Computer Networks – Exercise 9

IP & BGP

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“The Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of the IP address space for private internets:

10.0.0.0 – 10.255.255.255 (10/8 prefix)
172.16.0.0 – 172.31.255.255 (172.16/12 prefix)
192.168.0.0 – 192.168.255.255 (192.168/16 prefix)” [rfc1918]

Could 172.28.2.0/24 be used as the address space for an internal network?

Reserved 172.16.0.0/12 10101100.00010000.0.0
Internal 172.28.2.0/24 10101100.00011100.00000010.0

Answer: Yes
“The Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of the IP address space for private internets:

10.0.0.0 – 10.255.255.255 (10/8 prefix)
172.16.0.0 – 172.31.255.255 (172.16/12 prefix)
192.168.0.0 – 192.168.255.255 (192.168/16 prefix)” [rfc1918]

Could 10.255.255.0/24 be used as the address space for an internal network?

| Reserved   | 10.0.0.0/8        | 00001010.0.0.0    |
| Internal   | 10.255.255.0/24   | 00001010.11111111.11111111.0 |

**Answer:** Yes
Assume we configure 8.8.8.0/24 as the internal address space. What happens if a user at a system with IP 8.8.8.2 attempts to establish a network connection with a system on the Internet at IP address 8.8.8.8?

**Answer:** Any internal machine trying to communicate with a computer outside the network with IP 8.8.8.8 would assume that 8.8.8.8 is on the same local segment, thus would attempt to find the destination on the local network rather than doing NAT and forwarding to the Internet.
ICMP is usually listed as a layer 3 (network layer) protocol. Since ICMP messages use an IP header to encapsulate their data, could ICMP be better classified as a layer 4 (transport) protocol?

**Answer:** The answer depends on your interpretation of OSI model layers. ICMP is not designed as a standalone layer 3 protocol, but rather as an extension to another one (IP). One valid answer would be to say that ICMP is layer 4 because a layer 3 header is added to these packets. Some might argue that it is 3 because it must be implemented alongside IP. Some might say it is 3.5 or “at the top” of layer 3.
“ICMP, uses the basic support of IP as if it were a higher level protocol, however, ICMP is actually an integral part of IP, and must be implemented by every IP module” [rfc792]
Question 2.1
Show the path vector that AS5 sends out at time 1. Which of its neighbors does AS5 send this path vector to?

**Answer:**
Prefix: 13.13.0.0/16  
Path: {AS5, AS1}  
Send To: AS4, AS6, AS7
Show the path vector that AS7 sends out at time 2. To which of its neighbors does AS7 send the path vector?

**Answer:**
Prefix: 13.13.0.0/16
Path: \{AS7, AS5, AS1\}
Send To: AS6, AS8
List all valid AS-level paths from AS8 to the prefix 13.13.0.0/16. Argue why \{AS8, AS7, AS6, AS1\} is a valid (or invalid) AS-level path.

**Answer:**
{AS8, AS4, AS5, AS1}
{AS8, AS7, AS5, AS1}
The path \{AS8, AS7, AS6, AS1\} is invalid.
Question 2.1 (d)

Which path will AS8 use to route to the prefix 13.13.0.0/16? Why?

Answer: AS8 will use the path through its customer AS4, for financial reasons, since AS4 has to pay AS8 for traffic.
Assume that Link 5–7 is removed from the topology. Would AS7 announce the prefix 13.13.0.0/16 with {AS7, AS6, AS1} to AS8? Briefly explain.

**Answer:** No. AS7 would act as a transit AS although it is connected with peering links to both AS8 and AS6.
• **Route Selection Policy:** Preferred routes in box ordered by decreasing preference. If there is no preferred route, keep routing table empty.

• **Export Policy:** Announce the route that has been selected by the route selection policy to all neighboring ASes.
Initially, assume that the BGP routing tables at ASes 1, 2, 3, and 4 are empty. Then, AS D announces itself to its neighbors. What routes do ASes 1, 2, 3, 4 use to reach AS D?

**Answer:** {1D}, {None}, {None}, {4D}
Then all ASes (i.e., ASes 1, 2, 3, 4, and D) simultaneously make BGP announcements based on the Export Policy. What routes do ASes 1, 2, 3, and 4 use to reach AS D?

**Answer:** \{1D\}, \{21D\}, \{34D\}, \{4D\}
Again, all ASes simultaneously make BGP announcements based on the Export Policy. What routes do ASes 1, 2, 3, and 4 use to reach AS D?

**Answer:** \{1D\}, \{234D\}, \{321D\}, \{4D\}
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**Answer:** ${1D}, {234D}, {321D}, {4D}$
Do you see any pattern? Comment about BGP convergence.

**Answer:** Routes for 2 and 3 keep oscillating. It suggests that BGP does not converge.