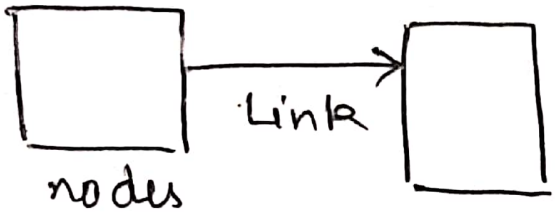
A group of computers associated devices connected by communication lines, wires other devices which are capable of sharing files and other resource between users is called computer networks.



Goal of computer Network -

- Resources sharing
- Cost Reduction
- Improve performance
- provide communication medium.

Network topology -

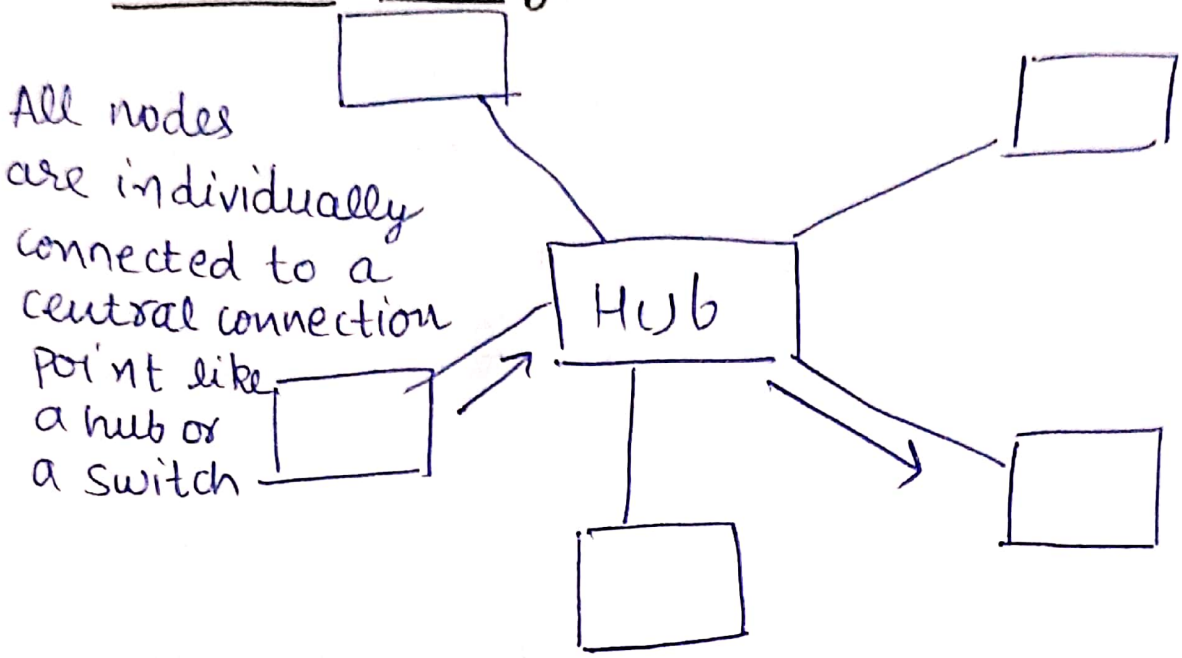
→ Star topology
→ Ring topology
→ Tree topology
→ Bus topology
→ Mesh topology
→ Hybrid topology

A physical connection & logical connection between computer of a network, indicating which pairs of computer are able to

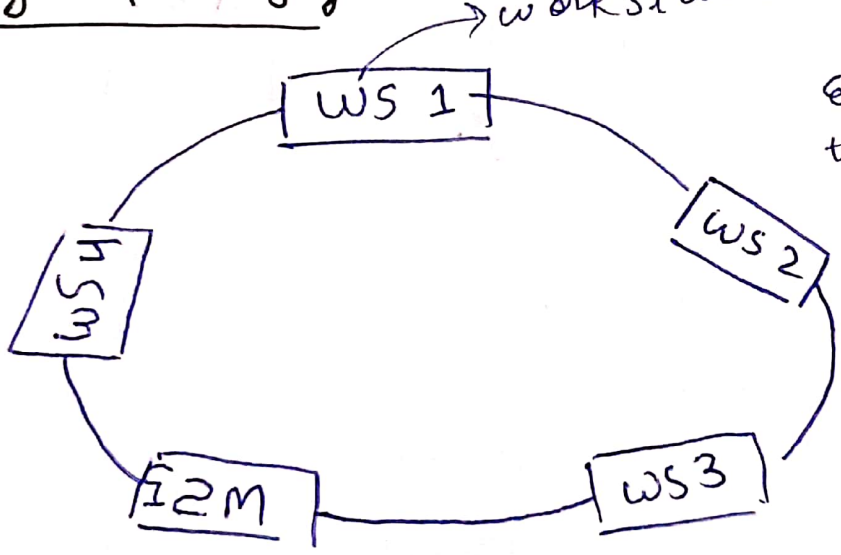
communicate through, & which is known as topology.

A topology Refers to the way in which the n points or stations of a networks are Links together

Star topology -

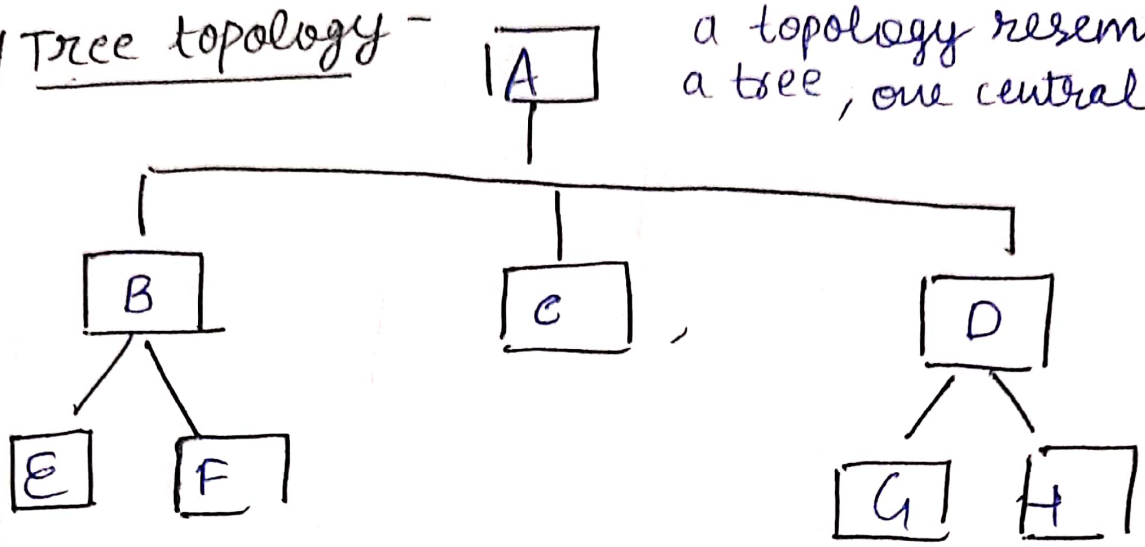


Ring topology -



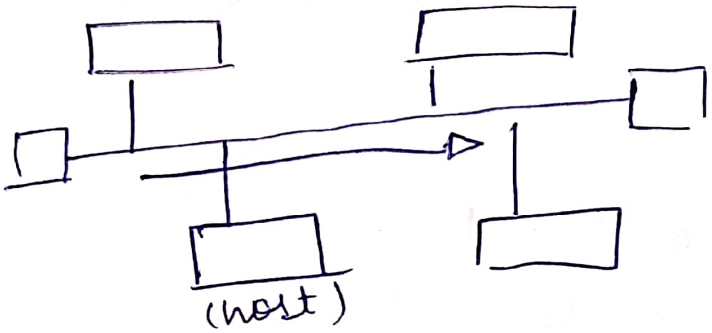
Each node connects to a exactly two other nodes, forming a single continous pathway

Tree topology -



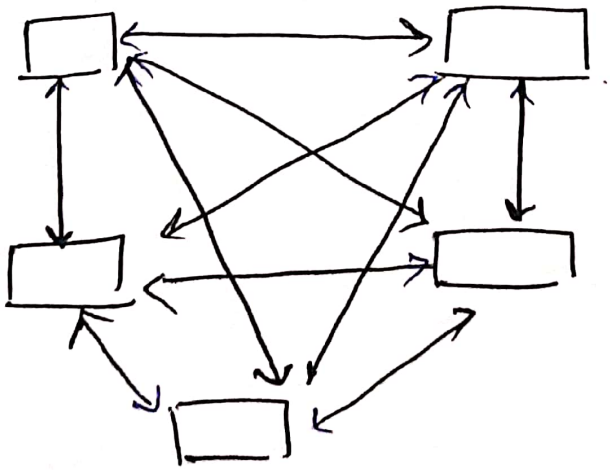
a topology resembles a tree, one central node

Bus topology - (Horizontal)



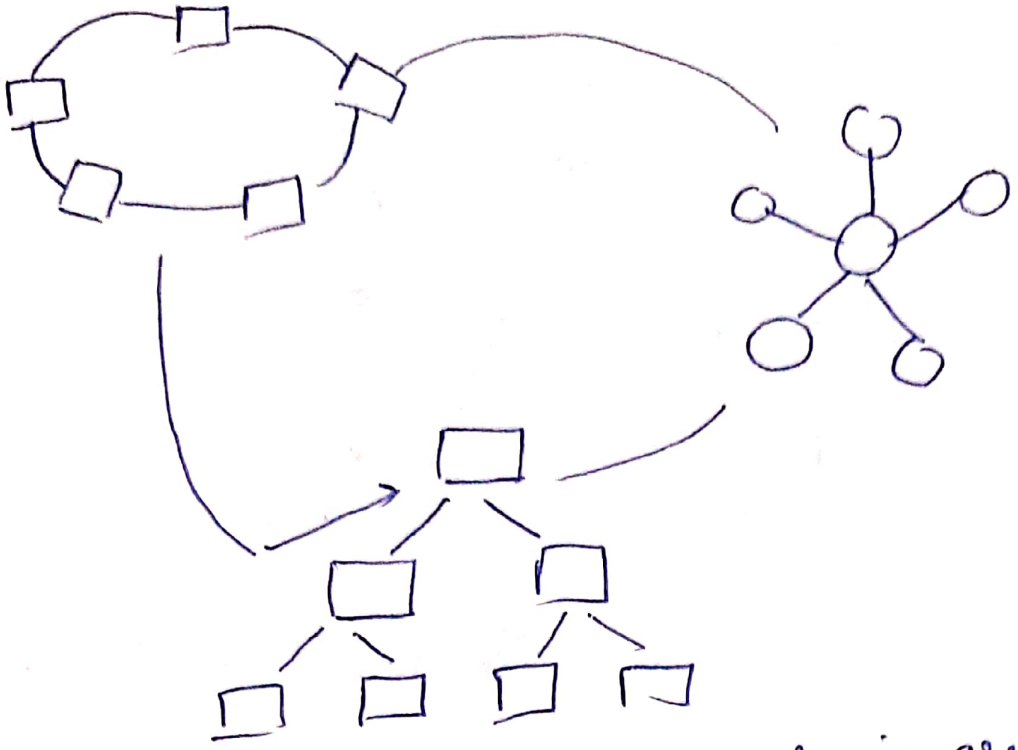
Notes are directly connected to a common
A host on a bus network is called a station.

Mesh topology



type of network in which each node is connected to Every other node in network.

Hybrid topology -



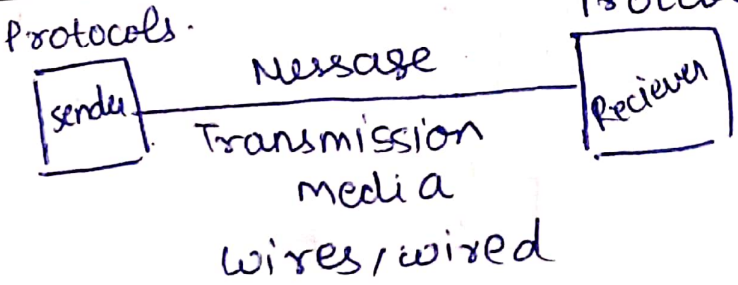
two or more different topologies are connected/ integrated or combined to lay out a network.

Data communication -

Characteristics -

- Accuracy
- Timelines
- Delivery
- Jitter.

Components -



- Message
- Sender
- Reciever
- transmission media
- protocol.

Data Representation -

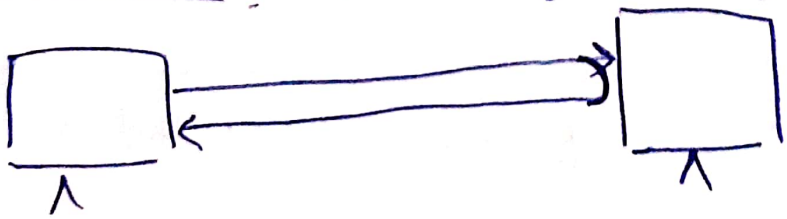
- Text
- Numbers
- image.
- Audio
- vedio.

Data flow (transmission model)

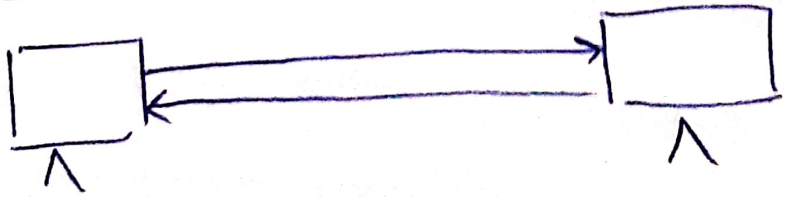
- Simplex
- Half Duplex
- Duplex

Simplex (unidirectional)

- Half Duplex (walky talky)



- Duplex

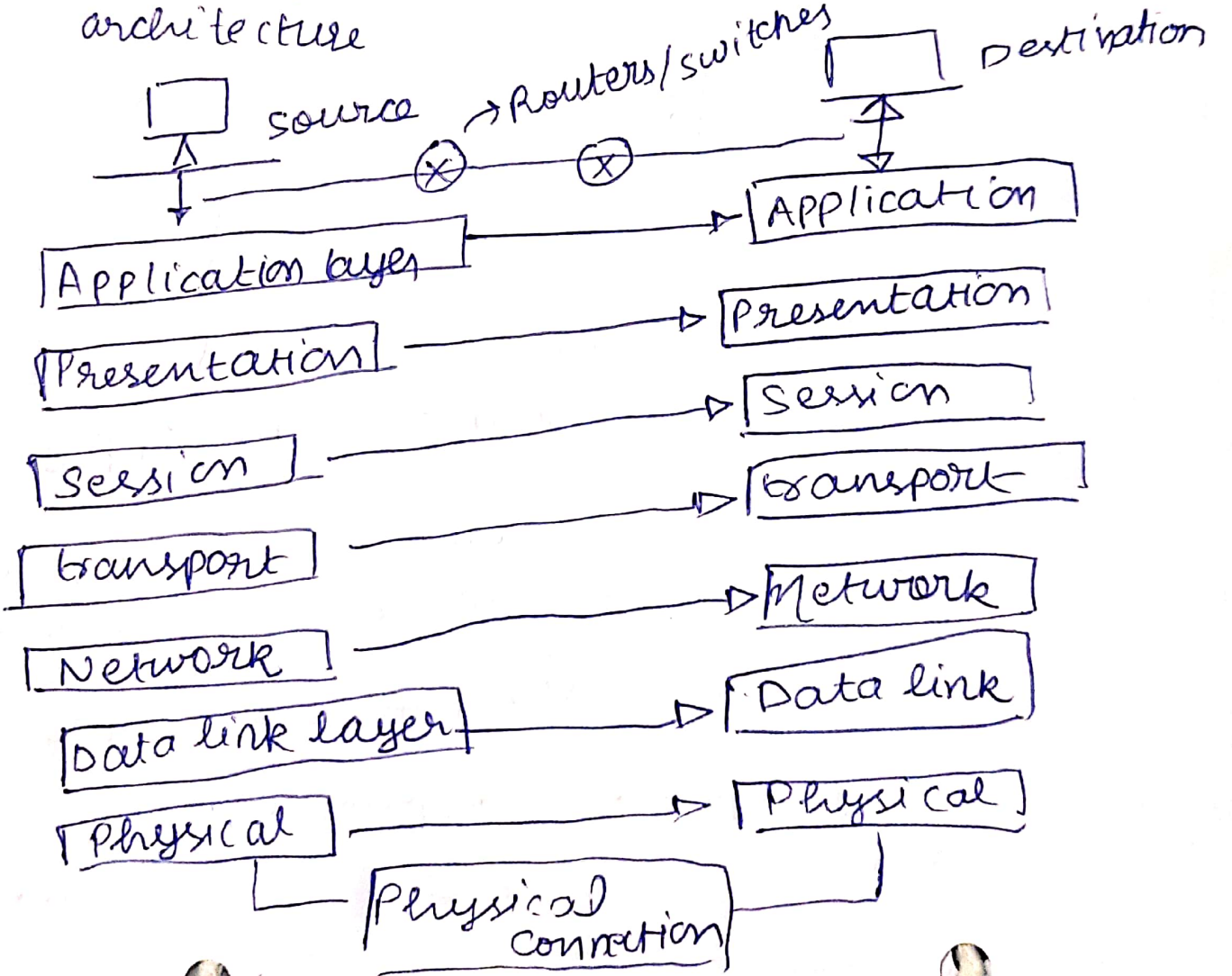


categories of Network -

- LAN (Local area network)
- MAN (Metroporitan area network)
- WAN (wide Area Network)

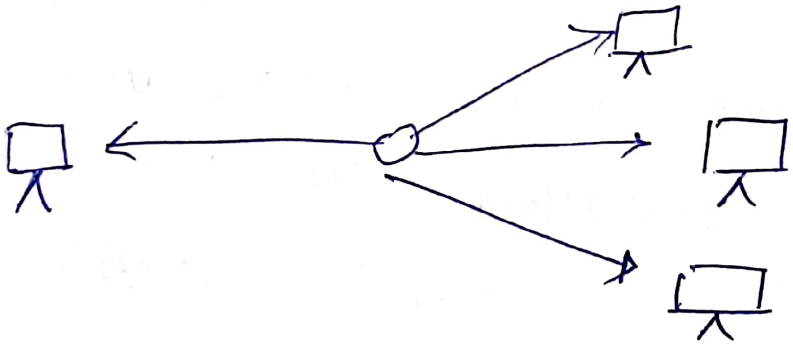
OSI Refrence Model -

↳ open System Interconnection
↳ Introduced in 1970
↳ There are 7 layers
↳ Model for understanding & designing architecture



Physical layer functionalities -

- Physical characteristics of Interfaces & Medium
- Representation of Bits
- Data rate
- Synchronization of Bits
- Line configuration.
- Physical topologies.
- transmission mode.



Data link layer -

- Framing
- Physical addressing
- Flow control
- Error control
- Access control

Session layer -

→ Dialog control

→ Synchronization points

Presentation layer -

- Translation -
- Encryption
- Compression.

Application layer -

- Network virtual terminal
- File transfer, access & management.
- Mail services
- Directory storage.

ment
· Project
· Practical

TCP/IP Protocol

Application	Application layer SMTP, FTP, HTTP, DNS so on
Presentation	
Session	
transport	TCP UDP
Network (Internet)	ICMP IGMP RARP ARP IP
Data link	Host to network Physical layer
Physical	

Protocols –

- ARP – (Address Resolution protocol)
- RARP – (Reverse Address Resolution protocol)
- ICMP – (Internet control Message protocol)
- IGMP – (Internet Group Message protocol)

TCP - transmission control protocol.
UDP - user Data gram protocol.

Applications -

SMTP - Simple mail transfer protocol

HTTP - Hypertext transmission protocol

FTP - file transmission protocol

DNS - Domain name system

Addressing -

↳ Physical

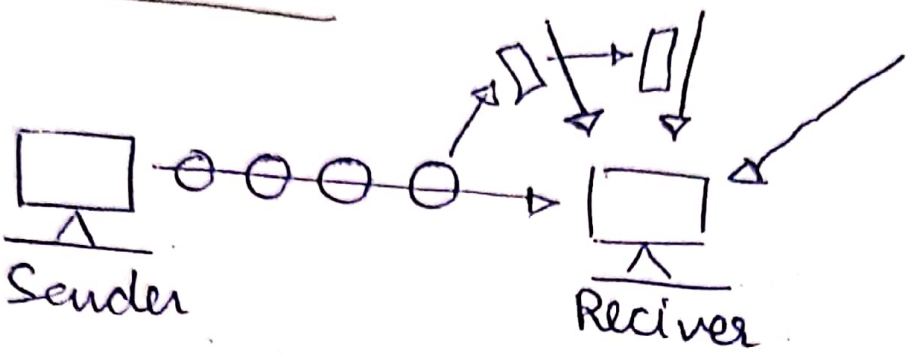
↳ logical

↳ port

↳ specific

Unit-2

Flow control -



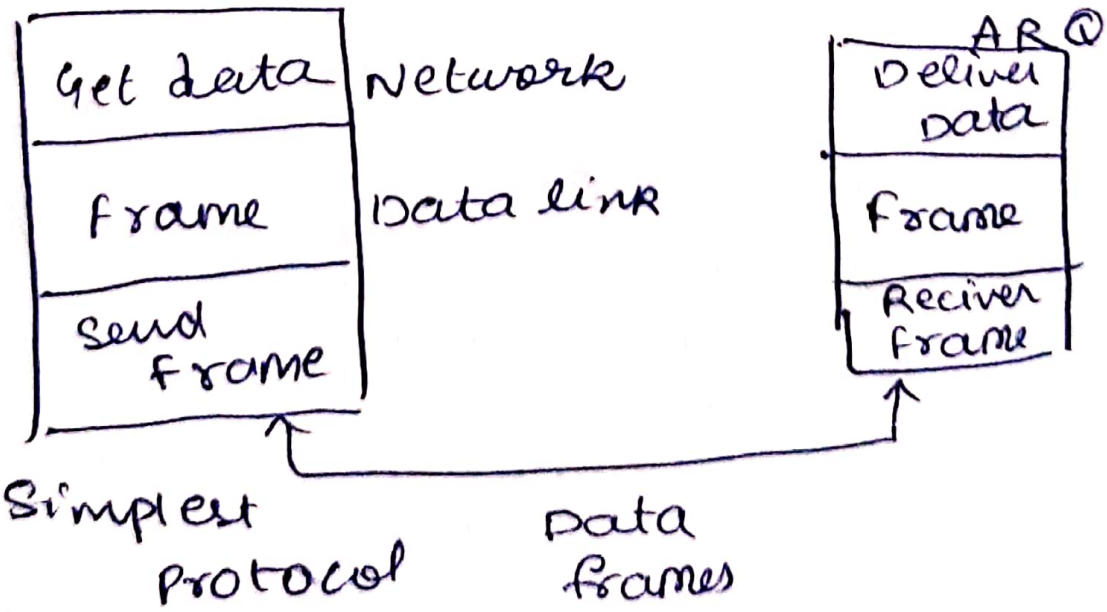
-: Error correction & Error detection :-

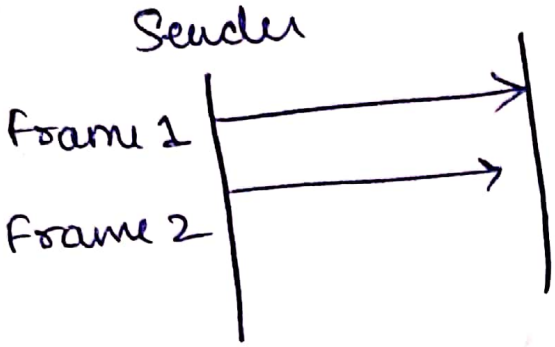
Flow control

Protocols

Noiseless Channel
- Simplest
- stop & wait

Noisy channels
- Stop & wait ARQ
- Go-BACK-N ARQ
- Selective Repeat





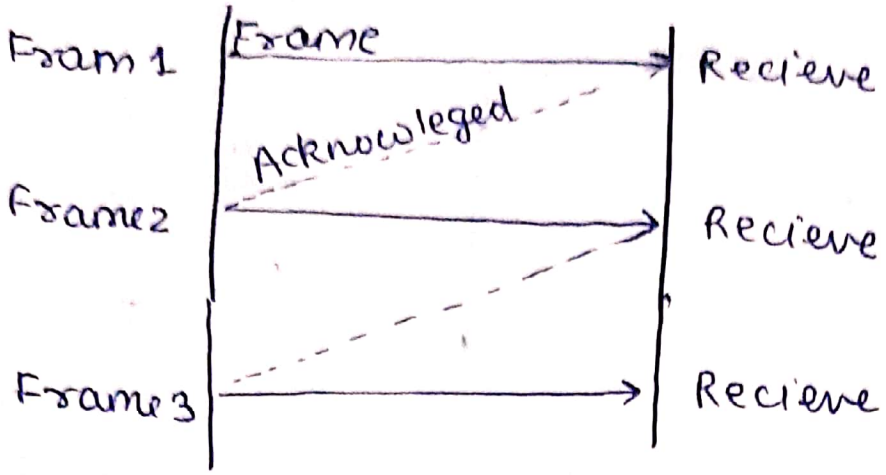
Sender side algorithm

```
while (true){                    // Repeat forever
    waitForEvent();              // sleep until an event occur
if (Event(Request to send)){     // There is a Packet
        GetData();               //  to send
        MakeFrame();
        Send frame();            // send the frame
    }
}
```

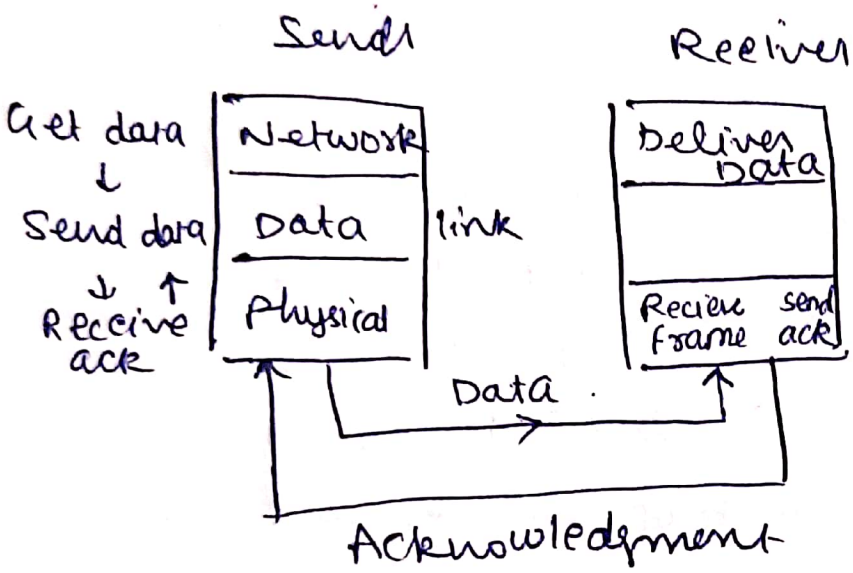
Reciever side algorithm

```
while (true){                    // Repeat forever.
    wait,forEvent();             // sleep until an Event occurs
if (Event(Arrival Notification)){ // Data frame
                                 //  Arrived
        Recived,Frame();
        Extract Data();
        Deliver Data();          // Deliver Data to
                                 //  N/w layer
    }
}
```

Stop & wait protocol -



- unidirection.



Sender side algorithm -

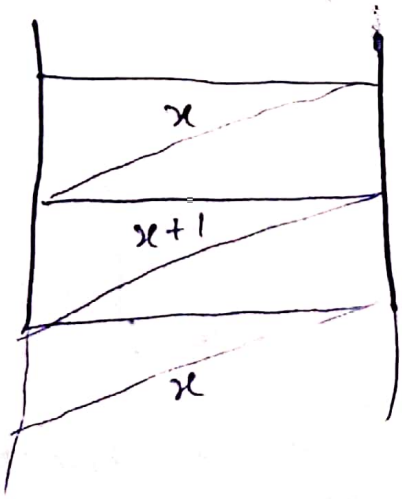
```
while (true)    //Repeat process forever
    can send = true{ //allow the first frame to go
    wait for Event();  // sleep until an event occur
    if (Event (Request to send) AND can send) {
        Get Data();
        Make frame();
        Send frame();      // Send the data frame
        can send = false;  // can not send until ack received
```

```
}
wait for Event();
if (event (Arrival Notification){
    Reciere frame();        // Reciere the ACK
                               fram
    can send = true;
```

Reciver side algorithm

```
while (true){              // Repeat forever.
    wait For Event();      // Sleep until an event
                              occur.
if ( Event(arrival Notification)){
    Reciever frame();
    Extract Data();
    Deliver(data);         // Send the data frame
    Send frame();          // cannot send until
                              ack Arrived.
}
}
```

Stop & wait automatic Repeat



$x = 0$
$x + 1 = 1$
Modulo 2
arithmatic
Mean

Sn → sequence no

Sender Side algorithm

```
Sn = 0                          // Frame 0 should be sent first
can_send = true;
while (true) {
waitforEvent();
  if (Event(Request To Send) And can_send) {
      GetData();
      Make Frame(Sn);
      Store Frame(Sn);
      Send Frame(Sn);
      Start Timer();
      Sn = Sn+1
      can_send = false;
  }
  wait For Even();
    if (Event Arrival Notification) {
       Recieve Frame(ackno);
    if (not corrupted AND ack no. == Sn) {
      Stop Timer();
      Purge frame(Sn-1);
       can send = true;
    }
  }
   if(Event(timeout){
        start timer();
        Resend frame(Sn-1);
  }
}
```

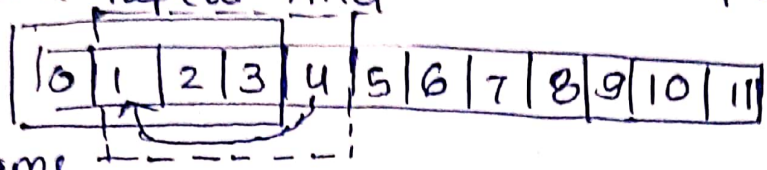
Reciever side algorithm

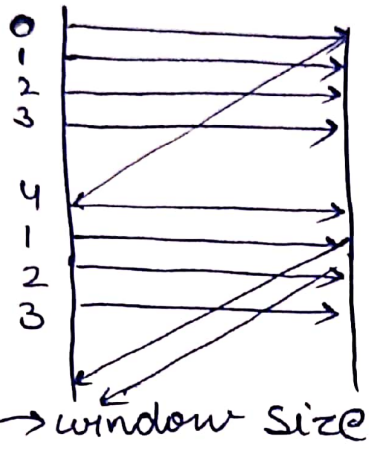
```
Rn=0
while (true) {
  waitForEvent()
  if (Event (arrivialNotification));
  {
    Recieve frame();
    if (corrupted(frame));
      Sleep();
    if (seq No. == Rn) {
      Extract data();
        DeliverData();
          Rn = Rn + 1
      }
      SendFrame(Rn)
  }
```

20/02/23

Go Back-N-ARQ } sliding window protocol.
Selective Repeat ARQ

↑ size of window

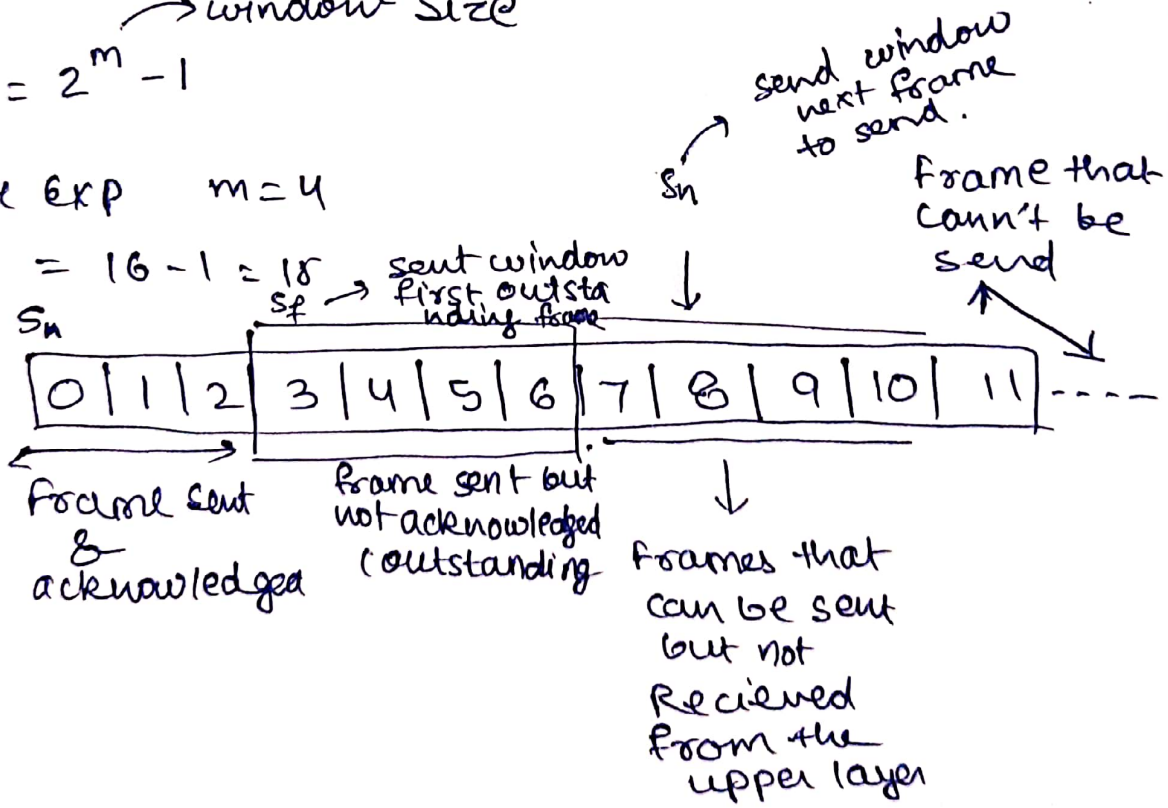




Seq. No $= 2^m - 1$

For Exp $m = 4$

$= 16 - 1 = 15$



MAC

CSMA (carrier Sence Media access)

- 1-persistant
- 0-persistant
- p-persistant

CSMA/CD -

(collision sence Media Access / collision Detection)

↳ No acknowledgement

transmission time = $\frac{\text{length of msg.}}{\text{Bandwith}}$

Propagation Delay = $\frac{\text{Distance}}{\text{velocity}}$.

* condition to detect collision
  transmission time > Propagation Delay.

* $TT \geq 2 * PD$

$\frac{LM}{BW} \geq 2 * PD$

$LM \geq 2 * PD * BW$

* η (Efficiency) = $\frac{1}{1 + 6.44a}$

$a = \frac{\text{Prograpagation Delay}}{tt}$