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COMPUTER NETWORKS

TUTORIAL 03

1.a)

Circuit-switched network is more suitable for the stated situation.

- ➢ The continuous flow of the data
- ➢ The longevity of the connection
- ➢ Circuit-switched network's feature to provide uniform delay in between data units contrary to the non-uniform delay of the other one.

All above points, put together, justifies the answer.

1.b)

If the network is packet-switched,

- ➢ Data units shall be divided into packets
- ➢ Due to multiple paths taken by different packets, some packets can be stuck into the traffic
- ➢ Some might even get lost

Considering the increment in the packet-length, the delay will increase as stated in above points.

2.

Propagation speed, $c = 3 \times 10^8$ m/s

Packet size, $L = 16000$ bits

a)

Link 1

Distance, $D = 2000$ m

Transmission rate, $R = 10^7$ bits/s

Propagation delay = D / c

$= 2000 / (3 \times 10^8)$

$= 6.7 \times 10^{-6}$ s or 6.7 us

Transmission delay = L / R

$= 16000 / 10^7$

$= 1.6 \times 10^{-3}$ s or 1600 us

Link 2

Distance, $D = 5 \times 10^5$ m

Transmission rate, $R = 10^8$ bits/s

Propagation delay = D / c

$= (5 \times 10^5) / (3 \times 10^8)$

$= 1.667 \times 10^{-3}$ s or 1667 us

Transmission delay = L / R

$= 16000 / 10^8$

$= 1.6 \times 10^{-4}$ s or 160 us

Link 3

Distance, D = 3000 m

Transmission rate, R = 10^9 bits/s

Propagation delay = D / c

$= 3000 / (3 \times 10^8)$

$= 10^{-5}$ s or 10 us

Transmission delay = L / R

$= 16000 / 10^9$

$= 1.6 \times 10^{-5}$ s or 16 us

b)

Total Propagation delay = 6.7 + 1667 + 160

= 1833.7 us

Total Transmission delay = 1600 + 160 + 16

= 1776 us

Total delay = 1833.7 + 1776

= 3609.7 us

= 3.6 ms

3.

Packet length, $L = 2500$ bytes $= 2 \times 10^4$ bits

Propagation speed, $c = 2.5 \times 10^8$ m/s

Transmission rate, $R = 3 \times 10^6$ b/s

a)

Distance, $D = 7.2 \times 10^6$ m

Propagation delay = D / c

$= (7.2 \times 10^{6)} / (3 \times 10^8)$

$= 2.4 \times 10^{-2}$ s or 24 ms

Transmission delay = L / R

$= (2 \times 10^4) / 10^9$

$= 2 \times 10^{-5}$ s or 20 us

Total delay = 24000 + 20

= 24020 us

= 2.402 ms

b)

Distance = d

Packet length = L

Propagation speed = ps

Transmission rate = bps

Total delay = Propagation delay + Transmission delay

= d / ps + L / bps

c)

The length of the packet affects the delay. Higher the length, higher the delay.

Transmission rate affects the delay. Higher the transmission rate, lower the delay.

4.

Distance, D = 1.5×10^6 m

Frame length, L = 6×10^6 bits

Number of links, n = 8 (Link at the far side is not considered)

Processing Time, pt = 2 us

Queueing Time, qt = 3 us

Propagation speed, c = 2×10^8 m/s

Transmission rate, R = 4×10^6 b/s

Propagation delay = D / c

$= (1.5 \times 10^6) / (3 \times 10^8)$

$= 5 \times 10^{-3}$ s or 5 ms

Transmission delay = n x ((L / R) + pt + qt)

$= 8 \times (((6 \times 10^6) / (4 \times 10^6)) + 2 \text{ us} + 3 \text{ us})$

$= 8 \times (1.5 \times 10^6 \text{ us} + 5 \text{ us})$

$= 1.2 \times 10^7 + 40$ us

Total delay = $5000 + 1.2 \times 10^7 + 40$ us

= 12 seconds (almost)