

Preparation

Task 1. This question contains three points

Answer:

- Point 1:

Done.

- Point 2: create a bridge named xenbr1 and attach the second interface (eno2) of your server to it, such that all traffic on that interface is delivered to the bridge:

```
root@bristol:/home/kotaiba# brctl addbr xenbr1
root@bristol:/home/kotaiba# brctl addif xenbr1 eno2
device eno2 is already a member of a bridge; can't enslave it to bridge xenbr1.
```

```
root@bristol:/home/kotaiba# brctl show
bridge name bridge id          STP enabled  interfaces
xenbr0      8000.feffffffffffff    no          vif10.0
              vif12.0
              vif14.0
              vif7.0
xenbr1      8000.d4ae52bfe4db     no          eno2
```

Make it up:

```
root@bristol:/home/kotaiba# ip link set xenbr1 up

root@bristol:/home/kotaiba# ifconfig xenbr1
xenbr1      Link encap:Ethernet  HWaddr d4:ae:52:bf:e4:db
            inet addr:192.168.0.11  Bcast:192.168.255.255  Mask:255.255.0.0
            inet6 addr: fe80::d6ae:52ff:febf:e4db/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:1184 errors:0 dropped:0 overruns:0 frame:0
            TX packets:74 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:61299 (61.2 KB)  TX bytes:8434 (8.4 KB)
```

- Point 3: extend the “vif =” line in your /etc/xen/ <DomU-hostname>.cfg, as follows.

```
vif          = [ 'ip=145.100.108.83 ,mac=00:16:3E:B3:F7:B3,bridge=xenbr0',
'mac=00:16:3e:dd:ee:ff,bridge=xenbr1' ]
```

Now we reboot the Guest-02 VM:

```
root@bristol:/home/kotaiba# xl reboot Guest-02
Rebooting domain 12
```

Test after make eth1 interface up:

```
root@Guest-02:~# ip link set eth1 up

root@Guest-02:~# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 145.100.108.83 netmask 255.255.255.240 broadcast
145.100.108.95
    inet6 fe80::216:3eff:feb3:f7b3 prefixlen 64 scopeid 0x20<link>
    ether 00:16:3e:b3:f7:b3 txqueuelen 1000 (Ethernet)
    RX packets 150 bytes 6870 (6.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 37 bytes 2534 (2.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::216:3eff:fedd:eeff prefixlen 64 scopeid 0x20<link>
    ether 00:16:3e:dd:ee:ff txqueuelen 1000 (Ethernet)
    RX packets 469 bytes 24932 (24.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 3 bytes 266 (266.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 166 bytes 12356 (12.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 166 bytes 12356 (12.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lxcbr0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    inet 10.0.3.1 netmask 255.255.255.0 broadcast 0.0.0.0
    ether 00:16:3e:00:00:00 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Task 2. Get the latest version of the pogo script from gitlab. In the configurations directory you will find a blank configuration for your BGP network (Figure 3). Adjust it to match your own IP addressing scheme given in Figure 4).

Create the network with pogo.

Answer:

$$ZZ = 11$$

Name	0	S3-IX IP	AS	IPv4 Block
Kotaiba Alachkar	172.16.0.11	64611	10.11.0.0/16	

bgp.cfg file:

```
#####  
####  
#GLOBAL CONFIG  
#####  
####  
#  
#                               10.66.0.0/16  
#  
#  
#  
#  
#           10.66.1.0/24      10.66.14.0/24      10.66.4.0/24  
#           --+--              v                --+--  
#               |              v                |  
#           .1 | eth0          v                .4 | eth0  
#       +-----+-----+              v                +-----+  
#172.16.0.0/24    |             |eth2          v          eth2|  
# OS3 IX         | Router1 +-----+-----+ Router4 |  
# -----+----- |             |.1              .4 |  
#   |             +-----+-----+              +-----+  
#   |             eth1|.1              eth1|.4  
#   | eth2          |             |  
#   | +-----+-----+             |  
#   | |             |eth1 | 10.66.123.0/24             |  
# |--+ Router2 +-----+ <<<<<<<<<<<< >>>>>>>> |  
# .2 |             |.2              10.66.45.0/24 |  
#   +-----+-----+             |  
#   .2 | eth0          |             |  
#       |             eth1|.3              eth1|.5  
#       +-+--+       +-----+-----+              +-----+  
# 10.66.2.0/24     |             |eth2          eth2|  
#   | Router3 +-----+-----+ Router5 |  
#   |             |.3              ^          .5|  
# +-----+-----+             ^          +-----+  
# .3 | eth0          ^              .5 |eth0  
#   |             ^              |  
#       +-+--+       ^              +-+--+  
# 10.66.3.0/24     ^              10.66.5.0/24  
#                   ^
```

```
# 10.66.35.0/24

[global]

session_path = /tmp

#memory per uml instance
mem = 50M
root_image= /tmp/uml_debian.img
hubs = 10

#####
####
#HOST CONFIG
#####
####

[router1]
role= router
home=/root/uml_home
pass_quaggadir="/root/pogo/configurations/bgp/router1"
eth1 = 0,10.11.1.1/24
eth123 = 5,10.11.123.1/24
eth14 = 6,10.11.14.1/24

[router2]
role = router
home=/root/uml_home
pass_quaggadir="/root/pogo/configurations/bgp/router2"
eth2 = 9,172.16.0.11/24
eth123 = 5,10.11.123.2/24

[router3]
role = router
home=/root/uml_home
pass_quaggadir="/root/pogo/configurations/bgp/router3"
eth3 = 2,10.11.3.3/24
eth123 = 5,10.11.123.3/24
eth35 = 8,10.11.35.3/24

[router4]
role = router
home=/root/uml_home
pass_quaggadir="/root/pogo/configurations/bgp/router4"
eth4 = 3,10.11.4.4/24
eth45 = 7,10.11.45.4/24
eth14 = 6,10.11.14.4/24

[router5]
role = router
```

```
home=/root/uml_home
pass_quaggadir="/root/pogo/configurations/bgp/router5"
eth5 = 4,10.11.5.5/24
eth45 = 7,10.11.45.5/24
eth35 = 8,10.11.35.5/24
```

Create and start the configuration:

```
root@Guest-02:~/pogo# python pogo.py create configurations/bgp/bgp.cfg
INFO: Creating ogo-ovs0 switch
INFO: Creating ogo-ovs1 switch
INFO: Creating ogo-ovs2 switch
INFO: Creating ogo-ovs3 switch
INFO: Creating ogo-ovs4 switch
INFO: Creating ogo-ovs5 switch
INFO: Creating ogo-ovs6 switch
INFO: Creating ogo-ovs7 switch
INFO: Creating ogo-ovs8 switch
INFO: Creating ogo-ovs9 switch
INFO: Creating host router1. This will take some time.
INFO: Creating host router2. This will take some time.
INFO: Creating host router3. This will take some time.
INFO: Creating host router4. This will take some time.
INFO: Creating host router5. This will take some time.

root@Guest-02:~/pogo# python pogo.py start configurations/bgp/bgp.cfg
INFO: Starting sniffer on ogo-ovs0 switch
INFO: Starting sniffer on ogo-ovs1 switch
INFO: Starting sniffer on ogo-ovs2 switch
INFO: Starting sniffer on ogo-ovs3 switch
INFO: Starting sniffer on ogo-ovs4 switch
INFO: Starting sniffer on ogo-ovs5 switch
INFO: Starting sniffer on ogo-ovs6 switch
INFO: Starting sniffer on ogo-ovs7 switch
INFO: Starting sniffer on ogo-ovs8 switch
INFO: Starting sniffer on ogo-ovs9 switch
INFO: Starting host router1.
INFO: Starting host router2.
INFO: Starting host router3.
INFO: Starting host router4.
INFO: Starting host router5.
There are screens on:
    3939.router5      (12/05/17 13:20:49)    (Detached)
    3284.router4      (12/05/17 13:20:44)    (Detached)
    2931.router3      (12/05/17 13:20:41)    (Detached)
    2516.router2      (12/05/17 13:20:36)    (Detached)
    2157.router1      (12/05/17 13:20:33)    (Detached)
5 Sockets in /run/screen/S-root.
```

Task 3. Connect the eth1 of the DomU VM to the correct openvSwitch instance using `ovs-vsctl add-port ogo-ovs{X} eth1`, where X is the number of the hub for the 172.16.0.0/24 peering network connected to router2 in the `bgp.cfg` file (9 by default).

Answer:

```
root@Guest-02:~/pogo# ovs-vsctl add-port ogo-ovs9 eth1
```

Task 4. Once that is done, you can log into router2. You should now have an eth0 interface that connects to the OS3 IX. Make sure that all your bridges and interfaces are up. Check if you can ping a machine in the OS3 IX LAN: `ping 172.16.0.42`

Answer:

In my case it's eth2 (since I name it like this in the configuration file `eth{L#}`):

```
root@router2:~# ifconfig
eth2      Link encap:Ethernet  HWaddr 00:16:3e:1b:94:35
          inet addr:172.16.0.11  Bcast:172.16.0.255  Mask:255.255.255.0
          inet6 addr: fe80::216:3eff:fe1b:9435/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:829 errors:0 dropped:0 overruns:0 frame:0
          TX packets:11 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:55796 (55.7 KB)  TX bytes:914 (914.0 B)

eth123    Link encap:Ethernet  HWaddr 00:16:3e:fc:e7:00
          inet addr:10.11.123.2  Bcast:10.11.123.255  Mask:255.255.255.0
          inet6 addr: fe80::216:3eff:fefc:e700/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:26 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:2246 (2.2 KB)  TX bytes:776 (776.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          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:536 (536.0 B)  TX bytes:536 (536.0 B)
```

```
root@router2:~# ping 172.16.0.42
PING 172.16.0.42 (172.16.0.42) 56(84) bytes of data.
64 bytes from 172.16.0.42: icmp_seq=1 ttl=64 time=1.23 ms
64 bytes from 172.16.0.42: icmp_seq=2 ttl=64 time=0.640 ms
64 bytes from 172.16.0.42: icmp_seq=3 ttl=64 time=0.515 ms
^C
--- 172.16.0.42 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.515/0.796/1.234/0.314 ms
```

Peering and Transit

Task 5. Set up BGP on router2 using your assigned AS number. This will be your border router.

Answer:

```
router2# conf t
router2(config)# router bgp 64611
router2(config-router)# bgp router-id 172.16.0.11
router2(config-router)# network 10.11.0.0/16
```

Task 6. Use your border router to peer with two of your colleagues. Test if the connectivity between the networks is as you expected, and document your findings. What does the network in your group look like, and what are the relations? Hint: Use "neighbor a.b.c.d next-hop-self" or BGP may take a short-cut over the shared LAN later

Answer:

Before I proceed in this question I already fixed the ospf IPs in the ospfd.cfg file for each router.

I will be peer with LENNART and PETER:

```
router2# conf t
router2(config)# router bgp 64611
router2(config-router)# bgp router-id 172.16.0.11
router2(config-router)# network 10.11.0.0/16
```

```

router2(config-router)# neighbor LENNART peer-group
router2(config-router)# neighbor LENNART remote-as 64617
router2(config-router)# neighbor PETER peer-group
router2(config-router)# neighbor PETER remote-as 64626
router2(config-router)# neighbor 172.16.0.17 peer-group LENNART
router2(config-router)# neighbor 172.16.0.26 peer-group PETER
router2(config-router)# redistribute connected

```

```

router2(config)# do show ip bgp summary
BGP router identifier 172.16.0.11, local AS number 64611
RIB entries 51, using 5712 bytes of memory
Peers 2, using 9136 bytes of memory
Peer groups 2, using 64 bytes of memory

```

Neighbor State/P fxRcd	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	
172.16.0.17	4	64617	22	25	0	0	0	00:13:04	18
172.16.0.26	4	64626	23	26	0	0	0	00:11:14	18

Total number of neighbors 2

We also need to enable router bgp distribution on router 2 (ospf)

```

router2(config-router)# redistribute bgp

```

```

router2# sh ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       0 - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel,
       > - selected route, * - FIB route

0>* 10.11.1.0/24 [110/20] via 10.11.123.1, eth123, 00:28:27
0>* 10.11.3.0/24 [110/20] via 10.11.123.3, eth123, 00:28:24
0>* 10.11.4.0/24 [110/30] via 10.11.123.1, eth123, 00:28:23
0>* 10.11.5.0/24 [110/30] via 10.11.123.3, eth123, 00:28:14
0>* 10.11.14.0/24 [110/20] via 10.11.123.1, eth123, 00:28:27
0>* 10.11.35.0/24 [110/20] via 10.11.123.3, eth123, 00:28:24
0>* 10.11.45.0/24 [110/30] via 10.11.123.1, eth123, 00:28:14
   *                               via 10.11.123.3, eth123, 00:28:14
0   10.11.123.0/24 [110/10] is directly connected, eth123, 00:29:17
C>* 10.11.123.0/24 is directly connected, eth123
B>* 10.17.0.0/16 [20/0] via 172.16.0.17, eth2, 00:09:45
B>* 10.17.1.0/24 [20/20] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.3.0/24 [20/20] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.4.0/24 [20/30] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.5.0/24 [20/30] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.14.0/24 [20/20] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.35.0/24 [20/20] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.45.0/24 [20/30] via 172.16.0.17, eth2, 00:05:45
B>* 10.17.123.0/24 [20/0] via 172.16.0.17, eth2, 00:09:45

```



```
B>* 10.26.1.0/24 [20/20] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.3.0/24 [20/20] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.4.0/24 [20/30] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.5.0/24 [20/30] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.14.0/24 [20/20] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.35.0/24 [20/20] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.45.0/24 [20/30] via 172.16.0.26, eth2, 00:05:25
B>* 10.26.123.0/24 [20/0] via 172.16.0.26, eth2, 00:07:25
C>* 127.0.0.0/8 is directly connected, lo
C>* 172.16.0.0/24 is directly connected, eth2
```

Test:

Ping Lennart router3 from my router3:

```
root@router3:~# ping 10.17.35.3
PING 10.17.35.3 (10.17.35.3) 56(84) bytes of data.
64 bytes from 10.17.35.3: icmp_seq=1 ttl=62 time=1.49 ms
64 bytes from 10.17.35.3: icmp_seq=2 ttl=62 time=1.01 ms
64 bytes from 10.17.35.3: icmp_seq=3 ttl=62 time=0.923 ms
^C
--- 10.17.35.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.923/1.144/1.492/0.249 ms
```

Ping Peter router5 from my router3:

```
root@router3:~# ping 10.26.5.5
PING 10.26.5.5 (10.26.5.5) 56(84) bytes of data.
64 bytes from 10.26.5.5: icmp_seq=1 ttl=61 time=2.47 ms
64 bytes from 10.26.5.5: icmp_seq=2 ttl=61 time=0.804 ms
64 bytes from 10.26.5.5: icmp_seq=3 ttl=61 time=0.810 ms
64 bytes from 10.26.5.5: icmp_seq=4 ttl=61 time=0.810 ms
64 bytes from 10.26.5.5: icmp_seq=5 ttl=61 time=0.802 ms
^C
--- 10.26.5.5 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4061ms
rtt min/avg/max/mdev = 0.802/1.139/2.473/0.667 ms
```

Task 7. Configure your border router such that even though you have a direct peering relation with one of your colleagues, all the outbound traffic goes via your other colleague. Do the same for inbound traffic. Are you in full control of the routing? Explain.

Answer:

Outbound:

```
router2(config-router)# neighbor LENNART weight 100
```

Apply it:

```
router2(config)# router bgp 64611
router2(config-router)# neighbor LENNART route-map LENNART-BGP out
```

Inbound:

```
router2(config)# route-map LENNART-BGP permit
router2(config)# route-map LENNART-BGP permit 10
router2(config-route-map)# set metric 100
```

So now if I use trace route to Peter router 3, the traffic will go over Lennart (172.16.0.17) then it will go to Peter (172.16.0.26):

```
router2(config-router)# do traceroute ip 10.26.5.5
traceroute to 10.26.5.5 (10.26.5.5), 30 hops max, 60 byte packets
 1  172.16.0.17 (172.16.0.17)  3.009 ms  2.359 ms  2.275 ms
 2  172.16.0.26 (172.16.0.26)  2.425 ms  2.368 ms  2.301 ms
 3  10.26.123.3 (10.26.123.3)  2.809 ms  3.259 ms  2.626 ms
 4  10.26.5.5 (10.26.5.5)  3.157 ms  3.051 ms  2.975 ms
```

Proof it:

```
router2# 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>* 10.17.0.0/16 [20/0] via 172.16.0.17, eth2, 01:10:31
B>* 10.17.1.0/24 [20/20] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.3.0/24 [20/20] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.4.0/24 [20/30] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.5.0/24 [20/30] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.14.0/24 [20/20] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.35.0/24 [20/20] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.45.0/24 [20/30] via 172.16.0.17, eth2, 01:06:31
B>* 10.17.123.0/24 [20/0] via 172.16.0.17, eth2, 01:10:31
B>* 10.26.1.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.3.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.4.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.5.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.14.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.35.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.45.0/24 [20/0] via 172.16.0.17, eth2, 00:03:30
B>* 10.26.123.0/24 [20/0] via 172.16.0.17, eth2, 00:03:00
```

Are you in full control of the routing? Explain?

No, I'm not in control because I use AS_PATH prepending or a MED. The stuff that I advertised are not significant anymore because the other router can always choose to implement a different routing policy. which means that I'm not in full control.

Feedback received: Show that it works for inbound.

I finished this assignment in the same day and I destroyed the VM and the xen hypervisor (after that I noticed that I didn't proof the inbound traffic)

I will use trace rout from one of my peers to my network.

```
# traceroute 10.11.3.3
traceroute to 10.11.3.3 (10.11.3.3), 30 hops max, 60 byte packets
 1  172.16.0.35 (172.16.0.35)  0.864 ms  0.848 ms  0.832 ms
 2  172.16.0.21 (172.16.0.21)  1.133 ms  0.964 ms  1.099 ms
 3  10.11.3.3 (10.11.3.3)  2.292 ms  *  *
```

As we see my router which isn't the best first hop, so the peers used another router instead of mine.

Task 8. Document the current BGP routing table. Now choose a colleague from another group and setup peering with him. Write the peering setup on the board so that the rest of the class knows who is peering with whom. Describe the peering relations after you've added the new peer. What new routes did you get? How did the AS Path lengths change?

Answer:

Current BGP routing table:

```
router2# show ip bgp
BGP table version is 0, local router ID is 172.16.0.11
Status codes: s suppressed, d damped, h history, * valid, > best, =
multipath,
                i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop        Metric LocPrf Weight Path
*> 10.11.0.0/16    0.0.0.0          0         32768 i
*> 10.11.1.0/24    10.11.123.1      20        32768 ?
*> 10.11.3.0/24    10.11.123.3      20        32768 ?
```

*> 10.11.4.0/24	10.11.123.1	30	32768 ?
*> 10.11.5.0/24	10.11.123.3	30	32768 ?
*> 10.11.14.0/24	10.11.123.1	20	32768 ?
*> 10.11.35.0/24	10.11.123.3	20	32768 ?
*> 10.11.45.0/24	10.11.123.1	30	32768 ?
*> 10.11.123.0/24	0.0.0.0	0	32768 ?
* 10.17.0.0/16	172.16.0.17		0 64626 64617 i
*>	172.16.0.17	0	0 64617 i
* 10.17.1.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.3.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.4.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.5.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.14.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.35.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.45.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.123.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	0	0 64617 ?
*> 10.26.1.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.3.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.4.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.5.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.14.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.35.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.45.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.123.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	0	0 64626 ?
* 172.16.0.0/24	172.16.0.26	0	0 64626 ?
*	172.16.0.17	0	0 64617 ?
*>	0.0.0.0	0	32768 ?

Total number of prefixes 27

I will set the peering for this question with Isaac "23".

```

router2(config)# router bgp 64611
router2(config-router)# neighbor ISAAC peer-group
router2(config-router)# neighbor ISAAC remote-as 64623

```

```
router2(config-router)# neighbor 172.16.0.23 peer-group ISAAC
```

Show routing table now:

```
router2(config-router)# do sh ip bgp
```

BGP table version is 0, local router ID is 172.16.0.11

Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,

i internal, r RIB-failure, S Stale, R Removed

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 8.8.0.0/16	172.16.0.23				0 64623 64635
64636 6					
4642 i					
*> 10.11.0.0/16	0.0.0.0	0		32768	i
*> 10.11.1.0/24	10.11.123.1	20		32768	?
*> 10.11.3.0/24	10.11.123.3	20		32768	?
*> 10.11.4.0/24	10.11.123.1	30		32768	?
*> 10.11.5.0/24	10.11.123.3	30		32768	?
*> 10.11.14.0/24	10.11.123.1	20		32768	?
*> 10.11.35.0/24	10.11.123.3	20		32768	?
*> 10.11.45.0/24	10.11.123.1	30		32768	?
*> 10.11.123.0/24	0.0.0.0	0		32768	?
*> 10.12.0.0/16	172.16.0.23				0 64623 64635
64636 6					
4642 64612 i					
*> 10.13.0.0/16	172.16.0.23				0 64623 64635
64636 6					
4642 64612 64613 i					
*> 10.15.0.0/16	172.16.0.23				0 64623 64635
64636 6					
4642 64615 i					
*> 10.16.0.0/16	172.16.0.23				0 64623 64635
64636 6					
4616 i					
* 10.17.0.0/16	172.16.0.17				0 64626 64617 i
*>	172.16.0.17	0			0 64617 i
* 10.17.1.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	20			0 64617 ?
* 10.17.3.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	20			0 64617 ?
* 10.17.4.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	30			0 64617 ?
* 10.17.5.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	30			0 64617 ?
* 10.17.14.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	20			0 64617 ?
* 10.17.35.0/24	172.16.0.17				0 64626 64617 ?
*>	172.16.0.17	20			0 64617 ?
* 10.17.45.0/24	172.16.0.17				0 64626 64617 ?

*>	172.16.0.17	30	0 64617 ?
* 10.17.123.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	0	0 64617 ?
*> 10.21.0.0/16	172.16.0.23		0 64623 64635
64636 6			
4642 64615 64621 i			
*> 10.23.0.0/16	172.16.0.23	0	0 64623 i
*> 10.26.1.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.3.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.4.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.5.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.14.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.35.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.45.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.123.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	0	0 64626 ?
*> 10.27.0.0/16	172.16.0.23		0 64623 64640
64627 i			
*> 10.28.0.0/16	172.16.0.23		0 64623 64635
64636 6			
4628 i			
*> 10.30.0.0/16	172.16.0.23		0 64623 64640
64630 i			
*> 10.35.0.0/16	172.16.0.23		0 64623 64635 i
*> 10.36.0.0/16	172.16.0.23		0 64623 64635
64636 i			
*> 10.40.0.0/16	172.16.0.23		0 64623 64640 i
*> 10.40.1.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.3.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.4.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.5.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.14.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.35.0/24	172.16.0.23		0 64623 64640 ?
*> 10.40.45.0/24	172.16.0.23		0 64623 64640 ?
*> 10.42.0.0/16	172.16.0.23		0 64623 64635
64636 6			
4642 i			
*> 145.100.0.0	172.16.0.23		0 64623 64635
64636 6			
4642 i			
* 172.16.0.0/24	172.16.0.23		0 64623 64635
64636 6			
4642 64612 i			
*	172.16.0.26	0	0 64626 ?

```
*          172.16.0.17          0          0 64617 ?
*>         0.0.0.0              0          32768 ?

Total number of prefixes 49
```

What new routes did you get? How did the AS Path lengths change?

As we see above now I have a lot of new routes which I got from Lennart and Isaac (.40, .42, .36, .35, .30, .28, .27, and etc..). The AS path lengths change depends on the peers for example we can notice a certain prefix need 6 AS to reach the destination. However, on the peers that I configured we notice a fast path till reach the destination.

Task 9. Setup peering with 172.16.0.42/AS64642. This BGP peer has been allocated the IP block 10.42.0.0/16 but it also advertises other ranges. Configure your BGP router such that it accepts only valid routes from this peer.

Answer:

Peering setup:

```
router2(config-router)# neighbor 172.16.0.42 remote-as 64642
```

Routing table now:

```
router2(config-router)# do sh ip bgp
BGP table version is 0, local router ID is 172.16.0.11
Status codes: s suppressed, d damped, h history, * valid, > best, =
multipath,
                i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
*> 8.8.0.0/16      172.16.0.42           0             0 64642 i
*                  172.16.0.23           0             0 64623 64635
64636 6
4642 i
*> 10.11.0.0/16    0.0.0.0               0             32768 i
*> 10.11.1.0/24    10.11.123.1           20            32768 ?
*> 10.11.3.0/24    10.11.123.3           20            32768 ?
*> 10.11.4.0/24    10.11.123.1           30            32768 ?
*> 10.11.5.0/24    10.11.123.3           30            32768 ?
*> 10.11.14.0/24   10.11.123.1           20            32768 ?
*> 10.11.35.0/24   10.11.123.3           20            32768 ?
*> 10.11.45.0/24   10.11.123.1           30            32768 ?
*> 10.11.123.0/24  0.0.0.0               0             32768 ?
*> 10.12.0.0/16    172.16.0.12           0 64642 64612 i
*                  172.16.0.23           0 64623 64635
```

64636 6			
4642 64612 i			
*> 10.13.0.0/16	172.16.0.13		0 64642 64612
64613 i			
*	172.16.0.23		0 64623 64635
64636 6			
4642 64612 64613 i			
*> 10.15.0.0/16	172.16.0.15		0 64642 64615 i
*	172.16.0.23		0 64623 64635
64636 6			
4642 64615 i			
*> 10.16.0.0/16	172.16.0.16		0 64642 64636
64616 i			
*	172.16.0.23		0 64623 64635
64636 6			
4616 i			
* 10.17.0.0/16	172.16.0.17		0 64626 64617 i
*>	172.16.0.17	0	0 64617 i
* 10.17.1.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.3.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.4.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.5.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.14.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.35.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.45.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.123.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	0	0 64617 ?
*> 10.21.0.0/16	172.16.0.15		0 64642 64615
64621 i			
*	172.16.0.23		0 64623 64635
64636 6			
4642 64615 64621 i			
* 10.23.0.0/16	172.16.0.23		0 64642 64623 i
*>	172.16.0.23	0	0 64623 i
*> 10.26.1.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.3.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?
*> 10.26.4.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.5.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	30	0 64626 ?
*> 10.26.14.0/24	172.16.0.17		100 64617 64626 ?
*	172.16.0.26	20	0 64626 ?

*> 10.26.35.0/24	172.16.0.17		100	64617	64626	?
*	172.16.0.26	20	0	64626	?	
*> 10.26.45.0/24	172.16.0.17		100	64617	64626	?
*	172.16.0.26	30	0	64626	?	
*> 10.26.123.0/24	172.16.0.17		100	64617	64626	?
*	172.16.0.26	0	0	64626	?	
* 10.27.0.0/16	172.16.0.23		0	64642	64623	
64640 6						
4627 i						
*>	172.16.0.23		0	64623	64640	
64627 i						
*> 10.28.0.0/16	172.16.0.28		0	64642	64636	
64628 i						
*	172.16.0.23		0	64623	64635	
64636 6						
4628 i						
* 10.30.0.0/16	172.16.0.23		0	64642	64623	
64640 6						
4630 i						
*>	172.16.0.23		0	64623	64640	
64630 i						
* 10.35.0.0/16	172.16.0.35		0	64642	64636	
64635 i						
*>	172.16.0.23		0	64623	64635	i
*> 10.36.0.0/16	172.16.0.36		0	64642	64636	i
*	172.16.0.23		0	64623	64635	
64636 i						
* 10.40.0.0/16	172.16.0.23		0	64642	64623	
64640 i						
*>	172.16.0.23		0	64623	64640	i
* 10.40.1.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.3.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.4.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.5.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.14.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.35.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.45.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?

```

*> 10.42.0.0/16      172.16.0.42      0      0 64642 i
*                    172.16.0.23      0 64623 64635
64636 6
4642 i
*> 145.100.0.0      172.16.0.42      0      0 64642 i
*                    172.16.0.23      0 64623 64635
64636 6
4642 i
* 172.16.0.0/24      172.16.0.12      0 64642 64612 i
*                    172.16.0.23      0 64623 64635
64636 6
4642 64612 i
*                    172.16.0.26      0      0 64626 ?
*                    172.16.0.17      0      0 64617 ?
*>                    0.0.0.0      0      32768 ?

```

Total number of prefixes 49

Create a filter:

```

router2(config)# ip prefix-list TASK9 permit 10.42.0.0/16
router2(config)# router bgp 64611
router2(config-router)# neighbor 172.16.0.42 prefix-list TASK9 in

```

check table now:

```

router2(config-router)# do sh ip bgp
BGP table version is 0, local router ID is 172.16.0.11
Status codes: s suppressed, d damped, h history, * valid, > best, =
multipath,
                i internal, r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 8.8.0.0/16	172.16.0.42	0		0	64642 i
*	172.16.0.23			0	64623 64635
64636 6					
4642 i					
*> 10.11.0.0/16	0.0.0.0	0		32768	i
*> 10.11.1.0/24	10.11.123.1	20		32768	?
*> 10.11.3.0/24	10.11.123.3	20		32768	?
*> 10.11.4.0/24	10.11.123.1	30		32768	?
*> 10.11.5.0/24	10.11.123.3	30		32768	?
*> 10.11.14.0/24	10.11.123.1	20		32768	?
*> 10.11.35.0/24	10.11.123.3	20		32768	?
*> 10.11.45.0/24	10.11.123.1	30		32768	?
*> 10.11.123.0/24	0.0.0.0	0		32768	?
*> 10.12.0.0/16	172.16.0.12			0	64642 64612 i
*	172.16.0.23			0	64623 64635
64636 6					
4642 64612 i					

*> 10.13.0.0/16	172.16.0.13		0 64642 64612
64613 i			
* 172.16.0.23			0 64623 64635
64636 6			
4642 64612 64613 i			
*> 10.15.0.0/16	172.16.0.15		0 64642 64615 i
* 172.16.0.23			0 64623 64635
64636 6			
4642 64615 i			
*> 10.16.0.0/16	172.16.0.16		0 64642 64636
64616 i			
* 172.16.0.23			0 64623 64635
64636 6			
4616 i			
* 10.17.0.0/16	172.16.0.17		0 64626 64617 i
*>	172.16.0.17	0	0 64617 i
* 10.17.1.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.3.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.4.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.5.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.14.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.35.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	20	0 64617 ?
* 10.17.45.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	30	0 64617 ?
* 10.17.123.0/24	172.16.0.17		0 64626 64617 ?
*>	172.16.0.17	0	0 64617 ?
*> 10.21.0.0/16	172.16.0.15		0 64642 64615
64621 i			
* 172.16.0.23			0 64623 64635
64636 6			
4642 64615 64621 i			
* 10.23.0.0/16	172.16.0.23		0 64642 64623 i
*>	172.16.0.23	0	0 64623 i
*> 10.26.1.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		20	0 64626 ?
*> 10.26.3.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		20	0 64626 ?
*> 10.26.4.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		30	0 64626 ?
*> 10.26.5.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		30	0 64626 ?
*> 10.26.14.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		20	0 64626 ?
*> 10.26.35.0/24	172.16.0.17		100 64617 64626 ?
* 172.16.0.26		20	0 64626 ?

*> 10.26.45.0/24	172.16.0.17		100	64617	64626	?
*	172.16.0.26	30	0	64626	?	
*> 10.26.123.0/24	172.16.0.17		100	64617	64626	?
*	172.16.0.26	0	0	64626	?	
* 10.27.0.0/16	172.16.0.23		0	64642	64623	
64640 6						
4627 i						
*>	172.16.0.23		0	64623	64640	
64627 i						
*> 10.28.0.0/16	172.16.0.28		0	64642	64636	
64628 i						
*	172.16.0.23		0	64623	64635	
64636 6						
4628 i						
* 10.30.0.0/16	172.16.0.23		0	64642	64623	
64640 6						
4630 i						
*>	172.16.0.23		0	64623	64640	
64630 i						
* 10.35.0.0/16	172.16.0.35		0	64642	64636	
64635 i						
*>	172.16.0.23		0	64623	64635	i
*> 10.36.0.0/16	172.16.0.36		0	64642	64636	i
*	172.16.0.23		0	64623	64635	
64636 i						
* 10.40.0.0/16	172.16.0.23		0	64642	64623	
64640 i						
*>	172.16.0.23		0	64623	64640	i
* 10.40.1.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.3.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.4.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.5.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.14.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.35.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
* 10.40.45.0/24	172.16.0.23		0	64642	64623	
64640 ?						
*>	172.16.0.23		0	64623	64640	?
*> 10.42.0.0/16	172.16.0.42	0	0	64642	i	
*	172.16.0.23		0	64623	64635	

```

64636 6
4642 i
*> 145.100.0.0      172.16.0.42      0      0 64642 i
*      172.16.0.23      0 64623 64635
64636 6
4642 i
* 172.16.0.0/24    172.16.0.12      0 64642 64612 i
*      172.16.0.23      0 64623 64635
64636 6
4642 64612 i
*      172.16.0.26      0      0 64626 ?
*      172.16.0.17      0      0 64617 ?
*>      0.0.0.0      0      32768 ?

```

Total number of prefixes 49

It seems that the filter denies any prefixes from .42 that are not 10.42.0.0/16 which is the only prefix that is valid. We can still see the invalid prefixes but they are advertised to me. That means that the prefix filter works.

Task 10. Explain what the purpose of AS112 is.

Answer:

“Many sites connected to the Internet make use of IPv4 addresses that are not globally unique. Examples are the addresses designated in [RFC1918] for private use within individual sites. Devices in such environments may occasionally originate Domain Name System (DNS) [RFC1034] queries (so-called “reverse lookups”) corresponding to those private-use addresses. Since the addresses concerned have only local significance, it is good practice for site administrators to ensure that such queries are answered locally [RFC6303]. However, it is not uncommon for such queries to follow the normal delegation path in the public DNS instead of being answered within the site. The AS112 project encompasses a loosely coordinated collection of independently operated nameservers. Each nameserver functions as a single node in an AS112 anycast cloud [RFC4786] and is configured to answer authoritatively for a particular set of nominated zones. The AS112 project is named after the Autonomous System Number (ASN) that was assigned to it.”

Source:

1- <https://tools.ietf.org/html/rfc6304>

Task 11. Perform a traceroute to 145.100.101.1 using the “Traceroute IPv4” tool on <https://www.transip.nl/network/> and note the ASs that are traversed. Now trace 145.100.104.1. Why does this trace take a different route, although both addresses are part of OS3’s 145.100.96.0/20 range?

Answer:

- Tracerout to 145.100.101.1:

```
traceroute to 145.100.101.1 (145.100.101.1), 30 hops max, 48 byte packets
1 v210.router1.dcg.transip.net (149.210.210.220) 0.203 ms
2 r1-a0.e1.ams7.transip.net (157.97. 168.1) 0.327 ms
3 e1-a7.e1.ams8.transip.net (157.97.168.3) 0.439 ms
4 transip.nikhef.openpeering.nl (82.150.159.225) 0.482 ms
5 telecity-ixr.openpeering.nl (217.170.0.244 ) 0.961 ms
6 storm.as1101.net (80.249.210.65) 1.493 ms
7 styx.os3.nl (145.100.101.1) 1.231 ms
```

- Tracerout to 145.100.104.1:

```
traceroute to 145.100.104.1 (145.100.104.1), 30 hops max, 48 byte packets
1 v210.router1.dcg.transip.net (149.210.210.220) 0.216 ms
2 r1-a0.e1.ams0.transip.net (157.97. 168.9) 0.388 ms
3 ae2.jnr02.Asd001A.surf.net (80.249.208.50) 0.666 ms
4 ae0.500.jnr01.asd002a.surf.net (145.145.176.1) 4.463 ms
5 *
6 *
7 snb.router.customer.surf.net (145.145.19.186) 1.082 ms! N
```

Credits to BART to help me in this.

The possible reason for that these two prefixes (145.100.104.1 and 145.100.101.1) belong to two different autonomous system.

- 145.100.101.1 belongs to AS1146 (which is OS3 AS).
- 145.100.104.1 belongs to AS1103 (which is Surfnets AS).

Since Surfnets AS doesn't import anything from OS3 AS, another AS path is used for traffic to AS1146. That's why we see here two different route paths.

Feedback received: Explain how this works given the IPs are from the same /20

The reason behind the difference is that the first address (145.100.101.1) came from more specific network prefix from single router. However, the second address (145.100.104.1) is part of large aggregate. We can notice that the AS path of (145.100.101.1) lead to OS3 AS path (the more specific network prefix) while (145.100.104.1) routed from SURFnet AS path.

Source:

1- <https://bgp.he.net/>