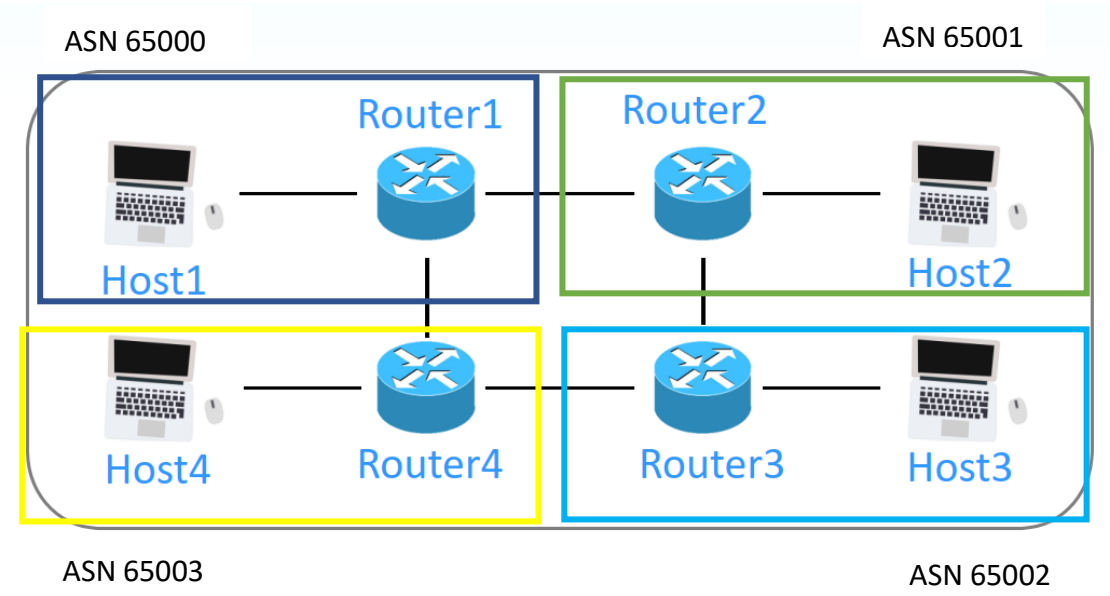
SDN project6 report

1. Topologys

借用 spec 上的圖片用來表示簡圖

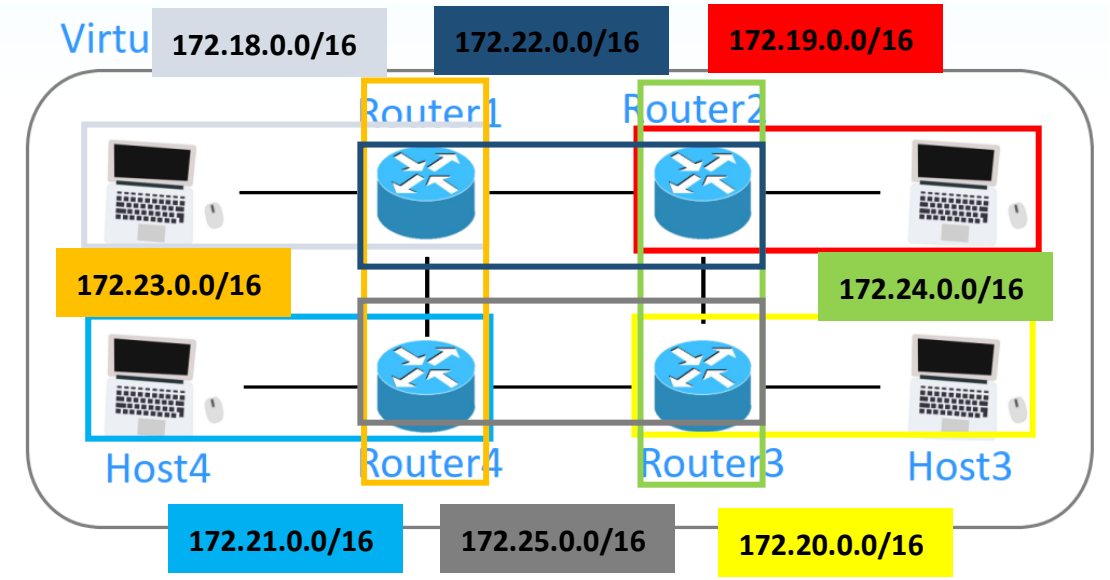
甲、ASN

借用 spec 上的圖片用來表示簡圖



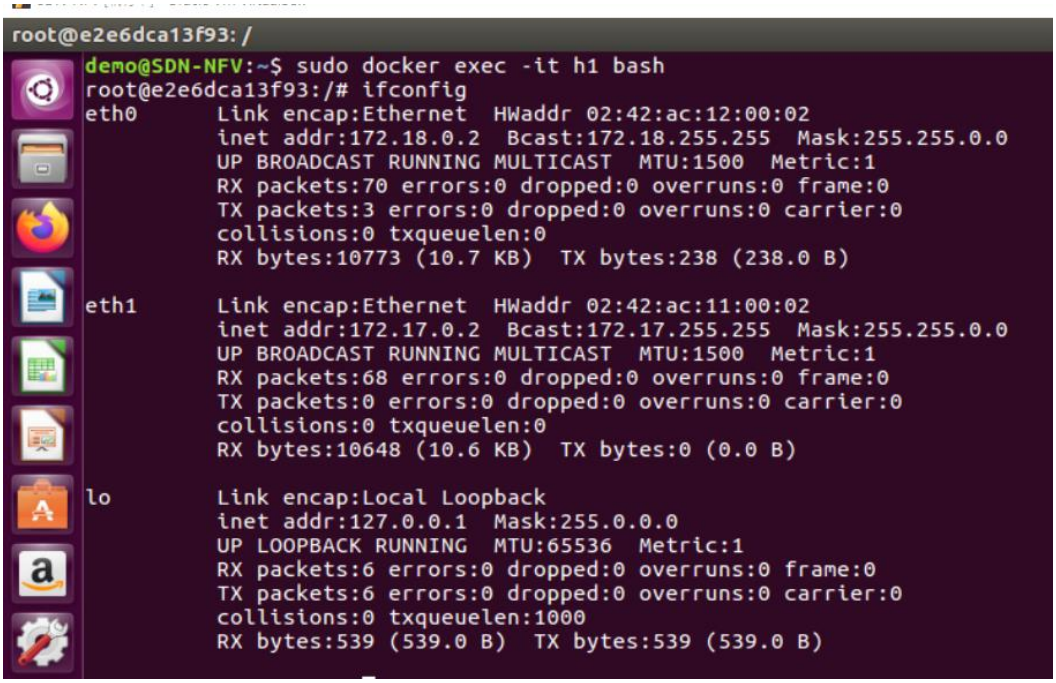
乙、Interfaces & IP address

簡圖如下

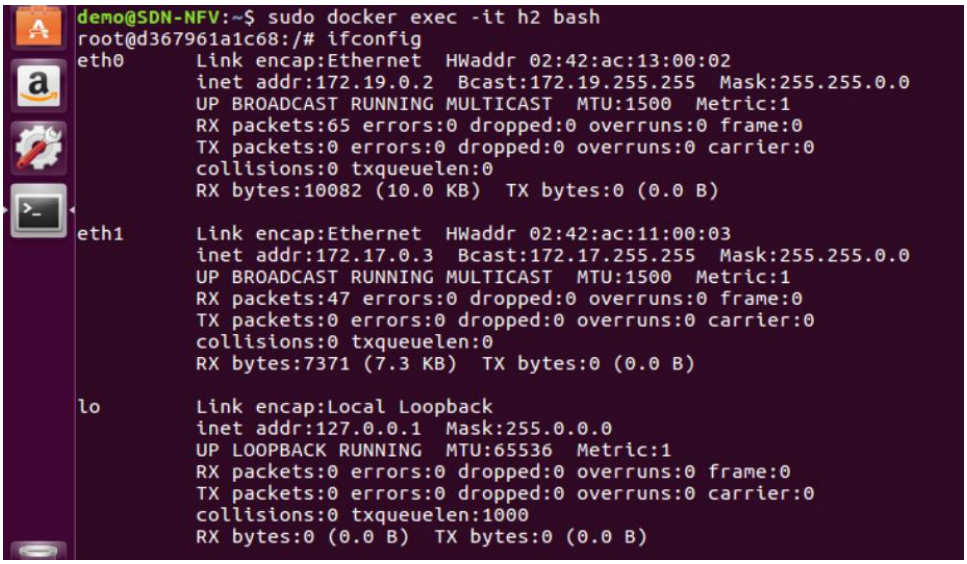


具體請看下圖

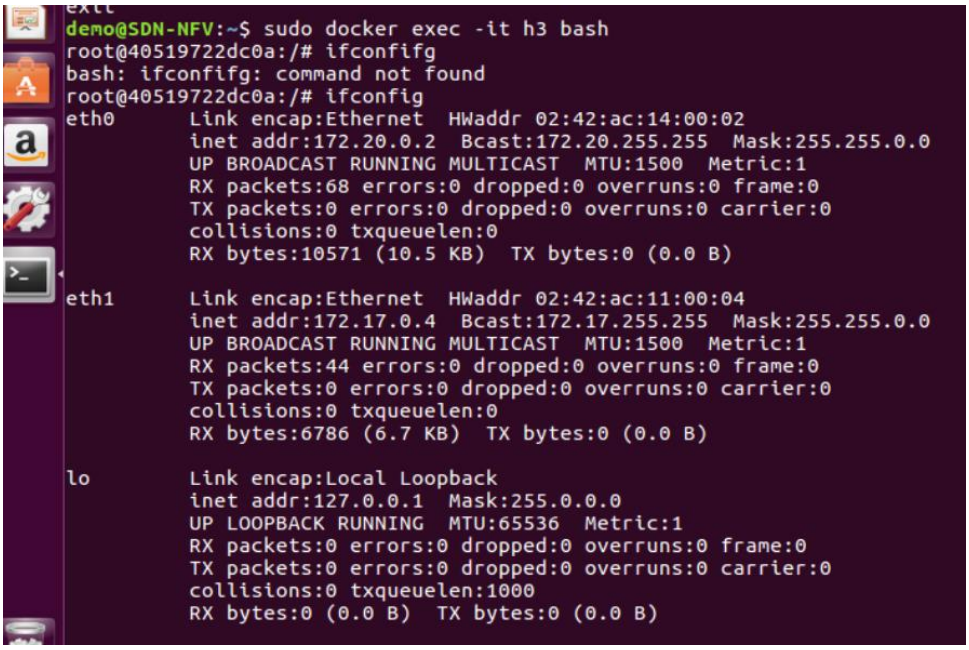
h1


root@e2e6dca13f93: /
demo@SDN-NFV:~$ sudo docker exec -it h1 bash
root@e2e6dca13f93:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:12:00:02
inet addr:172.18.0.2 Bcast:172.18.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:70 errors:0 dropped:0 overruns:0 frame:0
TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:10773 (10.7 KB) TX bytes:238 (238.0 B)
eth1 Link encap:Ethernet HWaddr 02:42:ac:11:00:02
inet addr:172.17.0.2 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:68 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:10648 (10.6 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:6 errors:0 dropped:0 overruns:0 frame:0
TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:539 (539.0 B) TX bytes:539 (539.0 B)

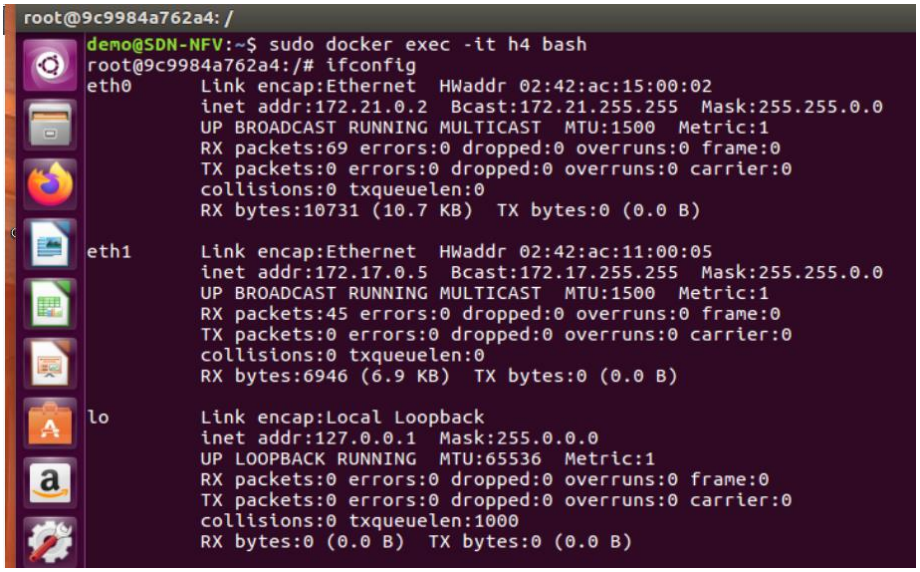
h2


demo@SDN-NFV:~$ sudo docker exec -it h2 bash
root@d367961a1c68:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:13:00:02
inet addr:172.19.0.2 Bcast:172.19.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:65 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:10082 (10.0 KB) TX bytes:0 (0.0 B)
eth1 Link encap:Ethernet HWaddr 02:42:ac:11:00:03
inet addr:172.17.0.3 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:47 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:7371 (7.3 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 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:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

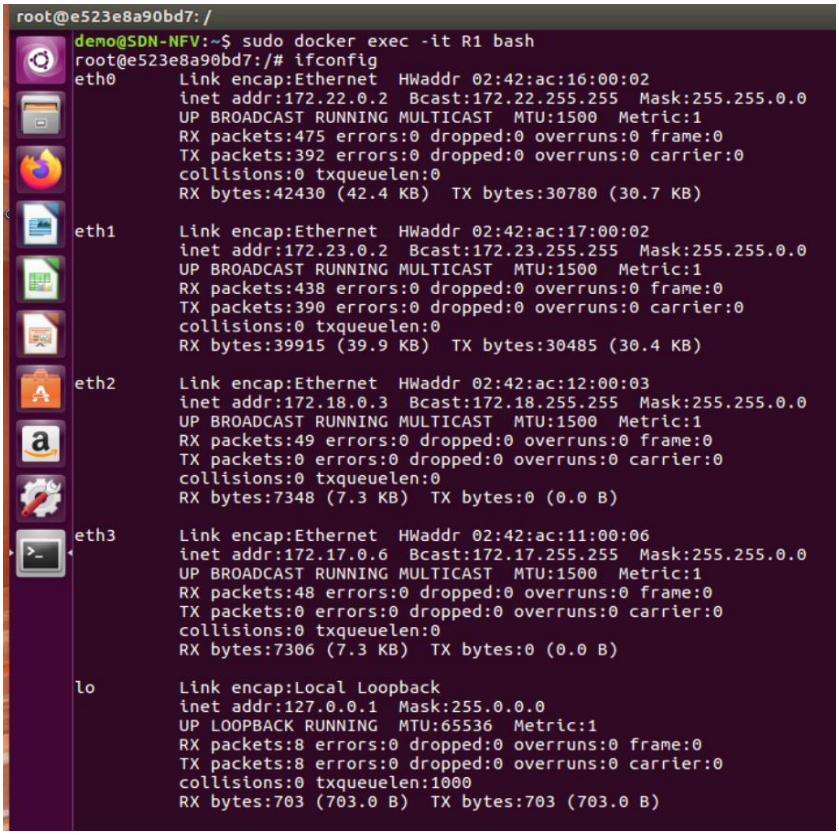
h3


demo@SDN-NFV:~$ sudo docker exec -it h3 bash
root@40519722dc0a:/# ifconfifg
bash: ifconfifg: command not found
root@40519722dc0a:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:14:00:02
inet addr:172.20.0.2 Bcast:172.20.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:68 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:10571 (10.5 KB) TX bytes:0 (0.0 B)
eth1 Link encap:Ethernet HWaddr 02:42:ac:11:00:04
inet addr:172.17.0.4 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:44 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:6786 (6.7 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 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:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

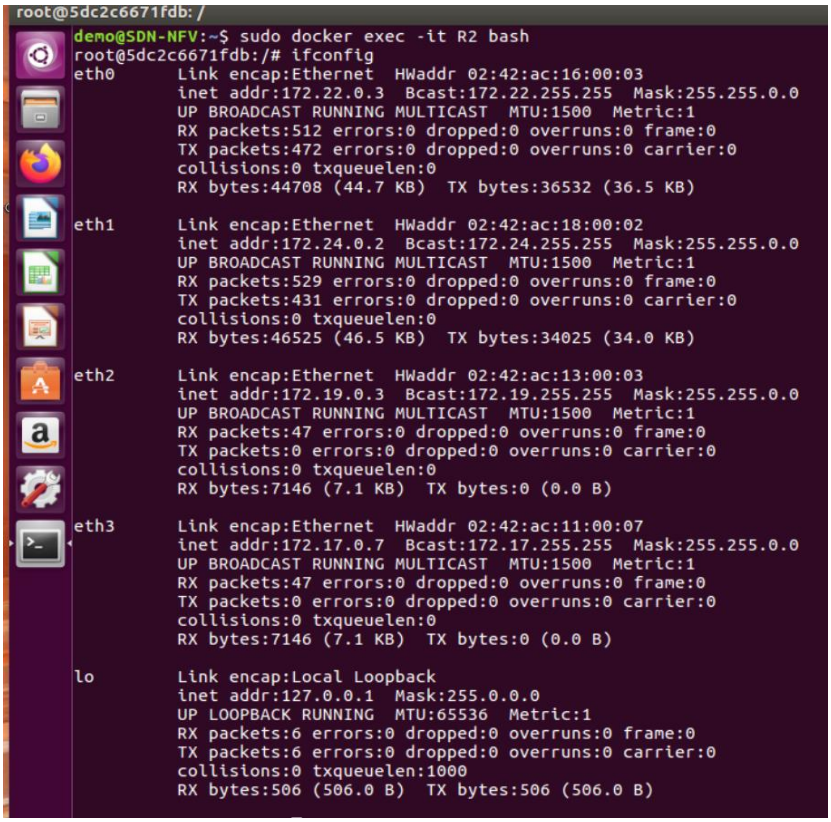
h4


root@9c9984a762a4: /
demo@SDN-NFV:~$ sudo docker exec -it h4 bash
root@9c9984a762a4:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:15:00:02
inet addr:172.21.0.2 Bcast:172.21.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:69 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:10731 (10.7 KB) TX bytes:0 (0.0 B)
eth1 Link encap:Ethernet HWaddr 02:42:ac:11:00:05
inet addr:172.17.0.5 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:45 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:6946 (6.9 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 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:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

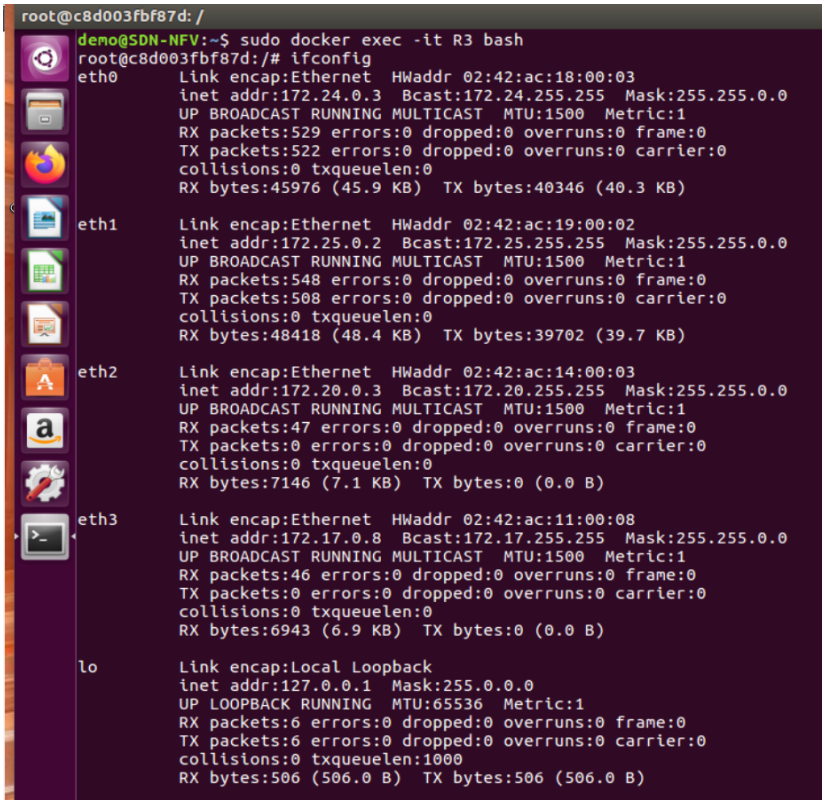
R1


root@e523e8a90bd7: /
demo@SDN-NFV:~$ sudo docker exec -it R1 bash
root@e523e8a90bd7:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:16:00:02
inet addr:172.22.0.2 Bcast:172.22.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:475 errors:0 dropped:0 overruns:0 frame:0
TX packets:392 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:42430 (42.4 KB) TX bytes:30780 (30.7 KB)
eth1 Link encap:Ethernet HWaddr 02:42:ac:17:00:02
inet addr:172.23.0.2 Bcast:172.23.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:438 errors:0 dropped:0 overruns:0 frame:0
TX packets:390 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:39915 (39.9 KB) TX bytes:30485 (30.4 KB)
eth2 Link encap:Ethernet HWaddr 02:42:ac:12:00:03
inet addr:172.18.0.3 Bcast:172.18.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:49 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:7348 (7.3 KB) TX bytes:0 (0.0 B)
eth3 Link encap:Ethernet HWaddr 02:42:ac:11:00:06
inet addr:172.17.0.6 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:48 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:7306 (7.3 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:8 errors:0 dropped:0 overruns:0 frame:0
TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:703 (703.0 B) TX bytes:703 (703.0 B)

R2


root@5dc2c6671fdb: /
demo@SDN-NFV:~$ sudo docker exec -it R2 bash
root@5dc2c6671fdb:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:16:00:03
inet addr:172.22.0.3 Bcast:172.22.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:512 errors:0 dropped:0 overruns:0 frame:0
TX packets:472 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:44708 (44.7 KB) TX bytes:36532 (36.5 KB)
eth1 Link encap:Ethernet HWaddr 02:42:ac:18:00:02
inet addr:172.24.0.2 Bcast:172.24.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:529 errors:0 dropped:0 overruns:0 frame:0
TX packets:431 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:46525 (46.5 KB) TX bytes:34025 (34.0 KB)
eth2 Link encap:Ethernet HWaddr 02:42:ac:13:00:03
inet addr:172.19.0.3 Bcast:172.19.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:47 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:7146 (7.1 KB) TX bytes:0 (0.0 B)
eth3 Link encap:Ethernet HWaddr 02:42:ac:11:00:07
inet addr:172.17.0.7 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:47 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:7146 (7.1 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:6 errors:0 dropped:0 overruns:0 frame:0
TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:506 (506.0 B) TX bytes:506 (506.0 B)

R3

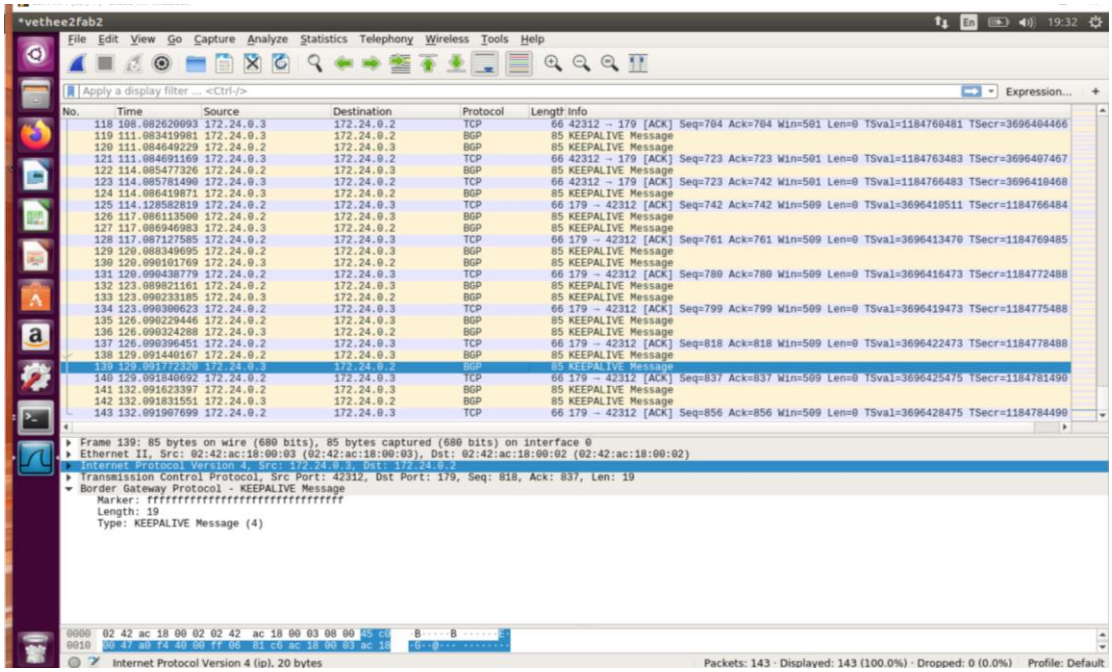

root@c8d003fbf87d: /
demo@SDN-NFV:~$ sudo docker exec -it R3 bash
root@c8d003fbf87d:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:18:00:03
inet addr:172.24.0.3 Bcast:172.24.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:529 errors:0 dropped:0 overruns:0 frame:0
TX packets:522 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:45976 (45.9 KB) TX bytes:40346 (40.3 KB)
eth1 Link encap:Ethernet HWaddr 02:42:ac:19:00:02
inet addr:172.25.0.2 Bcast:172.25.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:548 errors:0 dropped:0 overruns:0 frame:0
TX packets:508 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:48418 (48.4 KB) TX bytes:39702 (39.7 KB)
eth2 Link encap:Ethernet HWaddr 02:42:ac:14:00:03
inet addr:172.20.0.3 Bcast:172.20.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:47 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:7146 (7.1 KB) TX bytes:0 (0.0 B)
eth3 Link encap:Ethernet HWaddr 02:42:ac:11:00:08
inet addr:172.17.0.8 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:46 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:6943 (6.9 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:6 errors:0 dropped:0 overruns:0 frame:0
TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:506 (506.0 B) TX bytes:506 (506.0 B)

R4


root@834efdb0dfb4: /
root@c8d003fbf87d:/# exit
exit
demo@SDN-NFV:~$ sudo docker exec -it R4 bash
root@834efdb0dfb4:/# ifconfig
eth0 Link encap:Ethernet HWaddr 02:42:ac:17:00:03
inet addr:172.23.0.3 Bcast:172.23.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:575 errors:0 dropped:0 overruns:0 frame:0
TX packets:524 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:48439 (48.4 KB) TX bytes:40846 (40.8 KB)
eth1 Link encap:Ethernet HWaddr 02:42:ac:19:00:03
inet addr:172.25.0.3 Bcast:172.25.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:578 errors:0 dropped:0 overruns:0 frame:0
TX packets:505 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:49406 (49.4 KB) TX bytes:39481 (39.4 KB)
eth2 Link encap:Ethernet HWaddr 02:42:ac:15:00:03
inet addr:172.21.0.3 Bcast:172.21.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:47 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:7146 (7.1 KB) TX bytes:0 (0.0 B)
eth3 Link encap:Ethernet HWaddr 02:42:ac:11:00:09
inet addr:172.17.0.9 Bcast:172.17.255.255 Mask:255.255.0.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:46 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:6943 (6.9 KB) TX bytes:0 (0.0 B)
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:8 errors:0 dropped:0 overruns:0 frame:0
TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:762 (762.0 B) TX bytes:762 (762.0 B)

2. BGP packet capture through Wireshark

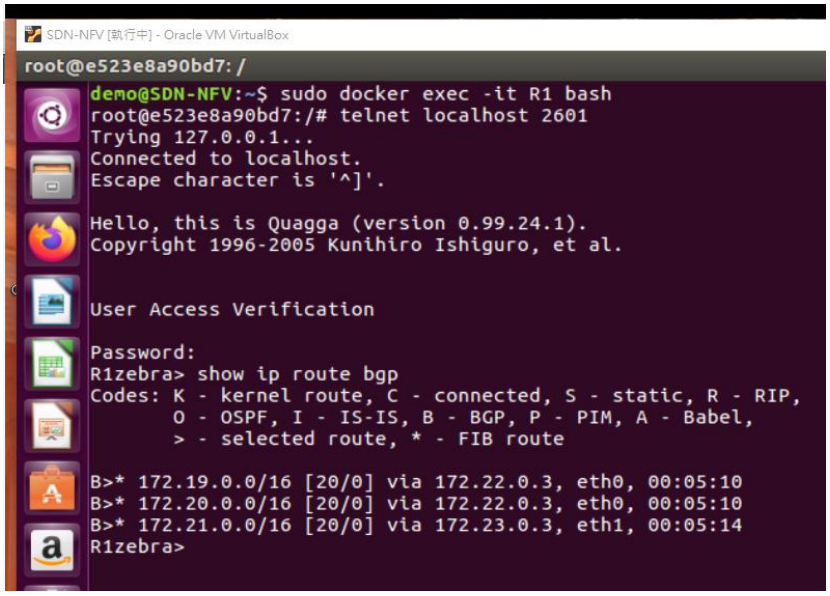
   如下圖，可看見 172.24.0.3(R3)和 172.24.0.2(h3)互相傳遞 BGP keep-alive message 用以保持 TCP connection 的建立



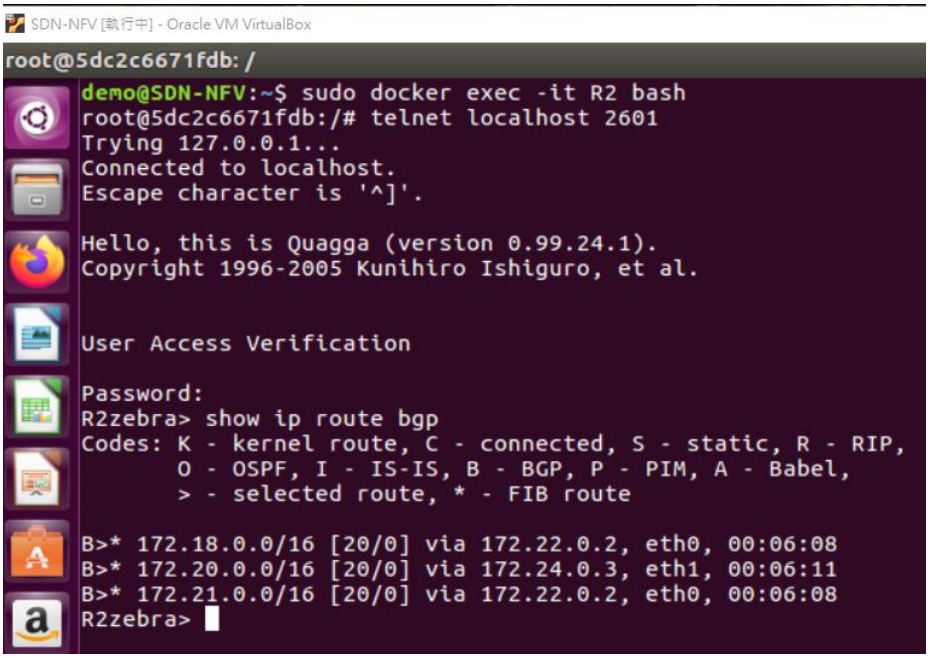
3. Route screen shot of zebra & bgpd daemon

   telnet 到 zebra 的結果如下圖

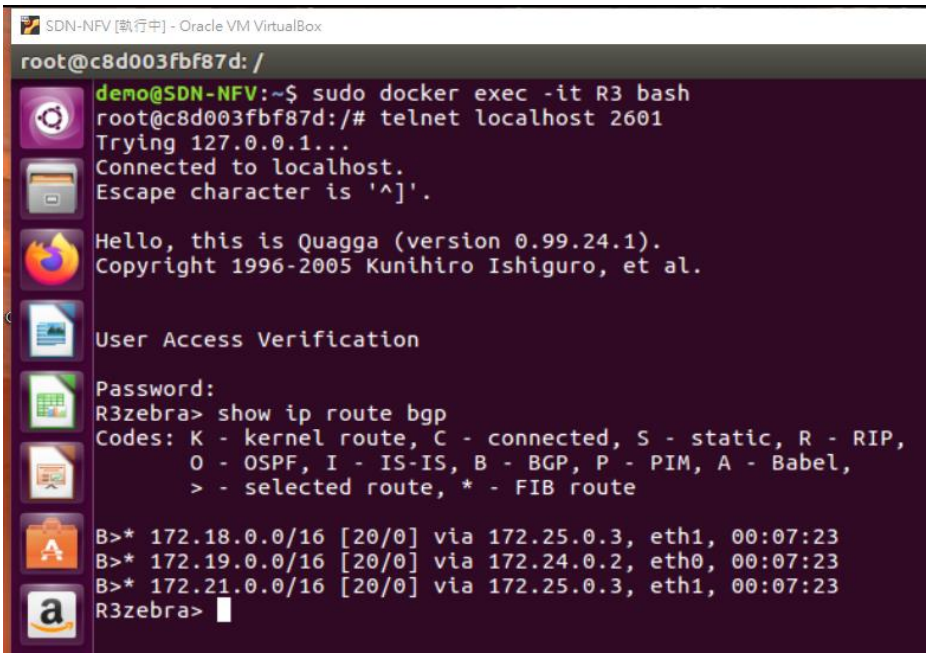
   R1



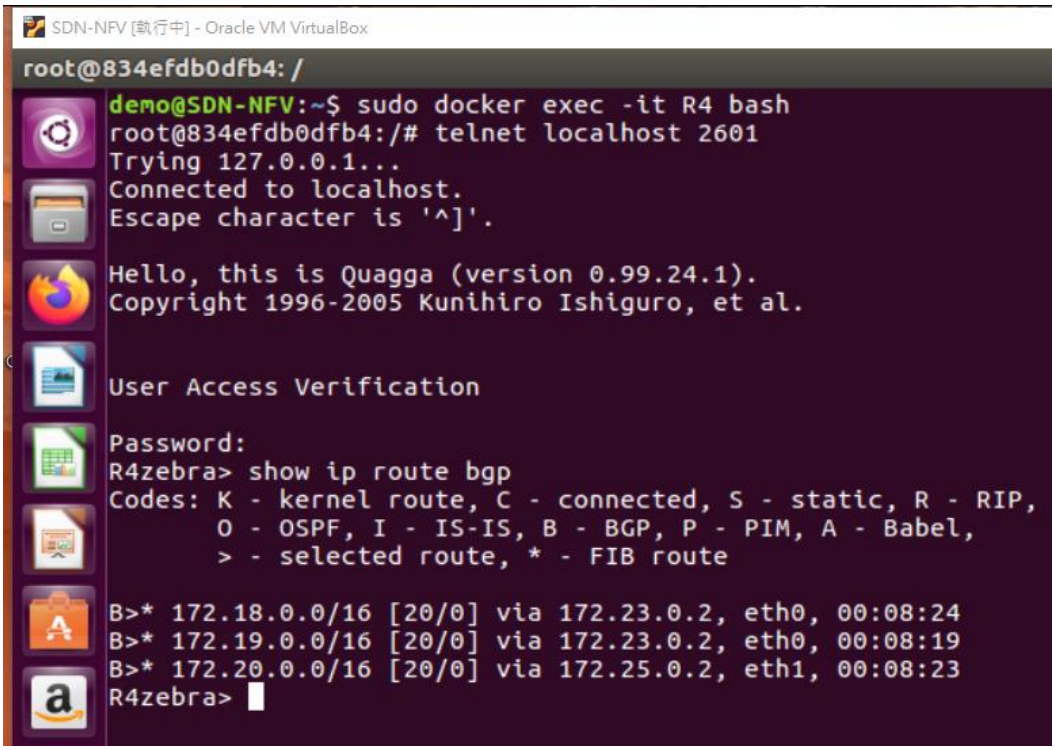
R2


SDN-NFV [執行中] - Oracle VM VirtualBox
root@5dc2c6671fdb: /
demo@SDN-NFV:~$ sudo docker exec -it R2 bash
root@5dc2c6671fdb:/# telnet localhost 2601
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Hello, this is Quagga (version 0.99.24.1).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
User Access Verification
Password:
R2zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel,
> - selected route, * - FIB route
B>* 172.18.0.0/16 [20/0] via 172.22.0.2, eth0, 00:06:08
B>* 172.20.0.0/16 [20/0] via 172.24.0.3, eth1, 00:06:11
B>* 172.21.0.0/16 [20/0] via 172.22.0.2, eth0, 00:06:08
R2zebra>

R3

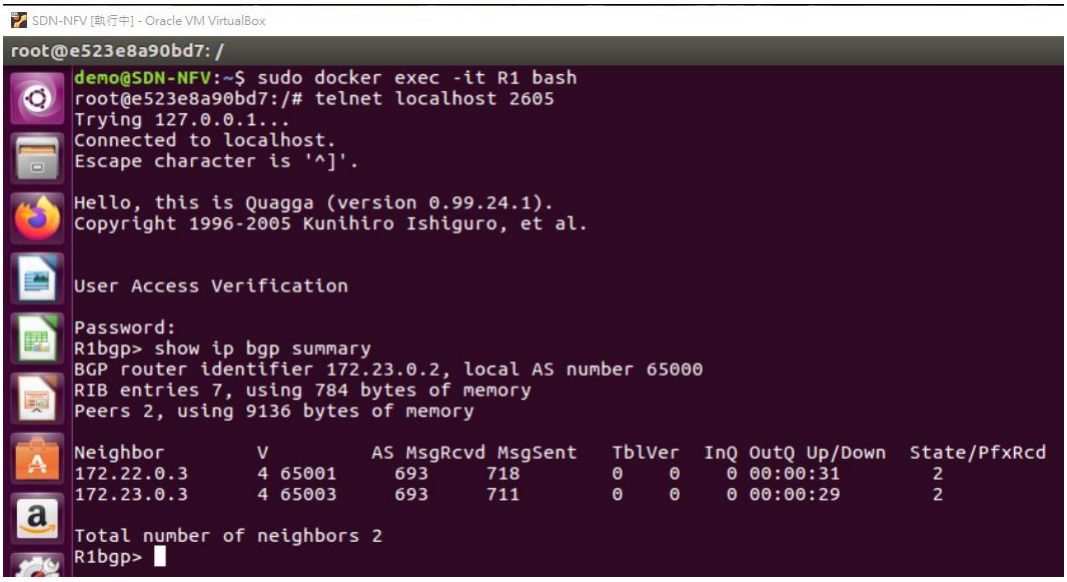

SDN-NFV [執行中] - Oracle VM VirtualBox
root@c8d003fbf87d: /
demo@SDN-NFV:~$ sudo docker exec -it R3 bash
root@c8d003fbf87d:/# telnet localhost 2601
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Hello, this is Quagga (version 0.99.24.1).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
User Access Verification
Password:
R3zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel,
> - selected route, * - FIB route
B>* 172.18.0.0/16 [20/0] via 172.25.0.3, eth1, 00:07:23
B>* 172.19.0.0/16 [20/0] via 172.24.0.2, eth0, 00:07:23
B>* 172.21.0.0/16 [20/0] via 172.25.0.3, eth1, 00:07:23
R3zebra>

R4

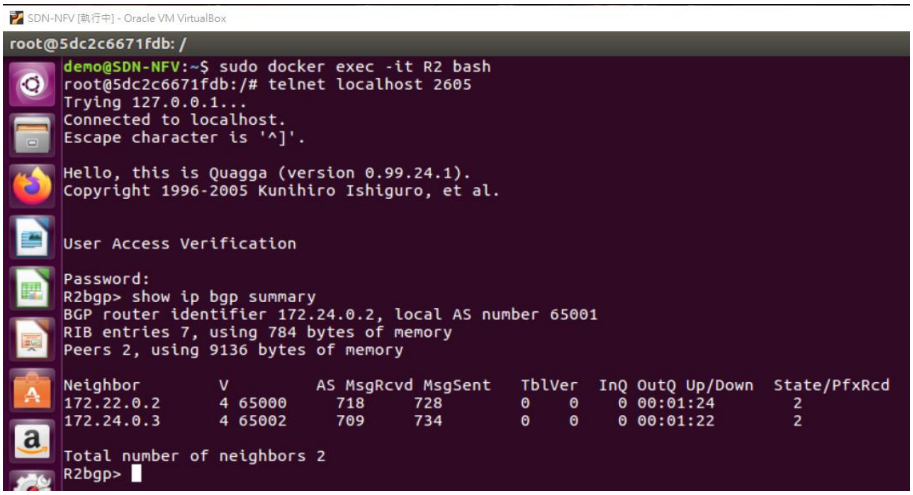


telnet 到 bgpd 的結果如下圖

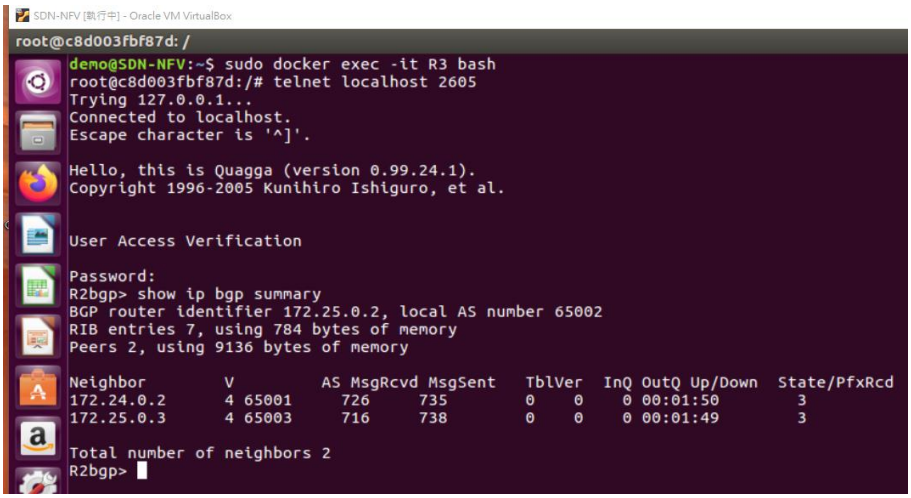
R1



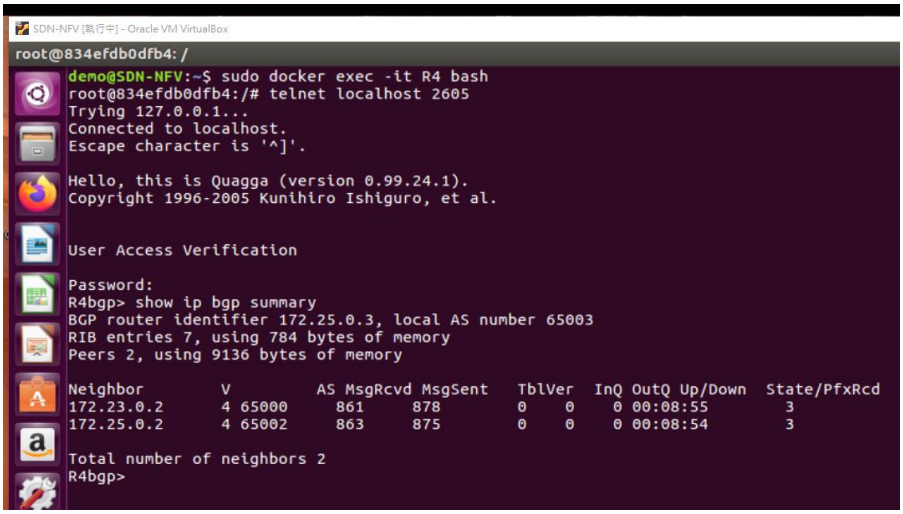
R2



R3(這裡的 bgpd.conf 中沒有改到 hostname，所以 command line 顯示出來是 R2bgp，但結果是正確的，是 R3 的結果)



R4



4. What I’ve learned

   因為之前在教授的網路系統總整與實作有碰過 docker 的設定以及更複雜的網路系統，因此這次的 project 對我而言比較沒有難度，就只是把學過的內容再複習一次(ONOS java 的 code 比較難寫，一堆 class 到處引用來引用去的 QQ)