**COMSATS University Islamabad (CUI)**

**Department of Computer Science**

**CSC339- Data Communication and Computer Networks**

**BSE-5B FALL 2021**

**Assignment-1 Due Date: October 12, 2021**

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**Question 1**

What are some of the physical media that Ethernet can run over?

**Ans:** Today, Ethernet most commonly runs over twisted-pair copper wire. It also can run over fibers optic links.

**Question 2**

What information is used by a process running on one host to identify a process running on another host?

**Ans:** The process running on one host uses the IP address of the another host and port number of the socket of another host.

**Question 3**

What are the propagation time and the transmission time for a 2.5 kbyte message (let’s say an email) if the bandwidth of the network is 1 Gbps? It is assumed that the distance between the sender and the receiver is 12,000 km and that travels at 2.4 x10^8 m/s?

**Ans**: L = 2.5 kbyte

= 2.5x103x8 bits =

R = 1 Gbps

= 1x109 bps

d = 12000km

= 12000 x103m

s = 2.4x108 m/s

=

= 0.05

**Propagation delay = 50msec**

=

=

**Transmission delay = 0.02 msec**

**Question 4**

What advantage does a circuit-switched network have over a packet switched network? What advantage does TDM have over FDM in a Circuit Switch Network?

**Ans:**

Circuit switch provides a dedicated path between source and destination. This path has a fixed bandwidth and has less delay. Circuit switching also ensure the delivery of data in sequence. Whereas packet switching lacks in these standards.

In FDM time is divided into frames of fixed duration. When a connection is established, network dedicates one time slot in every frame to this connection. While in FDM the frequency spectrum of a link is in divided among the connections. So, this gives advantages to TDM like:

* It becomes more flexible.
* Every user can use maximum bandwidth in its provided time slot.

**Question 5**

Suppose two Nodes, **A** and **B**, connected by a single link of rate R bps. It is assumed that the two nodes are separated by *m* meters, and let the propagation speed along the link is *s* meters/sec. Node A is to send a packet of size *L* bits to Node B.

1. Express the propagation delay,  in term of *m* and *s*.
2. Ignore processing and queuing delays. Find an expression for the end-to-end (E2E) delay.
3. Determine the transmission time of the packet in terms of Land *R.*
4. Assume Node A begins to transmit the packet at time  where is the last bit of the packet?
5. Assume . At time , where is the first bit of the packet?
6. Assume   
   

**Ans:**

1. Express the propagation delay, *dprop* in term of *m* and *s*.

dprop **=**  sec

1. Ignore processing and queuing delays. Find an expression for the end-to-end (E2E) delay.

End-to-end delay **=**  sec +  sec

1. Determine the transmission time of the packet *dtrans* in terms of Land *R.*

dtrans **=**  sec

1. Assume Node A begins to transmit the packet at time *t* = 0. At time *t* = *dtrans* where is the last bit of the packet?

Last bit will be leaving node A.

1. Assume  *dprop* is greater than *ttrans* . At time *t* = *dtrans* , where is the first bit of the packet?

First bit will be set on the link propagating towards B.

1. Assume *s* = 2.5 10 8,*L* =120 and *R* = 56 kbps. Find the distance *m* so that *dprop* equals *dtrasns*

dprop= dtran

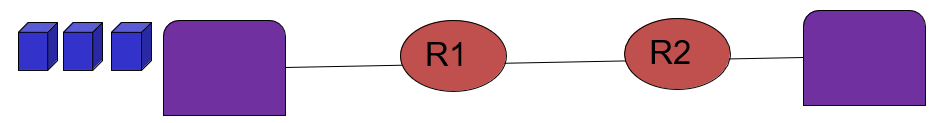
=

m = x

m = 5.36 m = 536 km

**Question 6**

Consider a 2 Mbps link, having packet size 1000 bits with 200 Km link length. It is noted that the propagation speed (typical fibar link) is . It is assumed that, 2 packets in queue when our packet arrives (processing delay is zero). Please compute the delay on multi links.



1. What will be the transmission delay when the first packet reaches the 1st router?
2. What will be the transmission delay when the first packet reaches the 2nd router?
3. What will be the transmission delay when the first packet reaches the destination?
4. What will be the total end-to-end delay from source to designation?

**Ans:**

1. What will be the delay when the first packet reaches the 1st router?

t0 = dtran + dprop + dqueue

= + +

= + +

=+ +

=

=2.51 msec

1. What will be the delay when the first packet reaches the 2nd router?

t1= t0 + dtran + dprop + dqueue

= + +

=2.51msec + + +

=+ +

=

=5.02 msec

1. What will be the delay when the first packet reaches the destination?

t2 = t1 + dtran + dprop + dqueue

= + +

= + +

=+ +

=

=7.5 msec

1. What will be the total end-to-end delay from source to designation?

Total end-to-end delay= t0+ t1+t2

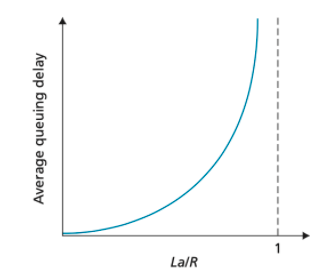
= 2.51msec + 2.51msec + 2.51mse = 7.5 msec

**Question 7**

Consider the queuing delay in a router buffer, where the packet experiences a delay as it waits to be transmitted onto the link. The length of the queuing delay of a specific packet will depend on the number of earlier-arriving packets that are queued and waiting for transmission onto the link. If the queue is empty and no other packet is currently being transmitted, then our packet’s queuing delay will be zero. On the other hand, if the traffic is heavy and many other packets are also waiting to be transmitted, the queuing delay will be long.

Assume a constant transmission rate of R = 1000000 bps, a constant packet-length L = 6500 bits, and a is the average rate of packets/second. Traffic intensity I = La/R, and the queuing delay is calculated as I(L/R) (1 - I) for I < 1.

1. In practice, does the queuing delay tend to vary a lot?
2. Assuming that a = 32, what is the queuing delay? Give your answer in milliseconds (ms)
3. Assuming that a = 62, what is the queuing delay? Give your answer in milliseconds (ms)
4. Assuming the router's buffer is infinite, the queuing delay is 1.5638 ms, and 1324 packets arrive. How many packets will be in the buffer 1 second later?
5. If the buffer has a maximum size of 592 packets, how many of the 1324 packets would be dropped upon arrival from the previous question?



**Ans:**

1. In practice, does the queuing delay tend to vary a lot?

Yes, queuing delay tends to vary a lot depending on the arrival of the packet. The packet coming first would have zero delay but the packets coming afterwards would have the delay according to its position in the queue nL/R.

1. Assuming that a = 32, what is the queuing delay? Give your answer in milliseconds (ms)

= = 0.208sec= 208msec

As I<1

dqueue  = (1-I)

dqueue=0.208 x x (1-0.208)

dqueue=1.07 x 10-3 sec

dqueue=1.07 msec

1. Assuming that a = 62, what is the queuing delay? Give your answer in milliseconds (ms)

I= = = 0.403sec= 403msec

As I<1

dqueue  = (1-I)

So,

dqueue=0.403 x x (1-0.403)

dqueue=1.56 x 10-3 sec

dqueue=1.56 msec

1. Assuming the router's buffer is infinite, the queuing delay is 1.5638 ms, and 1324 packets arrive. How many packets will be in the buffer 1 second later?

1.5638msec= 0.0015638 sec

In one second the total packets transmitted would be 639. Hence the packets in buffer after 1 second would be 685

1. If the buffer has a maximum size of 592 packets, how many of the 1324 packets would be dropped upon arrival from the previous question?

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