TUTORIAL 1

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- You have 10 users plugged into a hub running 10Mbps half-duplex. There is a server connected to the switch running 10Mbps half-duplex as well. How much bandwidth does each host have to the server?
- A. 100 kbps
- B.1 Mbps
- C. 2 Mbps
- D. 10 Mbps

- Soln :- The usage of half duplex. Only one can transmit at a time and can use full bandwidth.

- Option D

- Calculate the total time required to transfer a 1.5 MB file in the following cases, assuming RTT of 80ms, and an initial 2XRTT of “handshaking” before it is sent. (10Mbps medium)
- RTT=Round Trip Time = Time taken to reach destination and back.

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Solution:

We will count the transfer as completed when the last data bit arrives at its destination

1.5MB = 12,582,912 bits, 2 initial RTTs (160ms) + (12,582,912)/(10,000,000) bps (transmit) +40ms (propagation) = 1.458 secs (approx)

- Suppose a 128 kbps p2p link is set up between earth and a rover on mars. The distance from the earth to mars (when they are the closest together) is approximately 55Gm, and data travels over the link at the speed of light $3x10^8$ m/s

  a) Calculate the minimum RTT for the link

  b) Calculate the delay X bandwidth product of the link

  c) A camera on the rover takes pictures of its surroundings and sends these to the earth. How quickly can it reach Mission Control on Earth? Assume that each image is 5Mb in size,

  1 Gigameter =10^9 meter

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  Solution:

  a) Propagation Delay of the link is $55X10^9$ / ($3X10^8$) = 184 secs, Thus RTT = 368 secs

  b) The delay X bandwidth product for the link is the Delay X bandwidth = 23552b=23Mb

  c) After a picture is taken, it must be transmitted on the link and completely propagated, before Mission Control can interpret it.

  Transmit delay for 5Mb of data is 40 secs [packet length/datarate]

  Hence, total time = transmit delay + propagation delay = 224 secs

- Calculate the latency (from first bit sent to the last bit received) for the following:

  a) 1 Gbps Ethernet with a single store and forward switch in the path, and a packet size of 5000bits. Assume that each link introduces a propagation delay of 10 micro second and that the switch begins retransmitting immediately after it has finished receiving the packet.

  b) Same as above but with 3 switches

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  Solution:

  a) For each link it takes 1 Gbps; so for 5 Kb = 5 µs to transmit the packet on the link, after which it takes an additional 10 µs for the last bit to propagate across the link. Thus for a LAN with only one switch that starts forwarding only after receiving the whole packet, the total transfer delay is the

  transmit delays + two propagate delays = 30 µs.

  b) For 3 switched and thus 4 links, the total delay is 4 transmit + 4 prop. Delay = 60 µs

- **Q6**

Suppose host A is sending a large file to host B. The two end hosts are 10msec apart (20ms RTT), connected by a 1Gbps link. Assume that they are using a packet size of 1000 bytes to transmit the file .

a) At least how big would the window size have to be for the channel utilization to be greater than 80% consider RTT
b) No of packets on link to achieve that channel capacity

- **Q6**
- Suppose host A is sending a large file to host B. The two end hosts are 10msec apart (20ms RTT), connected by a 1Gbps link. Assume that they are using a packet size of 1000 bytes to transmit the file .
- At least how big would the window size have to be for the channel utilization to be greater than 80% consider RTT
- Solution
- Bandwidth –delay product= 10^9 x 20 x 10^3 =2 x 10^7 bits
- For 80% utilization it will be 2x 10^7 x .8 =1.6 x 10^7
- Number of packets 1.6 x 10^7 / 8x1000 = 2000 packets