

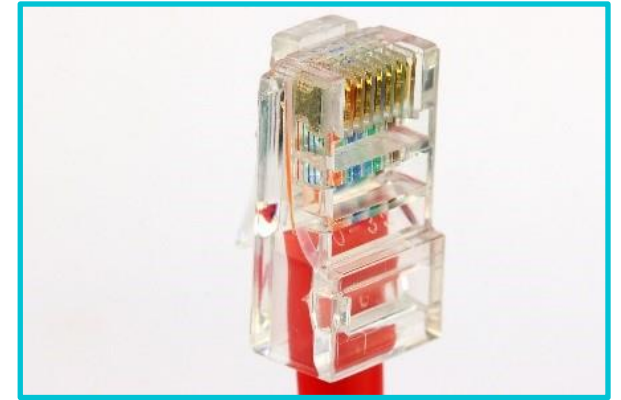
Networking

Copper Cables

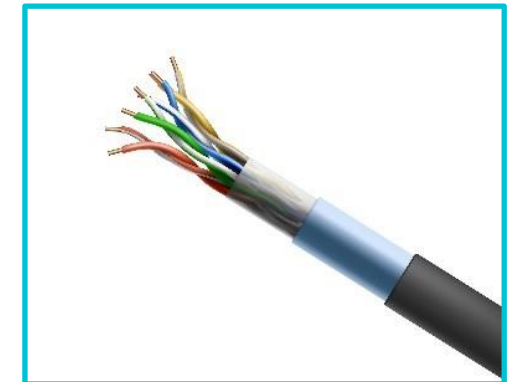


Twisted Pairs

- One of the most common copper cables is the **twisted pair** cable
 - AKA ethernet cables
 - There are 8 colored copper cables inside that are twisted to help reject outside electromagnetic interference
 - Four-color pairs (green, blue, brown, orange), each having a solid color wire and a striped wire (with white).
 - When used with networking, these twisted pair cables commonly use the RJ45 connectors.



RJ45 Connector



Inside of a twisted pair cable



Types of Twisted Pair Cables

- A twisted pair with a shield is known as an **STP** (shielded twisted pair) while an unshielded is a **UTP** (unshielded twisted pair)
 - The shields in the STP wires are there to also help against electromagnetic interference, they are often a thin piece of foil or a wire that is braided



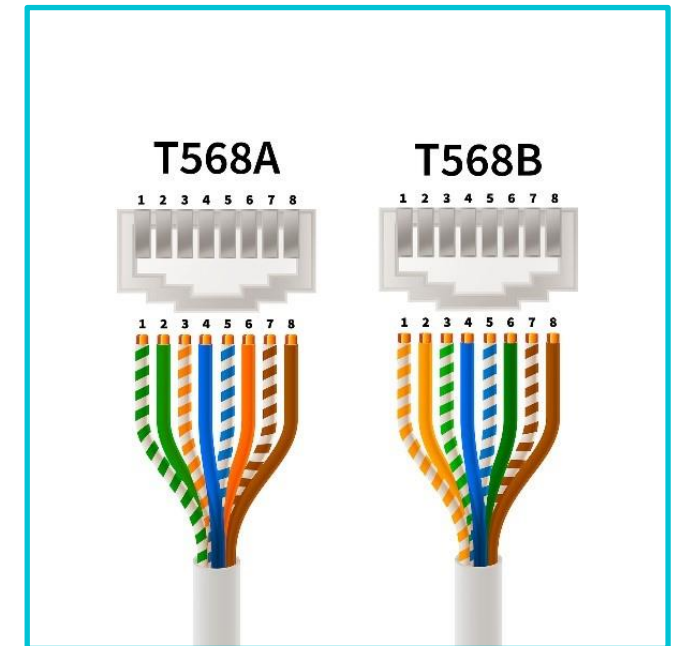
Cable Specifications

Cable Category	Shielding	Frequency	Maximum Length	Transmission Speed
Cat 5	No	100 MHz	100 meters	0.1 Gbps
Cat5e	No	100 MHz	100 meters	1 Gbps
Cat 6	Sometimes	250 MHz	100 meters	1 Gbps
Cat 6A	Sometimes	500 MHz	100 meters	10 Gbps
Cat 7	Yes	600 MHz	100 meters	10 Gbps
Cat 8	Yes	2 GHz	30 meters	40 Gbps



Twisted Pairs Wiring Standards

Pins	T568A	T568A (abbreviated)	T568B	T568B (Abbreviated)
Pin 1	Striped Green	g	Striped Orange	o
Pin 2	Solid Green	G	Solid Orange	O
Pin 3	Striped Orange	o	Striped Green	g
Pin 4	Solid Blue	B	Solid Blue	B
Pin 5	Striped Blue	b	Striped Blue	b
Pin 6	Solid Orange	O	Solid Green	G
Pin 7	Striped Brown	b	Striped Brown	b
Pin 8	Solid Brown	B	Solid Brown	B



Straight-Through and Crossover Cables

- A **straight-through** connects two different devices
 - Most common ethernet cable
 - Examples
 - PC connected directly to router
 - Gaming console connected directly to router
 - Same wiring standard on both ends of cable
- A **crossover cable** connects two of the same device
 - Forms unique network between two devices
 - Different wiring standard on opposite ends of cable



Copper Ethernet Standards

Standard	Founded	Speed	Distance	Cable
10BASE-T	1990	10 Mbps	100 meters	CAT 3
100BASE-TX	1995	100 Mbps	100 meters	CAT 5, 5e, 6
1000BASE-T	1999	1 Gbps	100 meters	CAT 5
10GBASE-T	2006	10 Gbps	100 meters	CAT 5e, 6, 6A, 7
40GBASE-T	2016	40 Gbps	30 meters	CAT 8



Coaxial and Twinaxial Cables

- A **coaxial cable** is used in households to deliver cable internet and television
 - Commonly have one copper core wire that is surrounded by insulators and other shields
 - RG-59 and RG-6 are the two most common ratings of coaxial cables
 - RG-59 is used for shorter distances and is cheaper since the core is slightly smaller
 - RG-6 has a bigger core and is used for longer distances
- **Twinaxial Cables** have two cores for faster data transmission
 - Commonly found in data centers to help transmit the data more quickly in and out of the center
 - Not as fast as fiber optics
 - Significantly cheaper and can be used for quick, short distance transmissions



Coaxial Connectors

