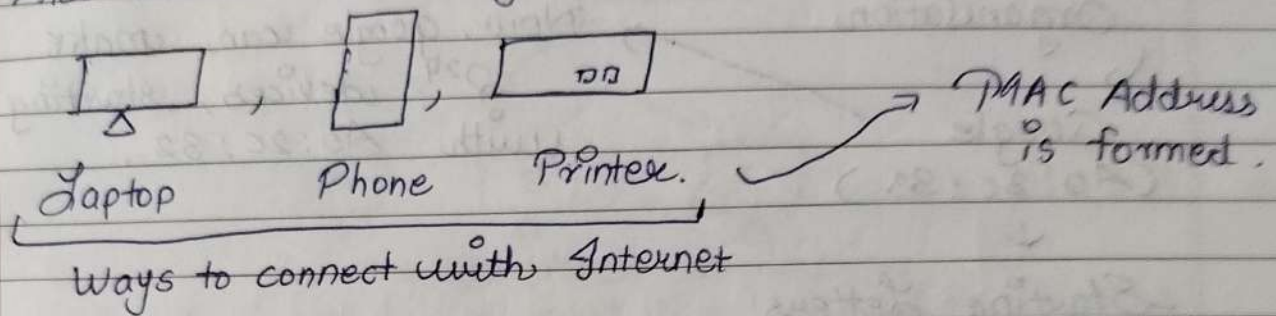# Lecture - 8 - OSI Model In Depth

* MAC Address

- Media Access Control Address.
- It is unique, so it doesn't change.
- Also known as Physical Address.

Laptop   Phone   Printer. → MAC Address is formed.

Ways to connect with Internet

* NIC [Network Interface Card]
↓
Jitne ways se Internet connect kar sakta → NIC

No. of MAC Address = No. of ways to connect with Internet

- Only devices had only one way of connecting to internet, so only one MAC address was there.

- MAC Address doesn't change and is not provided by internet, but when way of connecting to internet changes, MAC address changes, it is assigned to you only.
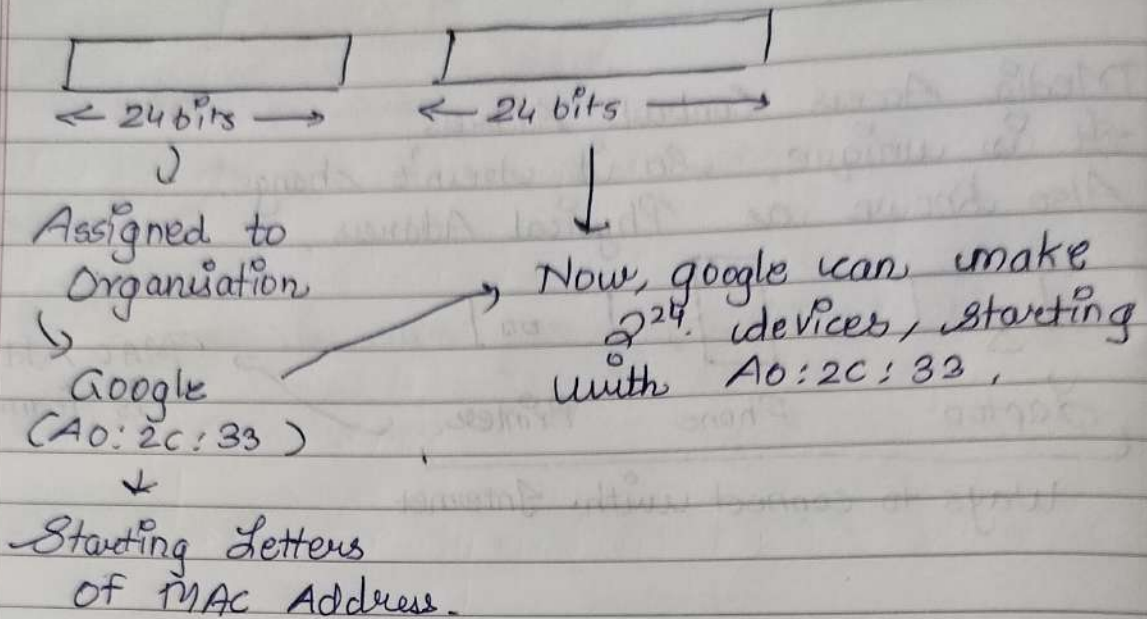
* Format of MAC Address.

- 48 bit number, represented in Hexa-decimal form.

$$\begin{bmatrix} 00:00:00:00:00:00 \\ FF:FF:FF:FF:FF:FF \end{bmatrix}$$

4 bit 4 bit   ⟹   6 * 8 = 48 bits
Portion   4+4 = 8

* How MAC is distributed.

← 24 bits →   ← 24 bits →

Assigned to
Organisation   Now, google can make
⤷ 2^{24} devices, starting
Google   with A0:2c:33.
(A0:2c:33)
↓
Starting Letters
of MAC Address.

Eg→ Orade
(34:28:6F)
↓
They can also make 2^{24} devices.

- MAC Address is 12 digit hexadecimal number, basically 48 digit binary number.

* Notation of MAC Address

1) Hypen Hexadecimal notation ⌐

       00 - 0a - 83 - b1 - c0 - 8e.

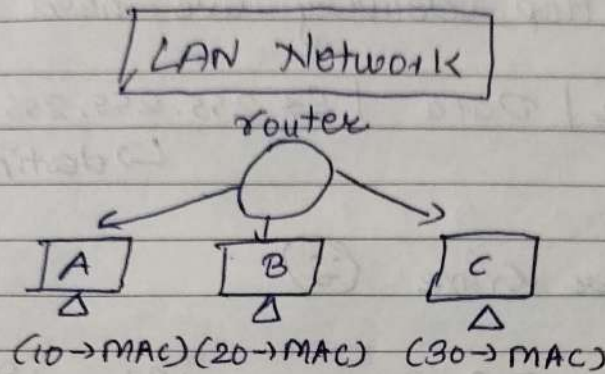2) Colon - Hexadecimal notation ⌐

       00 : 0a : 83 : b1 : c0 : 8e

3) Period separated hexadecimal notation ⌐

       000.a83.b1c.0e

* Data Link Layer.

1) Hop to Hop delivery
2) Giving Physical Address.

```
            ┌─────────────────┐
            │  LAN Network    │
            └─────────────────┘
                 router
                  ◯
             ↙    │    ↘
          ┌───┐ ┌───┐ ┌───┐
          │ A │ │ B │ │ C │
          └───┘ └───┘ └───┘
           △     △     △
        (10→MAC)(20→MAC) (30→MAC)
```

- A can transfer/send data using MAC address in that particular network.
- Router will assign Private IP Address & those private IP address are known by devices.

- ARP → Address Resolution Protocol.

```
              Broadcast & MAC Address   Pucha
     ┌───┐  ──────────────────────────→ ┌───┐
     │ A │                              │ B │
     └───┘  ←──────────────────────     └───┘
      △          MAC Address.            △
   (192.38.6.1)                      (192.38.6.2)
```
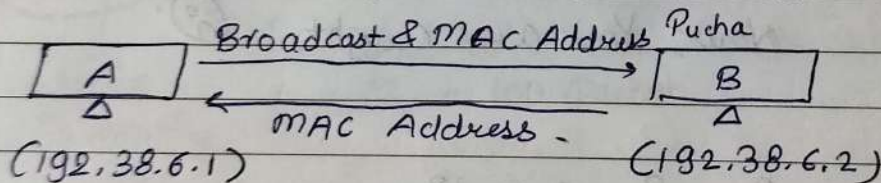
- You want to send data but don't know MAC address of that 'B' device. 'A' will broadcast message with help of IP & [ARP] will request broadcast to all device (give MAC of B) and 'B' will respond with MAC Address.
- ARP helps to find MAC Addresses of devices in the particular network.
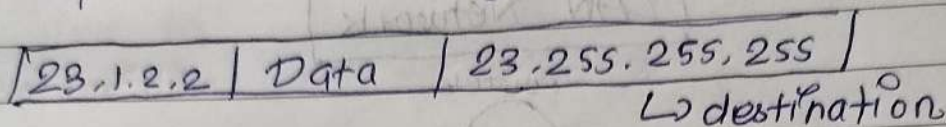
* Broadcasting

- Jab bhi IP Address Allocate hote.

```
       ↙              ↘
    23.0.0.0        23.255.255.255
   (n/w address)    (broadcast address)
```

Hop to Hop

Sender ↑ ↑ Reciever
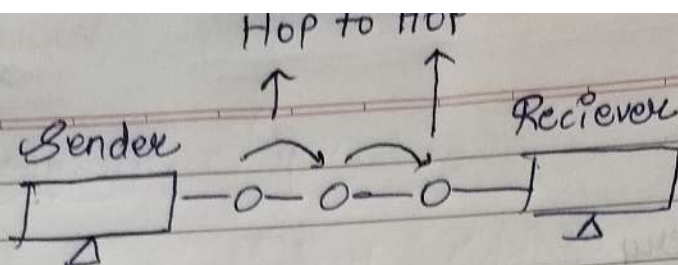
- For Hop-to-Hop delivery we need MAC Address.

| 23.1.2.2 | Data | 23.255.255.255 |

↳ destination

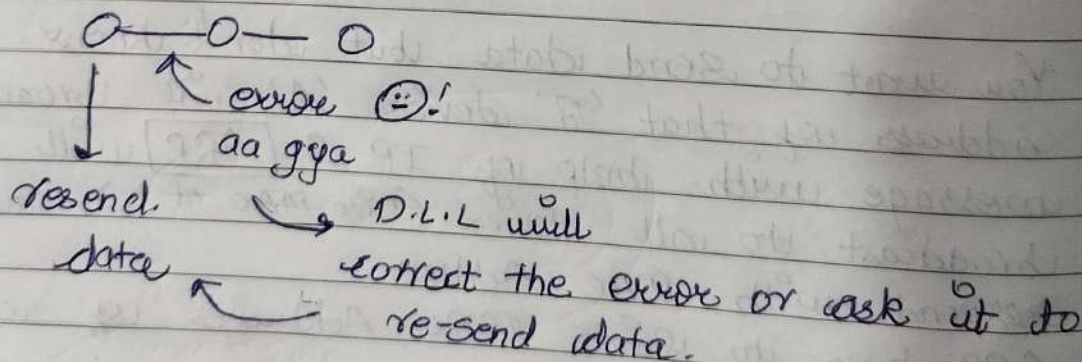- You did Cyber Crime 😊

  ↳ Your ISP will know which website you visit (IP)
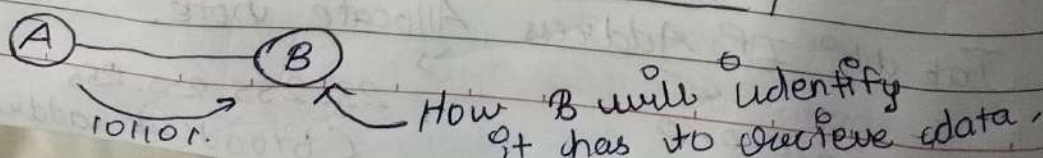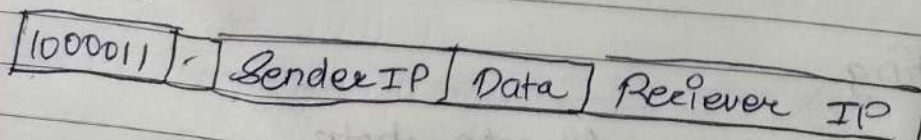
  ↓

  But how ISP will know device will allocate to that IP.

  ↓

→ Now, ISP will search for MAC Address.

Use of MAC Address.

  ↓

  Now, You are Caught 😟!

* Error Detection & Correction.

O——O—— O

  error 😊!

  aa gya

resend data

  ↳ D.L.L will correct the error or ask it to re-send data.

* Framing

| 1000011 | Sender IP | Data | Reciever IP |

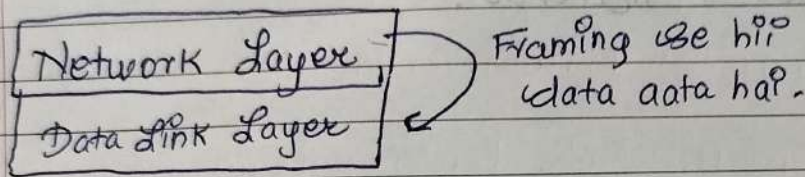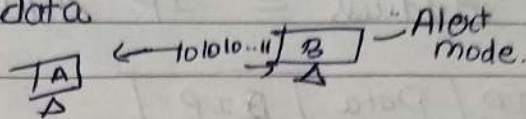(A)——o—o—o——(B)

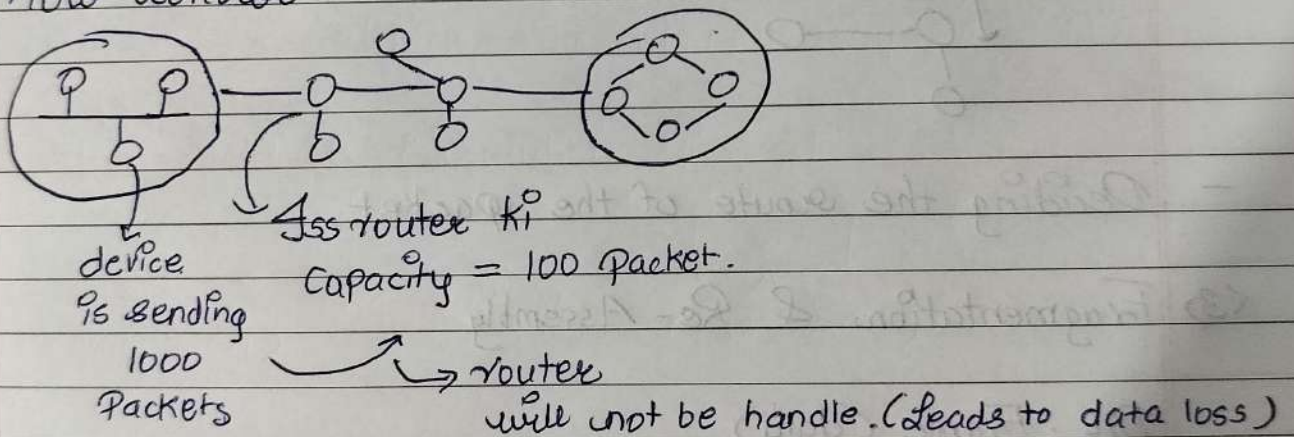101101

How B will identify it has to recieve data.

– There should be some pattern, so that B understands that data, is about to come.

– D.L.L Sends data as 101010.-- 11 to B, so that B gets ready to recieve data.

– As soon as B will read 11, it will become ready to read original data.
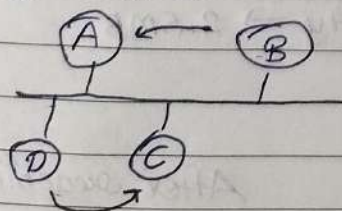
$$A \leftarrow 101010\text{..}11 \quad B \quad \text{—Alert mode.}$$

```
┌─────────────────┐
│ Network Layer   │──┐   Framing se hii
├─────────────────┤  │   data aata hai.
│ Data Link Layer │←─┘
└─────────────────┘
```

※ Flow Control

device is sending 1000 Packets

Iss router ki Capacity = 100 Packet.

→ router will not be handle. (Leads to data loss)

– Sare packets ko ek sath nahi Bhejna.
– Sending desired amount of data to devices in Sequence is called flow control.
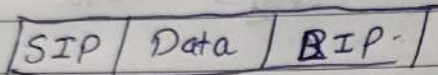
※ Access Control

A ←— B
D — C

– Pehle D wala C ko send karega then B wala A ko.
– This controlling of devices is done by D.L.L and it is called Accessing. This improves efficiency of cables.

3 Network Layer.

(1) Assigning Logical Address.
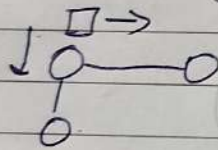
        Device ko IP Address dena.

- Logical Address = IP Address

| SIP | Data | BIP. |

- Connecting Sender & Reciever.

(2) Routing

- Router has 3 Layers.

- Deciding the route of the packet,
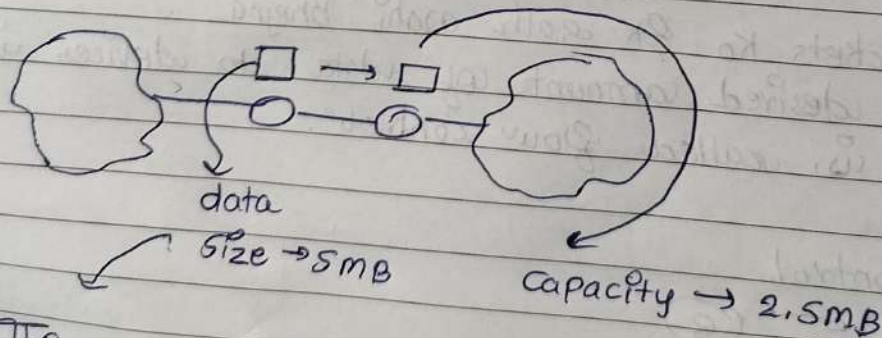
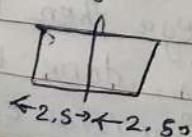(3) Fragmentation & Re-Assembly

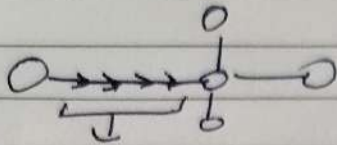DLL : Frame (data)
NL : Packet (data)

    data
       Size → 5MB   Capacity → 2.5MB

This packet will be
divided in fragments.

                                    After reaching
                       → dest, they are
       ←2.5→←2.5→   re-assembled.

(4) Congestion Control

A lot of   Traffic   ⟿ Delay, Collision
data is being ⟿ is created   & data loss
Sent

- If all senders will send data, then traffic will be created.
- There should be a systematic way (protocols) through which data should be sent.

- Bandwidth is max. speed through which data can transmit over a network.
- Throughput is actual speed through which data is being transferred.