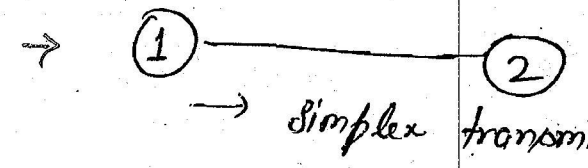
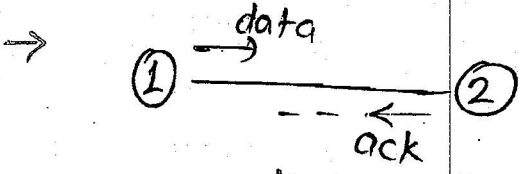
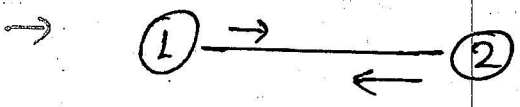


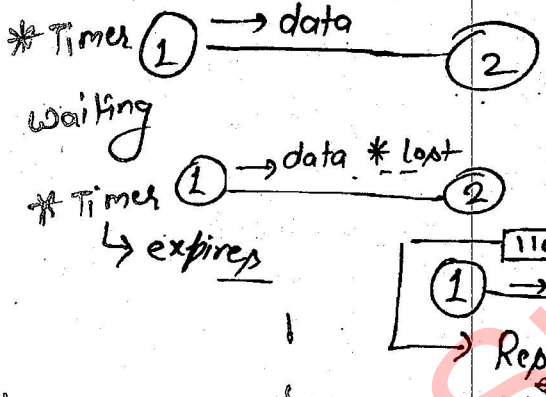
→ Simplex transmission



Half duplex transmission.



:- full duplex Transmission.



★ Since the waiting time is finite, the timer is required.

★ once the data is lost, inorder to retransmit the data, buffer is required.

Transmission time = $\frac{\text{Data size}}{\text{Band width}}$

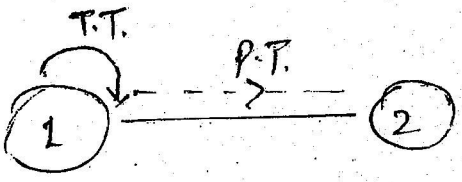
⇒ "The Time taken to place the data on the Network is known as Transmission time."

Band Width = 10 Mbps

Mega = 10^6	micro = 10^{-6}
Giga = 10^9	nano = 10^{-9}

$$T.T. = \frac{2\times10^3 \times 8 \text{ bits}}{10\times10^6 \text{ bit/sec}} = 16\times10^{-4} \text{ sec.}$$

$$= 1.6 \text{ ms.}$$



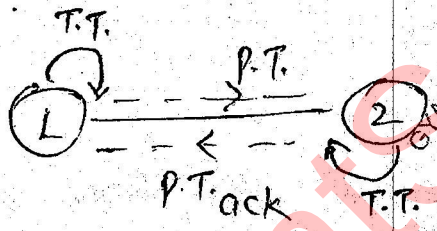
$$\text{Propogation Time} = \frac{\text{length of cable}}{\text{velocity of medium}}$$

(2.) $l = 2000$ m

$v = 2*10^8$ m/sec.

$$P.T. = \frac{l}{v} = \frac{2000\text{m}}{2\times10^8 \text{ m/sec.}} = 10^{-5} \text{ sec}$$

$$= 10 \mu\text{sec.}$$



$Ack_{size} << Data\ size$

$$T.T._{ack} = \frac{Ack\ size}{B.W.}$$

$T.T.$ ack is negligible

$$P.T._{ack} = P.T._{data}$$

$$\text{Total time} = T.T._{data} + P.T._{data} + \cancel{T.T._{ack}} + P.T._{ack}$$

$$\text{Total time} = T.T. + 2P.T.$$

* Link utilization of sender $= 1 * \frac{T.T.}{T.T. + 2 * P.T.} * 100\%$

(3) Link utilization $\% = 50\%$

$$50' = \frac{T.T.}{T.T. + 2 * P.T.} * \frac{2}{100}$$

$$\Rightarrow T.T. + 2 * P.T = 2 T.T.$$

$$\Rightarrow \underline{T.T. = 2PT}$$

(4) $L.U. = 50\%$

$B.W. = 10 MBPS$

$l = 200m$

$v = 2 * 10^8$ m/sec.

Calculate the data size.

$T.T. = 2PT.$

$P.T. = \frac{200m}{2 \times 10^8 \text{ m/sec.}} = 10^{-6}$ sec.

$T.T. = \frac{\text{Data size}}{B.W.}$

$\frac{\text{Data size}}{B.W.} = 2 * P.T.$

$\frac{\text{Data size}}{10 \times 10^6} = 2 \times 10^{-6}$

Data size $= 20$ bits

* Throughput :-

$$\text{Throughput} = \frac{\text{Data size}}{T.T. + 2 * P.T} \quad \text{bps}$$

"The Rate at which user transmits the data is known as throughput."

(1)

B.w. = 10 Mbps

Datasize = 100 bits

l = 200 m

$v = 2 * 10^8$ m/sec

$$T.T. = \frac{\text{Data size}}{B.w.} = \frac{100 \text{ bits}}{10^7 \text{ bits/sec}} = 10^{-5} \text{ sec}$$

$= 10 \mu$ sec.

$$P.T. = \frac{l}{v} = \frac{200}{2 \times 10^8} = 10^{-6} = 1 \mu \text{sec}$$

$$\text{Throughput} = \frac{\text{Data size}}{\text{total time}} = \frac{100}{T.T. + 2 * P.T.} = \frac{100}{10\mu\text{sec} + 2 * 1\mu\text{sec}}$$

$$= \frac{100}{12 \mu\text{sec}} = 8.3 \text{ Mbps}.$$

$$\% \text{ Link utilization} = \frac{T.T.}{T.T. + 2 * P.T.} \times 100 \%$$

$$= \frac{\text{Data size}/B.w.}{T.T. + 2 * P.T.} \rightarrow \text{throughput}$$

$$\% \text{ LU} = \frac{\text{throughput}}{B.w.}$$

$\frac{\quad}{10\ Mbps} * 100\%$

$= 03\%$

(7.) B.ω. = 10 Mbps

Calculate 1 bit delay ?

1 sec = 10^7 bits

10^{-7} sec. ⟸ 1 bit

Or

T.T. = $\frac{1}{10^7} = 10^{-7}$ b/sec

$= 0.1$ μsec.

(8) B.ω. = 100 Mbps

v = $2 * 10^8$ m/sec.

Calculate 1 bit delay in meters of cable.

1 bit delay :-

T.T. = $\frac{1}{10^8} = 10^{-8}$

1 sec. = $2 * 10^8$ meters

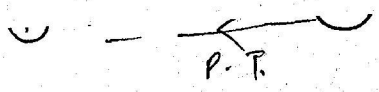
1 bit delay = 10^{-8} sec. = 2 meters of cable

→ 1 bit delay in meters = bits are having 2 meters distance b/w them while moving.

Notes :-

T.T. = $\frac{\text{Data size}}{\text{B.ω}}$ → characteristic of computer

P.T. = $\frac{l}{v}$ → characteristic of link



⇒ R.T.T. = 2 * P.T.

↳ (Round trip time) :- characteristic of link.

(9.) B.ω. = 10 Mbps

R.T.T. = 50 μsec.

calculate no of bits transmitted in R.T.T. value ?

1 sec. = 10^7 bits

50 μsec. = $50 \times 10^{-6} \times 10^7$ bits

No of bits in R.T.T. ⇒ 500 bits

(10.) B.ω. = 100 Mbps

R.T.T. = 25 μsec.

Data size = 50 bits

calculate No of data units in R.T.T. ?

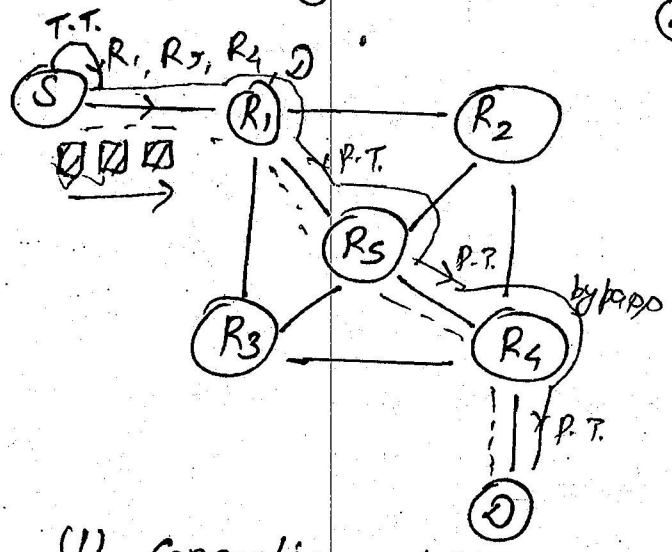
1 sec = 10^8 bits

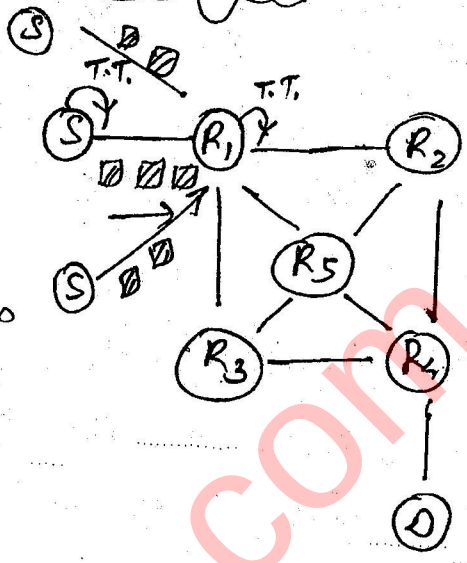
25 μsec. = $10^8 \times 25 \times 10^{-6}$ = 2500 bits

No of bits in R.T.T = 2500 bits

No of data units = $\frac{\text{total bits}}{\text{data size}} = \frac{2500}{50} = \underline{50 \text{ units}}$

⇒ Circuit switching & packet switching :-





(Sec.) (i) Connection establishment
(x sec.) (ii) Data transfer
(Sec.) (iii) Connection release

(i) Data transfer.

'Circuit switching'

'Packet switching'

In circuit switching there are three phases : Connection establishment, data transfer, data release. where as in packet switching data can be transmitted directly.

Circuit Switching -

★ Three phases :
- Connection establishment
- data transfer
- ~~data~~ Connection release.

★ In circuit switching each data unit will have the entire path address

Packet Switching -

★ Data can be transmitted directly
- data transfer (1 phase only).

★ In packet switching each data unit will have the destination address, the intermediate path is decided by Router.

* Circuit switching is not a store and forward technique. the packet simply bypass the queue of the router.

* In circuit switching, the transmission of the packet is done by the source.

* In this technique, the delay between the data units is 'uniform' or same.

* Resource reservation is a feature of circuit switching

* wastage of Resources are more in circuit switching

* In circuit switching 'Congestion' can occur during connection establishment phase.

'Congestion' :- when more No. of packets are coming in less time then the router buffer will be full in no time then the Router is 'Congested'

'Store and forward' technique where the packets are stored, algorithm is applied and forwarded, on the best path.

* In packet switching the transmission of data is done not only by the source but also by intermediate routers.

* In packet switching, the delay between the data units is 'variable'.

* Resources are sharable in packet switching.

* wastage is less of Resources in this technique.

In packet switching 'Congestion' can occur during data transfer phase.

★ Circuit switching is not a fault tolerant technique because the data can not be diverted via other paths	★ Packet switching is a fault tolerant technique. because the data can be diverted via other paths.
★ It is reliable	★ It is unreliable (Packet switching).
★ It is used for 'long messages'.	★ It is used for 'short messages'.
★ Circuit switching is slow	★ Packet switching is fast.