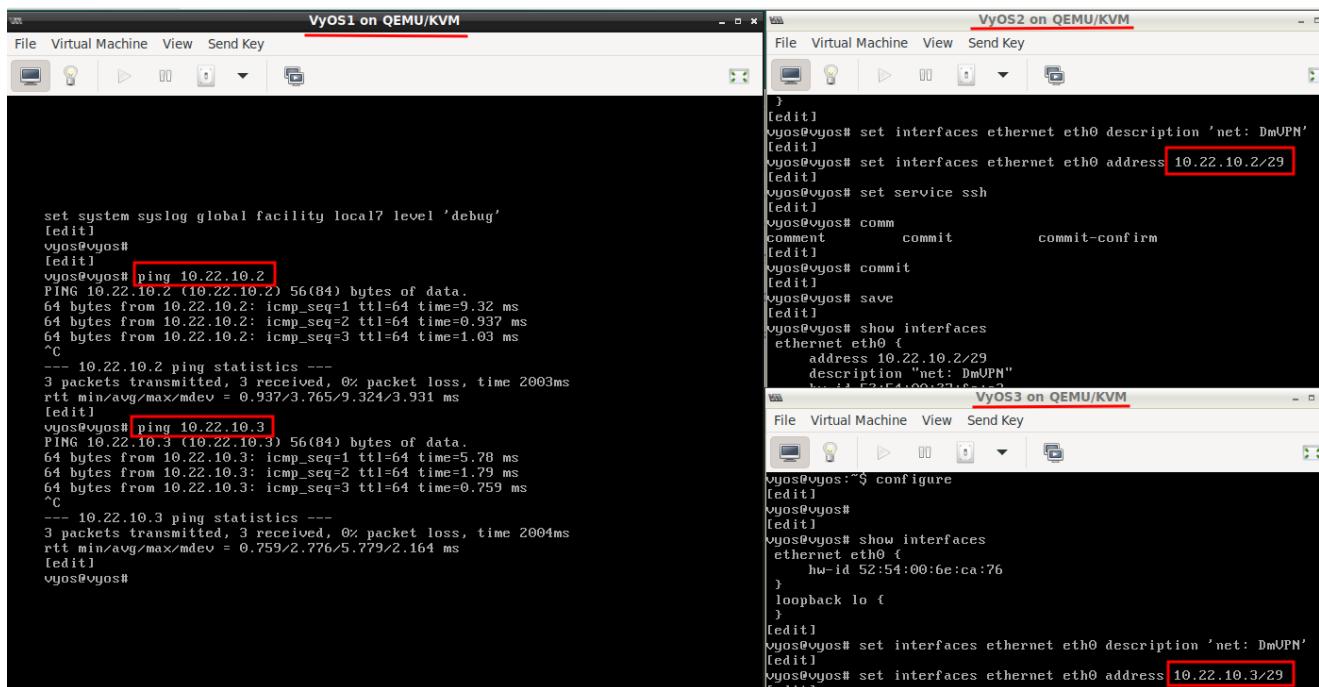
# VyOS3
#
# *****
configure
set interfaces ethernet eth0 description 'net: DmVPN'
set interfaces ethernet eth0 address 10.22.10.3/29
set service ssh
commit
save

```

```
# ping to VyOS1
ping 10.22.10.3
```

```
vyos@vyos:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface      IP Address      MAC                      VRF      MTU     S/L     Description
---           ---           ---           ---           ---           ---           ---
eth0          -             52:54:00:6e:ca:76   default    1500    u/u
lo            127.0.0.1/8    00:00:00:00:00:00   default   65536    u/u
              ::1/128
vyos@vyos:~$ configure
[edit]
vyos@vyos#
[edit]
vyos@vyos# show interfaces
  ethernet eth0 {
    hw-id 52:54:00:6e:ca:76
  }
  loopback lo {
  }
[edit]
vyos@vyos# set interfaces ethernet eth0 description 'net: DmUPN'
[edit]
vyos@vyos# set interfaces ethernet eth0 address 10.22.10.3/29
[edit]
vyos@vyos# set service ssh
[edit]
vyos@vyos# commit

[edit]
vyos@vyos#
[edit]
vyos@vyos# save
```



```
# host Ubuntu.  
# Установим утилиту SCREEN для удобства переключения между  
консолями ВМ:  
user@host:~$ sudo apt install screen  
user@host:~$ screen  
user@host:~$ ssh -l vyos 10.100.10.5
```

The screenshot shows a terminal window titled "screen" (circled in red). The title bar also displays the command "administrator@debserv: ~". The terminal content shows a successful SSH login to a VyOS system at 10.100.10.5. The user is prompted for a password and receives a welcome message. A file tree is displayed, showing a single file named "current". The banner includes links to documentation, news, and bug reports. The terminal ends with a standard Linux-style copyright notice and the prompt "vyos@v-hub:~\$".

```
File Edit Tabs Help 1 screen administrator@debserv: ~  
administrator@debserv:~$ ssh -l vyos 10.100.10.5 2  
vyos@10.100.10.5's password:  
Welcome to VyOS!  
  
[ ] . VyOS 1.5-rolling-202403020021  
[ ] current  
  
* Documentation: https://docs.vyos.io/en/latest  
* Project news: https://blog.vyos.io  
* Bug reports: https://vyos.dev  
  
You can change this banner using "set system login banner post-login" command.  
  
VyOS is a free software distribution that includes multiple components,  
you can check individual component licenses under /usr/share/doc/*/copyright  
Last login: Thu Mar  7 23:48:17 2024 from 10.100.10.1  
vyos@v-hub:~$ █
```

```
# Нажимаем Ctrl+A затем Shift+A.  
# Внизу экрана появится строка Set window's title to: bash  
# Стираем bash, вводим VyOS-hub. Нажимаем Enter.
```

```
administrator@debserv: ~
File Edit Tabs Help
administrator@debserv:~$ ssh -l vyos 10.100.10.5
vyos@10.100.10.5's password:
Welcome to VyOS!

  [ ]
  | VyOS 1.5-rolling-202403020021
  |   current
  |
* Documentation: https://docs.vyos.io/en/latest
* Project news: https://blog.vyos.io
* Bug reports: https://vyos.dev

You can change this banner using "set system login banner post-login" command.

VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*/*copyright
Last login: Thu Mar  7 23:48:17 2024 from 10.100.10.1
vyos@v-hub:~$  
vyos@v-hub:~$
```

Ctrl + A  
Shift + A  
(del bash)  
VyOS-hub

Set window's title to: VyOS-hub

```
# Нажимаем Ctrl+A затем С.
user@host:~$ ssh -l vyos 10.100.10.5
vyos@v-hub:~$ ssh 10.22.10.2
# Нажимаем Ctrl+A затем Shift+A.
# Внизу экрана появится строка Set window's title to: bash
# Стираем bash, вводим VyOS-spoke1. Нажимаем Enter.
# Нажимаем Ctrl+A затем С.
user@host:~$ ssh -l vyos 10.100.10.5
vyos@v-hub:~$ ssh 10.22.10.3
# Нажимаем Ctrl+A затем Shift+A.
# Внизу экрана появится строка Set window's title to: bash
# Стираем bash, вводим VyOS-spoke2. Нажимаем Enter.
Для переключения между консолями ВМ нажимаем Ctrl+A затем Shift+" (двойные кавычки, где буква Э).
```

Num	Name	Flags
0	VyOS-hub	\$
1	VyOS-spoke1	\$
2	VyOS-spoke2	\$

Ctrl + A  
 Shift + " (Ξ)

```
# Перейдем на VyOS-spoke1.
# Вводим следующие команды:
vyos@vyos:~$ configure
vyos@vyos:# set system host-name v-spl
vyos@vyos:# commit
vyos@vyos:# save
vyos@vyos:# exit
vyos@vyos:~$ exit
vyos@v-hub:~$ ssh 10.22.10.2
vyos@v-spl:~$
```

```
# Перейдем на VyOS-spoke2. Нажимаем Ctrl+A затем Shift+"
# Вводим следующие команды:
vyos@vyos:~$ configure
vyos@vyos:# set system host-name v-sp2
vyos@vyos:# commit
vyos@vyos:# save
vyos@vyos:# exit
vyos@vyos:~$ exit
vyos@v-hub:~$ ssh 10.22.10.3
vyos@v-sp2:~$
```

```
[edit]
vyos@vyos# set system host-name v-sp2
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ exit
logout
Connection to 10.22.10.3 closed.
vyos@v-hub:~$ ssh 10.22.10.3
vyos@10.22.10.3's password:
Welcome to VyOS!
```

```
vyos@vyos:~$ hostname
v-hub
vyos@vyos:~$ ip route
default nhid 12 via 10.100.10.1 dev eth0 proto static metric 20
10.22.10.0/29 dev eth1 proto kernel scope link src 10.22.10.1
10.100.10.0/26 dev eth0 proto kernel scope link src 10.100.10.5
```

```
vyos@vyos:~$ hostname
v-sp1
vyos@vyos:~$ ip route
10.22.10.0/29 dev eth0 proto kernel scope link src 10.22.10.2
vyos@vyos:~$
```

```
vyos@vyos:~$ hostname
v-sp2
vyos@vyos:~$ ip route
10.22.10.0/29 dev eth0 proto kernel scope link src 10.22.10.3
```

VyOS-hub:

Перейдем на VyOS-hub. Нажимаем Ctrl+A затем Shift+”

# Вводим следующие команды:

```
# =====
# VyOS (HUB)
# =====
# esp_h1 to ESP-h1. ike_h1 to IKE-h1 ?
# -----
```

```
vyos@v-hub:~$ configure
set interfaces tunnel tun66 address '172.16.10.1/24'
```

```
set interfaces tunnel tun66 encapsulation 'gre'

# --- Error VyOS 1.5, 1.4 (1.3 is OK):
set interfaces tunnel tun66 multicast 'enable'
# --- VyOS 1.5, 1.4:
set interfaces tunnel tun66 enable-multicast

set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.1'
set interfaces tunnel tun66 source-interface 'eth1'

# --- ERROR VyOS 1.5 (VyOS 1.3 is OK):
set protocols nhrp tunnel tun66 cisco-authentication 'qwerty123'
# --- VyOS 1.5:
set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
# 'secret' as 'qwerty123' > 8
# Password should contain up to eight non-whitespace characters
# Value validation failed

set protocols nhrp tunnel tun66 holding-time '300'
set protocols nhrp tunnel tun66 multicast 'dynamic'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut

set system time-zone 'Europe/Moscow'

# esp_h1 better ESP-h1
# --- ERROR VyOS 1.5, 1.4 (1.3 is OK):
set vpn ipsec esp-group esp_h1 compression 'disable'
# Configuration path: vpn ipsec esp-group ESP-h1 compression
[disable] is not valid
# --- Vyos 1.5, 1.4:
# set vpn ipsec esp-group esp_h1 compression
# show vpn ipsec esp-group esp_h1 compression
# delete vpn ipsec esp-group esp_h1 compression

# esp_h1 better ESP-h1
set vpn ipsec esp-group esp_h1 lifetime '1800'
```

```
set vpn ipsec esp-group esp_h1 mode 'transport'
set vpn ipsec esp-group esp_h1 pfs 'dh-group2'
set vpn ipsec esp-group esp_h1 proposal 1 encryption 'aes256'
set vpn ipsec esp-group esp_h1 proposal 1 hash 'sha1'
set vpn ipsec esp-group esp_h1 proposal 2 encryption '3des'
set vpn ipsec esp-group esp_h1 proposal 2 hash 'md5'

# ike_h1 better IKE-h1
# --- ERROR VyOS 1.5, 1.4 (1.3 is OK):
set vpn ipsec ike-group ike_h1 ikev2-reauth 'no'
# Configuration path: vpn ipsec ike-group IKE-h1 ikev2-reauth
[no] is not valid
# show vpn ipsec ike-group ike_h1 ikev2-reauth
# set vpn ipsec ike-group ike_h1 ikev2-reauth
# delete vpn ipsec ike-group ike_h1 ikev2-reauth

set vpn ipsec ike-group ike_h1 key-exchange 'ikev1'
set vpn ipsec ike-group ike_h1 lifetime '3600'
set vpn ipsec ike-group ike_h1 proposal 1 dh-group '2'
set vpn ipsec ike-group ike_h1 proposal 1 encryption 'aes256'
set vpn ipsec ike-group ike_h1 proposal 1 hash 'sha1'
set vpn ipsec ike-group ike_h1 proposal 2 dh-group '2'
set vpn ipsec ike-group ike_h1 proposal 2 encryption 'aes128'
set vpn ipsec ike-group ike_h1 proposal 2 hash 'sha1'

set vpn ipsec interface 'eth1'

# ----- Vyos 1.3: ?
# set vpn ipsec ipsec-interfaces interface 'eth1'

set vpn ipsec profile dm66 authentication mode 'pre-shared-secret'
set vpn ipsec profile dm66 authentication pre-shared-secret
'qwerty12'
# --- Vyos 1.5, 1.4: (passwd <= 8)
set vpn ipsec profile dm66 authentication pre-shared-secret
'qwerty12'
```

```

set vpn ipsec profile dm66 bind tunnel 'tun66'
set vpn ipsec profile dm66 esp-group 'esp_h1'
set vpn ipsec profile dm66 ike-group 'ike_h1'

vyos@v-hub:# commit
vyos@v-hub:# save

# --- not listet
[ vpn ipsec ] ??? not listed Vyos 1.4
loaded ike secret 'ike-dmvpn-tun66' ??? not listed Vyos 1.4
[edit]

# ospf
set protocols ospf area 0
set protocols ospf interface tun66 priority '255'
set protocols ospf interface tun66 area '0'

# --- Vyos 1.3 ???
set protocols ospf interface tun66 priority '255'

vyos@v-hub:# commit
vyos@v-hub:# save

```

Проверяем командой:

```
vyos@v-hub:# run show ip ospf database
```

```

vyos@v-hub# run show ip ospf database      Net - 10.22.10.3/28
VPN - 172.16.10.2/24                         VPN - 172.16.10.3/24
OSPF Router with ID (172.16.10.1)

Router Link States (Area 0.0.0.0)

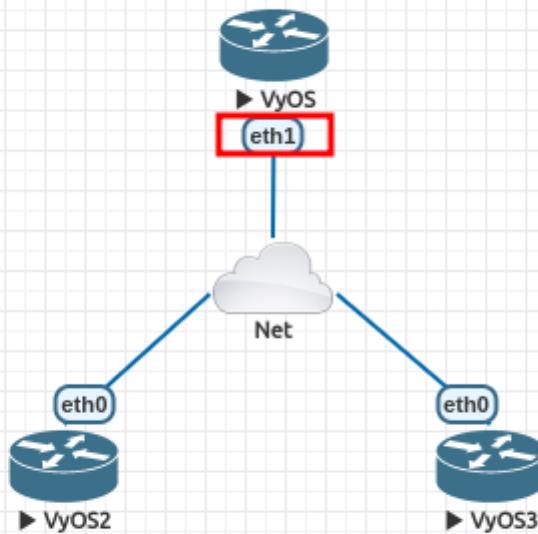
Link ID          ADV Router        Age  Seq#      CkSum  Link count
172.16.10.1     172.16.10.1      80  0x80000003 0x8f6a 1

```

```
vyos@v-hub:~$ show configuration commands | grep tunnel
set interfaces tunnel tun66 address '172.16.10.1/24'
set interfaces tunnel tun66 enable-multicast
set interfaces tunnel tun66 encapsulation 'gre'
set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.1'
set interfaces tunnel tun66 source-interface 'eth1'
set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun66 holding-time '300'
set protocols nhrp tunnel tun66 multicast 'dynamic'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut
set vpn ipsec profile dm66 bind tunnel 'tun66'
```

```
vyos@v-hub:~$ conf
[edit]
vyos@v-hub# show interfaces
ethernet eth0 {
    address 10.100.10.5/26
    address 10.22.10.1/29
    description "net: Internet"
    hw-id 50:00:00:01:00:00
}
ethernet eth1 {
    description "net: DmVPN"
    hw-id 50:00:00:01:00:01
}
loopback lo {
}
tunnel tun66 {
    address 172.16.10.1/24
    enable-multicast
    encapsulation gre
    parameters {
        ip {
            key 1
        }
    }
    source-address 10.22.10.1
    source-interface eth1
}
[edit]
vyos@v-hub#
```

HUB  
ssh -l vyos 10.100.10.5  
Net - 10.22.10.1/28  
VPN - 172.16.10.1/24



Spoke1  
Net - 10.22.10.2/28  
VPN - 172.16.10.2/24

Spoke2  
Net - 10.22.10.3/28  
VPN - 172.16.10.3/24

eth0: VyOS1 not ping to VyOS2, VyOS3

eth1: VyOS1 ping success to VyOS2, VyOS3 and Net - cloud

VyOS-spoke1:

VyOS-spoke1:

```
# Перейдем на VyOS-spoke1.  
# ======  
# VyOS Spoke1  
# ======  
# esp_s1 to ESP-s1. ike_s1 to IKE-s1  
# -----
```

```
# Вводим следующие команды:  
vyos@v-spoke1:~$ configure  
vyos@v-spoke1:#  
set interfaces tunnel tun66 address '172.16.10.2/24'  
set interfaces tunnel tun66 encapsulation 'gre'  
set interfaces tunnel tun66 ip adjust-mss 'clamp-mss-to-pmtu'  
  
# --- Error VyOS 1.5, 1.4 (1.3 is OK):  
set interfaces tunnel tun66 multicast 'enable'
```

```
# --- VyOS 1.5, 1.4:
set interfaces tunnel tun66 enable-multicast

set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.2'
set interfaces tunnel tun66 source-interface 'eth0'

set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
# ?--- set protocols nhrp tunnel tun66 holding-time '300'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 nbma-address
'10.22.10.1'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 register
set protocols nhrp tunnel tun66 multicast 'nhs'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut

set system time-zone 'Europe/Moscow'

# Manual better ESP-s1
# --- Error 1.4, 1.5
set vpn ipsec esp-group esp_s1 compression 'disable'
# set vpn ipsec esp-group esp_s1 compression
# show vpn ipsec esp-group esp_s1 compression
# delete vpn ipsec esp-group esp_s1 compression

set vpn ipsec esp-group esp_s1 lifetime '1800'
set vpn ipsec esp-group esp_s1 mode 'transport'
set vpn ipsec esp-group esp_s1 pfs 'dh-group2'
set vpn ipsec esp-group esp_s1 proposal 1 encryption 'aes256'
set vpn ipsec esp-group esp_s1 proposal 1 hash 'sha1'
set vpn ipsec esp-group esp_s1 proposal 2 encryption '3des'
set vpn ipsec esp-group esp_s1 proposal 2 hash 'md5'

# Manual better IKE-s1
set vpn ipsec ike-group ike_s1 close-action 'none'
# --- Vyos-1.4, Vyos-1.5 ERROR:
# set vpn ipsec ike-group ike_s1 ikev2-reauth 'no'
set vpn ipsec ike-group ike_s1 key-exchange 'ikev1'
```

```
set vpn ipsec ike-group ike_s1 lifetime '3600'
set vpn ipsec ike-group ike_s1 proposal 1 dh-group '2'
set vpn ipsec ike-group ike_s1 proposal 1 encryption 'aes256'
set vpn ipsec ike-group ike_s1 proposal 1 hash 'sha1'
set vpn ipsec ike-group ike_s1 proposal 2 dh-group '2'
set vpn ipsec ike-group ike_s1 proposal 2 encryption 'aes128'
set vpn ipsec ike-group ike_s1 proposal 2 hash 'sha1'

set vpn ipsec interface 'eth0'
set vpn ipsec profile dm66 authentication mode 'pre-shared-secret'
set vpn ipsec profile dm66 authentication pre-shared-secret 'qwerty12'
set vpn ipsec profile dm66 bind tunnel 'tun66'
set vpn ipsec profile dm66 esp-group 'esp_s1'
set vpn ipsec profile dm66 ike-group 'ike_s1'
```

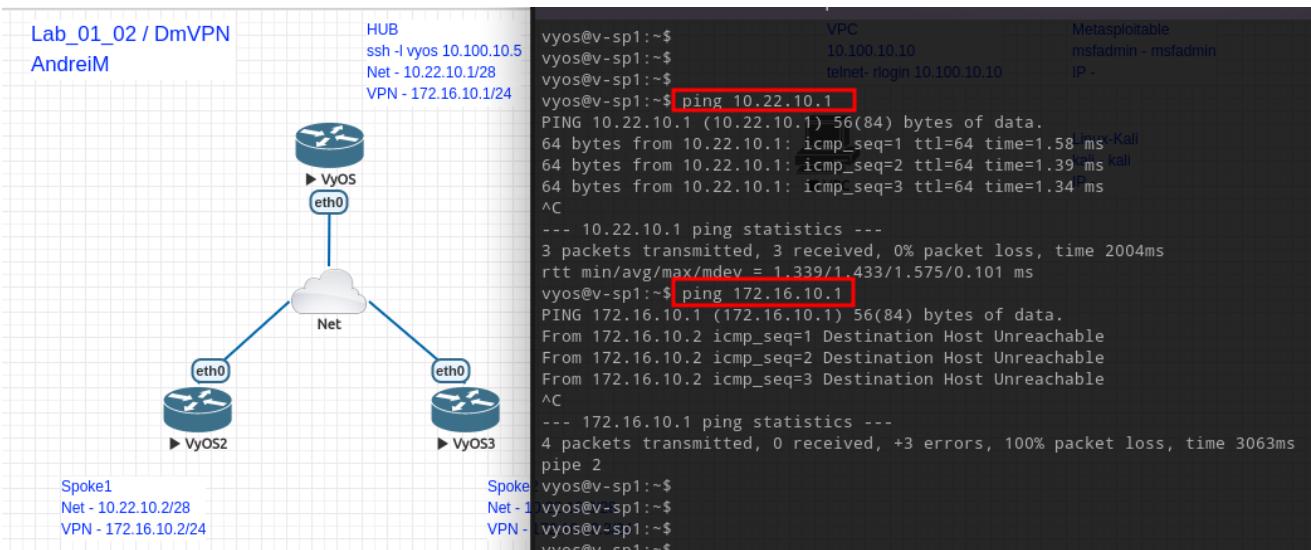
```
vyos@v-spl1:# commit
# ??? not listed
# loaded ike secret 'ike-dmvpn-tun66' ??? not listed Vyos 1.4
vyos@v-spl1:# save
```

```
# ospf
set protocols ospf area 0
set protocols ospf interface tun66 area '0'
set protocols ospf interface tun66 priority '0'
```

```
vyos@v-spl1:# commit
vyos@v-spl1:# save
```

Проверим ping to VyOS-hub:

```
vyos@v-spl1:# ping 172.16.10.1
```



```

vyos@v-sp1:# 
set protocols ospf area 0
set protocols ospf interface tun66 area '0'
set protocols ospf interface tun66 priority '0'
vyos@v-sp1:# commit
vyos@v-sp1:# save

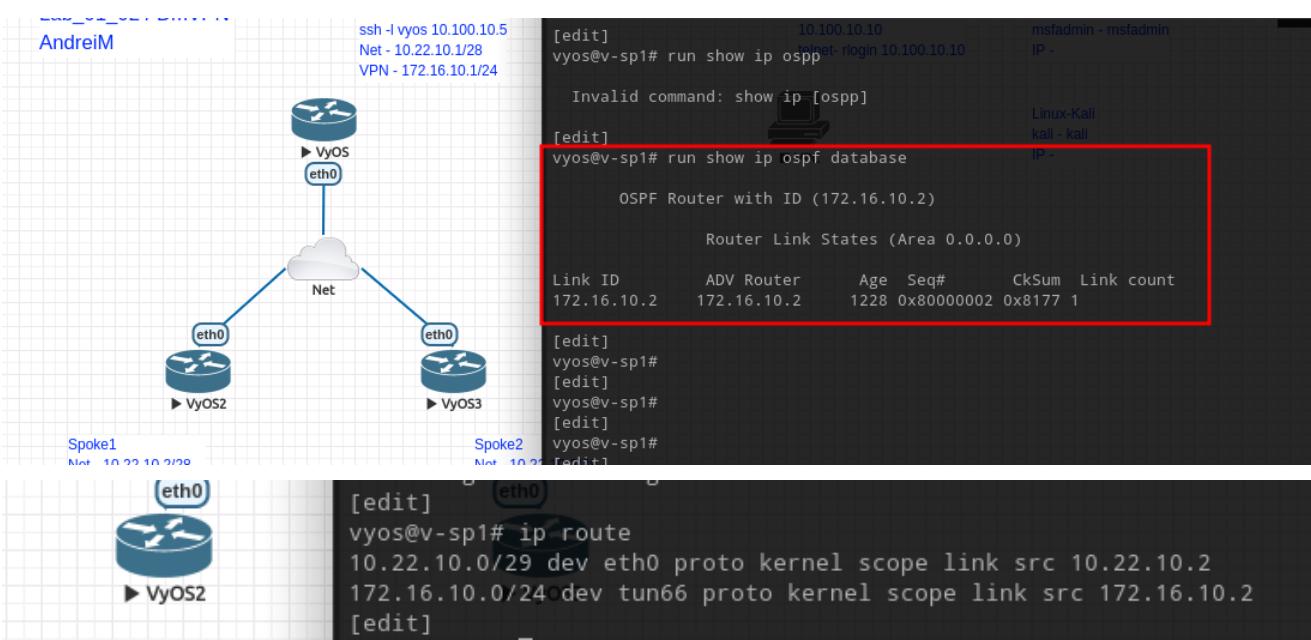
```

Проверяем командой:

```

vyos@v-sp1:# run show ip ospf database
vyos@v-sp1:# ip route

```



*eth0: VyOS1 not ping to VyOS2, VyOS3*

*eth1: VyOS1 ping success to VyOS2, VyOS3*

```
vyos@v-spl:~$ show configuration commands | grep tunnel
set interfaces tunnel tun66 address '172.16.10.2/24'
set interfaces tunnel tun66 enable-multicast
set interfaces tunnel tun66 encapsulation 'gre'
set interfaces tunnel tun66 ip adjust-mss 'clamp-mss-to-pmtu'
set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.2'
set interfaces tunnel tun66 source-interface 'eth0'
set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 nbma-address '10.22.10.1'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 register
set protocols nhrp tunnel tun66 multicast 'nhs'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut
set vpn ipsec profile dm66 bind tunnel 'tun66'
vyos@v-spl:~$
```

далее переходим в Hub:

```
vyos@v-hub# set protocols ospf default-information originate
always
[edit]
vyos@v-hub# commit
[edit]
vyos@v-hub# save
```

```
vyos@v-hub:# show vpn ipsec
vyos@v-hub:# ip route
```

```
vyos@v-hub# ip route
default nhid 14 via 10.100.10.1 dev eth0 proto static metric 20
10.22.10.0/29 dev eth0 proto kernel scope link src 10.22.10.1
10.100.10.0/26 dev eth0 proto kernel scope link src 10.100.10.5
172.16.10.0/24 dev tun66 proto kernel scope link src 172.16.10.1
```

VyOS-spoke2:

```
# Перейдем на VyOS-spoke2.
# =====
# VyOS Spoke2
# =====
# esp_s1 to ESP-S1. ike_s1 to IKE-S1
# -----
# Вводим следующие команды:
vyos@v-sp2:~$ configure
vyos@v-sp2:#
set interfaces tunnel tun66 address '172.16.10.3/24'
```

```
set interfaces tunnel tun66 encapsulation 'gre'
set interfaces tunnel tun66 ip adjust-mss 'clamp-mss-to-pmtu'

# --- ERROR:
set interfaces tunnel tun66 multicast 'enable'
# --- Vyos 1.5, 1.4:
set interfaces tunnel tun66 enable-multicast
set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.3'
set interfaces tunnel tun66 source-interface 'eth0'

set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 nbma-address
'10.22.10.1'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 register
set protocols nhrp tunnel tun66 multicast 'nhs'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut

set system time-zone 'Europe/Moscow'

# Manual better ESP-h1 ???
# --- ERROR Vyos 1.5, 1.4:
# set vpn ipsec esp-group esp_s1 compression 'disable'

set vpn ipsec esp-group esp_s1 lifetime '1800'
set vpn ipsec esp-group esp_s1 mode 'transport'
set vpn ipsec esp-group esp_s1 pfs 'dh-group2'
set vpn ipsec esp-group esp_s1 proposal 1 encryption 'aes256'
set vpn ipsec esp-group esp_s1 proposal 1 hash 'sha1'
set vpn ipsec esp-group esp_s1 proposal 2 encryption '3des'
set vpn ipsec esp-group esp_s1 proposal 2 hash 'md5'

# Manual better IKE-s1
set vpn ipsec ike-group ike_s1 close-action 'none'
# --- ERROR Vyos 1.5, 1.4:
# set vpn ipsec ike-group ike_s1 ikev2-reauth 'no'
set vpn ipsec ike-group ike_s1 key-exchange 'ikev1'
```

```

set vpn ipsec ike-group ike_s1 lifetime '3600'
set vpn ipsec ike-group ike_s1 proposal 1 dh-group '2'
set vpn ipsec ike-group ike_s1 proposal 1 encryption 'aes256'
set vpn ipsec ike-group ike_s1 proposal 1 hash 'sha1'
set vpn ipsec ike-group ike_s1 proposal 2 dh-group '2'
set vpn ipsec ike-group ike_s1 proposal 2 encryption 'aes128'
set vpn ipsec ike-group ike_s1 proposal 2 hash 'sha1'

set vpn ipsec interface 'eth0'
set vpn ipsec profile dm66 authentication mode 'pre-shared-secret'
set vpn ipsec profile dm66 authentication pre-shared-secret 'qwerty12'
set vpn ipsec profile dm66 bind tunnel 'tun66'
set vpn ipsec profile dm66 esp-group 'esp_s1'
set vpn ipsec profile dm66 ike-group 'ike_s1'

```

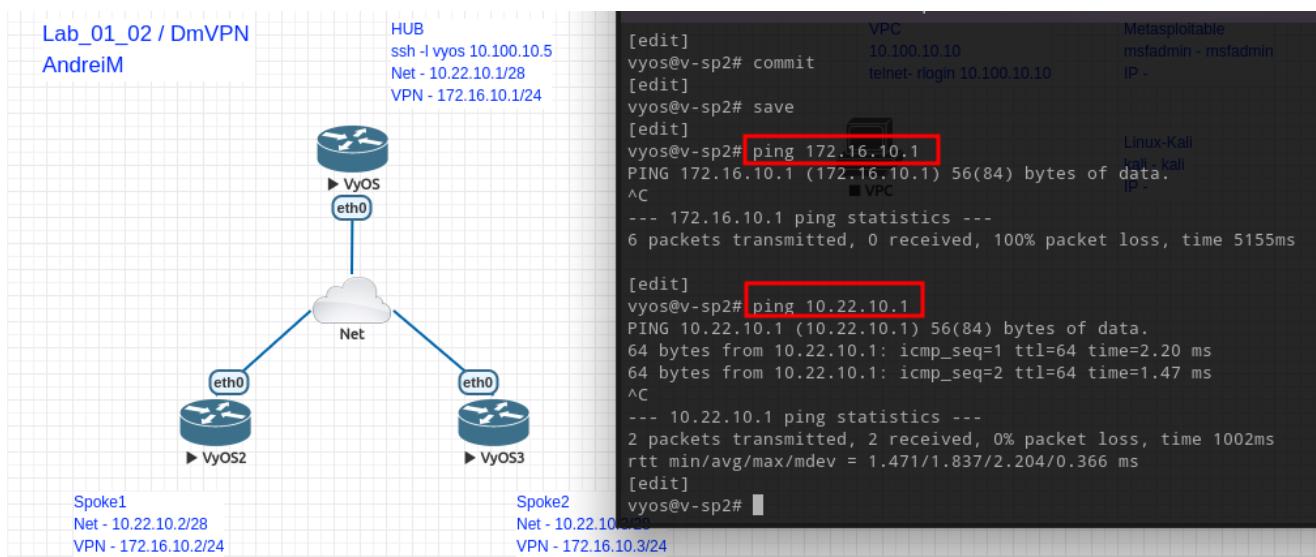
```

vyos@v-sp2:# commit
loaded ike secret 'ike-dmvpn-tun66' ??? not listed Vyos-1.5, 1.4
vyos@v-sp2:#save

```

Проверим ping до VyOS-hub:

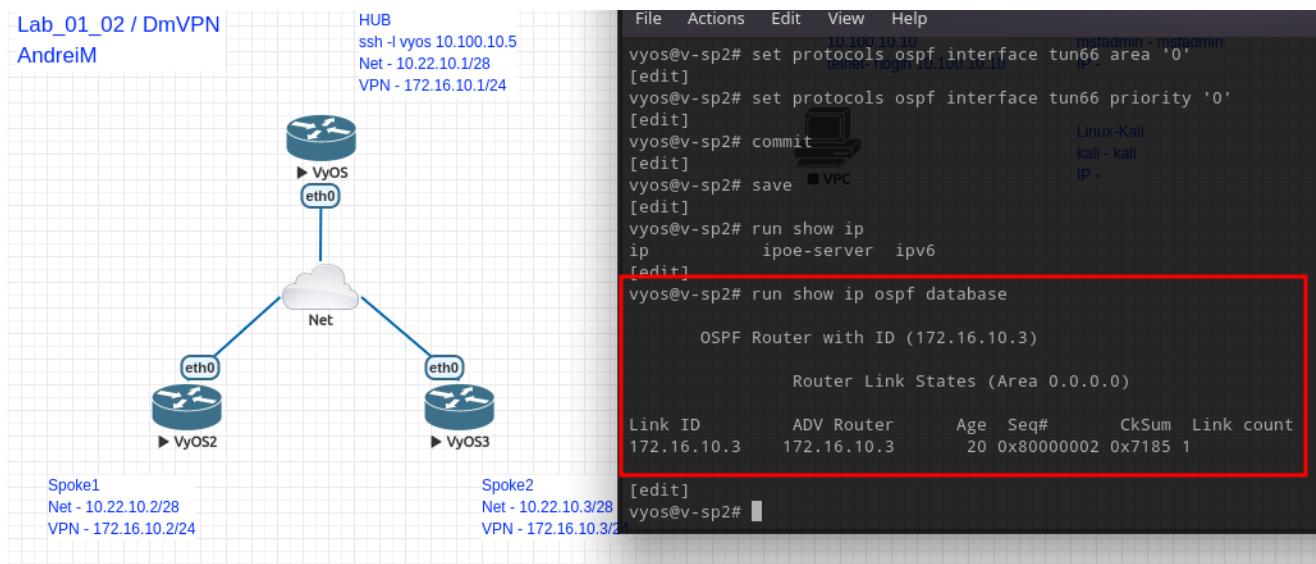
```
vyos@v-sp2:# ping 172.16.10.1
```



```
# Введем следующие команды:
vyos@v-sp2:# set protocols ospf area 0
set protocols ospf interface tun66 area '0'
set protocols ospf interface tun66 priority '0'
vyos@v-sp2:# commit
vyos@v-sp2:# save
```

Проверяем командой:

```
vyos@v-sp2:# run show ip ospf database
```

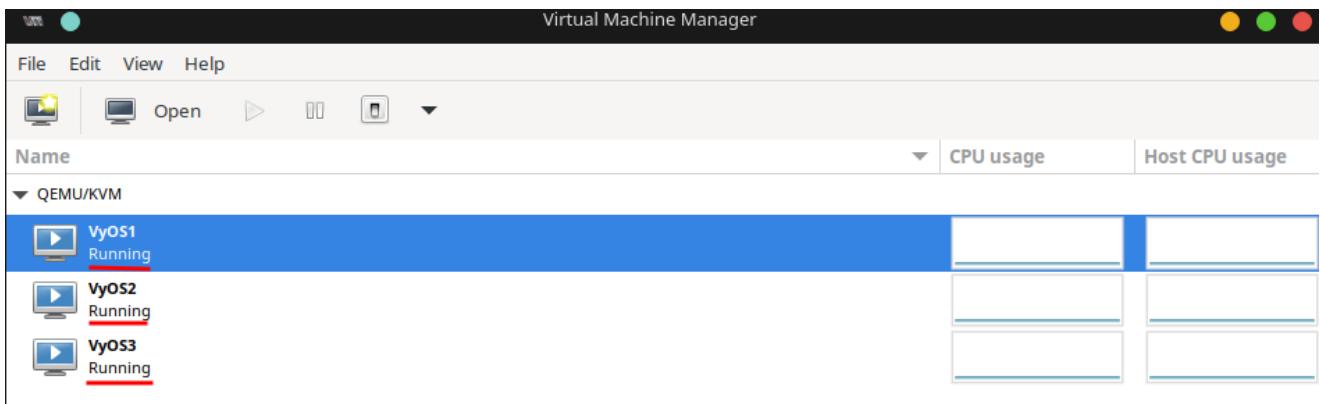


eth0: VyOS1 not ping to VyOS2, VyOS3

eth1: VyOS1 ping success to VyOS2, VyOS3

```
vyos@v-sp2:~$ show configuration commands | grep tunnel
set interfaces tunnel tun66 address '172.16.10.3/24'
set interfaces tunnel tun66 enable-multicast
set interfaces tunnel tun66 encapsulation 'gre'
set interfaces tunnel tun66 ip adjust-mss 'clamp-mss-to-pmtu'
set interfaces tunnel tun66 parameters ip key '1'
set interfaces tunnel tun66 source-address '10.22.10.3'
set interfaces tunnel tun66 source-interface 'eth0'
set protocols nhrp tunnel tun66 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 nbma-address '10.22.10.1'
set protocols nhrp tunnel tun66 map 172.16.10.1/24 register
set protocols nhrp tunnel tun66 multicast 'nhs'
set protocols nhrp tunnel tun66 redirect
set protocols nhrp tunnel tun66 shortcut
set vpn ipsec profile dm66 bind tunnel 'tun66'
```

**Для зачета предоставить скриншоты с ВМ  
команды:**



The screenshot shows the 'QEMU/KVM - Connection Details' window. The 'Virtual Networks' tab is selected. On the left, there are two network connections: 'vm-int' and 'vm-net'. 'vm-net' is currently selected and highlighted in blue. On the right, the 'Details' tab is active, displaying the following configuration:

Name:	vm-net
Device:	virbr1
State:	Active
Autostart:	<input checked="" type="checkbox"/> On Boot
Domain:	vm-net
▼ IPv4 configuration	
Network:	10.100.10.0/26
DHCP range:	10.100.10.32 - 10.100.10.62
Forwarding:	NAT

```
vyos@v-hub:# run show ip ospf database
vyos@v-sp1:# run show ip ospf database
vyos@v-sp2:# run show ip ospf database
```

Проверяем, что не так.

Добавлено в коде выше # ---

Проверим далее в *EVE-NG*, GNS3 (с Vyos-1.5 Cisco R1-R4)

## Пробуем Vyos-1.5-Rolling в EVE-NG по методичке:

- VyOS-DmVPN [Hub-Spoke-VyOS/Cisco](#)
- VyOS-DmVPN [Dual-Hub](#)
- VyOS-Rolling [1.5-ISO-download](#)

- Cisco-EVE-NG [Cisco (7206VXR)](<https://www.eve-ng.net/index.php/documentation/howtos/howto-add-cisco-dynamips-images-cisco-ios/>)
- Cisco-download [7200](#)

```
# EVE-NG
# ***

# if .bin
unzip -p c7200-adventuresek9-mz.152-4.S7.bin > c7200-
adventuresek9-mz.152-4.S7.image

/opt/unetlab/wrappers/unl_wrapper -a fixpermissions

dynamips -P 1700 -t 1710 /opt/unetlab/addons/dynamips/c1710-
bk9no3r2sy-mz.124-23.image
dynamips -P 7200 /opt/unetlab/addons/dynamips/c7200-
adventuresek9-mz.152-4.S7.image
dynamips -P 3725 /opt/unetlab/addons/dynamips/c3725-
adventuresek9-mz.124-15.T14.image
root@eve-ng:~# top

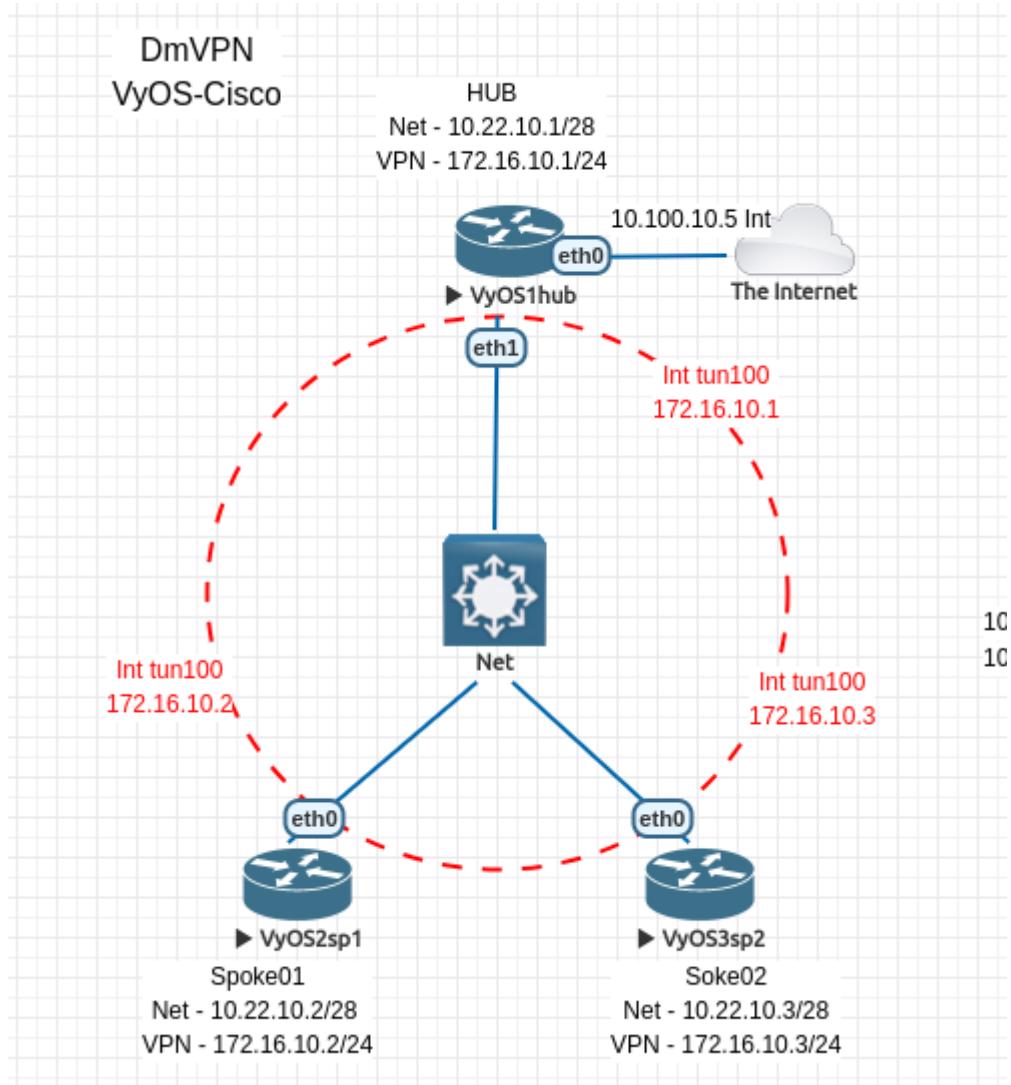
#
Exit from initial configuration dialog (no), and quit to get the
con0 prompt:

root@eve-ng:~# top
 PID USER      PR  NI      VIRT      RES      SHR S %CPU %MEM
 ...
 

# Cisco
Router>enable
Router>conf t
Router(...)#exit
Router#wr

sh config commands
sh ip ospf database
...
```

## DmVPN Vyos-1.5



## VyOS-1.5 1-3

```
# HUB VyOS
# ***
conf
set service host-name v-hub

# manual: eth0 192.0.2.1/24 example.
# hub
eth0 10.100.10.5 outside (internet).
eth1 10.22.1.2 inside (intern)
tun 172.16.10.1/24
# ---

set interfaces ethernet eth0 description 'net: Internet'
set interfaces ethernet eth0 address 10.100.10.5/26
set interfaces ethernet eth1 description 'net: DmVPN'
set interfaces ethernet eth1 address 10.22.10.1/29
```

```
set service ssh
# ...
# set protocols static route .... name-server ...?

# hw: tun66 ... manual: tun100 172.16.253.134/29... source-
address '192.0.2.1'
# ---
set interfaces tunnel tun100 address '172.16.10.1/24'
set interfaces tunnel tun100 encapsulation 'gre'
set interfaces tunnel tun100 source-address '10.22.10.1'
# --- eth1 (inside)
set interfaces tunnel tun100 source-interface 'eth1'
set interfaces tunnel tun100 enable-multicast
set interfaces tunnel tun100 parameters ip key '1'

set protocols nhrp tunnel tun100 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun100 holding-time '300'
set protocols nhrp tunnel tun100 multicast 'dynamic'
set protocols nhrp tunnel tun100 redirect
set protocols nhrp tunnel tun100 shortcut

set system time-zone 'Europe/Moscow'

set vpn ipsec esp-group ESP-HUB lifetime '1800'
set vpn ipsec esp-group ESP-HUB mode 'transport'
set vpn ipsec esp-group ESP-HUB pfs 'dh-group2'
set vpn ipsec esp-group ESP-HUB proposal 1 encryption 'aes256'
set vpn ipsec esp-group ESP-HUB proposal 1 hash 'sha1'
set vpn ipsec esp-group ESP-HUB proposal 2 encryption '3des'
set vpn ipsec esp-group ESP-HUB proposal 2 hash 'md5'
set vpn ipsec ike-group IKE-HUB key-exchange 'ikev1'
set vpn ipsec ike-group IKE-HUB lifetime '3600'
set vpn ipsec ike-group IKE-HUB proposal 1 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 1 encryption 'aes256'
set vpn ipsec ike-group IKE-HUB proposal 1 hash 'sha1'
set vpn ipsec ike-group IKE-HUB proposal 2 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 2 encryption 'aes128'
set vpn ipsec ike-group IKE-HUB proposal 2 hash 'sha1'

# --- eth1 inside
set vpn ipsec interface 'eth1'

set vpn ipsec profile NHRPVPN authentication mode 'pre-shared-
secret'
```

```
set vpn ipsec profile NHRPVPN authentication pre-shared-secret  
'qwerty12'  
set vpn ipsec profile NHRPVPN bind tunnel 'tun100'  
set vpn ipsec profile NHRPVPN esp-group 'ESP-HUB'  
set vpn ipsec profile NHRPVPN ike-group 'IKE-HUB'  
  
commit  
save  
  
# ospf  
set protocols ospf area 0  
set protocols ospf interface tun100 priority '255'  
set protocols ospf interface tun100 area '0'  
  
commit  
save
```

## Spoke

```
# Spoke VyOS  
# ***  
  
# Spoke-1  
# eth0 - 10.22.2.2 (intern)  
# manual: set interfaces ethernet eth0 address 'dhcp'  
  
# manual: eth0 192.0.2.1/24 example.  
# hub  
eth0 10.100.10.5 outside (internet).  
eth1 10.22.10.1 inside (intern)  
tun 172.16.10.1/24  
# ---  
  
set interfaces ethernet eth0 description 'net: DmVPN'  
set interfaces ethernet eth0 address 10.22.10.2/29  
set service ssh  
  
set system time-zone 'Europe/Budapest'  
  
# hw: tun66 ... manual: tun100 172.16.253.133/29... source-  
address '0.0.0.0' ... source-address 10.22.10.2 ?  
# ---
```

```
set interfaces tunnel tun100 address '172.16.10.2/29'
set interfaces tunnel tun100 source-address 0.0.0.0
set interfaces tunnel tun100 encapsulation 'gre'
set interfaces tunnel tun100 enable-multicast
set interfaces tunnel tun100 parameters ip key '1'

set protocols nhrp tunnel tun100 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun100 holding-time '300'
# --- to v-hub ...
set protocols nhrp tunnel tun100 map 172.16.10.1/29 nbma-address
'10.22.10.1'
set protocols nhrp tunnel tun100 map 172.16.10.1/29 register
set protocols nhrp tunnel tun100 multicast 'nhs'
set protocols nhrp tunnel tun100 redirect
set protocols nhrp tunnel tun100 shortcut

set vpn ipsec esp-group ESP-HUB lifetime '1800'
set vpn ipsec esp-group ESP-HUB mode 'transport'
set vpn ipsec esp-group ESP-HUB pfs 'dh-group2'
set vpn ipsec esp-group ESP-HUB proposal 1 encryption 'aes256'
set vpn ipsec esp-group ESP-HUB proposal 1 hash 'sha1'
set vpn ipsec esp-group ESP-HUB proposal 2 encryption '3des'
set vpn ipsec esp-group ESP-HUB proposal 2 hash 'md5'
set vpn ipsec ike-group IKE-HUB close-action 'none'
set vpn ipsec ike-group IKE-HUB key-exchange 'ikev1'
set vpn ipsec ike-group IKE-HUB lifetime '3600'
set vpn ipsec ike-group IKE-HUB proposal 1 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 1 encryption 'aes256'
set vpn ipsec ike-group IKE-HUB proposal 1 hash 'sha1'
set vpn ipsec ike-group IKE-HUB proposal 2 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 2 encryption 'aes128'
set vpn ipsec ike-group IKE-HUB proposal 2 hash 'sha1'

set vpn ipsec interface 'eth0'

set vpn ipsec profile NHRPVPN authentication mode 'pre-shared-
secret'
set vpn ipsec profile NHRPVPN authentication pre-shared-secret
'secret'
set vpn ipsec profile NHRPVPN bind tunnel 'tun100'
set vpn ipsec profile NHRPVPN esp-group 'ESP-HUB'
set vpn ipsec profile NHRPVPN ike-group 'IKE-HUB'

commit
```

```
save

# ospf
set protocols ospf area 0
set protocols ospf interface tun100 priority '255'
set protocols ospf interface tun100 area '0'

commit
save

# Spoke-2
# eth0 - 10.22.3.2 (intern)
# manual: set interfaces ethernet eth0 address 'dhcp'

# manual: eth0 192.0.2.1/24 example.
# hub
eth0 10.100.10.5 outside (internet).
eth1 10.22.10.1 inside (intern)
tun 172.16.10.1/24
# ---

set interfaces ethernet eth0 description 'net: DmVPN'
set interfaces ethernet eth0 address '10.22.10.3/24'
set service ssh

set system time-zone 'Europe/Moscow'

# hw: tun66 ... manual: tun100 172.16.253.132/29... source-
address '0.0.0.0' ... source-address 10.22.3.2 ?
# ---

set interfaces tunnel tun100 address '172.16.10.3/29'
set interfaces tunnel tun100 source-address 0.0.0.0
set interfaces tunnel tun100 encapsulation 'gre'
set interfaces tunnel tun100 enable-multicast
set interfaces tunnel tun100 parameters ip key '1'

set protocols nhrp tunnel tun100 cisco-authentication 'qwerty12'
set protocols nhrp tunnel tun100 holding-time '300'
# --- to v-hub
set protocols nhrp tunnel tun100 map 172.16.10.1/29 nbma-address
'10.22.10.1'
```

```
set protocols nhrp tunnel tun100 map 172.16.10.1/29 register
set protocols nhrp tunnel tun100 multicast 'nhs'
set protocols nhrp tunnel tun100 redirect
set protocols nhrp tunnel tun100 shortcut

set vpn ipsec esp-group ESP-HUB lifetime '1800'
set vpn ipsec esp-group ESP-HUB mode 'transport'
set vpn ipsec esp-group ESP-HUB pfs 'dh-group2'
set vpn ipsec esp-group ESP-HUB proposal 1 encryption 'aes256'
set vpn ipsec esp-group ESP-HUB proposal 1 hash 'sha1'
set vpn ipsec esp-group ESP-HUB proposal 2 encryption '3des'
set vpn ipsec esp-group ESP-HUB proposal 2 hash 'md5'
set vpn ipsec ike-group IKE-HUB close-action 'none'
set vpn ipsec ike-group IKE-HUB key-exchange 'ikev1'
set vpn ipsec ike-group IKE-HUB lifetime '3600'
set vpn ipsec ike-group IKE-HUB proposal 1 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 1 encryption 'aes256'
set vpn ipsec ike-group IKE-HUB proposal 1 hash 'sha1'
set vpn ipsec ike-group IKE-HUB proposal 2 dh-group '2'
set vpn ipsec ike-group IKE-HUB proposal 2 encryption 'aes128'
set vpn ipsec ike-group IKE-HUB proposal 2 hash 'sha1'

set vpn ipsec interface 'eth0'

set vpn ipsec profile NHRPVPN authentication mode 'pre-shared-secret'
set vpn ipsec profile NHRPVPN authentication pre-shared-secret 'secret'
set vpn ipsec profile NHRPVPN bind tunnel 'tun100'
set vpn ipsec profile NHRPVPN esp-group 'ESP-HUB'
set vpn ipsec profile NHRPVPN ike-group 'IKE-HUB'

commit
save

# ospf
set protocols ospf area 0
set protocols ospf interface tun100 priority '255'
set protocols ospf interface tun100 area '0'

commit
save
```

ping 172.16.10.1 (to v-hub)

```
[edit] ms
vyos@v-sp1# ping 172.16.10.1
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.
64 bytes from 172.16.10.1: icmp_seq=1 ttl=64 time=1.35 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=1.45 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=1.62 ms
^C
--- 172.16.10.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.352/1.475/1.623/0.111 ms
[edit]
```

```
vyos@v-sp2# ping 172.16.10.1
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.
64 bytes from 172.16.10.1: icmp_seq=1 ttl=64 time=1.34 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=64 time=1.41 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=64 time=1.47 ms
^C
--- 172.16.10.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.344/1.408/1.472/0.052 ms
[edit]
vyos@v-sp2#
```

```
vyos@v-hub:# run show ip ospf database
```

```
vyos@v-sp1:# run show ip ospf database
```

```
vyos@v-sp2:# run show ip ospf database
```

```
vyos@v-hub# run show ip ospf database
OSPF Router with ID (172.16.10.1)
Router Link States (Area 0.0.0.0)
Link ID      ADV Router      Age  Seq#      CkSum      Link count
172.16.10.1  172.16.10.1   641  0x80000003  0x8f6a     1
[edit]
```

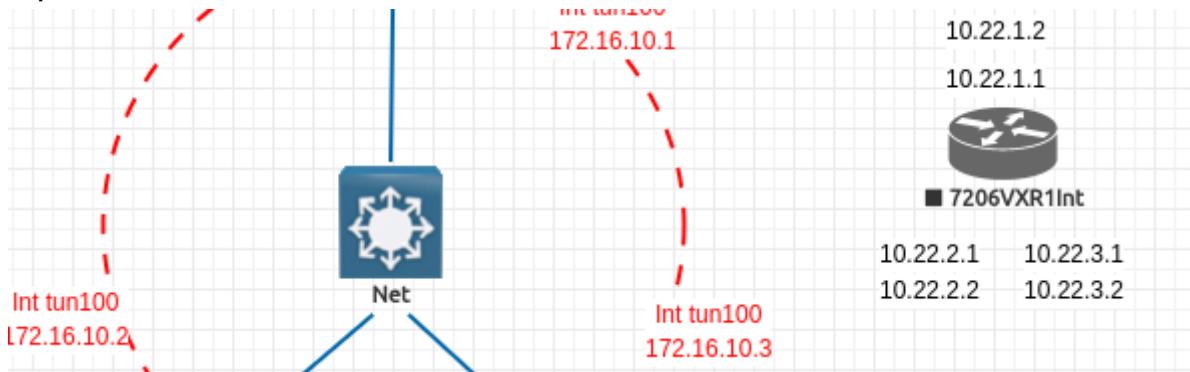
```
vyos@v-sp1# run show ip ospf database
OSPF Router with ID (172.16.10.2)
Router Link States (Area 0.0.0.0)
Link ID      ADV Router      Age  Seq#      CkSum      Link count
172.16.10.2  172.16.10.2   498  0x80000003  0x1de1     1
[edit]
```

```

vyos@v-sp2# run show ip ospf database
      OSPF Router with ID (172.16.10.3)
      Router Link States (Area 0.0.0.0)
      1.2
      Link ID          ADV Router      Age  Seq#      CkSum      Link count
      172.16.10.3    172.16.10.3    334  0x80000003  0x0def    1
      [edit] Link count

```

Optional: Cisco R1 or use 'Net- Connection-Switch'



```

# --- Cisco R1
# 10.22.10.1... 10.22.10.2 ... 10.22.10.3 ?
# ---
R1>enable
R1#conf t
R1(config)#int fa 0/0
R1(config-if)#ip address 10.22.1.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#int fa 1/0
R1(config-if)#ip address 10.22.2.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#int fa 2/0
R1(config-if)#ip address 10.22.3.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#exit
R1#wr

```

EVE-NG Cisco-spoke 1-4 (Example: manual)

```

# manual:
# spoke01-spoke04 Cisco 7206VXR

```

```
enable
conf t
...
show config
# ---

crypto keyring DMVPN
    pre-shared-key address 192.0.2.1 key secret
!
crypto isakmp policy 10
    encr aes 256
    authentication pre-share
    group 2
crypto isakmp invalid-spi-recovery
crypto isakmp keepalive 30 30 periodic
crypto isakmp profile DMVPN
    keyring DMVPN
    match identity address 192.0.2.1 255.255.255.255
!
crypto ipsec transform-set DMVPN-AES256 esp-aes 256 esp-sha-hmac
    mode transport
!
crypto ipsec profile DMVPN
    set security-association idle-time 720
    set transform-set DMVPN-AES256
    set isakmp-profile DMVPN
!
interface Tunnel10
    ! individual spoke tunnel IP must change
    ip address 172.16.253.129 255.255.255.248
    no ip redirects
    ip nhrp authentication secret
    ip nhrp map 172.16.253.134 192.0.2.1
    ip nhrp map multicast 192.0.2.1
    ip nhrp network-id 1
    ip nhrp holdtime 600
    ip nhrp nhs 172.16.253.134
```

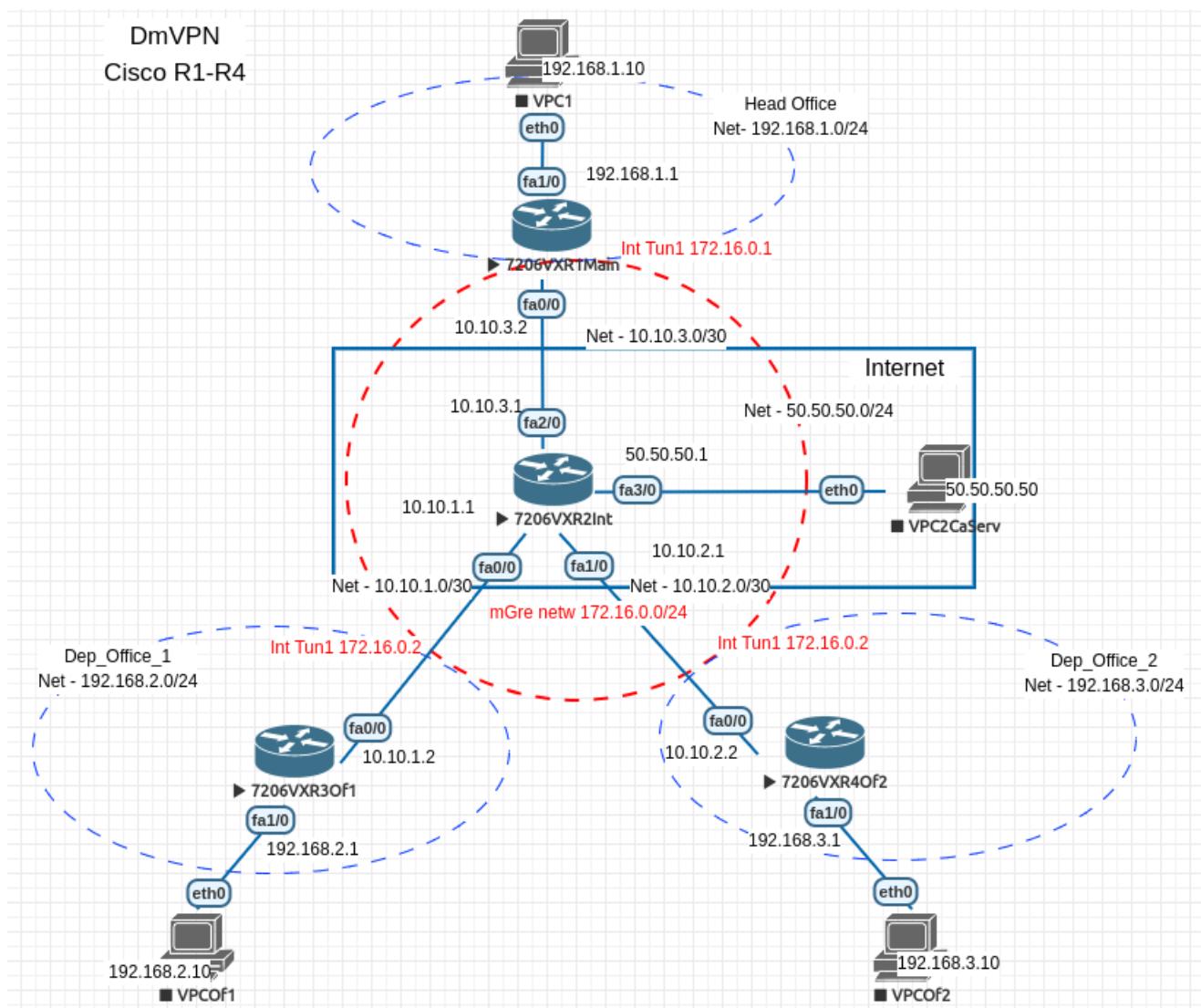
```

ip nhrp registration timeout 75
tunnel source FastEthernet0/0
tunnel mode gre multipoint
tunnel protection ipsec profile DMVPN
tunnel key 1
!
interface FastEthernet0/0
  ip address dhcp
  duplex half

```

Проверим DmVPN на **Cisco R1 - R4 7206VX** в *EVE-NG*:

[Ciscoacs DmVPN](#)



```

# Network
# Main Router R1
# ---

```

```
enable
conf t
(config)#hostname R1
(config)#int fa 0/0
R1(config-if)#ip address 10.10.3.2 255.255.255.252
R1(config-if)#ip nat outside
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#int fa 1/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#ip nat inside
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#ip access-list extended FOR_NAT
R1(config-ext-nacl)#permit ip 192.168.1.0 0.0.0.255 any
R1(config-ext-nacl)#exit
R1(config)#ip nat inside source list FOR_NAT interface fa 0/0
overload
R1(config)#ip route 0.0.0.0 0.0.0.0 10.10.3.1
R1(config)#exit
R1#wr
```

```
# --- R3 Office 1
R3#conf t
R3(config)#int fa 0/0
R3(config-if)#ip address 10.10.1.2 255.255.255.252
R3(config-if)#ip nat outside
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#int fa 1/0
R3(config-if)#ip address 192.168.2.1 255.255.255.0
R3(config-if)#ip nat inside
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#ip access-list extended FOR_NAT
R3(config-ext-nacl)#permit ip 192.168.2.0 0.0.0.255 any
R3(config-ext-nacl)#exit
R3(config)#ip nat inside source list FOR_NAT interface fa 0/0
overload
R3(config)#ip route 0.0.0.0 0.0.0.0 10.10.1.1
R3(config)#exit
R3#wr
```

```
# --- R4 Office 2
R4(config)#int fa 0/0
R4(config-if)#ip address 10.10.2.2 255.255.255.252
R4(config-if)#ip nat outside
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#int fa 1/0
R4(config-if)#ip address 192.168.3.1 255.255.255.0
R4(config-if)#ip nat inside
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#ip access-list extended FOR_NAT
R4(config-ext-nacl)#permit ip 192.168.3.0 0.0.0.255 any
R4(config-ext-nacl)#exit
R4(config)#ip nat inside source list FOR_NAT interface fa 0/0
overload
R4(config)#ip route 0.0.0.0 0.0.0.0 10.10.2.1
R4(config)#exit
R4#wr
```

```
# --- Internet R2
R2(config)#int fa 0/0
R2(config-if)#ip address 10.10.1.1 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#int fa 1/0
R2(config-if)#ip address 10.10.2.1 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#int fa 2/0
R2(config-if)#ip address 10.10.3.1 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#int fa 3/0
R2(config-if)#ip address 50.50.50.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#exit
R2#wr
```

```

R1>ping 10.10.3.1 ✓
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/46/56 ms
R1>ping 10.10.1.2 ✓
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/48/60 ms
R1>ping 10.10.2.2 ✓
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 48/53/60 ms
R1>ping 50.50.50.1 ✓
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 50.50.50.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/47/56 ms
R1>

```

Настроим GRE туннели (mGRE) и протокол NHRP (Next Hop Resolution Protocol). В качестве hub-роутера будет выступать MainRouter \_R1.

- *tunnel 1* – создаем туннельный интерфейс
- *nhrp map multicast dynamic* – указываем, чтобы hub-роутер автоматически сопоставлял IP-адреса туннельных и физических интерфейсов Branch роутеров;
- *network-id 1* – задаем идентификационный номер сети, в которой будет работать NHRP (д.б. одинаковым на всех роутерах);

```

# --- NHRP
enable
conf t
R1(config)#int tunnel 1
R1(config-if)#ip address 172.16.0.1 255.255.255.0
R1(config-if)#ip mtu 1416
R1(config-if)#tunnel source fastEthernet 0/0
R1(config-if)#tunnel mode gre multipoint
R1(config-if)#ip nhrp map multicast dynamic
R1(config-if)#ip nhrp network-id 1
R1(config-if)#ip nhrp authentication pass
R1(config-if)#exit
R1(config)#exit
#wr

```

```

# --- R3 Dep_Office_1
conf t

```

```
R3(config)#interface tunnel 1
R3(config-if)#ip address 172.16.0.2 255.255.255.0
R3(config-if)#ip mtu 1416
R3(config-if)#tunnel source fastEthernet 0/0
R3(config-if)#tunnel mode gre multipoint
R3(config-if)#ip nhrp nhs 172.16.0.1
R3(config-if)#ip nhrp map 172.16.0.1 10.10.3.2
R3(config-if)#ip nhrp map multicast 10.10.3.2
R3(config-if)(config-if)#ip nhrp network-id 1
R3(config-if)#ip nhrp authentication pass
R3(config-if)#ip nhrp registration no-unique
R3(config-if)#exit
R3(config)#exit
#wr
```

```
# --- R4 Dep_Office_2
R4#conf t
R4(config)#interface tunnel 1
R4(config-if)#ip address 172.16.0.3 255.255.255.0
R4(config-if)#ip mtu 1416
R4(config-if)#tunnel source fastEthernet 0/0
R4(config-if)#tunnel mode gre multipoint
R4(config-if)#ip nhrp nhs 172.16.0.1
R4(config-if)#ip nhrp map 172.16.0.1 10.10.3.2
R4(config-if)#ip nhrp map multicast 10.10.3.2
R4(config-if)#ip nhrp network-id 1
R4(config-if)#ip nhrp authentication pass
R4(config-if)#ip nhrp registration no-unique
R4(config-if)#exit
R4(config)#exit
#wr
```

```

R4>sh ip nhrp nhs
Legend: E=Expecting replies, R=Responding, W=Waiting
Tunnell:
172.16.0.1 RE priority = 0 cluster = 0

R4>sh ip nhrp brief
  Target          Via          NBMA        Mode   Intfc  Claimed
172.16.0.1/32    172.16.0.1   10.10.3.2  static  Tul    <  >
172.16.0.2/32    172.16.0.2   10.10.1.2  dynamic Tul    <  >
R4>sh ip nhrp
172.16.0.1/32 via 172.16.0.1
  Tunnell created 00:03:44, never expire
  Type: static, Flags: used
  NBMA address: 10.10.3.2
172.16.0.2/32 via 172.16.0.2
  Tunnell created 00:02:36, expire 01:57:23
  Type: dynamic, Flags: router used
  NBMA address: 10.10.1.2
R4>■

```

OSPF - протокол динамической маршрутизации OSPF, для обмена внутренними сетями между центральным офисом и филиалами. В нашем случае mGRE интерфейсы образуют NBMA сеть, так что данный аспект следует учитывать при настройке (как настраивать OSPF в NBMA сетях, можно посмотреть [тут](#)). Сеть 172.16.0.0/24 будет входить в area 0, а локальные сети в Area 1, Area 2, Area 3 соответственно. DR-ом будет выступать Main\_Router R1.

```

# OSPF
# --- Router Main_R1
R1>enable
R1#conf t
R1(config)#router ospf 1
R1(config-router)#network 172.16.0.0 0.0.0.255 area 0
R1(config-router)#network 192.168.1.0 0.0.0.255 area 1
R1(config-router)#exit
R1(config)#interface tunnel 1
R1(config-if)#ip ospf priority 10
R1(config-if)#ip ospf network broadcast
R1(config-if)#ip ospf hello-interval 30
R1(config-if)#exit
R1(config)#exit
R1#wr

# --- Router R3 Dep_Office_1
R3#conf t
R3(config)#router ospf 1
R3(config-router)#network 172.16.0.0 0.0.0.255 area 0
R3(config-router)#network 192.168.2.0 0.0.0.255 area 2

```

```

R3(config-router)#exit
R3(config)#int tunnel 1
R3(config-if)#ip ospf priority 0
R3(config-if)#ip ospf network broadcast
R3(config-if)#ip ospf hello-interval 30
R3(config-if)#exit
R3(config)#exit
R3#wr

```

```

# --- Router R4 Dep_Office_2
R4#conf t
R4(config)#router ospf 1
R4(config-router)#network 172.16.0.0 0.0.0.255 area 0
R4(config-router)#network 192.168.3.0 0.0.0.255 area 3
R4(config-router)#exit
R4(config)#int tunnel 1
R4(config-if)#ip ospf priority 0
R4(config-if)#ip ospf network broadcast
R4(config-if)#ip ospf hello-interval 30
R4(config-if)#exit
R4(config)#exit
R4#wr

```

```

R4#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2
      i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
      ia - IS-IS inter area, * - candidate default, U - per-user static route
      o - ODR, P - periodic downloaded static route, H - NHRP, l - LISPs
      + - replicated route, % - next hop override

Gateway of last resort is 10.10.2.1 to network 0.0.0.0

S*   0.0.0.0/0 [1/0] via 10.10.2.1
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
      |    10.10.2.0/30 is directly connected, FastEthernet0/0
      L    10.10.2.2/32 is directly connected, FastEthernet0/0
      C    172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
      |    172.16.0.0/24 is directly connected, Tunnel1
      L    172.16.0.3/32 is directly connected, Tunnel1
      IA  192.168.1.0/24 [110/1001] via 172.16.0.1, 00:09:23, Tunnel1
      IA  192.168.2.0/24 [110/1001] via 172.16.0.2, 00:09:23, Tunnel1
      C    192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
      |    192.168.3.0/24 is directly connected, FastEthernet1/0
      L    192.168.3.1/32 is directly connected, FastEthernet1/0

```

```

# --- IPSec VPN
# R1 Main
enable

```

```
R1#conf t
R1(config)#clock timezone GMT +2
...
R1(config)#crypto isakmp policy 10
# создаем политику для первой фазы (настройка IKE). По умолчанию,
если нет других настроек, используется аутентификация по
сертификатам
R1(config-isakmp)#hash md5
R1(config-isakmp)#encryption 3des
R1(config-isakmp)#exit
R1(config)#crypto ipsec transform-set MYSET esp-3des
R1(cfg-crypto-trans)#mode transport
R1(cfg-crypto-trans)#exit
R1(config)#crypto ipsec profile MYPROFILE
R1(ipsec-profile)#set transform-set MYSET
R1(ipsec-profile)#exit
R1(config)#int tunnel 1
R1(config-if)#tunnel protection ipsec profile MYPROFILE
R1(config-if)#exit
R1(config)#exit
R1#wr
```

```
# R3 Dep_Office_1 timezone GMT +1 Bern
R3>ena
R3#conf t
R3(config)#clock timezone GMT +1
...
R3(config)#crypto isakmp policy 10
R3(config-isakmp)# encr 3des
R3(config-isakmp)# hash md5
R3(config-isakmp)#exit
R3(config)#crypto ipsec transform-set MYSET esp-3des
R3(cfg-crypto-trans)# mode transport
R3(cfg-crypto-trans)#exit
R3(config)#crypto ipsec profile MYPROFILE
R3(ipsec-profile)# set transform-set MYSET
R3(ipsec-profile)#exit
R3(config)#int tunnel 1
R3(config-if)#tunnel protection ipsec profile MYPROFILE
R3(config-if)#exit
R3(config)#exit
R3#wr
```

```
# R4 Dep_Office_2 timezone GMT +3 Moscow
```

```

R4>ena
R4#conf t
R3(config)#clock timezone GMT +2
...
R4(config)#crypto isakmp policy 10
R4(config-isakmp)# encr 3des
R4(config-isakmp)# hash md5
R4(config-isakmp)#exit
R4(config)#crypto ipsec transform-set MYSET esp-3des
R4(cfg-crypto-trans)# mode transport
R4(cfg-crypto-trans)#exit
R4(config)#crypto ipsec profile MYPROFILE
R4(ipsec-profile)# set transform-set MYSET
R4(ipsec-profile)#exit
R4(config)#int tunnel 1
R4(config-if)# tunnel protection ipsec profile MYPROFILE
R4(config-if)#exit
R4(config)#exit
R4#wr

```

```

R1>show ip ospf database
      OSPF Router with ID (192.168.1.1) (Process ID 1)

      Router Link States (Area 0)

Link ID        ADV Router        Age        Seq#        Checksum Link count
192.168.1.1   192.168.1.1   1174       0x80000005 0x00D0DD 1
192.168.2.1   192.168.2.1   1910       0x80000004 0x0004EA 1
192.168.3.1   192.168.3.1   3100       0x80000003 0x0002EA 1

      Summary Net Link States (Area 0)

Link ID        ADV Router        Age        Seq#        Checksum
192.168.1.0   192.168.1.1   240        0x80000003 0x00B9AA
192.168.2.0   192.168.2.1   1910       0x80000002 0x00A9B9
192.168.3.0   192.168.3.1   3142       0x80000001 0x0099C8

      Router Link States (Area 1)

Link ID        ADV Router        Age        Seq#        Checksum Link count
192.168.1.1   192.168.1.1   240        0x80000003 0x00AD40 1

      Summary Net Link States (Area 1)

Link ID        ADV Router        Age        Seq#        Checksum
172.16.0.0    192.168.1.1   240        0x80000003 0x001B0C

```

```
R3>show ip ospf dd
```

```
R3>show ip ospf database
```

OSPF Router with ID (192.168.2.1) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
192.168.1.1	192.168.1.1	1878	0x80000004	0x0008E9	1
192.168.2.1	192.168.2.1	1328	0x80000005	0x00BEED	1
192.168.3.1	192.168.3.1	3258	0x80000003	0x0002EA	1

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.0.1	192.168.1.1	3259	0x80000002	0x000EB8

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
192.168.1.0	192.168.1.1	2399	0x80000002	0x00BBA9
192.168.2.0	192.168.2.1	18	0x80000003	0x00A7BA
192.168.3.0	192.168.3.1	3302	0x80000001	0x0099C8

Router Link States (Area 2)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
192.168.2.1	192.168.2.1	18	0x80000003	0x00A446	1

Summary Net Link States (Area 2)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.0.0	192.168.2.1	18	0x80000003	0x001412

```
R4>show ip ospf dd
```

```
R4>show ip ospf database
```

OSPF Router with ID (192.168.3.1) (Process ID 1)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
192.168.1.1	192.168.1.1	1871	0x80000004	0x0008E9	1
192.168.2.1	192.168.2.1	2042	0x80000004	0x0004EA	1
192.168.3.1	192.168.3.1	1322	0x80000005	0x00ACFD	1

Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.0.1	192.168.1.1	3362	0x80000002	0x000EB8

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
192.168.1.0	192.168.1.1	2384	0x80000002	0x00BBA9
192.168.2.0	192.168.2.1	2042	0x80000002	0x00A9B9
192.168.3.0	192.168.3.1	1405	0x80000002	0x0097C9

Router Link States (Area 3)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
192.168.3.1	192.168.3.1	1405	0x80000002	0x009D4B	1

Summary Net Link States (Area 3)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.0.0	192.168.3.1	1405	0x80000002	0x000F17

```
R4>
```

## 2. Установка EVE-NG (в VMM из .ISO)

Скачать по ссылкам образы / полезная литература:

Linux [GNS3-Linux](#)

Ubuntu Server 20 (focal) [download] (<https://ubuntu.com/download/server>)

VyOS-1.4 через DOCKER или GitHub (поиск ~444M)

Build VyOS [docs](#)

### Установка EVE-NG Serv

из образа EVE-NG OVF

- user: root / password: eve (terminal)
- user: admin / password: eve (http)

Useful-Links:

Files: <https://www.eve-ng.net/focal/>

EVE-NG Community installation [Full ISO Download](#)

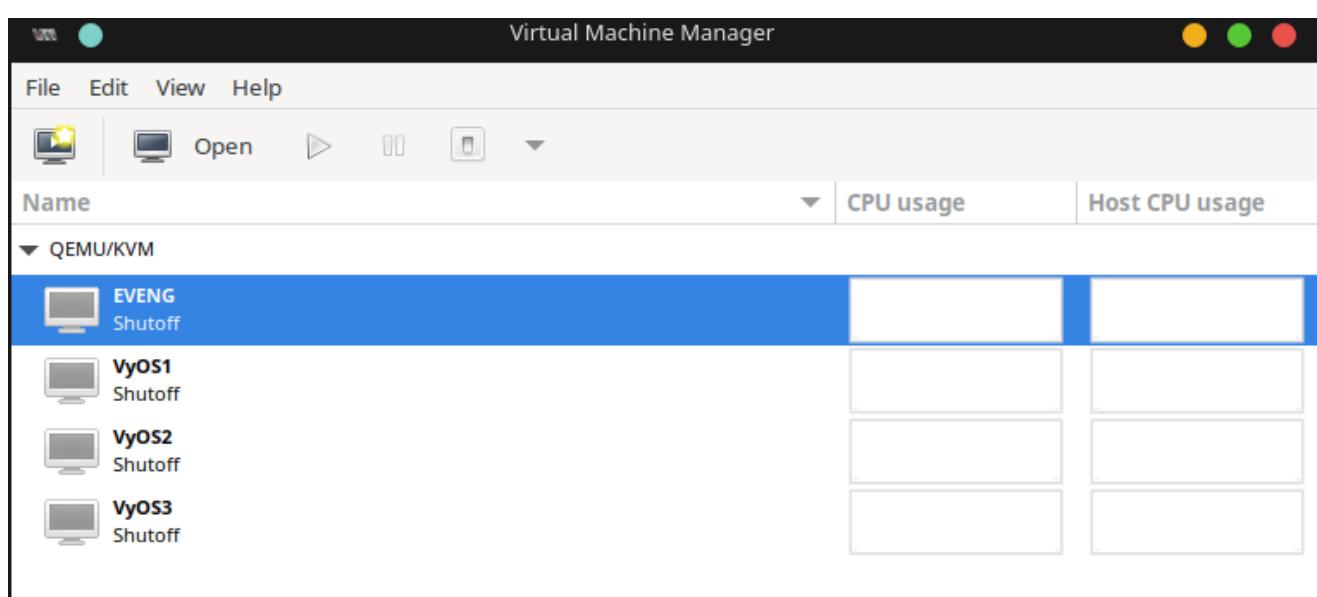
Create own Linux host [Eve-NG howto-create](#)

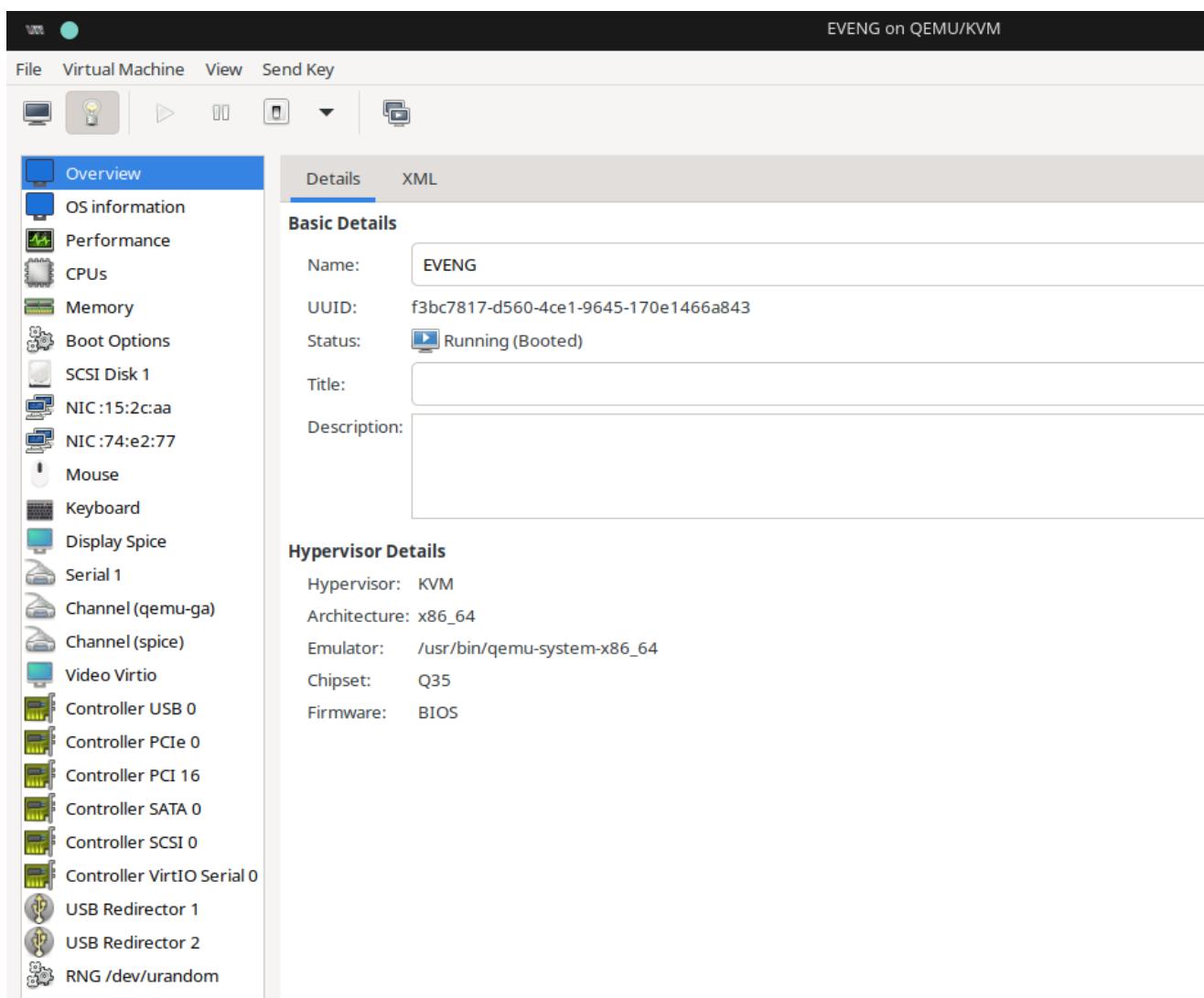
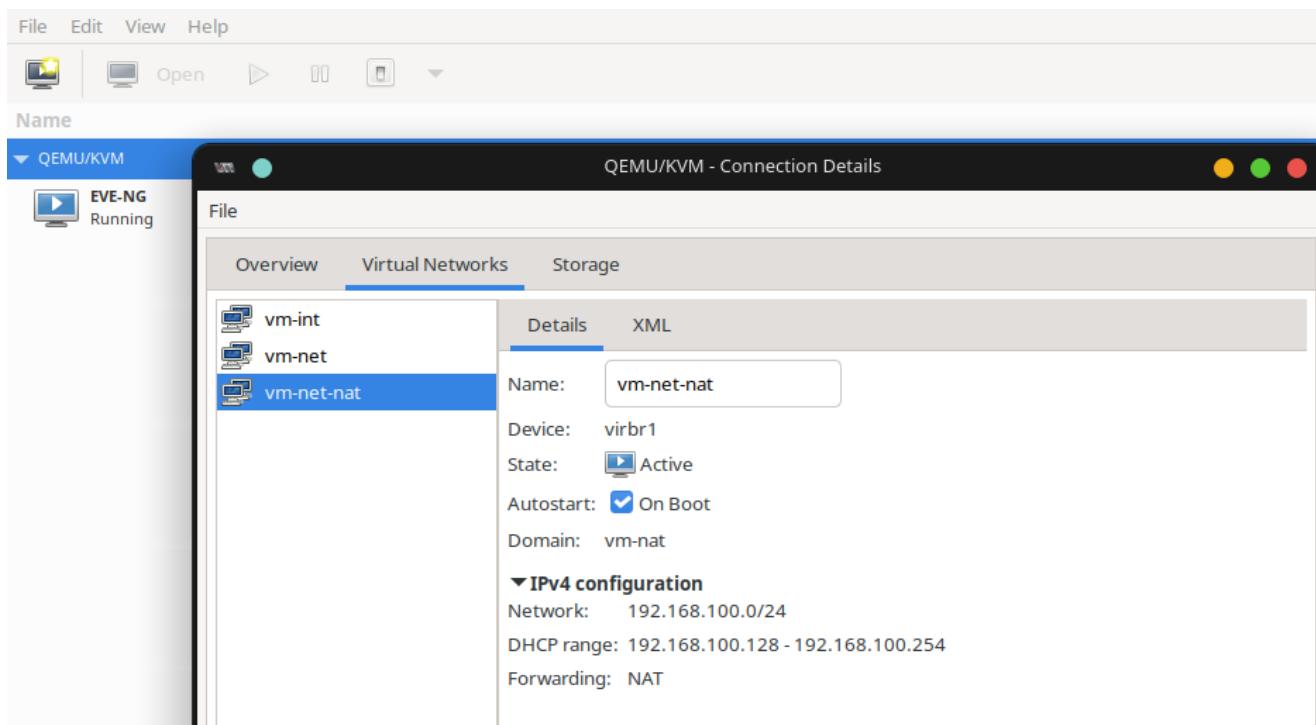
Download Addons/dynamips /iol / qemu [labhub](#)

### Install in Virt-manager

open VMM and Create a new VM

Choose Local install media (.ISO)





```
### Альтернативно: своя сборка под Ubuntu 20 Server (focal)
### 1. --- install EVE-NG in own Ubuntu 20 (focal)
# https://www.eve-ng.net/focal/
```

```
# https://www.eve-ng.net/focal/install-eve.sh

wget -qO - https://www.eve-ng.net/focal/install-eve.sh | sudo sh
# Start
root@eve-ng:~# dpkg -l eve-ng

# 2. --- Install dependencies
- `python3` _(required)_
- `telnet` _(required)_
- `wireshark` _(recommended)_
- `ssh-askpass` _(recommended)_
- `vinagre` _(recommended)_
- `docker` _(optional)_

# 3. ---
sudo usermod -aG wireshark $USER
sudo dpkg-reconfigure wireshark-common

# 4. --- Ubuntu Integration ?
sudo add-apt-repository ppa:smartfinn/eve-ng-integration
sudo apt-get update
sudo apt-get install eve-ng-integration

# 5-a ---- if not works
mkdir -p ~/.local/share/applications/
xdg-mime default eve-ng-integration.desktop x-scheme-
handler/capture
xdg-mime default eve-ng-integration.desktop x-scheme-
handler/telnet
xdg-mime default eve-ng-integration.desktop x-scheme-
handler/docker
xdg-mime default eni-rdp-wrapper.desktop application/x-rdp

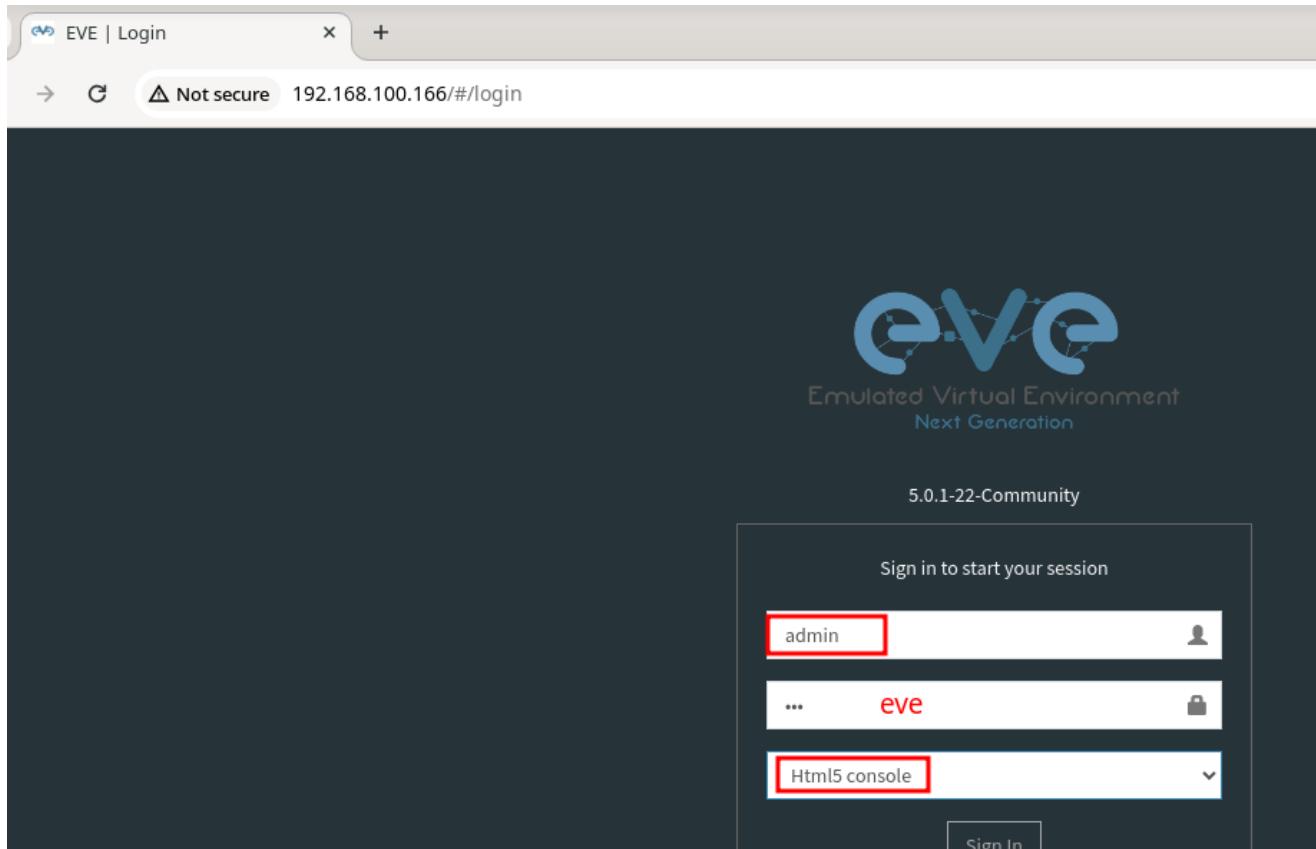
# 5-b ---- if not works
sed -i.orig 's/"\(\telnet\|capture\|docker\)":\'\n(true\|false\),\?//g' "$HOME/.config/google-
chrome/Default/Preferences"
```

```
# 6. --- Chrome  
Download Chrome .deb  
sudo dpkg -i google-chrome-stable_current_amd64.deb  
Start with IP
```

...

```
root@eve-ng:~# dpkg -l eve-ng  
Desired=Unknown/Install/Remove/Purge/Hold  
| Status=Not/Inst/Conf-files/Unpacked/half-conf/Half-inst/trig-aWait/Trig-pend  
/ Err?=(none)/Reinst-required (Status,Err: uppercase=bad)  
||/ Name          Version      Architecture Description  
=====  
ii  eve-ng        5.0.1-22      amd64      A new generation software for networking labs.  
root@eve-ng:~# ping google.com  
PING google.com (142.250.185.238) 56(84) bytes of data.  
64 bytes from fra16s53-in-f14.1e100.net (142.250.185.238): icmp_seq=1 ttl=112 time=18.6 ms  
64 bytes from fra16s53-in-f14.1e100.net (142.250.185.238): icmp_seq=2 ttl=112 time=18.0 ms
```

```
apt update  
apt upgrade
```



Также можно установить в **Google Cloud**

Read 3.4 <https://www.eve-ng.net/index.php/documentation/community-cookbook/>  
Start: <https://console.cloud.google.com/getting-started>

Step 1. GCP top bar, click on “My First Project”



Step 2. Next pop up window, click “NEW PROJECT”



Step 3. Enter your project name, and confirm “CREATE”

Project name \*  ?

Project ID: eve-test-276509. It cannot be changed later. [EDIT](#)

Location \*  [BROWSE](#)

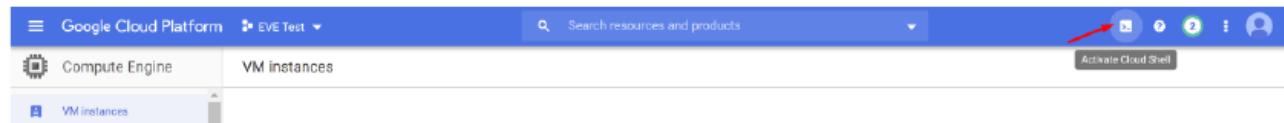
Parent organisation or folder

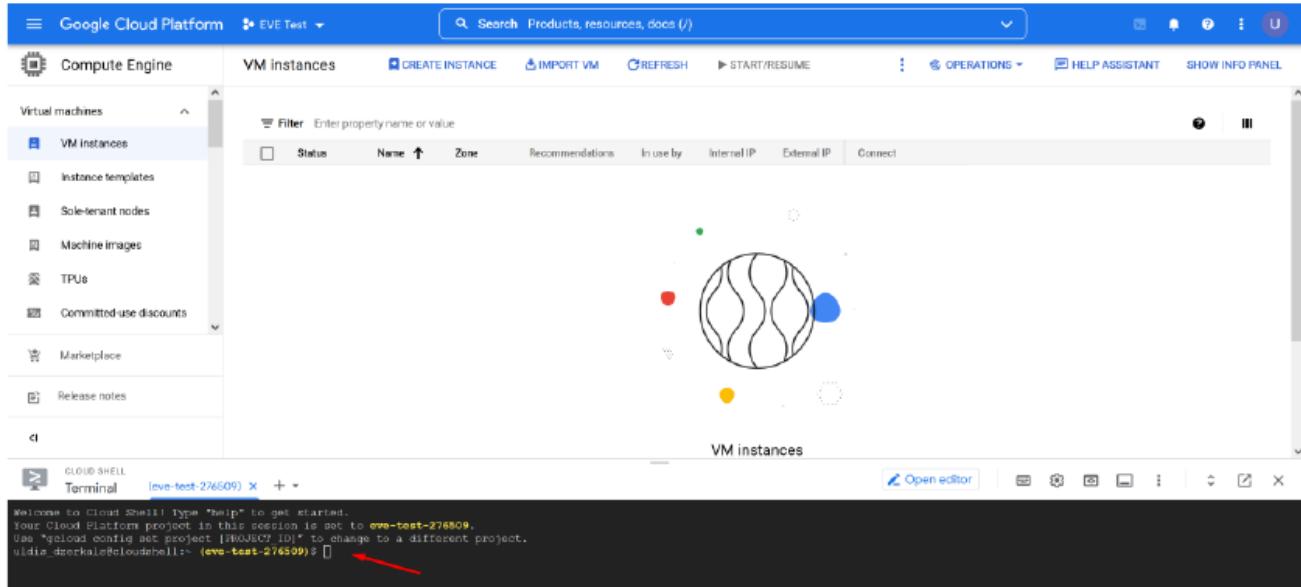
[CREATE](#) [CANCEL](#)

This will take some time.

### 3.4.3 Preparing Ubuntu boot disk template

Step 1: Open the google cloud shell and press: “START CLOUD SHELL”





Step 2: create a nested Ubuntu 20.04 image model. Copy and paste the below command into the shell. Use copy/paste. **crtl +c/crtl +v**. **It is single line command**. Confirm with “enter”:

```
gcloud compute images create nested-ubuntu-focal --source-image-family=ubuntu-2004-lts --source-image-project=ubuntu-os-cloud --licenses https://www.googleapis.com/compute/v1/projects/vm-options/global/licenses/enable-vmx
```

```
gcloud compute images create nested-ubuntu-focal --source-image-family=ubuntu-2004-lts --source-image-project=ubuntu-os-cloud --licenses https://www.googleapis.com/compute/v1/projects/vm-options/global/licenses/enable-vmx
```

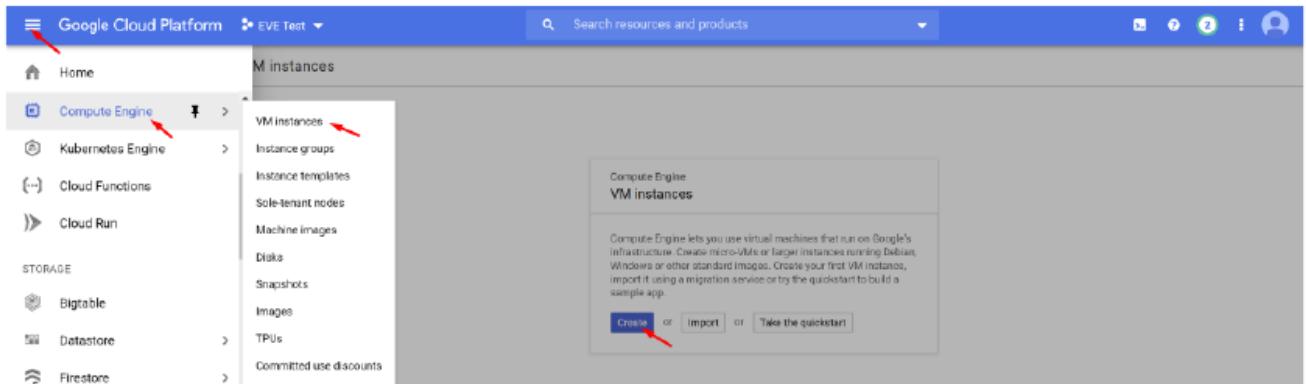
```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to eve-test-276509.
Use "gcloud config set project PROJECT_ID" to change to a different project.
uid@darkale:~$ gcloud compute images create nested-ubuntu-focal --source-image-family=ubuntu-2004-lts --source-image-project=ubuntu-on-cloud --licenses https://www.googleapis.com/compute/v1/projects/ubuntu-on-cloud/global/licenses/nested-ubuntu-focal
Created https://www.googleapis.com/compute/v1/projects/eve-test-276509/global/images/nested-ubuntu-focal.
NAME: nested-ubuntu-focal
PROJECT: eve-test-276509
FAMILY:
DEPRECATED:
STATUS: READY
uid@darkale:~$
```

You will get the following output when your image is ready:

```
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to eve-test-276509.
Use "gcloud config set project PROJECT_ID" to change to a different project.
uid@darkale:~$ gcloud compute images create nested-ubuntu-focal --source-image-family=ubuntu-2004-lts --source-image-project=ubuntu-on-cloud --licenses https://www.googleapis.com/compute/v1/projects/ubuntu-on-cloud/global/licenses/nested-ubuntu-focal
Created https://www.googleapis.com/compute/v1/projects/eve-test-276509/global/images/nested-ubuntu-focal.
NAME: nested-ubuntu-focal
PROJECT: eve-test-276509
FAMILY:
DEPRECATED:
STATUS: READY
uid@darkale:~$
```

### 3.4.4 Creating VM

Step 1: Navigate: Navigation Menu/Compute Engine/VM Instances and press “Create”



Step 2: Assign the name for your VM

Step 3: Set your own region and zone

Step 4: Edit your Machine Configuration. General-Purpose. Choose the series of CPU platform, Preferred are Intel CPUs Skylake or Cascade.

Step 5: Choose your desirable CPU and RAM settings.

**IMPORTANT:** “Deploy a container image” must be UNCHECKED.

Name *	<input type="text" value="eve-com-5"/>	<a href="#">?</a>
--------	----------------------------------------	-------------------

Labels <a href="#">?</a>	<a href="#">+ ADD LABELS</a>
--------------------------	------------------------------

Region * <input type="text" value="europe-west2 (London)"/>	<a href="#">?</a>	Zone * <input type="text" value="europe-west2-c"/>	<a href="#">?</a>
Region is permanent		Zone is permanent	

# Machine configuration

## Machine family

GENERAL-PURPOSE COMPUTE-OPTIMISED MEMORY-OPTIMISED GPU

Machine types for common workloads, optimised for cost and flexibility

Series

N2

Powered by Intel Cascade Lake and Ice Lake CPU platforms

Machine type

n2-standard-4 (4 vCPU, 16 GB memory)



vCPU

4

Memory

16 GB

## ▼ CPU PLATFORM AND GPU

## Display device

Enable to use screen capturing and recording tools.

Enable display device



## Step 6: Select Boot disk. Press Change

### Boot disk ?

Name	eve-com-5
Type	New balanced persistent disk
Size	10 GB
Image	Debian GNU/Linux 11 (bullseye)

**CHANGE**



Step 7. Select Custom images, Select Project (EVE-test) and the custom boot images you created previously. Choose HDD disk type and size. HDD size can vary depends of your needs.

## Boot disk

Select an image or snapshot to create a boot disk, or attach an existing disk. Can't find what you're looking for? Explore hundreds of VM solutions in [Marketplace](#)

PUBLIC IMAGES

CUSTOM IMAGES

SNAPSHOTS

EXISTING DISKS

SELECT A PROJECT

Show images from: EVE Test

Show deprecated images

Image \*

nested-ubuntu-focal

Created on 21 May 2022, 10:10:47

Boot disk type \*

SSD persistent disk

Size (GB) \*

50

▼ SHOW ADVANCED CONFIGURATION

SELECT

CANCEL

## Step 7: Allow http traffic and create VM

Identity and API access [?](#)

Service account [?](#)  
Compute Engine default service account

Access scopes [?](#)  
 Allow default access  
 Allow full access to all Cloud APIs  
 Set access for each API

Firewall [?](#)  
Add tags and firewall rules to allow specific network traffic from the Internet.

Allow HTTP traffic  
 Allow HTTPS traffic

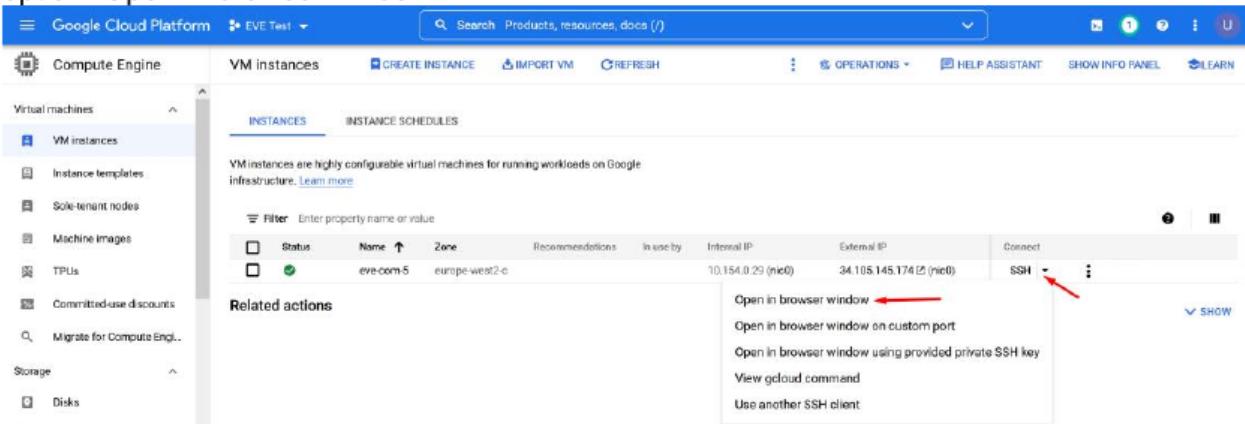
▼ Management, security, disks, networking, sole tenancy

You will be billed for this instance. [Compute Engine pricing](#) ↗

[Create](#) [Cancel](#)

### 3.4.5 EVE-NG-Community installation

Step 1: Click VM Instances to get access SSH to your VM, Connect to the VM with the first option “Open in browser window”



The screenshot shows the Google Cloud Platform Compute Engine VM Instances page. On the left, there's a sidebar with 'Virtual machines' expanded, showing 'VM instances' selected. The main area displays a table of VM instances. One row is selected, showing details like name 'eve.com-5', zone 'europe-west2-c', internal IP '10.154.0.29 (nic0)', and external IP '34.108.145.174 (nic0)'. To the right of the table is a 'Connect' button with a dropdown menu. The menu is open, showing several options: 'Open in browser window' (with a red arrow pointing to it), 'Open in browser window on custom port', 'Open in browser window using provided private SSH key', 'View gcloud command', and 'Use another SSH client'. The 'Open in browser window' option is highlighted.

```
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.13.0-1024-qcp x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage

 System information as of Sat May 21 09:22:51 UTC 2022

 System load: 0.15           Processes:          128
 Usage of /: 3.6% of 48.29GB Users logged in:      0
 Memory usage: 1%           IPv4 address for ens4: 10.154.0.29
 Swap usage: 0%

 1 update can be applied immediately.
 To see these additional updates run: apt list --upgradable

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

uldis_dzerkals@eve:com:5:~$
```

Step 2: Launch installation with:

Type the below command to become root:

```
sudo -i
```

Start EVE-COMM installation

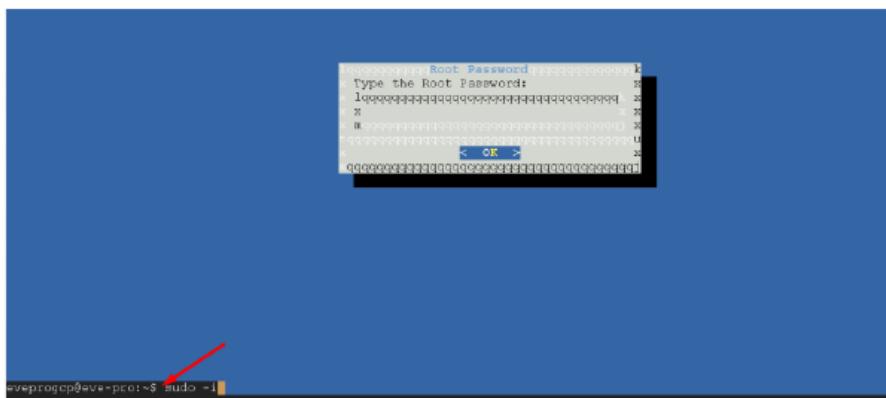
```
wget -O - https://www.eve-ng.net/focal/install-eve.sh | bash -i
```

Step 3: Update and upgrade your new EVE-COMM

```
apt update
apt upgrade
Confirm with Y
```

Step 5. Reboot EVE. Allow some time for reboot and then press “Reconnect”

Once the IP wizard screen appears, press **ctrl +c** and type the below command to become root:  
`sudo -i`



Now follow the IP setup wizard.

**IMPORTANT:** set IP as **DHCP!**

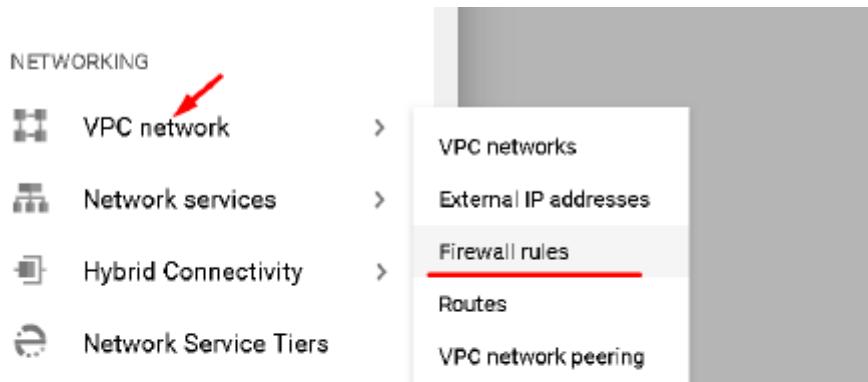
Step 6: Reboot

### 3.4.6 Access to Google Cloud EVE-COMM

Use your public IP for accessing EVE via **http**.

The screenshot shows the Google Cloud Network interface with the IP address 35.189.66.46 highlighted. Below it is a screenshot of the EVE-COMM web interface, which is a dark-themed login page for the 'Emulated Virtual Environment Next Generation 5.0.1-8-Community'. It includes fields for 'Username' and 'Password', a 'Native console' dropdown, and a 'Sign In' button.

### 3.4.7 Optional: GCP Firewall rules for native console use



## Step 2: Create new firewall rule

The screenshot shows the 'Firewall rules' page. At the top, there are tabs for 'Firewall rules' (selected), '+ CREATE FIREWALL RULE' (highlighted with a red box and arrow), 'REFRESH', and 'DELETE'. Below the tabs, there is a note about firewall rules controlling traffic and a link to learn more. There is also a note about App Engine firewalls.

Step 1: Navigate: Navigation menu/VPC Network/Firewall rules

Step 3: Create an ingress FW rule; allow TCP ports 0-65535

**Direction of traffic** [?](#)

Ingress

Egress

**Action on match** [?](#)

Allow

Deny

**Targets** [?](#)

All instances in the network

**Source filter** [?](#)

IP ranges

**Source IP ranges** [?](#)

0.0.0.0/0

**Second source filter** [?](#)

None

**Protocols and ports** [?](#)

Allow all

Specified protocols and ports

tcp : 0-65535

udp : all

Other protocols

protocols, comma separated, e.g. ah, sctp

Disable rule

Create Cancel

#### Step 4: Create an egress FW rule; allow TCP ports 0-65535

Firewall rules control incoming or outgoing traffic to an instance. By default, incoming traffic from outside your network is blocked. [Learn more](#)

Name [?](#)

egress-eve

**Direction of traffic** 

- Ingress  
 Egress 

**Action on match** 

- Allow  
 Deny

**Targets** 

All instances in the network 

**Destination filter** 

IP ranges 

**Destination IP ranges** 

0.0.0.0/0 

**Protocols and ports** 

- Allow all  
 Specified protocols and ports

**tcp** :

0-65535 

**udp** :

all

**Other protocols**

protocols, comma separated, e.g. ah, sctp

**Disable rule** 

 **Create** **Cancel**

## Summary FW rules.

Name	Type	Targets	Filters	Protocols / ports	Action	Priority	Network
egress-eve	Egress	Apply to all	IP ranges: 0.0.0.0/0	tcp:0-65535	Allow	1000	default
default-allow-https	Ingress	https-server	IP ranges: 0.0.0.0/0	tcp:443	Allow	1000	default
ingress-eve	Ingress	Apply to all	IP ranges: 0.0.0.0/0	tcp:0-65535	Allow	1000	default

## 3.5 EVE Management IP Address setup

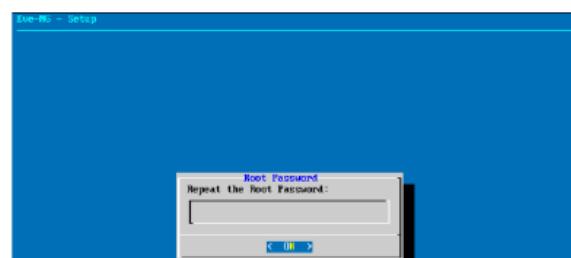
### 3.5.1 Management static IP address setup (preferred)

The steps below will walk you through the network setup and assign a static management IP for EVE.

Step 1: Log into the EVE CLI using the default login **root/eve**. After login, type your preferred root password for EVE, default is **eve**. **Remember it for further use.** Confirm with enter

NOTE: Typed characters in the password field are not visible.

Step 2: Retype your root password again and confirm with enter.

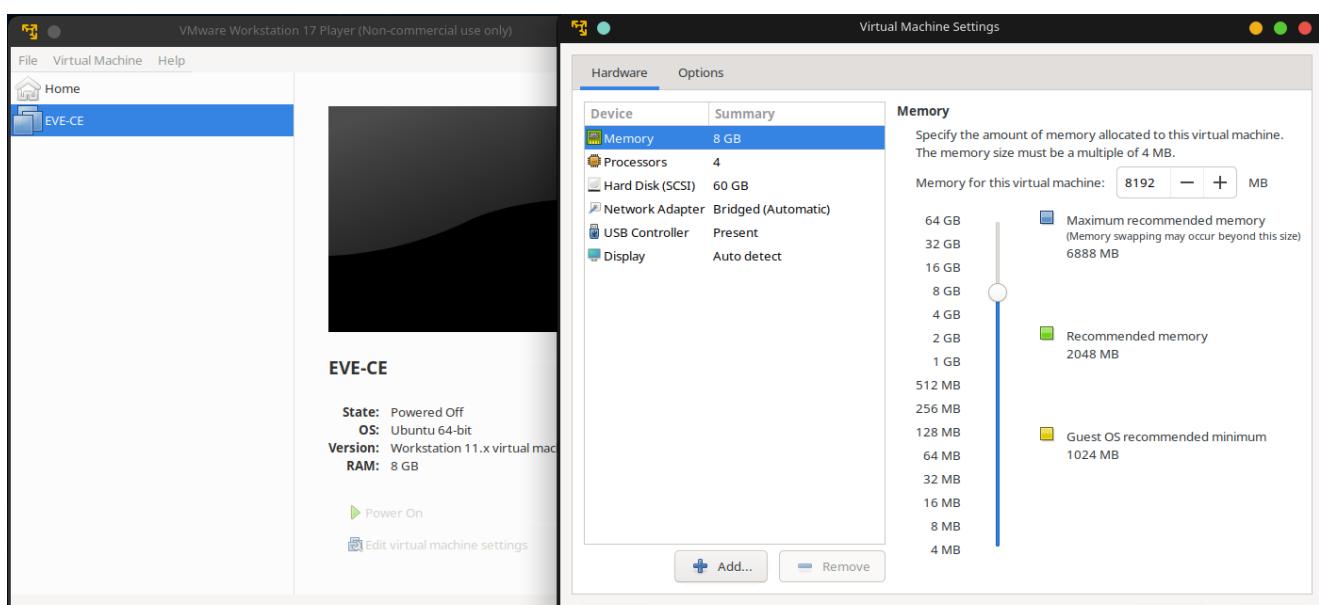


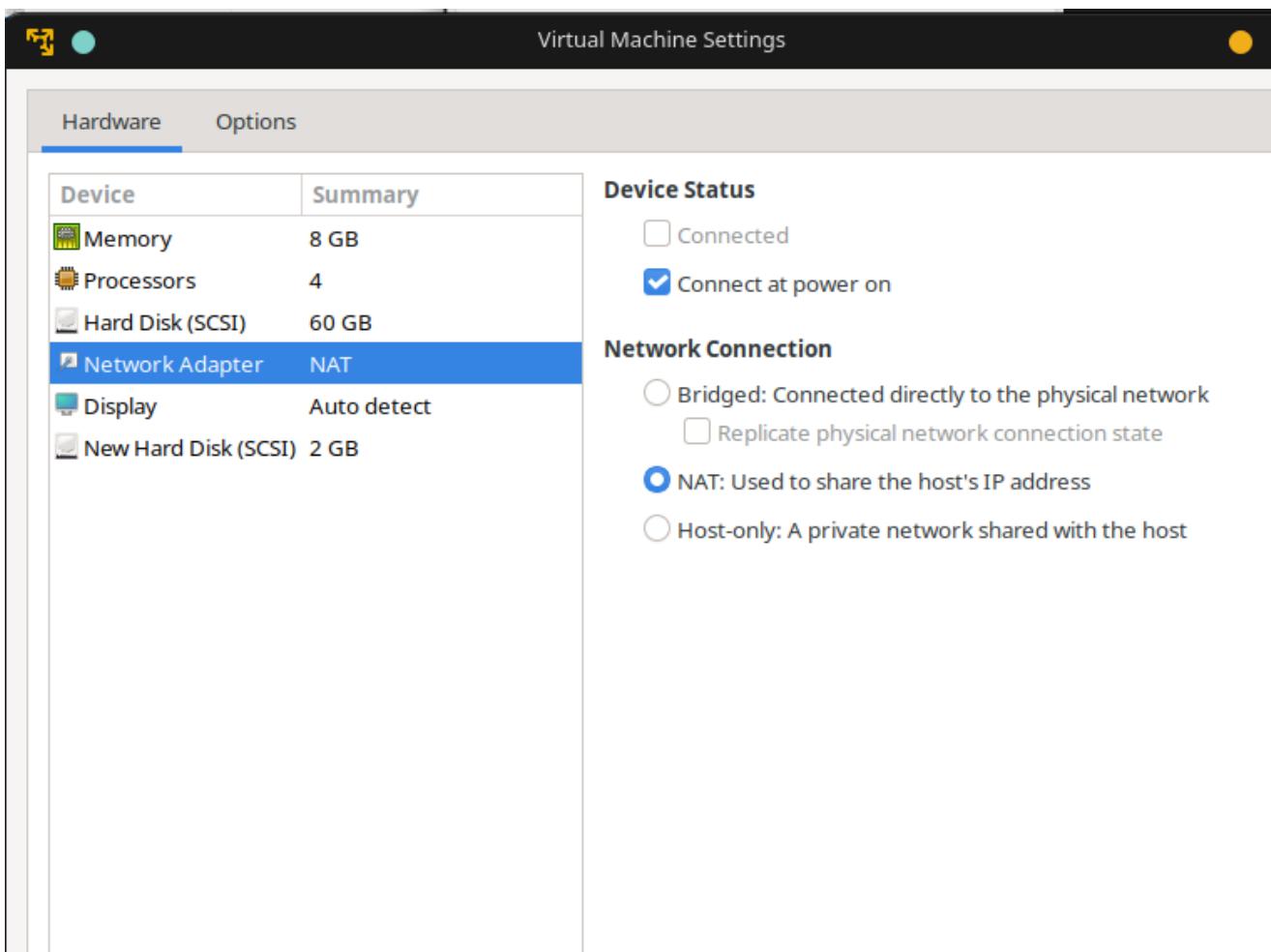
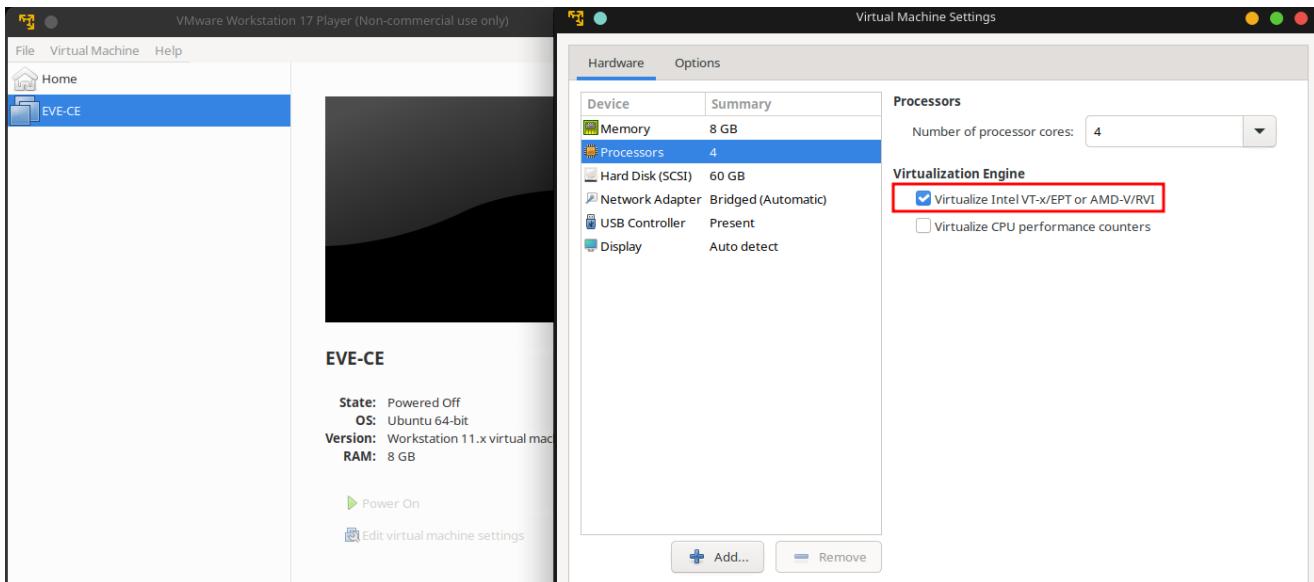
Также можно установить в **VMware**

Download EVE-NG OVF (.ZIP)

Open a Virtual Machine. Select OVP-File. Import.

Download .ISO





С **VirtualBox.org** EVE\_ install (.OVE) **NOT SUPPORTED !!!** (Errors, failures...) работает с ошибками.

## Addons EVE-NG / Vyos

1. Cisco:

<https://www.eve-ng.net/index.php/documentation/howtos/howto-add-cisco-dynamips-images-cisco-ios/>

Cisco official [download](#)

[Cisco Bibl.1](#)

[Cisco Bibl.2](#)

<https://software.cisco.com/download/home/284364978/type/282046477/release/3.16.5S>

<https://networkrare.com/free-download-cisco-ios-images-for-gns3-and-eve-ng/>

<https://labhub.eu.org/UNETLAB%20I/addons/dynamips/>

## 2. VyOS:

<https://www.eve-ng.net/index.php/documentation/howtos/howto-add-vyos-vyatta/>

<https://docs.vyos.io/en/equuleus/configuration/vpn/dmvpn.html>

Образы Линукс [download eve-ng](#)

- Links:

[https://www.youtube.com/watch?v=\\_o9fw4S6Q6E](https://www.youtube.com/watch?v=_o9fw4S6Q6E)

## EVE

```
admin / password: eve (http)
root / eve (terminal)
apt update
apt upgrade
apt install wireshark
```

```
# host
ssl root@IP
```

```
# fixpermissions
root@eveserver:# /opt/unetlab/wrappers/unl_wrapper -a
fixpermissions
```

```
# Fix Errors and set static IP after installation. Restart the
setup process
root@eve-ng:~# rm -f /opt/ovf/.configured
su -
...
# Fix eve-ng SQL
```

```
.unl_wrapper -a resoredb
```

start Chrome browser

Set "Html5 console" to use web browser

Загружаем через *FileZilla* файлы .image в директорию

/opt/unetlab/addons/dynamips

Remote site: /opt/unetlab/addons/dynamips

The screenshot shows the 'dynamips' folder selected in the left tree view. The right panel displays a table of files:

Filename	Filesize	Filetype	Last modified	Permissions
..				
c1710-bk9no3r2sy-mz.124-23.image	37,540...	image-file	02/28/2024 ...	-rw-r--r--
c3725-adventerprisek9-mz.124-15.T14.image	97,859...	image-file	02/28/2024 ...	-rw-r--r--
c7200-adventerprisek9-mz.152-4.M11.image	128,487...	image-file	02/28/2024 ...	-rw-r--r--
c7200-adventerprisek9-mz.152-4.S7.image	93,595...	image-file	02/28/2024 ...	-rw-r--r--

Загружаем файлы .bin в директорию /opt/unetlab/addons/iol/bin

Remote site: /opt/unetlab/addons/iol/bin

The screenshot shows the 'bin' folder selected in the left tree view. The right panel displays a table of files:

Filename	Filesize	Filetype	Last modified	Perm
..				
L2-ADVENTERPRISEK9-M-15.2-20150703.bin	110,978...	bin-file	02/29/2024 ...	-rw-r--
L3-ADVENTERPRISEK9-M-15.4-2T.bin	159,350...	bin-file	02/29/2024 ...	-rw-r--

Далее подключаем dynamips:

```

# .img Mikrotic chr-7.14.img. Copy and create (with scp like in
win) from Host to EVE-NG hda.qcow2:
HOST:~$ scp -r ~/Downloads/CISCO_eve-com/chr-7.14.img
root@172.16.82.130:/opt/unetlab/addons/qemu/mikrotik-
7.14/hda.qcow2
root@eve-ng:~# ls -lh /opt/unetlab/addons/qemu/mikrotik-7.14/
total 128M
-rw-r--r-- 1 root root 128M Mar  2 23:21 hda.qcow2
root@eve-ng:/opt/unetlab/addons/qemu/mikrotik-7.14#
/opt/unetlab/wrappers/unl_wrapper -a fixpermissions

# .image files c1710, c3725, c7200
# unzip -p file.bin > file.image
root@evengserv:~# ls -lh /opt/unetlab/addons/dynamips
total 341M
-rw-r--r-- 1 root root 36M Feb 29 14:41 c1710-bk9no3r2sy-mz.124-
23.image
-rw-r--r-- 1 root root 94M Feb 29 14:41 c3725-adventuresek9-
mz.124-15.T14.image
-rw-r--r-- 1 root root 123M Feb 29 14:41 c7200-adventuresek9-
mz.152-4.M11.image
-rw-r--r-- 1 root root 90M Feb 29 14:41 c7200-adventuresek9-
mz.152-4.S7.image

# .bin files Cisco IOL (IOS on Linux)
root@evengserv:~# ls -lh /opt/unetlab/addons/iol/bin
total 258M
-rw-r--r-- 1 root root 106M Feb 29 15:03 L2-ADVENTERPRISEK9-M-
15.2-20150703.bin
-rw-r--r-- 1 root root 152M Feb 29 15:03 L3-ADVENTERPRISEK9-M-
15.4-2T.bin

# fixpermissions
cd
root@eveserver:# /opt/unetlab/wrappers/unl_wrapper -a
fixpermissions

```

Загружаем под EVE-NG **VyOS**:

EVE Image Foldername	Downloaded Filename	Version	vCPUs	vRAM	HDD format	Console
vyos-1.2.9	vyos-1.2.9-S1-amd64.iso	jessi debian vyos-1.2 ...	1-2	512-1024	virtioa	telnet chrome
vyos-1.4	vyos-1.4-rolling-202402060302-amd64.iso	bookworm debian vyos-1.4	2	512-1024	virtioa	telnet chrome

```
# mkdir /opt/unetlab addons/qemu/vyos-1.4
```

```
HOST to EVE-NG (copy and rename):~$ scp -r ~/Downloads/vyos-1.4-rolling-202402060302-amd64.iso
root@192.168.100.166:/opt/unetlab addons/qemu/vyos-1.4/cdrom.iso
```

```
root@eve-ng:/opt/unetlab addons# ls -lh qemu/vyos-1.4/
total 445M
-rw-r--r-- 1 root root 444M Mar 15 01:28 cdrom.iso
```

```
root@eve-ng:/opt/unetlab addons#
/opt/unetlab/wrappers/unl_wrapper -a fixpermissions
```

Remote site: /opt/unetlab addons/qemu/vyos-1.5

Filename	Filesize	Filetype	Last modified	Permissions	Owner
..					
vyos-1.5-rolling-202402291036-amd64.iso	465,567...	iso-file	02/29/2024 ...	-rw-r--r--	root

vyos-1.4

[Image-namings-virtio: \(Eve-ng\)](#)

```
--- Методичка
# Create image HDD virtio.qcow2

root@eve-ng:# cd /opt/unetlab/addons/qemu/vyos-...
root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.4# /opt/qemu/bin/qemu-img create -f qcow2 virtioa.qcow2 2G
Formatting 'virtioa.qcow2', fmt=qcow2 size=2147483648
encryption=off cluster_size=65536 lazy_refcounts=off
refcount_bits=16

root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# ls -lh
total 445M
-rw-r--r-- 1 root root 444M Mar 15 01:28 cdrom.iso
-rw-r--r-- 1 root root 193K Mar 15 01:35 virtioa.qcow2

root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# ls -lh
total 412M
-rw-r--r-- 1 root root 193K Mar 16 00:04 virtioa.qcow2
-rw-r--r-- 1 root root 411M Mar 15 23:57 vyos-1.2.9-S1-amd64.iso

root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# mv vyos-1.2.9-S1-amd64.iso cdrom.iso
root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# ls -lh
total 412M
-rw-r--r-- 1 root root 411M Mar 15 23:57 cdrom.iso
-rw-r--r-- 1 root root 193K Mar 16 00:04 virtioa.qcow2

# --- Optional vyos-1.4 or vyos-1.5 rolling
root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.4# ls -lh
total 445M
-rw-r--r-- 1 root root 444M Mar 15 23:57 cdrom.iso
-rw-r--r-- 1 root root 193K Mar 16 00:04 virtioa.qcow2
```

## VyOS install

The screenshot shows the 'File manager' interface in EVE-NG. A red circle labeled '1' highlights the 'Name\*' field, which contains 'lab\_01\_02'. Another red circle labeled '2' highlights the 'Seconds' dropdown next to the 'Config Script Timeout' input field, which contains '300'. The 'Description' and 'Tasks' fields are empty.

**Add New Lab**

Name\* lab\_01\_02 **2**  
Use only [A-Za-z0-9\_-]chars

Version\* 1  
Must be integer ([0-9]chars)

Author Enter Author

Config Script Timeout 300 Seconds

Description Enter description

Tasks Enter tasks

\* - Required Fields

The screenshot shows the 'File manager' interface in EVE-NG. A file named 'Lab\_01\_02.unl' is listed in the file list. Below the file list, detailed information about the file is shown: Lab Path: /Lab\_01\_02.unl, Version: 1, Description: (empty), and UUID: 64b7a4f6-8f0a-4f76-b3ca-d766746b45d1. The 'UUID' field is highlighted with a red box. At the bottom, there are 'Open', 'Edit', and 'Delete' buttons.

New Name Add folder Lab\_01\_02

Lab\_01\_02.unl 16 Mar 2024 01:16

Lab Path: /Lab\_01\_02.unl  
Version: 1  
UUID: 64b7a4f6-8f0a-4f76-b3ca-d766746b45d1  
Author:

Open Edit Delete

```

# --- Proof
# UUID: 64b7a4f6-8f0a-4f76-b3ca-d766746b45d1 (proof)
# commit installed image (qemu-img commit virtioa.qcow2)
# commit virtioa.qcow2. /0 - root. /1 - user

root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# ls
/opt/unetlab/tmp/0/64b7a4f6-8f0a-4f76-b3ca-d766746b45d1/1/
dev/           lib/          opt/          usr/
wrapper.txt
jail/          lib64/        .prepared    virtioa.qcow2

# --- Proof OK

# --- Optional
# --- Commit the creates image as default
# eth0 'll not shown at second routers, so install new...

root@eve-ng:/opt/unetlab/addons/qemu/vyos-1.2.9# cd
/opt/unetlab/tmp/0/64b7a4f6-8f0a-4f76-b3ca-d766746b45d1/1/

root@eve-ng:/opt/unetlab/tmp/0/64b7a4f6-8f0a-4f76-b3ca-
d766746b45d1/1# ls -lh
total 474M
drwxr-sr-x  3 root root 4.0K Mar 15 22:34 dev
drwxr-xr-x  5 root root 4.0K Mar 15 22:33 jail
lrwxrwxrwx  1 root root   8 May  3  2022 lib -> jail/lib
lrwxrwxrwx  1 root root  10 May  3  2022 lib64 -> jail/lib64
drwxr-sr-x 14 root root 4.0K Mar 15 22:34 opt
lrwxrwxrwx  1 root root   8 May  3  2022 usr -> jail/usr
-rw-r--r--  1 root unl  474M Mar 16 00:14 virtioa.qcow2
-rw-rw-r--  1 root unl   219 Mar 16 00:15 wrapper.txt

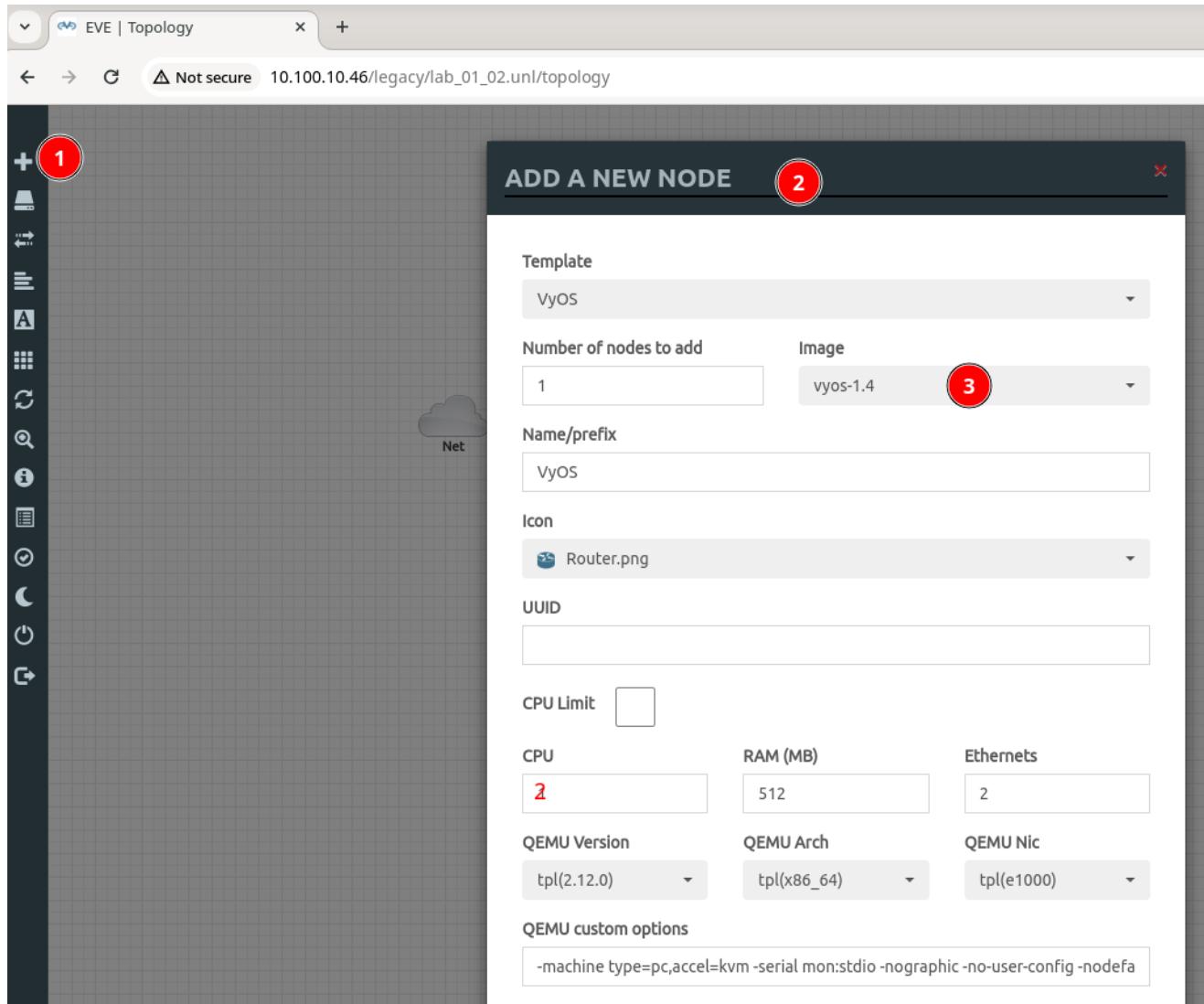
# --- optional:
root@eve-ng:~# rm /opt/unetlab/addons/qemu/vyos-1.2.9/cdrom.iso

root@eve-ng:~# ls -lh /opt/unetlab/addons/qemu/vyos-1.2.9
total 474M
-rw-r--r-- 1 root root 474M Mar 16 00:25 virtioa.qcow2

# --- fixpermissions
cd
root@eveserver:# /opt/unetlab/wrappers/unl_wrapper -a
fixpermissions

```

## Add Node - VyOS



CPU: 2 RAM: 512

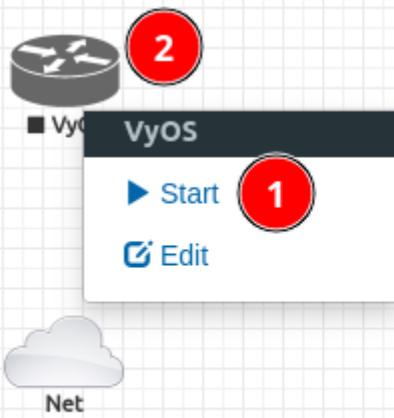
Ethernet: 2 or 1

tpl (...) ?

VyOS: Start and double click the icon

⚠ Not secure 192.168.56.45/legacy/

HUB  
Net- 10.22.1.1/28  
VPN - 172.16.10.1/24



EVE | Topology    VyOS    1    VyOS2    like P. 1 - 2    VyOS3    like P. 1 - 2    +

Not secure 10.100.10.46/html5/#/client/MzI3NjkAYwBteXNxbA==?token=9A74EC89B0C98EDAC8CF7AB7F5E15BEFCBED6E7E190C91

```
[ 17.471966] systemd[1]: Mounted dev-hugepages.mount - Huge Pages File System.
[ 17.504979] systemd[1]: Mounted dev-mqueue.mount - POSIX Message Queue File System.
[ 17.550051] systemd[1]: Started systemd-journald.service - Journal Service.
[ 17.775433] systemd-journald[330]: Received client request to flush runtime journal.
[ 17.898549] bridge: filtering via arp/ip/ip6tables is no longer available by default. Update your configuration to use brctl filter.
[ 18.037185] Bridge firewalls registered

Welcome to VyOS - vyos ttyS0

vyos login: vyos
Password: 2
Welcome to VyOS!

Check out project news at https://blog.vyos.io
and feel free to report bugs at https://vyos.dev

You can change this banner using "set system login banner post-login" command.

VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*/*copyright
vyos@vyos:~$ install image
Welcome to VyOS installation!
This command will install VyOS to your permanent storage.
Would you like to continue? [y/N] y
What would you like to name this image? (Default: 1.4-rolling-202402060302) 1.4-c5
Please enter a password for the "vyos" user (Default: vyos)
What console should be used by default? (K: KVM, S: Serial, U: USB-Serial)? (Default: K)
Probing disks
1 disk(s) found
The following disks were found:
Drive: /dev/vda (2.0 GB)
Which one should be used for installation? (Default: /dev/vda)
Installation will delete all data on the drive. Continue? [y/N] y
Searching for data from previous installations
No previous installation found
Would you like to use all the free space on the drive? [Y/n] y
Creating partition table...
Creating temporary directories
Mounting new partitions
Creating a configuration file
Copying system image files
```

login: vyos / password: vyos

```
install image
poweroff
```

Подключение Net: сетевые адAPTERы

*Plus - Node - Add Network (Cloud)*

Подключаем между собой, выбрав *eth0 (eth1)*

*Прим.: VyOS1, VyOS2, VyOS3 install image* для каждого роутера отдельно  
после запуска, иначе пропадает *eth0* в образе из *Commit*

VyOS1: *eth1* , иначе не проходит *ping*

```

pcl> save          Add VPC set pcname pc1
Saving startup configuration to startup.vpc
. done
ip 10...10 255...0 10...1
pcl> show ip      save

NAME      : pcl[1]
IP/MASK   : 10.100.10.10/24
GATEWAY   : 10.100.10.1
DNS        : 8.8.8.8
MAC        : 00:50:79:66:68:04
LPORT      : 20000
RHOST:PORT : 127.0.0.1:30000
MTU        : 1500

```

## HUB

```

vyos@v-hub:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface      IP Address           S/L  Description
-----  -----
eth0          10.100.10.5/26       u/u  net: Internet
eth1          10.22.10.1/29       u/u  net: DmVPN
lo            127.0.0.1/8         u/u
                  ::1/128

vyos@v-hub:~$ ip route
default via 10.100.10.1 dev eth0 proto static metric 20
10.22.10.0/29 dev eth1 proto kernel scope link src 10.22.10.1
10.100.10.0/26 dev eth0 proto kernel scope link src 10.100.10.5

```

## Spoke1

```

vyos@v-spl:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface      IP Address           S/L  Description
-----  -----
eth0          10.22.10.2/29       u/u  net: DmVPN
lo            127.0.0.1/8         u/u
                  ::1/128

vyos@v-spl:~$ ip route
10.22.10.0/29 dev eth0 proto kernel scope link src 10.22.10.2

```

## Spoke2

```

vyos@v-sp2:~$ show interfaces
Codes: S - State, L - Link, u - Up, D - Down, A - Admin Down
Interface      IP Address           S/L  Description
-----  -----
eth0          10.22.10.3/29       u/u  net: DmVPN
lo            127.0.0.1/8         u/u
                  ::1/128

vyos@v-sp2:~$ ip route
10.22.10.0/29 dev eth0 proto kernel scope link src 10.22.10.3

```

## Ping

```
vyos@v-hub:~$ ping 10.22.10.2
PING 10.22.10.2 (10.22.10.2) 56(84) bytes of data.
64 bytes from 10.22.10.2: icmp seq=1 ttl=64 time=2.52 ms
64 bytes from 10.22.10.2: icmp seq=2 ttl=64 time=2.21 ms
^C
--- 10.22.10.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 2.218/2.372/2.526/0.154 ms
vyos@v-hub:~$ ping 10.22.10.3
PING 10.22.10.3 (10.22.10.3) 56(84) bytes of data.
64 bytes from 10.22.10.3: icmp seq=1 ttl=64 time=1.56 ms
64 bytes from 10.22.10.3: icmp seq=2 ttl=64 time=1.50 ms
^C
--- 10.22.10.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
```

```
vyos@v-sp1:~$ ping 10.22.10.1
PING 10.22.10.1 (10.22.10.1) 56(84) bytes of data.
64 bytes from 10.22.10.1: icmp seq=1 ttl=64 time=1.56 ms
64 bytes from 10.22.10.1: icmp seq=2 ttl=64 time=1.35 ms
^C
--- 10.22.10.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.353/1.460/1.568/0.114 ms
vyos@v-sp1:~$ ping 10.22.10.3
PING 10.22.10.3 (10.22.10.3) 56(84) bytes of data.
64 bytes from 10.22.10.3: icmp seq=1 ttl=64 time=3.02 ms
64 bytes from 10.22.10.3: icmp seq=2 ttl=64 time=1.47 ms
^C
--- 10.22.10.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.478/2.253/3.029/0.776 ms
```

```
vyos@v-sp2:~$ ping 10.22.10.1
PING 10.22.10.1 (10.22.10.1) 56(84) bytes of data.
64 bytes from 10.22.10.1: icmp seq=1 ttl=64 time=1.60 ms
64 bytes from 10.22.10.1: icmp seq=2 ttl=64 time=1.30 ms
^C
--- 10.22.10.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.309/1.454/1.600/0.150 ms
vyos@v-sp2:~$ ping 10.22.10.2
PING 10.22.10.2 (10.22.10.2) 56(84) bytes of data.
64 bytes from 10.22.10.2: icmp seq=1 ttl=64 time=1.09 ms
64 bytes from 10.22.10.2: icmp seq=2 ttl=64 time=1.82 ms
^C
--- 10.22.10.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.096/1.459/1.823/0.365 ms
```

DmVPN настройки, как выше в пункте 1.

Own custom *Linux (Kali)* for EVE:

Eve-ng [filename for QEMU](#)

Eve-ng [own linux image](#)

Upload .ISO to *addons/qemu/kali-...* and rename to *cdrom.iso*

Remote site: /opt/unetlab/addons/qemu/kali-2024.1

The screenshot shows a file manager interface with the following details:

- Remote site: /opt/unetlab/addons/qemu/kali-2024.1
- File structure:
  - qemu
  - kali-2024.1 (selected)
  - ? config\_scripts
  - ? data
- File list:

Filename	Filesize	Filetype	Last modified
..			
cdrom.iso	4,102,38...	iso-file	03/17/2024 ...

```
root@eve-ng:~# cd /opt/unetlab/addons/qemu/linux-kali-2024.1/
root@eve-ng:/opt/unetlab/addons/qemu/linux-kali-2024.1# 
/opt/qemu/bin/qemu-img create -f qcow2 virtioa.qcow2 30G
Formatting 'virtioa.qcow2', fmt=qcow2 size=32212254720
encryption=off cluster_size=65536 lazy_refcounts=off
refcount_bits=16
```

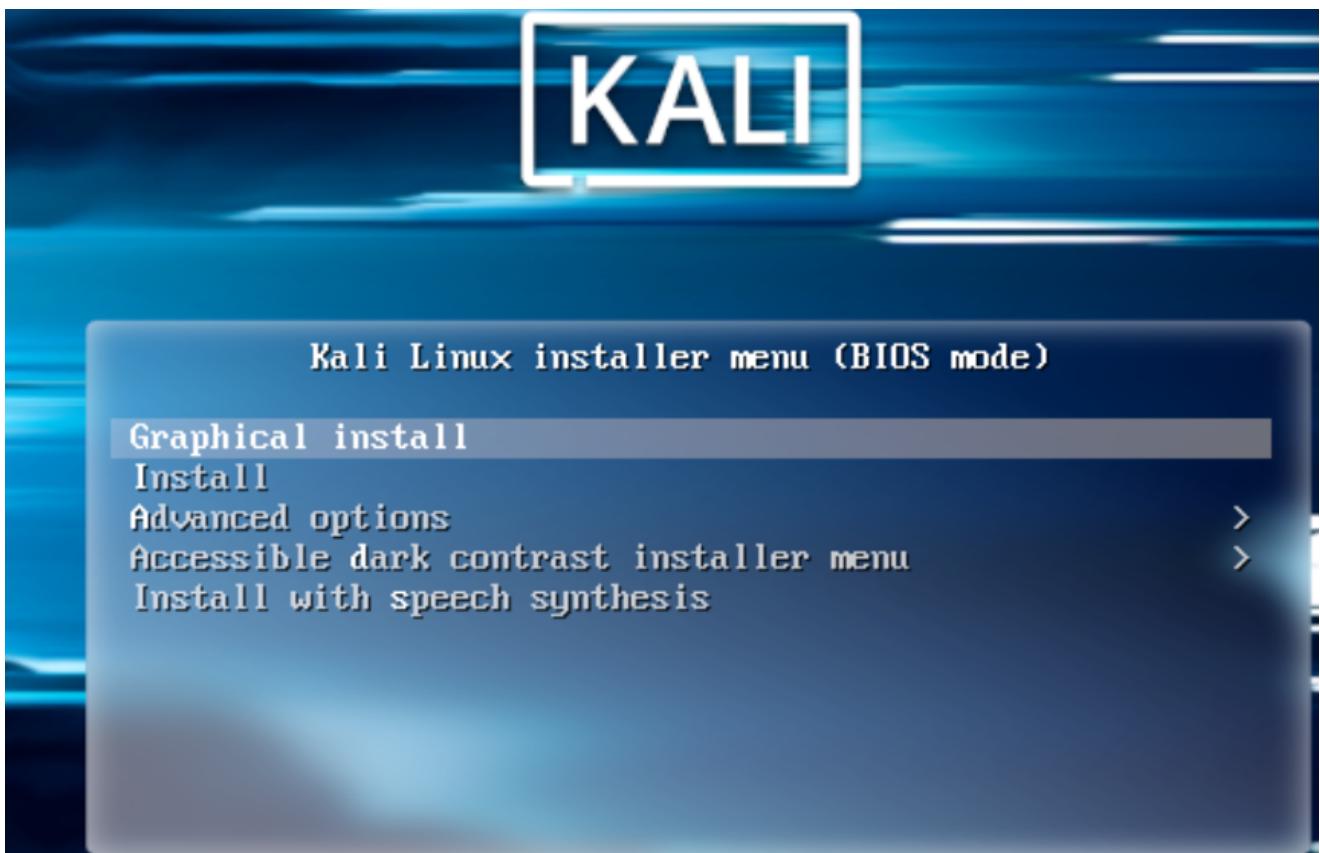
```
root@eve-ng:/opt/unetlab/addons/qemu/linux-kali-2024.1# ls -lh
total 3.9G
-rw-r--r-- 1 root root 3.9G Mar 17 12:51 cdrom.iso
-rw-r--r-- 1 root root 193K Mar 17 13:32 virtioa.qcow2
```

```
# --- Optional: Commit, compress
cd /opt/unetlab/tmp/.../...../....../...
/opt/qemu/bin/qemu-img commit virtioa.qcow2
```

```
eve-sparsify --compress virtioa virtioa.qcow2
compressedvirtioa.qcow2
mv compressedvirtioa.qcow2 virtioa.qcow2
```

```
# fixpermissions
root@eveserver:# /opt/unetlab/wrappers/unl_wrapper -a
fixpermissions
```

```
# Convert .ova to .qcow2
tar -xvf image-name.ova
qemu-img convert -O qcow2 image-name.vmdk new.qcow2
```



### 3. Установка GNS3 (Ubuntu 20.04 Serv):

Скачать по ссылкам образы / полезная литература:

Linux [GNS3-Linux](#)

Ubuntu Server 20 (focal) [download](#)

GNS3 [Version 2.2.46 - VMware](#)

GNS3 и [VyOS 1.3](#)

<https://github.com/GNS3/gns3-gui/releases>

<https://github.com/GNS3/gns3-gui/archive/refs/tags/v2.2.46.tar.gz>

Kali [Kali-GNS3](#)

Kali [Как установить Kali-GNS3](#)

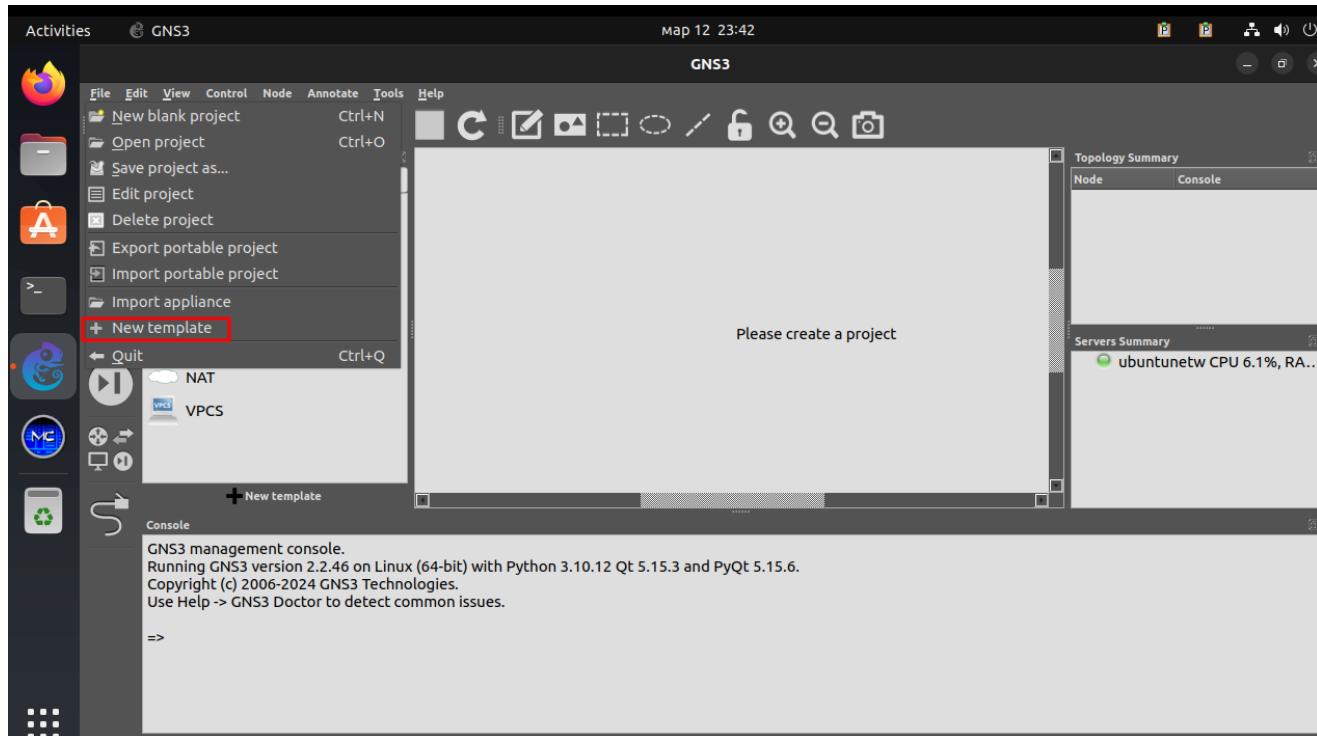
```
# --- Ubuntu GNS3 in own Ubuntu 20 Serv (focal)
sudo add-apt-repository ppa:gns3/ppa
sudo apt update
```

```

sudo apt install gns3-gui gns3-server dynamips
sudo dpkg --add-architecture i386
sudo apt update
sudo apt install gns3-iou
gns3

```

## GNS3:

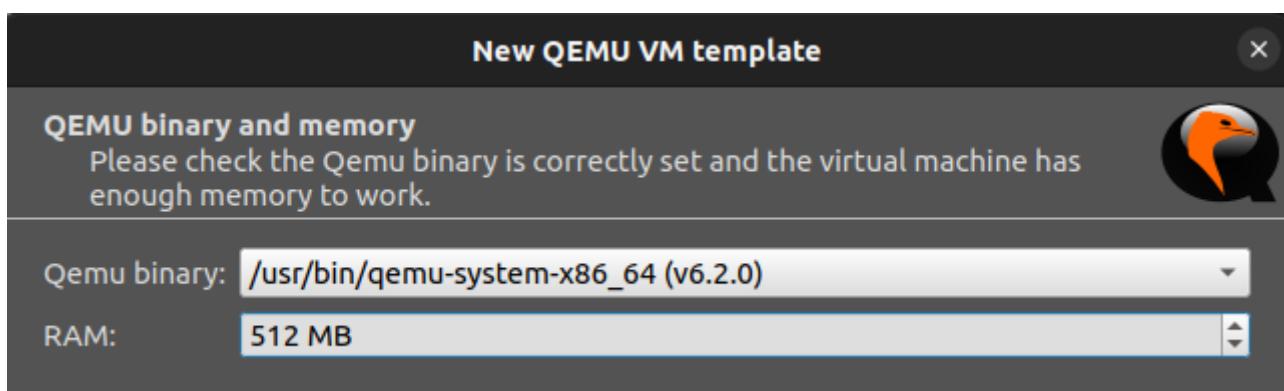
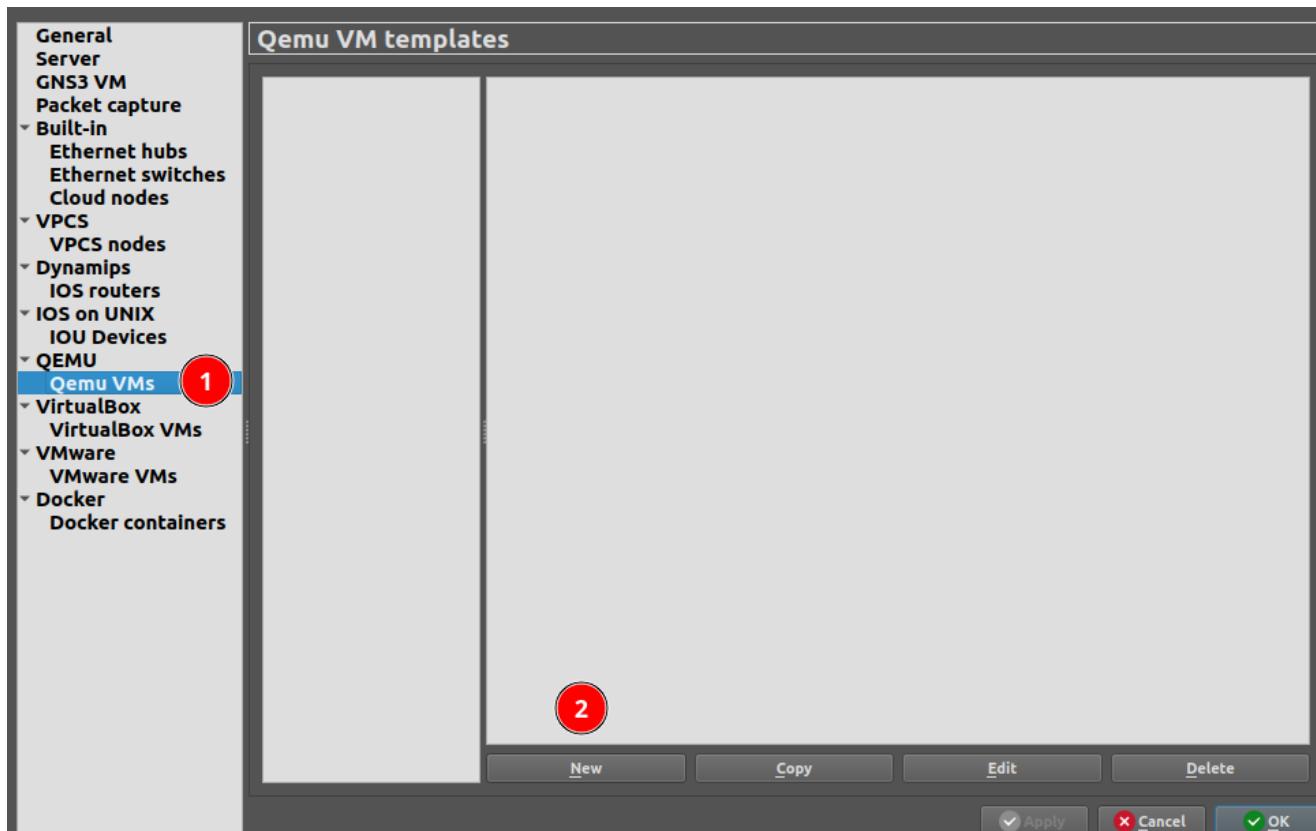
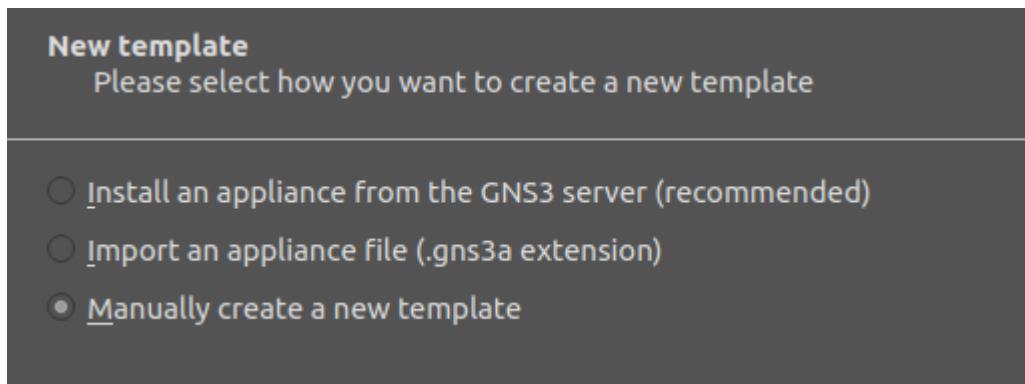


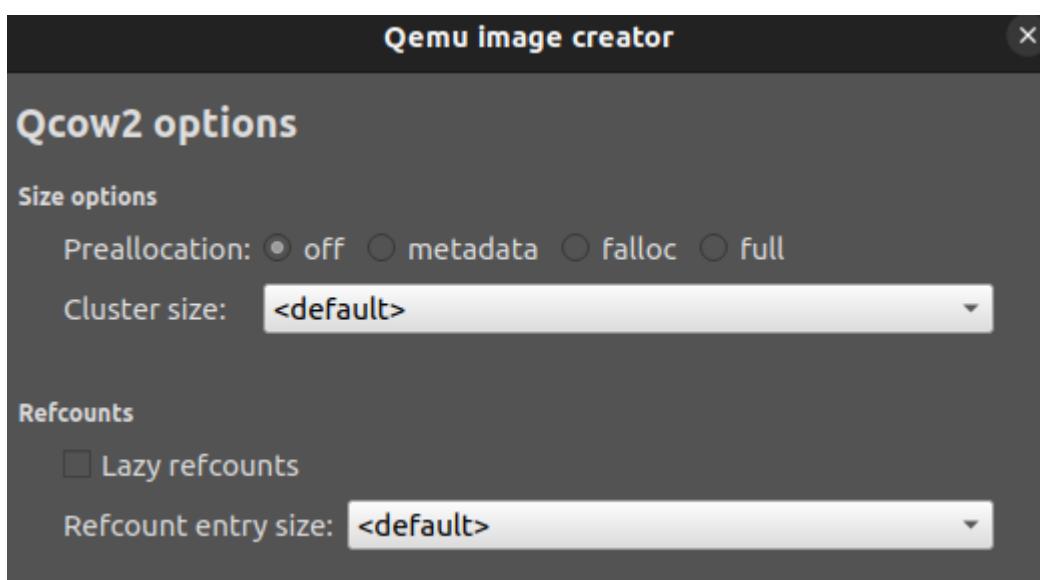
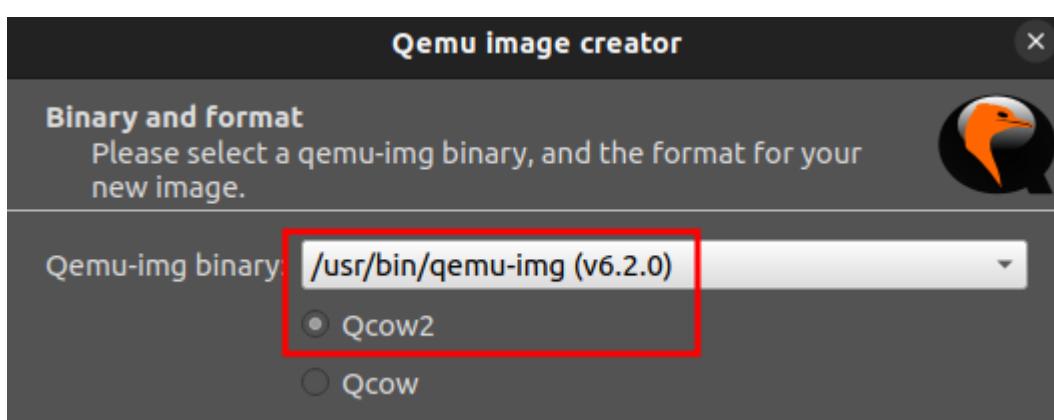
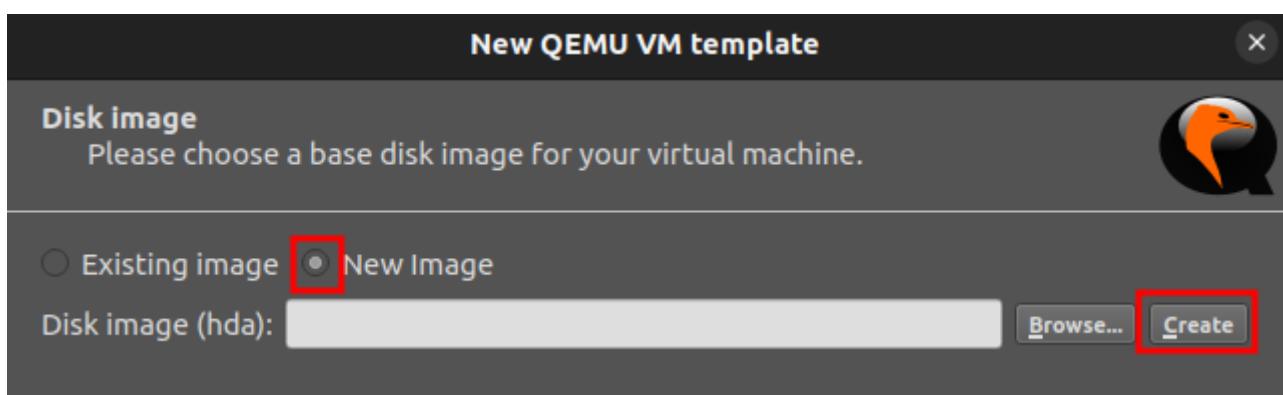
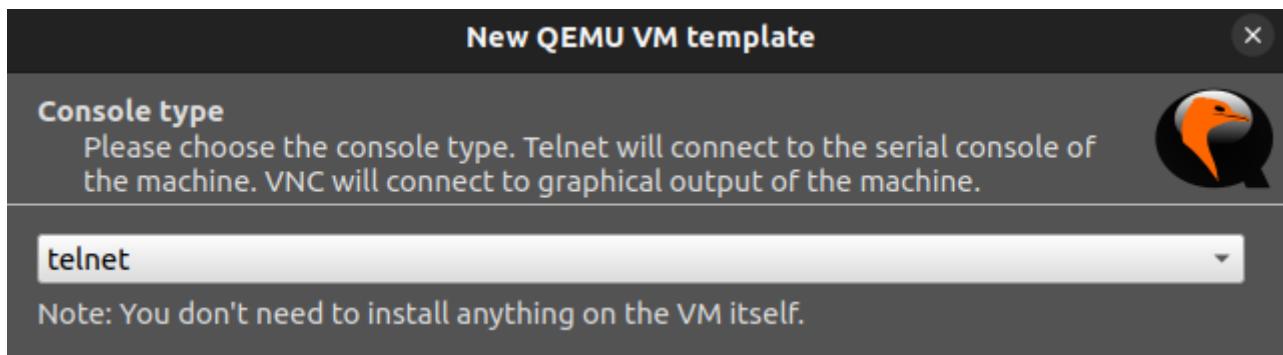
**Appliances from server**  
Select one or more appliances to install. Update will request the server to download appliances from our online registry.

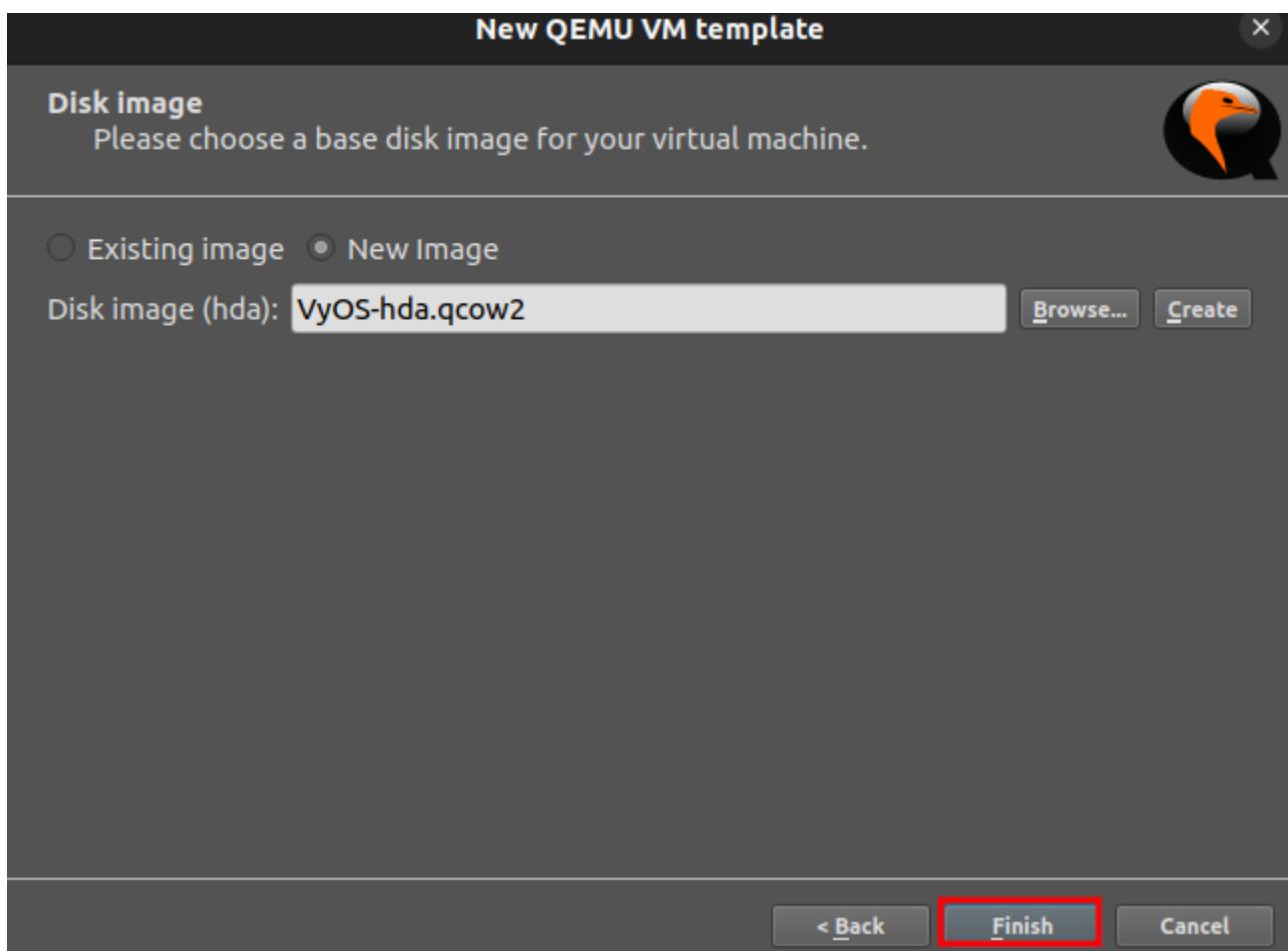
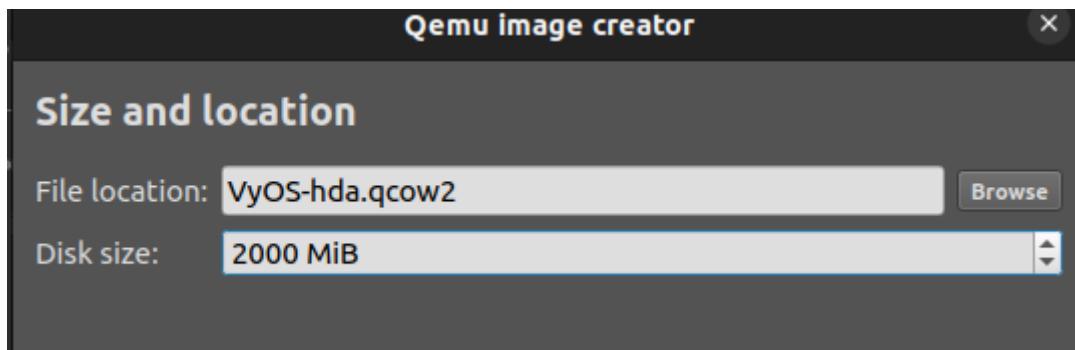
Appliance name	Emulator	Vendor
Firewalls		
Guests		
Routers		
6WIND Turbo Router	Qemu	6WIND
A10 vThunder	Qemu	A10
Alcatel 7750	Qemu	Alcatel
Big Cloud Fabric	Qemu	Big Switch Networks
BIRD	Qemu	CZ.NIC Labs
BIRD2	Qemu	CZ.NIC Labs
BSDRP	Qemu	Olivier Cochard-Labbe
Cisco 1700	Dynamips	Cisco
Cisco 2600	Dynamips	Cisco
Cisco 2691	Dynamips	Cisco
Cisco 3620	Dynamips	Cisco
Cisco 3640	Dynamips	Cisco
Cisco 3660	Dynamips	Cisco
Cisco 3725	Dynamips	Cisco
Cisco 3745	Dynamips	Cisco
Cisco 7200	Dynamips	Cisco
Cisco Catalyst 8000V	Qemu	Cisco
Cisco CSR1000v	Qemu	Cisco
Cisco IOS XRV	Oemu	Cisco

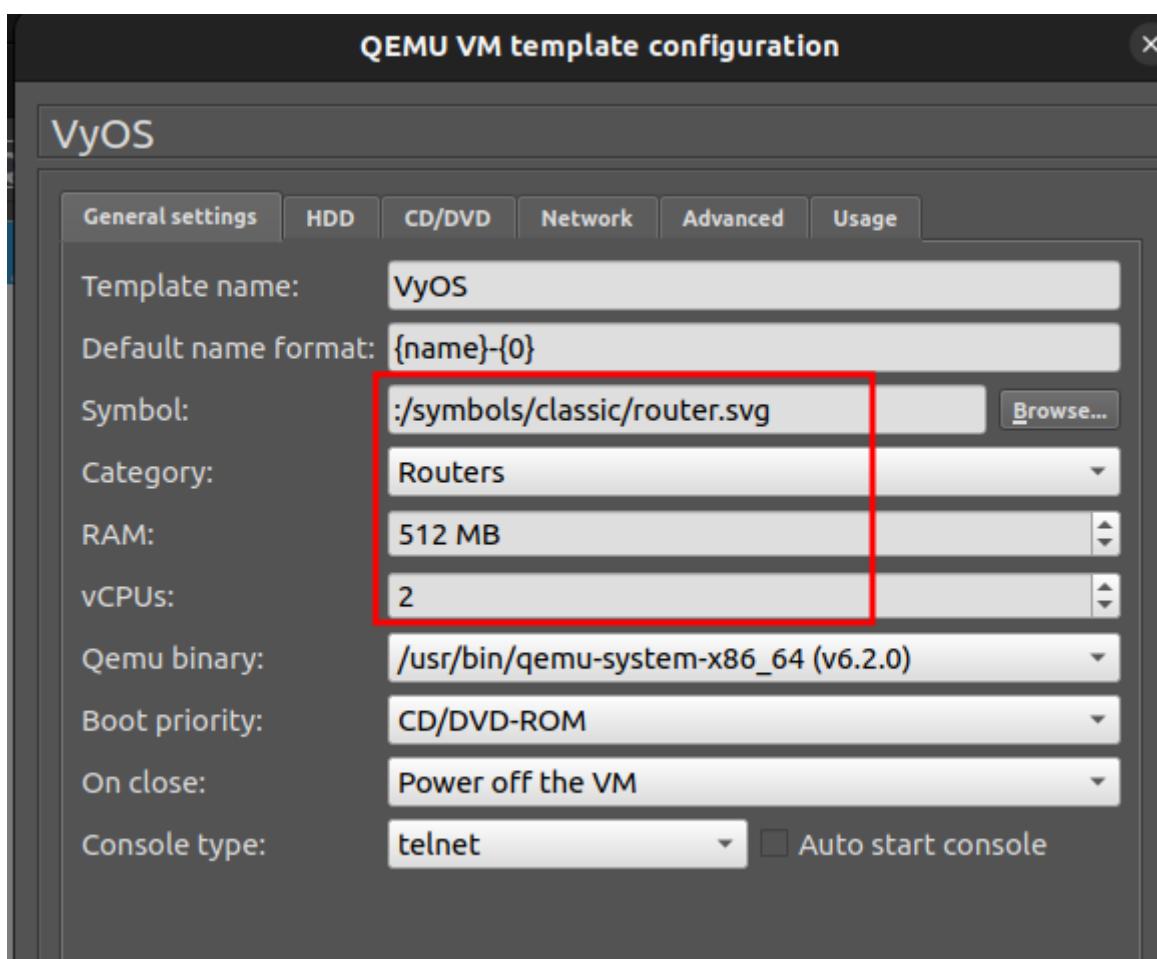
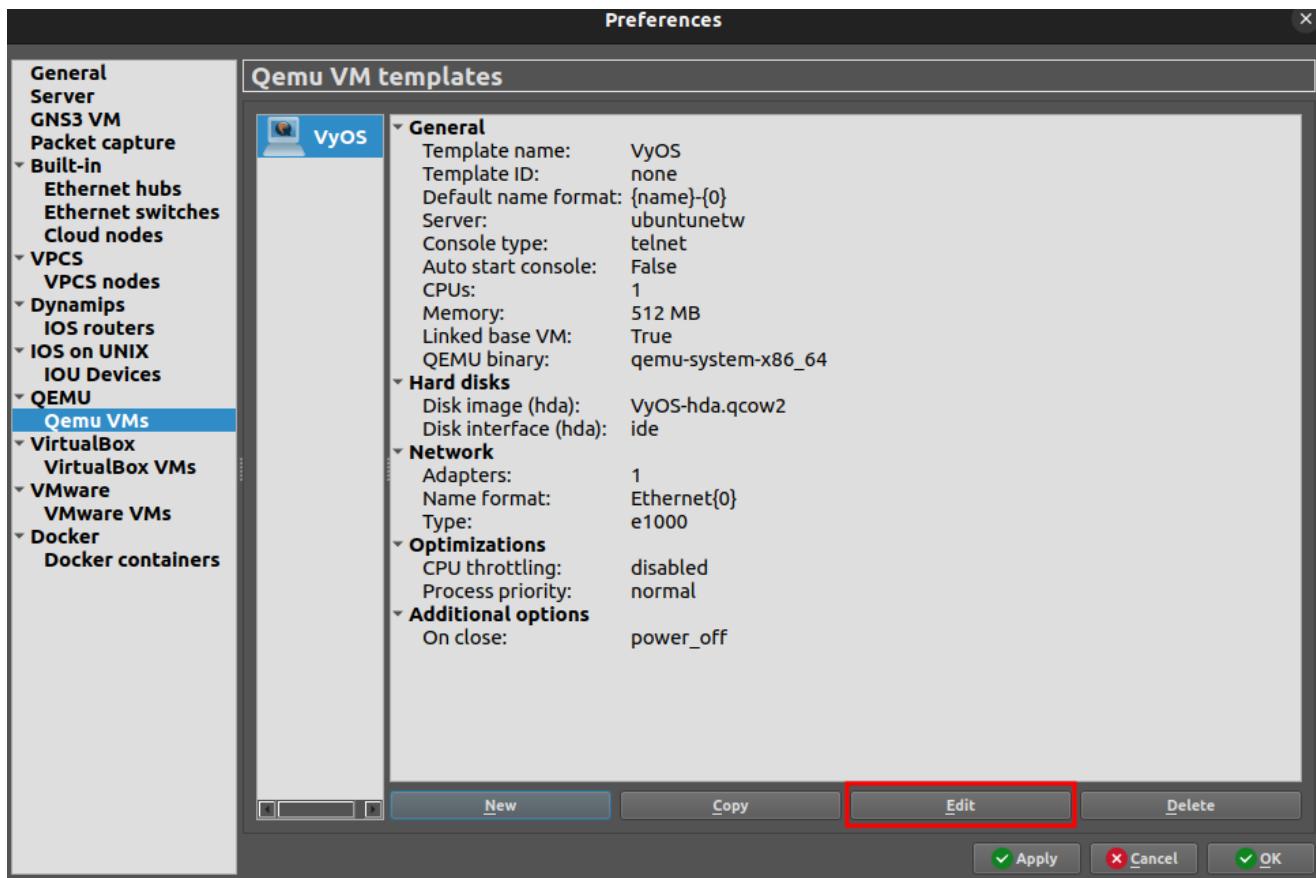
Buttons at the bottom: "Update from online registry" (1), "Back" (2), "Install" (3), and "Cancel".

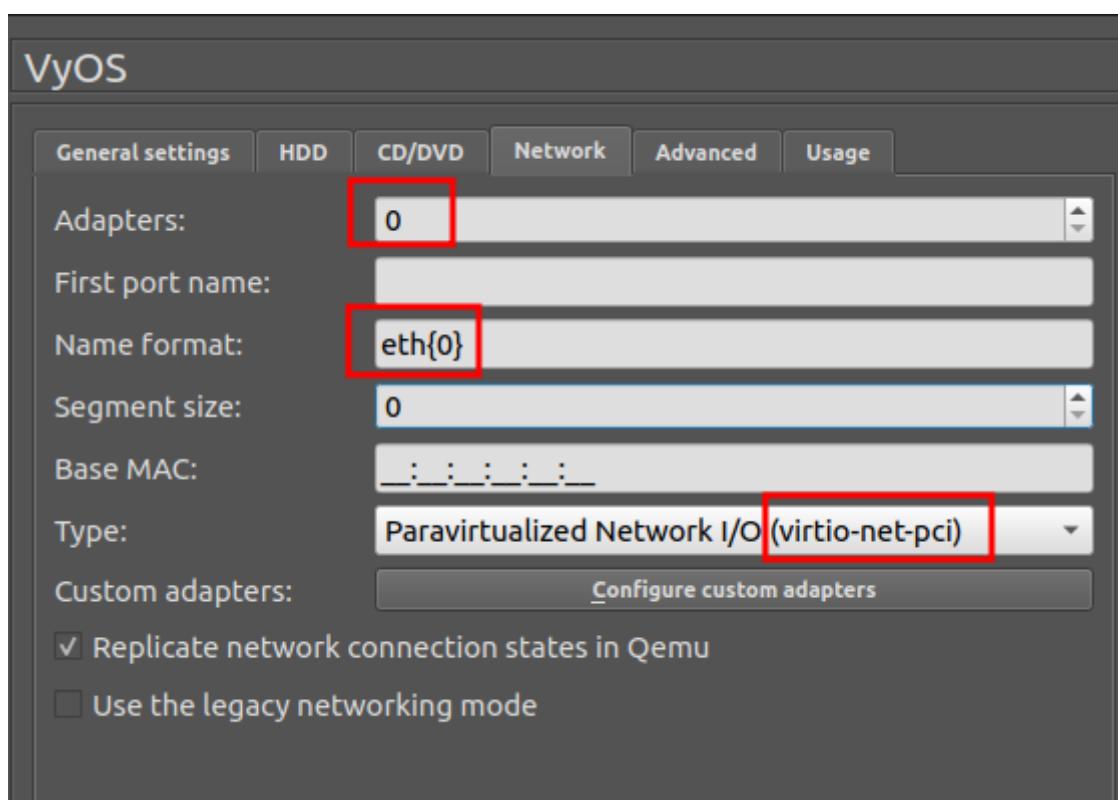
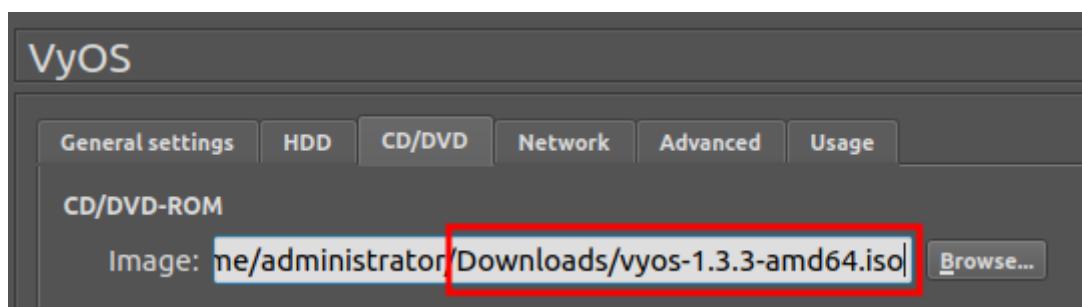
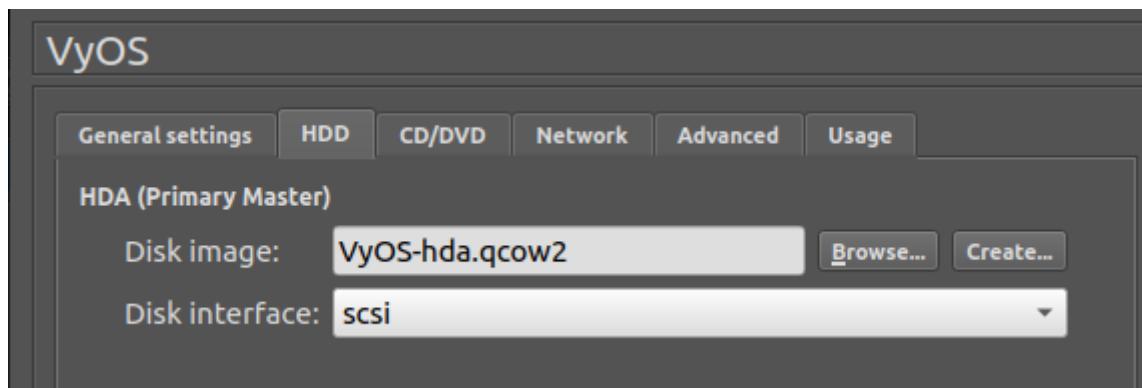
"< BACK" to New template











# VyOS

General settings    HDD    CD/DVD    Network    Advanced    Usage

## Linux boot specific settings

Initial RAM disk (initrd):  [Browse...](#)

Kernel image:  [Browse...](#)

Kernel command line:

## Bios

Bios image:  [Browse...](#)

## Optimizations

Activate CPU throttling

Percentage of CPU allowed:  [▼](#) [▲](#)

Process priority:  [▼](#)

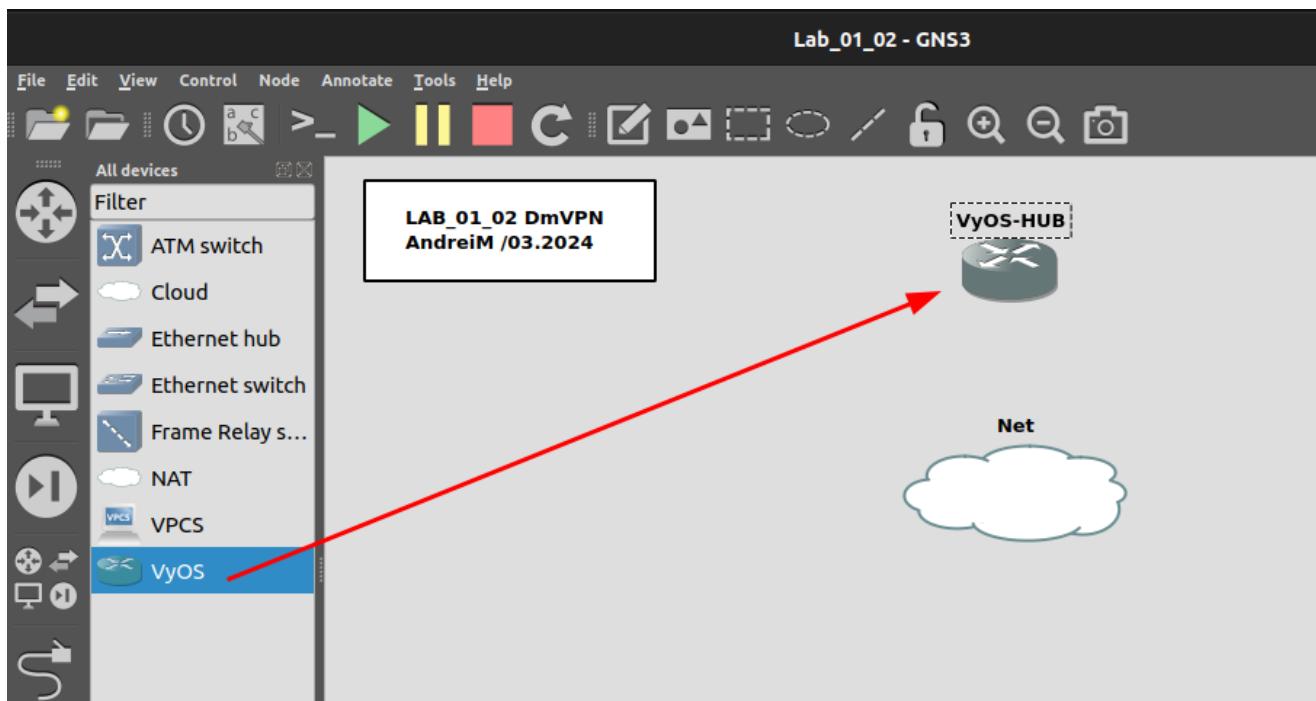
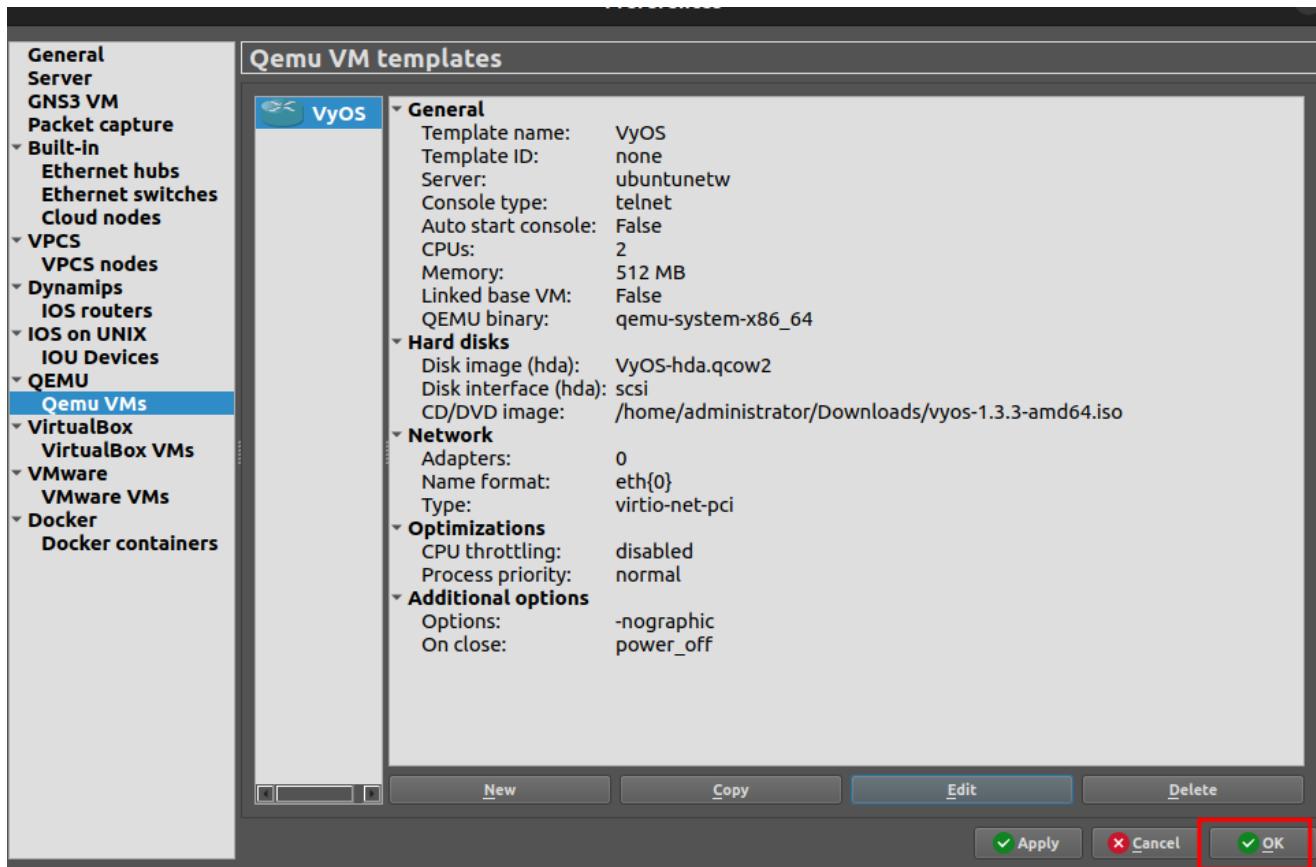
## Additional settings

Options:

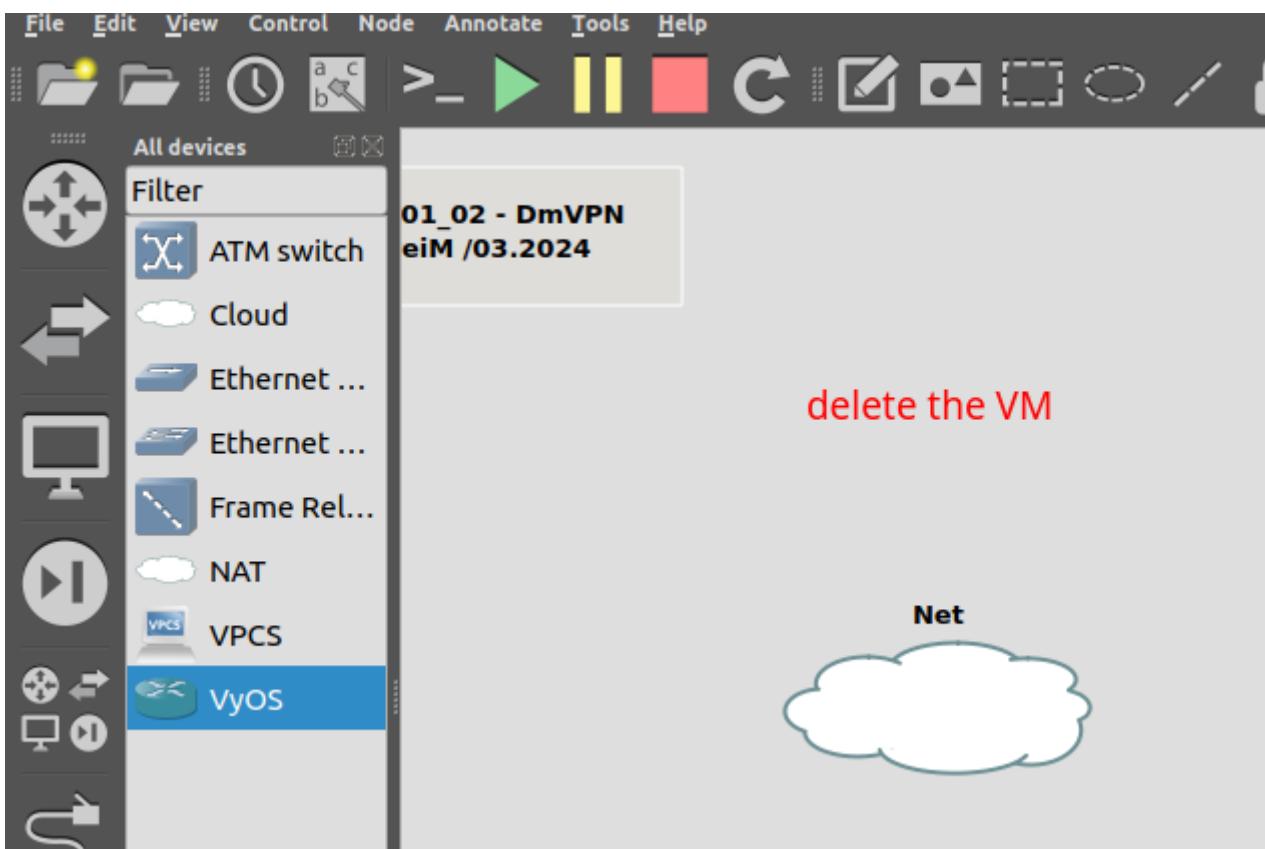
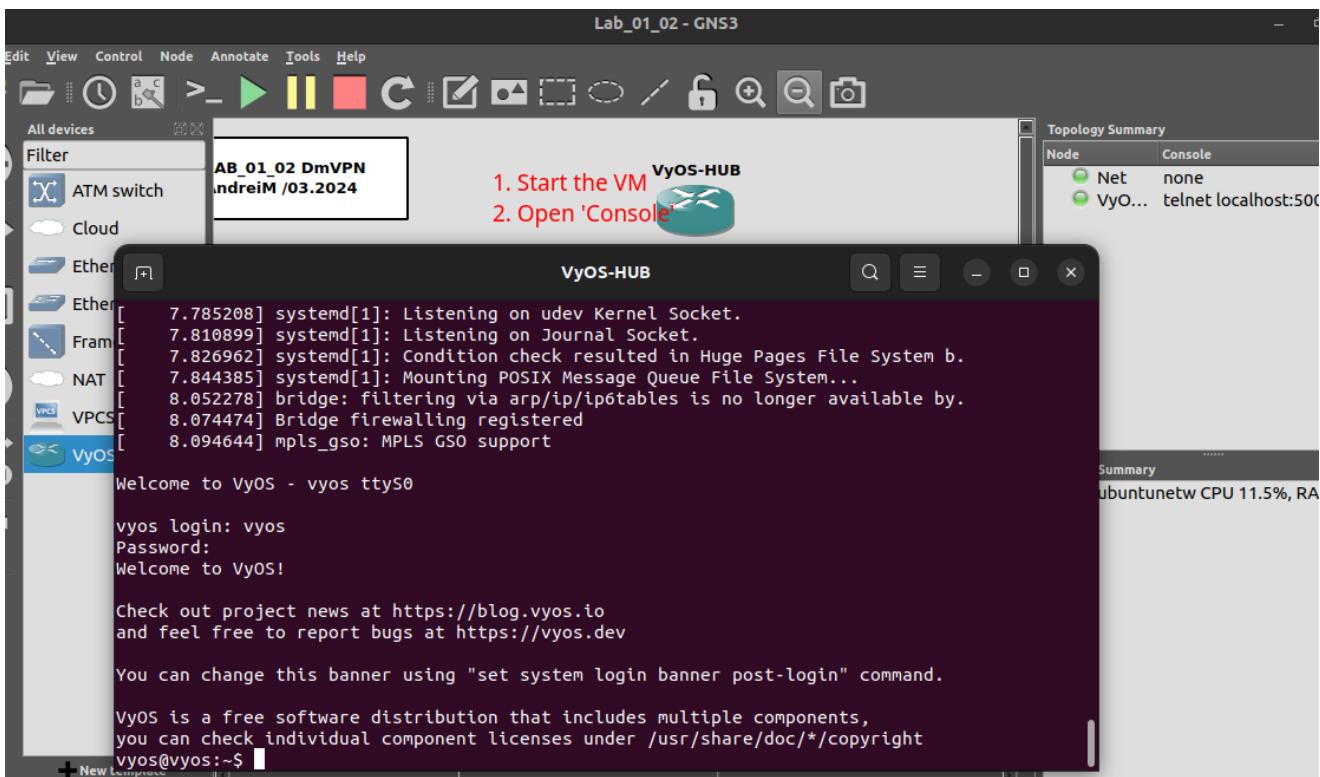
Enable Trusted Platform Module (TPM)

Enable UEFI boot mode

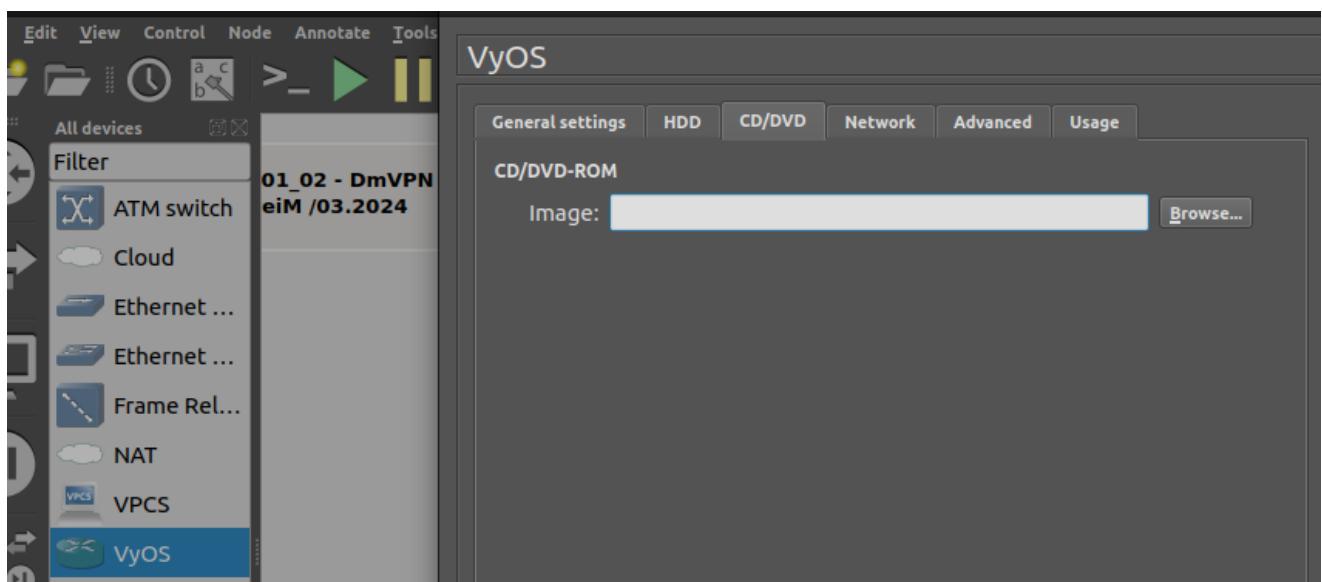
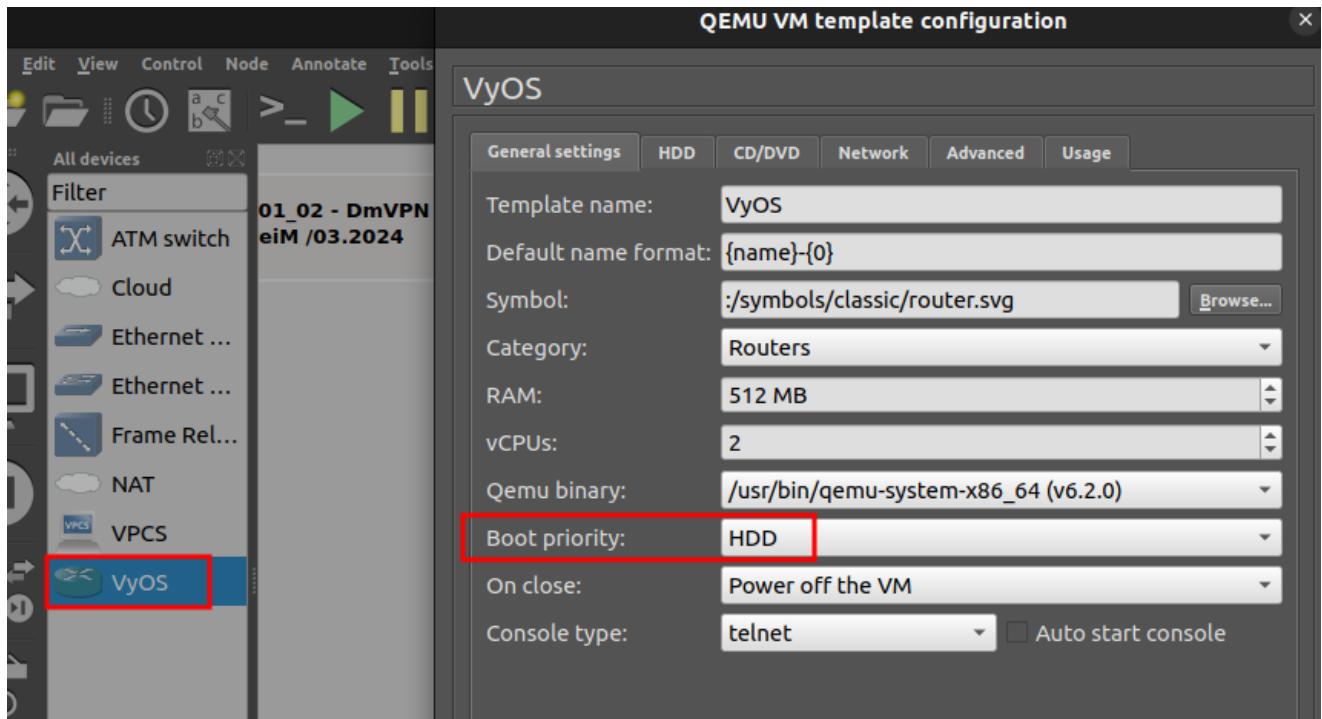
Use as a linked base VM

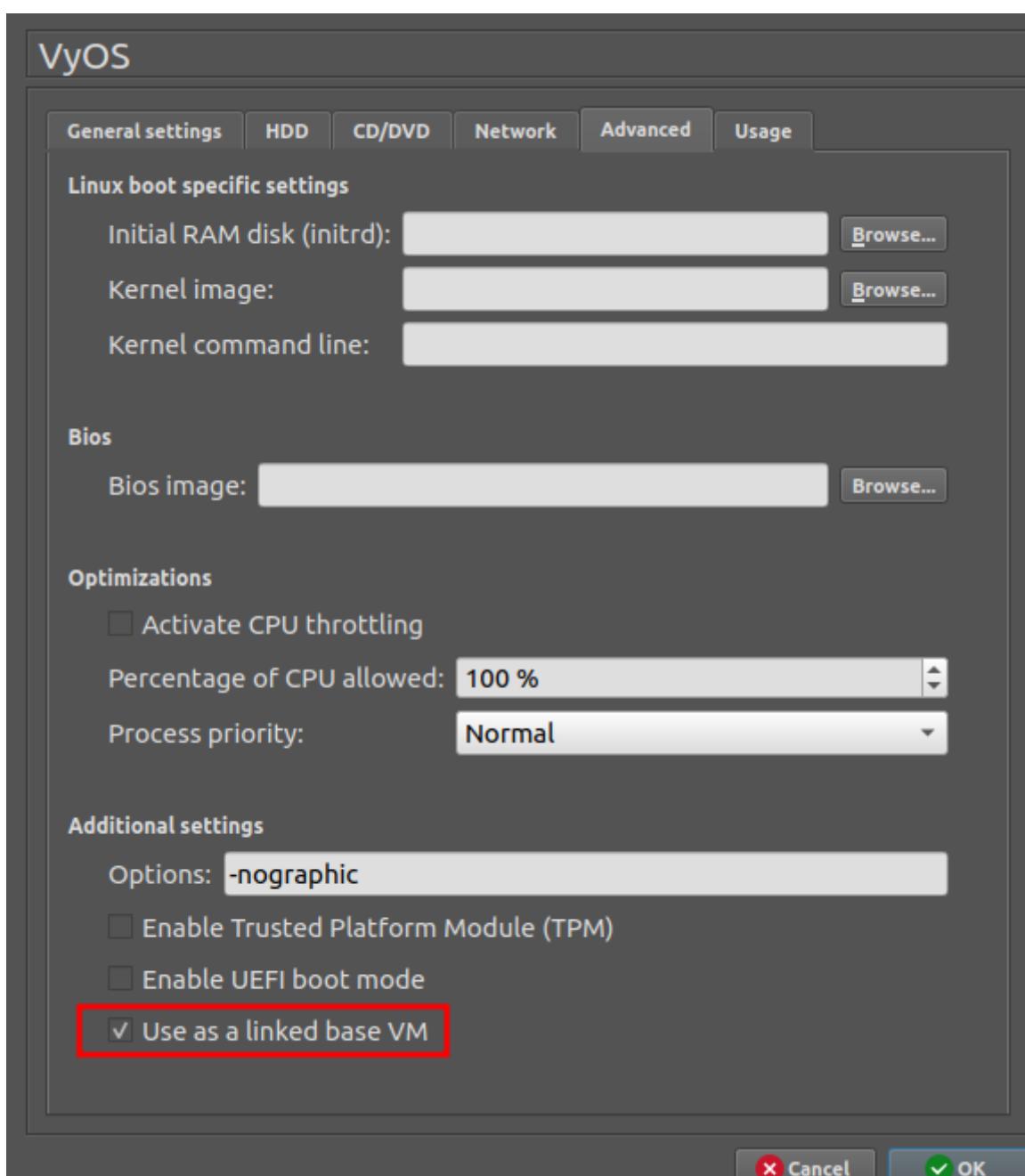
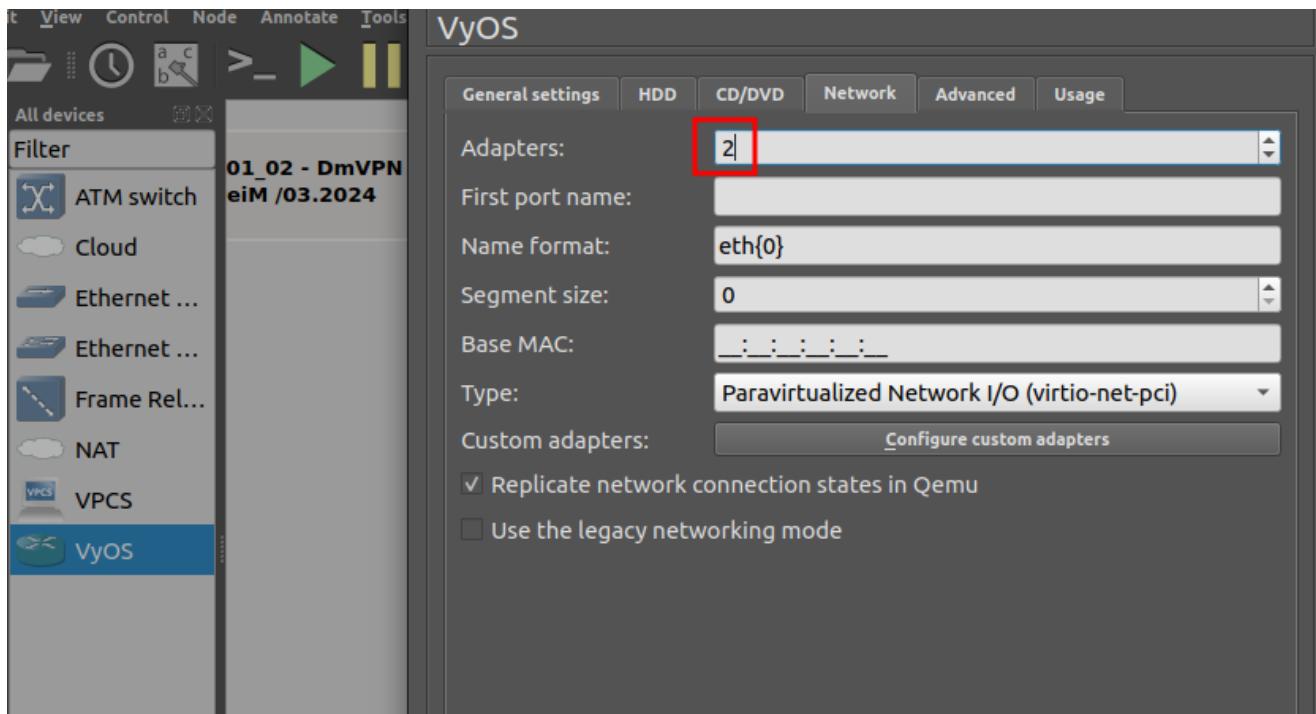


Start the VM (> Start)  
 Open Console (> Console)  
 user/password: vyos / vyos  
 install image  
 poweroff  
**Delete the VM from the GNS3 project**

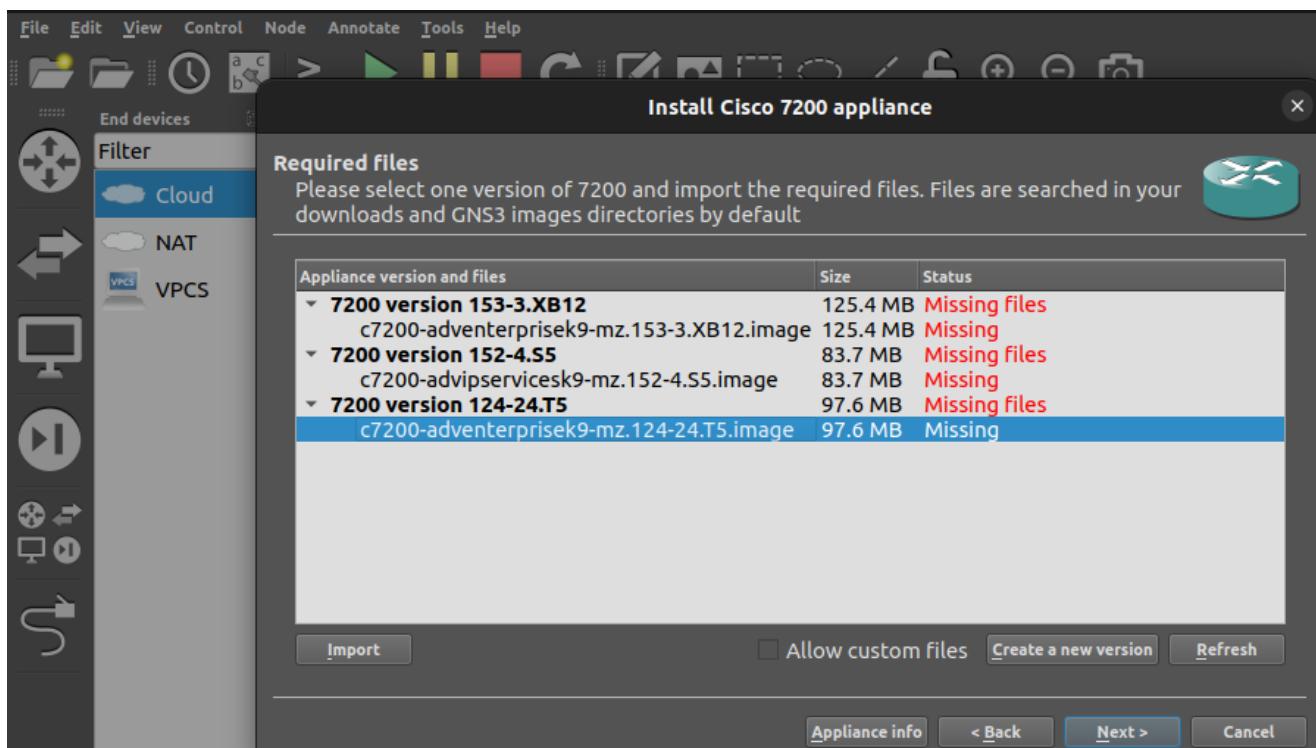


## Change to HDD



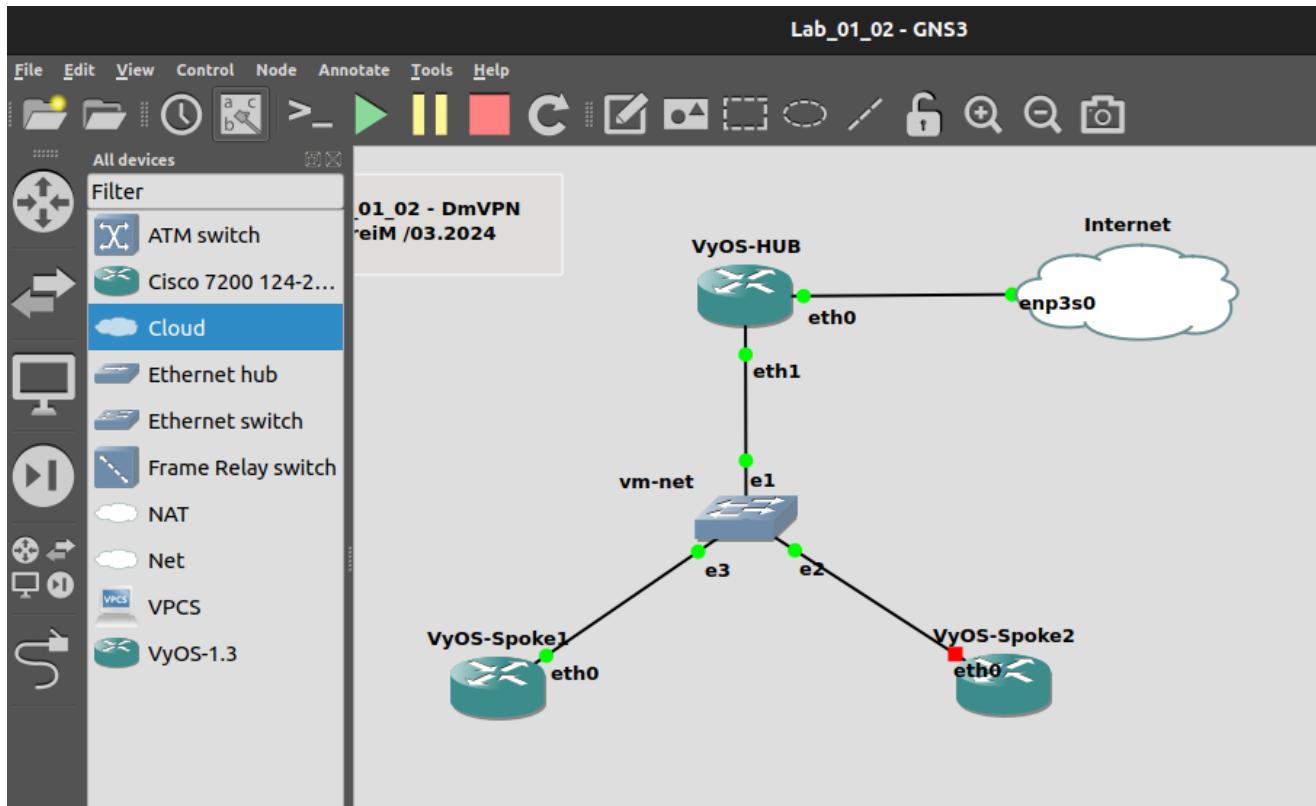


The VyOS VM is now ready to be deployed.



Смотрим в поисковике гугл.

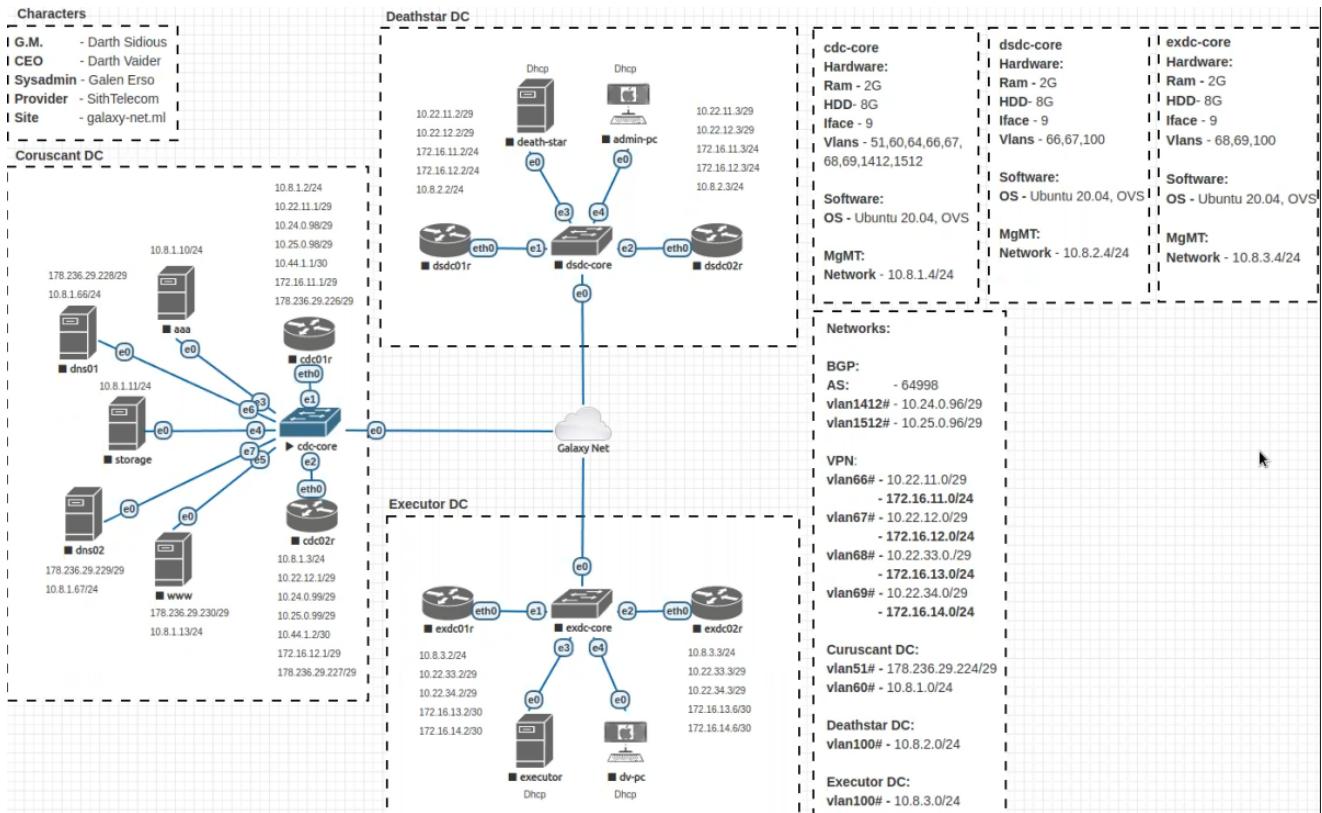
Проект LAB\_01\_02:



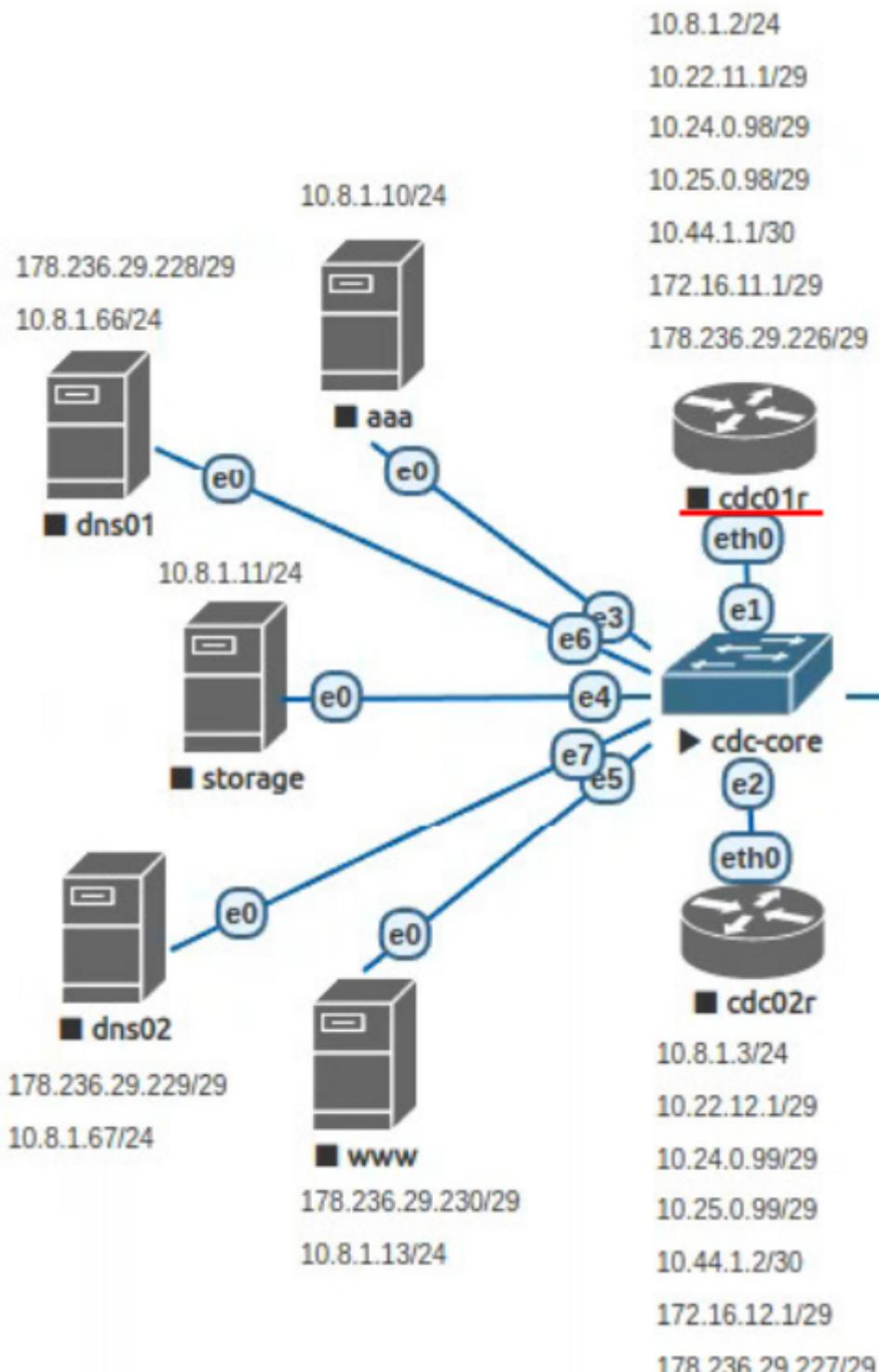
VyOS 1.4. OSFP

## Дополнительно

Урок 1\_2, методички



## Урок\_1:



```
configure
show
exit
reboot
```

```
# cdc01r
configure
set system host-name cdc01r
set system dom
set system domain-name MYDOMAIN.COM ****
show interfaces
```

```
set interfaces ethernet eth0 vif 1412 address 10.24.0.98/29 ****
show interfaces
set interfaces ethernet eth0 vif 1412 description 'Uplink to
sw.m0.c01.meganet.ru' ****
run show configuration commands
commit
show
run ping 10.24.0.97 ****
set policy prefix-list DEFAULT_ONLY rule 5 prefix 0.0.0.0/0
set policy prefix-list DEFAULT_ONLY rule 5 action permit
set policy prefix
set policy prefix-list OUR_ROUTES_OUT rule 5 prefix
178.236.29.224/29 ****
set policy prefix-list OUR_ROUTES_OUT rule 5 le 30
show policy
set policy prefix-list OUR_ROUTES_OUT rule 10 action 'permit'
set policy prefix-list OUR_ROUTES_OUT rule 10 le '30'
set policy prefix-list OUR_ROUTES_OUT rule 10 prefix
'10.8.1.0/24' ****
show pli
set policy route-map DEFAULT_ONLY rule 5 action permit
set policy route-map DEFAULT_ONLY rule 5 match ip address prefix-
list
DEFAULT_ONLY policy route-map DEFAULT_ONLY rule 5 match ip
address prefix-list
set policy route-map DEFAULT_ONLY rule 900 action deny
how policy
set policy route-map OUR_ROUTES_OUT rule 5 action permit
set policy route-map OUR_ROUTES_OUT rule 5 ip address prefix-list
OUR_ROUTES_OUT
show pli
commit
show policy
# FRRouting
vtysh
sudo su -
sh running-config
exit
ping 10.24.0.97 ****
ping 10.25.0.97 ****
sudo netstat -rn
set protocols
# vpls vpws
# ip inbound outbound
```

```
set interfaces ethernet eth0 vif 51 address '178.236.29.226/29'
*****
set interfaces ethernet eth0 vif 51 description 'Galaxy Empire
Internet' ****
set interfaces ethernet eth0 vif 60 address '10.8.1.2/24' ****
set interfaces ethernet eth0 vif 60 description 'Galaxy-Net
local' ****
set interfaces ethernet eth0 vif 64 address '10.44.1.1/30' ****
delete interfaces ethernet eth0 vif 64 ****
show interfaces
commit
run show interfaces
# whois AS-BLOCK ... ripe.net ...
set protocols bgp loa
set protocols bgp local-as 64998 ****
set protocols bgp neighbor 10.24.0.97 remote-as 42678 ****
set protocols bgp neighbor 10.25.0.97 remote-as 42678 ****
set protocols bgp neighbor 10.25.0.97 address-family ipv4 ****
show protocols bgp
export import ... OUR_ROUTES_OUT
show protocols
commit
run show ip bgp summary
run show ip bgp neighbors 10.24.0.97 advertised-routes
set protocols bgp address-family ipv4-unicats redistribute
connected
show protocols
netstat -rn
run show ip route
run show ip bgp neighbors 10.24.0.97 advertised-routes
show protocols
commit
run show ip bgp neighbors 10.24.0.97 advertised-routes
run show ip bgp neighbors 10.25.0.97 advertised-routes
# ssh
set service ssh
commit
save
# connect per ssh from remote host
ssh -l vyos 10.8.1.2 ****
...
show high-availability
# ge galaxy int internet
# ge-loc local
```

```
set high-availability  
commit  
run show vrrp  
save  
run show ip bgp summary
```

Из методички:

```
yum group install "File and Storage Server"  
yum install nfs-utils -y  
systemctl start nfs-server  
systemctl enable nfs-server  
systemctl status nfs-server  
nfs4_getfacl /mnt/nfs/var/nfsshare  
nfs4_setfacl -e /mnt/nfs/var/nfsshare/test_file  
cat /etc/exports  
showmount -e nfs-server.lab  
root@nfs-server ~]#firewall-cmd --get-active-zones  
firewall-cmd --permanent --zone=public --add-service=nfs  
firewall-cmd --reload  
firewall-cmd --get-active-zones  
firewall-cmd --permanent --zone=public --add-service=nfs  
firewall-cmd --permanent --zone=public --add-service=mountd  
firewall-cmd --permanent --zone=public --add-service=rpc-bind  
firewall-cmd --reload  
rpcinfo -p  
firewall-cmd --get-active-zones  
firewall-cmd --permanent --zone=public --add-service=samba  
firewall-cmd --reload  
firewall-cmd --get-active-zones firewall-cmd --permanent --  
zone=public  
--add-service=samba-client  
firewall-cmd --reload  
cat /usr/lib/firewalld/services/samba.xml  
yum install -y samba samba-common samba-winbind  
systemctl enable smb nmb winbind  
systemctl start smb nmb winbind  
systemctl status smb  
systemctl status winbind  
systemctl reload smb  
useradd testuser1 -s /sbin/nologin  
smbpasswd -a testuser1  
pdbedit -L
```

```
testparm
yum install samba-client
smbclient -L 192.168.1.39
yum install cifs-utils
mount.cifs //192.168.1.39/PublicShare /mnt/ -o
username=testuser1
mount | grep 39
yum install targetcli
targetcli
ls
lsblk
pvcreate /dev/sdb
vgcreate centos-target /dev/sdb
lvcreate -L 1G -n backstore centos-target
lvs
targetcli
cd backstores/block
cd /iscsi
create iqn.2019-10.com.example:server1-disk1
ls
cd iqn.2019-10.com.example:server1-disk1/tpg1/acls
create iqn.2019-10.com.example:client
cd /iscsi/
ls
cd iqn.2019-10.com.example:server1-disk1/tpg1/luns
create /backstores/block/disk1
cd /iscsi/
ls
cd iqn.2019-10.com.example:server1-disk1/tpg1/
cd portals/
delete 0.0.0.0 3260
create 192.168.1.41 3260
cd /iscsi/
ls
systemctl enable target
systemctl start target
firewall-cmd --permanent --add-port=3260/tcp
firewall-cmd --reload
yum install iscsi-initiator-utils
iqn.2019-10.com.example:client
vim /etc/iscsi/initiatorname.iscsi
systemctl start iscsi
systemctl enable iscsi
iscsiadm -m discoverydb -t st -p 192.168.1.41 -D
```

```
192.168.1.41:3260,1 iqn.2019-10.com.example:server1-disk1
iscsiadm -m node -T iqn.2019-10.com.example:server1-disk1 -l
lsblk
dmesg | tail -n 15
mkfs.ext4 /dev/sdb
mount /dev/sdb /tmp
mount | tail -n 1
```

## Урок\_2:

```
configure
show
exit
reboot
...
```

Из методички:

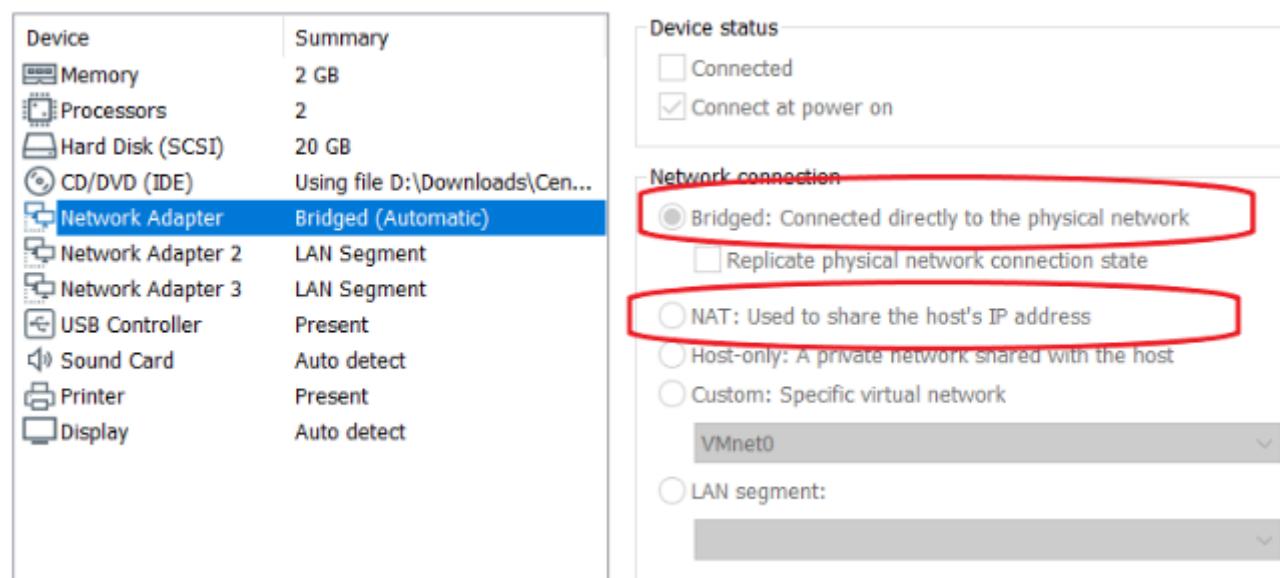
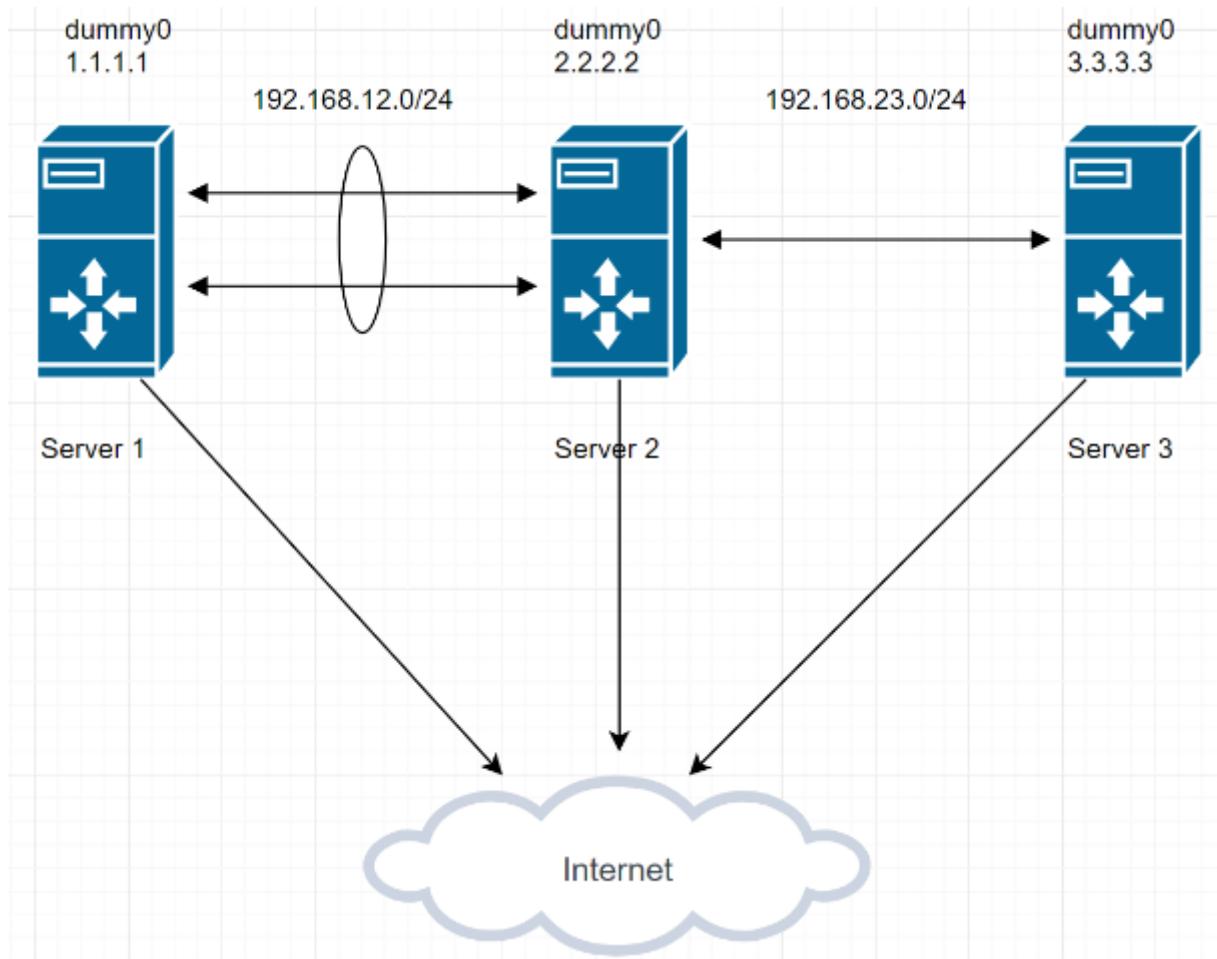
Установка FRR

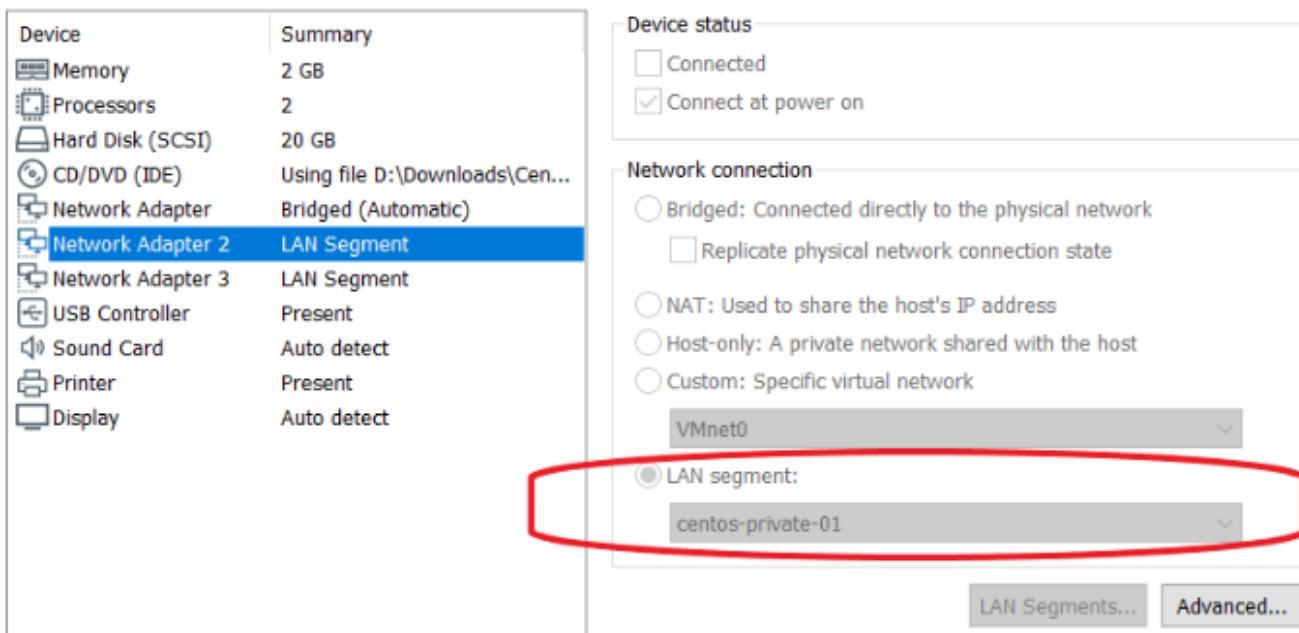
```
https://github.com/FRRouting/
wget https://github.com/FRRouting/frr/releases/download/frr-
7.0/frr-7.0-01.el7.centos.x86_64.rpm
wget https://c11.netdef.org/artifact/LIBYANG-
YANGRELEASE/shared/build-10/CentOS-7-x86_64-Packages/libyang-
0.16.111-0.x86_64.rpm
yum install -y libyang-0.16.111-0.x86_64.rpm
yum install frr-7.0-01.el7.centos.x86_64.rpm
vim /etc/sysctl.d/90-routing-sysctl.conf
net.ipv4.conf.all.forwarding=1
net.ipv6.conf.all.forwarding=1
sysctl -p /etc/sysctl.d/90-routing-sysctl.conf
cat /etc/frr/daemons
watchfrr_enable=yes
watchfrr_options="-r '/usr/lib/frr/frr restart %s' -s
'/usr/lib/frr/frr start %s' -k
'/usr/lib/frr/frr stop %s'"
#
zebra=yes
bgpd=no
ospfd=yes
ospf6d=no
```

```
ripd=no
ripngd=no
isisd=no
ldpd=no
pimd=no
nhrpdb=no
eigrpd=no
babeld=no
sharpd=no
pbrd=no
staticd=no
bfdd=no
fabricd=no
#
# Command line options for the daemons
#
zebra_options=(-A 127.0.0.1)
bgpd_options=(-A 127.0.0.1)
ospfd_options=(-A 127.0.0.1)
ospf6d_options=(-A ::1)
ripd_options=(-A 127.0.0.1)
ripngd_options=(-A ::1)
isisd_options=(-A 127.0.0.1)
ldpd_options=(-A 127.0.0.1)
pimd_options=(-A 127.0.0.1)
nhrpdb_options=(-A 127.0.0.1)
eigrpd_options=(-A 127.0.0.1)
babeld_options=(-A 127.0.0.1)
sharpd_options=(-A 127.0.0.1)
pbrd_options=(-A 127.0.0.1)
staticd_options=(-A 127.0.0.1)
bfdd_options=(-A 127.0.0.1)
fabricd_options=(-A 127.0.0.1)
vtysh_enable=yes
[root@r1 ~]# systemctl start frr.service
[root@r1 ~]# systemctl status frr
cat /etc/services | tail -n 15
ss -tulpan | egrep -i osp
vtysh
show run
R1---192.168.13.0/24---R2---192.168.23.0/24---R3
[root@r1 ~]# ip link add dummy0 type dummy
[root@r1 ~]# ip addr add 1.1.1.1/32 dev dummy0
[root@r1 ~]# ip link set dummy0 up
```

```
[root@r1 ~]# ip a s dummy0
[root@r1 ~]# ip a s ens37
[root@r3 ~]# ip link add dummy0 type dummy
[root@r3 ~]# ip addr add 3.3.3.3/32 dev dummy0
[root@r3 ~]# ip link set dummy0 up
[root@r3 ~]# ip a s dummy0
[root@r3 ~]# ip a s ens37
(1.1.1.1/32)R1---192.168.13.0/24---R2---192.168.23.0/24---
R3(3.3.3.3/32)
R1,R2,R3# firewall-cmd --add-protocol=ospf --permanent --
zone=public
R1,R2,R3# firewall-cmd --add-protocol=ospf --zone=public
vtysh
r1# conf t
r1(config)# router ospf
r1(config-router)# network 192.168.13.0/24 area 0
r1(config-router)# network 1.1.1.1/32 area 0
r1# show run
vtysh
r2# conf t
r2(config)# router ospf
r2(config-router)# network 192.168.13.0/24 area 0
r2(config-router)# network 192.168.23.0/24 area 0
r2(config-router)# ^Z
r2# show run
...
...
```

## FRR





## Дополнительно:

### Глоссарий

### Дополнительные материалы

### Используемые источники

1. Официальная документация Redhat  
[https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/7/](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/)
2. Product Documentation for Red Hat Enterprise Linux 7.  
[https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/7/](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/)
3. Основные протоколы хранения: использование и перспективы.  
<https://habr.com/ru/company/raidix/blog/329472/>
4. iSCSI. <https://en.wikipedia.org/wiki/iSCSI>
5. Информация по BIRD. <https://bird.network.cz/>
6. Информация по ExaBGP. <https://github.com/Exa-Networks/exabgp>
7. Информация по настройке и протоколу OSPF  
[https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute\\_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html)
8. Проект FRR. <https://frrouting.org/>
9. Документация от Cisco Systems. [https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute\\_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html)
10. Документация от RedHat. [https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/7/](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/)

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