CS & IT ENGINEERING

COMPUTER NETWORKS

Medium Access Control

Lecture No-08

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TOPICS TO BE COVERED

Multiple Access Protocols-8

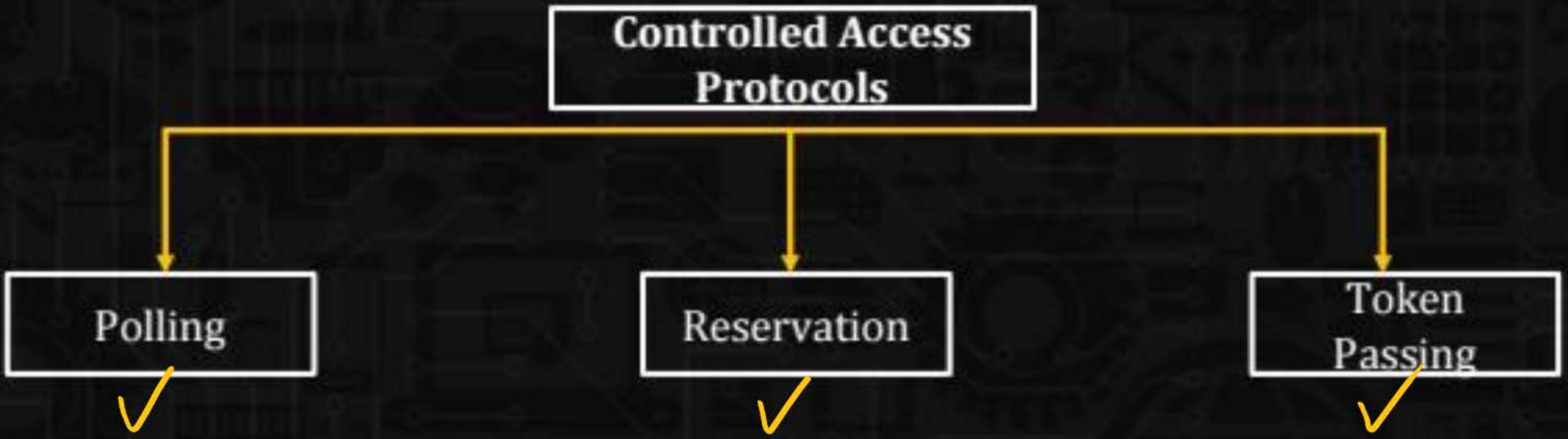
Controlled Access Protocols

Controlled Access Protocol

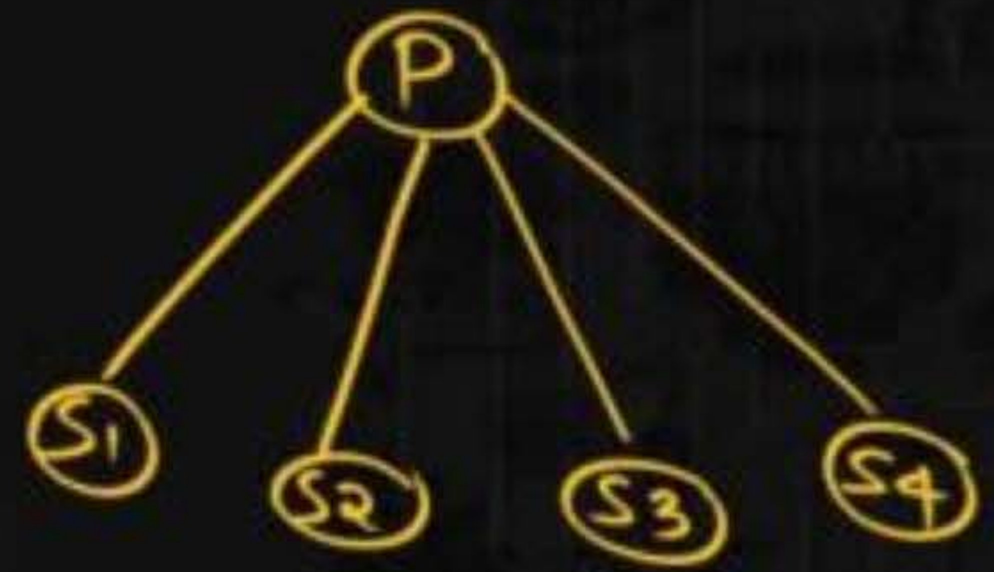
It can be done in the following two ways

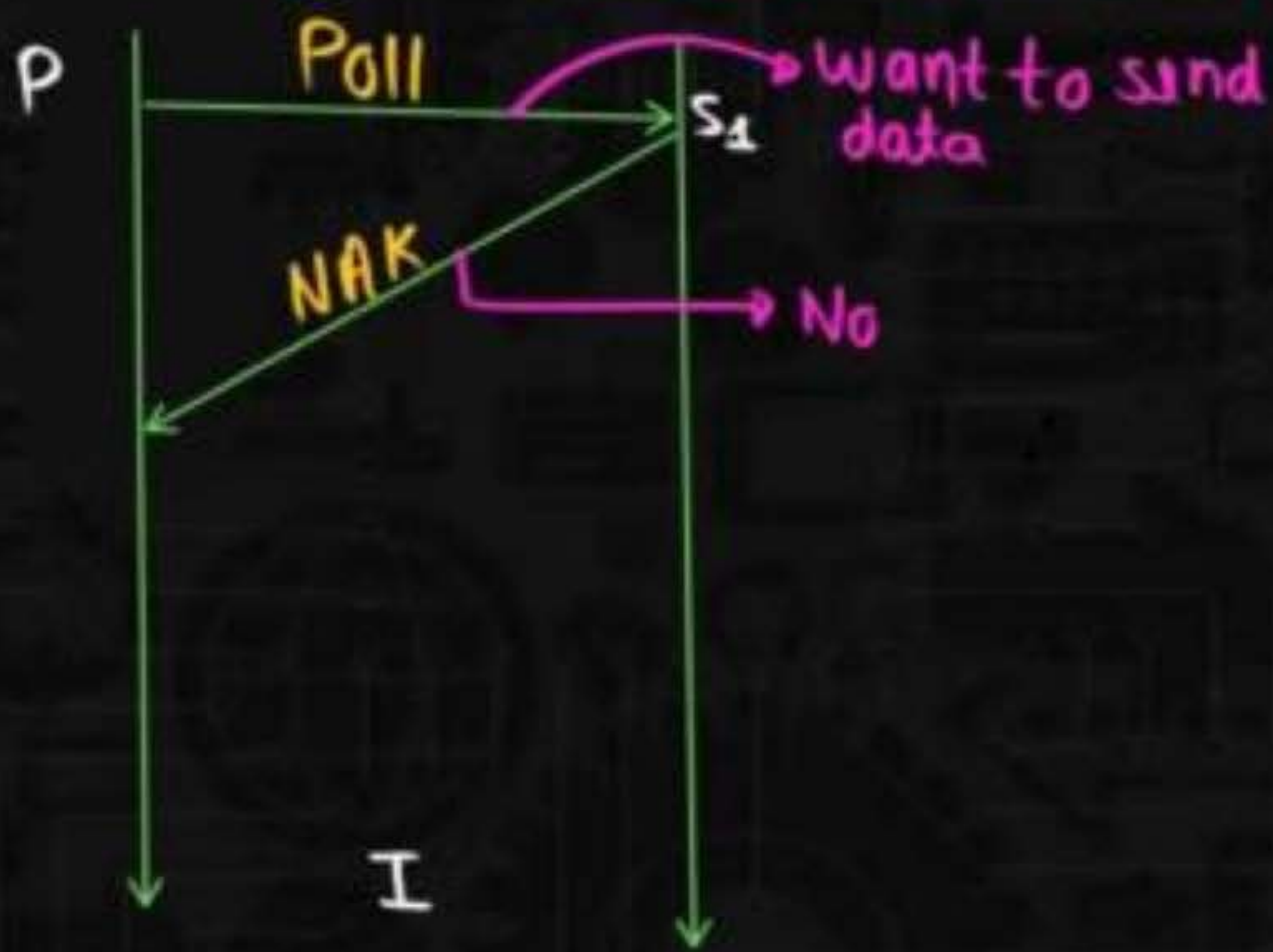
1. We have a concept of primary and secondary station. Primary station will control all secondary station.
2. If concept of primary or secondary station is missing then if any station want to send the data , it can send only in a case if all other stations gives permission to it.

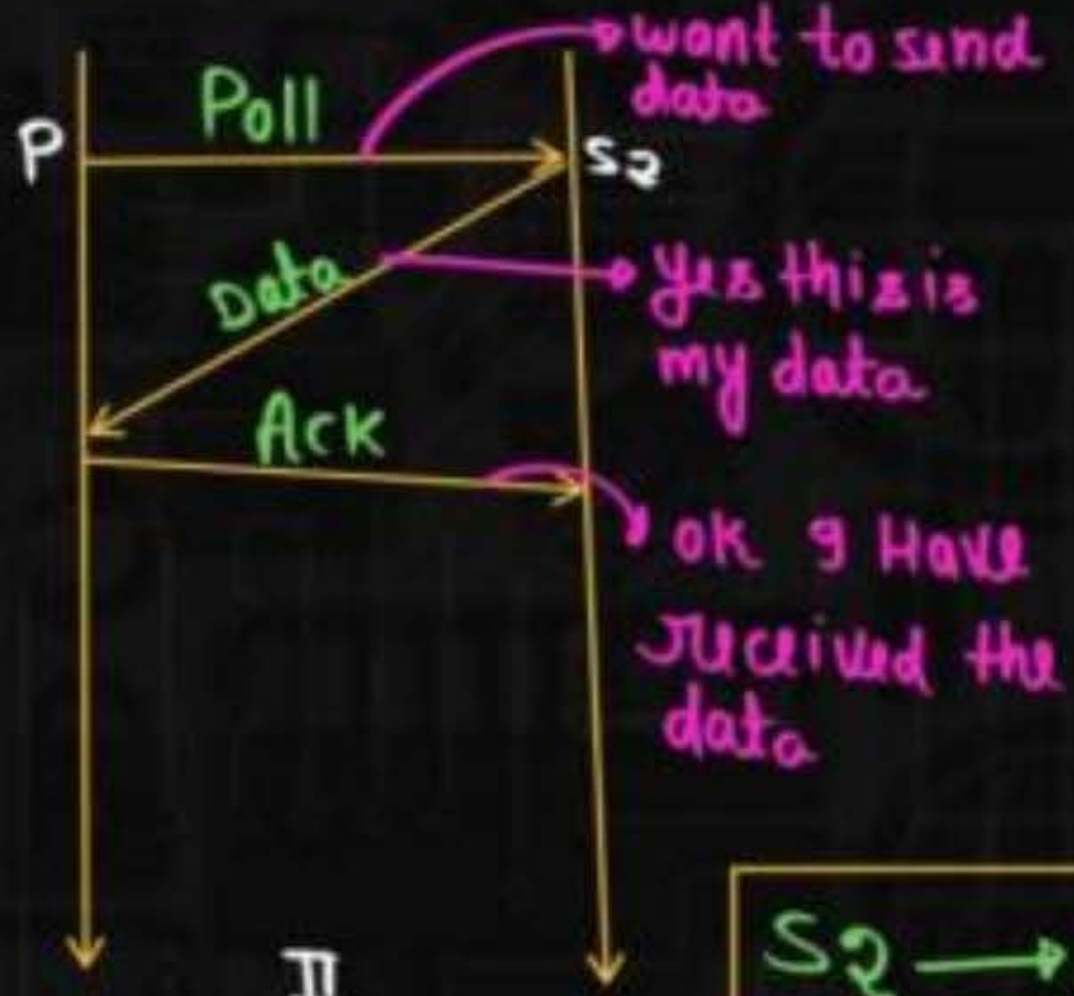
Note: controlled Access Protocol are collision free protocol.


Controlled Access Protocols
Polling
Reservation
Token Passing

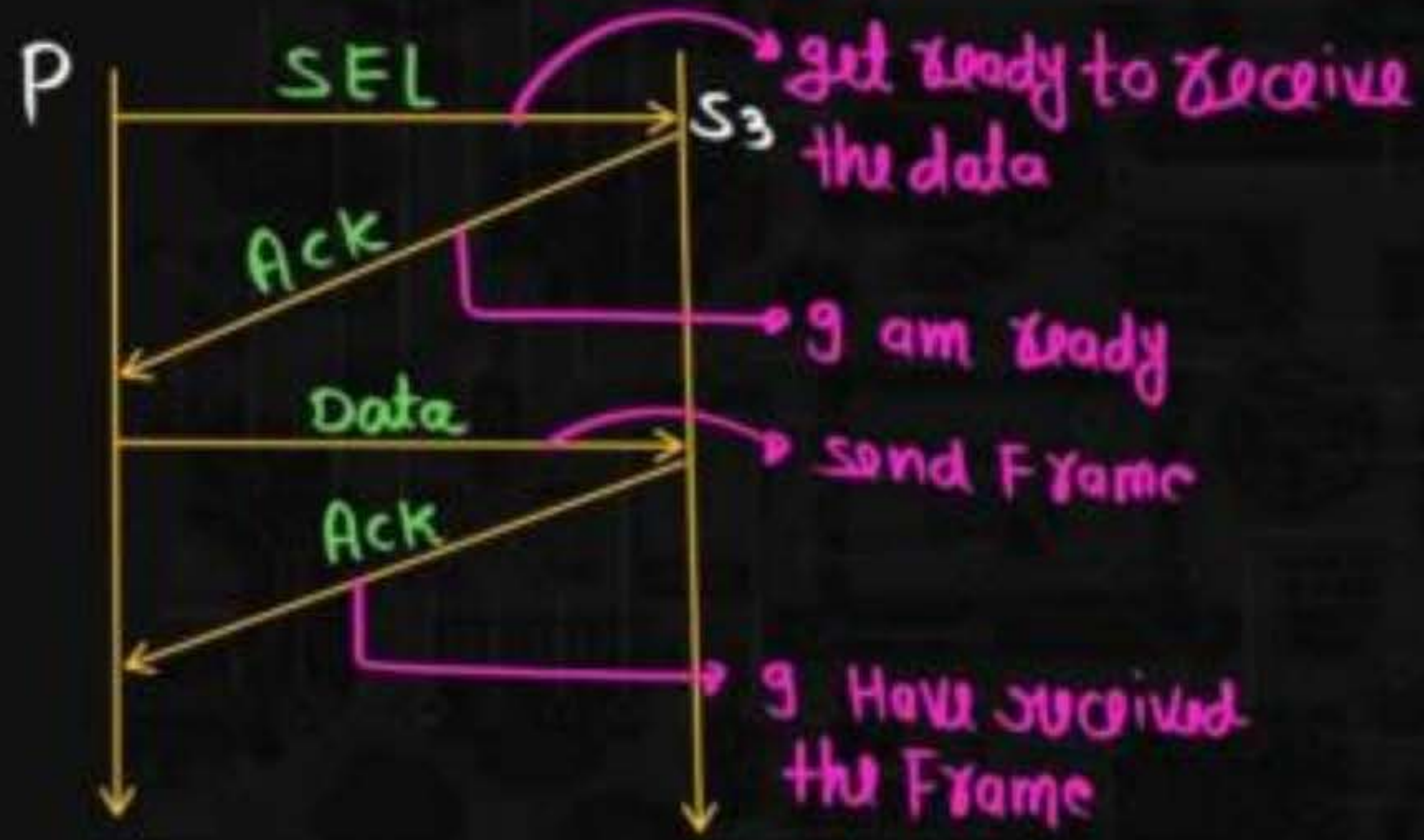
Polling







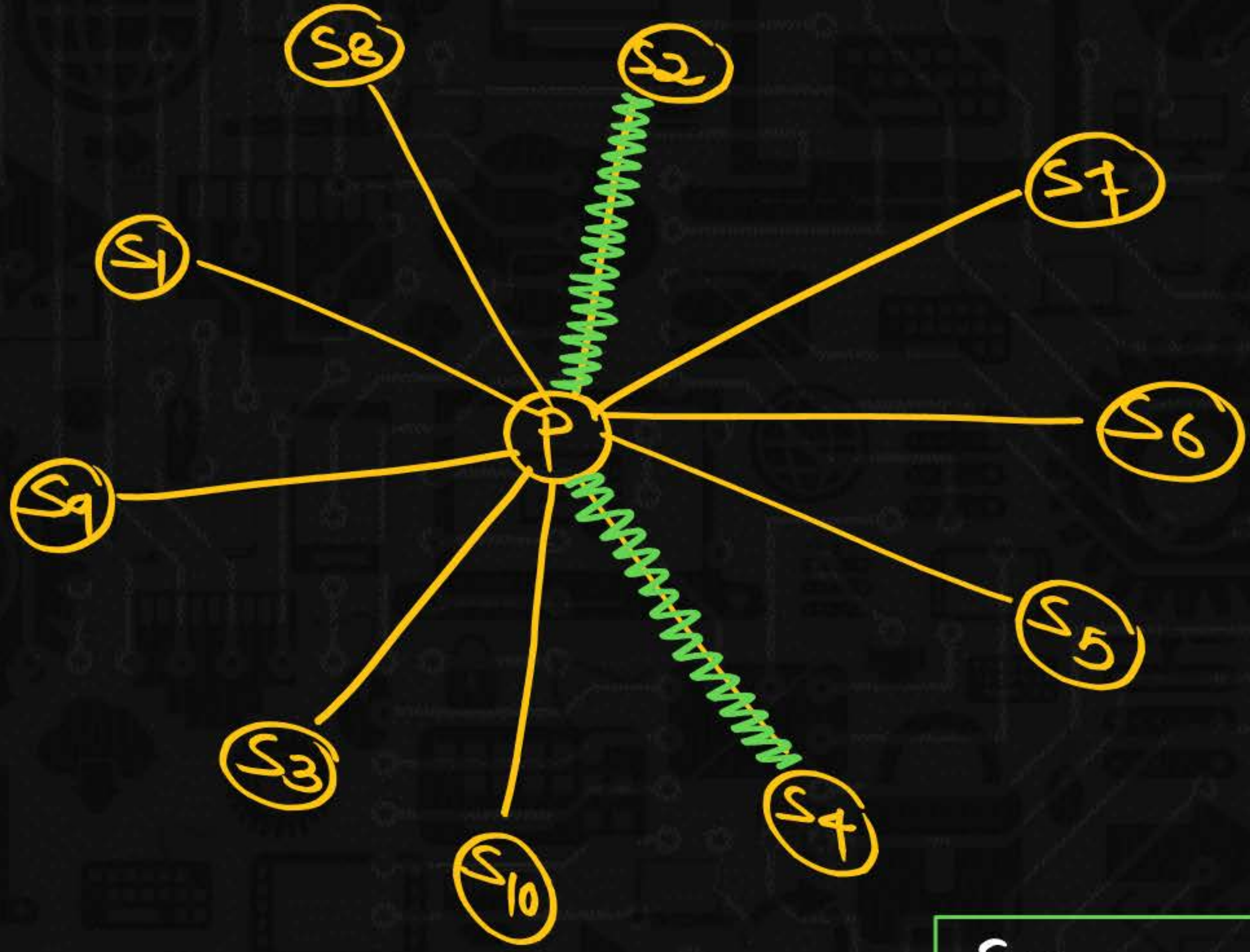
$\boxed{S_2 \longrightarrow S_3}$


P
SEL
S_3
get ready to receive the data
Ack
I am ready
Data
Send Frame
Ack
I Have received the Frame

III

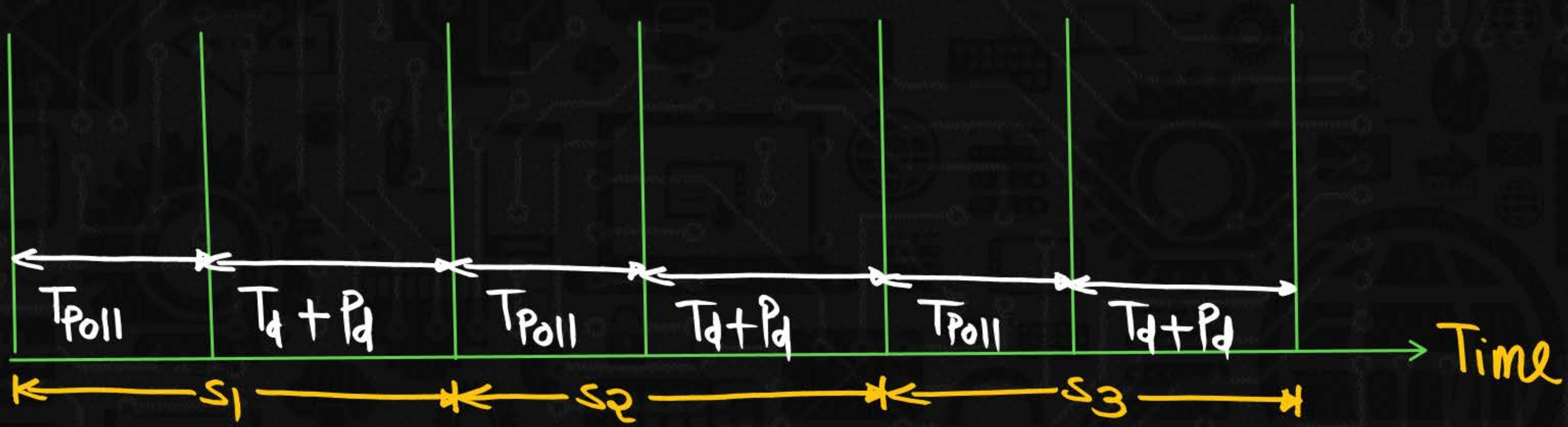
Note:

- Every station will send the data through primary station.
- Two secondary station can not communicate directly.
- Common topology used in polling mechanism is star topology.
- Bandwidth utilization is low because lots of time is wasted by sending the poll message.
- Drawback of polling is if primary station fails ,the system goes down.



S2 ⟶ S4

efficiency of Polling



$$\text{efficiency} = \frac{\text{useful time}}{\text{Total time}}$$

$$\boxed{\text{efficiency} = \frac{T_d}{T_{poll} + T_d + P_d}}$$

$$\boxed{\text{Throughput} = \eta * B}$$

Q.1 A broadcast channel has 10 nodes and total capacity of 10 Mbps. It uses polling for medium access. Once a node finishes transmission, there is a polling delay of 80 μs to poll the next node. Whenever a node is polled, it is allowed to transmit a maximum of 1000 bytes. The maximum throughput of the broadcast channel is:

[GATE - 2005]

A. 1Mbps

B. 100/11Mbps

C. 10Mbps

D. 100Mbps

Total No. of Node = 10

B = 10 mbps

T_{Poll} = 80 μsec

Packet size = 1000 Byte

$T_d = \frac{\text{Pktsize}}{\text{Bandwidth}}$

$= \frac{8000 \text{ bits}}{10 * 10^6 \text{ bits/sec}}$

$= 800 * 10^{-6}$ sec

= 800 μsec

$$\text{efficiency} = \frac{\text{useful time}}{\text{total time}}$$

$$= \frac{T_d}{T_{poll} + T_d + \cancel{P_d}}$$

0

$$= \frac{800}{80 + 800 + 0}$$

$$= \frac{80\cancel{0}\ \cancel{\mu sec}}{88\cancel{0}\ \cancel{\mu sec}}$$

$$= \frac{\cancel{80}}{\cancel{88}} = \frac{10}{11}$$

$$\text{Throughput} = \eta * B$$

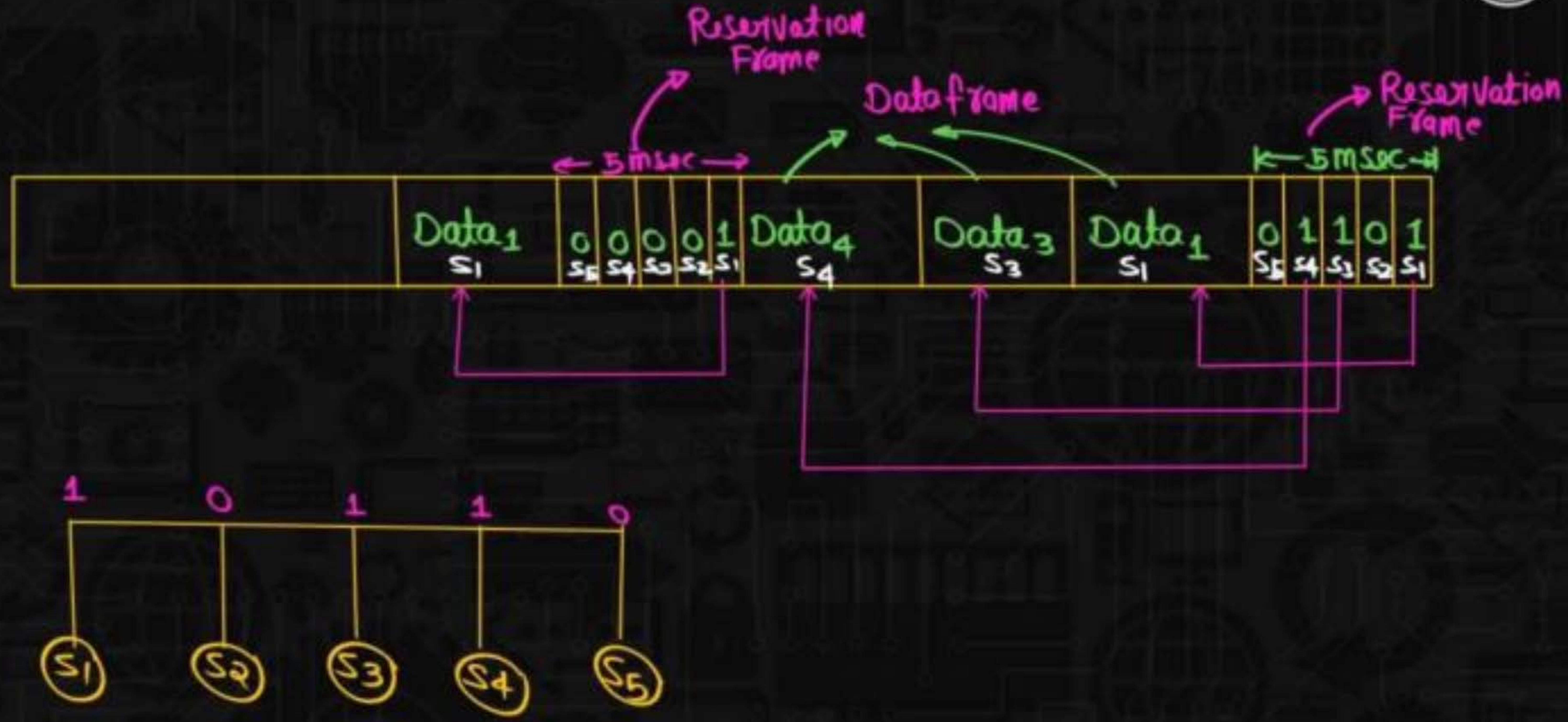
$$= \frac{10}{11} * 10\text{mbps}$$

$$= \frac{100}{11}\text{mbps}$$

Reservation

Reservation

1. In the reservation method , a station needs to make a reservation before sending the data.
2. Time is divided into intervals.
3. In each interval reservation frame precedes the data frames sent in that interval.
4. If there are N- stations in the system ,there are exactly N reservation minislots in the reservation frame. Means every station have its own minislot.
5. The stations that have made reservations can send their data frames after the reservation frame.



Reservation Frame
Data frame
Reservation Frame
5 msec
5 msec
Data1 S1
0 0 0 0 1
S5 S4 S3 S2 S1
Data4 S4
Data3 S3
Data1 S1
0 1 1 0 1
S5 S4 S3 S2 S1
1 0 1 1 0
S1 S2 S3 S4 S5

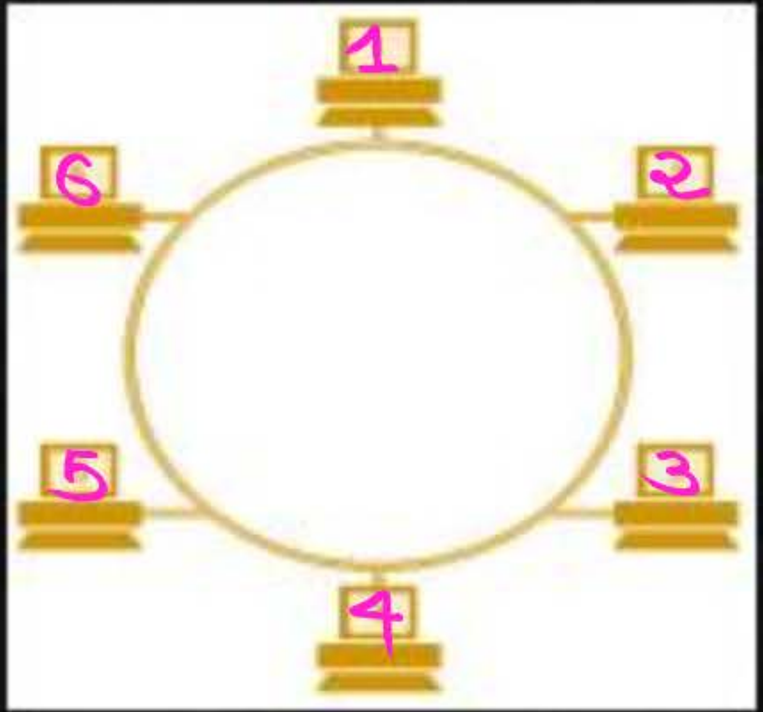
Example

- Let us take a example of 5 stations and 5 mini slot in the reservation frame. In the first interval only 1, 3 and 4 have mode reservations. In the second interval, only station 1 has made reservation.

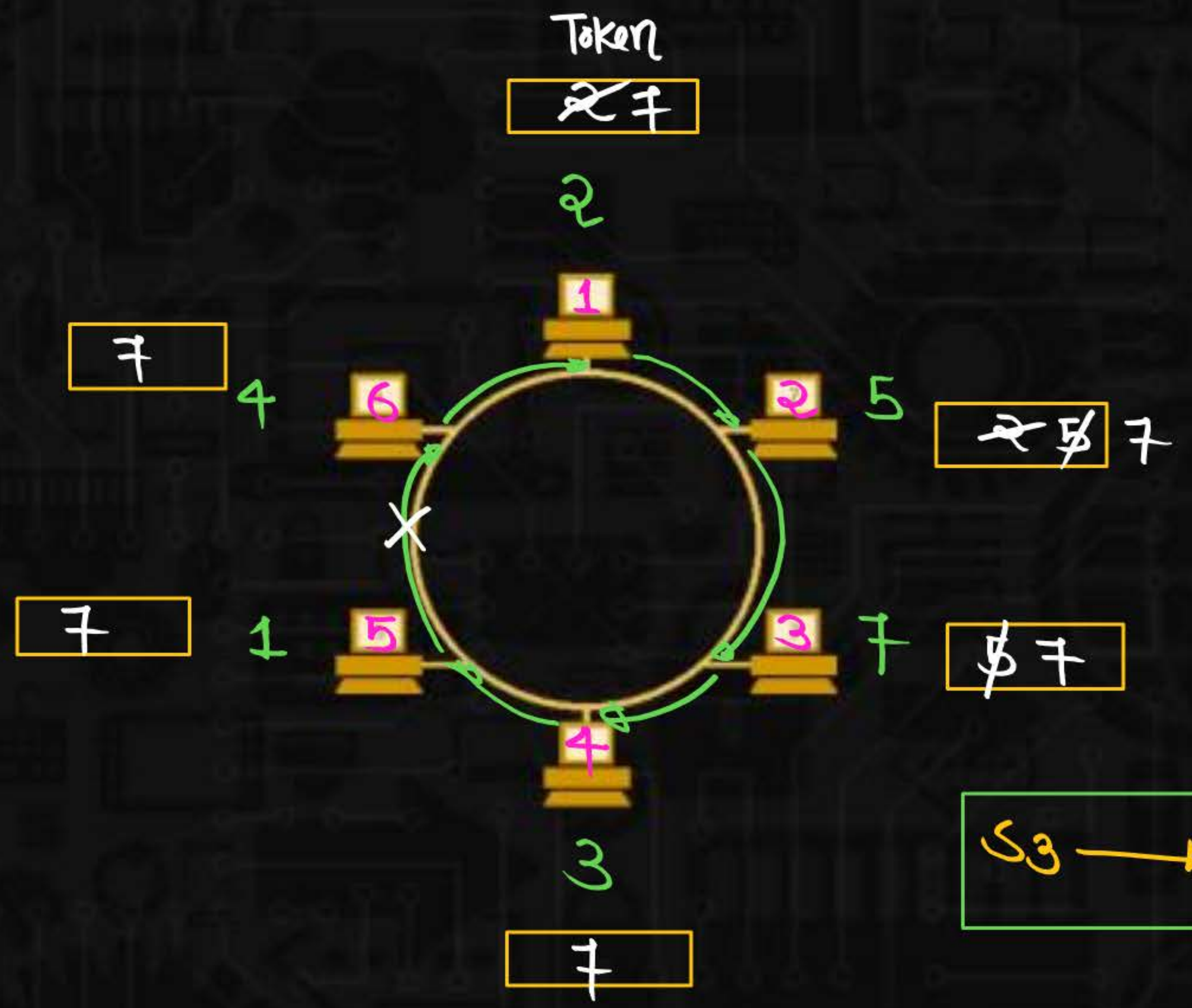
Token Passing

Token Passing

1. All the stations are logically connected to each other in the form of ring.



2. It uses a special frame called "token" that travels around the ring.
3. A station is allowed to transfer the data packet if and only if it has token.
4. Whenever station has no more data to send , it release the token.



Priority = 3bit

Range → 0 to 2^3-1

Range → 0 to 7

$S_3 \longrightarrow S_1$

Note:

- Best technique for broadcasting the packet.
- No acknowledgement.

Channelization Protocols

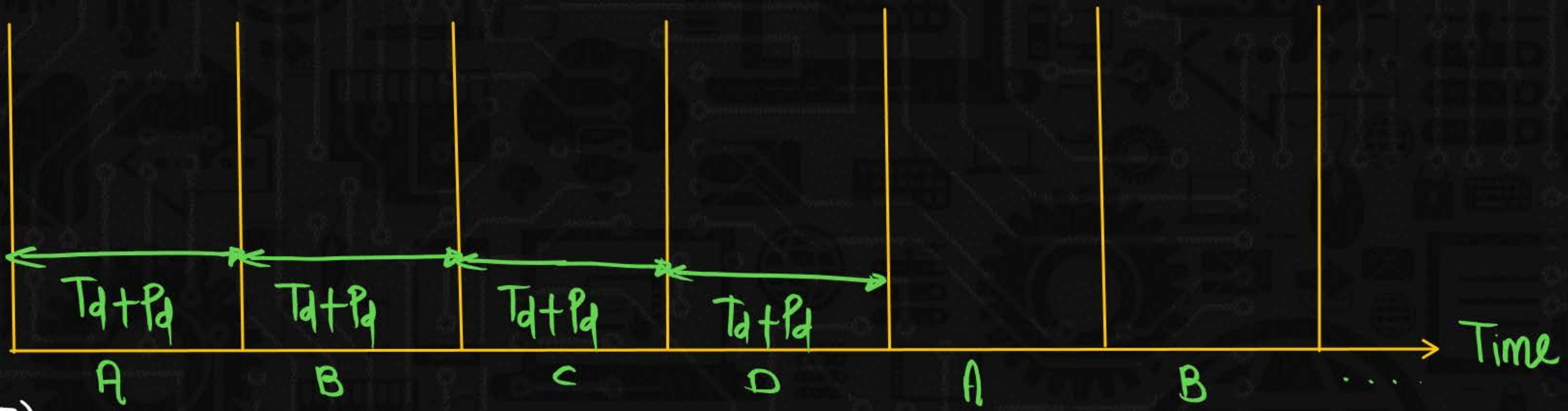
Centralized Access Protocols

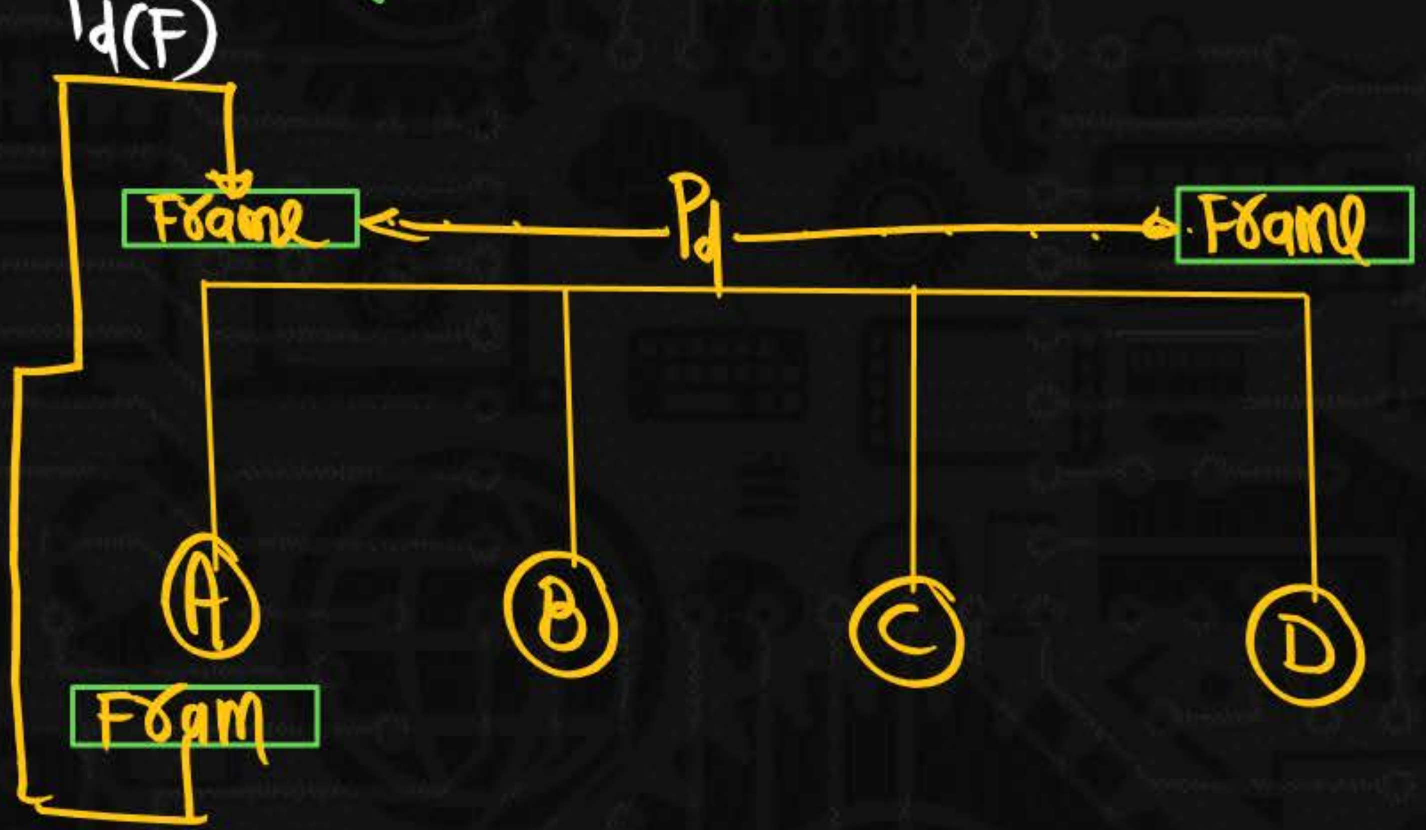
- * TDMA ✓
- FDMA X
- CDMA X

TDMA(Time division Multiple Access)

In time division multiple access-

- Time of the link is divided into fixed size intervals called as time slots.
- Time slots are allocated to the stations in round robin manner.
- Each station transmit its data during the time slot allocated to it.
- In case, station does not have any data to send, its time slot goes waste.





$$\text{efficiency} = \frac{\text{useful time}}{\text{Total time}}$$

$$\boxed{\text{efficiency} = \frac{T_d}{T_d + P_d}}$$

$$\text{efficiency} = \frac{\cancel{T_d}}{\cancel{T_d}\left[1 + \frac{P_d}{T_d}\right]}$$

$$\boxed{\text{efficiency} = \frac{1}{1+a}}$$

$$a = \frac{P_d}{T_d}$$

Disadvantage

- If any station does not have data to send during its time slot, then its time slot goes waste.
- This reduce the efficiency.
- This time slot could have been allocated to some other station willing to send data.

Note:

- Effective bandwidth/bandwidth utilization/Throughput

  $= \boxed{\text{Efficiency} * \text{Bandwidth}}$

- Maximum available effective bandwidth (Throughput)

  =Total no of stations* Bandwidth requirement of 1 station.

Throughput = N * 4 Kbps

4 Mbps = N * 4 Kbps

$\boxed{N = 1000}$

Problem:

If transmission delay and propagation delay of a packet in Time division multiplexing is 1 msec each at 8Mbps bandwidth, then-

a. Find the efficiency?

b. Find the effective bandwidth/throughput?

c. How many maximum stations can be connected to the network if each station requires 4kbps bandwidth ?

Sol/n: $T_d = 1\text{msec}$, $P_d = 1\text{msec}$, $B = 8\text{mbps}$

Soln (a)

$$\text{efficiency} = \frac{\text{useful time}}{\text{Total time}}$$

$$= \frac{T_d}{T_d + P_d}$$

$$= \frac{1\ \text{msec}}{1\ \text{msec} + 1\ \text{msec}}$$

$$= \frac{1\ \cancel{\text{msec}}}{2\ \cancel{\text{msec}}}$$

$$\boxed{\eta = 50\%}$$

Soln (b) Throughput $= \eta * B$

$$= \frac{1}{2} * 8\ \text{mbps}$$

$$= 4\ \text{mbps}$$

$$N * 4\ \text{Kbps} = 4\ \text{mbps}$$

$$N = \frac{\cancel{4}\ \text{M}\cancel{\text{bps}}}{\cancel{4}\ \text{K}\cancel{\text{bps}}}$$

$$N = \frac{10^6}{10^3}$$

$$\boxed{N = 1000}$$

2PM-4PM

9PM-11PM