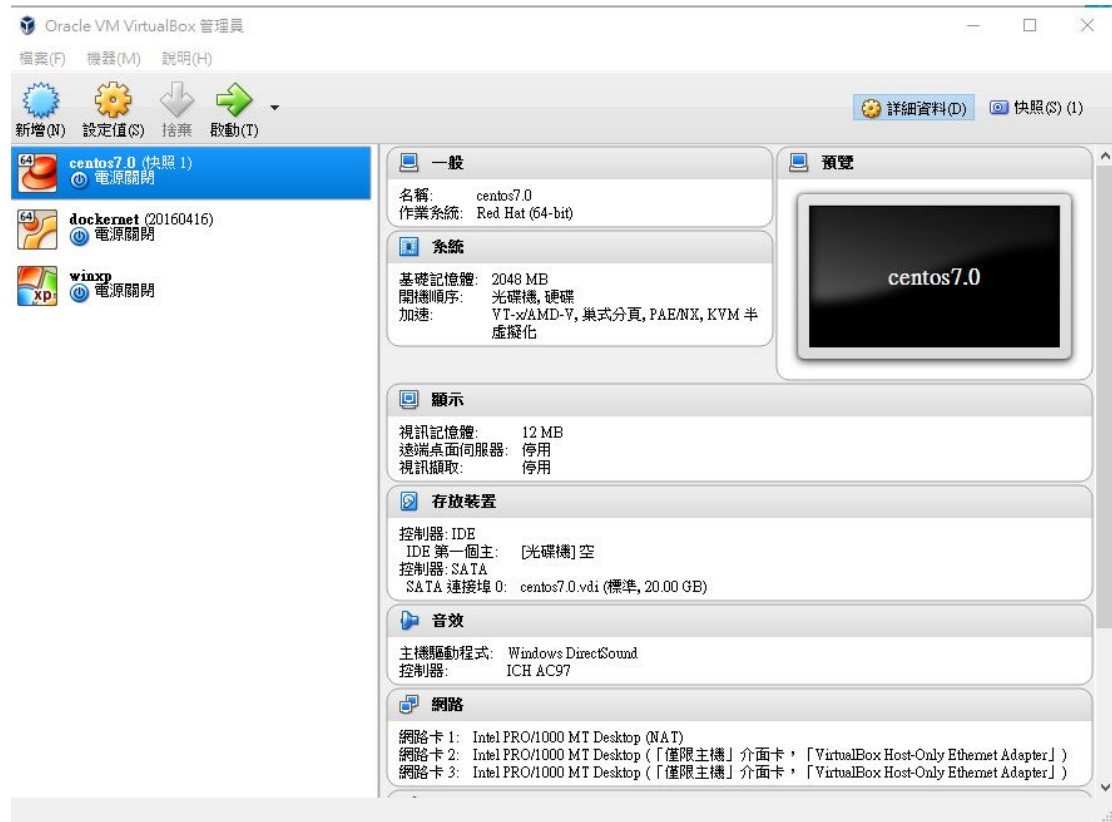
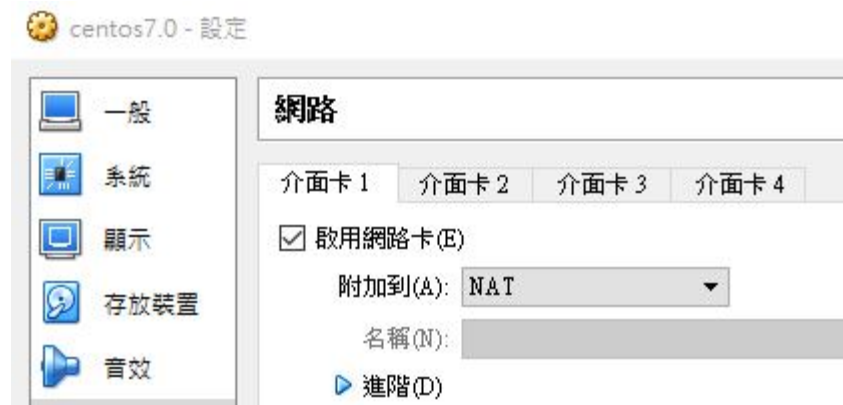
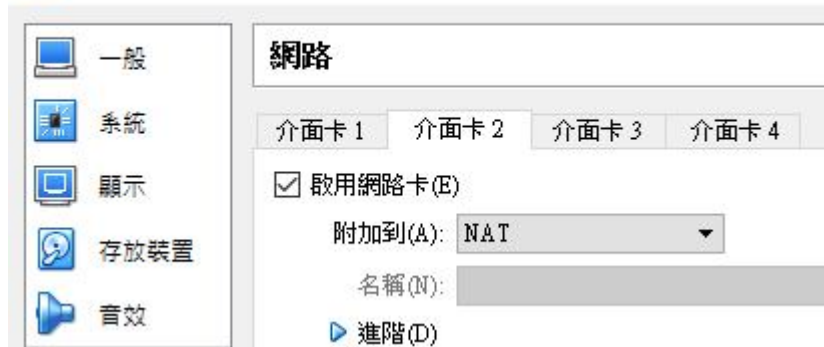


使用 virtualbox 安裝一虛擬機 centos 7.0 版



其網路設定為 (把兩張網卡都設成 NAT)





啟動虛擬機,並查詢網路設定,從下圖得知會有兩個介面,一個是 `enp0s3`,一個是 `enp0s8`

```
root@localhost:~  
File Edit View Search Terminal Help  
[root@localhost ~]# ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255  
    inet6 fe80::a00:27ff:fe11:fcfa prefixlen 64 scopeid 0x20<link>  
    ether 08:00:27:11:fc:fa txqueuelen 1000 (Ethernet)  
    RX packets 35 bytes 4279 (4.1 KiB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 60 bytes 7060 (6.8 KiB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.0.3.15 netmask 255.255.255.0 broadcast 10.0.3.255  
    inet6 fe80::a00:27ff:fed:c816 prefixlen 64 scopeid 0x20<link>  
    ether 08:00:27:fd:c8:16 txqueuelen 1000 (Ethernet)  
    RX packets 1 bytes 590 (590.0 B)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 28 bytes 4335 (4.2 KiB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

路由設定為

```
[root@localhost ~]# ip route show  
default via 10.0.2.2 dev enp0s3 proto static metric 100  
default via 10.0.3.2 dev enp0s8 proto static metric 101  
10.0.2.0/24 dev enp0s3 proto kernel scope link src 10.0.2.15 metric 100  
10.0.3.0/24 dev enp0s8 proto kernel scope link src 10.0.3.15 metric 100
```

先把自動化網路設定關閉

```
[root@localhost ~]# service network stop
Stopping network (via systemctl): [ OK ]
[root@localhost ~]# service NetworkManager stop
Redirecting to /bin/systemctl stop NetworkManager.service
[root@localhost ~]#
```

開始設定 link bonding mode=1,要確定 bonding mode 為 active-backup

```
[root@localhost ~]# modprobe bonding miimon=100 mode=1
[root@localhost ~]# cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)
```

```
Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: None
MII Status: down
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0
[root@localhost ~]# █
```

開始設定網卡的 master 為 bond0

```
[root@localhost ~]# ip link set enp0s3 down
[root@localhost ~]# ip link set enp0s8 down
[root@localhost ~]# ip link set enp0s3 master bond0
[root@localhost ~]# ip link set enp0s8 master bond0
[root@localhost ~]# ip link set bond0 up
```

用 ifconfig 查看目前網路設定

```
[root@localhost ~]# ifconfig
bond0: flags=5187<UP,BROADCAST,RUNNING,MASTER,MULTICAST> mtu 1500
    inet6 fe80::a00:27ff:fe11:fcfa prefixlen 64 scopeid 0x20<li
    ether 08:00:27:11:fc:fa txqueuelen 0 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 18 overruns 0 frame 0
    TX packets 28 bytes 4538 (4.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s3: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    ether 08:00:27:11:fc:fa txqueuelen 1000 (Ethernet)
    RX packets 55 bytes 5959 (5.8 KiB)
    RX errors 0 dropped 9 overruns 0 frame 0
    TX packets 98 bytes 11333 (11.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s8: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST> mtu 1500
    inet 10.0.3.15 netmask 255.255.255.0 broadcast 10.0.3.255
    ether 08:00:27:11:fc:fa txqueuelen 1000 (Ethernet)
```

發現 enp0s3 和 enp0s8 的網路還有 ip 設定,使用底下指令清除設定

```
[root@localhost ~]# ifconfig enp0s3 0  
[root@localhost ~]# ifconfig enp0s8 0
```

開始設定 bond0 的 ip 和 default gateway

```
[root@localhost ~]# ip addr add 10.0.2.15/24 brd + dev bond0  
[root@localhost ~]# ip route add default via 10.0.2.2
```

```
[root@localhost ~]# ip route show  
default via 10.0.2.2 dev bond0  
10.0.2.0/24 dev bond0 proto kernel scope link src 10.0.2.15
```

ping 8.8.8.8,發現可以連上網路

```
[root@localhost ~]# ping -c 3 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=43 time=24.4 ms  
64 bytes from 8.8.8.8: icmp_seq=2 ttl=43 time=22.3 ms  
64 bytes from 8.8.8.8: icmp_seq=3 ttl=43 time=24.9 ms  
  
--- 8.8.8.8 ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2004ms  
rtt min/avg/max/mdev = 22.316/23.900/24.908/1.148 ms  
[root@localhost ~]# █
```

再查看一下 bond0 (active slave: enp0s3)

```
[root@localhost ~]# cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: enp0s3
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: enp0s3
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 1
Permanent HW addr: 08:00:27:11:fc:fa
Slave queue ID: 0

Slave Interface: enp0s8
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 1
Permanent HW addr: 08:00:27:fd:c8:16
Slave queue ID: 0
[root@localhost ~]#
```

現在把 enp0s3 關閉,並測試 ping 8.8.8.8

```
[root@localhost ~]# ifconfig enp0s3 down
```

可以得知 enp0s3 現在是 down 的 (active slave:enp0s8)

```
[root@localhost ~]# cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: enp0s8
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: enp0s3
MII Status: down
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 1
Permanent HW addr: 08:00:27:11:fc:fa
Slave queue ID: 0

Slave Interface: enp0s8
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: 08:00:27:fd:c8:16
Slave queue ID: 0
```

測試 ping

```
[root@localhost ~]# ping -c 3 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=43 time=23.1 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=43 time=32.5 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=43 time=27.7 ms

--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2008ms
rtt min/avg/max/mdev = 23.198/27.830/32.505/3.802 ms
```

重新啟動 enp0s3,並關閉 enp0s8

```
[root@localhost ~]# ifconfig enp0s3 up
[root@localhost ~]# ifconfig enp0s8 down
```

(現在的 active slave: enp0s3)


```
[root@localhost ~]# cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)
```

```
Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: enp0s3
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0
```

```
Slave Interface: enp0s3
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 2
Permanent HW addr: 08:00:27:11:fc:fa
Slave queue ID: 0
```

```
Slave Interface: enp0s8
MII Status: down
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 3
Permanent HW addr: 08:00:27:fd:c8:16
Slave queue ID: 0
```

測試 ping

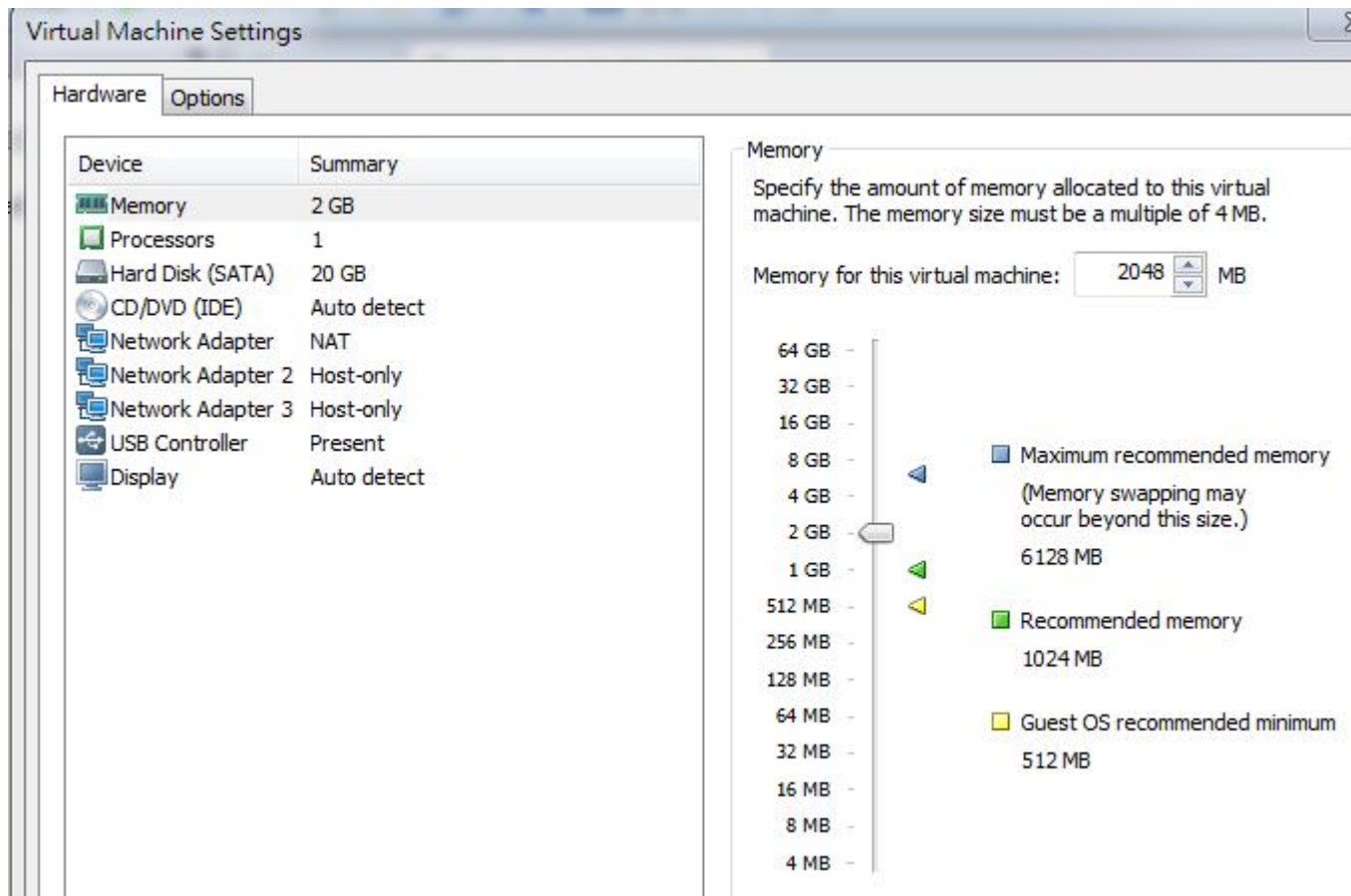
```
[root@localhost ~]# ping -c 3 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=43 time=25.7 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=43 time=26.1 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=43 time=24.4 ms

--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 24.412/25.429/26.143/0.749 ms
```

從以上的實驗可以證明容錯是可以的

.....
.....

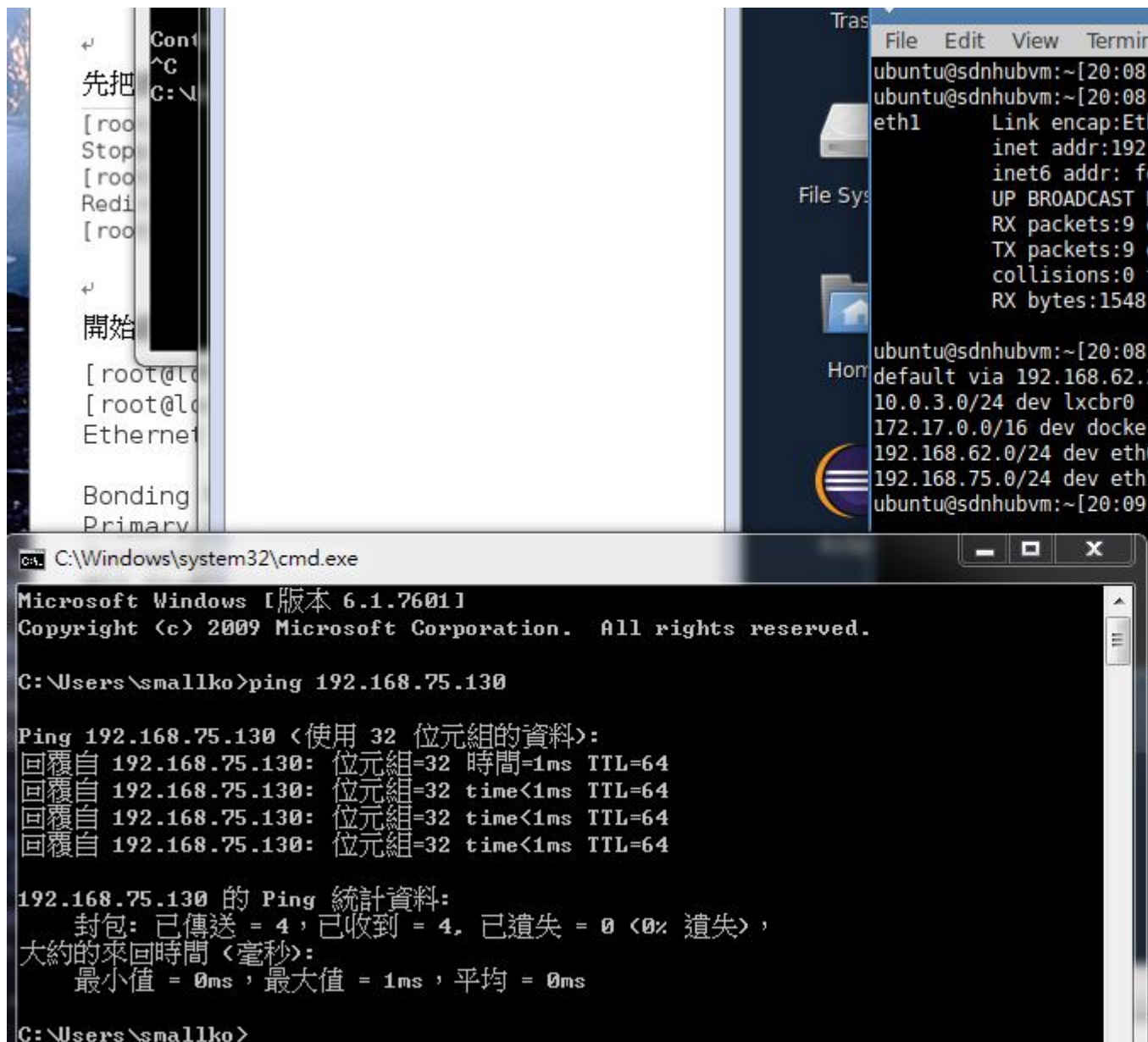
在 VMWARE 上測試 ubuntu (先安裝一個 ubuntu 虛擬機,網路設定如下,其中 NAT 是要讓虛擬機可以有對外連線,另外新增兩個 HOST-only 介面,這是要測試 linux binding,且讓 binding 後的介面可以跟實體機溝通)



啟動虛擬機,觀看網路設定,若有網卡沒有被 up,則使用 ifconfig 使其 up

```
Terminal
File Edit View Terminal Tabs Help
ubuntu@sdnhubvm:~[20:05]$ dmesg | grep eth
[ 1.587849] e1000 0000:02:01.0 eth0: (PCI:66MHz:32-bit) 00:0c:29:37:3d:1d
[ 1.587944] e1000 0000:02:01.0 eth0: Intel(R) PRO/1000 Network Connection
[ 1.968542] e1000 0000:02:04.0 eth1: (PCI:66MHz:32-bit) 00:0c:29:37:3d:27
[ 1.968633] e1000 0000:02:04.0 eth1: Intel(R) PRO/1000 Network Connection
[ 2.339653] e1000 0000:02:05.0 eth2: (PCI:66MHz:32-bit) 00:0c:29:37:3d:31
[ 2.339739] e1000 0000:02:05.0 eth2: Intel(R) PRO/1000 Network Connection
[ 19.672743] IPv6: ADDRCONF(NETDEV_UP): eth0: link is not ready
[ 19.672748] IPv6: ADDRCONF(NETDEV_UP): eth1: link is not ready
[ 19.672751] IPv6: ADDRCONF(NETDEV_UP): eth2: link is not ready
[ 21.248308] e1000: eth0 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: N
one
[ 21.261435] IPv6: ADDRCONF(NETDEV_UP): eth0: link is not ready
[ 21.261449] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
ubuntu@sdnhubvm:~[20:05]$ sudo ifconfig eth1 up
ubuntu@sdnhubvm:~[20:06]$ sudo ifconfig eth2 up
ubuntu@sdnhubvm:~[20:06]$
```

使用 dhclient eth1,設定 eth1 的 ip 設定,並在實體機測試是否可以跟 ubuntu 通訊



編輯/etc/modules

```
ubuntu@sdnhubvm:~[20:16]$ sudo vi /etc/modules
```

增加 bonding mode=1 miimon=100 (前面的設定可以不用加)

```
Terminal
File Edit View Terminal Tabs Help
1 # /etc/modules: kernel modules to load at boot time.
2 #
3 # This file contains the names of kernel modules that should be loaded
4 # at boot time, one per line. Lines beginning with "#" are ignored.
5 # Parameters can be specified after the module name.
6
7 lp
8 rtc
9 openvswitch
10 gre
11 libcrc32c
12 bonding mode=1 miimon=100
```

載入 bonding 模組

```
ubuntu@sdnhubvm:~[20:19]$ sudo modprobe bonding
ubuntu@sdnhubvm:~[20:19]$ cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: None
MII Status: down
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0
ubuntu@sdnhubvm:~[20:20]$
```

設定 bond0

```
ubuntu@sdnhubvm:~[20:20]$ sudo ip link set eth1 down
ubuntu@sdnhubvm:~[20:21]$ sudo ip link set eth2 down
ubuntu@sdnhubvm:~[20:21]$ sudo ip link set eth1 master bond0
ubuntu@sdnhubvm:~[20:21]$ sudo ip link set eth2 master bond0
ubuntu@sdnhubvm:~[20:21]$ sudo ip addr add 192.168.75.130/24 brd + dev bond0
ubuntu@sdnhubvm:~[20:22]$ sudo ip link set bond0 up
ubuntu@sdnhubvm:~[20:22]$
```

查看 ip 設定

```

ubuntu@sdnhubvm:~[20:23]$ ifconfig
bond0    Link encap:Ethernet  HWaddr 00:0c:29:37:3d:27
         inet addr:192.168.75.130  Bcast:192.168.75.255  Mask:255.255.255.0
         inet6 addr: fe80::20c:29ff:fe37:3d27/64 Scope:Link
         UP BROADCAST RUNNING MASTER MULTICAST  MTU:1500  Metric:1
         RX packets:139 errors:0 dropped:3 overruns:0 frame:0
         TX packets:33 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:19742 (19.7 KB)  TX bytes:3104 (3.1 KB)

docker0  Link encap:Ethernet  HWaddr 02:42:04:e2:d6:4e
         inet addr:172.17.0.1  Bcast:0.0.0.0  Mask:255.255.0.0
         UP BROADCAST MULTICAST  MTU:1500  Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

eth0     Link encap:Ethernet  HWaddr 00:0c:29:37:3d:1d
         inet addr:192.168.62.128  Bcast:192.168.62.255  Mask:255.255.255.0
         inet6 addr: fe80::20c:29ff:fe37:3d1d/64 Scope:Link
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:20771 errors:0 dropped:0 overruns:0 frame:0
         TX packets:9476 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:27974284 (27.9 MB)  TX bytes:604238 (604.2 KB)

eth1     Link encap:Ethernet  HWaddr 00:0c:29:37:3d:27
         inet addr:192.168.75.130  Bcast:192.168.75.255  Mask:255.255.255.0
         UP BROADCAST RUNNING SLAVE MULTICAST  MTU:1500  Metric:1
         RX packets:73 errors:0 dropped:0 overruns:0 frame:0
         TX packets:25 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:10313 (10.3 KB)  TX bytes:2456 (2.4 KB)

eth2     Link encap:Ethernet  HWaddr 00:0c:29:37:3d:27
         UP BROADCAST RUNNING SLAVE MULTICAST  MTU:1500  Metric:1
         RX packets:66 errors:0 dropped:3 overruns:0 frame:0
         TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000

```

發現 eth1 的 ip 設定還在,清除其 ip 設定, ifconfig eth1 0

```

ubuntu@sdnhubvm:~[20:24]$ ifconfig eth1
eth1     Link encap:Ethernet  HWaddr 00:0c:29:37:3d:27
         UP BROADCAST RUNNING SLAVE MULTICAST  MTU:1500  Metric:1
         RX packets:82 errors:0 dropped:0 overruns:0 frame:0
         TX packets:25 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:11423 (11.4 KB)  TX bytes:2456 (2.4 KB)

ubuntu@sdnhubvm:~[20:24]$

```

查看 bond0 設定,目前 active slave 為 eth1,並在實體機測試是否可以跟 bond0 通訊


```
ubuntu@sdnhubvm:~[20:24]$ cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: eth1
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: eth1
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: 00:0c:29:37:3d:27
Slave queue ID: 0

Slave Interface: eth2
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: 00:0c:29:37:3d:31
Slave queue ID: 0
ubuntu@sdnhubvm:~[20:24]$
```

C:\Windows\system32\cmd.exe

```
C:\Users\smallko>ping 192.168.75.130
```

```
Ping 192.168.75.130 <使用 32 位元組的資料>:
回覆自 192.168.75.130: 位元組=32 time<1ms
回覆自 192.168.75.130: 位元組=32 time<1ms
回覆自 192.168.75.130: 位元組=32 time<1ms
回覆自 192.168.75.130: 位元組=32 time<1ms
```

```
192.168.75.130 的 Ping 統計資料:
    封包: 已傳送 = 4, 已收到 = 4, 已遺失 = 0
    大約的來回時間 (毫秒):
        最小值 = 0ms, 最大值 = 0ms, 平均 = 0ms
```

```
C:\Users\smallko>
```

其他測試就與在 centos 相同