Universiteit Antwerpen
Faculteit Toegepaste Ingenieurswetenschappen

Lab of 3-Network Architecture

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2024-2025

Scheduled labs for PR01

Session	Date	Subject	Evaluation	Deadline (23:59)
1	01/10/2024	Introduction to the Linux Operating System	**N/A**	**N/A**
2	08/10/2024	Using the shell & exploring the filesystem	Report	14/10/2024
3	15/10/2024	Working with text files, managing running processes and writing shell scripts	Report	22/10/2024
4	23/10/2024	Learning system administration, getting & managing software	Report	28/10/2024
5	29/10/2024	Wireshark introduction	Report	05/11/2024
6	06/11/2024	Protocols in action: TCP and UDP	Report	11/11/2024
7	12/11/2024	Ethernet and ARP	Report	19/11/2024
8	20/11/2024	Setting up a DHCP server	Report	25/11/2024
9	26/11/2024	Setting up a DNS server	Report	03/12/2024
10	04/12/2024	Network Address Translation	Report	09/12/2024
11	10/12/2024	Remote Access & Firewalls (1)		**N/A**
12	18/12/2024	Remote Access & Firewalls (2)	Blackboard test	

Scheduled labs for PR02

Session	Date	Subject	Evaluation	Deadline (23:59)
1	02/10/2024	Introduction to the Linux Operating System	N/A	N/A
2	09/10/2024	Using the shell & exploring the filesystem	Report	15/10/2024
3	16/10/2024	Working with text files, managing running processes and writing shell scripts	Report	22/10/2024
4	23/10/2024	Learning system administration, getting & managing software	Report	29/10/2024
5	30/10/2024	Wireshark introduction	Report	05/11/2024
6	06/11/2024	Protocols in action: TCP and UDP	Report	12/11/2024
7	13/11/2024	Ethernet and ARP	Report	19/11/2024
8	20/11/2024	Setting up a DHCP server	Report	26/11/2024
9	27/11/2024	Setting up a DNS server	Report	03/12/2024
10	04/12/2024	Network Address Translation	Report	10/12/2024
11	11/12/2024	Remote Access & Firewalls (1)		**N/A**
12	18/12/2024	Remote Access & Firewalls (2)	Blackboard test	

Common mistakes

- Not restarted service
- Console does not show up
- /etc/apt/sources.list not updated
- Install the package on the wrong machine
- Command “dhclient” not executed as sudo
- Keep only one network connected to the VM
- Configure IP address of the DHCP correctly

Session 9

Setting up a DNS Server

A refresher…

Setup of a service

General steps for setting up a “server”:

1. Install the service
2. Configure the server
3. Start the server
4. Secure the server (*This step is reserved for future sessions*)
5. Monitor the server (service status, log files, ...)

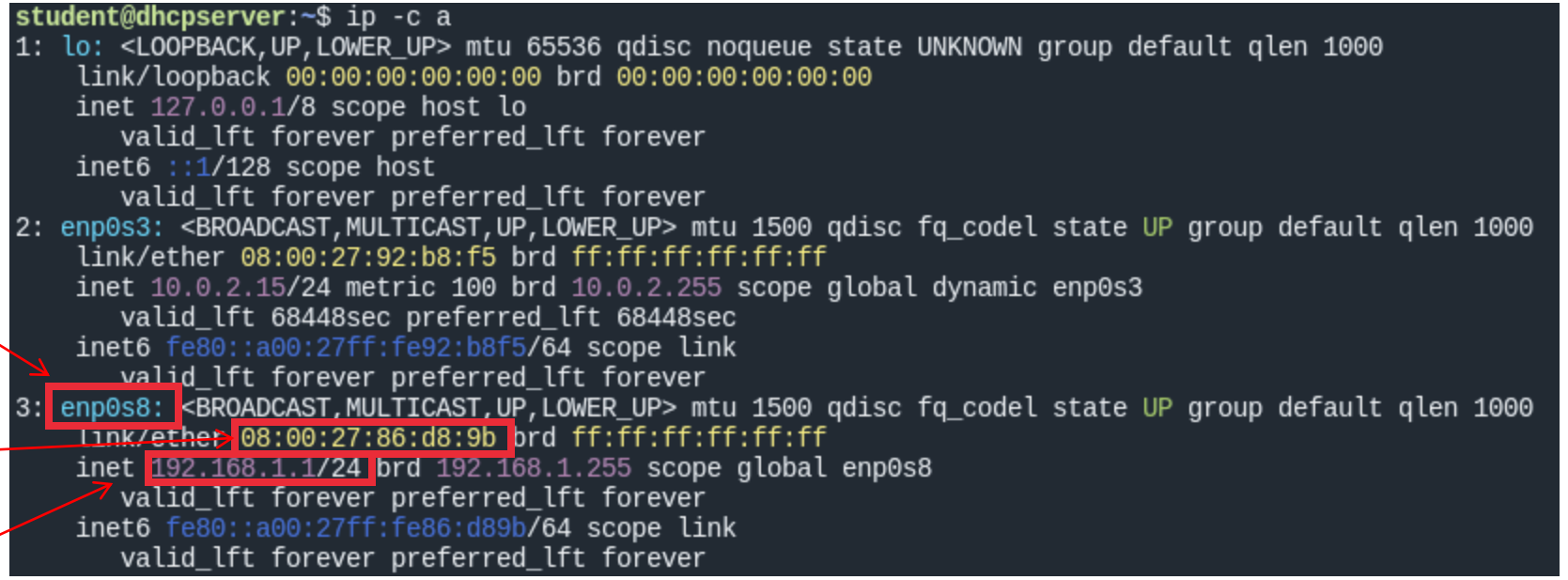
IP address

The **ip** command. An example output of
$ ip -c a (equal to **$ ip -c address**)

The internal network adapter name

MAC address

IP address



Network adapter address assignment

Assigning an IP address to a certain network adapter.

Temporarily: use the **ip** command.

```
dns-server@dns:~$ sudo ip a add 192.168.1.1/24 dev enp0s8
```

MODIFYING ADDRESS AND LINK PROPERTIES

SUBCOMMAND	DESCRIPTIONS AND TASKS
`addr add`	Add an address `ip addr add 192.168.1.1/24 dev em1` Add address 192.168.1.1 with netmask 24 to device em1
`addr del`	Delete an address `ip addr del 192.168.1.1/24 dev em1` Remove address 192.168.1.1/24 from device em1

From the “ip command cheat sheet for Red Hat enterprise Linux”

Network adapter address assignment

Assigning an IP address to a certain network adapter.
Permanently: configure the interfaces config files **(/etc/network/interfaces**)

```
dhcp-server@dhcp:~$ sudo nano /etc/network/interfaces
```

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
allow-hotplug enp1s0
iface enp1s0 inet static
        address 192.168.1.1/24
        gateway 192.168.1.254
        # dns-* options are implemented by the resolvconf package, if installed
        dns-nameservers 192.168.1.2
        dns-search labnet.local
```

```
dhcp-server@dhcp:~$ sudo systemctl restart networking.service
```

Command list overview – Virtual Machine

Command	Explanation
sudo virt-install	Installation of virtual machine. Extra parameters needed.
sudo virsh list --all	List all VMs.
sudo virsh start <my_vm>	Start a VM. Replace <my_vm> with the name of your VM.
sudo virsh shutdown <my_vm>	Shutdown a VM. Replace <my_vm> with the name of your VM.
sudo virsh destroy <my_vm>	Forcefully shutdown a VM. Replace <my_vm> with the name of your VM.
sudo virsh undefine <my_vm>	Delete a VM. Replace <my_vm> with the name of your VM.
sudo virsh console <my_vm>	Connect to VM console. Replace <my_vm> with the name of your VM.
Qwerty: “Ctrl +]” Azerty: “Ctrl + $”	Exit the console to go back to host.

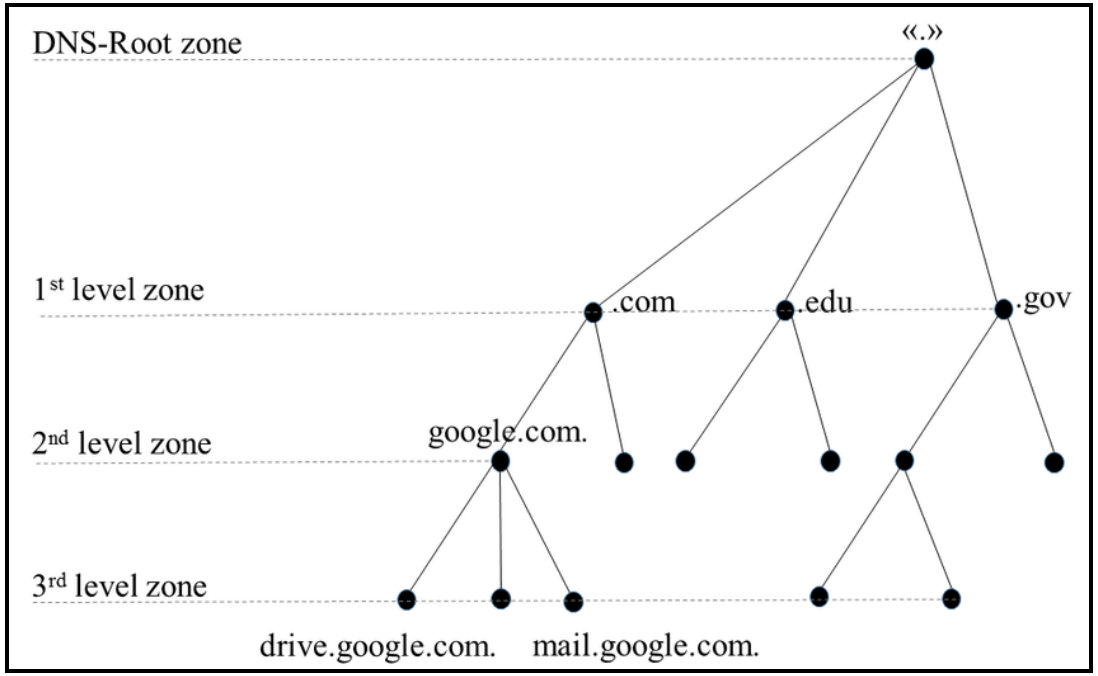
Command list overview – Networks

Command	Explanation
sudo virsh net-define <network.xml>	Network definition. Replace <network.xml> with the correct filename.
sudo virsh net-start <name>	Start the network. Replace <name> with the network name defined in your config.
sudo virsh net-autostart <name>	Automatic startup of a virtual network. Replace <name> with the name of your network name.
sudo virsh domiflist <vm_name>	List all attached interfaces. Replace <vm_name> with your VM name.
sudo virsh attach-interface --type network --source <name> --model virtio <vm_name> --persistent	Attach a network interface to a VM. Replace <vm_name> with the name of the VM, and <name> with your network name.
sudo virsh detach-interface <vm_name> network <mac_address>	Detach a network interface from your VM. Replace <vm_name> with the name of the VM, and <mac_address> with the mac address retrieved using domiflist.

Setup of a DNS Server

Introduction

- **Domain Name System (DNS)** is a protocol that translates human-readable domain names into machine-readable IP addresses.
- Similar to your friends' cell phone numbers in your phone. You don't remember their numbers by heart.
- Hierarchy
  - **Root domain servers**: "Where is .com handled?"
  - **Top level server**: "Where is example.com handled?"
  - **Authoritive servers**: "What is IP for example.com?"
- **Caching**



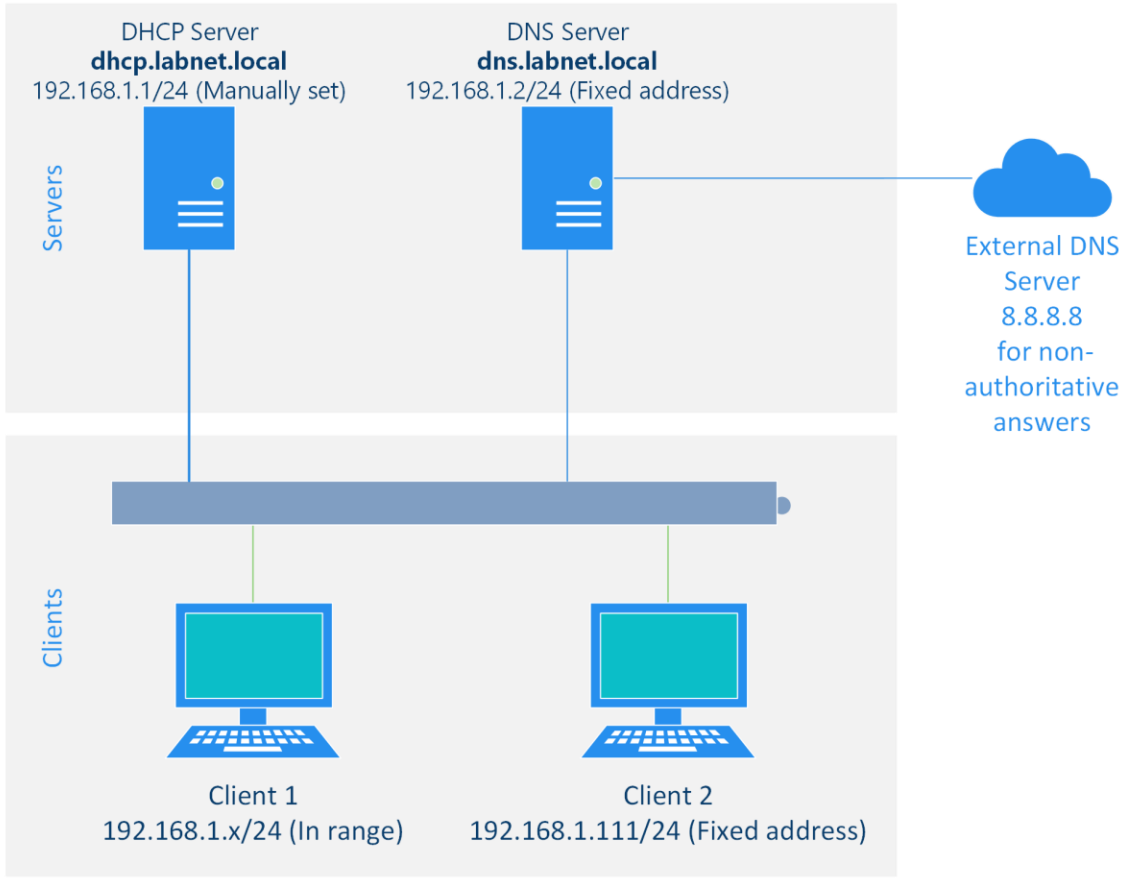
Objective

In the network diagram to the right, the DHCP and DNS servers can be referred to as **dhcp.labnet.local** and **dns.labnet.local** respectively.
Every device in this network is able to resolve those domain names to their corresponding IP addresses or IP addresses to domain names.

Configure the DNS server with:

- A **forward zone**, which resolves domain names to addresses.
- A **reverse zone**, which resolved addresses to domain names.

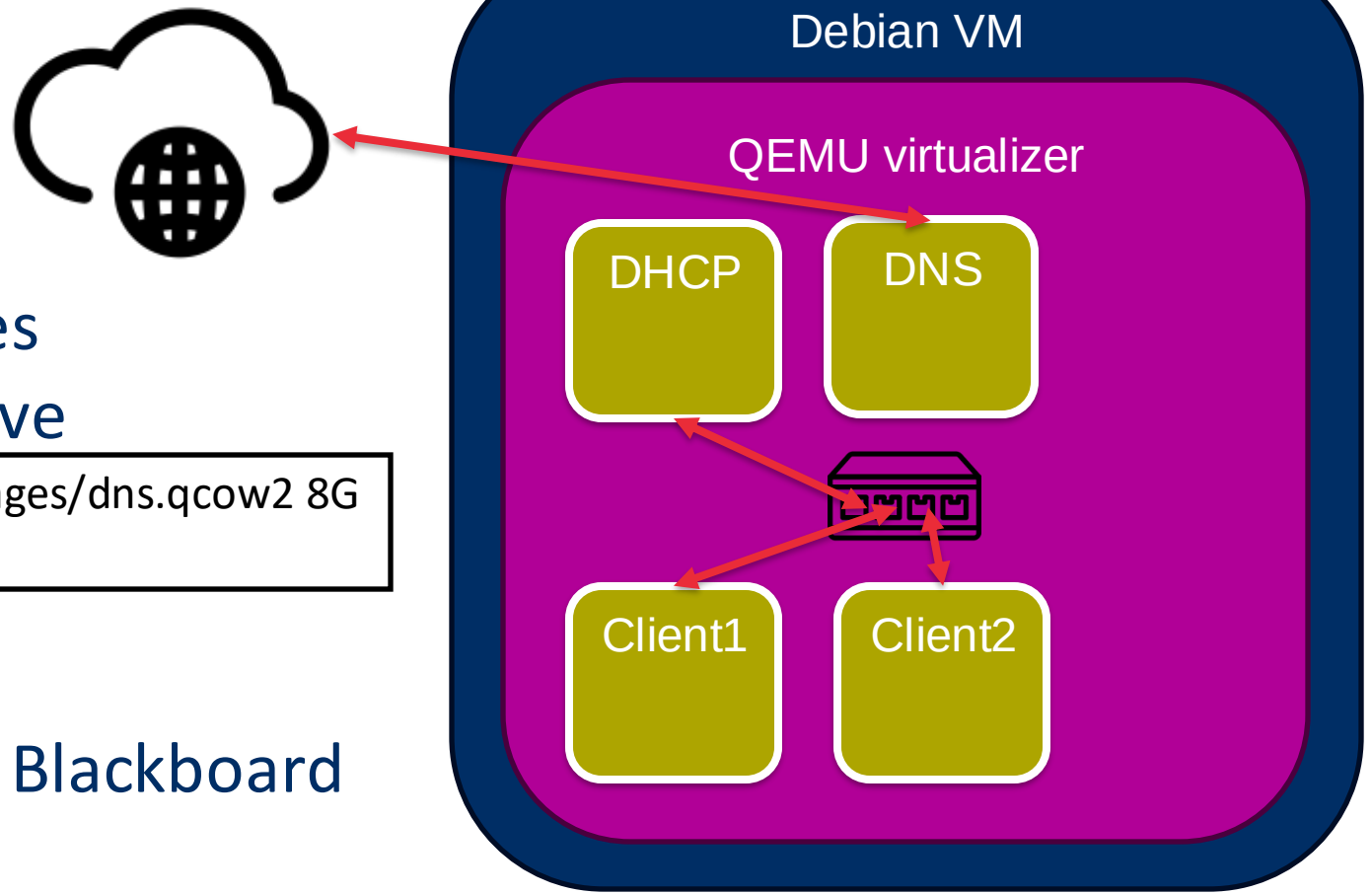
Reflect on the general 4 (4. excluded) steps of setting up a server in your reports.



1. Install the service

- Install a virtual machine
  - Go to /var/lib/libvirt/images
  - Configure a virtual hard drive

```
sudo qemu-img create -f qcow2 /var/lib/libvirt/images/dns.qcow2 8G
```

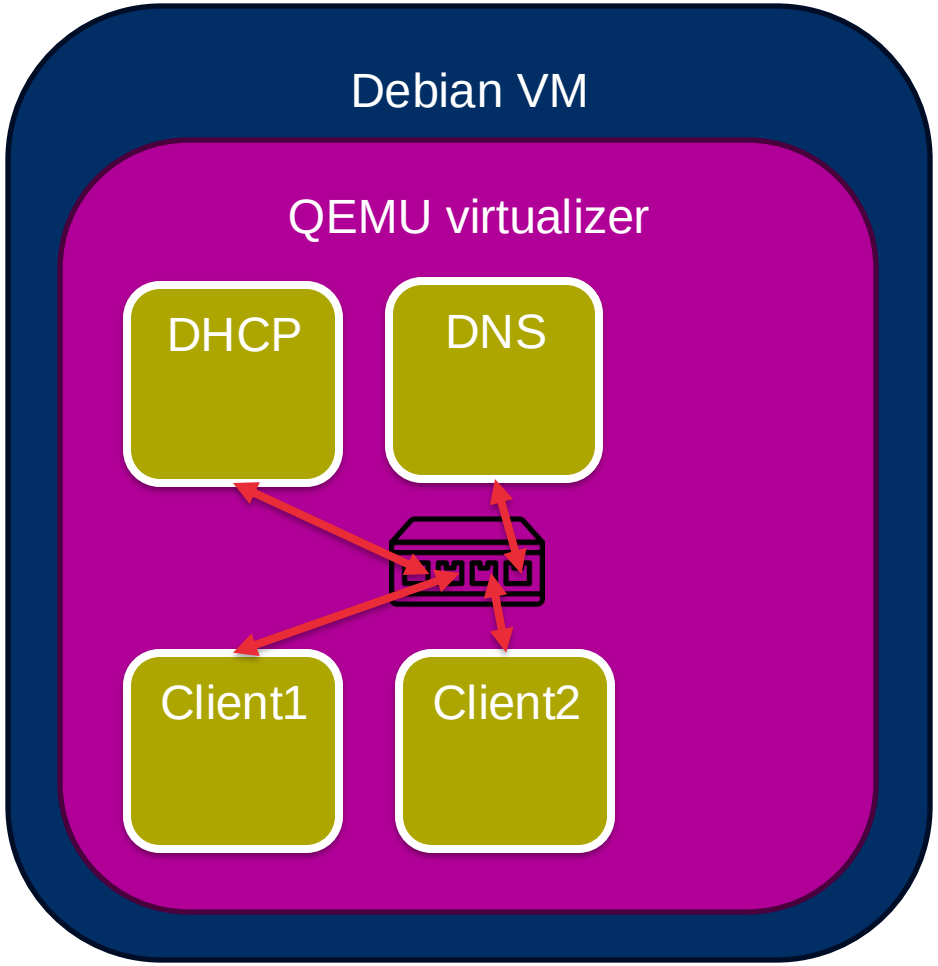


- Install VM: follow guide on Blackboard

```
sudo virt-install --name dns --ram 1024 --vcpus 1 --disk
path=/var/lib/libvirt/images/dns.qcow2,format=qcow2 --os-variant debian11 --network network=nat-network --
graphics none --extra-args="console=ttyS0" --location /var/lib/libvirt/images/<downloaded_image>.iso
```

2. Configure the server

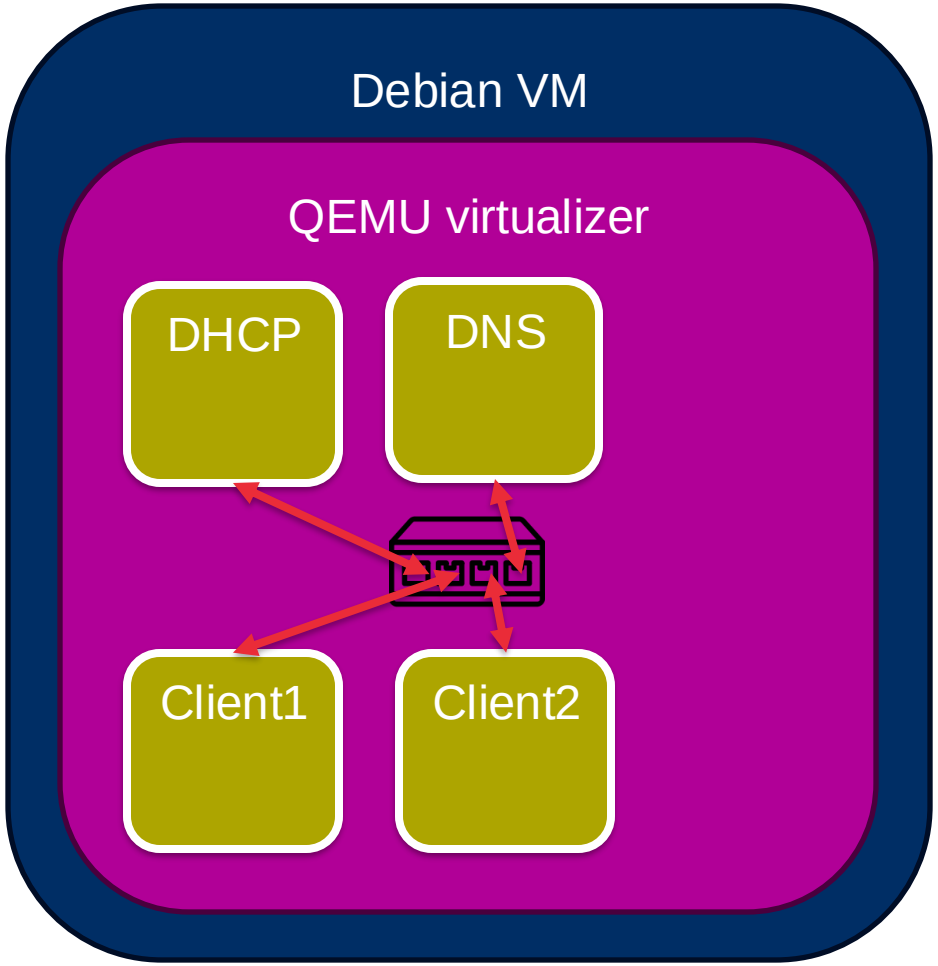
- Install the packages: **bind9** and **dnsutils**
- Disconnect the NAT network from the DNS
- Connect the internal network to the DNS
- Edit the configuration files in /etc/bind so
  - The DNS server is a **primary server** for the FQDN labnet.local
  - The **forward and reverse** zone files are configured. Use db.<address> as naming convention in the DNS data files.
  - Create and configure all **records** for DHCP and DNS server.
  - Setup a "**forwarder**" as shown on slide 15



3. Start the server

- To (re)load the config, you should (re)start the service

```
systemctl restart bind9
```

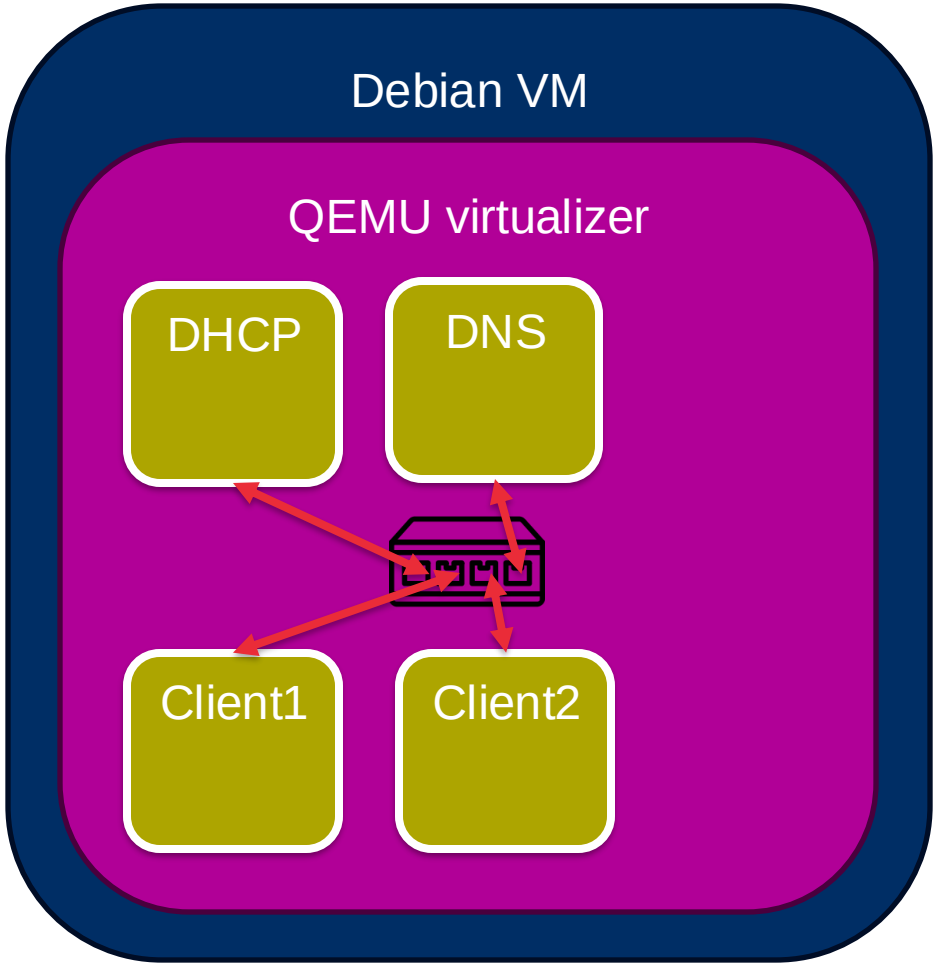


5. Monitor the server

- Check logs of the server

```
systemctl status bind9
```

- Remember the nslookup command…



Sample outputs

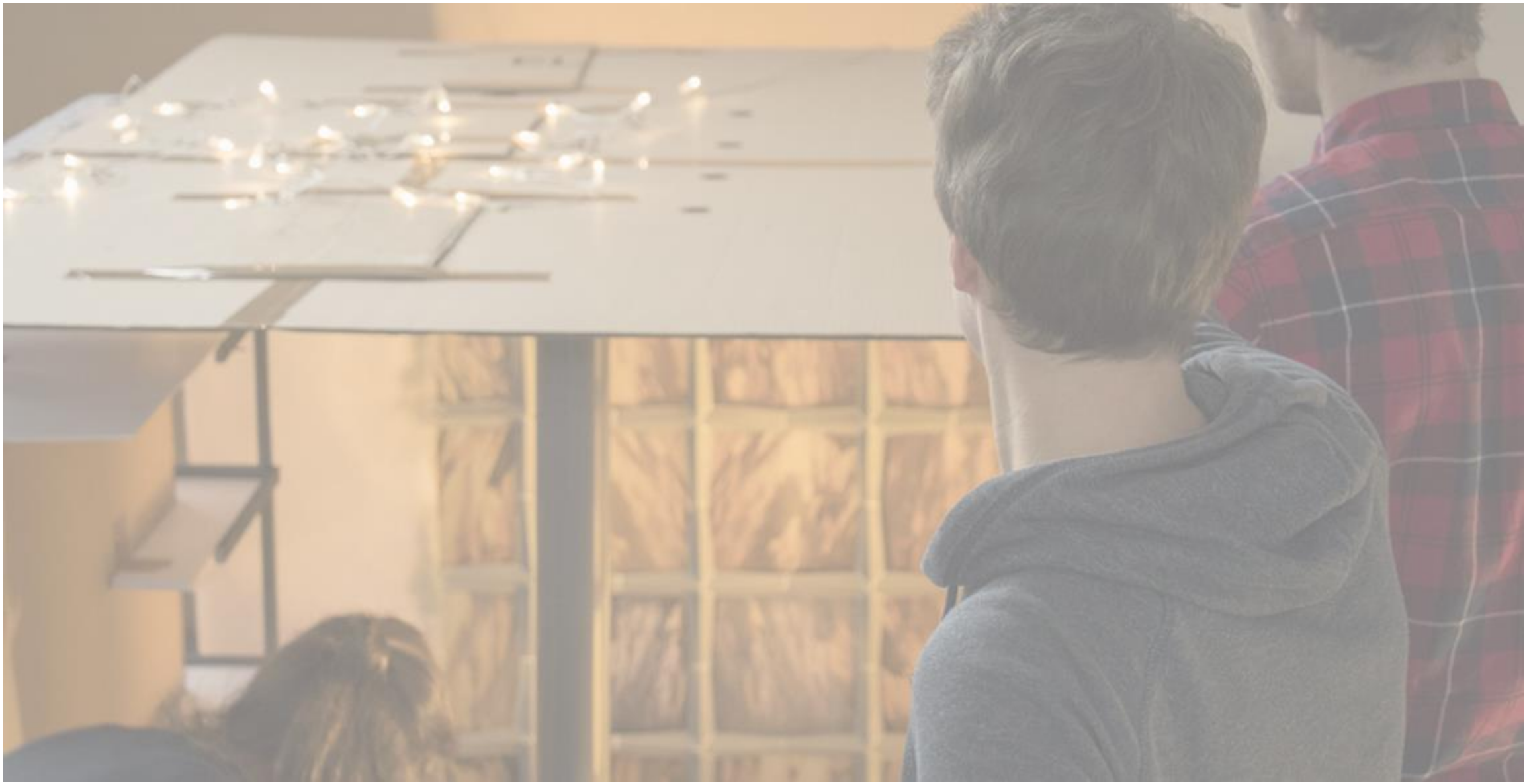
```
root@dnsserver:~# nslookup dhcp.labnet.local
Server: 192.168.1.2
Address: 192.168.1.2#53


Name: dhcp.labnet.local
Address: 192.168.1.1
```

```
root@dnsserver:~# nslookup 192.168.1.1
1.1.168.192.in-addr.arpa name = dhcp.labnet.local.
```

Resource

- https://ubuntu.com/server/docs/domain-name-service-dns



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