

CS3530 Networking Hands-on: VM Hosts, Linux Bridge, and Static Networking

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Objective and Contents

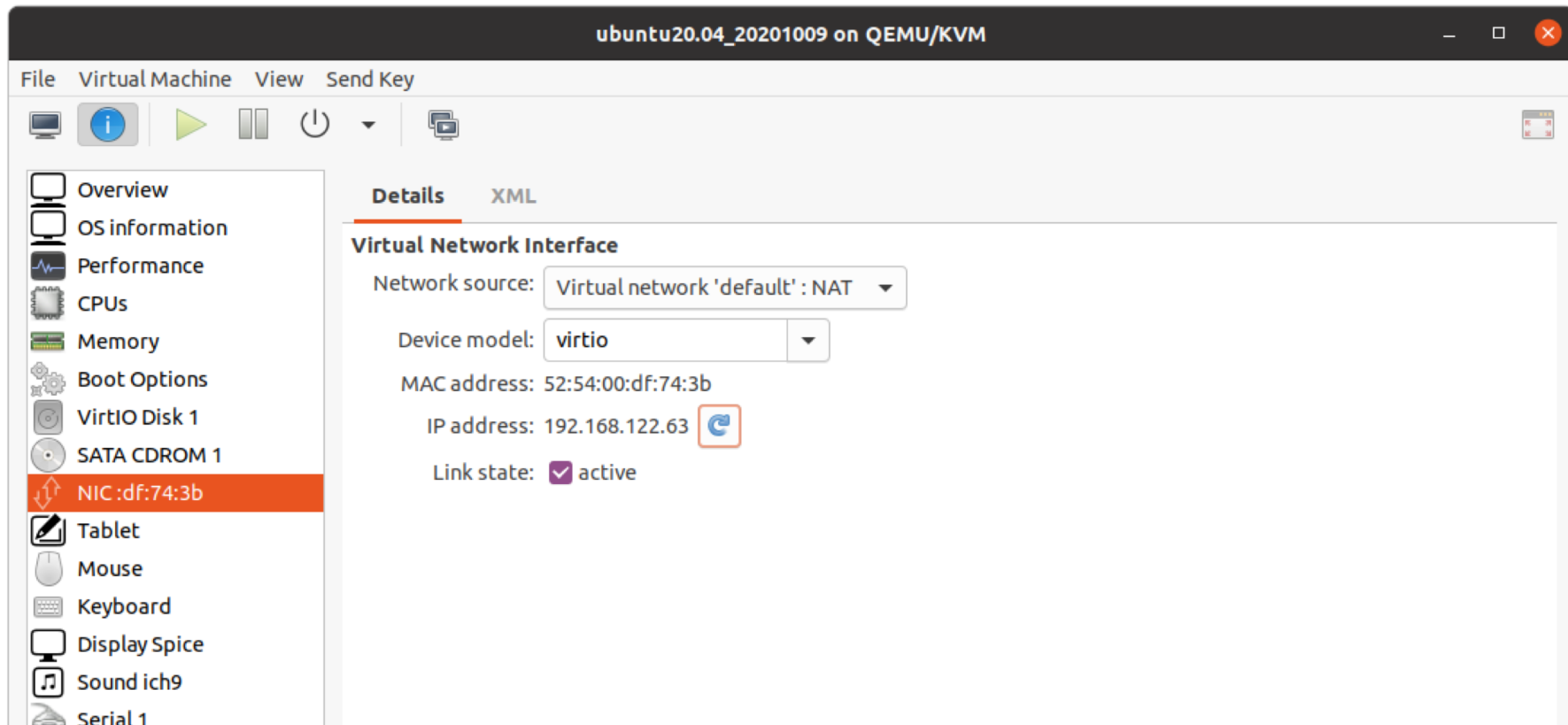
- Objective
 - Getting used to the hands-on using VM hosts and Linux Bridge
 - Practically understanding the basic network configuration on Linux
- Contents
 - Configuring network on and between the 2 VM instances
 - Checking connectivity between the 2 VM instances

Useful Links

- Network Configuration
 - <https://ubuntu.com/server/docs/network-configuration>

Checking the network configuration of a VM (1/2)

- GUI based information on virt-manager



Checking the network configuration of a VM (2/2)

- A Linux command on the VM itself

`ip addr show`



The screenshot shows a QEMU/KVM window titled "ubuntu20.04_20201009 on QEMU/KVM". The window has a menu bar with "File", "Virtual Machine", "View", and "Send Key". Below the menu bar is a toolbar with icons for power, reset, and other VM controls. The main area is a terminal window with a black background and white text. The terminal shows the command `ip addr show` being executed, and the output is as follows:

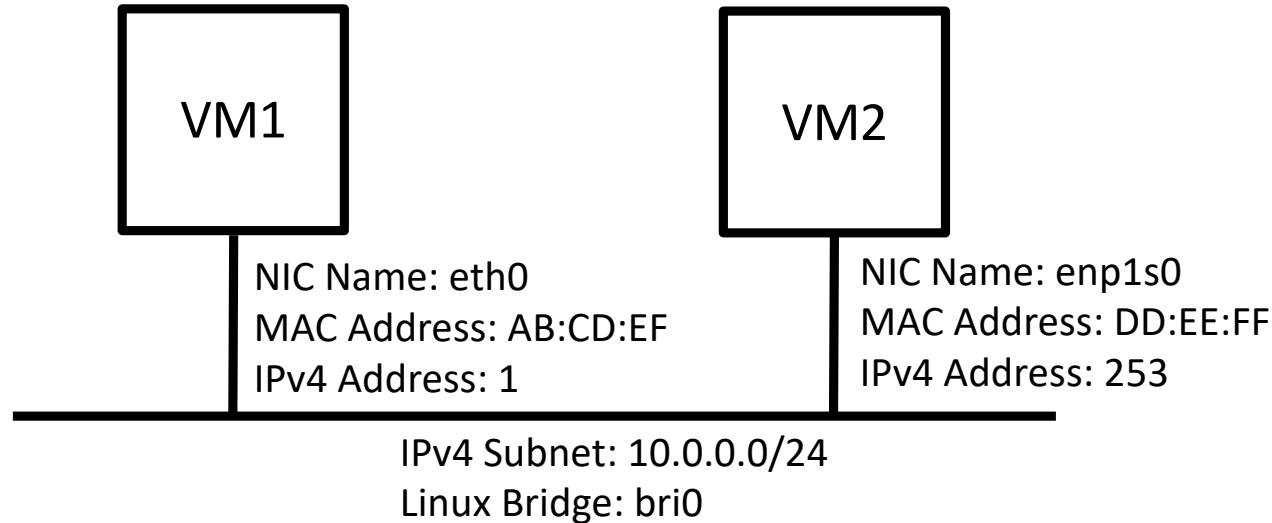
```
kotaro@server1:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp1s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 52:54:00:df:74:3b brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.253/24 brd 10.0.0.255 scope global enp1s0
        valid_lft forever preferred_lft forever
    inet 192.168.122.63/24 brd 192.168.122.255 scope global dynamic enp1s0
        valid_lft 3581sec preferred_lft 3581sec
    inet6 fe80::5054:ff:fedf:743b/64 scope link
        valid_lft forever preferred_lft forever
kotaro@server1:~$
```

Steps

- Configuring Linux Bridge on your Ubuntu Desktop
- Configuring network on virt-manager and Ubuntu Servers
- Checking and benchmarking network connectivity between Ubuntu Servers

The Network Diagram

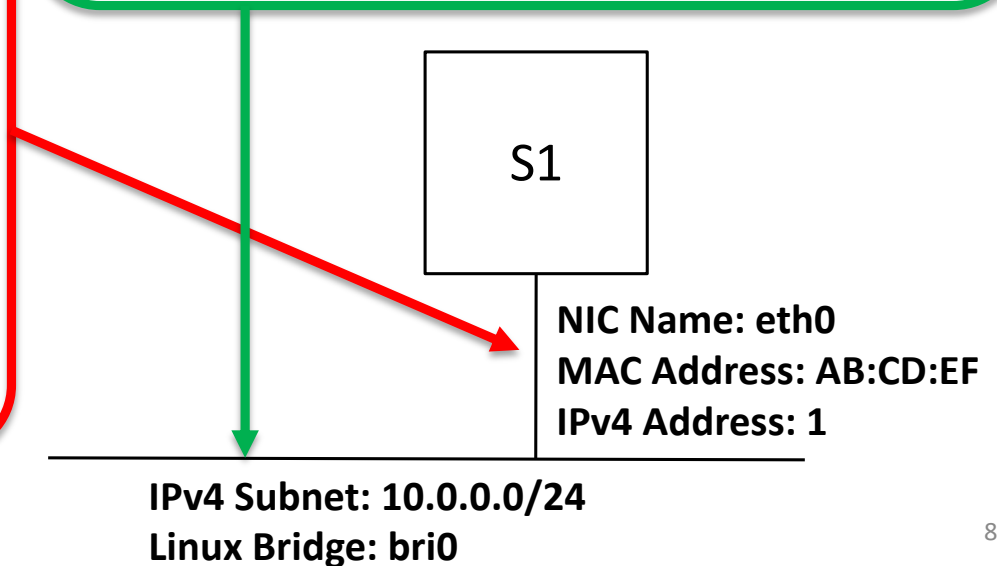
- Connect Two VMs, S1 and S2, using Linux Bridge
 - VMs are implemented using Ubuntu Server LTS 20.04
 - Networking between S1 and S2 is done in a step-by-step manner



How to read a network diagram?

- NIC Name
 - Name of NIC recognized by OS
 - Can be “eth0”, “enp1s0”, etc.
 - “eth0” may be widely known.
- MAC Address
 - MAC (Ethernet) Address of NIC
 - Last 6 HEX Characters are recommended to note down for consistency with virt-manager
- IPv4 Address
 - IPv4 address given to NIC
 - Together with Subnet IP address, IPv4 Address for eth0 should be 10.0.0.1
 - Can be the static number given by you, or the dynamic number assigned using DHCP
 - In case of “static”, the host part should be enough expecting that IPv4 Subnet is mentioned properly. Otherwise, should be “DHCP”

- IPv4 Subnet
 - The network address with subnet mask which will be operated using a Linux Bridge
- Linux Bridge
 - The name of linux bridge that each NIC of the VMs should attach through KVM setting
 - **Linux Bridge itself does not take a subnet configuration**



Creating a Virtual Network for VM-to-VM Communication using Linux Bridge

- Creating a Linux bridge interface on Host Ubuntu

```
sudo brctl addbr bri0
```

- Making the interface up and running

```
sudo ip link set bri0 up
```

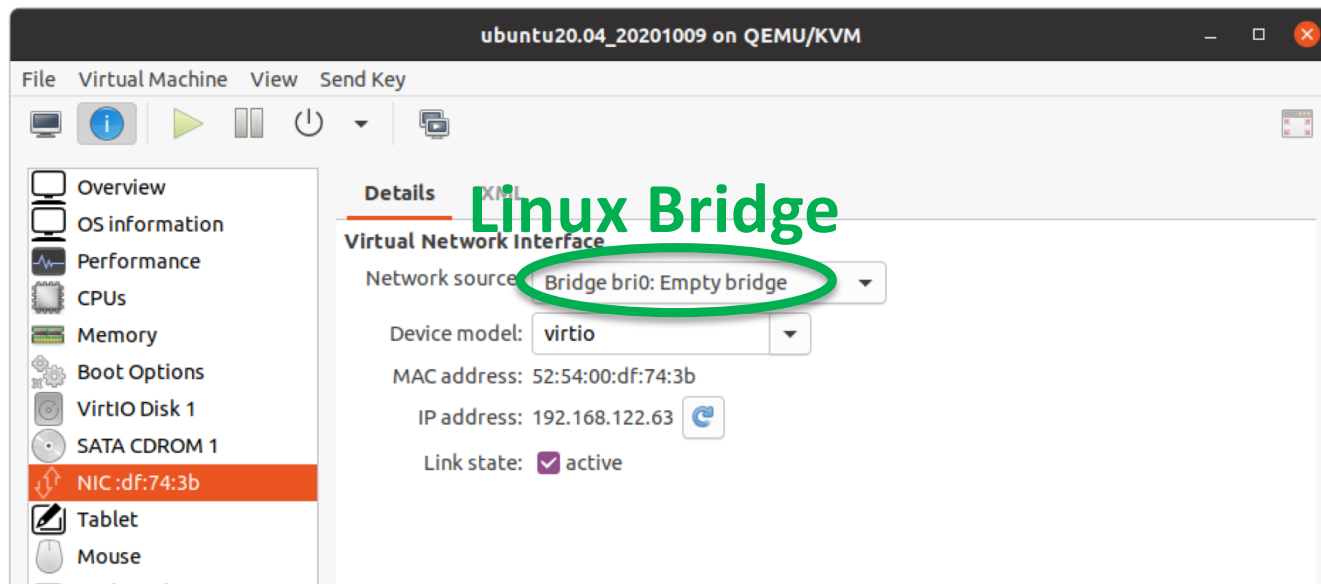
- Linux Bridge can be operated as a NIC

```
ip addr show bri0
```

- Analogy: You unpacked a switching hub and switched it on. However, your VM is not connected to the switch.
- Very important points
 - Don't configure DHCP or a static IP address to a Linux bridge if not needed
 - If an IP address is configured, Ubuntu host (your laptop) will use the IP address
 - Sometimes your laptop may get a trouble

Attaching a NIC of a VM to the Linux bridge on virt-manager

- Analogy: attaching a LAN cable between VM and a switching hub.



Important tips to avoid confusion

- The mapping among “NIC Name”, “MAC Address” and “Linux Bridge” is important to avoid confusion of which NIC to join which network on “virt-manager”
- “virt-manager” does not recognize “NIC Name”. You need to specify which “MAC address” connects which “Linux Bridge”.

The image shows a virt-manager window for an Ubuntu 20.04 VM and a terminal window on the VM. Annotations highlight the mapping between the NIC name, MAC address, and Linux bridge.

virt-manager Details:

- Linux Bridge:** Bridge bri0: Empty bridge (circled in green)
- MAC Address:** 52:54:00:df:74:3b (circled in red)
- NIC Name:** NIC:df:74:3b (circled in red)

Terminal Output (kotaro@server1):

```
ip addr show enp1s0
2: enp1s0: < BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gr
link/ether 52:54:00:df:74:3b brd ff:ff:ff:ff:ff:ff
inet 10.0.0.253/24 brd 10.0.0.255 scope global enp1s0
valid_lft forever preferred_lft forever
inet6 fe80::5054:ff:fedf:743b/64 scope link
valid_lft forever preferred_lft forever
```

Annotations in the terminal:

- NIC Name:** enp1s0 (circled in blue)
- MAC Address:** 52:54:00:df:74:3b (circled in red)

A blue dashed arrow points from the NIC name 'enp1s0' in the terminal to the 'NIC:df:74:3b' entry in the virt-manager details. A red dashed arrow points from the MAC address '52:54:00:df:74:3b' in the terminal to the 'MAC address: 52:54:00:df:74:3b' entry in the virt-manager details.

Manual (Static) IP Address Configuration on Ubuntu Server 20.04 LTS

- Temporary Configuration (Ex: Configure 10.0.0.1/24 to eth0)

```
sudo ip addr add 10.0.0.254/24 dev eth0
```

- Give the IP address to
- Checking the

Manual (Static) IP Address Configuration on Ubuntu Server 20.04 LTS

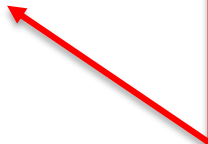
- Permanent Configuration

- Create and edit a script

```
sudo vi /etc/netplan/99_config.yaml
```

- Execute the script

```
sudo netplan apply
```



```
network:
  version: 2
  renderer: networkd
  ethernets:
    enp1s0:
      addresses:
        - 10.0.0.253/24
      gateway4: 10.0.0.254
      nameservers:
        search: [mydomain]
        addresses: [8.8.8.8]
```

Once you give an IP address to the VMs

- Let's Check the connectivity and performance
- Run ping and iperf on VMs.
- If you do not know the usage of ping and iperf, use "man" command to figure it out, and study what these commands do.
- To be announced as an assignment!!

Done!!