

Lab 5 (new)

Q1. The network topology as in the earlier figure (IP addresses of all routers and its interfaces, Hosts/IPs in the ASes)

AS1: 11.0.0.0/8	AS2: 12.0.0.0/8	AS3: 13.0.0.0/8
h11: 11.0.1.1	h21: 12.0.1.1	h31: 13.0.1.1
h12:11.0.2.1	h22: 12.0.2.1	h32: 13.0.2.1
h13: 11.0.3.1	h23: 12.0.3.1	h33: 13.0.3.1
Link (R1, R4): 9.0.4.1	Link (R2, R1): 9.0.0.2	Link (R3,R2): 9.0.1.2
Link (R1,R2): 9.0.0.1	Link (R2, R3): 9.0.1.1	-

Link(R4,R1): 9.0.4.2

Q2. Describe in detail the BGP traffic you were able to observe during re-establishment of routes in section 2.3.

No.	Time	Source	Destination	Protocol	Length	Info
200	36.400801	9.0.0.2	9.0.0.1	BGP	142	UPDATE Message, UPDATE Message
202	36.456319	9.0.0.1	9.0.0.2	BGP	142	UPDATE Message, UPDATE Message
204	36.507131	9.0.0.2	9.0.0.1	BGP	116	UPDATE Message

During re-establishment of routes (clear bgp external), the eBGP neighbour sessions are reset and the BGP routing tables need to be rebuilt. In the figure above, R1 (9.0.0.1) and R2 (9.0.0.2) send UPDATE messages to each other to update and advertise their own routing information.

Q3. Your answers to all the questions in sections 2.4

1. Currently, h11 can reach h21, but it cannot reach h31. Explain why this is the case by inspecting h11's routing tables ip route show and the routing tables R1 received from R2 (use the bgpd console)

```
R1-bgpd> show ip bgp
BGP table version is 2, local router ID is 9.0.0.1, vrf id 0
Default local pref 100, local AS 1
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found

   Network          Next Hop          Metric LocPrf Weight Path
*> 11.0.0.0/8       0.0.0.0              0         32768 i
*> 12.0.0.0/8       9.0.0.2              0          0 2 i

mininet> h11 ip route show
default nhid 6 via 11.0.1.254 dev h11-eth0 proto static metric 20
11.0.1.0/24 dev h11-eth0 proto kernel scope link src 11.0.1.1

mininet> R1 ip route show
9.0.0.0/24 dev R1-eth4 proto kernel scope link src 9.0.0.1
9.0.4.0/24 dev R1-eth5 proto kernel scope link src 9.0.4.1
11.0.1.0/24 dev R1-eth1 proto kernel scope link src 11.0.1.254
11.0.2.0/24 dev R1-eth2 proto kernel scope link src 11.0.2.254
11.0.3.0/24 dev R1-eth3 proto kernel scope link src 11.0.3.254
12.0.0.0/8 nhid 22 via 9.0.0.2 dev R1-eth4 proto bgp metric 20
mininet>
```

The routing table of h11 and R1 do not show any entries that are in AS3, hence it is unable to reach h31.

2. Modify the bgpd configuration files of R2 and R3 to allow h11 to reach h31. Hint: R2 and R3 needs to add each other as peering neighbors. Reference R1's configuration file and consult the bgpd configuration section of the frd documentation

```
mininet> h11 ip route show
mininet>
root@bgp-lab:~/Lab5# ./connect.sh R1
-bash: ./connect.sh: Permission denied
root@bgp-lab:~/Lab5#
```

The rough idea would be to add the IP address of R3 under the R2 conf file as a bgp router, and vice versa.

3. What does the next-hop-self force option do and why is it needed on R2 for AS1 to be able to reach AS3?

This option allows AS2 to advertise that it has a next hop router to other AS and nodes in AS1 can hop to AS2 to look for AS3 since AS1 knows that it does not have a direct link AS3.

4. After you ensured that the hosts in AS1 (served by R1) can reach the hosts in AS3 (served by R3), investigate if R1 itself can reach the hosts in AS3 using the mininet CLI. Interestingly, invoking the ping command with different options (shown below) have different results. Explain why this is the case with reference to your current understanding of the network topology, the routing tables, and the nature of the network layer.
- R1 ping h31 does not work, but
 - R1 ping -I R1-eth1 h31 works.

The second command is more specific as it specifies the interface to route from.

Q4. Describe in detail what happened when you started the attack on BGP.

```
root@bgp-lab:/home/vboxuser/Lab5# ./website.sh h11
Tue 18 Apr 2023 07:52:40 PM +08 --
Tue 18 Apr 2023 07:52:41 PM +08 --
Tue 18 Apr 2023 07:52:43 PM +08 --
Tue 18 Apr 2023 07:52:44 PM +08 --
Tue 18 Apr 2023 07:52:48 PM +08 --
Tue 18 Apr 2023 07:52:52 PM +08 --
Tue 18 Apr 2023 07:52:56 PM +08 --
Tue 18 Apr 2023 07:53:00 PM +08 --
Tue 18 Apr 2023 07:53:04 PM +08 --
Tue 18 Apr 2023 07:53:08 PM +08 --
Tue 18 Apr 2023 07:53:09 PM +08 --
Tue 18 Apr 2023 07:53:14 PM +08 --
Tue 18 Apr 2023 07:53:18 PM +08 --
Tue 18 Apr 2023 07:53:22 PM +08 --
Tue 18 Apr 2023 07:53:26 PM +08 --
Tue 18 Apr 2023 07:53:30 PM +08 --
Tue 18 Apr 2023 07:53:34 PM +08 --
Tue 18 Apr 2023 07:53:38 PM +08 --
Tue 18 Apr 2023 07:53:40 PM +08 --
Tue 18 Apr 2023 07:53:44 PM +08 --
Tue 18 Apr 2023 07:53:48 PM +08 --
Tue 18 Apr 2023 07:53:52 PM +08 --
Tue 18 Apr 2023 07:53:56 PM +08 --
Tue 18 Apr 2023 07:54:00 PM +08 --
```

(not sure know why nothing changed after editing)