# RJ-45
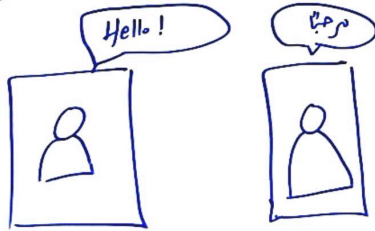
Registered Jack 45
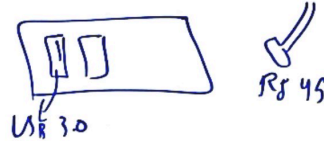
Physical [e.g Connectors]

Ethernet: a Collection of network Protocols / Standards

logical [e.g IP]

→ why do we need network Protocols



Hello!

¿¿¿

They can't understand each other



USB 3.0

RJ 45

⇒ Sorry Cable doesn't fit

Bit $\subset^0_1$      Byte $\Rightarrow$ Series of 8 bits

Speed is measured in Bits

GB = 8 GB
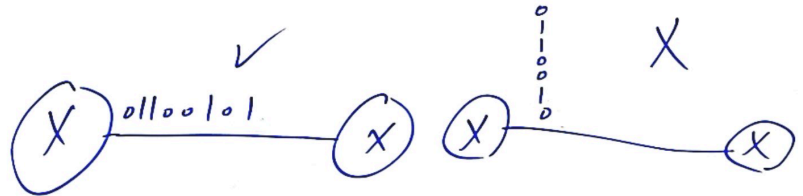
Giga Byte    Giga bit

1 kilo bit = 2,000 bits
1 Mb = 1,000,000 bits
1 Gb = 1,000,000,000 bits
1 Tb = 1,000,000,000,000 bits

$\checkmark$

(X) 0110010l ————— (X)  (X)———————(X)

0
1
0
0
1
0    X

[Ethernet   Standards

Defined in   IEEE   802.3  Standard in 1983

[Institute of Electrical and Electronics Engineers]

# Copper Standards

| Speed | Common Name | IFEE standard | Informal name | Maximum Length |
|---|---|---|---|---|
| 10 MbPS | Ethernet | 802.3i | speed (10) Base-T | 100 m |
| 100 MBPS | Fast Ethernet | 802.3u | 100 Base-T → Baseband Signaling | 100 m |
| 1 Gbps | Gigabit Ethernet | 802.3ab | 1000 Base (T) Twisted Pair Cabling | 100 m |
| 10 Gbps | 10 Gig Ethernet | 802.3an | 10G Base-T | 100 m |

Copper Cables => UTP Cables

Unshielded ← ↓↓ Twisted Pair
↳ Every 2 wires
are twisted together
to protect against EMI
# 4 Pairs

→ No metallic shield
→ Vulnerable to Electromagnetic
Interference

RJ-45 => 8 Pins

20 Base-T
200 Base-T = 2 Pairs = 4 wires

1000 Base-T
10G Base-T = 4 Pairs = 8 wires

Tx { 1 ———— 1 } Rx
2 ———— 2
(X) 2 ———— 3
3 ———— 4  [→/←]
Rx 4 · ———— 5
5 · ———— 6  Tx
6 · ———— 7
7 · ———— 8
8 ·
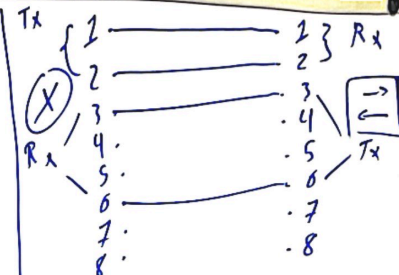
Strait through Cable
↳ each Pin number connect
to same Pin on the other
end

PC X Switch ✓
Switch X Router ✓
PC X PC    X

**20 Base     200 Base**

Transmit
Tx { 1 ———— 1 } Receive
2 ———— 2 } Rx
3 ———— 3 \
4 · · 4  [→/←]  Transmit
5 · · 5 /  Tx
6 ———— 6
7 · · 7
8 · · 8
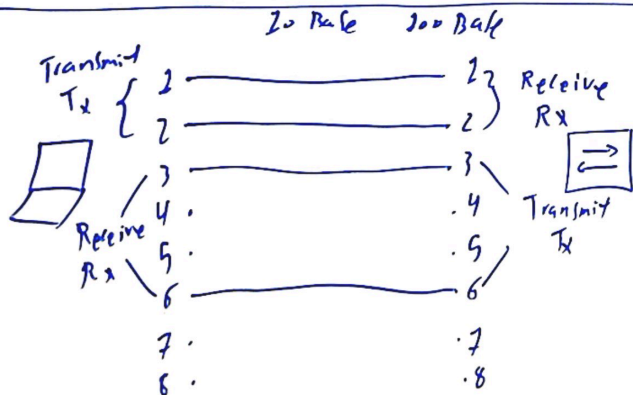
Receive
Rx

Full Duplex
↳ both devices
can send & Receive
at same time

04

Rx { 1
     2

Tx
3
4
5
6
7
8

1
2
3
4
5
6
7
8  } Rx

Tx
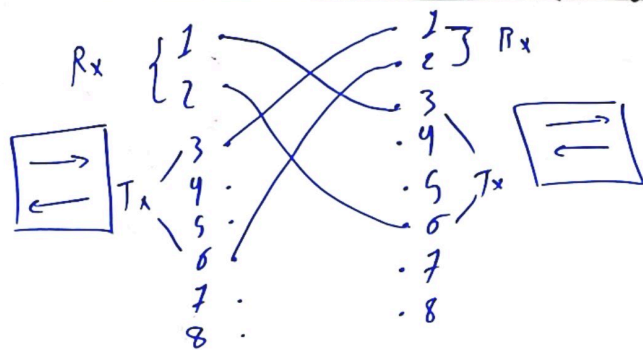
**Crossover Cable**
↳ The wires are crossed over

**Auto MDI-X**
↳ Allows devices to auto detect which pins their neighbouring devices transmit data in to then adjust which pins they can transmit or Receive data

| | Tx | Rx |
|---|---|---|
| X (crossed) | 1,2 | 3,6 |
| ≡ | 1,2 | 3,6 |
| ◹ | 1,2 | 3,6 |
| ⇄ (The only different) | 3,6 | 1,2 |

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1000 Base-T    10 GB Base-T

Each Pair is Bidirectional

Pairs are :
1,2 ⟹ Send & Receive
3,6
4,5
7,8

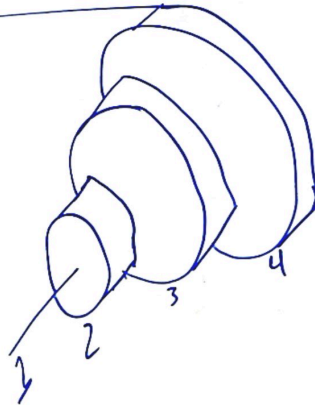---

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# Fiber optic Connections

## SFP Transceiver : Connect fiber optic Cables

Small Form-factor Pluggable

* Fiber optic Send Light over Glass fiber

* there are 2 Connectors on each end

Transmit ↘ ↖ Receive
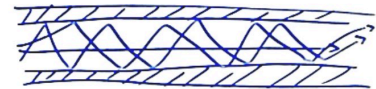
Tx                    Rx
(X)━━━━━━━━━━(X)
Rx                    Tx
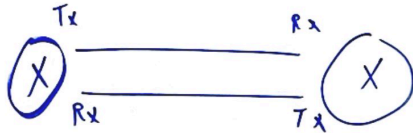
1. Fiber Glass Core itself
2. Cladding to reflect light
3. Protective buffer
4. outer Jacket of the Cable

### Single mode

multi mode

Multi mode
* Core diameter is wider
* Allows multiple angles (modes) of Light

* UTP < Multi mode < Single mode
 ↳ In terms of maximum length

* Cheaper than (Single mode) => laser based
 ↳ LED-based SFP transmitters

| Speed | Cable Type | IEEE Standard | Informal Name | Maximum Length |
|-------|-----------|---------------|---------------|----------------|
| 1 Gbps | Single/Multi | 802.3z | 1000 Base-LX | 550 m Multi<br>5 km Single |
| 10 Gbps | Multi | 802.3ae | 10 G Base-SR | 400 m |
| 10 Gbps | Single | 802.3ae | 10 GBase-LR | 20 km |
| 10 Gbps | Single | 802.3ae | 10 G Base-ER | 30 km |

On the back of the switch you see this:

10/100/1000 Base-T Ports (3-24) — Ports are Auto-MDIX

↳ accepts 10 Base-T, 100 Base-T, 1000 Base-T
↳ RJ-45 only
↳ 24 Ports
↳ Can be connected straight forward even with another switch

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