**Course:** EE407

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**Assignment:** 4

**R18. How long does it take a packet of length 1,000 bytes to propagate over a link of distance 2,500 km, propagation speed 2.5 · 10^8  m/s, and transmission rate 2 Mbps? More generally, how long does it take a packet of length L  to propagate over a link of distance d , propagation speed s , and transmission rate R bps? Does this delay depend on packet length? Does this delay depend on transmission rate?**

The propagation delay would be 2,500km/2.5E8 m/s = 10milliseconds. The generic would be Distance/Propagation Speed. No there is no proportionality to packet length. No the transmission rate does not affect this.

**R23. What are the five layers in the Internet protocol stack? What are the principal responsibilities of each of these layers?**

Application: Usage layer, FTP, HTTP   
Transport: Transferring data, TCP, UTP,   
Network: Network definitions, IP, routing, protocols,   
Link: Making the connection, Handshakes, PPP ethernet,   
Physical: Literal bits

**P10. Consider a packet of length L  which begins at end system A and travels over three links to a destination end system. These three links are connected by two packet switches. Let di, si,  and Ri  denote the length, propagation speed, and the transmission rate of link i,  for i  = 1, 2, 3. The packet switch delays each packet by dproc.  Assuming no queuing delays, in terms of di, si, Ri, (i  = 1,2,3), and L,  what is the total end-to-end delay for the packet? Suppose now the packet is 1,500 bytes, the propagation speed on all three links is 2.5 · 108  m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3 msec, the length of the first link is 5,000 km, the length of the second link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?**

DelayTotal=N(Dprocessing + Dtransmission + Dpropagation) = N(Dprocessing + (L/Ri) + (di / si))

i=1; 3(0.003 + (1500\*8 / 2,000,000) + (5,000,000/2.5E8)) = 0.087secs

i=2; 3(0.003 + (1500\*8 / 2,000,000) + (4,000,000/2.5E8)) = 0.075secs

i=3; 3(0.003 + (1500\*8 / 2,000,000) + (1,000,000/2.5E8)) = 0.039secs

DelayTotal =Di=1 +Di=2 +Di=3 = 0.087+0.075+0.039 = 0.201

**P31. In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation . Figure 1.27 illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 8 · 10^6  bits long that is to be sent from source to destination in Figure 1.27. Suppose each link in the figure is 2 Mbps. Ignore propagation, queuing, and processing delays.**

**a. Consider sending the message from source to destination without  message segmentation. How long does it take to move the message from the source host to the first packet switch? Keeping in mind that each switch uses store-and-forward packet switching, what is the total time to move the message from source host to destination host?**

**b. Now suppose that the message is segmented into 800 packets, with each packet being 10,000 bits long. How long does it take to move the first packet from source host to the first switch? When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the first switch. At what time will the second packet be fully received at the first switch?**

**c. How long does it take to move the file from source host to destination host when message segmentation is used? Compare this result with your answer in part (a) and comment.**

**d. In addition to reducing delay, what are reasons to use message segmentation?**

**e. Discuss the drawbacks of message segmentation.**

1. From source to first switch = bits/link speed = 8E6/2E6 = 4 seconds. With store and forward = 4 seconds x 3 links = 12 seconds
2. First packet to first switch = 1E4/2E6 = 5 milliseconds. Time received = Time first packet reaches second switch = 2 x 5 milliseconds = 10 milliseconds.
3. First packet at host in 5 x 3 = 15 milliseconds so the last packet is received in 15 milliseconds + 799\*5 milliseconds = 4.01 seconds which is about 1/3rd quicker than without segmentation.
4. Without message segmentation if there is an error in a bit the whole file needs to be retransmitted rather than just the segment with the error.Without segmentation huge packets for things like videos and large downloads have to be pushed and routers have to try and accommodate with huge delays.
5. Message segmentation causes a higher use of bandwidth because each individual packet that gets sent has a header which means there are more overall bits being sent.