Assignment
COMPUTER NETWORKS

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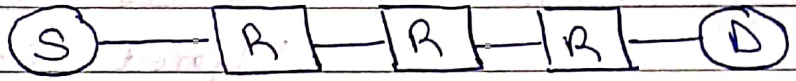
Q1 Assume that Source S and Destination D are connected through three intermediate routers labelled R. Determine and explain how many times each packet has to visit the network layer and the data link during a transmission from S to D.



Ans Network layer 5 times and data link 5 times. Here, network layer is considered only one and data link layer twice. Since, once the message comes to network layer, it tries to connect to R's network level. Network levels sends message via Data link layer.

The network layer at source (S) - Find R send message via Data link layer.

From this we can conclude Data link layer at S and D are used for only sending and recieving purpose respectively where data link layer at R's are used for both sending and recieving purpose.

Q2 What is the total delay (latency) from a frame of size 5 million bits that is being sent on a link 10 routers each having a queing time of 2μs & a process timing of 1μs. The length of the link is 2000km. The speed

of light inside the link is 2×10^8 m/s. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible?

Ans Given,

Frame of size = 5 million bits = 5×10^6 bits

Queuing time = 2 μs = 2×10^{-6} sec.

Processing time = 1 μs = 2×10^{-6} sec.

length of link (d) = 200 km = 200×10^3 km

Speed of light = 2×10^8 m/s

Bandwidth = 5×10^6 bps

Propagation time (T_p) = $\frac{\text{Distance}}{\text{Speed}} = \frac{2 \times 10^3}{2 \times 10^8} = 0.01$ sec

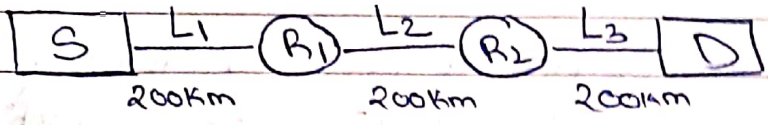
Transmission time (T_t) = $\frac{\text{Frame Size}}{\text{Bandwidth}} = \frac{5 \times 10^6}{5 \times 10^8} = 1$ sec

Delay = $T_p + T_t$ + Queuing time + Processing time

= $2 \times 10^{-6} + 1 \times 10^{-6} + 0.01 + 1$

= 1.010030 sec

Q3 A source node is transmitting a video of size 212 size bits to another node on a network with two intermediate routers (R_1, R_2, R_3) and having three links (L_1, L_2 & L_3). L_1 connects first node to R_1. L_2 connects R_1 to R_2 and L_3 connects R_2 to final node. And each links length is 200 km. Assume signal speed over link is 10^8 m/sec. Given link Bandwidth on each link is 2 Mbps. Find the total latency for the transmission of file if video is chunked into 2000 packets each of size of 2000 bits (Neg Queuing and Processing time).



Message size = 212 bits.
Bandwidth = 2Mbps = 2×10^6 bps.
Signal Speed = 10^8 m/s.
No. of packets (N) = 2000
Size of packets = 2000 bits
Distance b/w each node = 200Km = 200×10^3 m.

Transmission delay (Td) = Size of Nodes / Bandwidth

$S \rightarrow R_1$: $Td = \frac{2000 \times 212}{2 \times 10^6} = 12 \times 10^{-3} = 212$ ms

(i.e S sends 2000 packets to R_1)

Similarity Td from $R_1 \rightarrow R_2$ & $R_2 \rightarrow D$ will be same.
So, Total Transmission delay = (3 × 2.2)ms = 636 ms

Propogation Delay (Tp) = Distance b/w nodes / Signal Speed

$S \rightarrow R_1$: $Tp = \frac{200 \times 10^3}{10^3} = 2$ ms

Similarly Tp for $R_1 \rightarrow R_2$ and $R_2 \rightarrow D$ will be same.
So, Total Propogation speed = 6ms.
Total latency (Delay) for the transmission of file if Video is chunked into 2000 packets = N × (Total Td + Total Tp)

= 2000 (636ms + 6ms)
= 2000 × 642 × 10^{-3}
= 1284 sec.

Q4 An organization bought a following chunk of IP addresses 203.248.128.0/20. The organisation wants to give half of the chunk of address to Branch A and a quarter to Branch B, while keeping rest with it. What will be the valid allocation of addresses to A & B?

Ans Give, n(prefix) = 20

~~Prefix for~~ No. of IP addresses = $2^{(32-20)} = 2^{12}$

Out of 2^{12} IP addresses 2^{11} addresses are given to organization A remaining for themselves.

So, prefix for A is 21.

prefix for B is 22.

Now by setting 21 bits to either 0 or 1 for organization A.

203.248.10000000.0 → 203.248.128.0/21

203.248.10001000.0 → 203.248.136.0/21

Similarily fixing 22nd bit manipulation B

203.248.10000000.0 → 203.248.128.0/22

203.248.10000000.0 → 203.248.132.0/22

Q5 Explain the following terms:

a) Internet: It is a globally connected network system that uses TCP/IP to transmit data via various types of media. The internet is a network of global exchanges including private, public, business wireless and fibre-optic technologies.

b) Intranet: It is a private computer network that uses internet protocol technologies to securely share any part of an organization information or operational systems within the organization.

c) Extranet: It is a private network that uses Internet technology and the public telecommunication system to, securely share part of a business's information or operations with suppliers, vendors, partners, customers or other businesses.

d) Virtual Pirate Network: It is a technology that works, creates a safe and encrypted connection over a less secure network, such as the internet. VPN is a way to extend a private network using a public network such as internet.