Data Transmission

{ Multiple bit at a time } → Parallel Transmission

{ One bit at a time } → Serial Transmission

Parallel Transmission
n = 6 (no. of wires)

SENDER → [0 1 2 3 4 5] → RECEIVER

Serial Transmission

- Asynchronous
- Synchronous
- Isochronous

SENDER → RECEIVER

11/5/2024

{ Transmission Delay } { $T_d = \frac{L}{B}$ }

Extraa :—

T_d

[frame] ← L →

A (Sender) — P_d Transmission Media — B (Reciever)

(d) speed/velocity

{ $T_d = \frac{L}{B}$ } → { Time taken for putting packet/frame on outgoing link is transmission delay { T_d } }

{ $P_d = \frac{d}{S \text{ or } V}$ } → { Time taken to take data from one point to other is Propogation delay { P_d } / Propogation Time. }

{ $TT = T_d + P_d$ }

{ Total ~~transmission~~ Time }

Link
Wire
Cable
Channel
key

Line Configuration / Line Coding

→ { works at Physical Layer (Layer 1) }

{ Line Configuration defines how two or more devices are Connected with link }

Types of Line Configuration / Coding :—

Mesh Topology   Ring Topology   Star Topology

Main Cable { Backbone cable }

Drop Line

Terminators

Vampire Tap

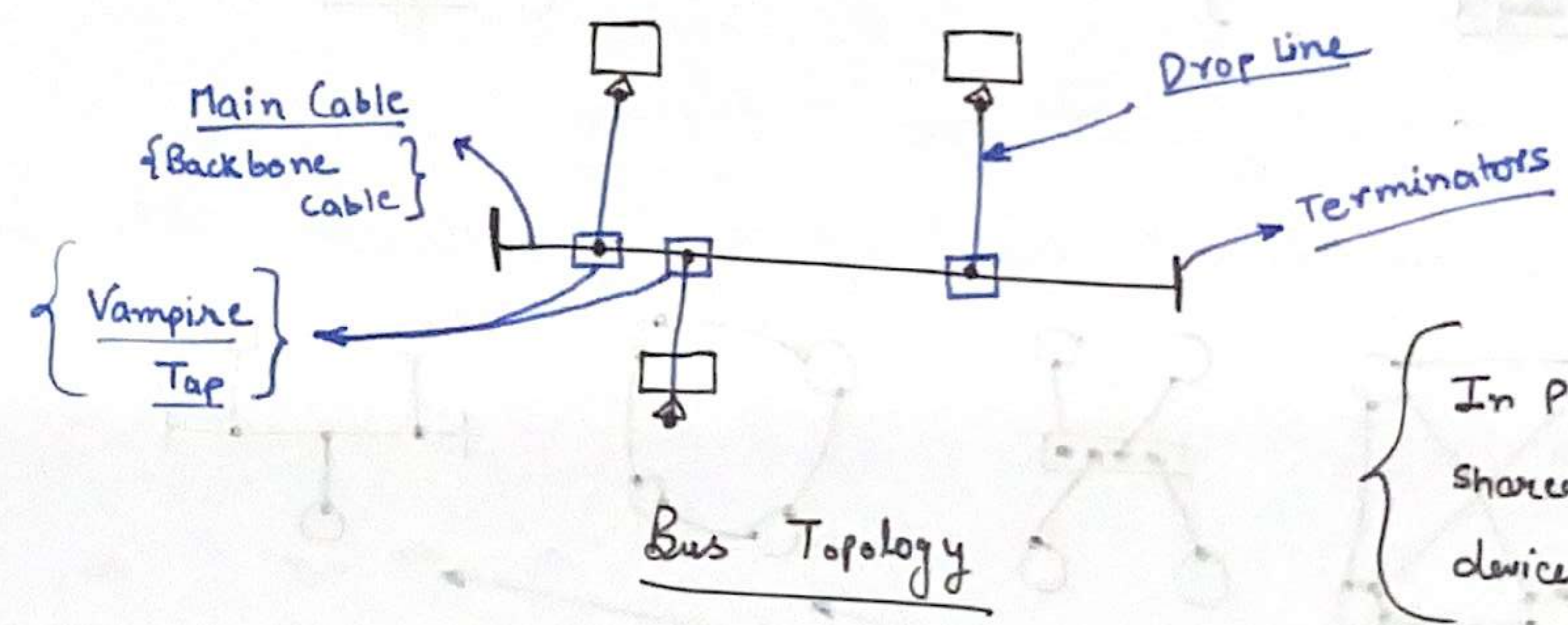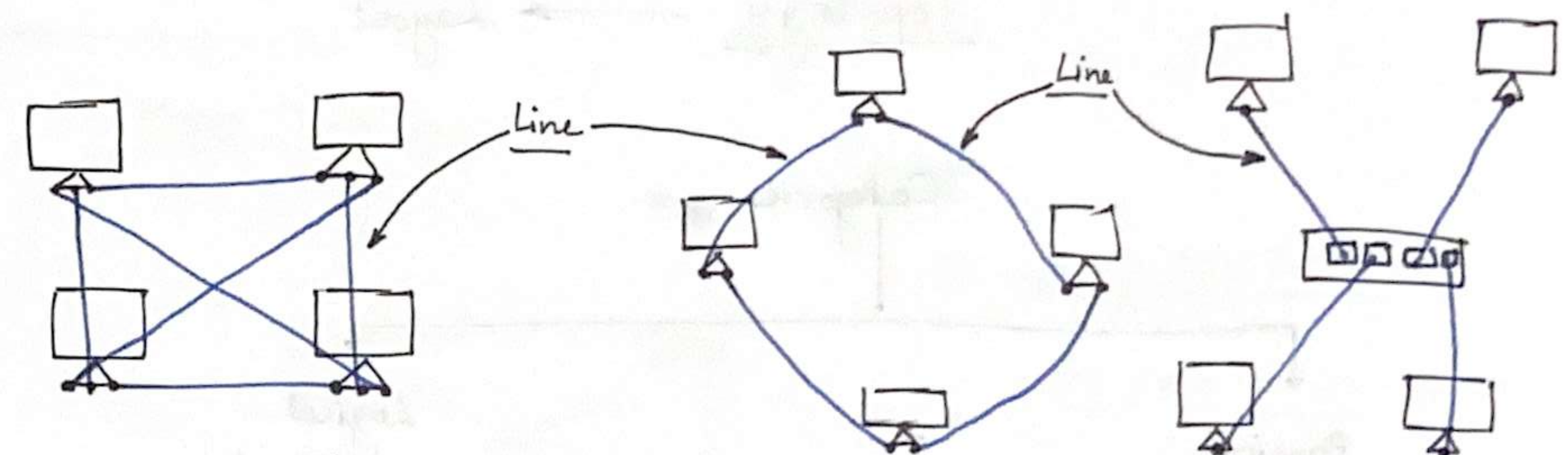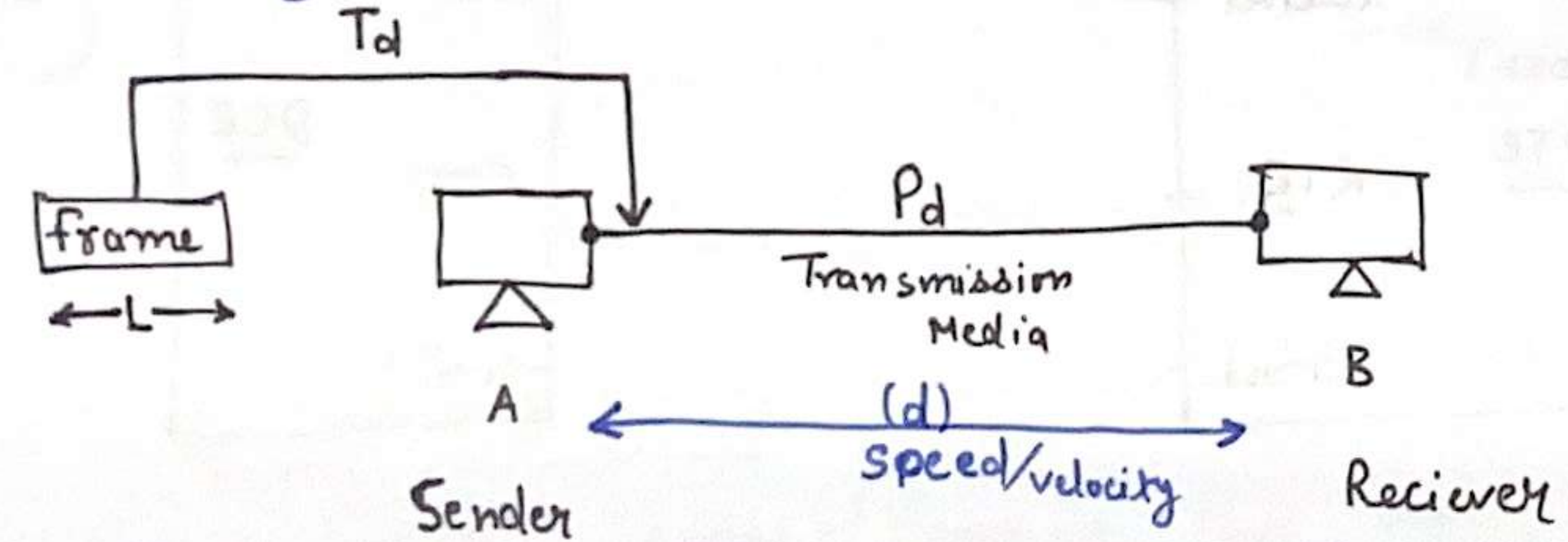Bus Topology

{ In P2P, a link is shared b/w two devices only }

① **Point to Point Configuration / Connection / Coding**

example :— Mesh Topology, Ring Topology, Star Topology

② **Multipoint Configuration**

Example :— Bus Topology.

{ If in a network a device is connected to all other devices in point to point manner then it is known as peer to Peer connection example: Fully Mesh Network }
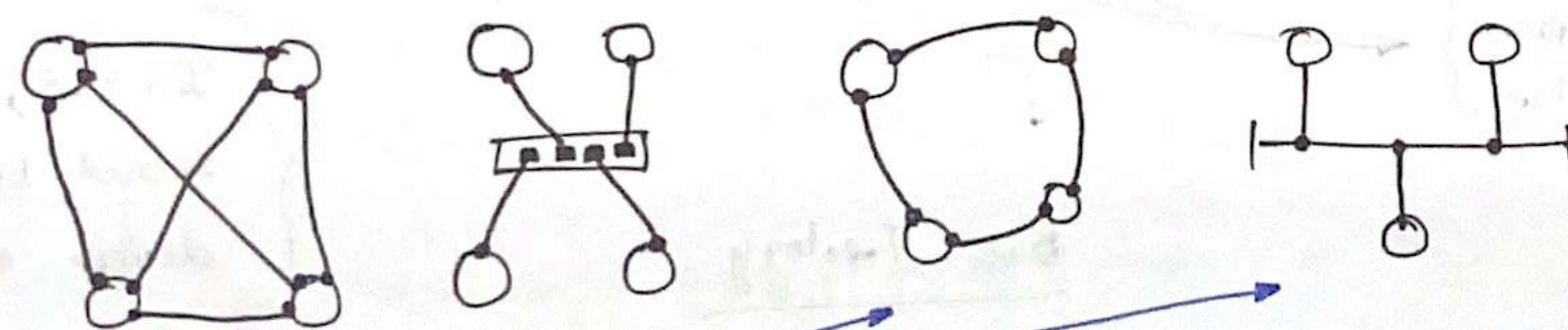
- In Multipoint Coding, a link is shared between several devices.

Topology ——→ means Layout

Categories

Physical Topology
{ Works at Physical Layer }

Logical Topology
{ works at Network Layer }

def { Graphical Representation of how devices are connected to each other is termed as Topology }

OR

def { Logical or Physical arrangement of network (computers/nodes) is termed as Topology }

Types of Topologies {5}

- Mesh Topology ————————→ Point to Point FanCoding
- Ring Topology ————→ Common LAN Topologies
- Star Topology
- Bus Topology ————→ Multipoint Configuration.
- Tree or Hybrid Topology

fundamental or Basic Topologies

Mesh Topology

n = no. of devices
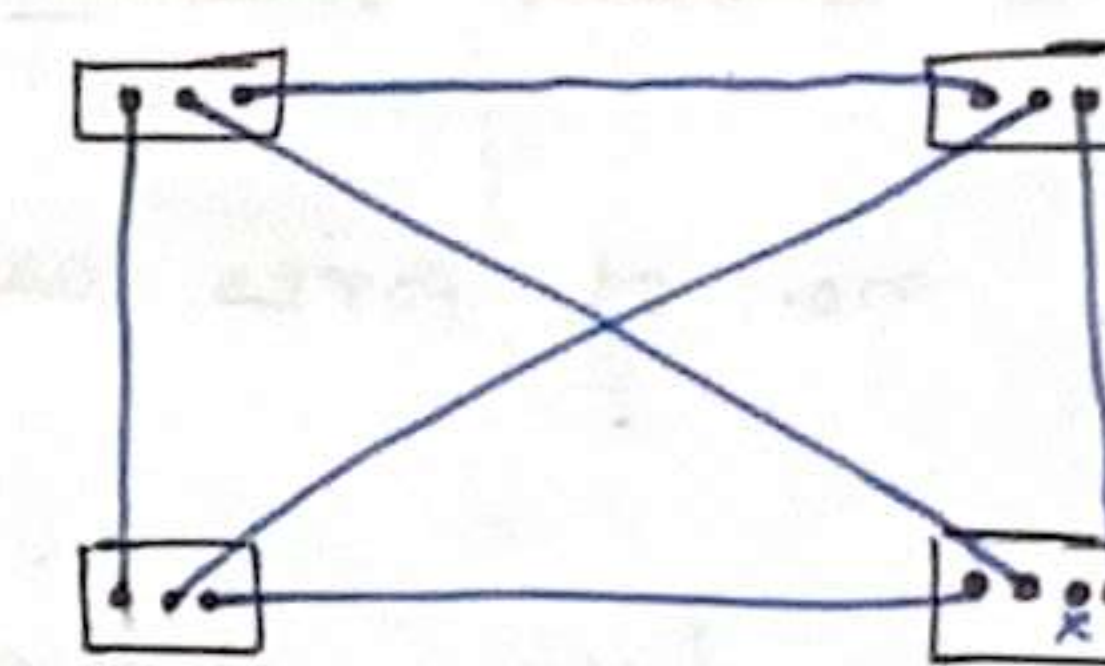
① No. of I/o Ports :→

- for each device :→ $(n-1)$

- for whole Network ⇒ { $n(n-1)$ }

Q⇒ ABC corporation of xyz has a fully connected mesh network consisting of 99 devices. Calculate no. of ports of each device.
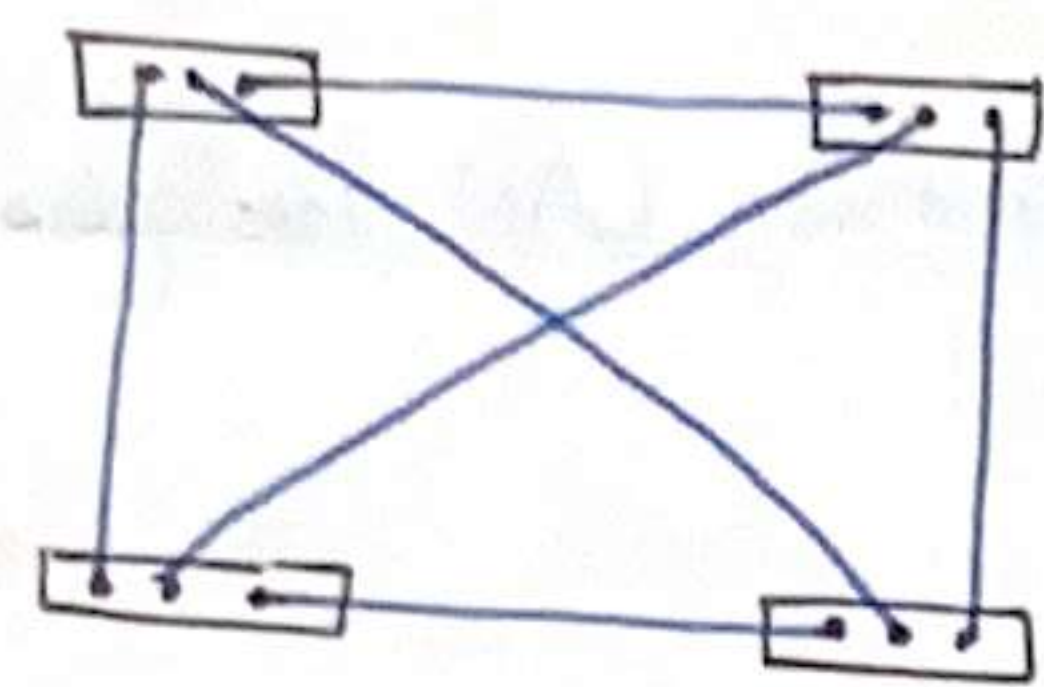{ RPSC Programmer 2013 }

⇒ $n = 99$
no. of ports on each device :→ 98

Q⇒ Assume six devices are arranged in a fully connected mesh topology. How many I/o ports must each device have?
{ BSPHCL JE Electrical 2019 }

⇒ 5

③ No. of wires/Cable/Links/Lines/Channel/keys

$$\Rightarrow \left\{ \frac{n \times (n-1)}{2} \right\}$$

OR

$$\left\{ \text{Total no. of ports} / 2 \right\}$$

no. of Links = $\frac{4 \times (4-1)}{2}$ = 6

Q:→ In a fully connected Mesh n/w with 10 computers total ___ no. of cables are required and ___ no. of ports are required for each device

{UGC NET CS 2016}

no. of ports ⇒ $\frac{10 \times 9}{2}$ ⇒ 45

no. of ports ⇒ 10-1 = 9
for each device

Q:→ How many total links are required to connect 10 devices for fully connected mesh n/w?

{BSHCL JE Electrical 2019}

⇒ 45

---

⑥.1 { If link fails: Each node will still be able to communicate }
↓
Robustness

③ {Line Coding config":→ Point to Point}

④ { Data flow = bi-directional }
{duplex / full-duplex} Mode

{dedicated Path}

⑤ { If node gets damaged :→ } Other nodes will still have full duplex conn" with other node

{Most Reliable}

⑥.2 { Privacy & Security :→ Message passed between 2 nodes will not be accessible by other nodes }
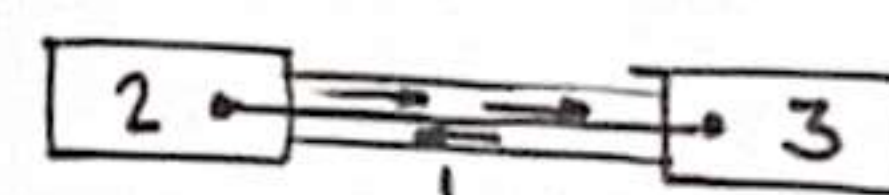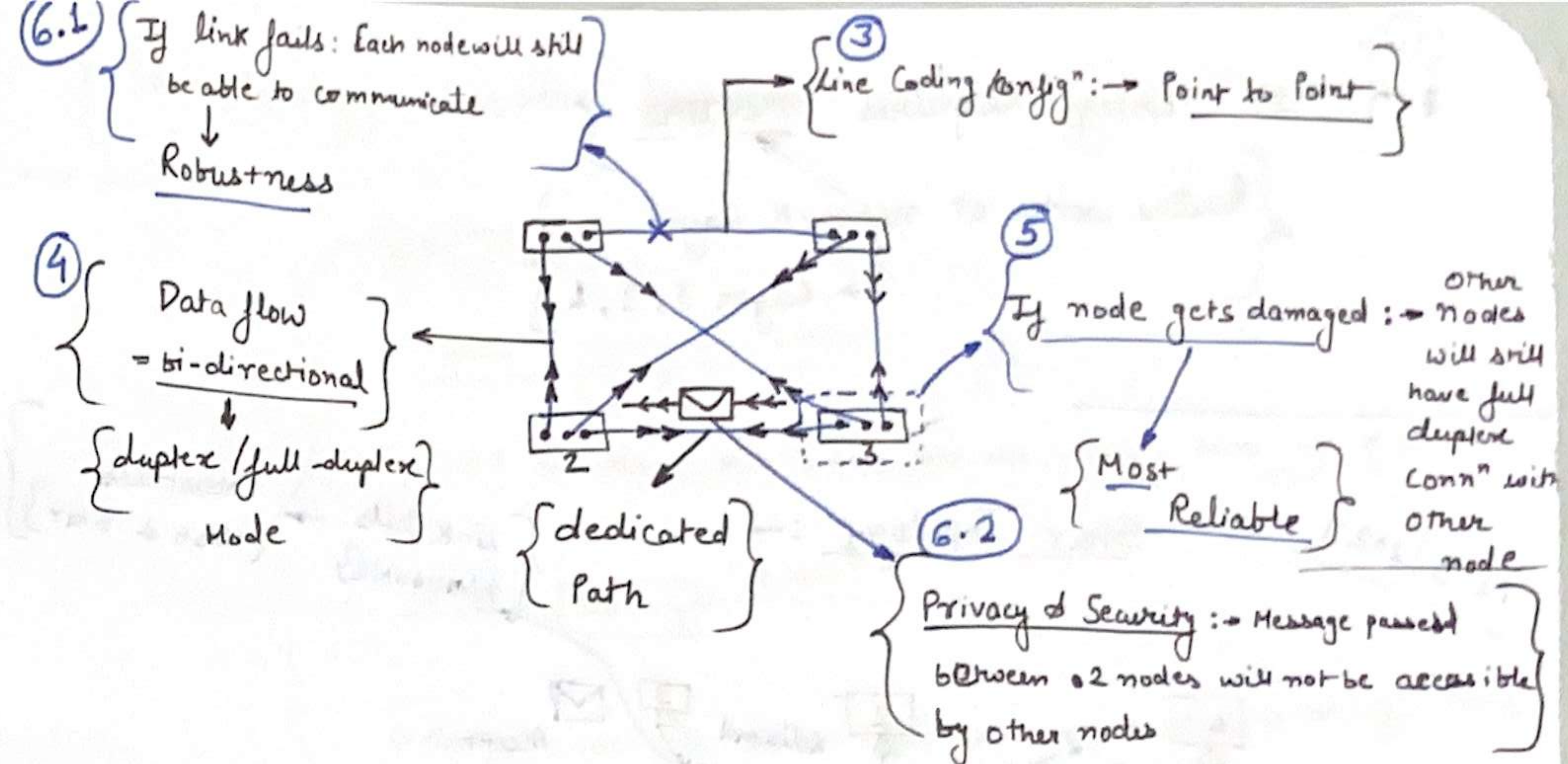
⑥.3 { dedicated Channel eliminates traffic Problem }

⑦ { Mesh topology provides peer to Peer Connection }

⑧ { Fault Identification is easy }

⑨ Disadvantages :→

— Requires most amount of wiring {Bulk wiring}
   expensive : wiring, no. of ports, installation

{ Extra :→ Amount of wiring :→
Mesh Top. > Star Top. > Bus / Ring Top.
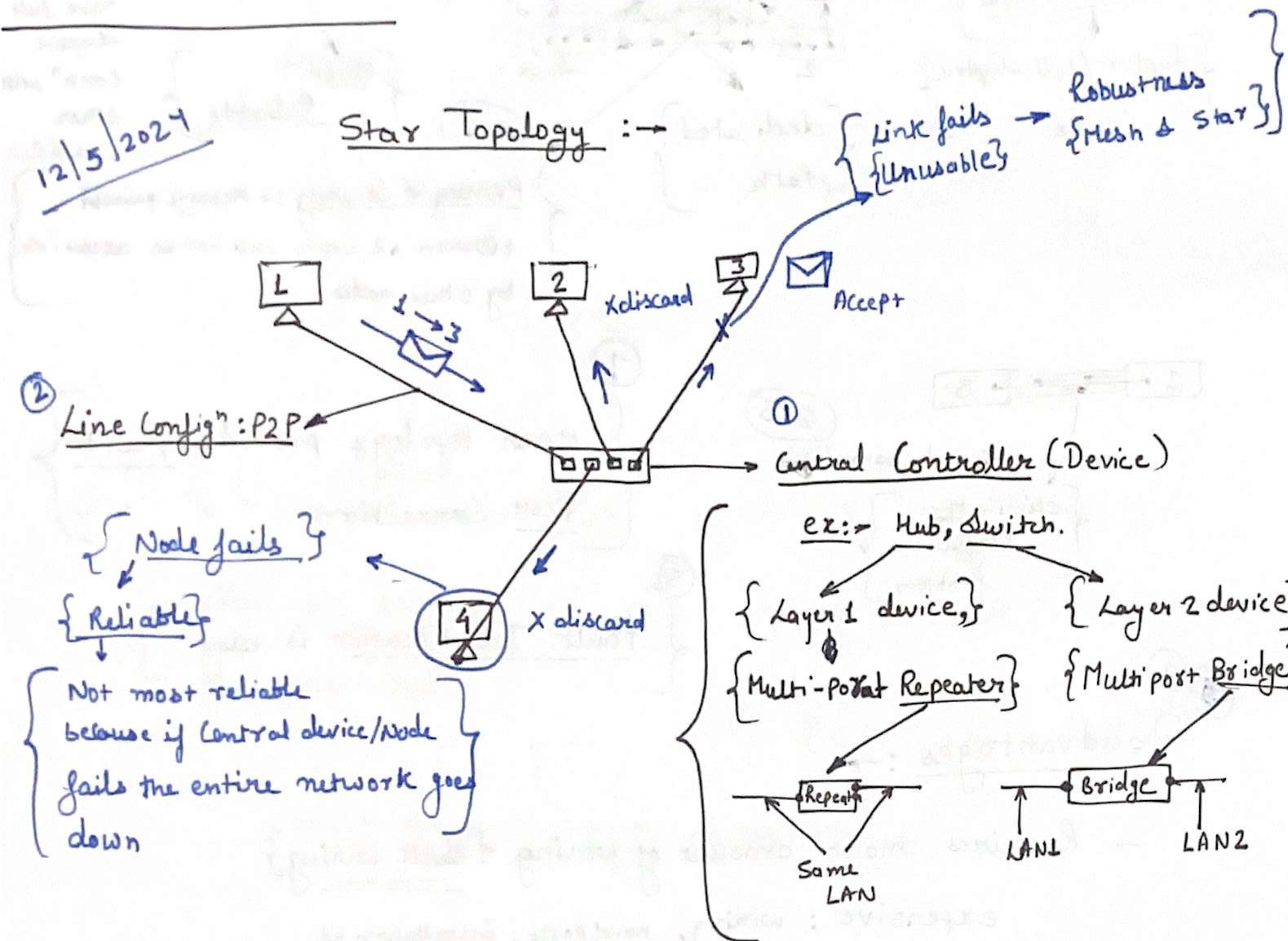{Most}   {Least} }

⑩ Advantage :→

— Mesh topology is used in WAN or internet or wireless network

— Used in telephone regional offices.

— Used in Smart buildings & HVAC System
{Heating Vent Ventilation & Conditioning.}

11. { Mesh Topology requires **Routers** }

{ Routers works at network Layer }
 └→ Layer 3, 2, 1

12/5/2024

Star Topology :—

{ Link fails (Unusable) } → Robustness {Mesh & Star}

1→3   X discard   Accept

② Line Config^n : P2P

{ Node fails }
{ Reliable }

Not most reliable because if central device/Node fails the entire network goes down

① Central Controller (Device)

ex:→ Hub, Switch.

{ Layer 1 device } ← Multi-Port Repeater

{ Layer 2 device } ← Multiport Bridge
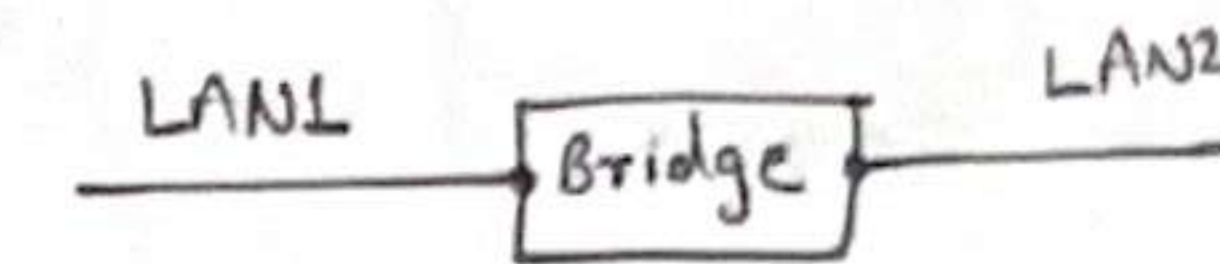
[Repeater] → Same LAN

[Bridge] → LAN1 | LAN2

No. of wires in Star Topology → (n-1) { on devices including hub/Central Controller }

{ If (n-1) is not there in option then n wires }

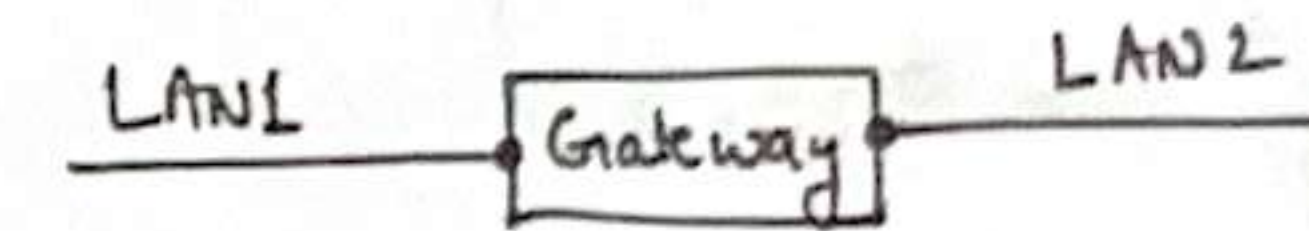No. of I/o ports on each device :→ 1

{ Star Topology requires less wires {n-1} than Mesh Topology $\frac{n\times(n-1)}{2}$ }

Extraa :→

LAN1 — [Bridge] — LAN2

Bridge used to connect two LANs that are working same type of N/w

LAN1 — [Gateway] — LAN2

Gateway is used to connect dissimilar n/w / n/w with diff^n protocol

---

① In Star Topology a Central Controller or device is used

② Star Topology provides P2P config^n

③ In Star Topology, no. of wires = (n-1) { or if option doesn't have (n-1) then (n) }

④ No. of I/o Ports on each node = 1

⑤ Star Topology requires less wire than Mesh.

⑥ Single Point Dependency :→ If the central controller fails then entire networks goes down

⑦ Robustness :→ if a link fails then also n/w or system will work efficiently.
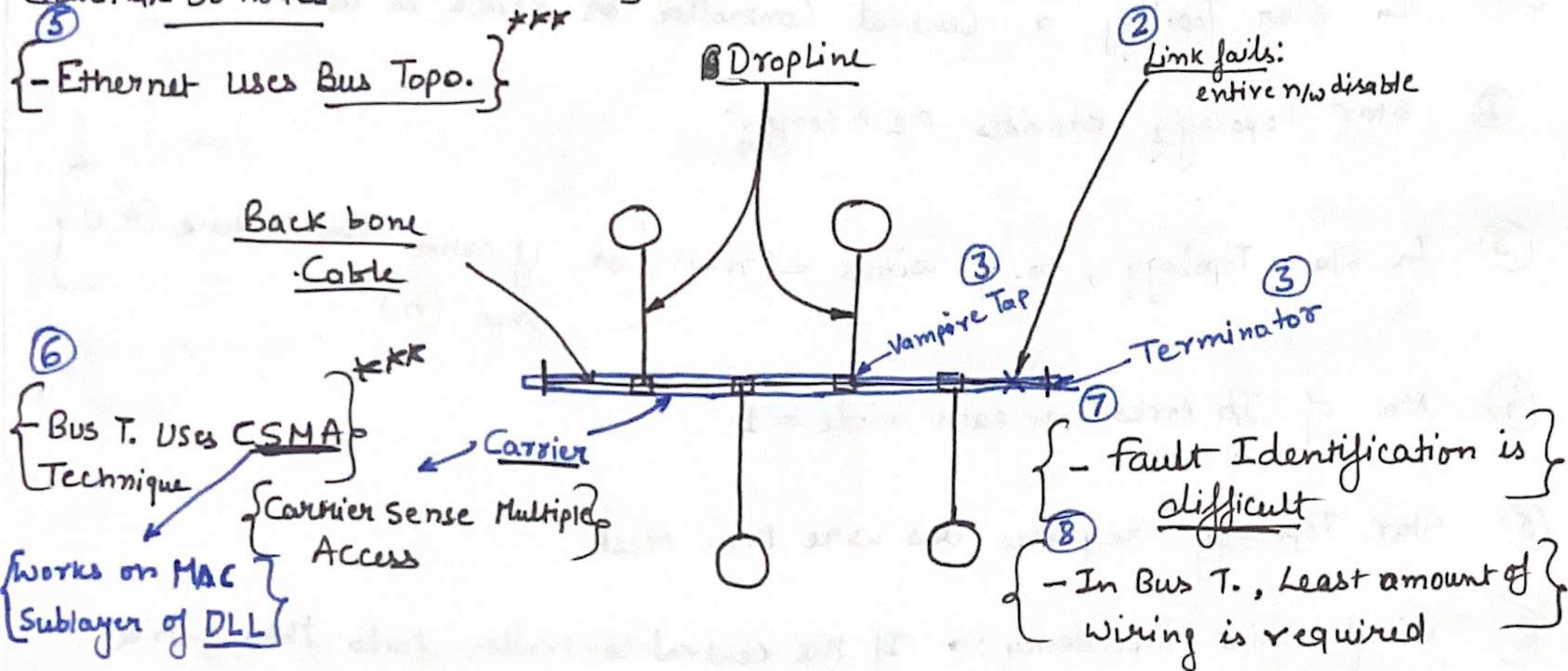
⑧ Common [LAN] Topology :→ Star, Ring & Bus

{ Ethernet (IEEE-802.3) } → Not collision free
{ is a standard of LAN }

(9)

Star Topology :— is used in Banks.

Ethernet :→	802.3	} Not Collision Free
Wifi →	802.11	
Token BUS →	802.4	} Collision Free
Token Ring →	802.5	
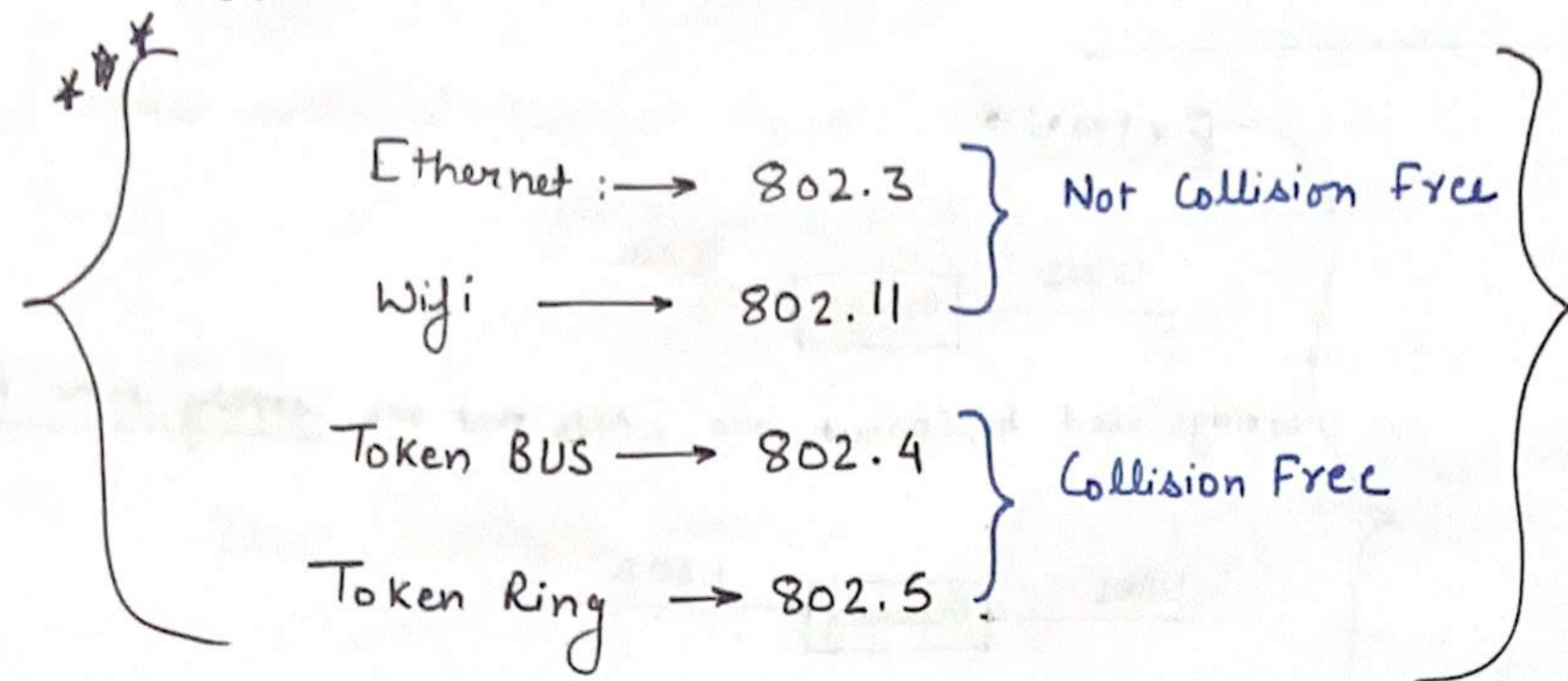
Bus Topology

① { — In Buse Topology we have Multipoint Configuaration. }

④ {— Acoording to IEEE, Bus Topo. should have Max 30 nodes }

⑤ {— Ethernet Uses Bus Topo. } ***

⑥ Drop Line

② Link fails: entire n/w disable

Back bone Cable

③ Vampire Tap

③ Terminator

⑥ { Bus T. Uses CSMA Technique

Carrier

Carrier Sense Multiple Access

{ Works on MAC Sublayer of DLL }

⑦ { — Fault Identification is difficult }

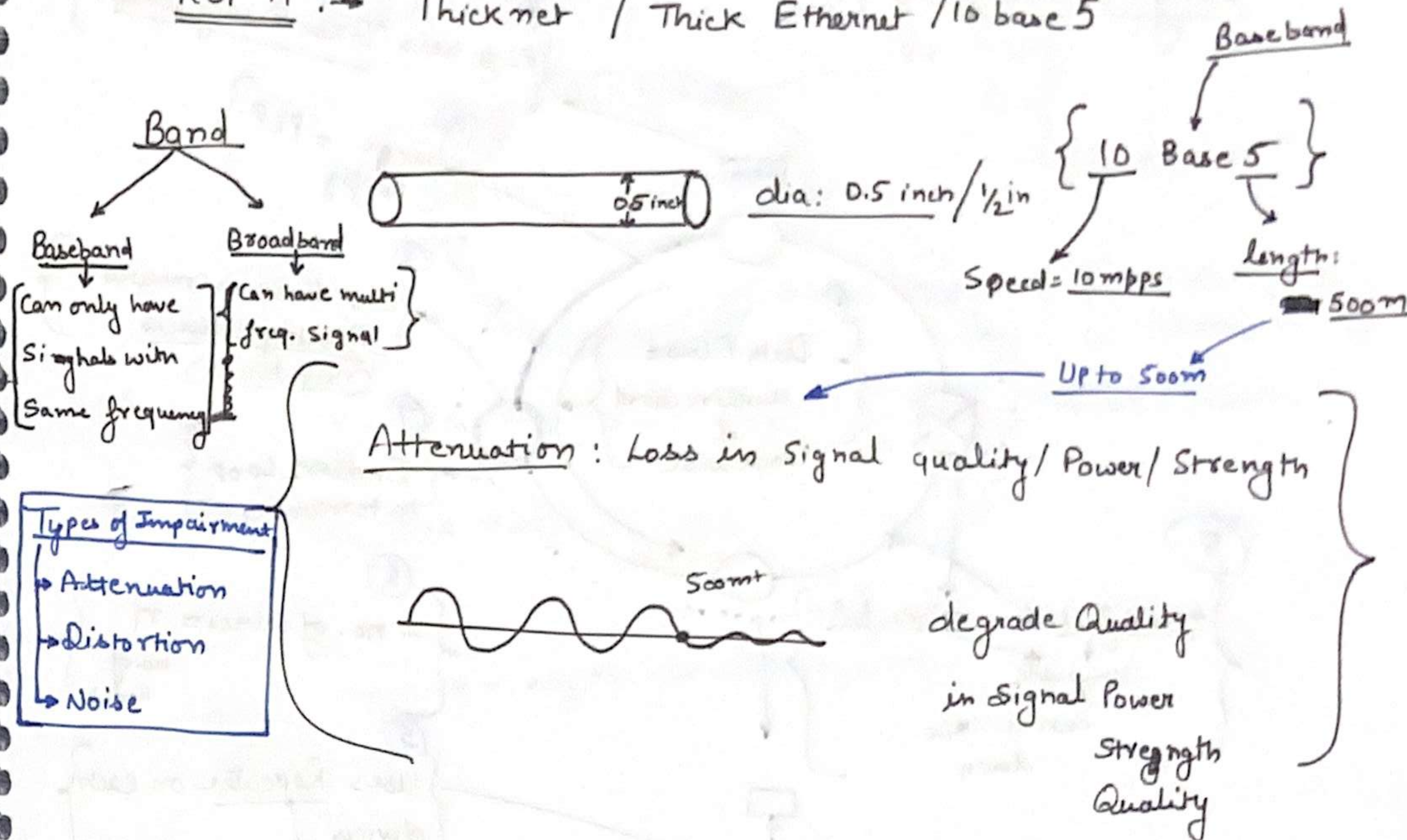⑧ { — In Bus T., Least amount of Wiring is required }

Earlier for Bus topology, we used to use Coaxial Cable { Thick headed coax }

Coaxial Cable :→   Developed in :→ 1858 by Oliver Heavyside

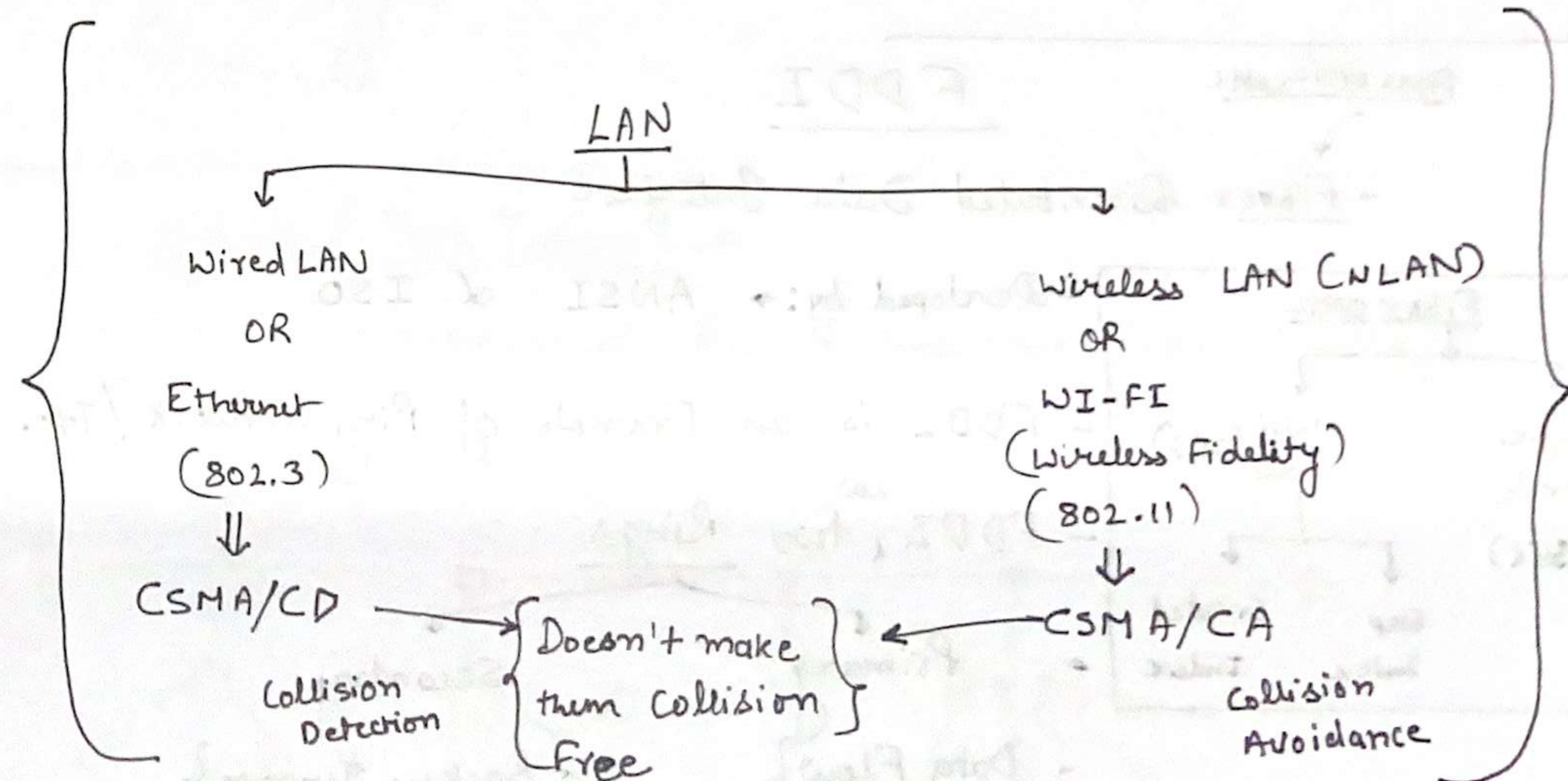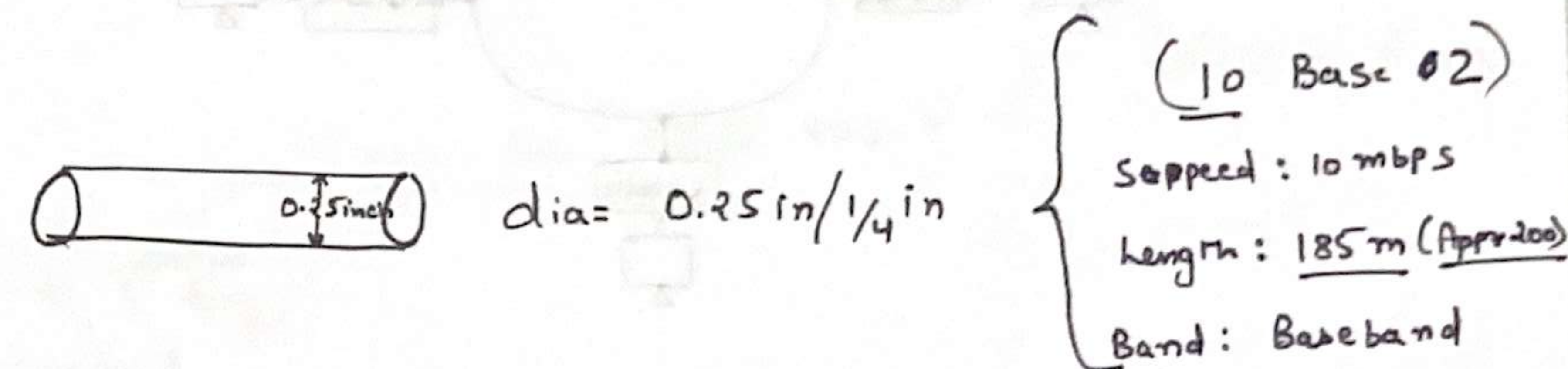| Category	Use	Impedence
{ Radio Goverment }		
RG-11	Early Ethernet	50 Ω
OR		
{ Radio Guide }		
RG-58		50 Ω
RG-59	Cable TV	75 Ω

RG-11 :→ Thicknet / Thick Ethernet / 10 base 5

Band

Baseband ← → Broadband

[Baseband [Can only have Signals with Same frequency]

[Broadband [Can have multi freq. signal]

0.5 inch   dia: 0.5 inch / ½ in

{ 10 Base 5 }   Baseband

Speed = 10 mpps

length: 500m

Up to 500m

Attenuation : Loss in Signal quality / Power / Strength

[Types of Impairment
→ Attenuation
→ Distortion
→ Noise]

500mt

degrade Quality in Signal Power Strength Quality

RG-58 :→ Thinnet / Thin Ethernet / 10 Base 2 / Cheapnet

0.25 inch   dia= 0.25 in / ¼ in

(10 Base 02)
Sappeed : 10 mbPS
Length : 185 m (Appr 200)
Band : Baseband

LAN

Wired LAN OR	Wireless LAN (NLAN) OR
Ethernet (802.3)	WI-FI (Wireless Fidelity) (802.11)
⇓	⇓
CSMA/CD	CSMA/CA
Collision Detection	Collision Avoidance

{ Doesn't make them Collision Free }

Ring Topology :→

④ { Ring uses Token Passing Concept }

② { Lin:e = P2P Config }

③ { Each device is connected to Exactly 2 devices (neighbours) }

① { - Data Flow = unidirectional & Clockwise }

⑦ { - Endless Loop } no terminating End

⑥ { - no. of wires = n } no. of nodes

⑤ { Uses Repeater on each devices } (Layer 1 device)

⑧ { -Link fail: } — unusable — entire n/w down

{ -Node fail: }

FDDI

- Fiber optic cable
- Fib~er Distributed Data Interface
- Developed by :→ ANSI & ISO
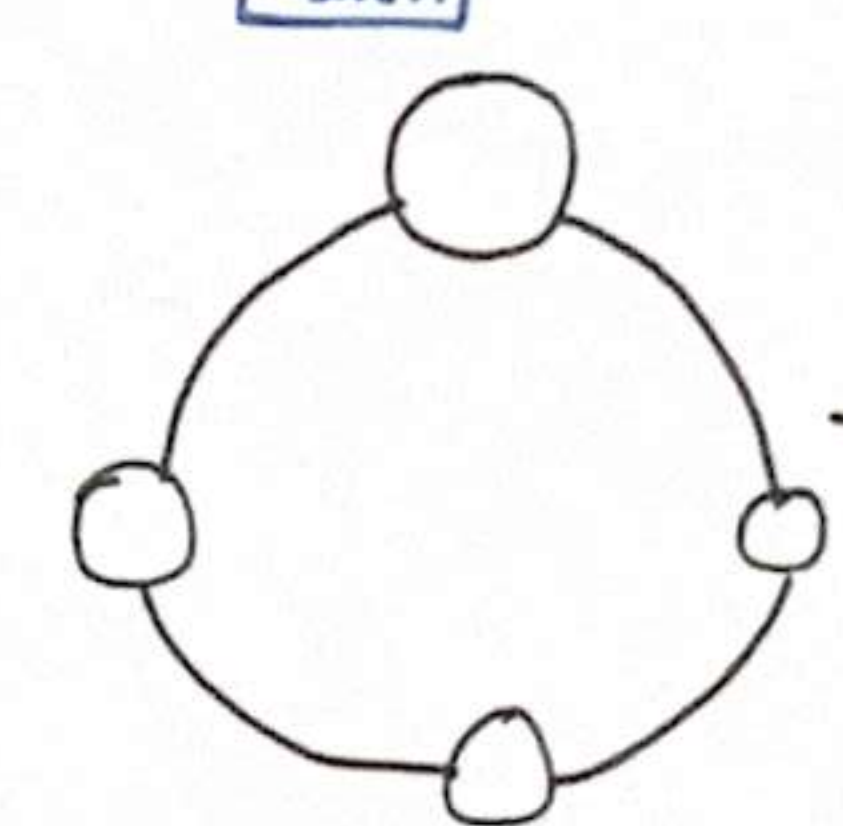- FDDI is an Example of Ring Network / Topo.
- FDDI has two Rings
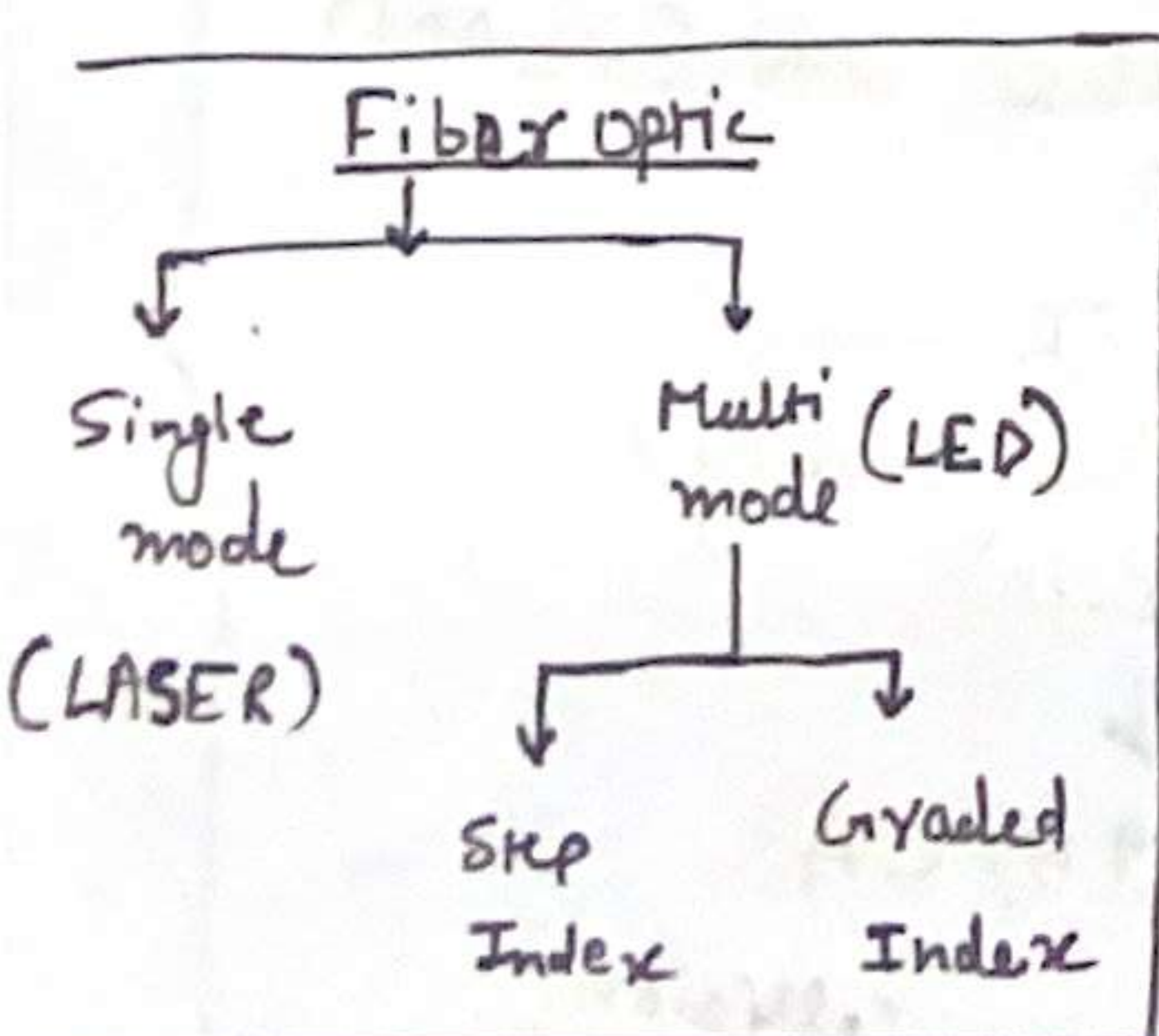
Fiber optic
- Single mode (LASER)
- Multi mode (LED)
  - Step Index
  - Graded Index

Primary { Data Flow }   Secondary { Backup Purpose }

FDDI :→

Primary Ring (Clockwise)

Secondary Ring { Back up Purpose (idle) } (Anti Clockwise)
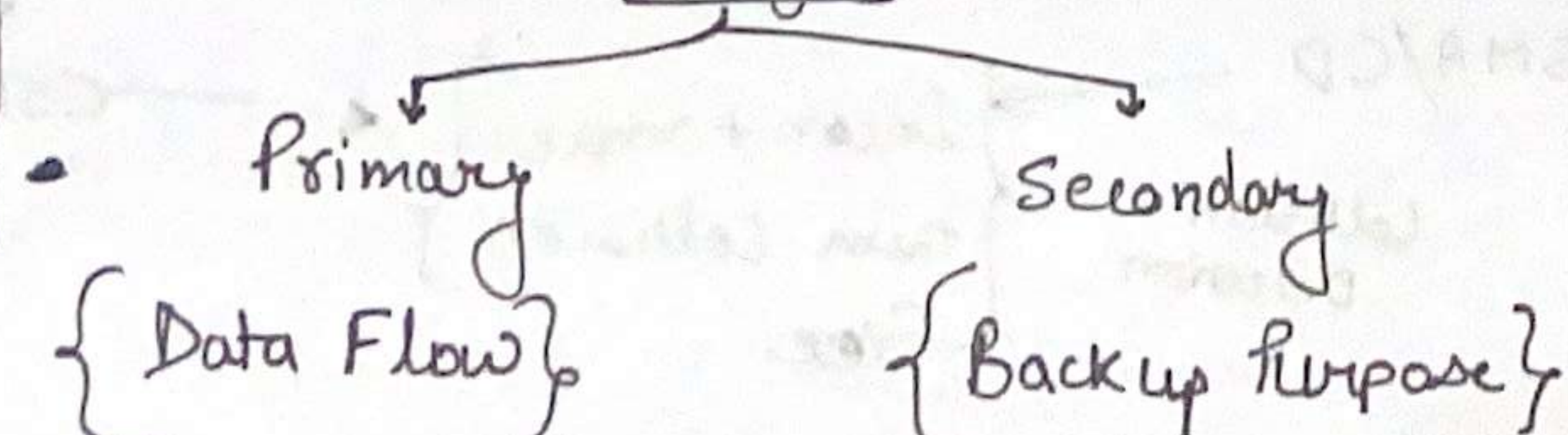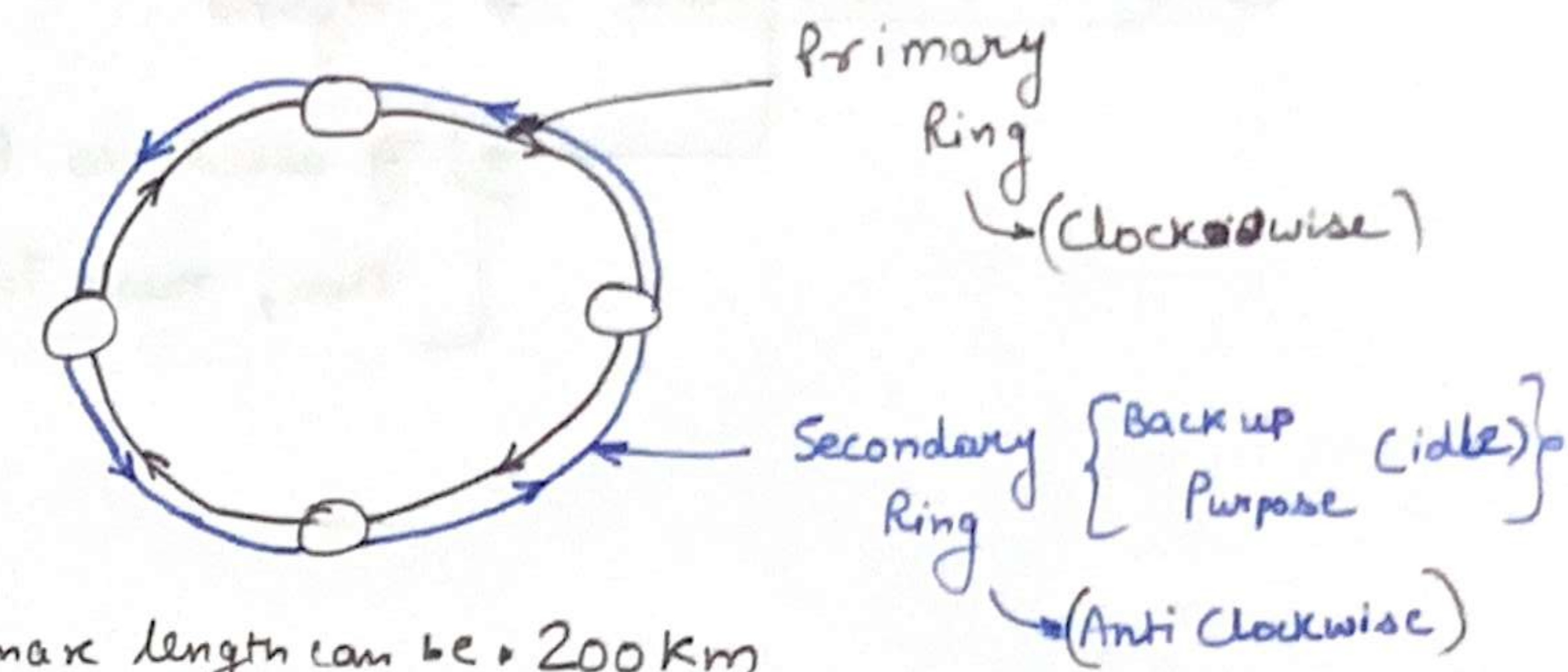
- In FDDI n/w, max length can be → 200 Km
- In FDDI n/w, max nodes : 1000

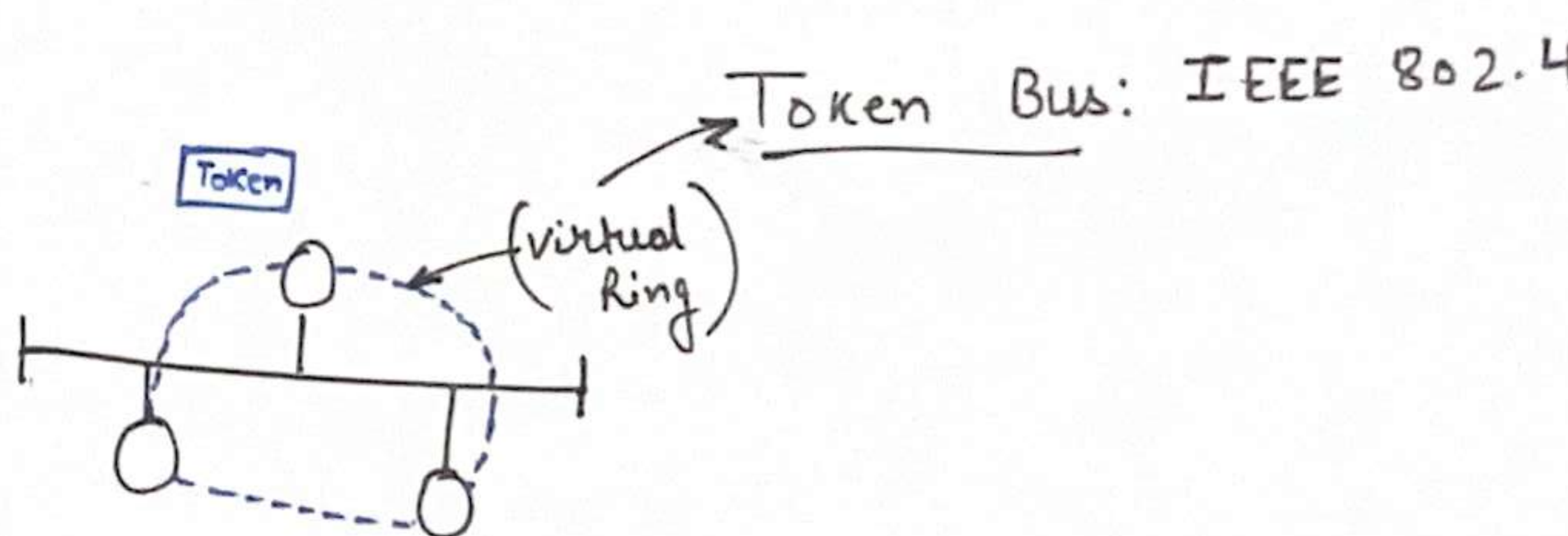{ At a time only one node will have Token }

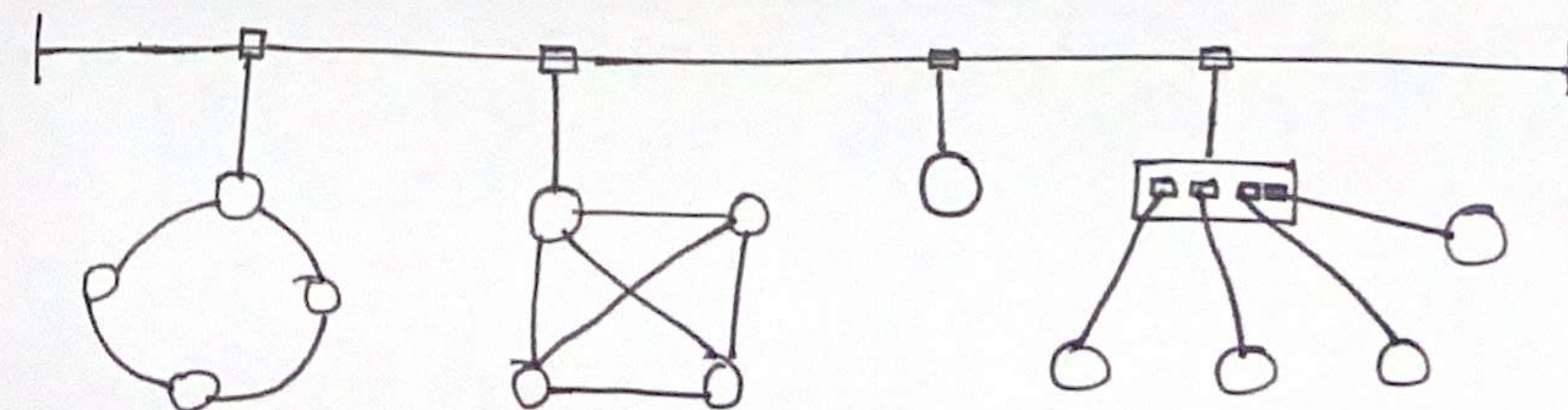→ Token Ring : IEEE 802.5 — Works at DLL { MAC Sublayer }

— Collision Free

→ Token Bus: IEEE 802.4

(virtual) Ring

Hybrid / Tree Topology :→

- Combination of Bus & ~~Tree~~ Star Topo. { Generally }

- Combination of 2 or more

- <u>Complex Architecture</u> :→ Hybrid

{ If asked b/w Bus, Ring, Star, Mesh }
then, mesh Topo