LXC Container

PRACTICAL WORK 2

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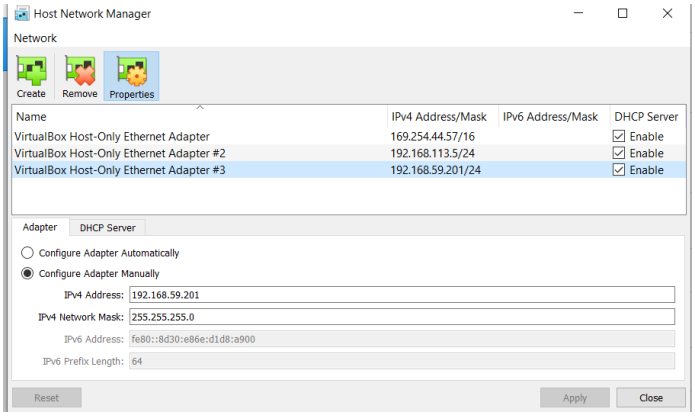
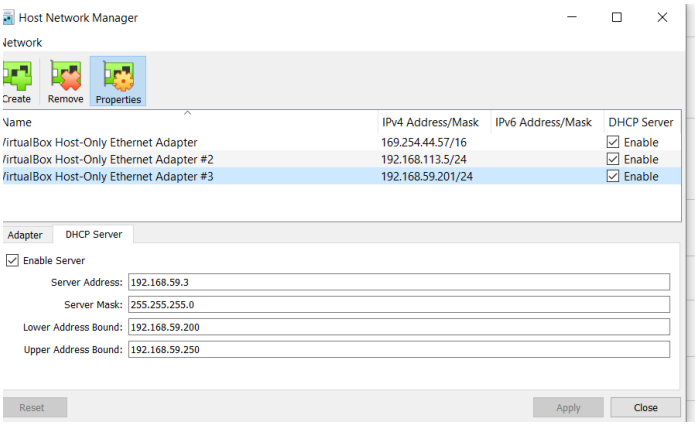
Table of Contents

I. Basic configuration

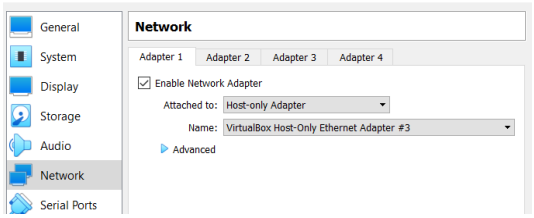
1. Network

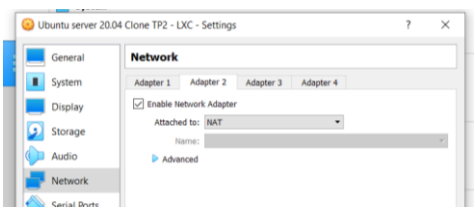
- Clone the Ubuntu VM from the first practical work
- Configure 2 network interfaces
    - Host only network with DHCP (VirtualBox Host-Only Ethernet Adapter #3)
        - address: 192.168.59.3/24
        - Range 200 – 250



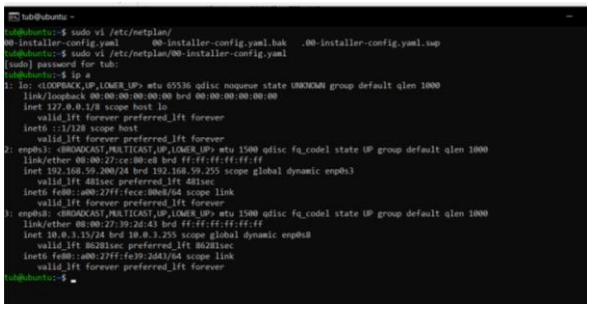


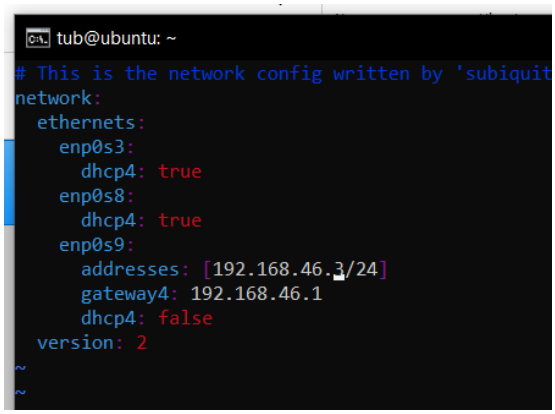
- NAT with DHCP





- ssh connection between host and guest : 192.168.59.200





2. LXC packages installation

➔ sudo apt-get install lxc lxctl

II. First container

Since now, we consider that the Ubuntu VM is the host machine

3. LXD init

```
tub@ubuntu:~$ sudo lxc list
If this is your first time running LXD on this machine, you should also run: lxd init
To start your first instance, try: lxc launch ubuntu:20.04

+------+-------+------+------+------+-----------+
| NAME | STATE | IPV4 | IPV6 | TYPE | SNAPSHOTS |
+------+-------+------+------+------+-----------+
tub@ubuntu:~$ lxd init
Would you like to use LXD clustering? (yes/no) [default=no]: no
Do you want to configure a new storage pool? (yes/no) [default=yes]: yes
Name of the new storage pool [default=default]: default
Name of the storage backend to use (ceph, btrfs, dir, lvm, zfs) [default=zfs]: zfs
Create a new ZFS pool? (yes/no) [default=yes]:
Would you like to use an existing empty block device (e.g. a disk or partition)? (yes/no) [default=no
Size in GB of the new loop device (1GB minimum) [default=5GB]:
Would you like to connect to a MAAS server? (yes/no) [default=no]:
Would you like to create a new local network bridge? (yes/no) [default=yes]:
What should the new bridge be called? [default=lxdbr0]:
What IPv4 address should be used? (CIDR subnet notation, “auto” or “none”) [default=auto]:
What IPv6 address should be used? (CIDR subnet notation, “auto” or “none”) [default=auto]:
Would you like the LXD server to be available over the network? (yes/no) [default=no]:
Would you like stale cached images to be updated automatically? (yes/no) [default=yes]
Would you like a YAML "lxd init" preseed to be printed? (yes/no) [default=no]:
tub@ubuntu:~$ lxd init
Would you like to use LXD clustering? (yes/no) [default=no]:
```

4. Stop & delete containers launched with “launch command”

```
+---------------+---------+
|     NAME      |  STATE  |
+---------------+---------+
| literate-drum | RUNNING |
+---------------+---------+
tub@ubuntu:~$ sudo lxc stop literate-drum
tub@ubuntu:~$ sudo lxc list -cns
+---------------+---------+
|     NAME      |  STATE  |
+---------------+---------+
| literate-drum | STOPPED |
+---------------+---------+
tub@ubuntu:~$ sudo lxc delete literate-drum
tub@ubuntu:~$ sudo lxc list -cns
+------+-------+
| NAME | STATE |
+------+-------+
tub@ubuntu:~$ sudo lxc list
+------+-------+------+------+------+-----------+
| NAME | STATE | IPV4 | IPV6 | TYPE | SNAPSHOTS |
+------+-------+------+------+------+-----------+
```

5. Check remote list

```
tub@ubuntu:/usr/share/lxc/templates$ lxc remote list
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
|      NAME       |                   URL                   |   PROTOCOL    |  AUTH TYPE  | PUBLIC | STATIC |
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
| images          | https://images.linuxcontainers.org      | simplestreams | none        | YES    | NO     |
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
| local (current) | unix://                                 | lxd           | file access | NO     | YES    |
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
| ubuntu          | https://cloud-images.ubuntu.com/releases | simplestreams | none        | YES    | YES    |
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
| ubuntu-daily    | https://cloud-images.ubuntu.com/daily   | simplestreams | none        | YES    | YES    |
+-----------------+-----------------------------------------+---------------+-------------+--------+--------+
tub@ubuntu:/usr/share/lxc/templates$
```

6. Download LXC templates

```
tub@ubuntu:~$ sudo apt-get install lxc-templates
```

7. Search Ubuntu images

```
tub@ubuntu:~$ lxc image list ubuntu:20.04
+--------------+--------------+--------+-------------------------------------+--------------+-----------------+----------+-------------------------------+
|    ALIAS     | FINGERPRINT  | PUBLIC |             DESCRIPTION             | ARCHITECTURE |      TYPE       |   SIZE   |          UPLOAD DATE          |
+--------------+--------------+--------+-------------------------------------+--------------+-----------------+----------+-------------------------------+
| arm64 (5 more) | 76f93244113d | yes    | ubuntu 20.04 LTS arm64 (release) (20211118) | aarch64      | VIRTUAL-MACHINE | 510.88MB | Nov 18, 2021 at 12:00am (UTC) |
| arm64 (5 more) | ed6764dcaa08 | yes    | ubuntu 20.04 LTS arm64 (release) (20211118) | aarch64      | CONTAINER       | 340.25MB | Nov 18, 2021 at 12:00am (UTC) |
| armhf (5 more) | 689180b0ff96 | yes    | ubuntu 20.04 LTS armhf (release) (20211118) | armv7l       | CONTAINER       | 313.20MB | Nov 18, 2021 at 12:00am (UTC) |
| armhf (5 more) | a3692967037b | yes    | ubuntu 20.04 LTS armhf (release) (20211118) | armv7l       | VIRTUAL-MACHINE | 819.31MB | Nov 18, 2021 at 12:00am (UTC) |
| f (11 more)    | 39bdbf191acd | yes    | ubuntu 20.04 LTS amd64 (release) (20211118) | x86_64       | CONTAINER       | 370.69MB | Nov 18, 2021 at 12:00am (UTC) |
| f (11 more)    | bdb3e3f468fc | yes    | ubuntu 20.04 LTS amd64 (release) (20211118) | x86_64       | VIRTUAL-MACHINE | 523.06MB | Nov 18, 2021 at 12:00am (UTC) |
| ppc64el (5 more) | 55e4914213f8 | yes    | ubuntu 20.04 LTS ppc64el (release) (20211118) | ppc64le      | CONTAINER       | 369.77MB | Nov 18, 2021 at 12:00am (UTC) |
| ppc64el (5 more) | 946d58f95903 | yes    | ubuntu 20.04 LTS ppc64el (release) (20211118) | ppc64le      | VIRTUAL-MACHINE | 548.56MB | Nov 18, 2021 at 12:00am (UTC) |
| s390x (5 more) | 5da2e3c94f33 | yes    | ubuntu 20.04 LTS s390x (release) (20211118) | s390x        | CONTAINER       | 337.61MB | Nov 18, 2021 at 12:00am (UTC) |
| s390x (5 more) | 7f7618d5beda | yes    | ubuntu 20.04 LTS s390x (release) (20211118) | s390x        | VIRTUAL-MACHINE | 478.38MB | Nov 18, 2021 at 12:00am (UTC) |
+--------------+--------------+--------+-------------------------------------+--------------+-----------------+----------+-------------------------------+
```

8. Download Ubuntu template & creation container

```
tub@ubuntu:~$ sudo lxc-create -n ctn01 -t ubuntu
```

9. Creation container Ubuntu

```
tub@ubuntu:~$ sudo lxc-create -n ctn01 -t ubuntu
Checking cache download in /var/cache/lxc/focal/rootfs-amd64 ...
Copy /var/cache/lxc/focal/rootfs-amd64 to /var/lib/lxc/ctn01/rootfs ...
Copying rootfs to /var/lib/lxc/ctn01/rootfs ...
Generating locales (this might take a while)...
  en_US.UTF-8... done
Generation complete.
Creating SSH2 RSA key; this may take some time ...
3072 SHA256:tPVNj7g0067Pjb/o8SZxhoXLT4tvfu20TKARw8lTDFs root@ubuntu (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:wSFphnrA459uId5nyjtowkrQmiEJzqSb3xFG/4rDsBI root@ubuntu (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:5lWau2yS3krPuBd0U6etuKqZ5RpBPwcosAp0NJrmsEw root@ubuntu (ED25519)
invoke-rc.d: could not determine current runlevel
invoke-rc.d: policy-rc.d denied execution of start.

Current default time zone: 'Etc/UTC'
Local time is now:      Thu Nov 25 15:43:01 UTC 2021.
Universal Time is now:  Thu Nov 25 15:43:01 UTC 2021.


##
# The default user is 'ubuntu' with password 'ubuntu'!
# Use the 'sudo' command to run tasks as root in the container.
##
```

10. Start container in background

```
ub@ubuntu:~$ sudo lxc-start -n ctn01 -d
```

11. Creation console *(by default: login: ubuntu, password: ubuntu / CTRL + a q)*

```
tub@ubuntu:~$ sudo lxc-console -n ctn01

Connected to tty 1
Type <Ctrl+a q> to exit the console, <Ctrl+a Ctrl+a> to enter Ctrl+a itself

Ubuntu 20.04.3 LTS ctn01 pts/0

ctn01 login: ubuntu
Password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.4.0-90-generic x86_64)

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

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.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ctn01:~$ ls
```

12. Get info about containers

Execution:

```
tub@ubuntu:~$ lxc-info -n ctn01
ctn01 doesn't exist
tub@ubuntu:~$ sudo lxc-info -n ctn01
Name:           ctn01
State:          RUNNING
PID:            33407
IP:             10.0.4.181
CPU use:        2.09 seconds
BlkIO use:      30.83 MiB
Memory use:     49.18 MiB
KMem use:       6.36 MiB
Link:           vethAa6FWB
 TX bytes:      1.86 KiB
 RX bytes:      2.02 KiB
 Total bytes:   3.88 KiB
```

State of the file system:

```
tub@ubuntu:/var/lib$ df
Filesystem                         1K-blocks    Used Available Use% Mounted on
udev                                  972560       0    972560   0% /dev
tmpfs                                 203548    1152    202396   1% /run
/dev/mapper/ubuntu--vg-ubuntu--lv   19475088 7929336  10533428  43% /
tmpfs                                1017728       0   1017728   0% /dev/shm
tmpfs                                   5120       0      5120   0% /run/lock
tmpfs                                1017728       0   1017728   0% /sys/fs/cgroup
/dev/loop2                             63360   63360         0 100% /snap/core20/1242
/dev/loop1                             63360   63360         0 100% /snap/core20/1169
/dev/loop0                             56832   56832         0 100% /snap/core18/2246
/dev/loop3                             56832   56832         0 100% /snap/core18/2253
/dev/loop4                             72064   72064         0 100% /snap/lxd/21029
/dev/loop5                             33280   33280         0 100% /snap/snapd/13640
/dev/loop6                             43264   43264         0 100% /snap/snapd/14066
/dev/loop7                             68864   68864         0 100% /snap/lxd/21835
/dev/sda2                             999320  108596    821912  12% /boot
tmpfs                                 203544       0    203544   0% /run/user/1000
tmpfs                                   1024       0      1024   0% /var/snap/lxd/common/ns
tub@ubuntu:/var/lib$
```

Location of guest's file system on the host (apt-get install tree):

```
tub@ubuntu:~$ sudo tree -d -L 3 /var/lib/lxc/
/var/lib/lxc/
└── ctn01
    └── rootfs
        ├── bin -> usr/bin
        ├── boot
        ├── dev
        ├── etc
        ├── home
        ├── lib -> usr/lib
        ├── lib32 -> usr/lib32
        ├── lib64 -> usr/lib64
        ├── libx32 -> usr/libx32
        ├── media
        ├── mnt
        ├── opt
        ├── proc
        ├── root
        ├── run
        ├── sbin -> usr/sbin
        ├── srv
        ├── sys
        ├── tmp
        ├── usr
        └── var
```

Host process:

```
2. tub@ubuntu: ~   4. tub@ubuntu: ~

CPU[||||||                                                    5.9%]   Tasks: 70, 117 thr; 1 running
Mem[|||||||||||||||||||||||||||||||||||||||||||||||||||||||||379M/1.94G]   Load average: 0.38 0.31 0.18
Swp[                                                      5.29M/2.00G]   Uptime: 02:57:28

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
    1 root       20   0   99M 10800  8264 S  0.0  0.5  0:02.56 /sbin/init maybe-ubiquity
49701 root       20   0  5392  2564  2308 S  0.0  0.1  0:00.00 ├─ [lxc monitor] /var/lib/lxc ctn01
49709 root       20   0 21984 10524  8324 S  0.0  0.5  0:00.33 │  └─ /sbin/init
49819 root       20   0 12176  6956  6112 S  0.0  0.3  0:00.01 │     ├─ sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
49818 root       20   0  8200  2248  2128 S  0.0  0.1  0:00.00 │     ├─ /sbin/agetty -o -p -- \u --noclear --keep-baud pts/3 115200,38400,9600 vt220
49817 root       20   0  8200  2244  2128 S  0.0  0.1  0:00.00 │     ├─ /sbin/agetty -o -p -- \u --noclear --keep-baud pts/2 115200,38400,9600 vt220
49816 root       20   0  8200  2288  2172 S  0.0  0.1  0:00.00 │     ├─ /sbin/agetty -o -p -- \u --noclear --keep-baud pts/1 115200,38400,9600 vt220
49815 root       20   0  8200  2344  2228 S  0.0  0.1  0:00.00 │     ├─ /sbin/agetty -o -p -- \u --noclear --keep-baud pts/0 115200,38400,9600 vt220
49814 root       20   0  8200  2292  2172 S  0.0  0.1  0:00.00 │     ├─ /sbin/agetty -o -p -- \u --noclear --keep-baud console 115200,38400,9600 vt220
49810 root       20   0 16256  6212  5508 S  0.0  0.3  0:00.06 │     ├─ (ostnamed)
49805 root       20   0 16476  6340  5624 S  0.0  0.3  0:00.07 │     ├─ /lib/systemd/systemd-logind
49804 syslog     20   0  219M  4224  3712 S  0.0  0.2  0:00.00 │     ├─ /usr/sbin/rsyslogd -n -iNONE
49809 syslog     20   0  219M  4224  3712 S  0.0  0.2  0:00.00 │     │  ├─ /usr/sbin/rsyslogd -n -iNONE
49808 syslog     20   0  219M  4224  3712 S  0.0  0.2  0:00.00 │     │  ├─ /usr/sbin/rsyslogd -n -iNONE
49807 syslog     20   0  219M  4224  3712 S  0.0  0.2  0:00.00 │     │  └─ /usr/sbin/rsyslogd -n -iNONE
49803 root       20   0 31616 18192 10612 S  0.0  0.9  0:00.20 │     ├─ /usr/bin/python3 /usr/bin/networkd-dispatcher --run-startup-triggers
49800 messagebu  20   0  7424  4200  3764 S  0.0  0.2  0:00.04 │     ├─ /usr/bin/dbus-daemon --system --address=systemd: --nofork --nopidfile --systemd-activation --syslog-only
49799 root       20   0  9412  2980  2772 S  0.0  0.1  0:00.00 │     ├─ /usr/sbin/cron -f
49790 systemd-n  20   0 26604  6672  5868 S  0.0  0.3  0:00.07 │     ├─ /lib/systemd/systemd-networkd
49764 root       19  -1 35080 11232 10372 S  0.0  0.6  0:00.10 │     └─ /lib/systemd/systemd-journald
44588 root       20   0  2616  1532  1404 S  0.0  0.1  0:00.10 ├─ /bin/sh /snap/lxd/21835/commands/daemon.start
44717 root       20   0 1375M 50612 28088 S  0.0  2.5  0:05.34 │  └─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45041 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.85 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45038 root       20   0 1375M 50612 28088 S  0.0  2.5  0:01.11 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45037 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.17 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45036 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.56 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45035 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.00 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45034 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.00 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45033 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.00 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
45032 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.00 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
44985 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.36 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
44983 lxd        20   0  7204  2392  2044 S  0.0  0.1  0:01.03 │     ├─ dnsmasq --keep-in-foreground --strict-order --bind-interfaces --except-interface=lo --pid-file= --no-ping --i
44737 root       20   0 1375M 50612 28088 S  0.0  2.5  0:00.95 │     ├─ lxd --logfile /var/snap/lxd/common/lxd/logs/lxd.log --group lxd
```

13. Connection to the guest's console

```
tub@ubuntu:~$ sudo lxc-console -n ctn01

Connected to tty 1
Type <Ctrl+a q> to exit the console, <Ctrl+a Ctrl+a> to enter Ctrl+a itself

Ubuntu 20.04.3 LTS ctn01 pts/0

ctn01 login: ubuntu
Password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.4.0-90-generic x86_64)
```

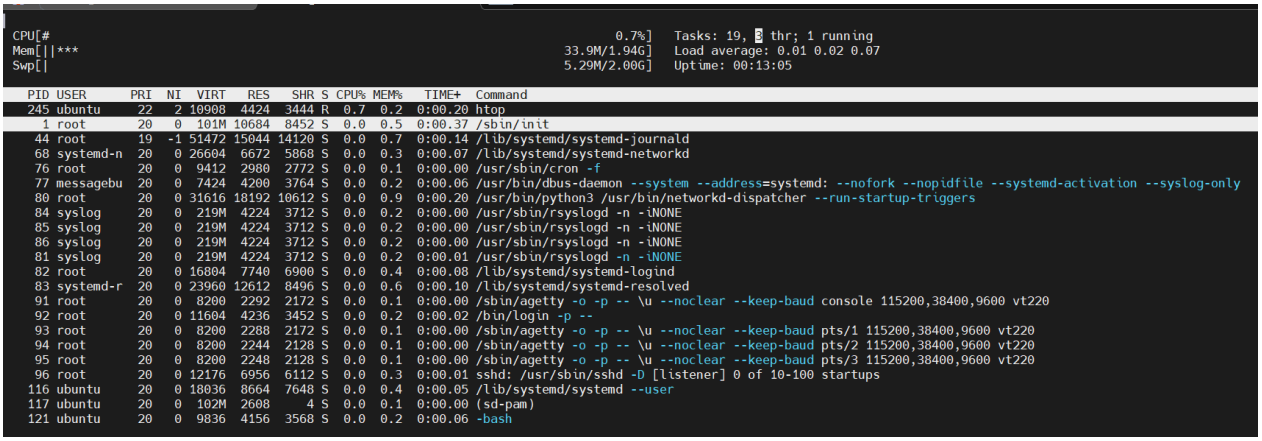
Right & access in the guest (only root has privileges):

```
ubuntu@ctn01:~$ ls -lh /
total 44K
lrwxrwxrwx   1 root root    7 Nov 25 15:23 bin -> usr/bin
drwxr-xr-x   2 root root 4.0K Apr 15  2020 boot
drwxr-xr-x   7 root root  540 Nov 25 17:03 dev
drwxr-xr-x  63 root root 4.0K Nov 25 16:18 etc
drwxr-xr-x   3 root root 4.0K Nov 25 16:06 home
lrwxrwxrwx   1 root root    7 Nov 25 15:23 lib -> usr/lib
lrwxrwxrwx   1 root root    9 Nov 25 15:23 lib32 -> usr/lib32
lrwxrwxrwx   1 root root    9 Nov 25 15:23 lib64 -> usr/lib64
lrwxrwxrwx   1 root root   10 Nov 25 15:23 libx32 -> usr/libx32
drwxr-xr-x   2 root root 4.0K Nov 25 15:24 media
drwxr-xr-x   2 root root 4.0K Nov 25 15:24 mnt
drwxr-xr-x   2 root root 4.0K Nov 25 15:24 opt
dr-xr-xr-x 341 root root    0 Nov 25 17:03 proc
drwx------   2 root root 4.0K Nov 25 15:24 root
drwxr-xr-x  13 root root  420 Nov 25 17:05 run
lrwxrwxrwx   1 root root    8 Nov 25 15:23 sbin -> usr/sbin
drwxr-xr-x   2 root root 4.0K Nov 25 15:24 srv
dr-xr-xr-x  13 root root    0 Nov 25 17:03 sys
drwxrwxrwt   9 root root 4.0K Nov 25 17:05 tmp
drwxr-xr-x  13 root root 4.0K Nov 25 15:24 usr
drwxr-xr-x  11 root root 4.0K Nov 25 15:24 var
ubuntu@ctn01:~$
```

Guest's file system (impossible to get back on the host's file system):

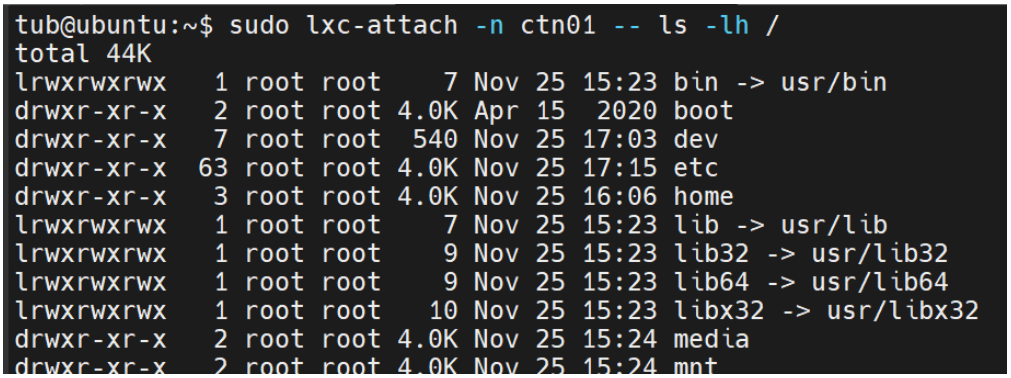
```
ubuntu@ctn01:/var/lib$ cd /var/lib/lxc/
-bash: cd: /var/lib/lxc/: No such file or directory
ubuntu@ctn01:/var/lib$ sudo tree -d -L 1 /
/
├── bin -> usr/bin
├── boot
├── dev
├── etc
├── home
├── lib -> usr/lib
├── lib32 -> usr/lib32
├── lib64 -> usr/lib64
├── libx32 -> usr/libx32
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin -> usr/sbin
├── srv
├── sys
├── tmp
├── usr
└── var
```

Running processes in the guest (it starts again from the 1 process):

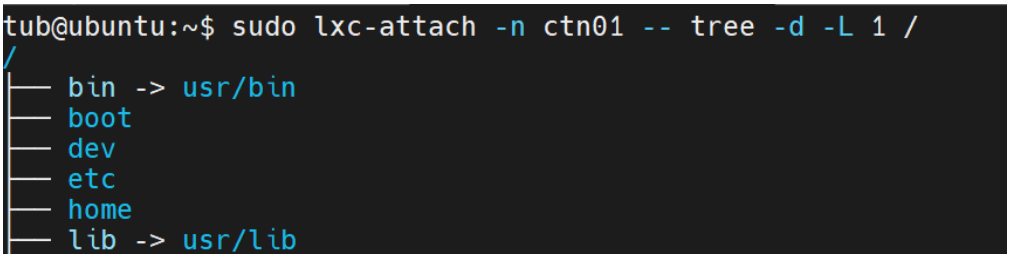


14. Quit the container (CTLR +a q) & re-execute the same commands

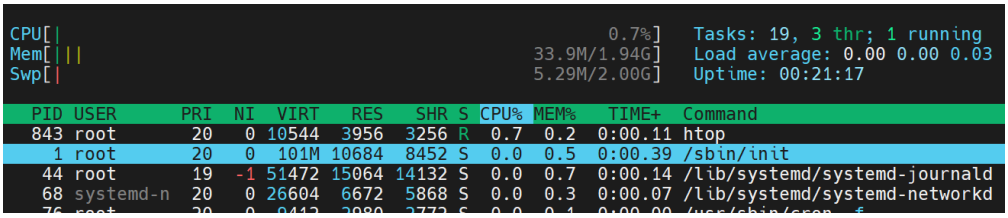
Privileges in the guest:



File system of the guest:



Guest's processes:



15. Stop container

```
tub@ubuntu:~$ sudo lxc-stop -n ctn01
tub@ubuntu:~$ sudo lxc-info -n ctn01
Name:           ctn01
State:          STOPPED
```

```
tub@ubuntu:~$ sudo lxc-ls --fancy -n ctn01
NAME  STATE   AUTOSTART GROUPS IPV4 IPV6 UNPRIVILEGED
ctn01 STOPPED 0         -      -    -    false
```

III. Resources limitation with command line

16. Set a memory limit to 256 MB

Current memory (2.00 GB):

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/meminfo | grep "MemTotal:"
MemTotal:        2035456 kB
```

Set the limit (256 MB = 268435456 Bytes in binary):

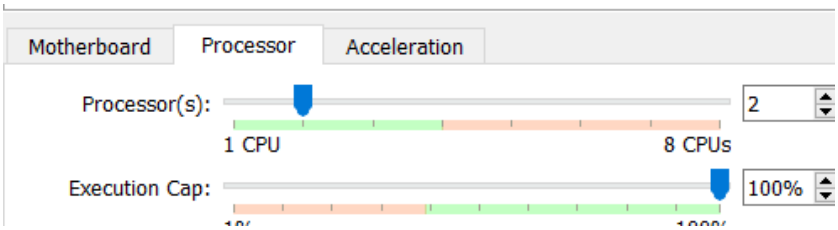
```
tub@ubuntu:~$ sudo lxc-cgroup -n ctn01 memory.limit_in_bytes 268435456
```

Result (262144 kB = 256 MB)

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/meminfo | grep "MemTotal:"
MemTotal:         262144 kB
```

17. Set a CPU limit to 50 % of the main CPU

Set 2 processor for the VM to demonstrate how to set a limit:



CPU Info of host (2 CPU with 2 cores on each):

```
tub@ubuntu:~$ cat /proc/cpuinfo
processor       : 0
vendor_id       : GenuineIntel
cpu family      : 6
model           : 142
model name      : Intel(R) Core(TM
stepping        : 10
cpu MHz         : 1991.997
cache size      : 8192 KB
physical id     : 0
siblings        : 2
core id         : 0
cpu cores       : 2
```

```
processor       : 1
vendor_id       : GenuineIntel
cpu family      : 6
model           : 142
model name      : Intel(R) Core(TM)
stepping        : 10
cpu MHz         : 1991.997
cache size      : 8192 KB
physical id     : 0
siblings        : 2
core id         : 1
cpu cores       : 2
```

Set the processor 0 with core id 1:

```
ub@ubuntu:~$ sudo lxc-cgroup -n ctn01 cpuset.cpus 0,1
```

CPU info of guest (1 CPU with 2 cores on each = 50% of CPU host):

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/cpuinfo
processor       : 0
vendor_id       : GenuineIntel
cpu family      : 6
model           : 142
model name      : Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
stepping        : 10
cpu MHz         : 1991.997
cache size      : 8192 KB
physical id     : 0
siblings        : 2
core id         : 1
cpu cores       : 2
```

IV. Gesture of the Physical mode network

The guest takes the host configuration interface!

Be careful we'll lose the SSH connection between the container (guest) and the host.

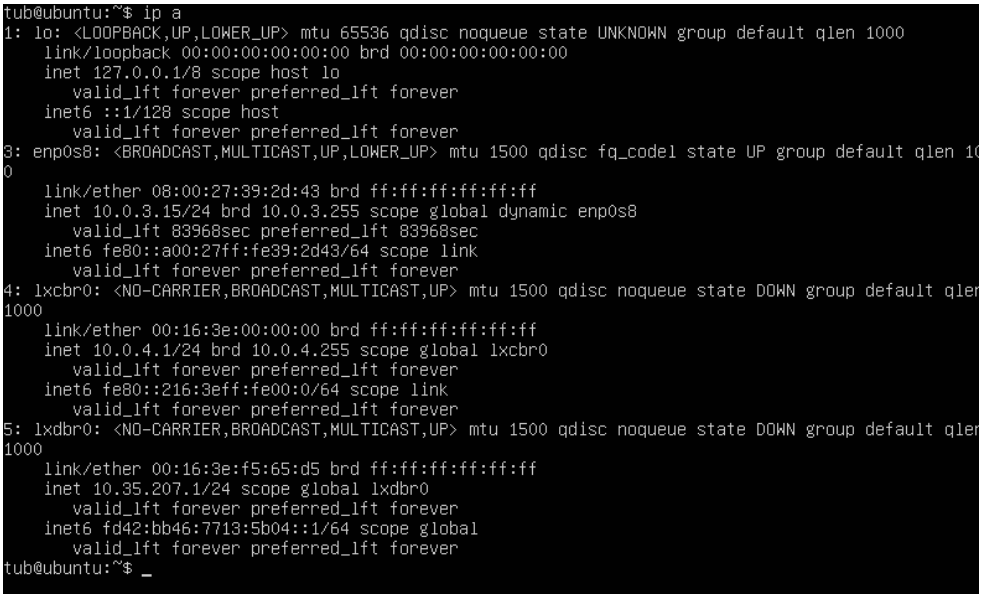
18. Set up the physical network

```
ub@ubuntu:~$ ip a
: 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: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:ce:80:e8 brd ff:ff:ff:ff:ff:ff
    inet 192.168.59.200/24 brd 192.168.59.255 scope global dynamic enp0s3
       valid_lft 309sec preferred_lft 309sec
    inet6 fe80::a00:27ff:fece:80e8/64 scope link
       valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:39:2d:43 brd ff:ff:ff:ff:ff:ff
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic enp0s8
       valid_lft 84308sec preferred_lft 84308sec
    inet6 fe80::a00:27ff:fe39:2d43/64 scope link
       valid_lft forever preferred_lft forever
4: lxcbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default qlen 1000
    link/ether 00:16:3e:00:00:00 brd ff:ff:ff:ff:ff:ff
    inet 10.0.4.1/24 brd 10.0.4.255 scope global lxcbr0
       valid_lft forever preferred_lft forever
    inet6 fe80::216:3eff:fe00:0/64 scope link
       valid_lft forever preferred_lft forever
5: lxdbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default qlen 1000
    link/ether 00:16:3e:f5:65:d5 brd ff:ff:ff:ff:ff:ff
    inet 10.35.207.1/24 scope global lxdbr0
       valid_lft forever preferred_lft forever
    inet6 fd42:bb46:7713:5b04::1/64 scope global
       valid_lft forever preferred_lft forever
tub@ubuntu:~$
```

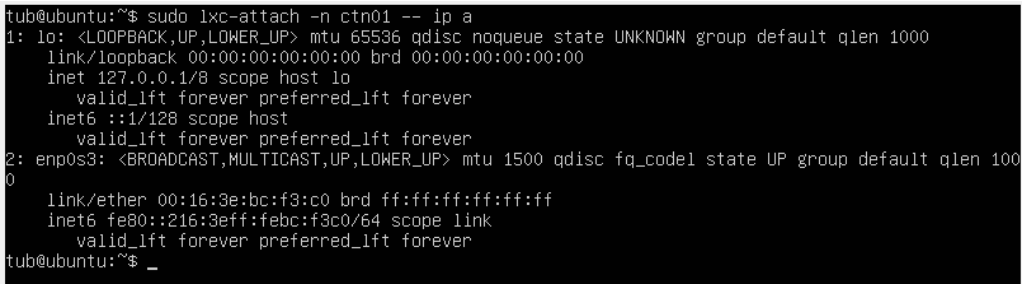
/var/lib/lxc/containerName/config

```
# Network configuration
lxc.net.0.type = phys
lxc.net.0.link = enp0s3
lxc.net.0.flags = up
lxc.net.0.hwaddr = 00:16:3e:bc:f3:c0
~
```

19. Host configuration after starting up the guest (enp0s3 has disappeared)



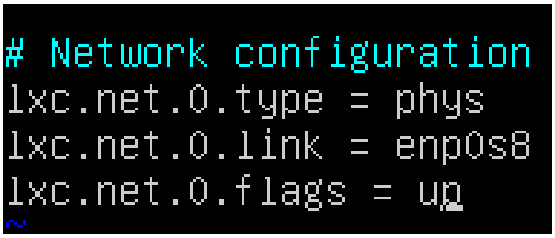
20. Guest configuration after starting up the guest (enp0s3 has appeared and no ip)



V. Package installation in a container

By switching on *"phys"* and selecting "enp0s3" interface (host only network) we couldn't reach internet with the container. So now we'll select the "enp0s8" interface of the host network.

21. Selecting enp0s8 interface (NAT) on host config file



enp0s8 has disappeared on the host :

```
tub@ubuntu:~$ ip a
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: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1
0
    link/ether 00:16:3e:bc:f3:c0 brd ff:ff:ff:ff:ff:ff
    inet 192.168.59.200/24 brd 192.168.59.255 scope global dynamic enp0s3
       valid_lft 187sec preferred_lft 187sec
    inet6 fe80::216:3eff:febc:f3c0/64 scope link
       valid_lft forever preferred_lft forever
4: lxcbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default qle
1000
    link/ether 00:16:3e:00:00:00 brd ff:ff:ff:ff:ff:ff
    inet 10.0.4.1/24 brd 10.0.4.255 scope global lxcbr0
       valid_lft forever preferred_lft forever
5: lxdbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default qle
1000
    link/ether 00:16:3e:f5:65:d5 brd ff:ff:ff:ff:ff:ff
    inet 10.35.207.1/24 scope global lxdbr0
       valid_lft forever preferred_lft forever
    inet6 fd42:bb46:7713:5b04::1/64 scope global
       valid_lft forever preferred_lft forever
tub@ubuntu:~$
```

22. Configure ip addresses on the guest

Edit the yaml file:

```
network:
  ethernets:
    eth0: {dhcp4: true}
    enp0s8: {dhcp4: true}
  version: 2
~
```

Current IP addresses on guest (after editing yaml file) -> now ping works!

```
ubuntu@ctn01:~$ ip a
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
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 100
0
    link/ether 08:00:27:39:2d:43 brd ff:ff:ff:ff:ff:ff
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic enp0s8
       valid_lft 85710sec preferred_lft 85710sec
    inet6 fe80::a00:27ff:fe39:2d43/64 scope link
       valid_lft forever preferred_lft forever
ubuntu@ctn01:~$ _
```

23. Apache 2 package installation

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- apt update
Hit:1 http://archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://security.ubuntu.com/ubuntu focal-security InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- apt-get install apache2
Reading package lists... Done
Building dependency tree
```

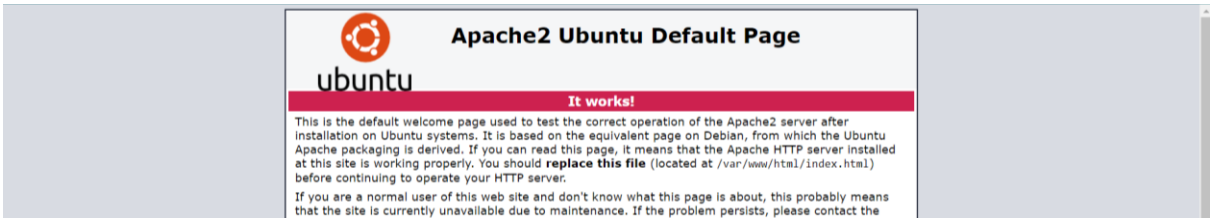
```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- systemctl status apache2
● apache2.service - The Apache HTTP Server
     Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
     Active: active (running) since Thu 2021-11-25 21:49:32 UTC; 1min 53s ago
       Docs: https://httpd.apache.org/docs/2.4/
   Main PID: 1438 (apache2)
      Tasks: 55 (limit: 2279)
     Memory: 5.5M
     CGroup: /system.slice/apache2.service
```

24. Access to the web server from host (Windows)

Guest configure file:

```
# Network configuration
lxc.net.0.type = phys
lxc.net.0.link = enp0s3
lxc.net.0.flags = up
```

Selecting enp0s3 interface again and browse (192.168.59.205) from Windows!



VI. Resources limitation

Memory info before limitation (2.00 GB) :

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/meminfo | grep 'MemTotal'
MemTotal:        2035232 kB
```

CPU info before limitation (2 processors):

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/cpuinfo | grep 'processor'
processor       : 0
processor       : 1
```

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/cpuinfo | grep 'core id'
core id         : 0
core id         : 1
```

25. Set limit on config file

```
#limits
lxc.cgroup.cpuset.cpus=0,1
lxc.cgroup.memory.limit_in_bytes=268435456
```

Memory info after limitation (256 MB):

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/meminfo | grep 'MemTotal'
MemTotal:         262144 kB
```

CPU info after limitation (1 processor):

```
tub@ubuntu:~$ sudo lxc-attach -n ctn01 -- cat /proc/cpuinfo | grep 'processor'
processor       : 0
```

VII. Return last network configuration to get access to VM with SSH

Current ip address of the container :

```
tub@ubuntu:~$ sudo lxc-info -n ctn01
Name:           ctn01
State:          RUNNING
PID:            4133
IP:             192.168.59.203
```

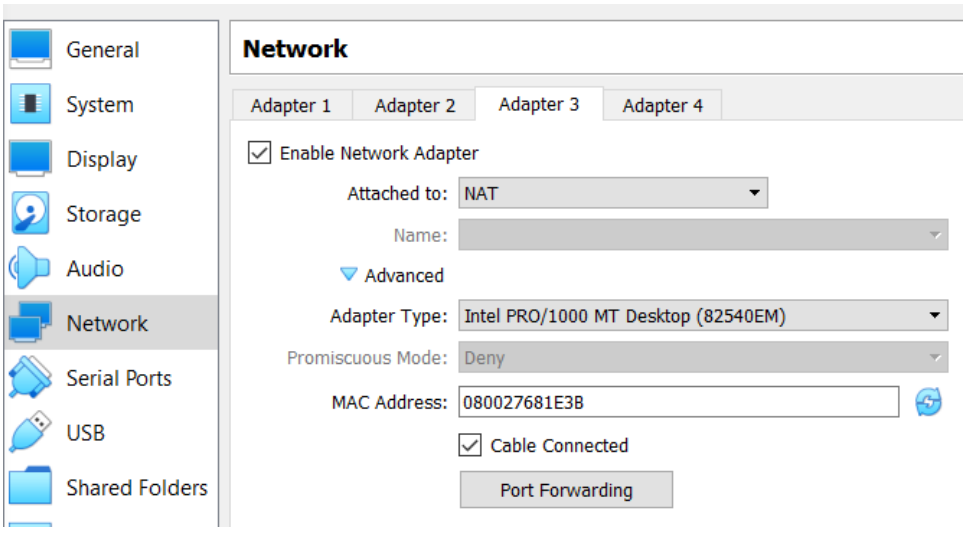
Container has ip address : 192.168.59.203 (with DHCP on enp0s3 interface)

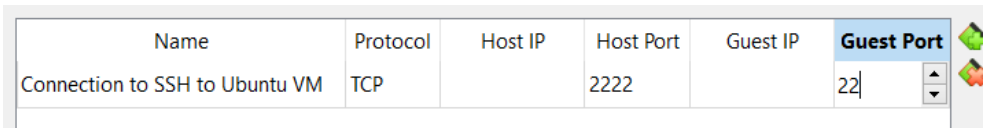
The problem is that the container will select the other interface (enp0s8) to get access to internet and then we'll be able to connect with SSH to the VM. The thing is we always change the configuration might lose the SSH connection.

Therefore we should forward 2222 port (Windows host) to the 22 port (VM Ubuntu)

Forwarding port on VirtualBox:

- Add a new NAT interface
- Forwarding port





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VIII. Scripting

- Create container with 256 MB of memory limitation & 50 % of CPU
- Physical mode network
- Apache installation

```
# Assign interfaces
searchNetMode="veth"
replaceNetMode="phys"

# Assign links
searchLink="lxcbr0"
replaceLink="enp0s8"

# Change network config
sed -i "s/$searchNetMode/$replaceNetMode/" $filenameConfig
sed -i "s/$searchLink/$replaceLink/" $filenameConfig

# Assign filename of the yaml file
filenameNet="/var/lib/lxc/$containerName/rootfs/etc/netplan/10-lxc.yaml"

# Assign link eth0
searchLinkETH="eth0"

# Change link in the yaml file
sed -i "s/$searchLinkETH/$replaceLink/" $filenameNet
```

```
# Start container
lxc-start -n $containerName

# *** Set container limit ***
lxc-cgroup -n $containerName cpuset.cpus 0,1 #50% of CPU
lxc-cgroup -n $containerName memory.limit_in_bytes 268435456 #256 MB

sleep 5

# *** Installation of Apache2 ***
lxc-attach -n $containerName -- apt update

sleep 5

lxc-attach -n $containerName -- apt-get install -y apache2

sleep 5

lxc-attach -n $containerName -- systemctl status apache2.service
```

IX. Template modification

- /etc/lxc/default.conf
- /usr/share/lxc/templates
- /usr/share/lxc/config/ubuntu.common.conf
- /usr/share/lxc/config/common.conf
- /usr/share/lxc/templates/lxc-ubuntu

26. Limits at the installation of all lxc containers

➔ /etc/lxc/default.conf

```
lxc.cgroup.cpuset.cpus=0,0
lxc.cgroup.memory.limit_in_bytes=268435456
```

```
tub@ubuntu:~$ sudo lxc-attach -n ctn04 -- cat /proc/meminfo | grep 'MemTotal'
MemTotal:         262144 kB
```

```
tub@ubuntu:~$ sudo lxc-attach -n ctn04 -- cat /proc/cpuinfo | grep 'processor'
processor       : 0
```

27. Package iputils at the installation

At the installation the cache is checked ! So we need to clear the cache :

```
Checking cache download in /var/cache/lxc/focal/rootfs-amd64 ...
```

Clear the cache:

```
sudo rm -rf /var/cache/lxc/focal
```

➔ /usr/share/lxc/templates/lxc-ubuntu

```
packages_template=${packages_template:-"apt-transport-https,ssh,vim,iputils"}
```