Assignment-1

CSE 1004 - Network and communication

Name : Vemula Poorna Chandra

Reg no : 18BCE0209

1. Physical distance = 10^6 m

Transmission rate / bandwidth = 10×10^6 bits/s

propagation speed = 2×10^8 m/s

$$\text{propagation delay} = \frac{\text{distance}}{\text{speed}} = \frac{10^6}{2 \times 10^8} = 5 \times 10^{-3} \text{ s.}$$

$$= 5 \text{ ms.}$$

$$\text{Transmission delay} = \frac{10 \times 10^3 \times 8}{10 \times 10^6} = 8 \times 10^{-3} \text{ s} = 8 \text{ ms.}$$

Time taken to transmit a 10 kbytes-packet = 13 ms.

2.

Total distance between the servers through Geo stationary satellite = 20,000 km.

bandwidth = 100 Mb/s

$$\text{propagation delay} = \frac{2 \times 10^4}{2.3 \times 10^8} = 8.69 \times 10^{-5} \text{ s}$$

number of bits during the propagation delay = $100 \text{ Mb} \times 8.69 \times 10^{-5}$

$$= 8.69 \times 10^{-3} \text{ Mb.}$$

$$= 8.69 \times 10^3 \text{ bits.}$$

$$\text{Time taken to send 10 bytes} = 8.69 \times 10^{-5} + \frac{10 \times 8}{10^8}$$

$$= 0.0869 \times 10^{-3} + 8 \times 10^{-7}$$

$= 8.0869 \times 10^{-7}$ s

Time taken to receive 2.5 bytes $= 8.69 \times 10^{-5} + \frac{2.5 \times 8}{10^8}$

$= 0.0869 \times 10^{-7} + 2 \times 10^{-7}$

$= 8.71 \times 10^{-7}$ s.

(3)

6 point-to-point links, 5 switches 5000-byte file,

1kB packet (24 B header + 1000 B data)

circuit switching : circuits pay an up front penalty of

1024 bytes on round trip for a total data count of

2048 + 5000 bytes = 7048 bytes

Total transfer latency = transmit delay for whole file + propagation delay + setup cost

$= \left(\frac{8n}{b}\right) + (5+1) * 0.002) + 2*(0.00000248 * 1000 + 0.02724)$

$= 0.0000028n + 0.07056$ s $(n = 5000)$

$= 0.08056$ sec.

packet switching :

transfer latency = (transmit delay for all pkts at the source) + (per-pkt transmit delay introduced by each switch) + (per-pkt processing delays introduced by each switch) + (propagation delay for all links)

$= (c*t) + (s*t) + (s*0.001) + ((s+1)*0.02)$

$= 0.00000248n + 0.02724 = 0.03748$ sec.

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5. Transmission delay = $\frac{\text{Message size}}{\text{band width}}$

$= \frac{8 \times 1000}{2 \times 10^6}$

$= 4 \times 10^{-3}$ s $= 4$ ms

Propagation delay = $\frac{\text{Distance}}{\text{propagation speed}}$

$= \frac{2500 \times 10^3}{2.5 \times 10^8}$

$= 10^{-2}$ s $= 10$ ms

Total delay = 14 ms

yes, the delay depends on packet length

yes, the delay depends on transmission rate.

6. Given

(i) $R_1 = 500$ kbps, $R_2 = 2$ Mbps, $R_3 = 1$ Mbps

The throughput for file transfer = $\min(R_1, R_2, R_3)$

= 500 kbps.

(ii) File size = 4 million bytes

= 4000000 x 8 bits

= 32000000

we know that throughput = 500 kbps

Time = $\frac{32000000}{500 \times 10^3}$ = 64 s.

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propagation delay, d_{prop} = $\frac{\text{Distance}}{\text{propagation speed}}$

= m/s

Transmission time/delay = $\frac{\text{Message size}}{\text{Bandwidth}}$

= $\frac{L}{R}$

where R is Bandwidth between Host A and B.

Latency = propagation delay + transmission delay

= $\frac{L}{R} + \frac{m}{s}$

= $\frac{sL + mR}{sR}$.

At $t = d_{trans}$, the last bit reaches host B.

if $d_{prop} > d_{trans}$, the first ~~half~~ bit of the packet is in the medium between the host A and B on its way to B.

if $d_{trans} > d_{prop}$, then first bit of the packet has already reached host B.

given $\frac{m}{s} = \frac{L}{R}$ $\therefore$ $m = \frac{s \times L}{R}$.