# UNIT- III

## MAC SUBLAYER

① **MAC Addressing** -

It is used by network adapters to uniquely identify themselves. 12-digit hexadecimal numbers.

② **Binary Exponential Back-off Algorithm (BEB)** -

It achieves congestion control by dynamically choosing the contention window. It work as follows -

(1) Each station draw a random number r from range $(0, C)$ and back offs for duration $r \times$ slot-time. C is called cotention windows.

(2) After expiry of the back-off interval, a station transmits its data frame if the medium is free. (0 or 1)

(3) If there are large number of stations trying to access the transmission medium, collisions take place and back-off increases exponentially. [doubles every time $\rightarrow C$)

③ DISTRIBUTED RANDOM ACCESS SCHEMES / CONTENTION SCHEMES -

④ **For data services** -

→ **ALOHA** -

The basic idea is applicable to any system in which uncoordinated users are competing for the use of a single shared channel.

(1) **Pure ALOHA** -

A user can transmit whenever they have the data (in form of packets). To determine whether a transmission was successful, a sender waits for an acknowledgement from the receiver for a time period. If no acknowledgement is received, the message will be sent again.

Advantages - simplicity, no synchronization is required.

Disadvantages - Collision of packets.

(2) **Slotted ALOHA** -

Time is divided into slots and users are allowed to transmit at specific instance of time.

Advantages - Simple to implement, Highly decentralized.

Disadvantages - Collisions waste slots, Idle slots.

④ For local Area Networks -

→ CSMA (Carrier Sense Multiple Access) protocols -

A station senses the carrier on the channel before starting its own transmission. When the channel is sensed to be idle, a station can take one of the three different approaches to transmit a packet on to the channel. These three protocols are -

(1) Non-persistent CSMA -

Waits random period of time then check for availability

(2) 1-persistent CSMA -

Monitor the channel continously and when it available it transmits the data.

(3) p-persistent CSMA -

When a station becomes ready to send and it senses the channel to be idle, it either transmits with a probability p or it defers transmission by one time slot with a probability $q = 1-p$. If the defered time slot is also idle, the station either transmits with probability p or defers again with a probability q. This process is repeated until either packets are transmitted or the channel become busy.

→ CSMA/CD (Collision Detection)

It detects the collision, the transmission is only done when the channel is free. If two stations, send data at the same time collision is detected, they wait for random time and then resend the data.

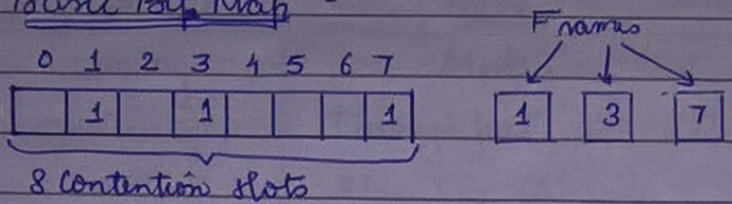
→ CSMA/CA (Collision Avoidance)

Collision are avoided through the use three strategies - Interframe space, contention window & acknowledgement

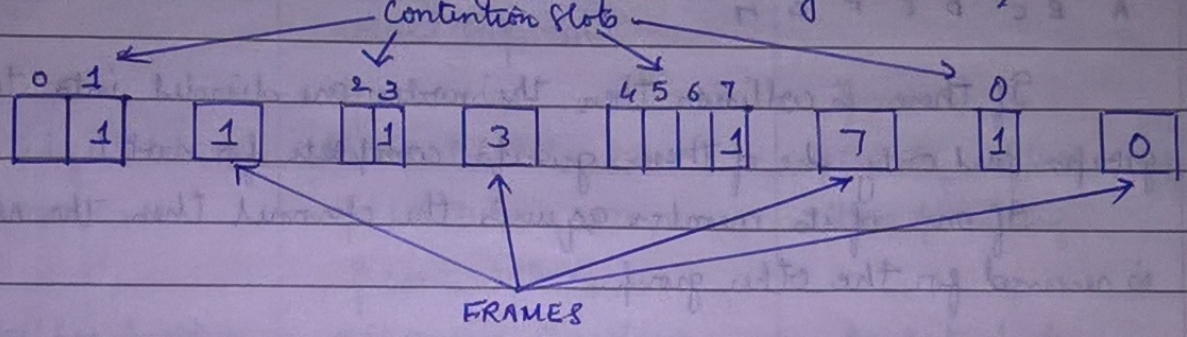
Uses Request to Send (RTS) and Clear to Send (CTS)

## COLLISION FREE PROTOCOLS –

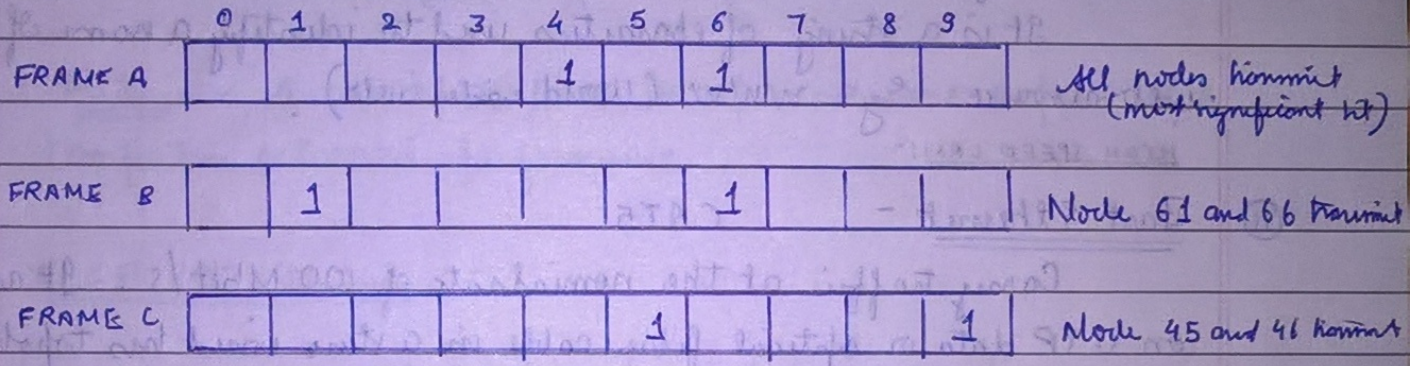
### ⑤ Basic Bit Map –




### ⑥ BRAP (Broadcast Recognition / Alternating Priorities) –

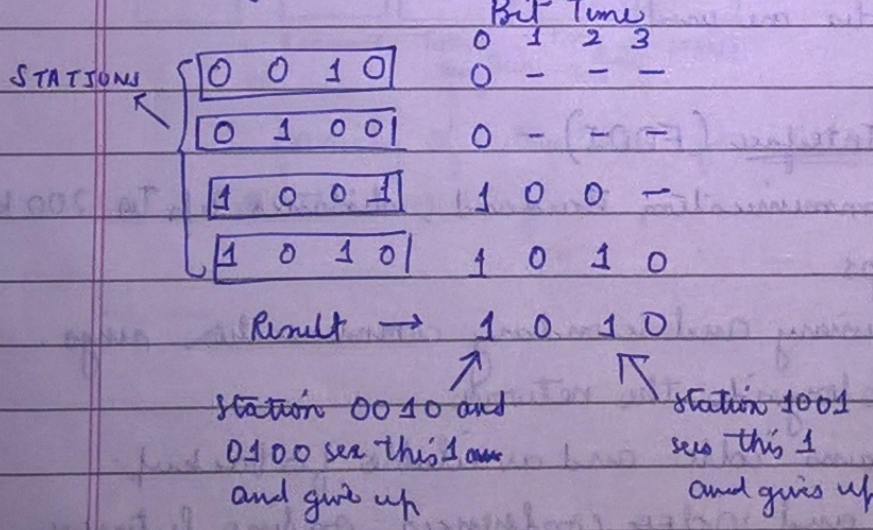



### ⑦ Multi-level Multi Access (MLMA) – 10 slots (decode)



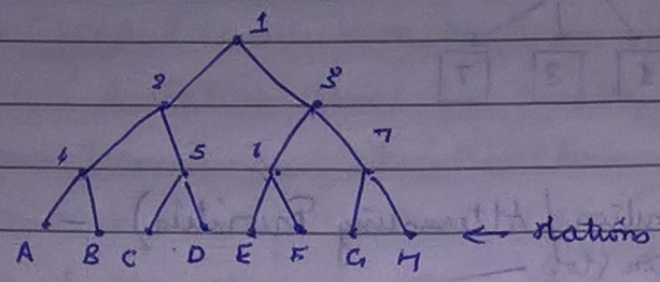

Node with addresses: 45, 49, 66 and 61

### ⑧ Binary Countdown –



## LIMITED CONTENTION PROTOCOLS -

### ⑨ Adaptive Tree Walk -




If there is collision then the nodes are divided into two equal groups and only one of these groups competes for slot 1.

If one of its member acquires the channel then the next slot is reserved for the other group.

### ⑩ URN (Uniform Resource Name) Protocol -

It is a string of characters used to identify a name of a web resource. Eg- WWW (world wide web).

HIGH SPEED LAN:-

### ⑪ Fast Ethernet - CAT5

Carry traffic at the nominal rate of 100 Mbit/s. It runs on UTP data or optical fibre cable in a star wired bus topology.

### ⑫ Gigabit Ethernet -

Maximum data rate of 1 gigabit per second. CAT5e or CAT ~~cables~~ twisted pair cables are used.

### ⑬ Fibre Distributed Data Interface (FDDI) -

Optical data communication standard, distance up to 200 K at a speed of 100 Mbps.

It has dual primary and secondary communication rings. Primary ring works alongside the network.

Secondary ring remains idle and available for backup.

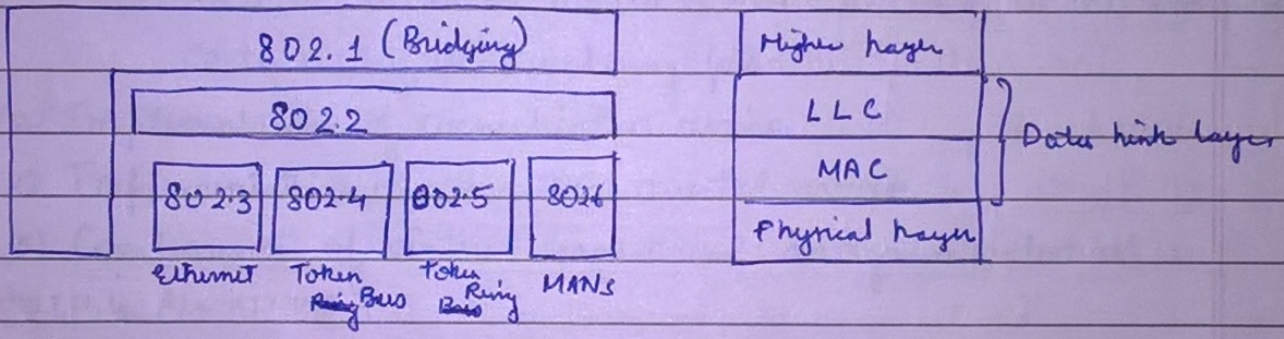
Used for voice and video conferences, online lectures, news and other multimedia.

(14) Performance Measuring metrics -

| Category | Metric | Units |
|---|---|---|
| Productivity | throughput<br>effective capacity | Mbps |
| Responsiveness | delay<br>round trip time<br>queue size | milliseconds<br><br>packets |
| Utilization<br>losses | Channel Utilization<br>packet loss rate<br>frame retries | percentage of time busy<br>loss percentage |
| Buffer problems | AP queue overflow<br>playout buffer underflow | packet drops<br>rebuffer events. |

Metric - A descriptor used to represent some aspect of a computer network's performance

(14) IEEE 802 Standards -




family of standards for LAN's

802.11 → Wifi