Comp 2322 Computer Networking

Homework Five

Due time: 11:59pm, April 16, 2024, Tuesday

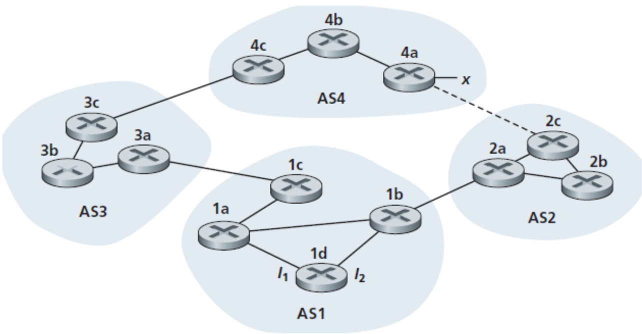
Total marks: 10 points

Submission Requirements:

You need to submit the homework to the blackboard via Learn@PolyU on or before the due time. Late submission will cause the marks to be deducted 25% per day.

Questions:

1) (2 points) Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4.



From which routing protocol: OSPF, RIP, eBGP, or iBGP, do the following routers learn about prefix x? Justify your answer.

a) Router 3c (1 point)

b) Router 1d (1 point)

Answers:

a)

Router 3c learns about x from eBGP.

b)

Router 1d learns about x from iBGP.

2) (4 points) Referring to the previous problem, once router 1d learns about x it will put an entry (x, I) in its forwarding table.

a) Will I be set to I_1 or I_2 for this entry? Why? (1 point)

b) Now suppose that there is a physical link between AS2 and AS4, shown by the dotted line. Suppose router 1d learns that x is accessible via AS2 as well as via AS3. Will I be set to I_1 or I_2? Why? (1 point)

c) Now suppose there is another AS, called AS5, which lies on the path between AS2 and AS4 (not shown in diagram). Suppose router 1d learns that x is accessible via AS2 AS5 AS4 as well as via AS3 AS4. If the shortest AS path first policy is applied, will I be set to I_1 or I_2? If the hot potato protocol is applied, will I be set to I_1 or I_2? Justify your answers. (2 points)

Answers:

a

I_1 will be set for this entry, because in this interface it begins the least cost path from 1d and starts to go towards 1c at the gateway router.

b)

I_2 will be set. Because In this case both I_1 and I_2 have equal AS-PATH length, but I2 begins the path that has the closest NEXT HOP router. So I_2 will be set.

c)

If the shortest AS path first policy is applied, I be set to I_1. Because I_1 begins the path where it has the shortest ASPATH.

If the hot potato protocol is applied, I be set to I_2, because AS3 AS4 is closer to AS1, due to minimizing the transit delay by forwarding traffic to the nearest exit point , so I_2 will be chosen.

3) (4 points) We consider the use of small packets for Voice-over-IP applications. Suppose that the packet consists of *L* bytes of data and 5 bytes of header.

a) A small packet size causes a fraction of link bandwidth to be consumed by overhead. The transmission overhead can be defined as the percentage of the amount of transmitted overhead bits relative to the total amount of transmitted bits. Determine the transmission overhead for *L* = 1,000 bytes and for *L* = 100 bytes. (2 points)

b) Consider sending a digitally encoded voice source directly. Suppose the source is encoded at a constant rate of 128 kbps. Assume each packet is entirely filled before the source sends the packet into the network. The time required to fill a packet is the packetization delay. Packetization delays larger than 20 msec can cause a noticeable and unpleasant echo. In terms of *L* bytes, determine the packetization delay in milliseconds. Also, determine the packetization delay for *L* = 1,000 bytes and for *L* = 100 bytes. (2 points)

Answers

a)

L = 1,000 bytes:

Data size = 1,000 bytes

Header size = 5 bytes

Total transmitted bits

= (Data size + Header size) * 8 bits/byte

= (1,000 + 5) * 8

= 8,040 bits

Overhead bits = Header size * 8 bits/byte = 5 * 8 = 40 bits

Transmission overhead = (Overhead bits / Total transmitted bits) * 100%

= (40 / 8,040) * 100%

= 0.497%

L = 100 bytes:

Data size = 100 bytes

Header size = 5 bytes

Total transmitted bits

= (Data size + Header size) * 8 bits/byte

= (100 + 5) * 8

= 840 bits

Overhead bits = Header size * 8 bits/byte = 5 * 8 = 40 bits

Transmission overhead = (Overhead bits / Total transmitted bits) * 100%

= (40 / 840) * 100%

= 4.762%

Therefore, transmission overhead for L = 1,000 bytes is 0.497%, and for L = 100 bytes is 4.762%.

b)

For L bytes:

Packet size (L) = L bytes *8 =8L bits

Packetization delay = (8L / Encoding rate)=(8L/ 128,000 bits per second)

For L = 1,000 bytes:

Packet Size = 1,000 bytes * 8 bits/byte = 8,000 bits

Packetization Delay = Packet Size / Transmission Rate = 8,000 bits / 128,000 bits per second = 62.5 milliseconds

For L = 100 bytes:

Packet Size = 100 bytes * 8 bits/byte = 800 bits

Packetization Delay = Packet Size / Transmission Rate = 800 bits / 128,000 bits per second = 6.25 milliseconds

Therefore, the packetization delay for L = 1,000 bytes is 62.5 milliseconds, and for L = 100 bytes, it is 6.25 milliseconds.