UNIVERSITÉ
DE REIMS
CHAMPAGNE-ARDENNE

Bridge

PRACTICAL WORK 4

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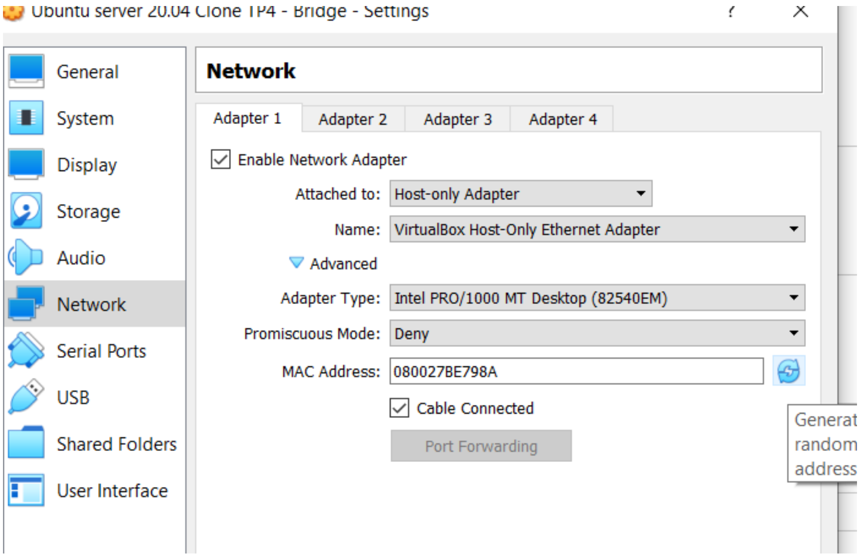


Network

☑ Enable Network Adapter

Attached to: Host-only Adapter

Name: VirtualBox Host-Only Ethernet Adapter

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

MAC Address: 080027BE798A

☑ Cable Connected

  - NAT
- Check if all QEMU & LXC packages are installed
- Check the QEMU Alpine VM
- Create rebase for each Alpine VM needed & checked the installation of all packages required

Since now the Ubuntu VM is considered as the host !

II. Starting with Bridges

In this first part on networking configuration, all bridges will be created at launch. So, all bridges definitions must be included in *netplan* configuration

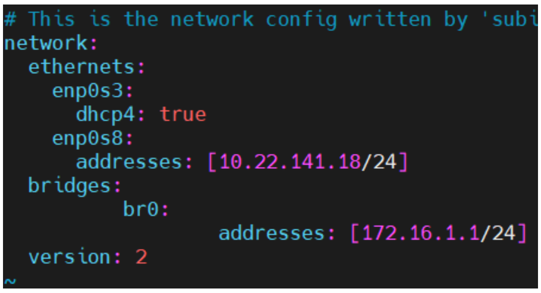
0. Configuration private bridge

In this part, all host connected to this configuration must have an fixed IP address. The IP addressing is up to you!

➔ Sudo apt-get install bridge-utils

1. Question 1 : Start up bridge configuration & plug in the (host only) interface

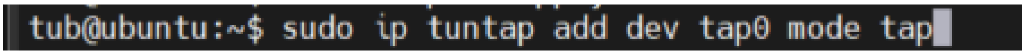
- Editing /etc/netplan/"…".yaml



```
# This is the network config written by 'subi
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      addresses: [10.22.141.18/24]
  bridges:
          br0:
                  addresses: [172.16.1.1/24]
  version: 2
~
```

2. Question 2: Connection between Bridges and Alpine Linux VMTs using TAPs

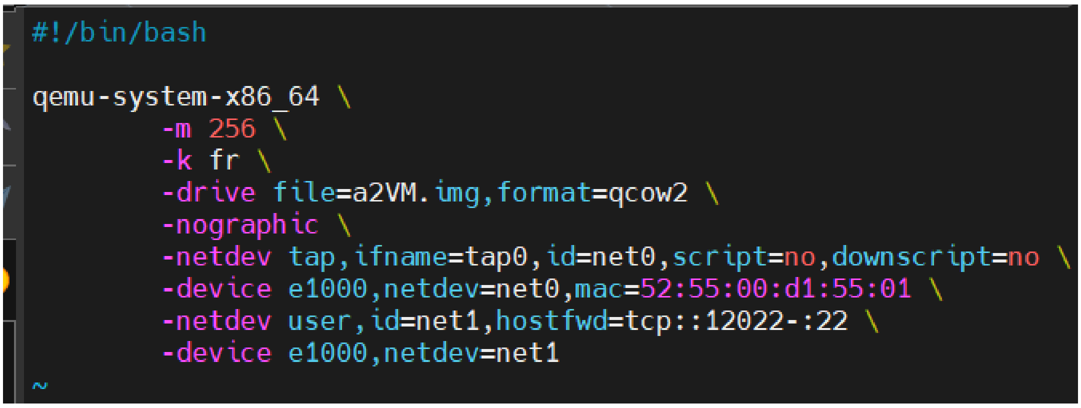
Create TAP (tap0 & tap1) interfaces:



```
tub@ubuntu:~$ sudo ip tuntap add dev tap0 mode tap
```

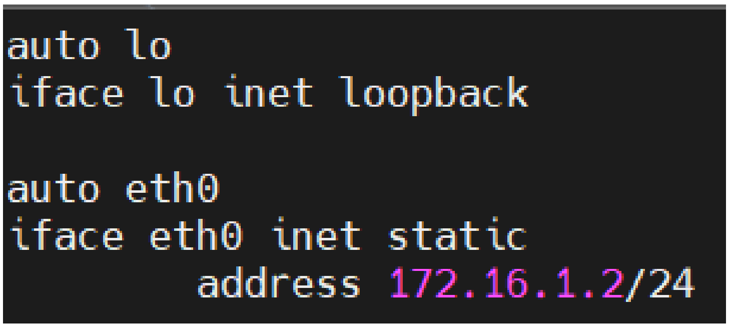
Forwarding ports between host and SSH VMs & Building tap back end network

- VM2:



```
#!/bin/bash

qemu-system-x86_64 \
        -m 256 \
        -k fr \
        -drive file=a2VM.img,format=qcow2 \
        -nographic \
        -netdev tap,ifname=tap0,id=net0,script=no,downscript=no \
        -device e1000,netdev=net0,mac=52:55:00:d1:55:01 \
        -netdev user,id=net1,hostfwd=tcp::12022-:22 \
        -device e1000,netdev=net1
~
```

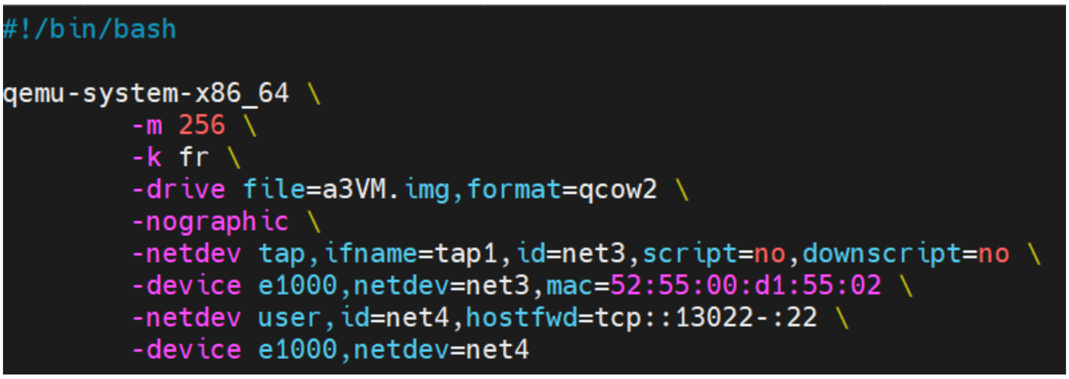
➔ sudo vi /etc/network/interfaces



```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
        address 172.16.1.2/24
```

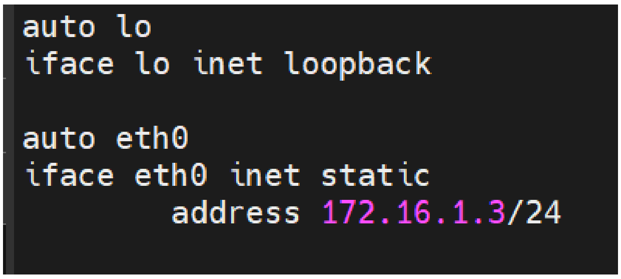
➔ sudo service networking restart

- VM3:



```
#!/bin/bash

qemu-system-x86_64 \
        -m 256 \
        -k fr \
        -drive file=a3VM.img,format=qcow2 \
        -nographic \
        -netdev tap,ifname=tap1,id=net3,script=no,downscript=no \
        -device e1000,netdev=net3,mac=52:55:00:d1:55:02 \
        -netdev user,id=net4,hostfwd=tcp::13022-:22 \
        -device e1000,netdev=net4
```

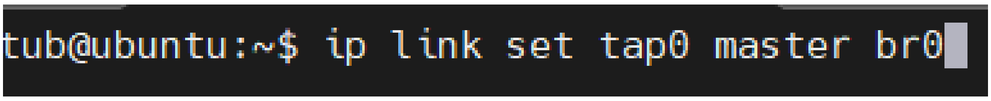
- ➔ sudo vi /etc/network/interfaces



```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
        address 172.16.1.3/24
```

- ➔ sudo service networking restart

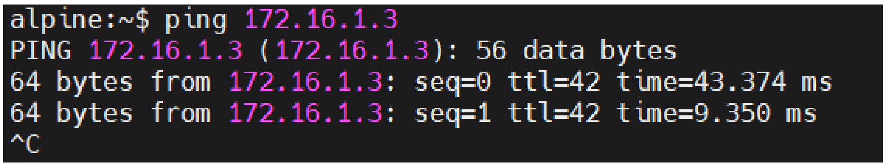
Add TAP interfaces to the bridge:



```
tub@ubuntu:~$ ip link set tap0 master br0
```

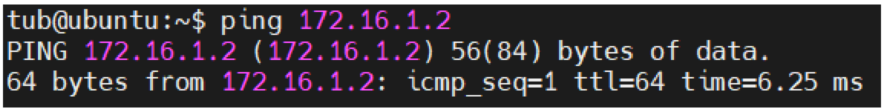
III. Test ping

- ➔ Between guests



```
alpine:~$ ping 172.16.1.3
PING 172.16.1.3 (172.16.1.3): 56 data bytes
64 bytes from 172.16.1.3: seq=0 ttl=42 time=43.374 ms
64 bytes from 172.16.1.3: seq=1 ttl=42 time=9.350 ms
^C
```

- ➔ Between host & guest



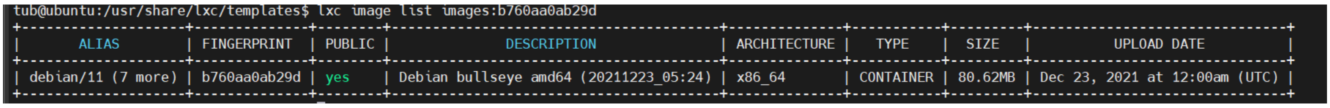
```
tub@ubuntu:~$ ping 172.16.1.2
PING 172.16.1.2 (172.16.1.2) 56(84) bytes of data.
64 bytes from 172.16.1.2: icmp_seq=1 ttl=64 time=6.25 ms
```

IV. Starting with containers

3. Install LXC containers

- ➔ sudo apt-get install lxc lxctl
- ➔ lxd init

- ➔ lxc remote list
- ➔ sudo apt-get instal lxc-templates
- ➔ lxc image list images:debian
- ➔ lxc image list images:debian/11
- ➔ lxc image list images: b760aa0ab29d



```
tub@ubuntu:/usr/share/lxc/templates$ lxc image list images:b760aa0ab29d
+--------------------+--------------+--------+----------------------------------------+--------------+-----------+---------+-------------------------------+
|       ALIAS        | FINGERPRINT  | PUBLIC |              DESCRIPTION               | ARCHITECTURE |   TYPE    |  SIZE   |          UPLOAD DATE          |
+--------------------+--------------+--------+----------------------------------------+--------------+-----------+---------+-------------------------------+
| debian/11 (7 more) | b760aa0ab29d | yes    | Debian bullseye amd64 (20211223_05:24) | x86_64       | CONTAINER | 80.62MB | Dec 23, 2021 at 12:00am (UTC) |
+--------------------+--------------+--------+----------------------------------------+--------------+-----------+---------+-------------------------------+
```

…

…

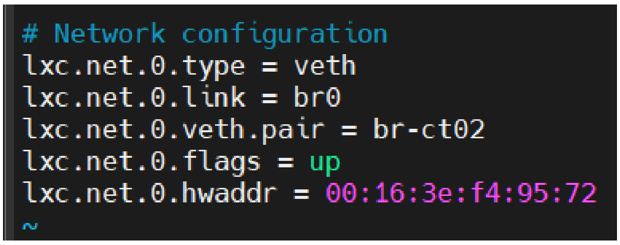
…

- ➔ sudo lxc-create -n ctn02 -t ubuntu
- ➔ sudo lxc-create -n ctn03 -t ubuntu

4. Container network configuration

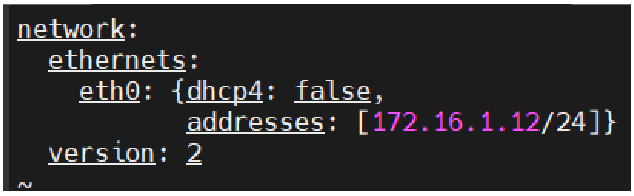
CTN02 on host:

- ➔ sudo vi /var/lib/lxc/containerName/config



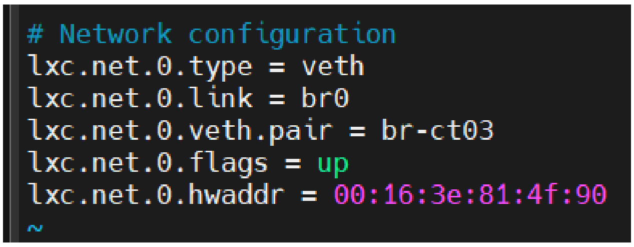
```
# Network configuration
lxc.net.0.type = veth
lxc.net.0.link = br0
lxc.net.0.veth.pair = br-ct02
lxc.net.0.flags = up
lxc.net.0.hwaddr = 00:16:3e:f4:95:72
~
```

CTN02 on guest:



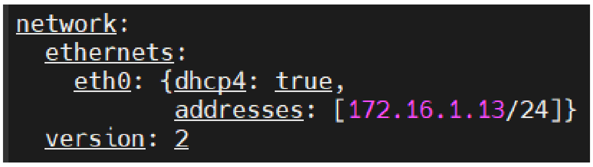
```
network:
  ethernets:
    eth0: {dhcp4: false,
           addresses: [172.16.1.12/24]}
  version: 2
~
```

CTN03 on host:



```
# Network configuration
lxc.net.0.type = veth
lxc.net.0.link = br0
lxc.net.0.veth.pair = br-ct03
lxc.net.0.flags = up
lxc.net.0.hwaddr = 00:16:3e:81:4f:90
~
```

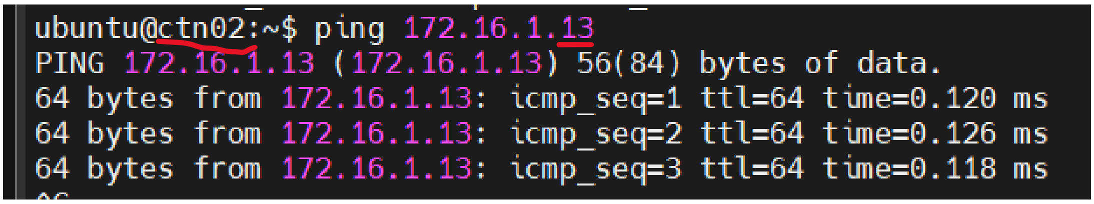
CTN03 on guest:



```
network:
  ethernets:
    eth0: {dhcp4: true,
           addresses: [172.16.1.13/24]}
  version: 2
```

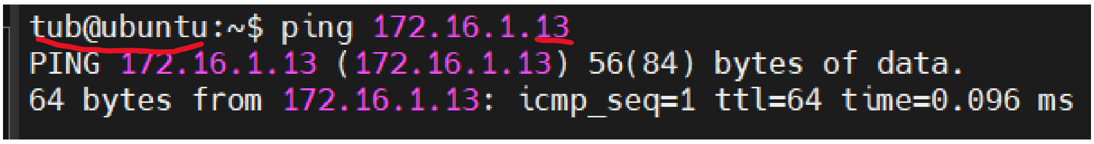
V. Test ping

- ➔ Between guests



```
ubuntu@ctn02:~$ ping 172.16.1.13
PING 172.16.1.13 (172.16.1.13) 56(84) bytes of data.
64 bytes from 172.16.1.13: icmp_seq=1 ttl=64 time=0.120 ms
64 bytes from 172.16.1.13: icmp_seq=2 ttl=64 time=0.126 ms
64 bytes from 172.16.1.13: icmp_seq=3 ttl=64 time=0.118 ms
```

- ➔ Between host & guest



```
tub@ubuntu:~$ ping 172.16.1.13
PING 172.16.1.13 (172.16.1.13) 56(84) bytes of data.
64 bytes from 172.16.1.13: icmp_seq=1 ttl=64 time=0.096 ms
```

VI. Ping between VMs & containers

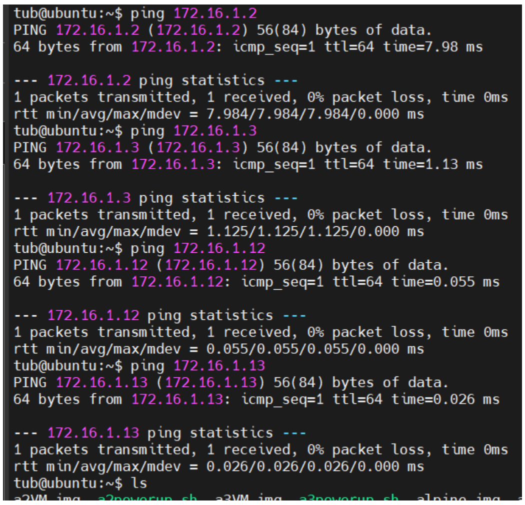
5. Starting up VMs

- ➔ sudo ip tuntap add dev tap0 mode tap
- ➔ sudo ip tuntap add dev tap1 mode tap
- ➔ sudo ./a2powerup.sh
- ➔ sudo ./a3powerup.sh
- ➔ sudo ip link set dev tap0 master br0
- ➔ sudo ip link set dev tap1 master br0
- ➔ sudo ip link set dev tap0 up
- ➔ sudo ip link set dev tap0 up

6. Starting up containers

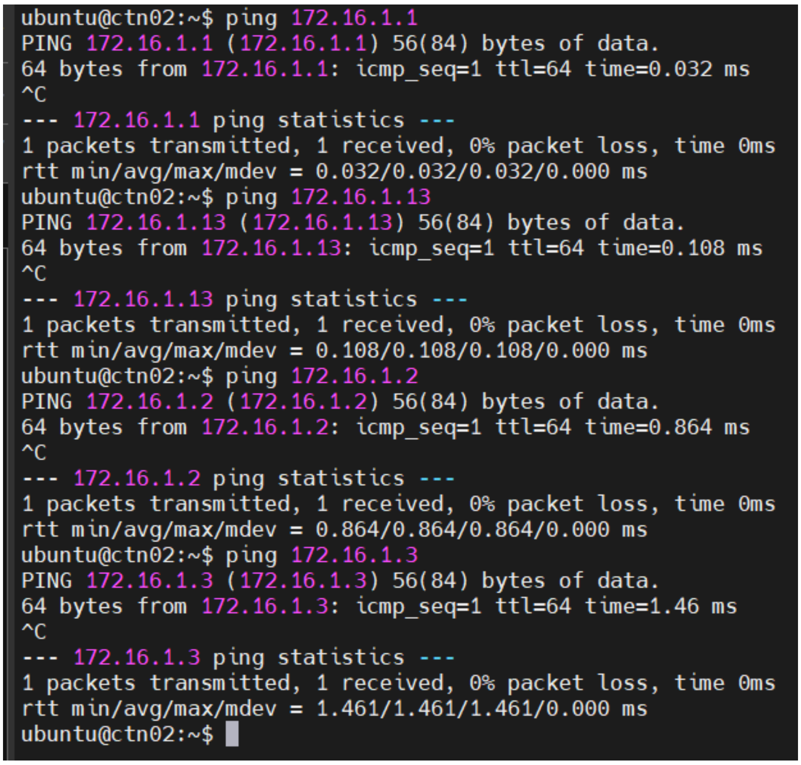
- ➔ sudo lxc-start -n ctn02
- ➔ sudo lxc-console -n ctn02
- ➔ sudo lxc-start -n ctn03
- ➔ sudo lxc-console -n ctn03

7. Test between host and all guests



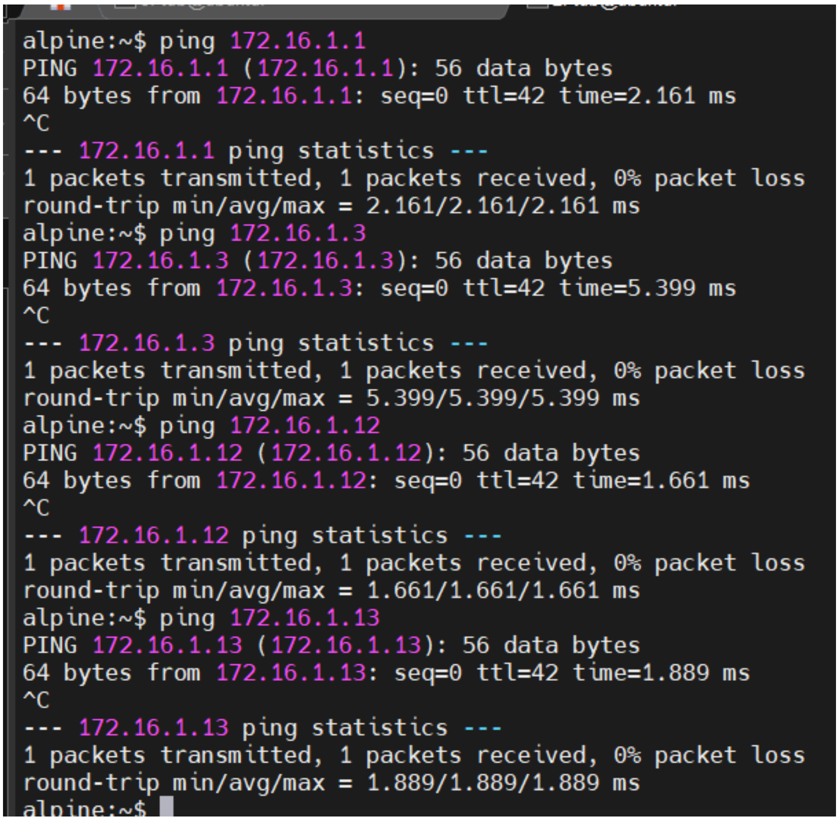
```
tub@ubuntu:~$ ping 172.16.1.2
PING 172.16.1.2 (172.16.1.2) 56(84) bytes of data.
64 bytes from 172.16.1.2: icmp_seq=1 ttl=64 time=7.98 ms

--- 172.16.1.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 7.984/7.984/7.984/0.000 ms
tub@ubuntu:~$ ping 172.16.1.3
PING 172.16.1.3 (172.16.1.3) 56(84) bytes of data.
64 bytes from 172.16.1.3: icmp_seq=1 ttl=64 time=1.13 ms

--- 172.16.1.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.125/1.125/1.125/0.000 ms
tub@ubuntu:~$ ping 172.16.1.12
PING 172.16.1.12 (172.16.1.12) 56(84) bytes of data.
64 bytes from 172.16.1.12: icmp_seq=1 ttl=64 time=0.055 ms

--- 172.16.1.12 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.055/0.055/0.055/0.000 ms
tub@ubuntu:~$ ping 172.16.1.13
PING 172.16.1.13 (172.16.1.13) 56(84) bytes of data.
64 bytes from 172.16.1.13: icmp_seq=1 ttl=64 time=0.026 ms

--- 172.16.1.13 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.026/0.026/0.026/0.000 ms
tub@ubuntu:~$ ls
a2VM.img  a2powerup.sh  a3VM.img  a3powerup.sh  alpine.img
```

8. Test between CTN02 and host and other guests



```
ubuntu@ctn02:~$ ping 172.16.1.1
PING 172.16.1.1 (172.16.1.1) 56(84) bytes of data.
64 bytes from 172.16.1.1: icmp_seq=1 ttl=64 time=0.032 ms
^C
--- 172.16.1.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.032/0.032/0.032/0.000 ms
ubuntu@ctn02:~$ ping 172.16.1.13
PING 172.16.1.13 (172.16.1.13) 56(84) bytes of data.
64 bytes from 172.16.1.13: icmp_seq=1 ttl=64 time=0.108 ms
^C
--- 172.16.1.13 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.108/0.108/0.108/0.000 ms
ubuntu@ctn02:~$ ping 172.16.1.2
PING 172.16.1.2 (172.16.1.2) 56(84) bytes of data.
64 bytes from 172.16.1.2: icmp_seq=1 ttl=64 time=0.864 ms
^C
--- 172.16.1.2 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.864/0.864/0.864/0.000 ms
ubuntu@ctn02:~$ ping 172.16.1.3
PING 172.16.1.3 (172.16.1.3) 56(84) bytes of data.
64 bytes from 172.16.1.3: icmp_seq=1 ttl=64 time=1.46 ms
^C
--- 172.16.1.3 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.461/1.461/1.461/0.000 ms
ubuntu@ctn02:~$
```

9. Test VM2 host and other guests



```
alpine:~$ ping 172.16.1.1
PING 172.16.1.1 (172.16.1.1): 56 data bytes
64 bytes from 172.16.1.1: seq=0 ttl=42 time=2.161 ms
^C
--- 172.16.1.1 ping statistics ---
1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 2.161/2.161/2.161 ms
alpine:~$ ping 172.16.1.3
PING 172.16.1.3 (172.16.1.3): 56 data bytes
64 bytes from 172.16.1.3: seq=0 ttl=42 time=5.399 ms
^C
--- 172.16.1.3 ping statistics ---
1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 5.399/5.399/5.399 ms
alpine:~$ ping 172.16.1.12
PING 172.16.1.12 (172.16.1.12): 56 data bytes
64 bytes from 172.16.1.12: seq=0 ttl=42 time=1.661 ms
^C
--- 172.16.1.12 ping statistics ---
1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 1.661/1.661/1.661 ms
alpine:~$ ping 172.16.1.13
PING 172.16.1.13 (172.16.1.13): 56 data bytes
64 bytes from 172.16.1.13: seq=0 ttl=42 time=1.889 ms
^C
--- 172.16.1.13 ping statistics ---
1 packets transmitted, 1 packets received, 0% packet loss
round-trip min/avg/max = 1.889/1.889/1.889 ms
alpine:~$
```

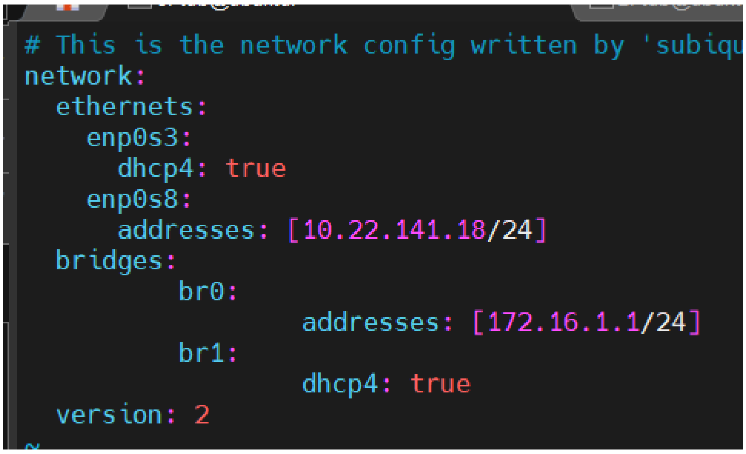
VII. Public bridge

10. Starting up VMs connected to br0

- ➔ sudo ./a2powerup.sh
- ➔ sudo ./a3powerup.sh

11. Create a public bridge br1 connected to public interface on the host

- ➔ sudo vi /etc/netplan/...yaml

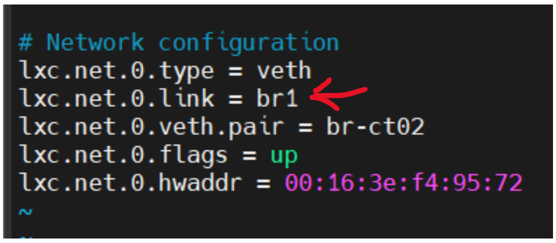


```
# This is the network config written by 'subiqu
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      addresses: [10.22.141.18/24]
  bridges:
          br0:
                  addresses: [172.16.1.1/24]
          br1:
                  dhcp4: true
  version: 2
```

- ➔ sudo ip link set dev enp0s3 master br1

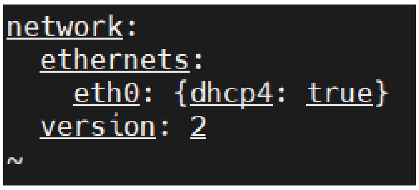
12. Starting up containers connected to br1

- ➔ sudo vi /var/lib/lxc/ctn02/config

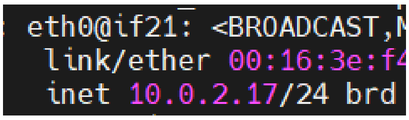


```
# Network configuration
lxc.net.0.type = veth
lxc.net.0.link = br1
lxc.net.0.veth.pair = br-ct02
lxc.net.0.flags = up
lxc.net.0.hwaddr = 00:16:3e:f4:95:72
~
```

- ➔ sudo lxc-start -n ctn02
- ➔ sudo lxc-console -n ctn02
- ➔ sudo vi /etc/netplan/...yaml

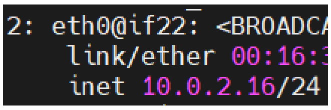


```
network:
  ethernets:
    eth0: {dhcp4: true}
  version: 2
~
```



```
: eth0@if21: <BROADCAST,M
   link/ether 00:16:3e:f4
   inet 10.0.2.17/24 brd
```

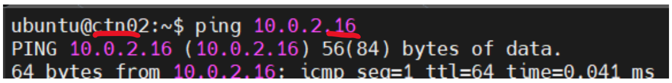
- ➔ Repeat the same commands for the CTN03



```
2: eth0@if22: <BROADCA
    link/ether 00:16:3
    inet 10.0.2.16/24
```

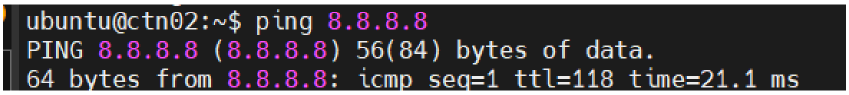
VIII. Test ping

13. Between guests



```
ubuntu@ctn02:~$ ping 10.0.2.16
PING 10.0.2.16 (10.0.2.16) 56(84) bytes of data.
64 bytes from 10.0.2.16: icmp_seq=1 ttl=64 time=0.041 ms
```

14. Outside network



```
ubuntu@ctn02:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=118 time=21.1 ms
```

15. Between host and guest

- ➔ Host unreachable
- ➔ Guest unreachable

IX. NAT

X. Appendix

16. Delete screen

- ➔ screen -X -S ID quit

17. Start new screen

- ➔ screen -S nameScreen

18. Attach running session

- ➔ screen -r nameScreen

19. Detach

- ➔ screen -d / C-a d

20. Create a windows

- ➔ C-a c

21. Change windows

- ➔ C-a number

22. List windows

➔ C-a “

23. Show window bar

➔ C-a w

24. Kill current window

➔ C-a k

25. Kill all window

➔ C-a \

26. Rename window

➔ C-a A

27. Split horizontally

➔ C-a S

28. Split vertically

➔ C-a |

29. Jump between win

➔ C-a Tab