

Interfaces and Cables

⊕ Interfaces & Cable

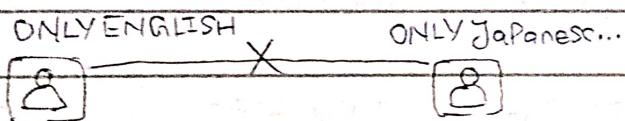
⊕ RJ-45 (RJ = Registered Jack)

⊕ Ethernet

↳ Ethernet is collection of network protocols/standards.

↳ for the purpose of this lesson, we will focus on types of cabling defined by Ethernet standards.

Why Do We Need Network Protocols/Standard?



⊕ Bits & Bytes

Connections b/w devices in a network are provided at a set speed these speeds are measured in bits per second

What is Bit?

- 0
- 1

• 1

• 0

• 0

• 1

• 1

• 1

→ What is Bytes?

8 bits = 1 Bytes

↳ speed is measured in bits per second

(Kbps, Mbps, Gbps, etc) not bytes per second

Data in ~~harddrive~~

↳ harddrive measured in bytes...

1 kibbit (kb) = 1,000 bits

1 megabit (Mb) = 1,000,000 bits

1 gigabit (Gb) = 1,000,000,000 bits

1 terabit (Tb) = 1,000,000,000,000 bits

④ Ethernet Standards.

↳ Define in the IEEE 802.3 standard in 1983

IEEE

↳ Institute of Electrical & Electronics Engineers

Ethernet standards (copper)

Speed	Common Name	IEEE Standard	Informal Name	Maximum length.
10 Mbps	Ethernet	802.3i	10 BASE-T	100m
100 Mbps	fast Ethernet	802.3u	100-BASE-T	100m
1Gbps	Gigabit Ethernet	802.3ab	1000BASE-T	100m
10 Gbps	10 Gig Ethernet	802.3an	10GBASE-T	100m

BASE = refers to baseband signaling

T = twisted pair

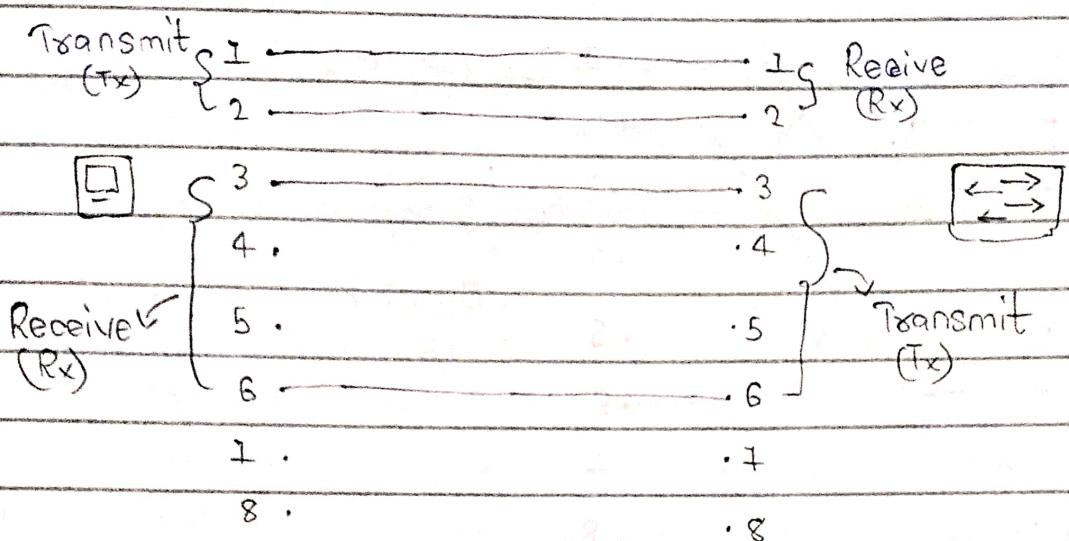
⑤ UTP Cables

Unshielded Twisted Pair

↳ Protects against EMI
(Electromagnetic Interference)

10BASE-T = 2 pairs (4 wires)

UTP Cables (10 BASE-T, 100 BASE-T)

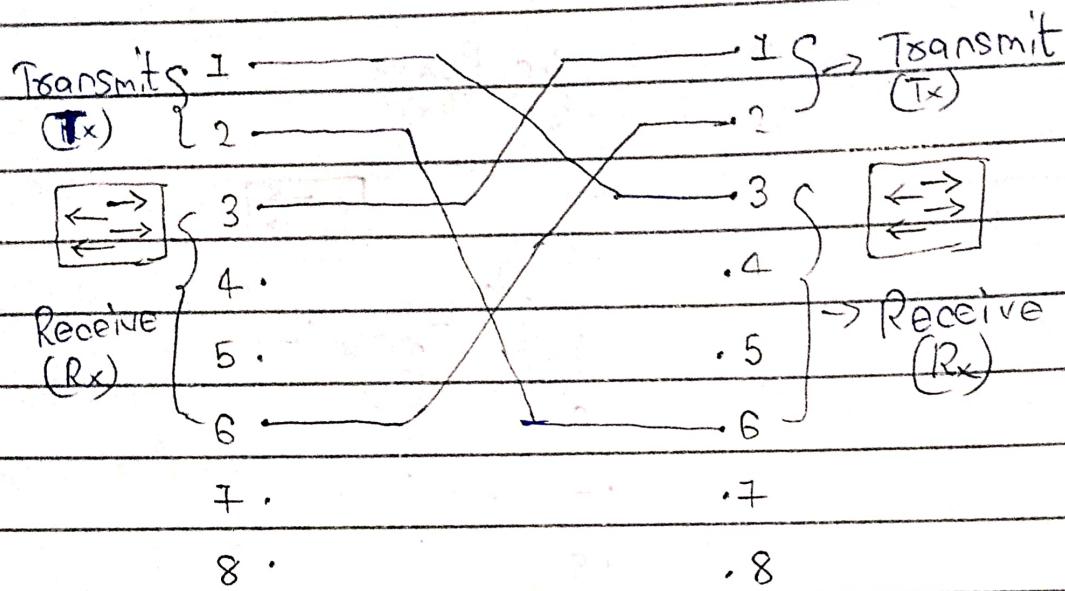


full-Duplex means both devices can send & Received data at the same time and no problem like collision were occurs. because they use separate wire for ~~send~~ & received data transmit

NOTE: If we remove PC on left side & consider a Router & Switch then Router Transmit Data through 1 & 2, And Received Data on 3 & 6 Similar like PC. & switch Received Data on 1 & 2 And transmit data on 3 & 6 These connection are also full-Duplex. And in straight-through cable means the connection will done like pin 1 to 1 & 3 to 3 these connection are straight & known as straight-through Cable.

When we try to connect two PC, Routers & Switch then straight-through cable are not use then we have to use crossover cable. & these are Done.

CROSSOVER-CABLE



the wires are crossed over each other
hence the name crossover-cable the transmit

Pin are one side are connected to the Received
Pin other side so two devices share the data
to each other with no problem.

NOTE:- If we try to connect two different devices
like PC to Router, Router to Switch
we can connect them by straight-through
cable & also by cross-over-cable but
we not connect two same devices like PC to PC
with straight-through cable.

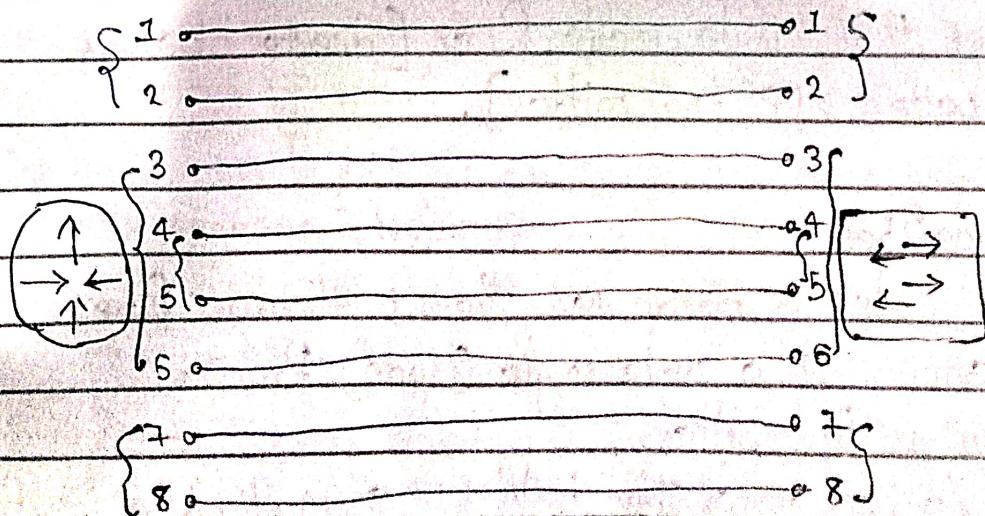
Device TYPES	Transmit (Tx) Pin	Receive (Rx) Pin
Router	1 ≠ 2	3 ≠ 6
firewall	1 ≠ 2	3 ≠ 6
PC	1 ≠ 2	3 ≠ 6
switch	3 ≠ 6	1 ≠ 2

④ Auto MDI-X

Now a day we have to not worry about about straight-through cable & crossovers-cable because we have Auto MDIX. it identify & is automatically detect with pi's age.

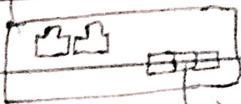
Auto MDI-X is a smart feature found in most modern computers, switches & routers. It helps the device automatically figure out which wires to use in a network cable & adjusts automatically so you can either type of cable.

⑤ UTP Cable (1000BASE-T, 10GBASE-T)



* Each pair is bidirectional.

④ Fiber-Optic Connections



known as SFP

SFP Transceiver

Small form-factor Pluggable

Connect fiber optic cables

Fiber-Optic cable

↳ Use two cable one for transmit & others for received

↳ There are two types of Optical fibers

① Single-mode

② Multimode

① Multimode fibers

↳ Core diameter is wider than single-mode fibers.

↳ Allows multiple angles (modes) of light wave to enter the fiberglass core.

↳ Allows longer cables than UTP, but shorter cables than single-mode fibers.

↳ Cheaper than single-mode fibers [due to cheaper LED-based SFP transmitters].

② Single Mode fibers

↳ Core diameter is narrower than multimode fibers.

↳ Light enters at a single angle (mode) from a laser-based transmitter.

↳ Allows longer cables than both UTP & Multimode fibers.

↳ More expensive than multimode fibers (due to more expensive laser-based SFP transmitters).

④ fiber optical cable standards

Informal Name	IEEE Standard	Speed	Cable Type	Maximum Length
1000 BASE-LX	802.3z	1Gbps	Multimode 8 Single-Mode	50cm (MM) 5km (SM)
10G BASE-SR	802.3ae	10Gbps	Multimode	400m
10G BASE-LR	802.3ae	10Gbps	Single-Mode	10km
10G BASE-ER	802.3ae	10Gbps	Single-Mode	30km

⑤ UTP vs fiber-optical cabling

UTP

- lower cost than fiber-optic.
- shorter maximum distance than fiber-optic [~100m]
- can be vulnerable to EMI (Electromagnetic Interference)
- RJ45 ports used with UTP are cheaper than SFP ports.
- emit (leak) a faint signal outside of the cable, which can be copied (= security risk)

fiber-optic

- Higher cost than UTP.
- longer maximum distance than UTP.
- No vulnerability to EMI
- SFP ports are more expensive than RJ45 ports (single-mode is more expensive than multimode)
- Does not emit any signal outside of the cable (= no security risk)