* Network Layers8 -

| Application |
| Transport | → End-to-End Layer (Host-to-Host) .
| Network |
| Data Link |
| Physical |

TCP
UDP (beside Transport)

IP (beside Network)

Data Link →
- → Point-to-Point
- Logical Link Control (LLC)
- Media Access Control (MAC) (48 bit
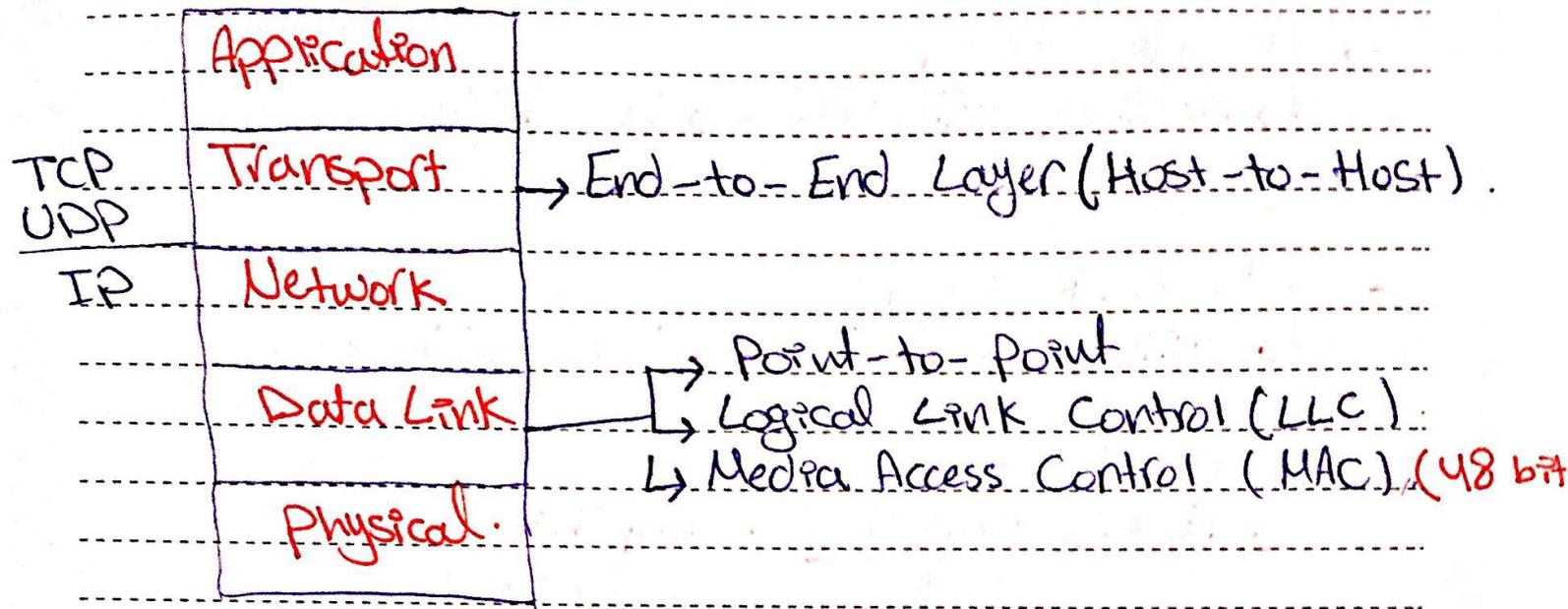
- LLC → Flow & error Control.

- TCP 8 Transmission Control Protocol.
  - Reliable Protocol
  - Connection Oriented
  - Flow & error recovery.

* Packet Loss.
  - Damage due to noise
  - Drop (Buffer over flow).

* Delay → Propagation $(T_{prop} = d(m) / V(m/s))$
         → Transmission $(T_{trans} = L(bits) / R_b (bits))$
         → Processing ?
         → Queuing } → Undeterministic.

* Networking Devices:-

- Network Layer
  ↳ Routers, Gateways → IP Addresses

- Data Link Layer
  ↳ Switches & bridges → MAC Addresses

- Physical Layer
  ↳ Hubs, Repeaters , Amplifiers
                                    ↳ Analog
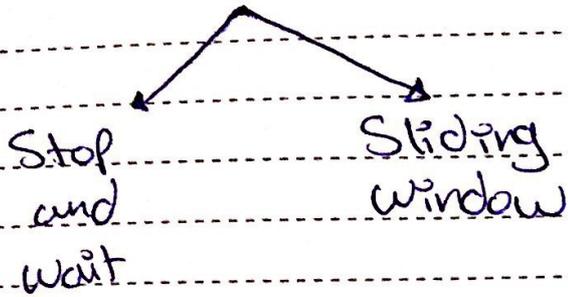Digital   transmission.
      transmission

- Transport Layer → check two, Damage &
                     Drop of packets.

- Repeaters will regenerate the signal excluding
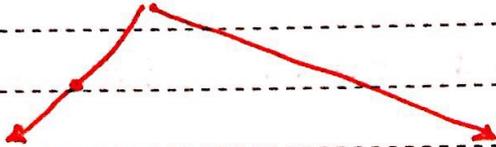   noise.

- Amplifiers will regenerate the signal including
      noise

* Flow Control

Stop and wait   Sliding window

* Error Control

Error detection (CRC)
- Cylic Redundancy Check

Error correction
- Retransmission

* Notes:

- Repeater

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•———[ R ]———•
```

- Hub.

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•—┐
•—┤
   [ H ]
•—┤
•—┘
```
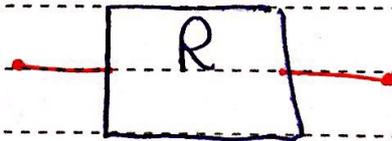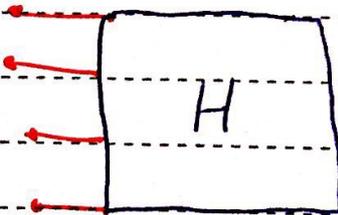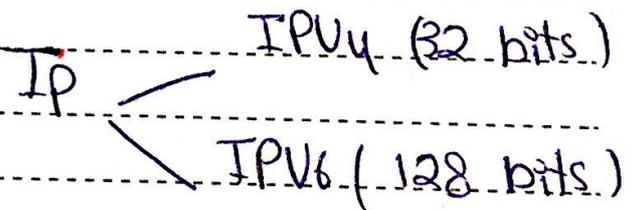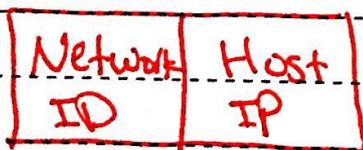
* Digital transmission Advantages :-

(1) High Bandwidth

(2) Low bit error rate

(3) easy to multiplex

(4) easy to secure

(5) using Repeaters that exclude noise.

** IP Addressing.

(1) Classful.
    ↳ Class A (0-127)

8	24	Big

    ↳ Class B (128-191)

16	16	Medium

    ↳ Class C (192-223)

24	8	Small

* IP Address

Network ID	Host IP

IP ⟨ IPV4 (32 bits.)
    IPV6 (128 bits.)

(2) Classless.

- Subnetting → one level
- VLSM → Multiple levels.

* Routing Protocols:-

    ↳ Distance vector (RIP, EIERP)

    ↳ Link state (OSPF).