Ministry of Higher Education and Scientific

Research Al-Mustaqbal University College

Department of Technical Computer Engineering

Computer Network 3rd Stage

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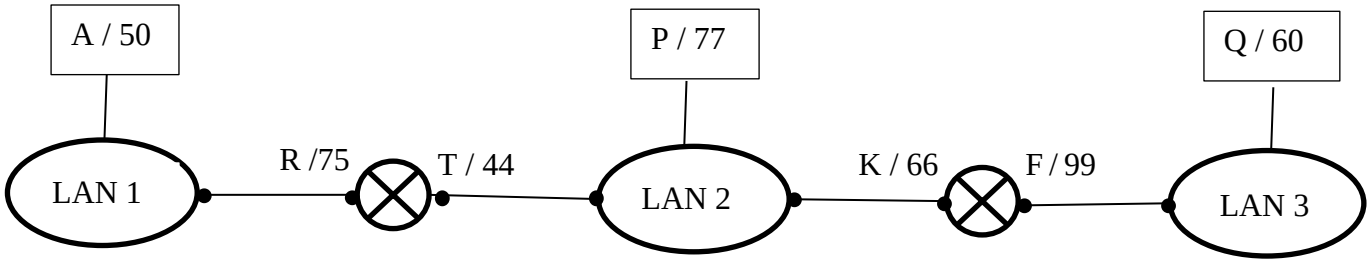
Q1/ Show the encapsulation process at the **network and Data link layer** at each node in the following cases:

a- If **A** send a message to **Q**
b- If **P** send a message to **Q**



a- Answer.

Through LAN1 (from A/50 to R/75)

Upper layer	Data			
Network layer	A Q	Data		
Data link layer	75 50	A Q	Data	T

Through LAN2 (from T/44 to K/66)

Upper layer	Data			
Network layer	A Q	Data		
Data link layer	66 44	A Q	Data	T

Through LAN3 (from F/99 to Q/60)

Upper layer	Data			
Network layer	A Q	Data		
Data link layer	60 99	A Q	Data	T

b- Answer.

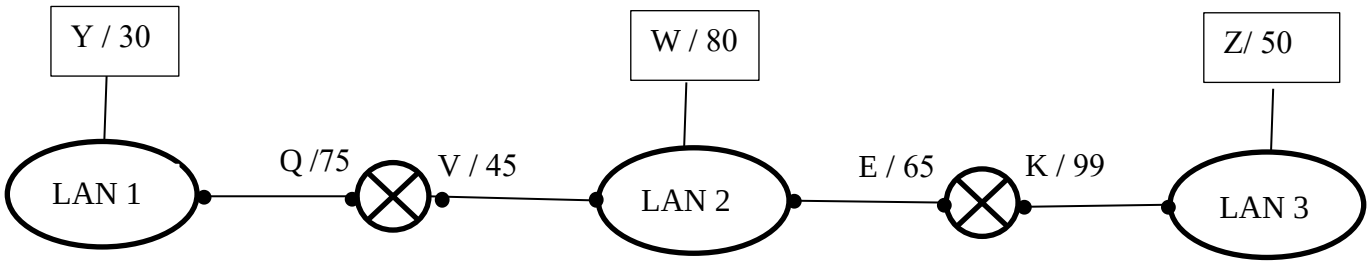
Through LAN2 (from P/77 to K/66)

Upper layer	Data			
Network layer	P Q	Data		
Data link layer	66 77	P Q	Data	T

Through LAN3 (from F/99 to Q/60)

Upper layer	Data			
Network layer	P Q	Data		
Data link layer	60 99	P Q	Data	T

Q2/ The encapsulation process at the Data link layer Through LAN2 only If **(Y)** send a message to **(Z)** are



a-

Upper layer	Data			
Network layer	R Y	Data		
Data link layer	65 45	R Y	Data	T

b-

Upper layer	Data			
Network layer	V E	Data		
Data link layer	65 45	V E	Data	T

c-

Upper layer	Data			
Network layer	R Y	Data		
Data link layer	30 50	R Y	Data	T

d-

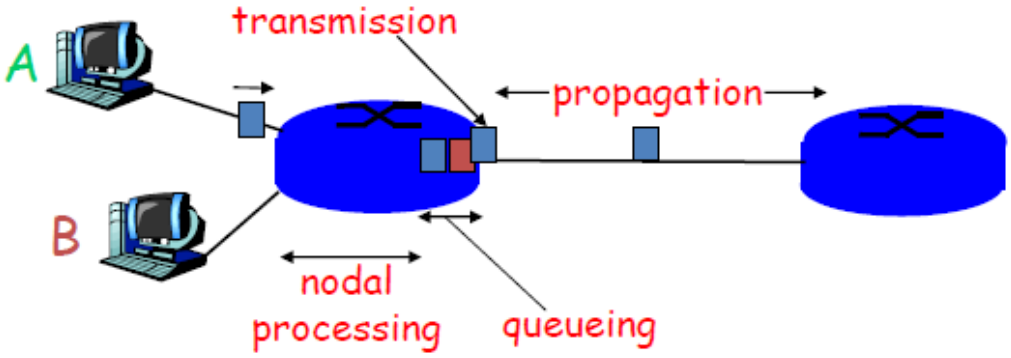
Upper layer	Data			
Network layer	V E	Data		
Data link layer	30 50	R Y	Data	T

Answer: a

Upper layer	Data			
Network layer	R Y	Data		
Data link layer	65 45	R Y	Data	T

Packet loss

Four sources of packet delay



$$d_{nodal} = d_{proc} + d_{queue} + d_{trans} + d_{prop}$$

1. *Processing*
2. *Queuing*
3. *Transmission*
4. *Propagation*

Nodal delay

$$d_{\text{nodal}} = d_{\text{proc}} + d_{\text{queue}} + d_{\text{trans}} + d_{\text{prop}}$$

- d_{proc} = processing delay
  dependes on time checking error, packet forwarding algorithm.
- d_{queue} = queuing delay
  - depends on congestion and packet on the link.
- d_{trans} = transmission delay
  - = L/R, significant for low-speed links
- d_{prop} = propagation delay
  - The propagation speed depends on the physical medium of the link (that is, fibre optics, twisted-pair copper wire, and so on = *d/s*

transmission delay $= \boldsymbol{d_{trans}}$

$$d_{trans} = \frac{length\ of\ the\ backet\ (bit)}{link\ transmission\ rate\ (bps)} = bit \times \frac{sec}{bit} = sec$$

$$d_{trans} = \frac{L\ (bit)}{R\ (bit/sec)} = \text{sec}$$

propagation delay $= \boldsymbol{d_{prop}}$

$$d_{prop} = \frac{Distance\ (m)}{Velocity\ (m/s)} = m \times \frac{sec}{m} = sec$$

$$d_{prop} = \frac{d\ (m)}{v\ (m/sec)} = \text{sec}$$

$$v\left(\frac{m}{sec}\right) = 3 \times 10^8 \times 0.7 = 2.1 \times 10^8 \quad m/s \qquad 0.7 \text{ delay } in\ fiberobtic$$

Q/ Suppose a 128 kbps point to point link is set up between earth and a rover on moon. The distance from the earth to moon (when they are the closest together) is approximately 385000 km, and data travels over the link at the speed of light 3×10^8 m/sec.
a) Calculate the Propagation Delay of the link.
b) A camera on the rover takes pictures of its surroundings and sends these to the earth. Calculate the transmission Delay to reach Mission Control on Earth? Assume that each image is 5Mb in size.
Ans.

$$\boldsymbol{a)} \quad d_{prop} = \frac{Distance\ (m)}{Velocity\ (m/s)}$$

$$d_{prop} = \frac{d\ (m)}{v\ (m/s)} = \frac{385000\ \times 10^3}{3 \times 10^8} = 1.2833\ \ sec$$

$$\boldsymbol{b)} \quad d_{trans} = \frac{length\ of\ the\ packet\ (bit)}{link\ transmission\ rate\ (bps)}$$

$$d_{trans} = \frac{L\ \ (bit)}{R\ (bit/sec)} = \frac{5 \times 10^6}{128 \times 10^3} = 39.0625\ \text{sec}$$

H.W.
Q/ Suppose a 100 kbps point to point link is set up between earth and a rover on mars. The distance from the earth to mars (when they are the closest together) is approximately 55 Gm, and data travels over the link at the speed of light $3X10^8$ m/s.
a) Calculate the Propagation Delay of the link.
b) A camera on the rover takes pictures of its surroundings and sends these to the earth. Calculate the transmission Delay to reach Mission Control on Earth? Assume that each image is 25Mb in size.