

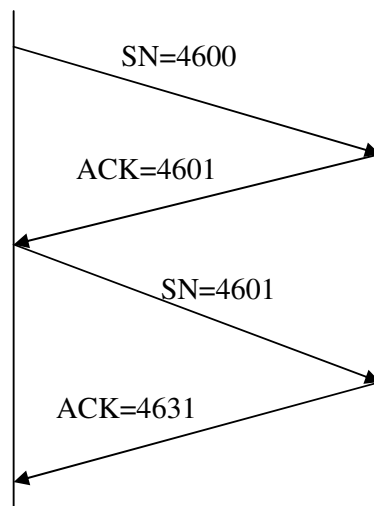
EE3009 Data Communications and Networking

Quiz 1 (Solution)

Semester A, 2014/15

1. The four sources of packet delay are transmission delay, propagation delay, processing delay and queuing delay.
2. If non-persistent HTTP is used, at most one object is sent over a TCP connection. To download multiple objects from a web server, multiple TCP connections are needed. If persistent HTTP is used, multiple objects can be sent over a single TCP connection.

3.



4. System throughput = $2p(1-p)$.

Differentiating the system throughput with respect to p , we obtain $2 - 4p$. The derivative is equal to zero when $p = 0.5$. By differentiating the throughput twice, we know that the point is a maximum point. Hence, the optimal value of p is 0.5.

5. Delay = 500 bytes / 4 Mbps + 1 ms + 500 / 1 Gbps + 5 ms
= 2 ms + 5.00005 ms
= 7.0 ms (2 significant figures)

6. Apply each subnet mask and if the corresponding subnet number matches the Subnet Number column, then use the entry in Next Hop.

a) Applying the subnet mask 255.255.254.0, we get 128.96.170.0.

Use interface 0 as the next hop.

b) Applying subnet mask 255.255.254.0, we get 128.96.166.0 (next hop is R2)

Applying subnet mask 255.255.252.0, we get 128.96.164.0 (next hop is R3)

As 255.255.254.0 is a longer prefix, use R2 as the next hop.

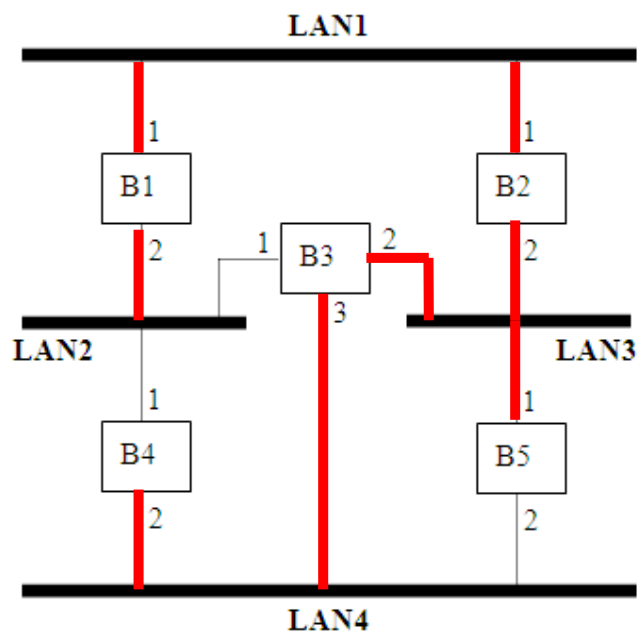
c) None of the subnet number entries match, hence use default R4 as the next hop.

d) Applying the subnet mask 255.255.254.0, we get 128.96.168.0.

Use interface 1 as the next hop.

7.

a) The spanning tree is shown below:



b) The packet will pass through B3, B2, and then B1.

c) In the given network, there is a cycle. If the spanning tree protocol is not used, the broadcast storm problem will occur. Furthermore, the spanning tree protocol can minimize the communication cost.

8. Seven Layers: application layer, presentation layer, session layer, transport layer, network layer, data link layer and physical layer.

Routing is a function performed by the network layer.

9. STP is less susceptible to noise.

10.

a) $\text{Transmission delay} = (24000 \text{ bits} / 3) / 20 \text{ Mbps} = 400 \mu \text{sec}$

b)

Total time required

= Time to send the entire file from A to the first router

+ Time to send the last packet from the first router to B (i.e. 3 links)

$$= 24000 \text{ bits} / 20 \text{ Mbps} + 3 \times 400 \mu \text{sec}$$

$$= 2.4 \text{ msec}$$

c)

Total time required

= Time to send the entire file from A to the first router

+ Time to send the last packet from the first router to B (i.e. 3 links)

$$= (24000 \text{ bits} / 20 \text{ Mbps} + 40 \mu \text{sec}) + 3 * (400 \mu \text{sec} + 40 \mu \text{sec})$$

$$= 2.56 \text{ msec}$$

(Alternatively, we can simply add $40 \mu \text{sec} * 4$ to the answer to part (b).)

11.

a)

$$\mu = \frac{100 \text{ Kbps}}{1000 \text{ bits}} = 100 \text{ packets / sec}$$

$$\lambda = 10 \times 300 \text{ packets / min} = \frac{3000}{60} \text{ packets / sec} = 50 \text{ packets / sec}$$

$$T = \frac{1}{\mu - \lambda} = \frac{1}{100 - 50} \text{ sec} = 0.02 \text{ sec}$$

b)

$$\mu = \frac{(100 / 10) \text{ Kbps}}{1000 \text{ bits}} = \frac{10 \times 10^3 \text{ bps}}{1000 \text{ bits}} = 10 \text{ packets / sec.}$$

$$\lambda = 300 \text{ packets / min} = \frac{300}{60} \text{ packets / sec} = 5 \text{ packets / sec}$$

$$T = \frac{1}{\mu - \lambda} = \frac{1}{10 - 5} \text{ sec} = 0.2 \text{ sec}$$

12. The maximum flow from s to t is equal to 13. No larger flow exists because the min-cut value is equal to 13, as shown in the following figure.

