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Unit-3

LAN → Unit-1

CRC, Token ring → Unit-2

Error detection:-

To detect the errors.

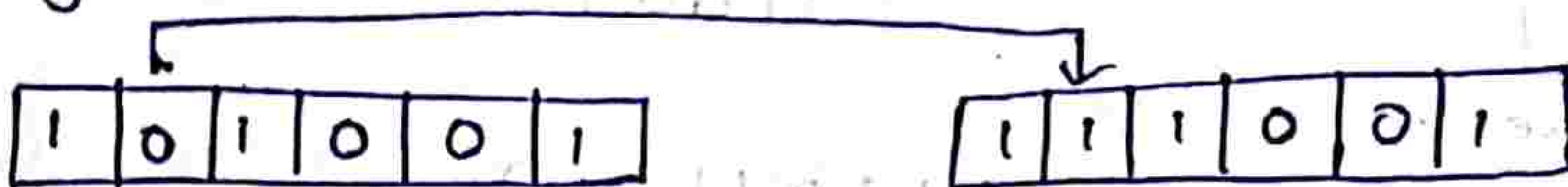
Types of errors:-

- 1) Single bit error.
- 2) Multiple bit error.
- 3) Burst error.

Single bit error:-

Only one bit can be changed. i.e, 0 to 1, or, 1 to 0.

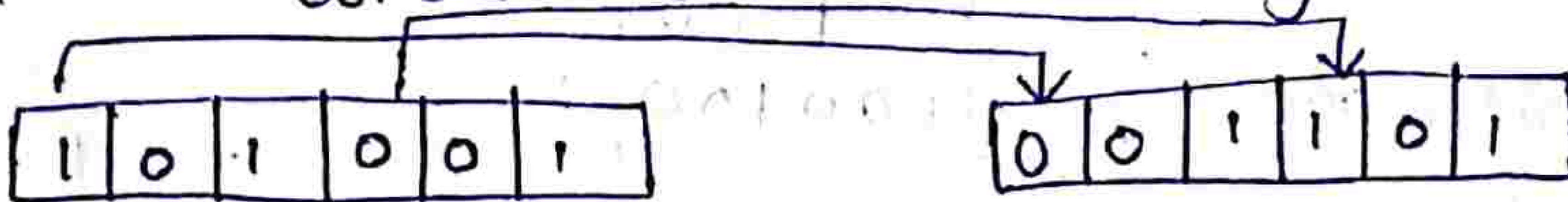
Ex:-



Multiple bit error:-

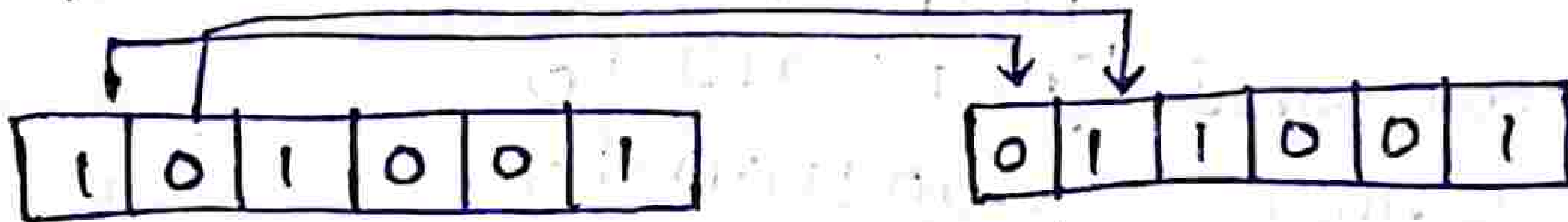
Here two ^{non} consecutive bits are changed. i.e, 0 to 1, or, 1 to 0

Ex:-



Burst error:-

Here, two consecutive bits are changed.



Methods of error detection / parity check:-

* It is of 4 methods:-

- 1) VRC
- 2) LRC
- 3) checksum
- 4) CRC

VRC:- [Vertical redundancy check]

* It calculate row wise.

* It contain n-number of bits/characters.

- * If the message contains even no. of ones then the parity is called "Even parity". It can be represented as '0'.
- * If the message contains odd no. of ones then the parity is called "Odd parity". It can be represented as '1'.

Ex: The message is . Then find out VRC.

1110111	0
1101111	0
1110010	0
1101100	0
1100100	1

Now, the data characters are

Row 1 - 11101110

11011110

11100100

11011000

11001001

* It having 2 cases:

Case 1: If the message is

1110111	0
1101111	0
1110110	1
1101100	0
1100100	1

Here, the parity bits are different. So, the transmission error occur.

Case 2: If the message is

1110111	0
1101111	0
1110010	0
0001100	0
1100100	1

Here, the parity bits are same but error has occur which could not be identified.

LRC: [Longitudinal redundancy check]

* It can be calculate column wise. It contain n-no. of bits/characters.

* If the message contains even no. of ones then the parity is called "Even parity". It can be represented as '0'.

* If the message contains odd no. of ones then the parity is called "Odd parity". It can be represented as '1'.

Ex: The message is;

11100111

11011101

00111001

10101001. Find out LRC

1	1	1	0	0	1	1	1
1	1	0	1	1	1	0	1
0	0	1	1	1	0	0	1
1	0	1	0	1	0	0	1
1	0	1	0	1	0	1	0

* It having 2 cases:-

Case 1:- If the message is

So, there is a transmission error.

Case 2:- If the message is

∴ Transmission error occurs even though same parity bits. But LRC can't detect the error.

0	0	0	0	0	1	1	1
1	1	0	1	1	1	0	1
0	0	1	1	1	0	0	1
1	0	1	0	1	0	0	1
0	1	0	0	1	0	1	0

0	1	0	0	0	1	1	1
1	1	0	1	1	1	0	0
0	0	1	1	1	0	0	0
1	0	1	0	1	0	0	1
1	0	1	0	1	0	1	0

Check sum:-

* It having two data characters

* It use X-OR operation.

* In sender side we have to apply its complement. In receiver side we have to add data character and its complement of sender side.

* Now, we have to add 3 data characters and apply its complement. Then, the results are '0'. So, there is no error in transmitting data from source to destination.

Ex:-

Sender

Receiver

1 0 1 1 0 1 1 0
1 1 0 0 1 0 0 1

1 0 1 1 0 1 1 0
1 1 0 0 1 0 0 1
1 0 0 0 0 0 0 0

0 1 1 1 1 1 1 1

1 1 1 1 1 1 1 1

→ its complement of this is the original result is 0 0 0 0 0 0 0 0

its complement =

1 0 0 0 0 0 0 0

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Ethernet:- [802.3]

* Ethernet means cable. It generate signals.

Types of ethernet:-

1) Standard ethernet [10 Mbps]

2) Fast ethernet [100 Mbps]

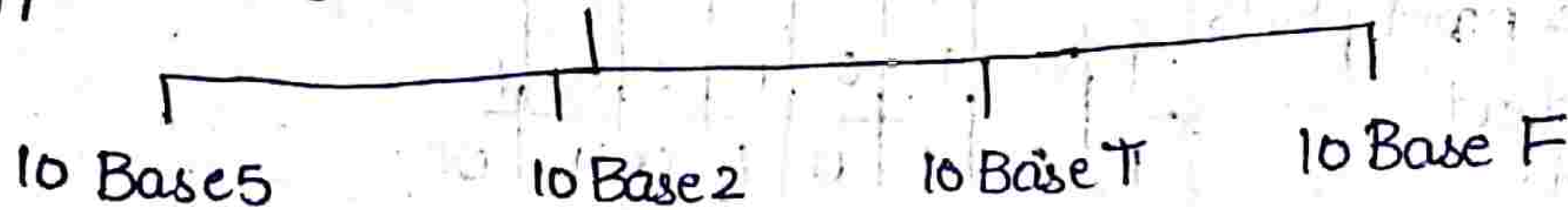
3) Gigabit ethernet [1 gbps]

4) Ten gigabit ethernet [10 gbps]

Standard ethernet:-

* The transmission speed is 10 Mbps.

Types of standard ethernet:-



10 Base 5:-

* 10 Base 5 is called "thick ethernet". The data transmission speed is 10 Mbps.

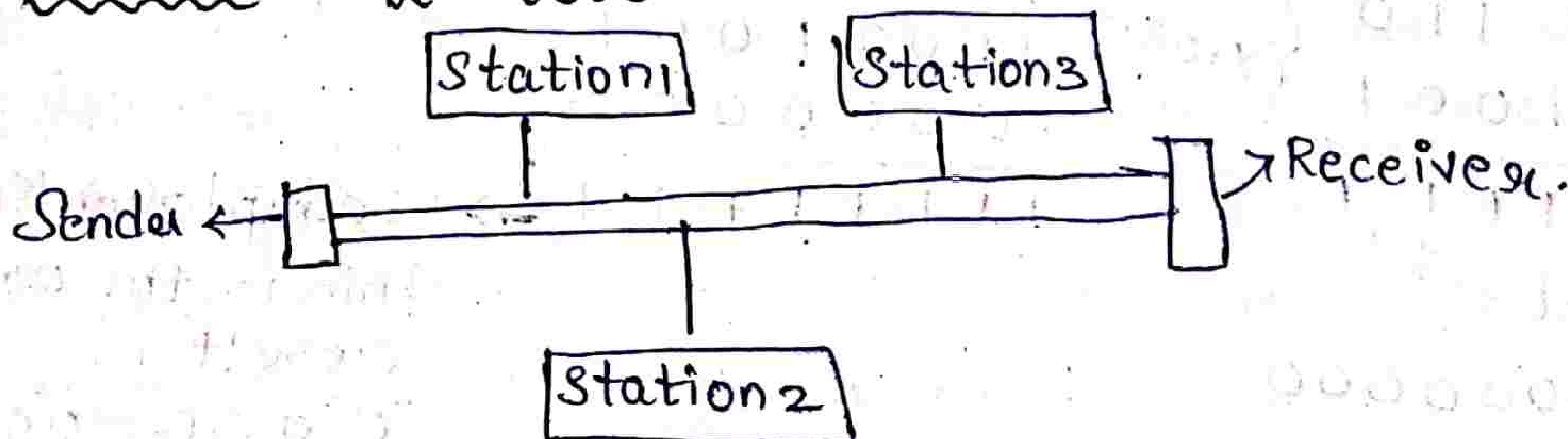
* It require base band signal.

* The cable length is 500 mts.

* The 10 base 5 by using bus topology [All devices are connected to single cable].

* The data can be transmitted in the form of bus.

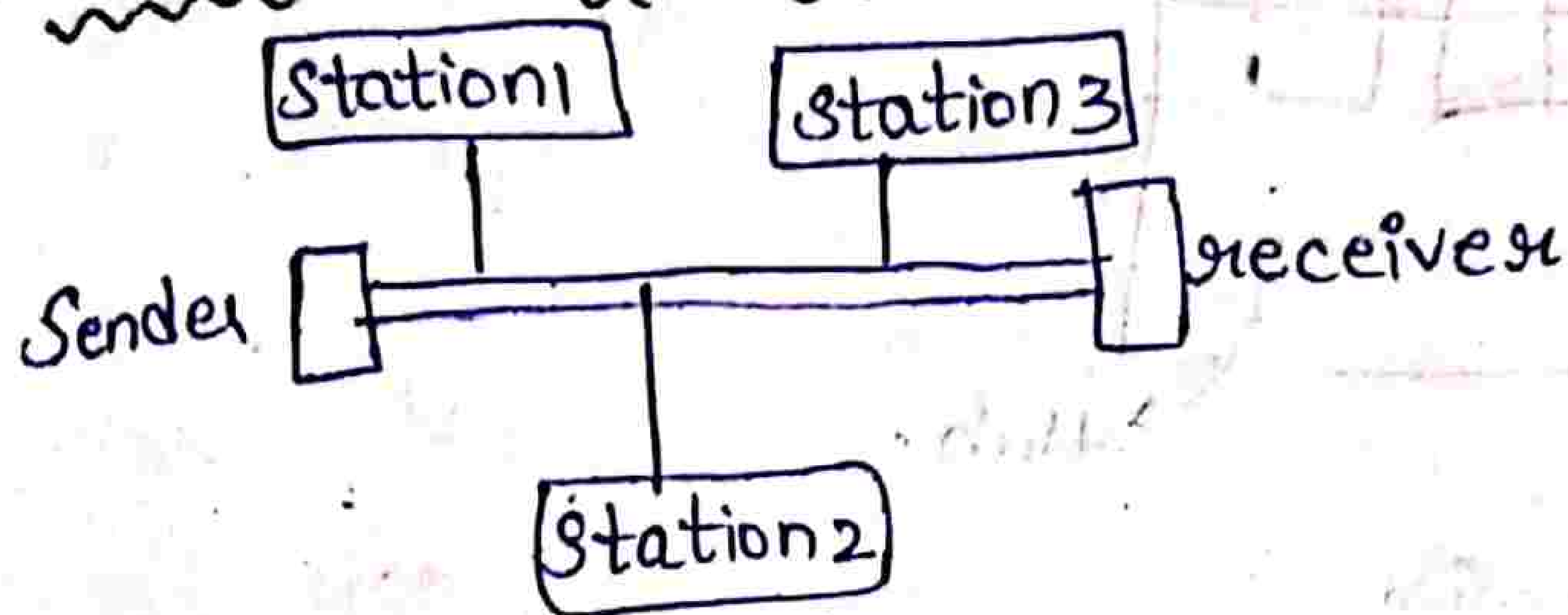
Architecture of 10 base 5:-



10 base 2:

- * 10 base 2 is called "thin ethernet". The data transmission speed is 10 Mbps.
- * It requires base band signal.
- * The cable length is 185mts.
- * The 10base2 uses bus topology. The data can be transmitted in the form of bus.

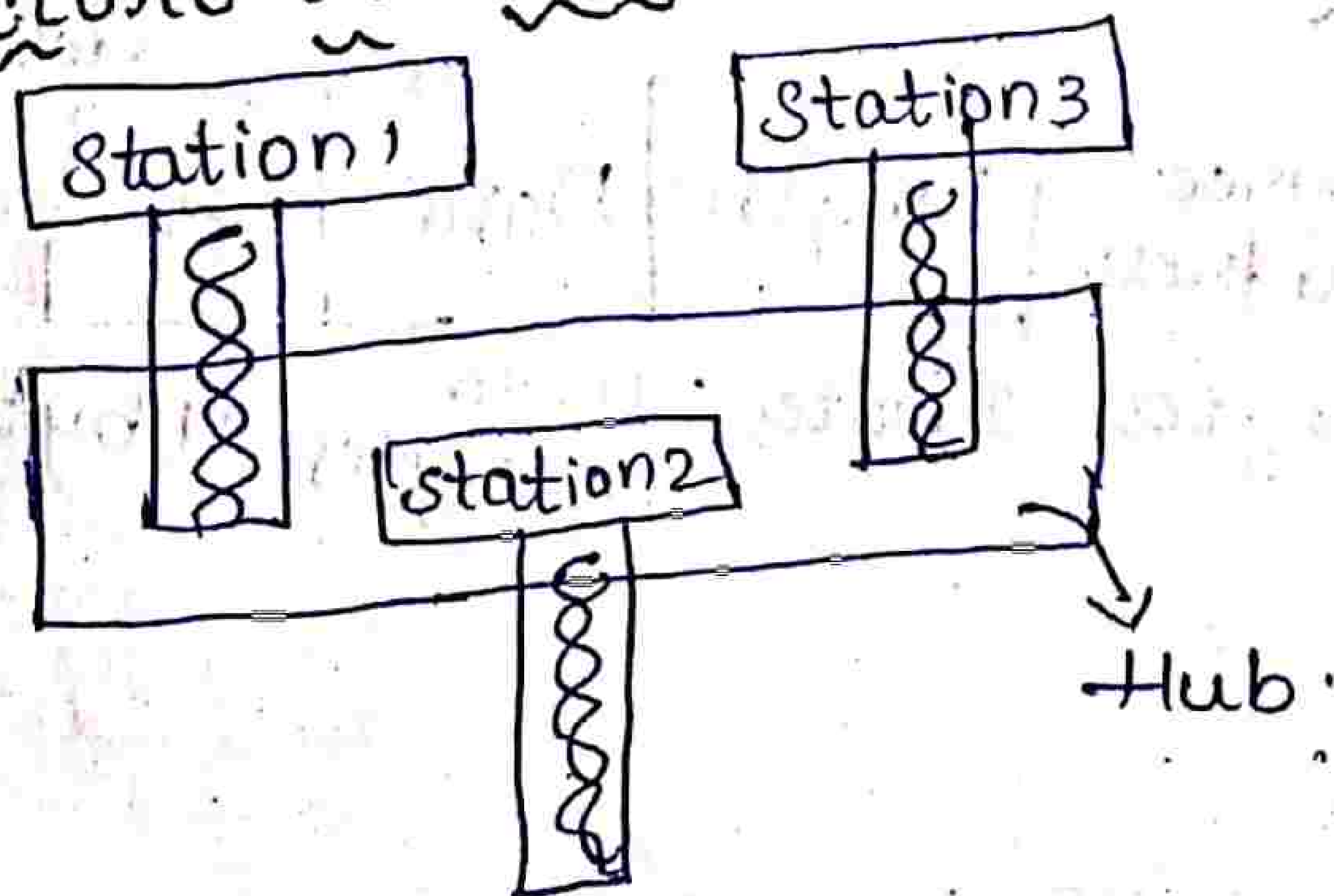
Architecture of 10base2:-



10 base T:-

- * 10 base T is called "twist ethernet". The data transmission speed is 10 Mbps.
- * It requires base band signal.
- * The cable length is 100mts.
- * It contains 2 wires, they are twist together. It can be represented in helica structure.
- * The 10baseT uses star topology. [All stations are connected from Sender to receiver by using hub].

Architecture of 10baseT:-



10 base F:-

- * 10base F is called "fibre ethernet". The data transmission

is 10Mbps.

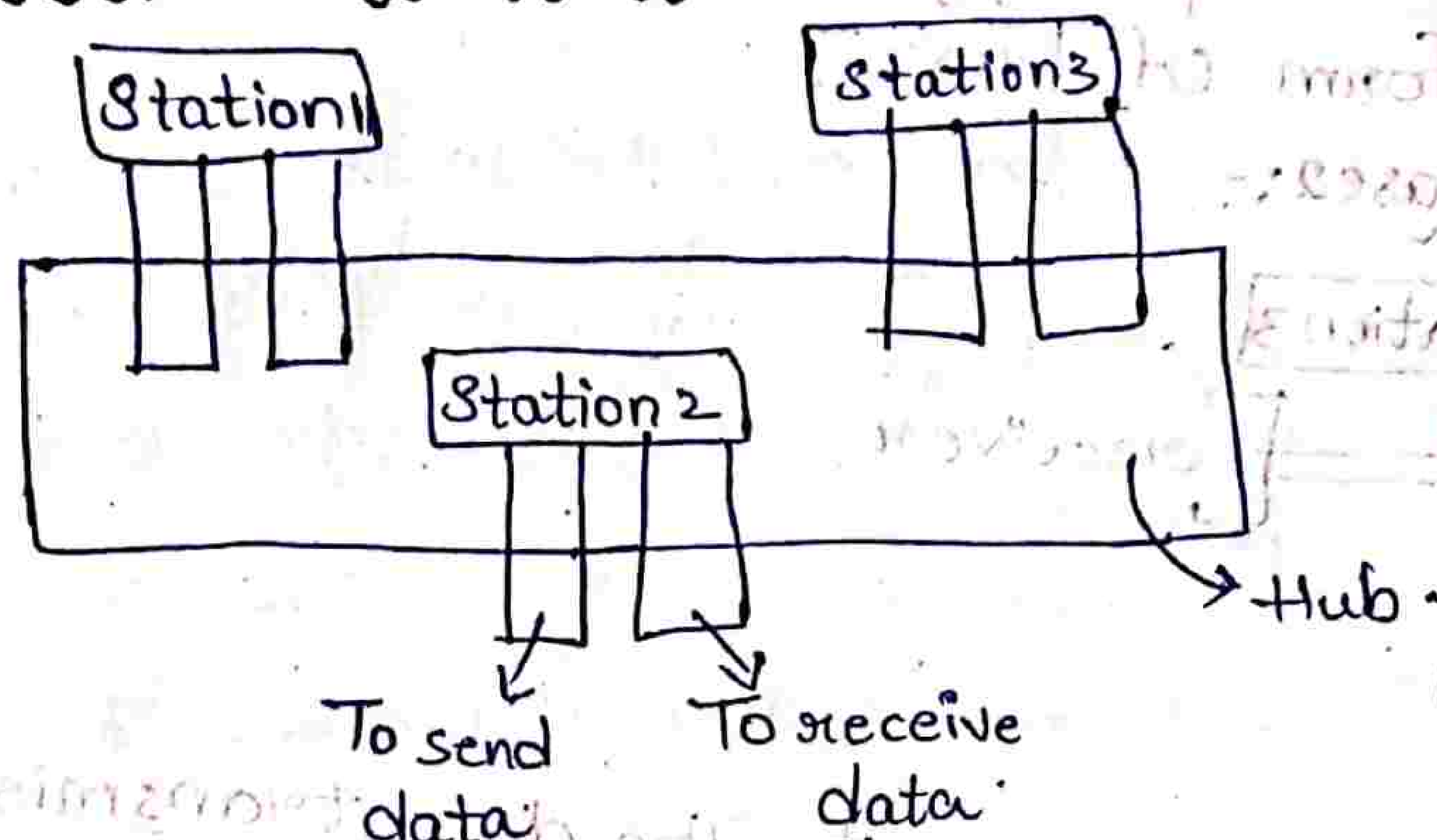
* It requires baseband signal.

* Cable length is 200mts.

* The 10base F uses star topology.

* It contains 2 pairs of cables.

Architecture of 10base F:-



Difference b/w standard ethernet:-

Characteristics	10 Base 5	10 Base 2	10 Base T	10 Base F
Media	Thick	Thin	Twist	Fibre
Cable length	500 mts	185 mts	100 mts	200 mts
Topology	Bus	Bus	Star	Star

Frame format of standard ethernet:-

* SFD → start of frame delimiter

Preamble	SFD	Destination address	Source address	Length	Data	CRC
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7 bytes 1 byte 6 bytes 6 bytes 2 bytes 47 to 1500 bytes 4 bytes

Fast ethernet:-

* It designs LAN protocol.

* Fast ethernet is called "IEEE 802.3U".

* The data transmission speed is 100Mbps.

- * It is 10 times fast at rate of 100 Mbps.
- * It follow the below instructions are:
 - 1) The data transmission speed is 100 Mbps.
 - 2) It require same frame length.

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- * It requires min and max frame length.
- * It contains 48-bit address.

Functions of fast ethernet:-

- 1) MAC sublayer (Medium access control)
Multiple.

2) Physical layer.

MAC sublayer: (1 way) (2 way).

- * It handles half-duplex and full-duplex.

Half duplex:-

- * Data transmitted only in one direction. Here, we are using switch to connect the elements.

- * Half duplex require CSMA/CD.



↳ data not sent at same time 2 sides

Full-duplex:-

- * Data transmitted in both directions at a time.

- * It can't support CSMA/CD.

- * The full duplex requires "Hub".



Physical layer:-

- * Data can be transmitted topologies and implementation.
 - ↳ Physical or logical arrangement of networks.

Types of topologies:-

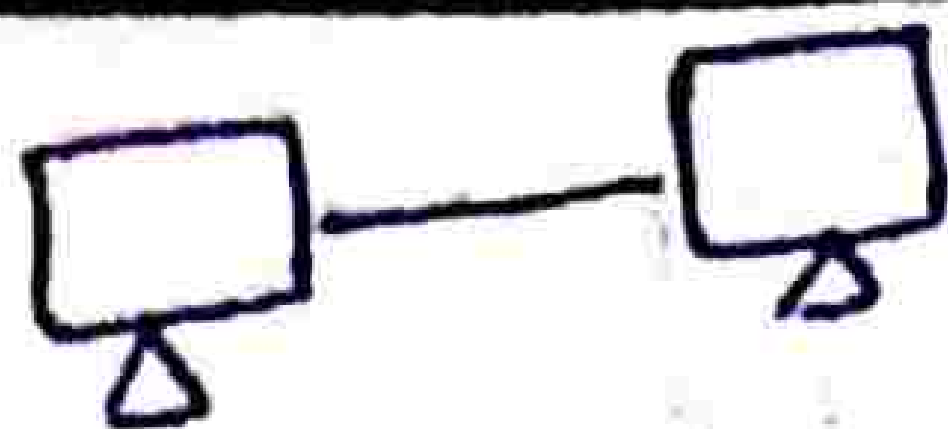
Used in fast ethernet.

- 1) Point-to-point.
- 2) Star.

Point-to-point:-

- * It's having 1 sender and 1 receiver.

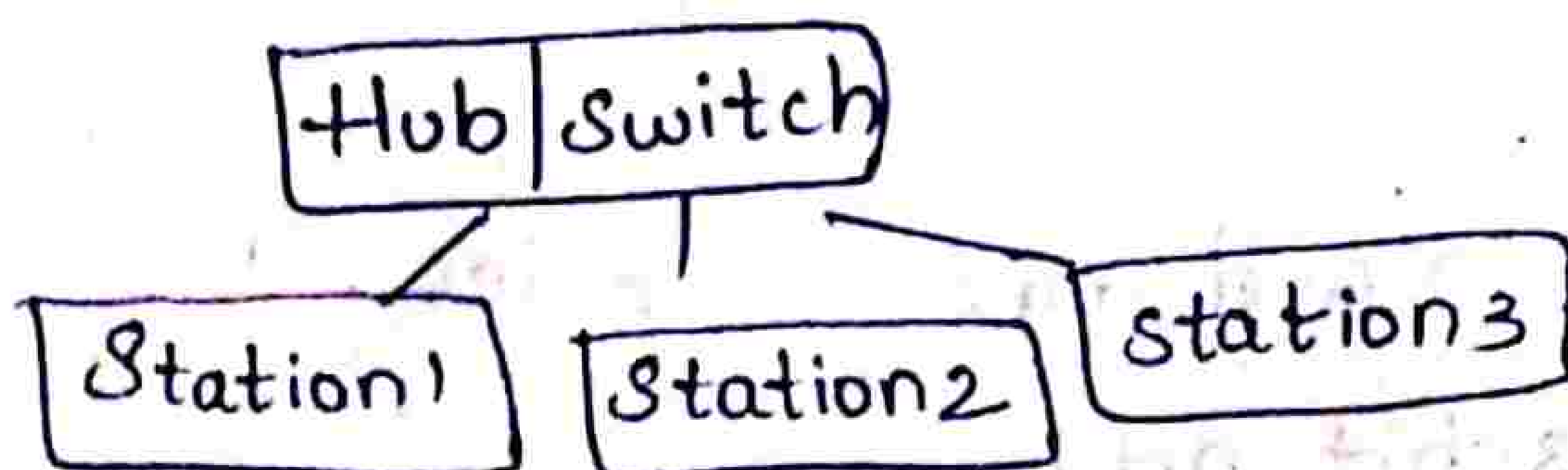
Architecture:-



Star:-

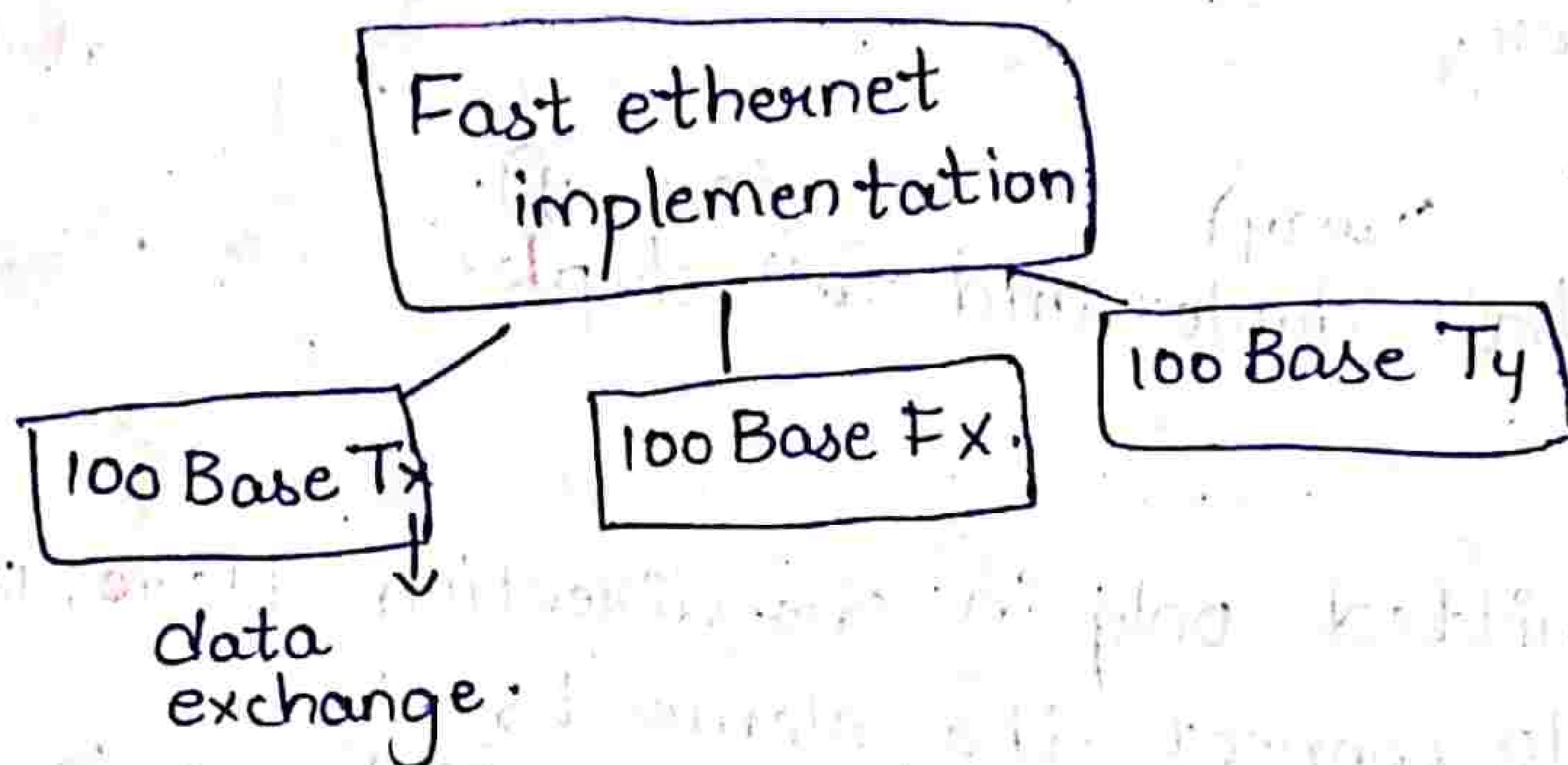
* All the stations/networks/devices are connected to central hub

Architecture:-



Implementation:-

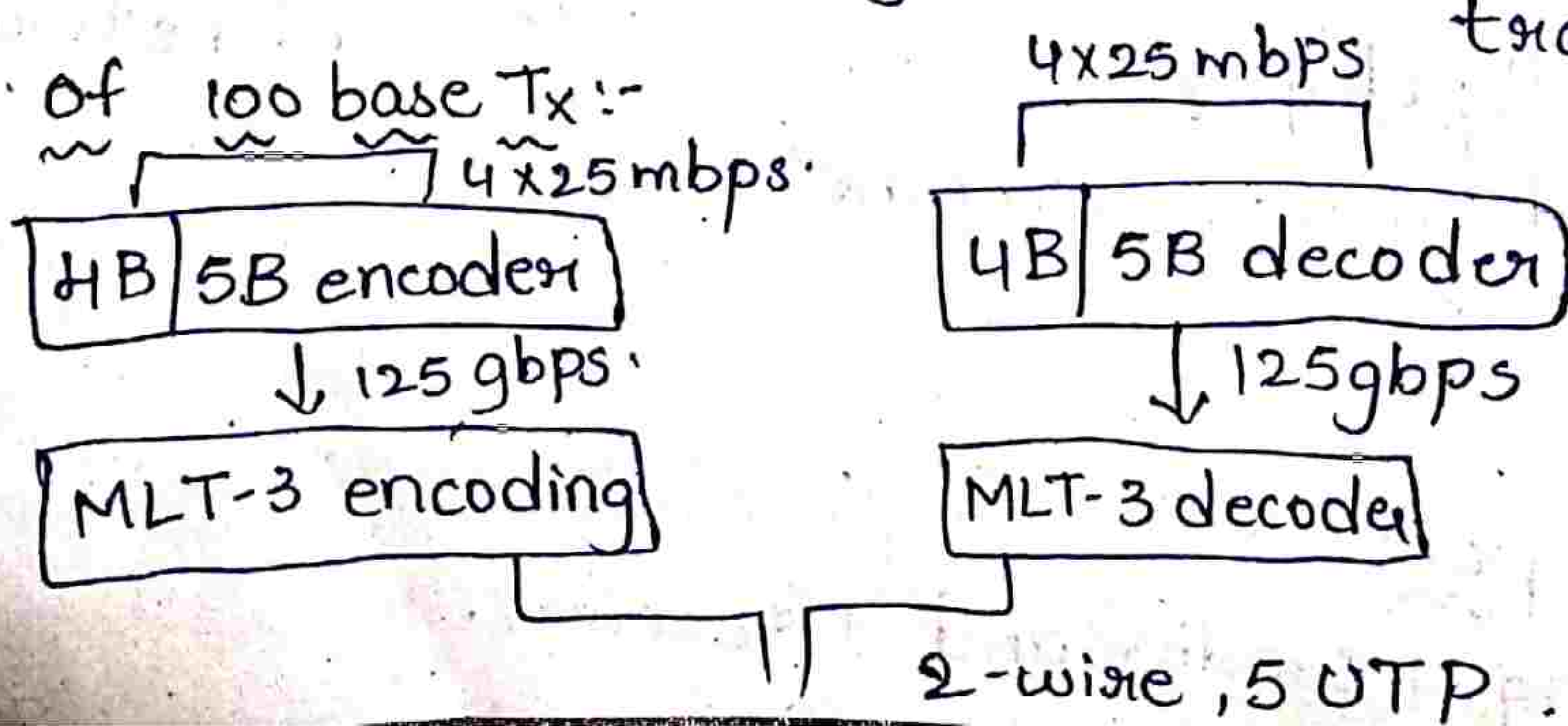
* It can be implement using 100 Base Tx, 100 Base Fx, 100 Base Ty
 ↓ 2 wires 5 UTP ↓ 2 wire ↓ 4 wires 3 UTP



100 Base Tx:-

- * Data transmission speed is 100 mbps.
- * It requires base band signals.
- * It contains twisted pair cables.
- * It contains 2 wires of category 5 of unsheilded twisted pair cable (UTP) [Doesn't cover any sheilding materials].
- * It contains 4B/5B block encoding.
- * It contain MLT-3 line encoding [MLT = Multi level transmission]

Architecture of 100 base Tx:-



100 Base Fx:-

* Data transmission speed is 100 mbps.

* It requires base band signals.

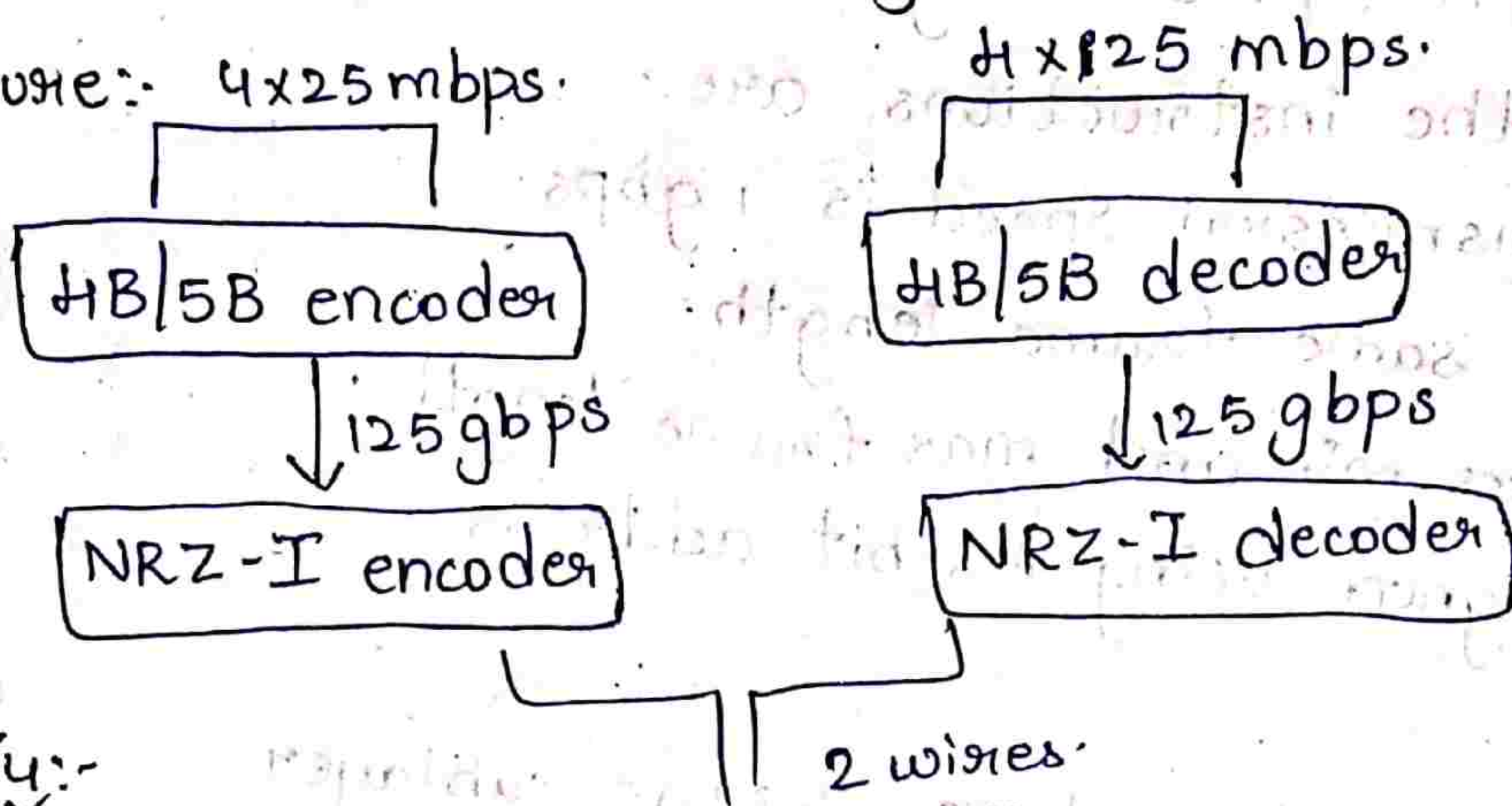
* It contains fibre optical cables.

* It contains 2 wires.

* It contain 4B/5B block encoding.

* It contain NRZ-I line encoding (Non-Return to zero-Inverse).

Architecture:- 4x25mbps.



100 base T4:-

* Data transmission speed is 100 mbps.

* It requires base band signals.

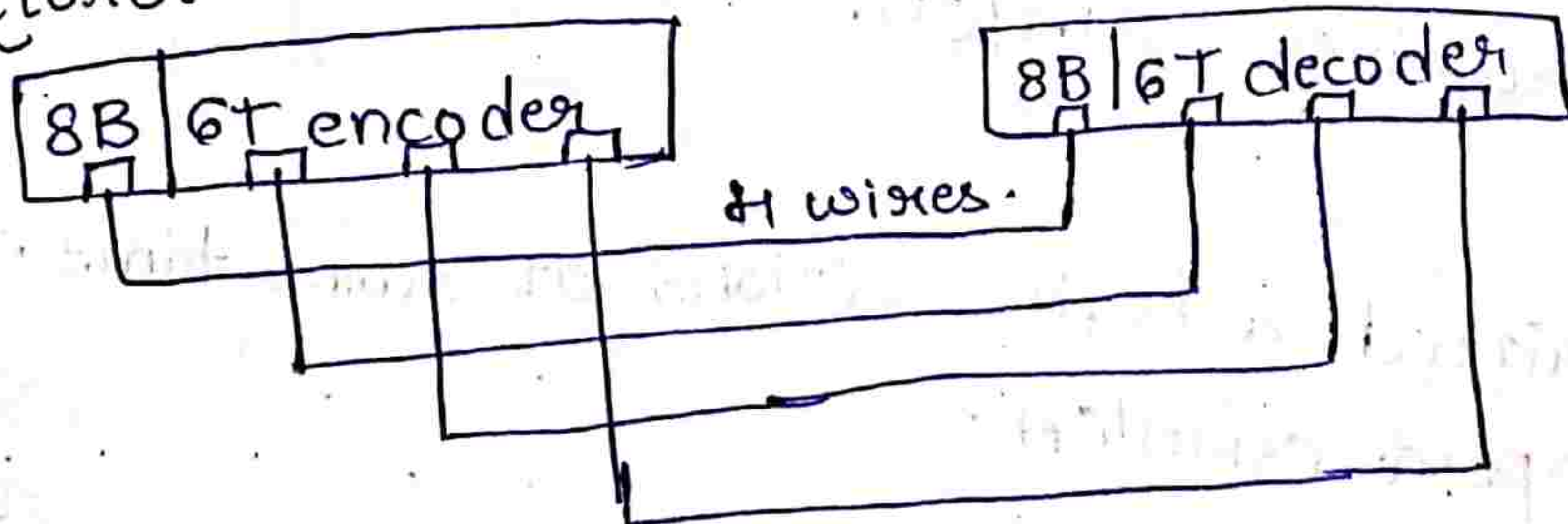
* It contains twisted pair cable.

* It contains 4 wires of category 3 UTP.

* It contains 8B/6T encoder (line encoding).

* It contains 4 wires.

Architecture:-



Difference b/w fast ethernet:-

Characteristics	100 Base Tx.	100 Base Fx.	100 Base T4
Media.	5 UTP using 2 wires.	It contains 2 wires and using fibre optic cable	It contains 4 wires and category 3 of UTP

Cable length	100m	100m	100 m
Block encoding	4B/5B	4B/5B	8B/6T
Line encoding	MLT-3	NRZ-I	

Gigabit ethernet:-

* Data transmission is high data rate.

* Transmission speed is 1 gbps.

* It follows the instructions are:-

1) Data transmission speed is 1 gbps.

2) It requires same frame length.

3) It requires min and max frame length.

4) It is designed using 48-bit address.

Functions:-

* We have 2 functions here:-
1. MAC sublayer
2. Physical layer.

MAC sublayer:-

* It handles half-duplex and full-duplex.

Half-duplex:-

* Data is transmitted in both the directions but not at same time.

* Half duplex requires CSMA/CD.

Full-duplex:-

* Data transmitted in both directions at same time.

* It can't support CSMA/CA.

* It requires hub.

Physical layer:- Data can be transmitted topologies and implementation.

Types of topologies:-

1. Point-to-point

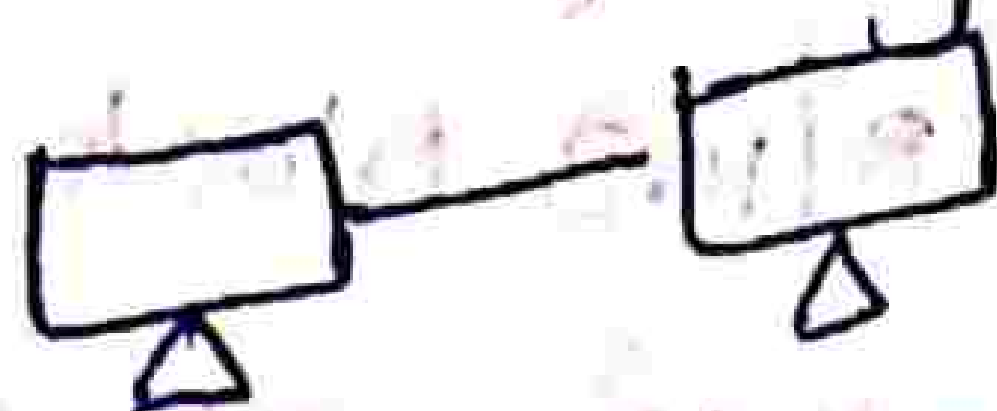
2. Star.

3. Two-Star.

4. Hierarchical star.

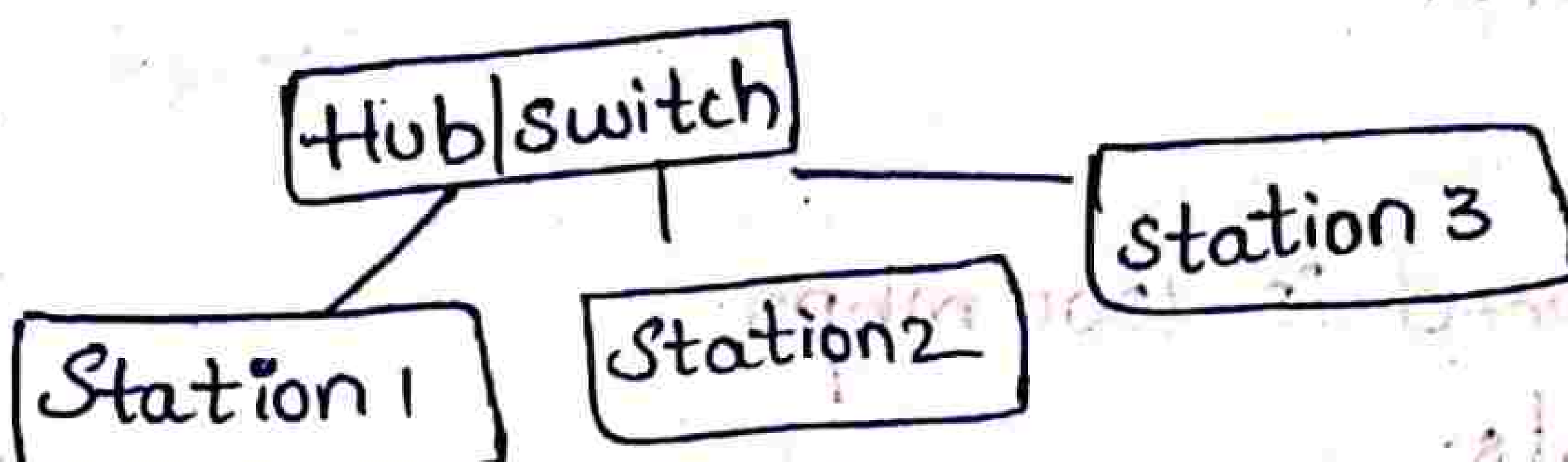
Point-to-point: It is having 1 sender and 1 receiver.

Architecture:

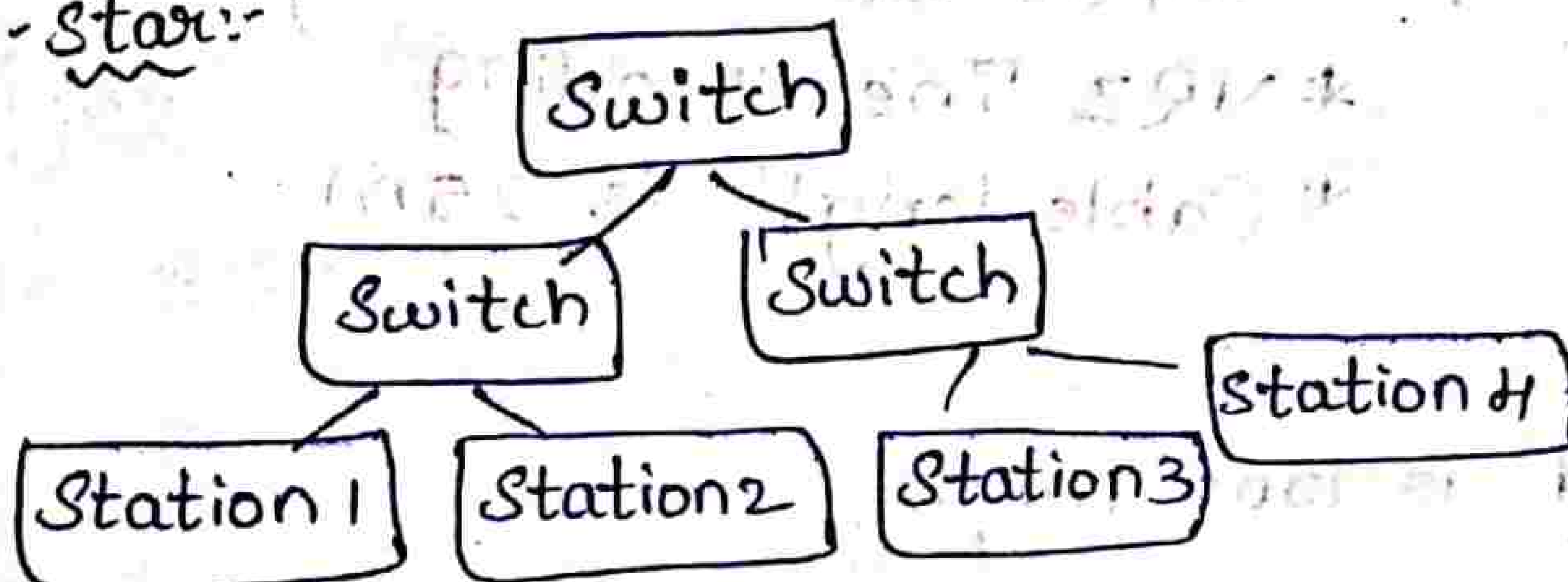


Star: All the stations connected to central device "Hub".

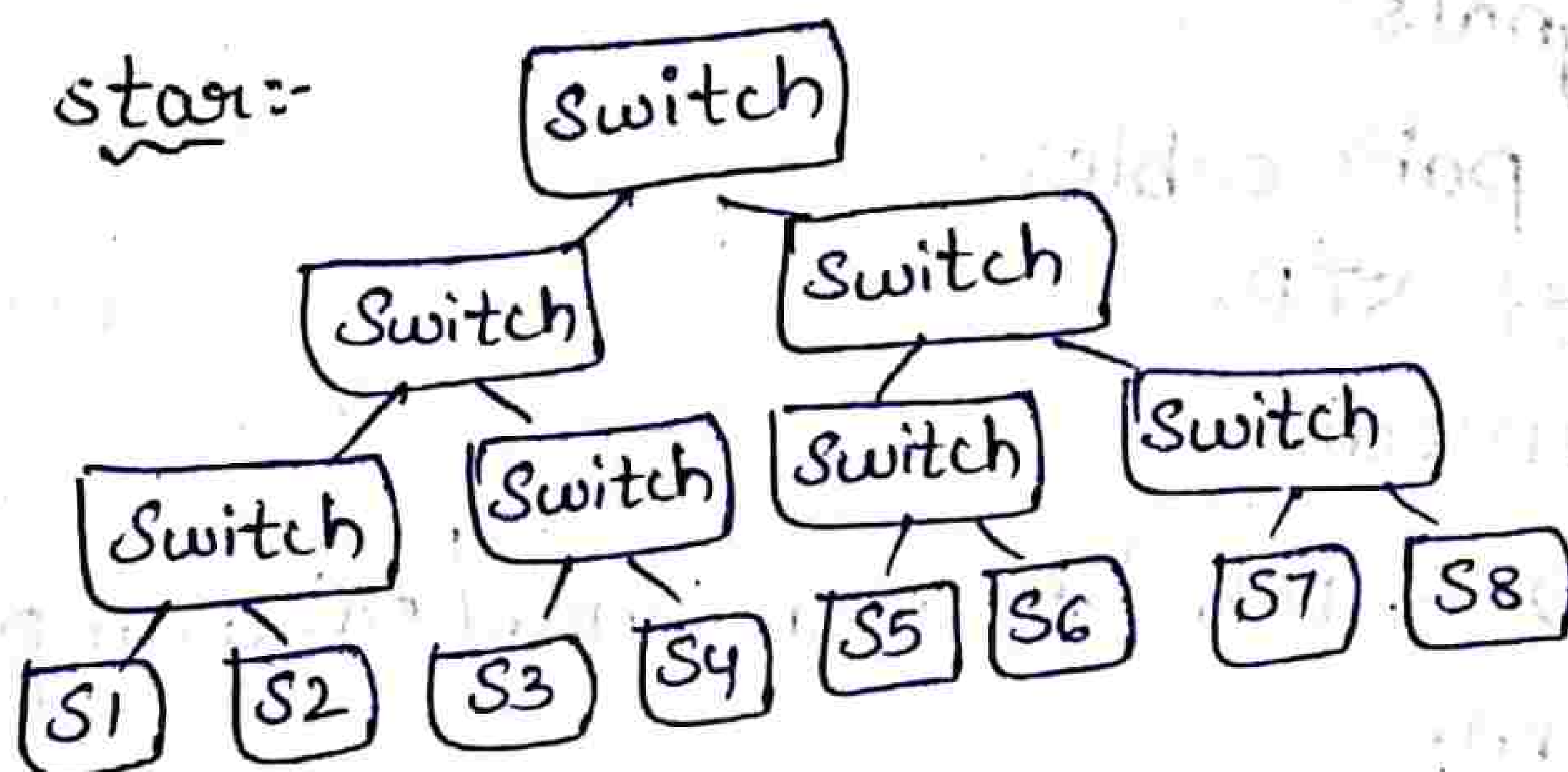
Architecture:



Two-star:

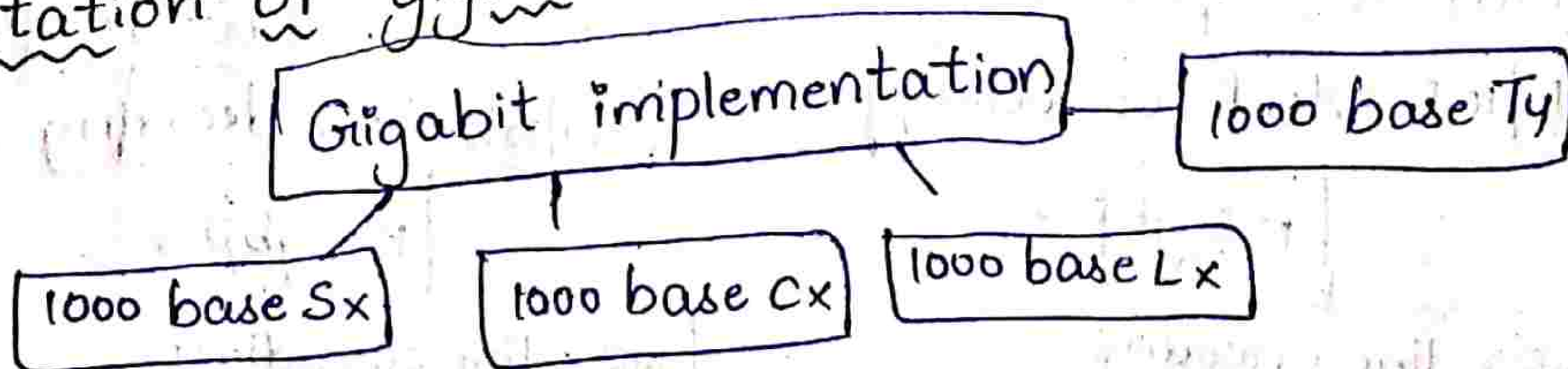


Hierarchical star:



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Implementation of gigabit:



1000 base Sx:

- * Data transmission speed is 1000 mbps.
- * It requires base band signals (digital signals)
- * Here ; S_x means short wave signals.
- * Here using 2 wires of STP (Shielded twisted pair cable)
- * Here using 8B/10B block encoding.

* Cable length is 550m.

* It contain NRZ line encoding.

1000 Base Lx:- * Data transmission speed is 1000 mbps.

* Base band signals required (digital signals).

* Lx means long wave signals.

* It use 2 wires of STP.

* Cable length is 5000m.

1000 Base Cx:-

* Data transmission speed is 1000 mbps.

* Uses baseband signals.

* Cx means copper wire.

* Contains 2 wires of STP.

* 8B/10B block encoding

* NRZ line encoding

* 8B/10B block encoding

* NRZ line encoding

* Cable length is 25m

1000 Base T4:-

* Data transmission speed is 1000 mbps.

* Uses baseband signals.

* T4 means twisted pair cables.

* Contains 4 wires of STP.

* No using of block encoding.

* Line encoding is 4D-PAM5 [4 dimensional / pulse amplification category 5]

Architecture of 1000 Base Sx, 1000 Base Lx, 1000 Base Cx:-

8x125mbps

8B/10B block encoding

125 gbps

NRZ line encoding

8x125mbps

8B/10B block decoding

125 gbps

NRZ line decoding

2 wires of STP

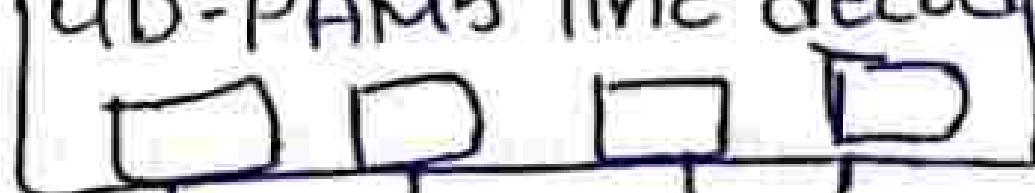
Architecture of 1000 base T4:-

4D-PAM5 line encoding



4 wires

4D-PAM5 line decoding



Difference b/w gigabit ethernet:-

Characteristics	1000 base Lx	1000 base Sx	1000 base Cx	1000 base Tx
Media	Contains long wave signals of 2 wires of STP	Contains short waves of 2 wires of STP.	Contains copper wires of 2 wires of STP.	Contains twisted pair cable of 4 wires
Cable length	5000m	550m	25m	100m.
No. of wires	2 wires	2 wires	2 wires	4 wires
Block encoding	8B/10B	8B/10B	8B/10B	-
Line encoding	NRZ	NRZ	NRZ	4D-PAM 5

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10 gigabit ethernet:-

- * The data transmission speed is 10gbps.
- * It requires baseband signals [digital signals].
- * ^{Instructions} ~~Functions~~ of 10 gigabit ethernet are:-
 1. The data transmission is 1gbps.
 2. It requires same frame length
 3. It requires min and max frame length.
 4. It is designed using 48-bit address.

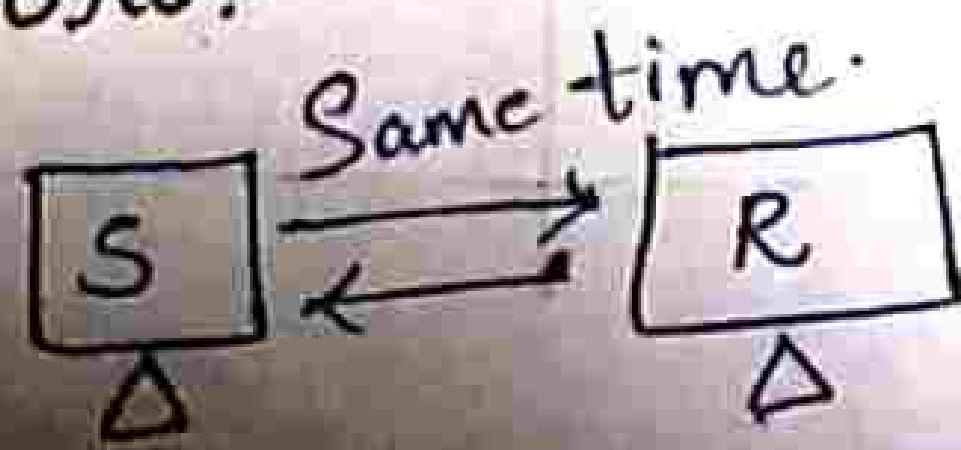
Functions:-

- * It defines only mac sublayer. There is no need of physical layer representation.

MAC sublayer:-

- * It can support only full duplex mode.
 - ↳ Data transmission in both directions. It occurs at same time

Architecture:-



Since all the cables are connected to switch. So, collision cannot be formed. It cannot CSMA/CD method.

Implementation of 10 gigabit ethernet:-

* It can implement 10G base S, 10G base L, 10G base E

10G base S:-

* The data transmission speed is 10 gbps.

* It requires baseband signals.

* It can generate short wave signals.

* Cable length is 300m.

10G base L:-

* Data transmission speed is 10 gbps.

* Requires baseband signals.

* Generate long wave signals.

* Cable length is 10km.

10G base E:-

* Data transmission speed is 10 gbps.

* Requires baseband signals.

* Generate extend signals.

* Cable length is 40km.

Difference b/w 10 gigabit ethernet:-

Characteristics	10G base S	10G base L	10G base E
Media	Short wave signals	Long wave signals	Extend signals
Cable length	300m	10km	40km