Computer Networks
Homework #1

Answer the following questions from your book:

1. Section 1.5 (R22, R23, R24, R25), page 70
2. Problem P6, page 72
3. Problem P25, page 76
4. Problem below

Consider a 3-hop communication path characterized as follows:

a) All links operate at 48000 bps
b) Propagation delay is 20 msec per link
c) Connection set-up time is made of 23 sec for dialing and 100 msec to send the request and receive the confirmation
d) Queueing as well as processing delays are negligible

   1. Using circuit switching, compute the total delay to transfer a 10,000 bytes long message.
   2. Assume that the message is divided into datagrams, each carrying 50 bytes of header information and P bytes of data information. Consecutive datagrams are submitted to the network 20 msec apart of each other. What is the value of P that guarantees better delay for datagram service over circuit switching?

You don't need to perform the actual calculations. You only need to set up the equations and say what needs to be done to find P. Find the actual value of P only if you want to do it.

Answers

Section 1.5:

R22. Five generic tasks are error control, flow control, segmentation and reassembly, multiplexing, and connection setup. Yes, these tasks can be duplicated at different layers. For example, error control is often provided at more than one layer.

R23. The five layers in the Internet protocol stack are – from top to bottom – the application layer, the transport layer, the network layer, the link layer, and the physical layer. The principal responsibilities are outlined in Section 1.5.1.

R24. Application-layer message: data which an application wants to send and passed onto the transport layer; transport-layer segment: generated by the transport layer and encapsulates application-layer message with transport layer header; network-layer datagram: encapsulates transport-layer segment with a network-layer header; linklayer frame: encapsulates network-layer datagram with a link-layer header.

R25. Routers process layers 1 through 3. (This is a little bit of a white lie, as modern routers sometimes act as firewalls or caching components, and process layer four as well**.**) Link layer switches process layers 1 through 2. Hosts process all five layers.

P6.

a) $d_{prop} = m/s$ seconds.
b) $d_{trans} = L/R$ seconds.
c) $d_{end\ to\ end} = (m/s + L/R)$ seconds.
d) The bit is just leaving Host A.
e) The first bit is in the link and has not reached Host B.
f) The first bit has reached Host B.
g) Want
$m = (L/R)*S = (100/28x10^3)*2.5x10^8 = 893$ Km

P25.

a) $R \times d_{prop} = R*(d/s) = 2x10^6*(20{,}000{,}000/2.5x10^8) = 160{,}000$ bits
b) 160,000 bits
c) The bandwidth-delay product of a link is the maximum number of bits that can be in the link
d) 1 bit is 125 meters long, which is longer than a football field
e) $d/(R \times d_{prop)} = d/(R \times d/s) = s/R$

Problem #4:

Tc = dial-up + set-up + Tx + 3*Tp = 23s + 10000*8/48000 + 3*0.02 = 24.82 sec

Tpkt = time for 1st pkt to get to (k-1) link + time for all the pkts to get from (k-1) link to destination

Tpkt = (k-1)*Tp + (k-1)* Tx (1st pkt) + 1*Tp + Tx (all pkts) + (all pkts –1)*(interpakt delay)

Tpkt= (k-1)*0.02 + (k-1)(P+50)*8/48000 + 0.02 + (M/P)(P+50)*8/48000 + (M/P-1)*0.02

Need to find P so that Tpkt < Tc