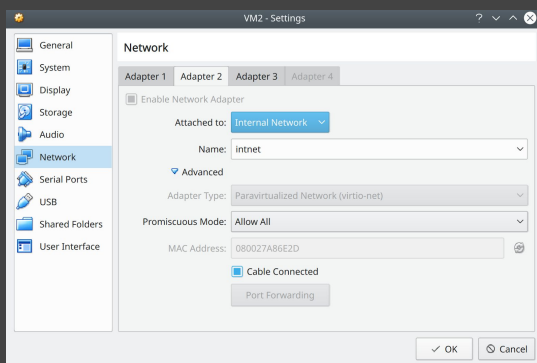
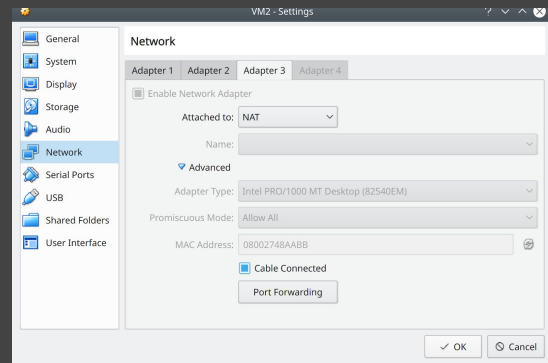
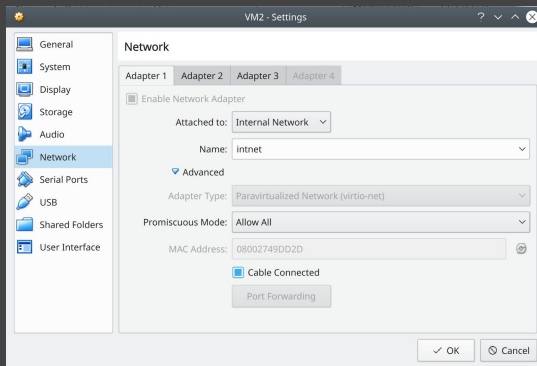


# Link aggregation

## Steps for bonding:

- Download ubuntu-18.04.3-live-server-amd64.iso
- Create one VM with following network configuration:



Two adapters for bonding, one adapter for internet connection

- Explore modes

Modes:

Mode 0 (balance-rr)

Mode 1 (active-backup)

Mode 2 (balance-xor)

Mode 3 (broadcast)

Mode 4 (802.3ad)

Mode 5 (balance-tlb)

Mode 6 (balance-alb)

There is no best mode and every mode is the most suitable for some situations.

As an example the following bonding modes:

Bonding Mode 0 (round-robin)

Bonding Mode 3 (broadcast)

Bonding Mode 5 (balance-tlb)

## Bonding Mode 6 (balance-alb)

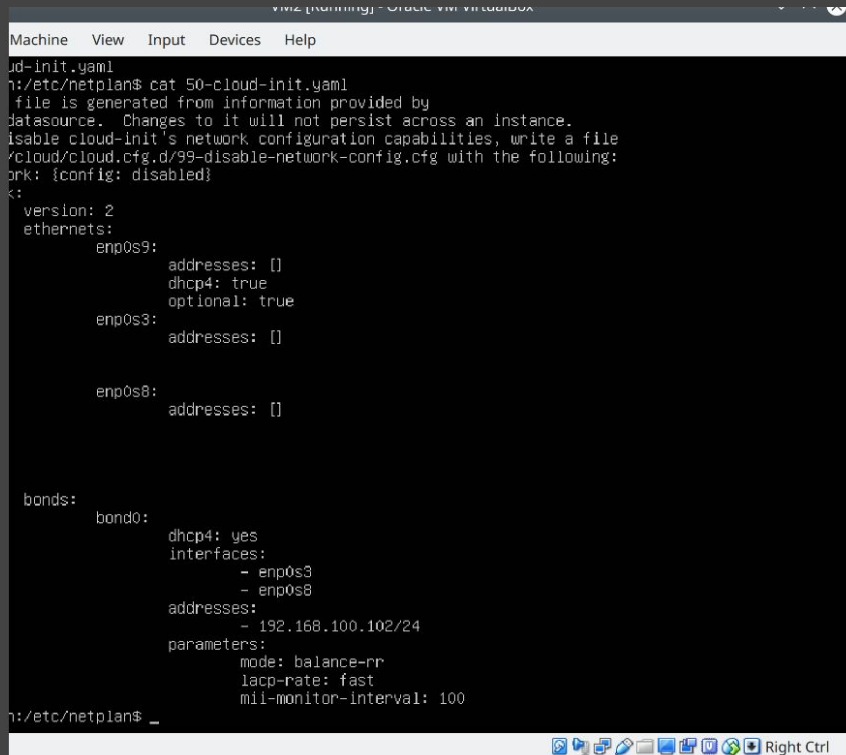
Do not guarantee in-order delivery of TCP streams.

- Run VM
- Install ifenslave via:  
`sudo apt-get install ifenslave`
- Check via:  
`sudo lsmod | grep bonding`  
If nothing shows up, try:  
`sudo modprobe bonding`

- File `/etc/modules` should look like this:

```
ban@ban:/etc/netplan$ cat /etc/modules
# /etc/modules: kernel modules to load at boot time.
#
# This file contains the names of kernel modules that should be loaded
# at boot time, one per line. Lines beginning with "#" are ignored.
bonding
```

- Check the interfaces names using `ifconfig -a`
- Configure netplan (with usage of interfaces from previous step):



```
Machine View Input Devices Help
ban@ban:/etc/netplan$ cat 50-cloud-init.yaml
# This file is generated from information provided by
# cloud-init. Changes to it will not persist across an instance.
# To disable cloud-init's network configuration capabilities, write a file
# to /cloud/cloud.cfg.d/99-disable-network-config.cfg with the following:
# network: {config: disabled}
network:
  version: 2
  ethernets:
    enp0s9:
      addresses: []
      dhcp4: true
      optional: true
    enp0s3:
      addresses: []

    enp0s8:
      addresses: []

  bonds:
    bond0:
      dhcp4: yes
      interfaces:
        - enp0s3
        - enp0s8
      addresses:
        - 192.168.100.102/24
      parameters:
        mode: balance-rr
        lacp-rate: fast
        miimon: 100
ban@ban:/etc/netplan$ _
```

- Run `sudo netplan apply`

- Turn off VM
- Create new VM via copy function in virtualbox
- Change new VM's netplan configuration a bit (pick another address)

```

cloud-init.yaml
@ban:/etc/netplan$ cat 50-cloud-init.yaml
This file is generated from information provided by
the datasource. Changes to it will not persist across an instance.
To disable cloud-init's network configuration capabilities, write a file
/etc/cloud/cloud.cfg.d/99-disable-network-config.cfg with the following:
network: {config: disabled}
work:
  version: 2
  ethernet:
    enp0s9:
      addresses: []
      dhcp4: true
      optional: true
    enp0s3:
      addresses: []

    enp0s8:
      addresses: []

  bonds:
    bond0:
      dhcp4: yes
      interfaces:
        - enp0s3
        - enp0s8
      addresses:
        - 192.168.100.101/24
      parameters:
        mode: balance-rr
        lacp-rate: fast
        mii-monitor-interval: 100
@ban:/etc/netplan$

```

- Run *ip link set bond0 promisc on* on both machines

## Testing

- ping is ok

```

@ban@ban:/etc/netplan$ ping 192.168.100.101
PING 192.168.100.101 (192.168.100.101) 56(84) bytes of data.
64 bytes from 192.168.100.101: icmp_seq=1 ttl=64 time=1.36 ms
64 bytes from 192.168.100.101: icmp_seq=2 ttl=64 time=1.28 ms
64 bytes from 192.168.100.101: icmp_seq=3 ttl=64 time=1.04 ms
64 bytes from 192.168.100.101: icmp_seq=4 ttl=64 time=1.33 ms
64 bytes from 192.168.100.101: icmp_seq=5 ttl=64 time=1.40 ms

```

- Checking bandwidth

Run *sudo apt-get install iperf3* on both machines

Run *iperf3 -s* from one machine

Run *iperf3 -c* from another machine

```

ban@ban:/etc/netplan$ iperf3 -c 192.168.100.102
Connecting to host 192.168.100.102, port 5201
[ 4] local 192.168.100.101 port 54284 connected to 192.168.100.102 port 5201
[ ID] Interval      Transfer    Bandwidth  Retr  Cwnd
[ 4] 0.00-1.00 sec  143 MBytes  1.20 Gbits/sec  318   252 KBytes
[ 4] 1.00-2.00 sec  137 MBytes  1.15 Gbits/sec  308   253 KBytes
[ 4] 2.00-3.00 sec  145 MBytes  1.22 Gbits/sec  354   257 KBytes
[ 4] 3.00-4.00 sec  142 MBytes  1.19 Gbits/sec  357   198 KBytes
[ 4] 4.00-5.00 sec  131 MBytes  1.09 Gbits/sec  343   242 KBytes
[ 4] 5.00-6.00 sec  133 MBytes  1.12 Gbits/sec  315   242 KBytes
[ 4] 6.00-7.00 sec  138 MBytes  1.16 Gbits/sec  276   249 KBytes
[ 4] 7.00-8.00 sec  146 MBytes  1.22 Gbits/sec  267   197 KBytes
[ 4] 8.00-9.00 sec  146 MBytes  1.22 Gbits/sec  263   199 KBytes
[ ID] Interval      Transfer    Bandwidth  Retr
[ 4] 0.00-10.00 sec  1.36 GBytes  1.17 Gbits/sec  3058
iperf Done.

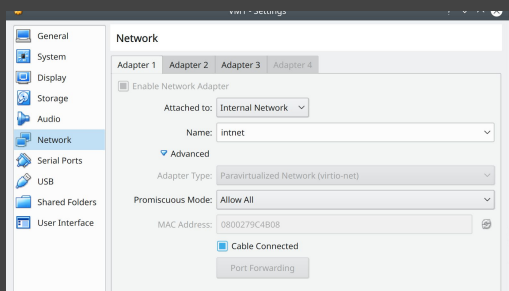
```

```

[ 5] 0.00-10.05 sec  1.01 GBytes  862 Mbits/sec
Receiver
-----
Server listening on 5201
Accepted connection from 192.168.100.101, port 54282
[ 5] local 192.168.100.102 port 5201 connected to 192.168.100.101 port 54284
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.00-1.00 sec  134 MBytes  1.12 Gbits/sec
[ 5] 1.00-2.00 sec  137 MBytes  1.15 Gbits/sec
[ 5] 2.00-3.00 sec  147 MBytes  1.23 Gbits/sec
[ 5] 3.00-4.00 sec  140 MBytes  1.17 Gbits/sec
[ 5] 4.00-5.00 sec  132 MBytes  1.10 Gbits/sec
[ 5] 5.00-6.00 sec  129 MBytes  1.08 Gbits/sec
[ 5] 6.00-7.00 sec  135 MBytes  1.13 Gbits/sec
[ 5] 7.00-8.00 sec  138 MBytes  1.16 Gbits/sec
[ 5] 8.00-9.00 sec  146 MBytes  1.23 Gbits/sec
[ 5] 9.00-10.00 sec  145 MBytes  1.22 Gbits/sec
[ 5] 10.00-10.05 sec  7.46 MBytes  1.25 Gbits/sec
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.00-10.05 sec  0.00 Bytes  0.00 bits/sec
sender

```

- Uncheck cable connected to check if our mode is fault-tolerant



```

[ 5] 2.00-3.00 sec  95.6 MBytes  802 Mbits/sec
[ 5] 3.00-4.00 sec  101 MBytes  850 Mbits/sec
[ 5] 4.00-5.00 sec  103 MBytes  860 Mbits/sec
[ 5] 5.00-6.00 sec  102 MBytes  858 Mbits/sec
[ 5] 6.00-7.00 sec  104 MBytes  872 Mbits/sec
[ 5] 7.00-8.00 sec  97.9 MBytes  821 Mbits/sec
[ 5] 8.00-9.00 sec  105 MBytes  881 Mbits/sec
[ 5] 8.00-9.00 sec  105 MBytes  881 Mbits/sec
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.00-9.00 sec  0.00 Bytes  0.00 bits/sec
[ 5] 0.00-9.00 sec  924 MBytes  861 Mbits/sec
iperf3: the client has terminated
-----
Server listening on 5201
Accepted connection from 192.168.100.102, port 35294
[ 5] local 192.168.100.101 port 5201 connected to 192.168.100.102 port 35296
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.00-1.00 sec  177 MBytes  1.49 Gbits/sec
[ 5] 1.00-2.00 sec  218 MBytes  1.83 Gbits/sec
[ 5] 2.00-3.00 sec  168 MBytes  1.41 Gbits/sec
[ 5] 3.00-4.00 sec  185 MBytes  1.55 Gbits/sec
[ 5] 4.00-5.00 sec  202 MBytes  1.69 Gbits/sec
[ 5] 5.00-6.00 sec  192 MBytes  1.61 Gbits/sec
[ 5] 6.00-7.00 sec  178 MBytes  1.49 Gbits/sec
[ 5] 7.00-8.00 sec  189 MBytes  1.59 Gbits/sec
[ 5] 7.00-8.00 sec  189 MBytes  1.59 Gbits/sec
[ ID] Interval      Transfer    Bandwidth
[ 5] 0.00-8.00 sec  0.00 Bytes  0.00 bits/sec
[ 5] 0.00-8.00 sec  1.49 GBytes  1.60 Gbits/sec
iperf3: the client has terminated
-----
Server listening on 5201

```