SDN Project3 Answer Sheet

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Interface	Device1 IP	Device2 IP	ASNs
R1h1br	h1: 172.20.0.2	R1: 172.20.0.3	R1: 65000
R2h2br	h2: 172.22.0.3	R2: 172.22.0.2	R2: 65001
R1R2br	R1: 172.23.0.2	R2: 172.23.0.3	-
R3h3br	h3: 172.24.0.3	R3: 172.24.0.2	R3: 65002
R4h4br	h4: 172.25.0.3	R4: 172.25.0.2	R4: 65003
R3R4br	R3: 172.26.0.2	R4: 172.26.0.3	-
R1R4br	R1: 172.27.0.2	R4: 172.27.0.3	-
R2R3br	R2: 172.28.0.2	R3: 172.28.0.3	-

R1

```
R1zebra> 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>* 172.22.0.0/16 [20/0] via 172.23.0.3, eth4, 15:28:38
B>* 172.24.0.0/16 [20/0] via 172.27.0.3, eth5, 15:28:44
B>* 172.25.0.0/16 [20/0] via 172.27.0.3, eth5, 15:37:15
```

```
R1bgp> show ip bgp summary
BGP router identifier 172.27.0.2, local AS number 65000
RIB entries 7, using 784 bytes of memory
Peers 2, using 9136 bytes of memory

Neighbor        V     AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/P
fxRcd
172.23.0.3      4 65001  11110   11115       0    0    0 09:06:49        3
172.27.0.3      4 65003  11109   11109       0    0    0 09:15:26        3

Total number of neighbors 2
```

```
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
default          172.23.0.1       0.0.0.0          UG    0      0        0 eth4
172.17.0.0       *                255.255.0.0      U     0      0        0 eth0
172.20.0.0       *                255.255.0.0      U     0      0        0 eth1
172.22.0.0       R2.R1R2br        255.255.0.0      UG    0      0        0 eth4
172.23.0.0       *                255.255.0.0      U     0      0        0 eth4
172.24.0.0       R4.R1R4br        255.255.0.0      UG    0      0        0 eth5
172.25.0.0       R4.R1R4br        255.255.0.0      UG    0      0        0 eth5
172.27.0.0       *                255.255.0.0      U     0      0        0 eth5
```

R2

```
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>* 172.20.0.0/16 [20/0] via 172.23.0.2, eth4, 15:36:18
B>* 172.24.0.0/16 [20/0] via 172.28.0.3, eth5, 15:36:21
B>* 172.25.0.0/16 [20/0] via 172.28.0.3, eth5, 15:36:21
```

```
R2bgp> show ip bgp summary
BGP router identifier 172.28.0.2, local AS number 65001
RIB entries 7, using 784 bytes of memory
Peers 2, using 9136 bytes of memory

Neighbor         V         AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down   State/P
fxRcd
172.23.0.2       4 65000   11101   11104       0     0      0 09:15:06        3
172.28.0.3       4 65002   11102   11102       0     0      0 09:15:09        3

Total number of neighbors 2
```

```
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
default          172.23.0.1       0.0.0.0          UG    0      0        0 eth4
172.17.0.0       *                255.255.0.0      U     0      0        0 eth0
172.20.0.0       R1.R1R2br        255.255.0.0      UG    0      0        0 eth4
172.22.0.0       *                255.255.0.0      U     0      0        0 eth1
172.23.0.0       *                255.255.0.0      U     0      0        0 eth4
172.24.0.0       R3.R2R3br        255.255.0.0      UG    0      0        0 eth5
172.25.0.0       R3.R2R3br        255.255.0.0      UG    0      0        0 eth5
172.28.0.0       *                255.255.0.0      U     0      0        0 eth5
```
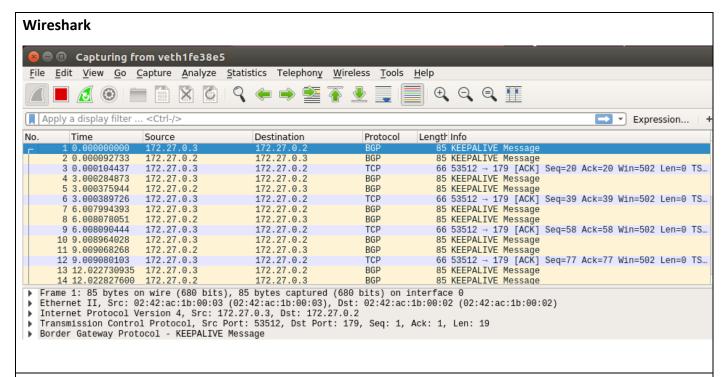
R3

```
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>* 172.20.0.0/16 [20/0] via 172.26.0.3, eth2, 15:42:29
B>* 172.22.0.0/16 [20/0] via 172.28.0.2, eth3, 15:42:24
B>* 172.25.0.0/16 [20/0] via 172.26.0.3, eth2, 15:42:29
```

```
R3bgp> show ip bgp summary
BGP router identifier 172.28.0.3, local AS number 65002
RIB entries 7, using 784 bytes of memory
Peers 2, using 9136 bytes of memory

Neighbor        V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down   State/P
fxRcd
172.26.0.3      4 65003   11210    11211       0    0     0 09:20:41          2
172.28.0.2      4 65001   11208    11212       0    0     0 09:20:36          2

Total number of neighbors 2
```

```
Destination      Gateway            Genmask          Flags Metric Ref    Use Iface
default          172.28.0.1         0.0.0.0          UG    0      0        0 eth3
172.17.0.0       *                  255.255.0.0      U     0      0        0 eth0
172.20.0.0       R4.R3R4br          255.255.0.0      UG    0      0        0 eth2
172.22.0.0       R2.R2R3br          255.255.0.0      UG    0      0        0 eth3
172.24.0.0       *                  255.255.0.0      U     0      0        0 eth1
172.25.0.0       R4.R3R4br          255.255.0.0      UG    0      0        0 eth2
172.26.0.0       *                  255.255.0.0      U     0      0        0 eth2
172.28.0.0       *                  255.255.0.0      U     0      0        0 eth3
```

R4

```
R4zebra> 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>* 172.20.0.0/16 [20/0] via 172.27.0.2, eth4, 15:53:38
B>* 172.22.0.0/16 [20/0] via 172.26.0.2, eth2, 15:44:59
B>* 172.24.0.0/16 [20/0] via 172.26.0.2, eth2, 15:45:09
```

```
R4bgp> show ip bgp summary
BGP router identifier 172.27.0.3, local AS number 65003
RIB entries 7, using 784 bytes of memory
Peers 2, using 9136 bytes of memory

Neighbor        V          AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down   State/P
fxRcd
172.26.0.2      4 65002   11430    11438       0    0     0 09:22:40          2
172.27.0.2      4 65000   11431    11437       0    0     0 09:31:09          2

Total number of neighbors 2
```

```
Destination      Gateway            Genmask          Flags Metric Ref    Use Iface
default          172.27.0.1         0.0.0.0          UG    0      0        0 eth4
172.17.0.0       *                  255.255.0.0      U     0      0        0 eth0
172.20.0.0       R1.R1R4br          255.255.0.0      UG    0      0        0 eth4
172.22.0.0       R1.R1R4br          255.255.0.0      UG    0      0        0 eth4
172.24.0.0       R3.R3R4br          255.255.0.0      UG    0      0        0 eth2
172.25.0.0       *                  255.255.0.0      U     0      0        0 eth3
172.26.0.0       *                  255.255.0.0      U     0      0        0 eth2
172.27.0.0       *                  255.255.0.0      U     0      0        0 eth4
```

Wireshark


```
Capturing from veth1fe38e5
File  Edit  View  Go  Capture  Analyze  Statistics  Telephony  Wireless  Tools  Help

Apply a display filter ... <Ctrl-/>                                    Expression...  +

No.   Time          Source        Destination   Protocol  Length  Info
    1 0.000000000   172.27.0.3    172.27.0.2    BGP        85  KEEPALIVE Message
    2 0.000092733   172.27.0.2    172.27.0.3    BGP        85  KEEPALIVE Message
    3 0.000104437   172.27.0.3    172.27.0.2    TCP        66  53512 → 179 [ACK] Seq=20 Ack=20 Win=502 Len=0 TS…
    4 3.000284873   172.27.0.3    172.27.0.2    BGP        85  KEEPALIVE Message
    5 3.000375944   172.27.0.2    172.27.0.3    BGP        85  KEEPALIVE Message
    6 3.000389726   172.27.0.3    172.27.0.2    TCP        66  53512 → 179 [ACK] Seq=39 Ack=39 Win=502 Len=0 TS…
    7 6.007994393   172.27.0.3    172.27.0.2    BGP        85  KEEPALIVE Message
    8 6.008078051   172.27.0.2    172.27.0.3    BGP        85  KEEPALIVE Message
    9 6.008090444   172.27.0.3    172.27.0.2    TCP        66  53512 → 179 [ACK] Seq=58 Ack=58 Win=502 Len=0 TS…
   10 9.008964028   172.27.0.3    172.27.0.2    BGP        85  KEEPALIVE Message
   11 9.009068268   172.27.0.2    172.27.0.3    BGP        85  KEEPALIVE Message
   12 9.009080103   172.27.0.3    172.27.0.2    TCP        66  53512 → 179 [ACK] Seq=77 Ack=77 Win=502 Len=0 TS…
   13 12.022730935  172.27.0.3    172.27.0.2    BGP        85  KEEPALIVE Message
   14 12.022827600  172.27.0.2    172.27.0.3    BGP        85  KEEPALIVE Message

▶ Frame 1: 85 bytes on wire (680 bits), 85 bytes captured (680 bits) on interface 0
▶ Ethernet II, Src: 02:42:ac:1b:00:03 (02:42:ac:1b:00:03), Dst: 02:42:ac:1b:00:02 (02:42:ac:1b:00:02)
▶ Internet Protocol Version 4, Src: 172.27.0.3, Dst: 172.27.0.2
▶ Transmission Control Protocol, Src Port: 53512, Dst Port: 179, Seq: 1, Ack: 1, Len: 19
▶ Border Gateway Protocol - KEEPALIVE Message
```

Learned:

1. Docker run –name [] image: 用現存的 image 直接建一個新的 docker. 快速部屬多個類似環境

2. Docker network create [bridgeName] 建立一個 network bridge 連接不同 devices

3. Docker network inspect [bridgeName] 查看 network bridge details

4. 安裝 quagga: 可以讓 Linux 具有 router 功能

5. 設定 quagga: 可以讓不同的 router 交換 bgp 封包