GRADE 12- CSS 4

HOW TO MAKE A NETWORK CABLE

LESSON # 3.1

MS. LESLIE ARRIO, LPT

NETWORKING CABLE

Networking cable are crucial for reliable, efficient and secure data transmission.

- Technical Importance - enable fast data transfer rates, minimizes data transmission delays, and provides stable, consistent connection.
- Practical Importance - Links devices, provides lag free gaming, enables smooth, high definition playback.

REVIEW:

What are the common Networking Cable we already discuss?

NETWORKING CABLE

COAXIAL CABLE

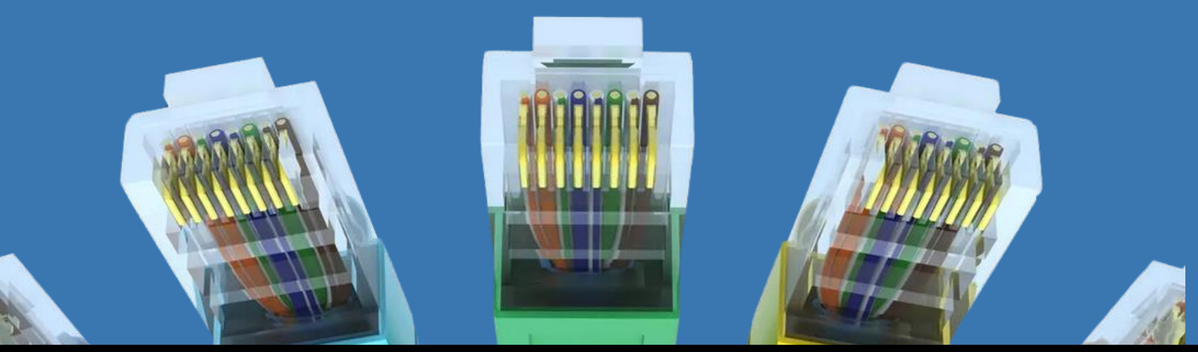
FIBER-OPTIC CABLE

ETHERNET CABLE

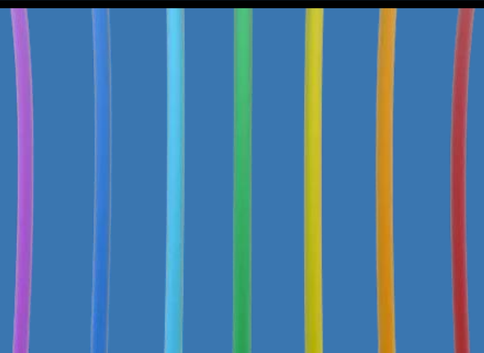
LEARNING OBJECTIVES:

At the end of the discussion, students should be able to:

1. Understand the basics of Ethernet, Coaxial, and fiber optics cables and their importance in networking
2. Identify the Ethernet Cable categories (Cat5e, Cat6, Cat7)
3. Demonstrate and Understand the cable creation and standards.



BASICS OF NETWORKING CABLE



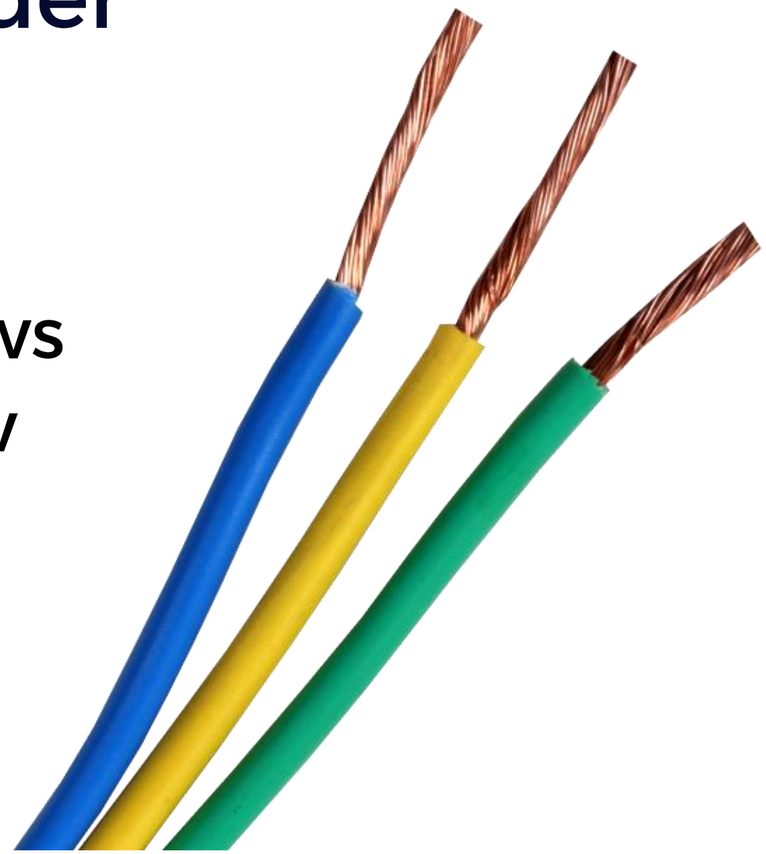
What is the difference between wires and cables?

WIRES AND CABLES

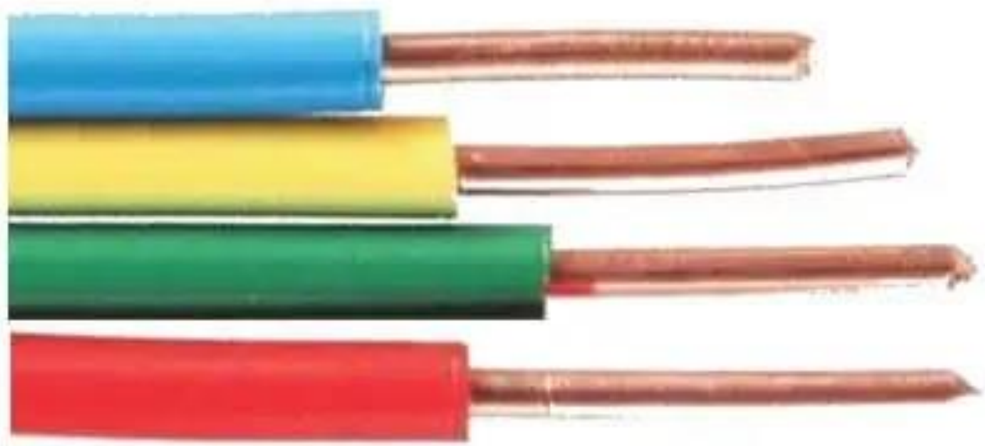
A wire is a single conductor a slender flexible strand or rod of metal.

material that allows electricity to flow through it

example:
Aluminum, Copper, Silver



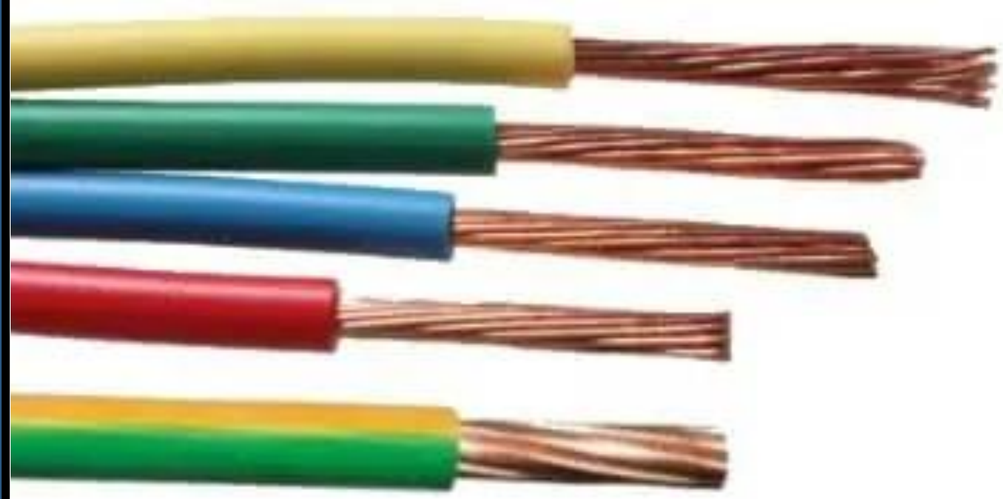
SOLID WIRE



Solid Wires

cables are better electrical conductors than stranded wire cables, and they provide superior, stable electrical characteristics over a wider range of frequencies. They’re also considered more rugged and less likely to be affected by vibration or susceptible to corrosion

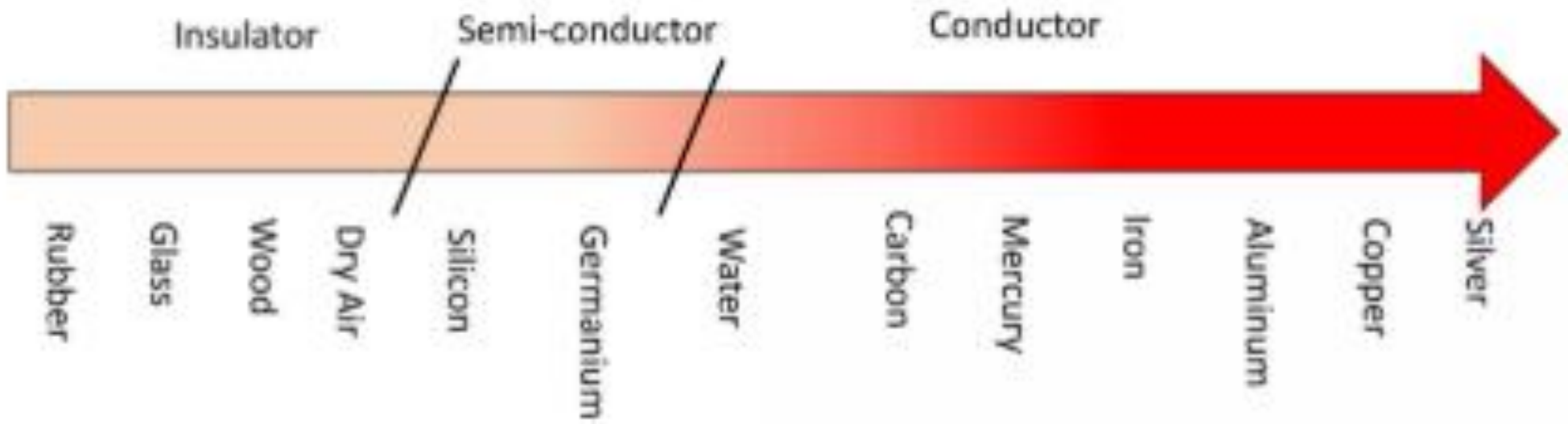
STRANDED WIRES



Stranded Wires

stranded cables are more flexible and can withstand bending, they make excellent patch cords for equipment connections and cross-connects where cables are frequently bent and manipulated

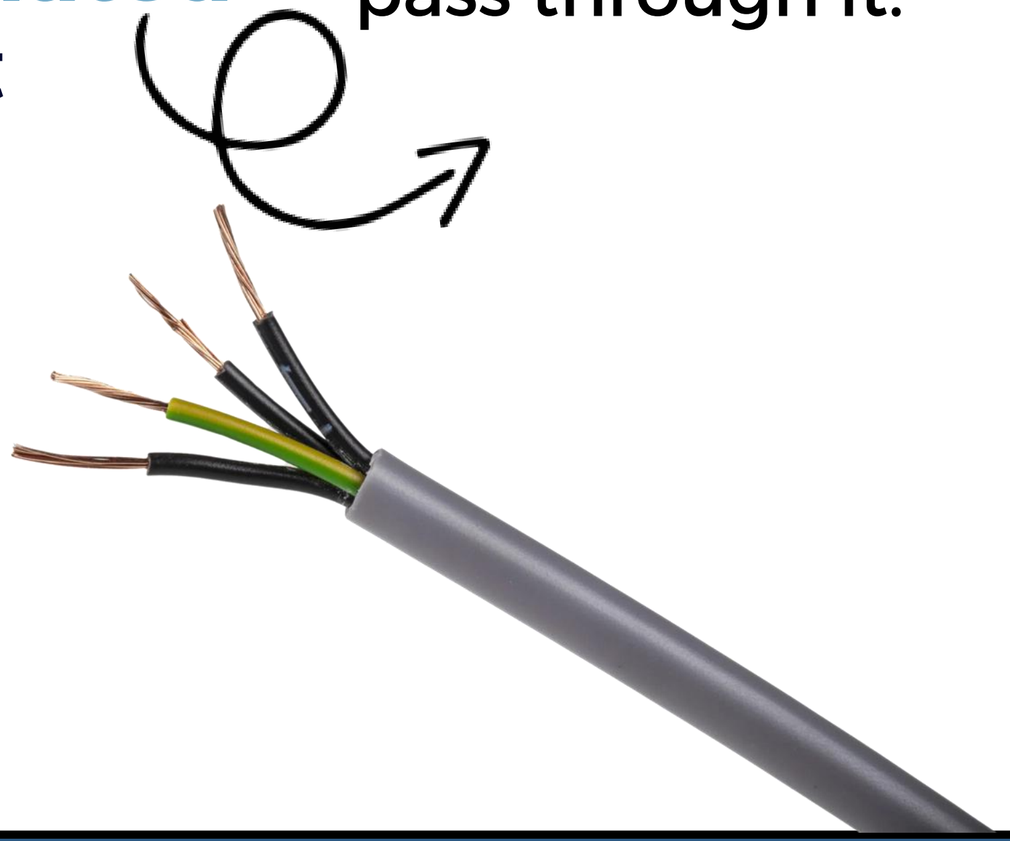
Increasing Conductivity Ability



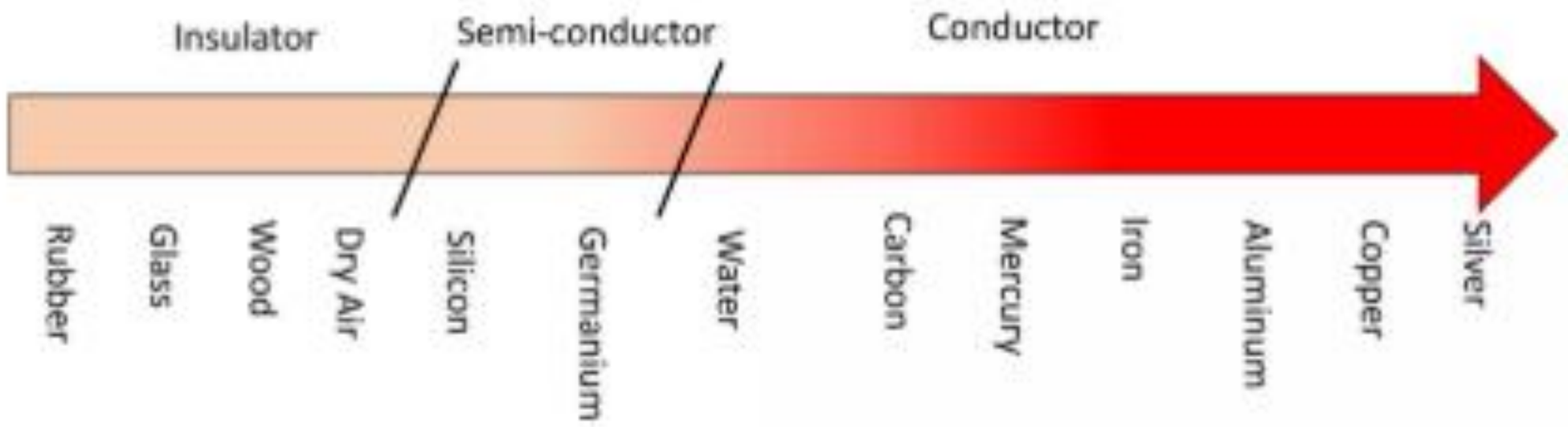
CABLES

material which does not easily allow heat and/or electricity to pass through it.

Cables are two or more **insulated** wires wrapped in one jacket



Increasing Conductivity Ability



CABLES

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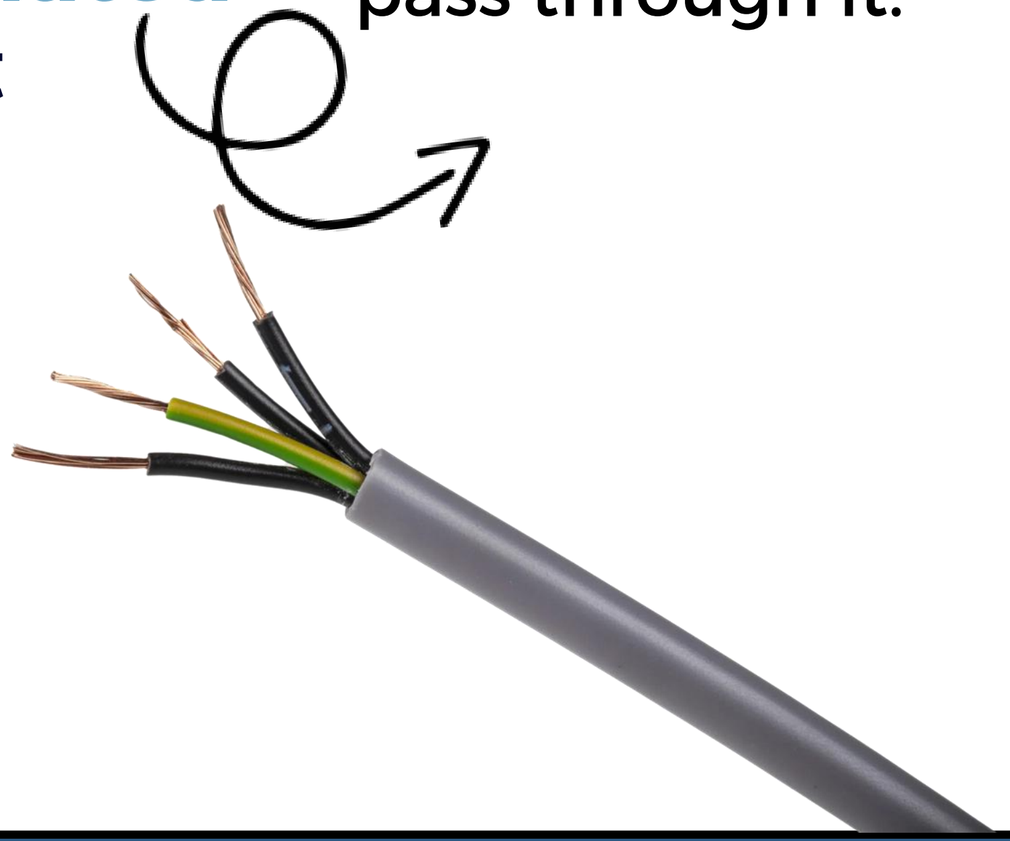
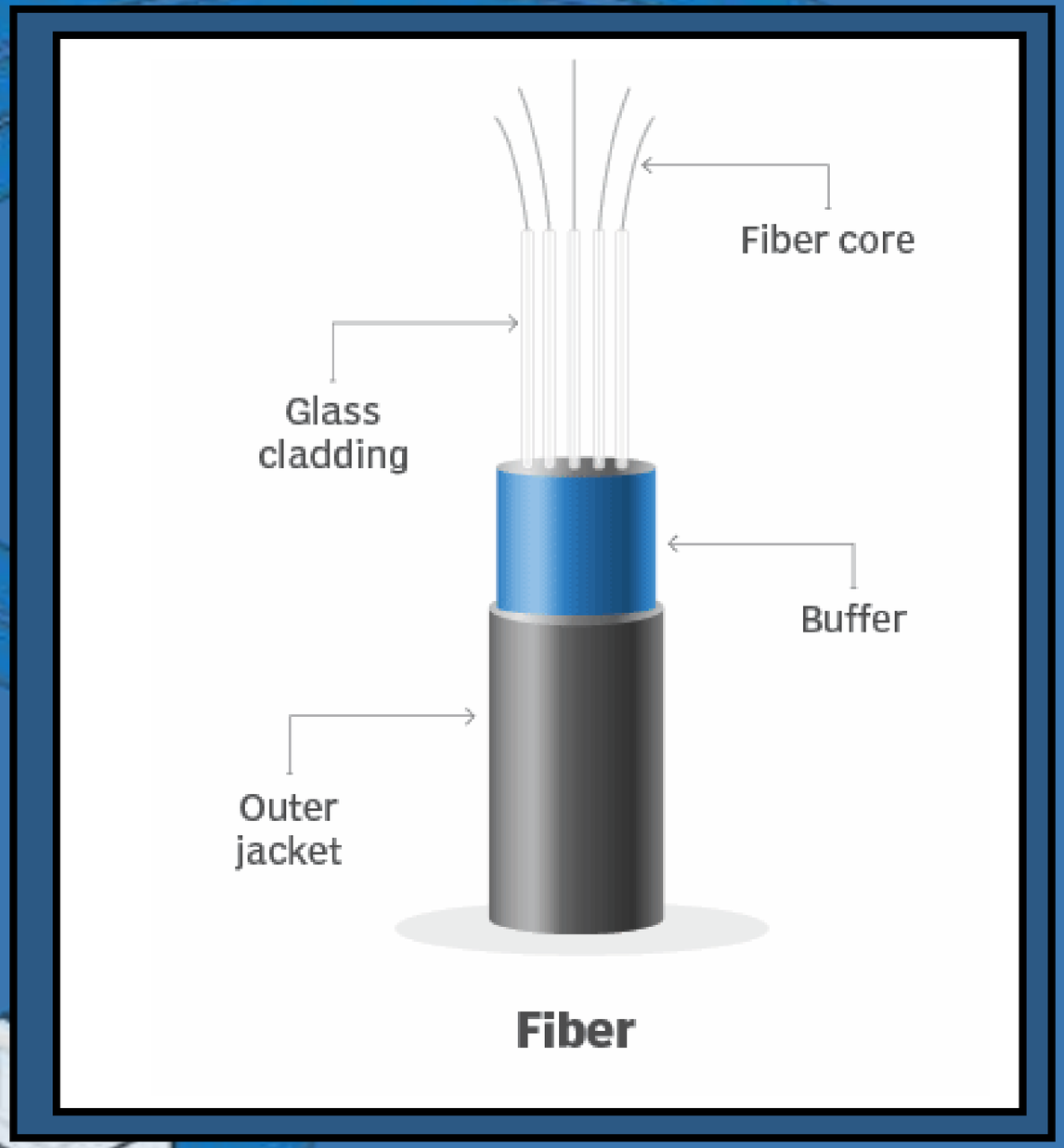


examples:

Fiber Optic
Coaxial Cable
Ethernet Cable

Coaxial



Fiber

COAXIAL CABLE TYPES

75 Ohm are mostly used for video signals.

50 Ohm cables tend to be used for data and wireless communications.

Ohm refers to the impedance, which is the measure of resistance in the cable to the flow of electrical energy.

COAXIAL CABLE TYPES

1. **RF coaxial cables** are used to carry radio frequency signals.

COAXIAL CABLE TYPES

2. Radio Guide, RG-6 coaxial cables have larger conductors, so they provide better signal quality. It has thicker dielectric insulation and are made with a different kind of shielding, allowing to handle GHz level signals more effectively. As this type of cable is thin, it can also be easily installed in walls or ceilings.

COAXIAL CABLE TYPES

2. RG-59 coaxial cable

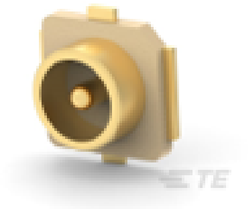
good choice for short runs and low-frequency transmissions.

3. RG-11 coaxial cables

it offers a lower attenuation level than RG-6 or RG-59, meaning it can carry data for longer distances.

COAXIAL CONNECTORS

also known as RF connectors, components designed as primary functions include terminating cables, connecting devices to power supplies, and joining cables together while maintaining the cable's shielding integrity. These connectors are crucial for preserving signal quality

CONNECTION STYLE	DESCRIPTION	COMMONLY USED TO
7/16 Connectors 	Durability and reliability in outdoor and high-moisture settings.	• Radio base stations • Broadcasting equipment • Used to help maintain consistent signal quality in varying weather condition.
FME connectors, an acronym for "For Mobile Equipment" 	These miniature connectors offer a reliable solution for mobile and portable devices.	• Cellular antennas and boosters • GPS devices and antennas • Wireless modems and routers • Portable radio equipment
Ultra miniature Coax connector (UMCC) 	Used for frequency signals up to 6 GHz in extremely small scale environments – for example, laptop circuit boards and embedded circuitry.	• Make connections to GPS • Connect to Wi-Fi antennas

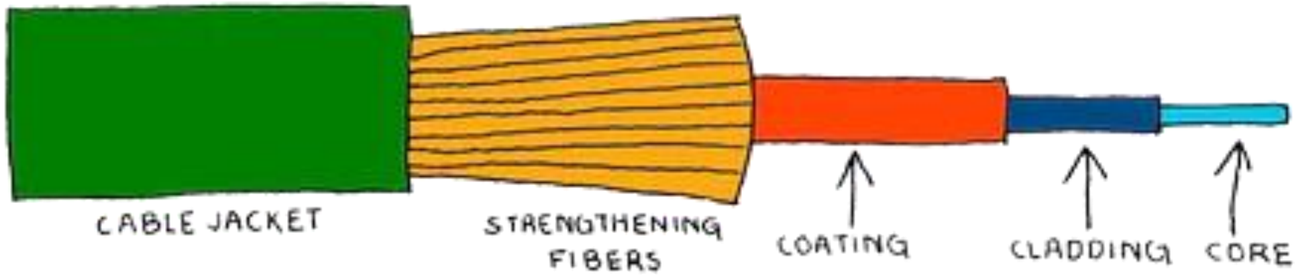
F CONNECTORS

are particularly compatible with RG6 and RG59 coaxial cables.

Male

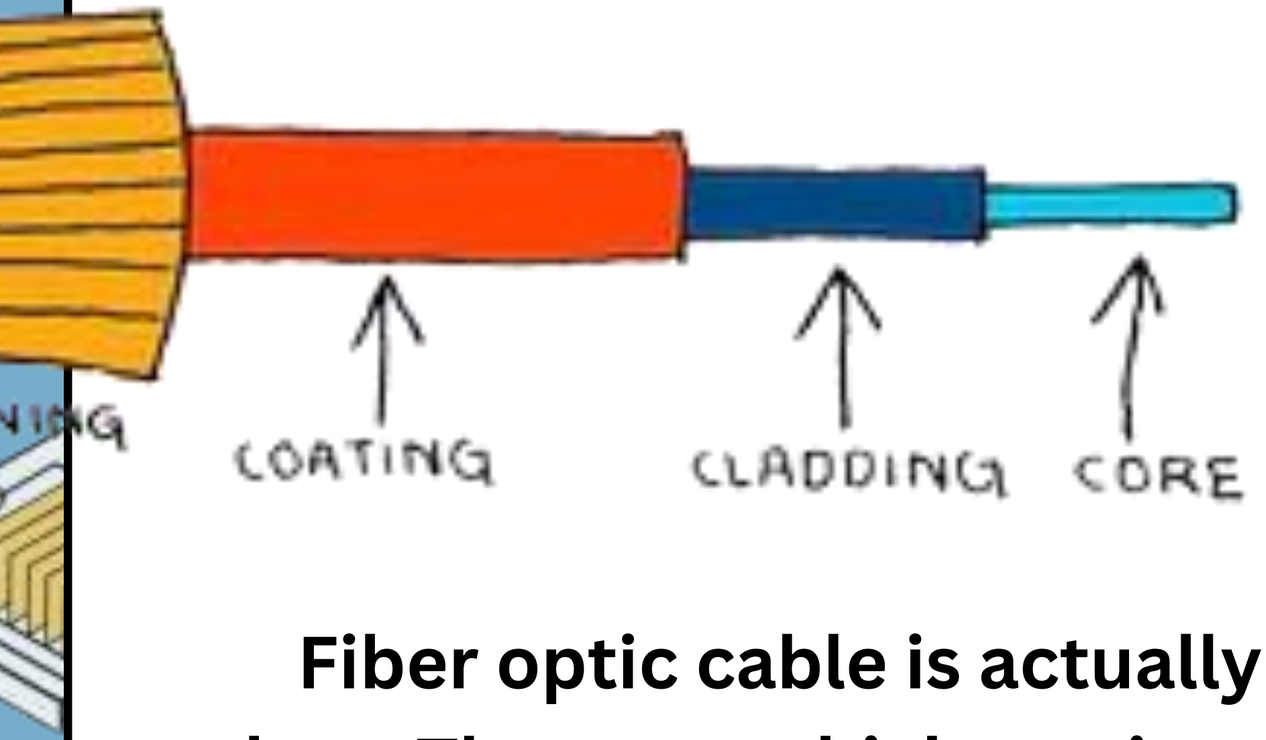
Female

FIBER OPTICS



Fastest internet/ data transmission that carry long distance

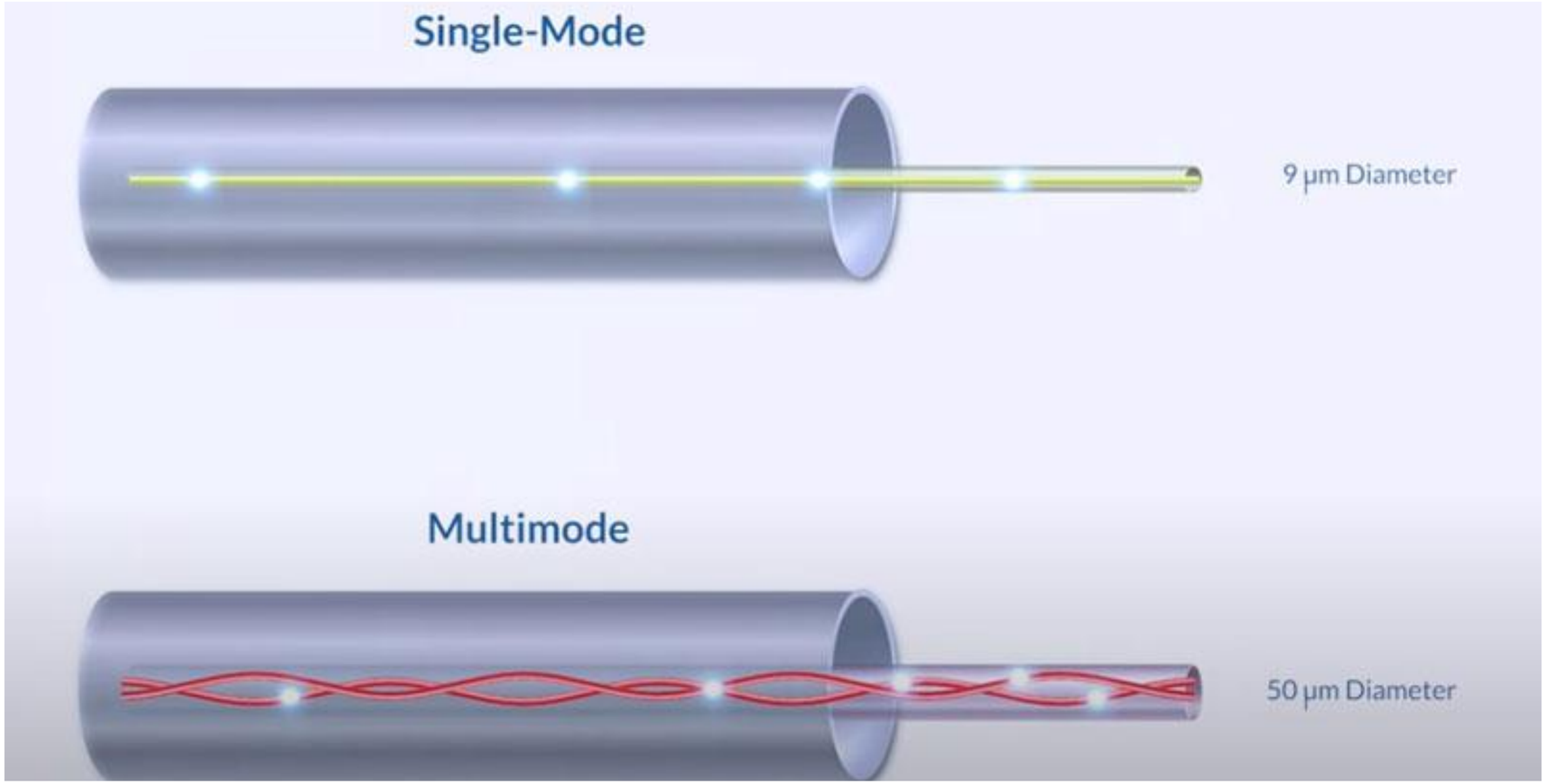
FIBER OPTICS



It uses a principle known as total internal reflection.

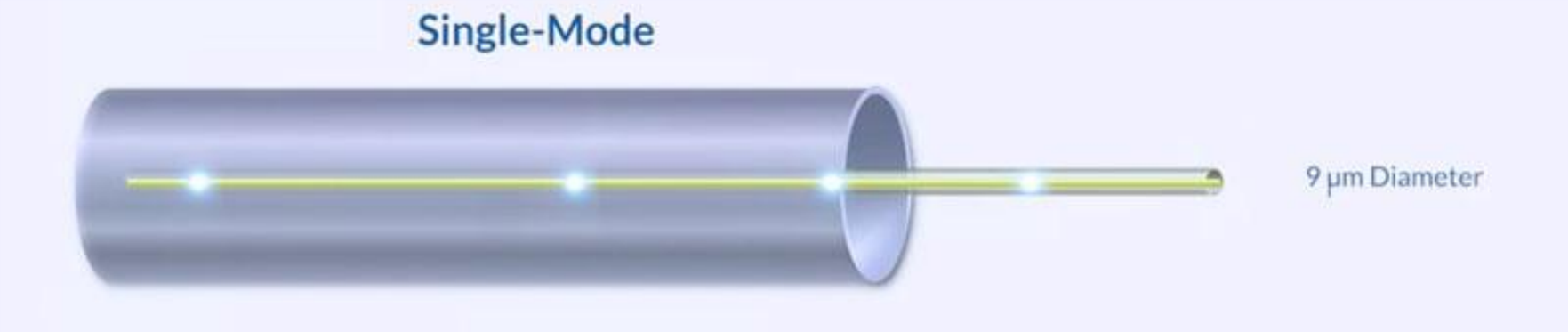
Fiber optic cable is actually composed of two layers of glass: The core, which carries the actual light signal, and the cladding, which is a layer of glass surrounding the core.

TYPES OF FIBER OPTIC CABLES



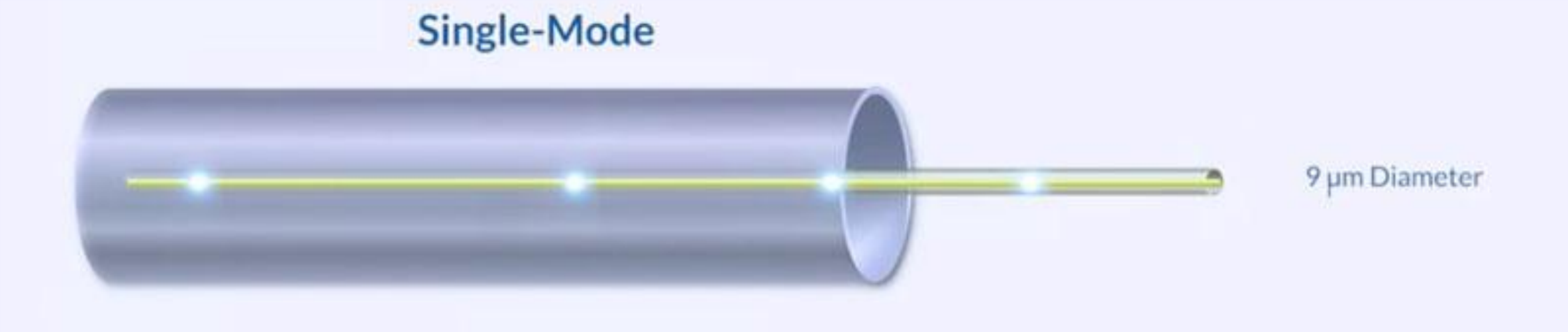
SINGLE MODE-FIBER

Single mode fiber also has high bandwidth. It is optimal for network-intensive activities such as VoIP, streaming movies, and high-capacity file transfers. This is because of the low attenuation (i.e., signal loss)



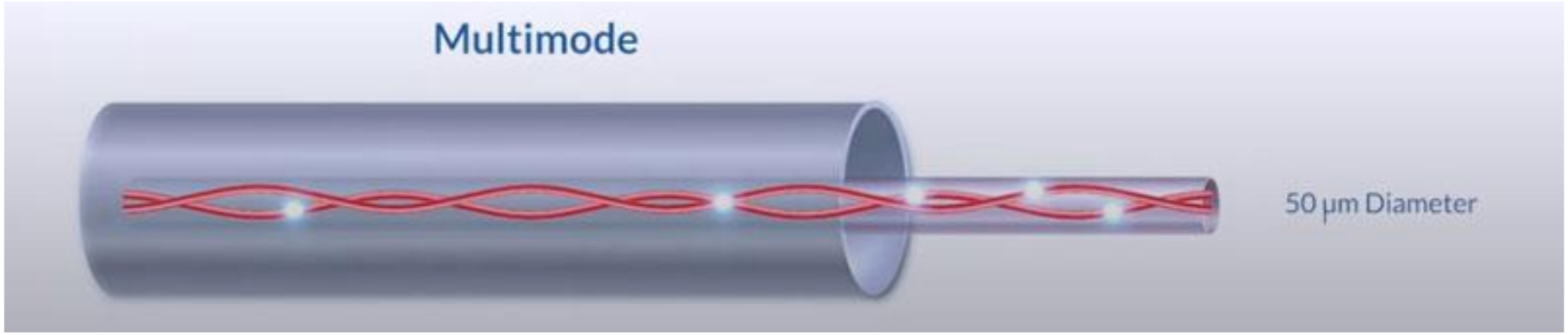
SINGLE MODE-FIBER

The hallmark feature of single mode fiber is its core size. Single mode fiber has a far smaller core size compared to multimode fiber, measuring in at only 8 to 10 micrometers. The minuscule diameter reduces signal loss, which facilitates long-distance communication.



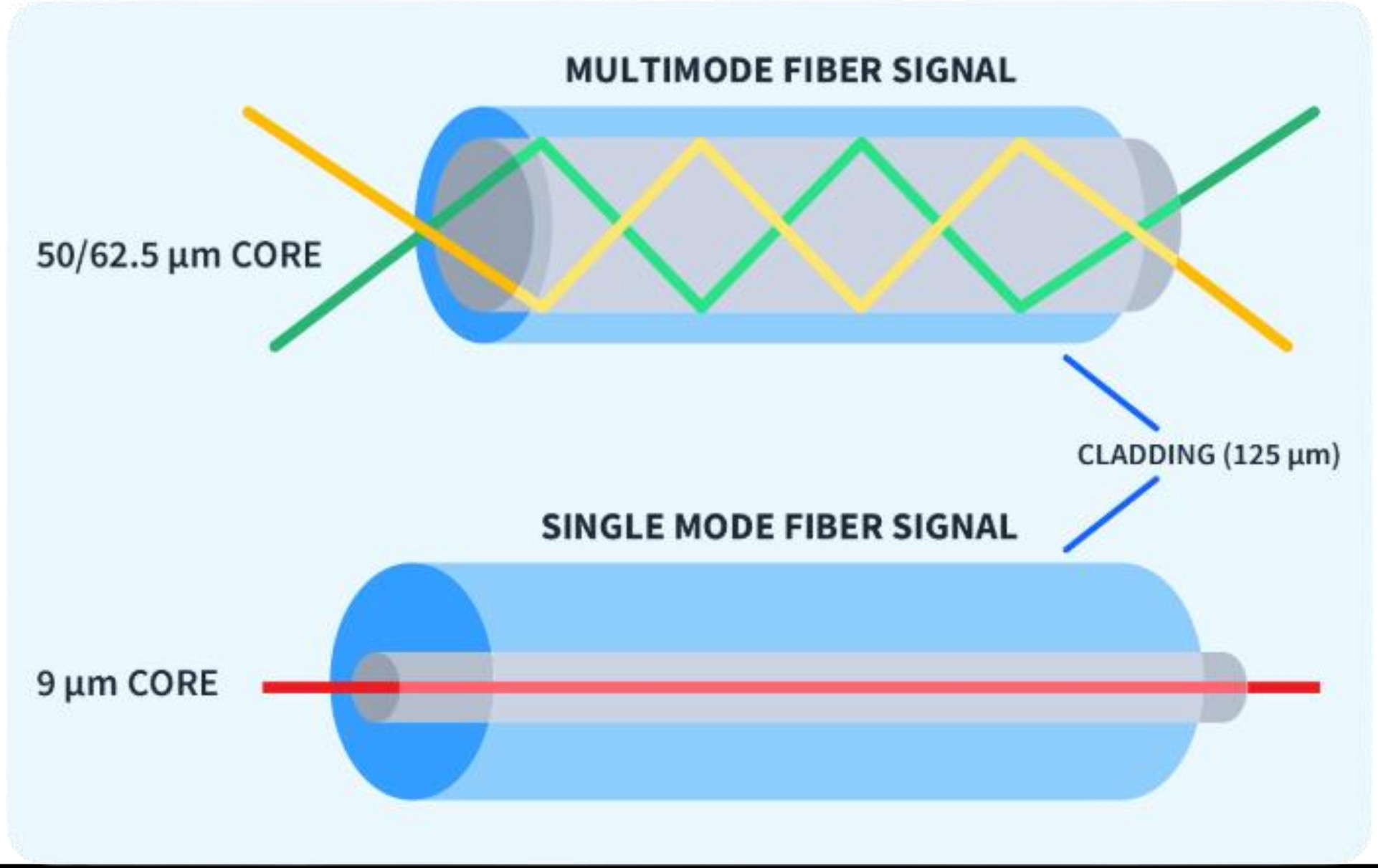
MULTI MODE-FIBER

Multimodes fiber optics allows multiple streams of light to travel simultaneously. This hallmark characteristic provides high bandwidth for small to medium distances. Multimodes are ideal for LANs due to their low cost, relatively simple setup, and high bandwidth.



TYPES OF MULTI MODE FIBER

Parameter	OM1	OM2	OM3	OM4
Core Diameter	62.5 micrometers	50 micrometers	50 micrometers	50 micrometers
Bandwidth	200 MHz·km	500 MHz·km	2000 MHz·km	4700 MHz·km
Max Data Rate	1 Gbps	1 Gbps	10 Gbps	10 Gbps
Max Distance	275 Meters	550 Meters	550 Meters	1000 Meters


MULTIMODE FIBER SIGNAL
50/62.5 µm CORE
CLADDING (125 µm)
SINGLE MODE FIBER SIGNAL
9 µm CORE

FIBER OPTIC CABLE SPLICE

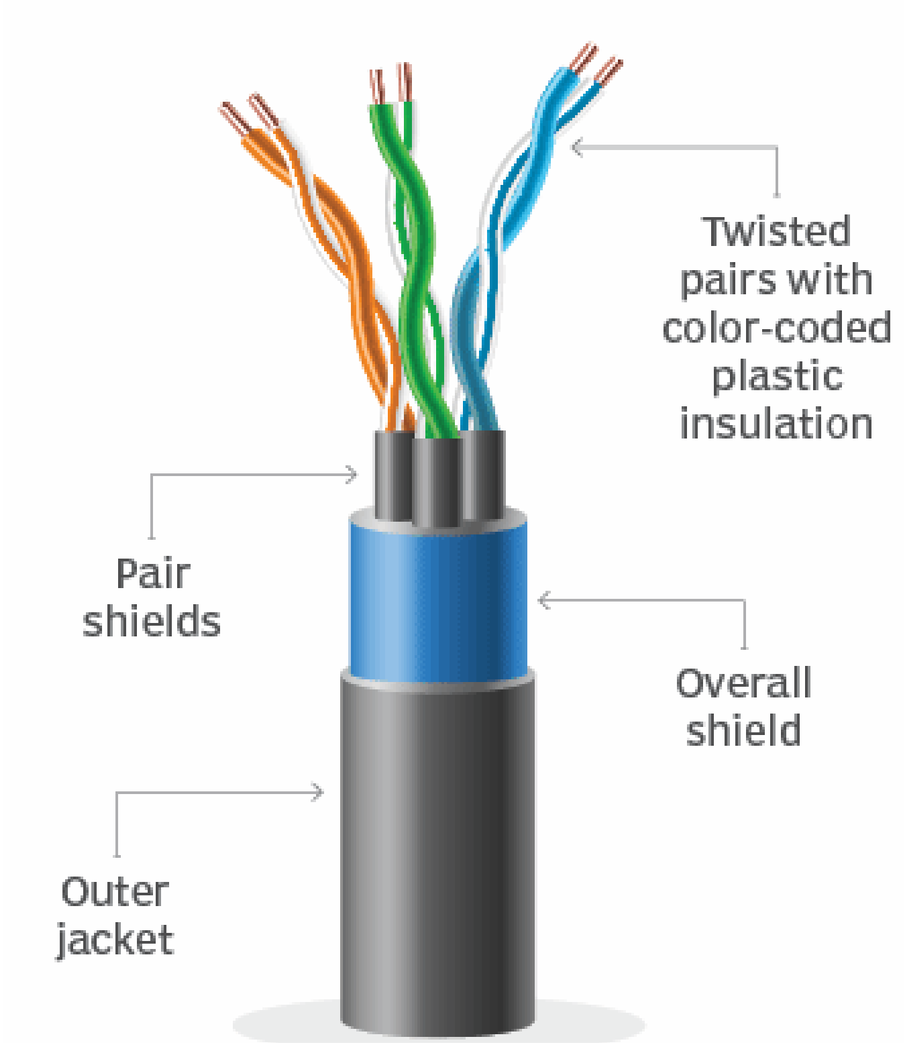
3 hole stripper tool

FIBER OPTIC CABLE SPLICE

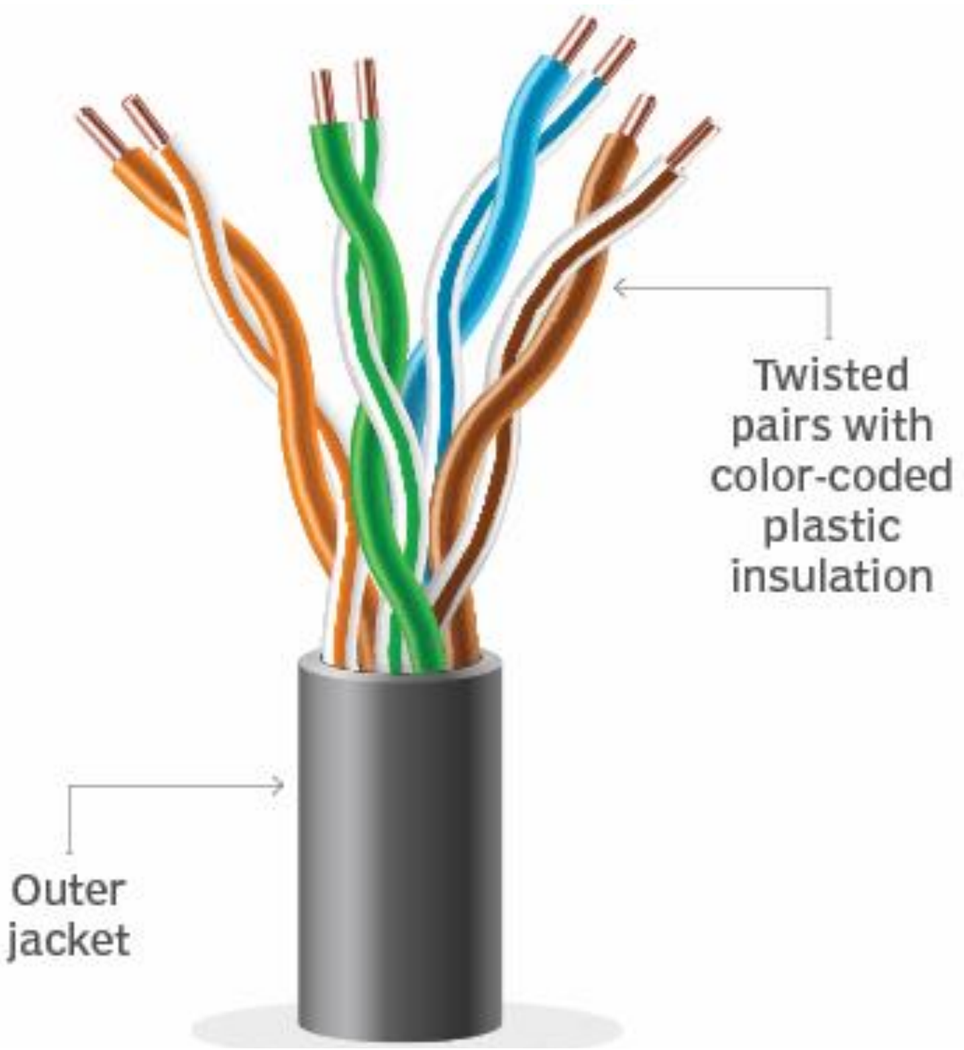
FIBER OPTIC CLEVER

TWISTED PAIR CABLING COMES IN TWO TYPES

shielded twisted pair (STP)

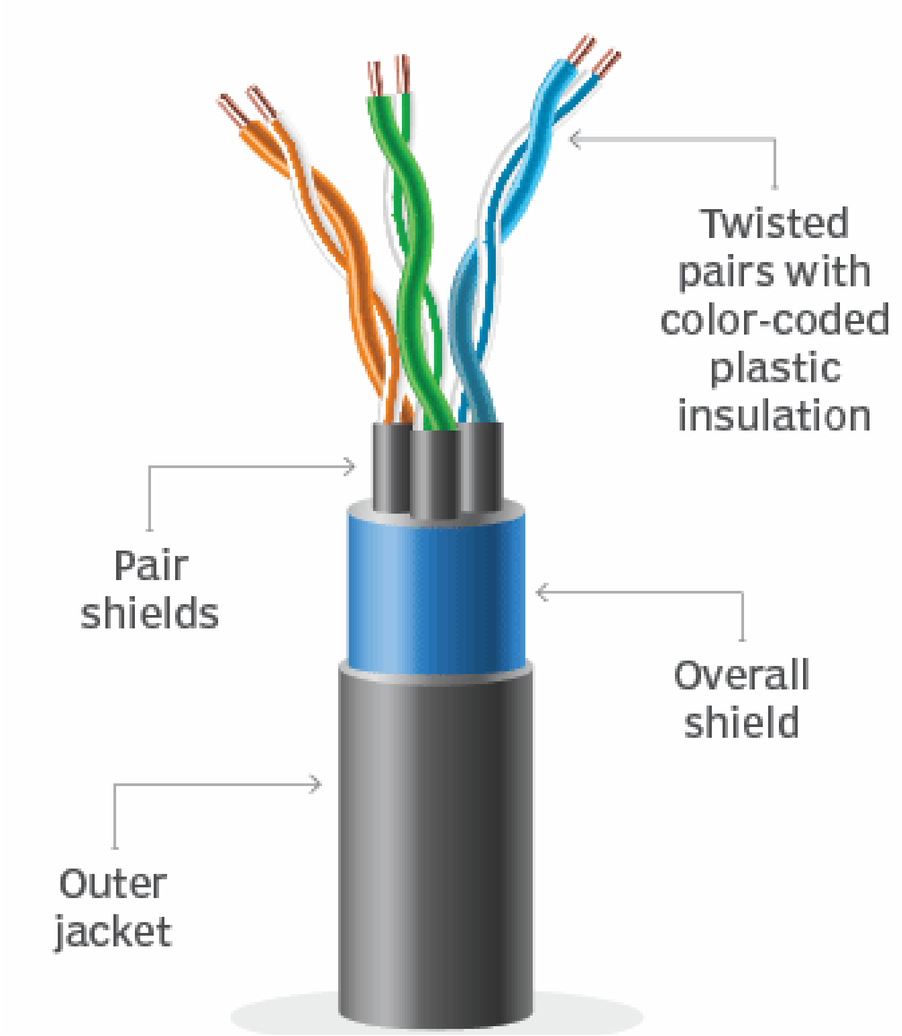


unshielded twisted pair (USTP)



TWISTED PAIR CABLING COMES IN TWO TYPES

shielded twisted pair (STP)



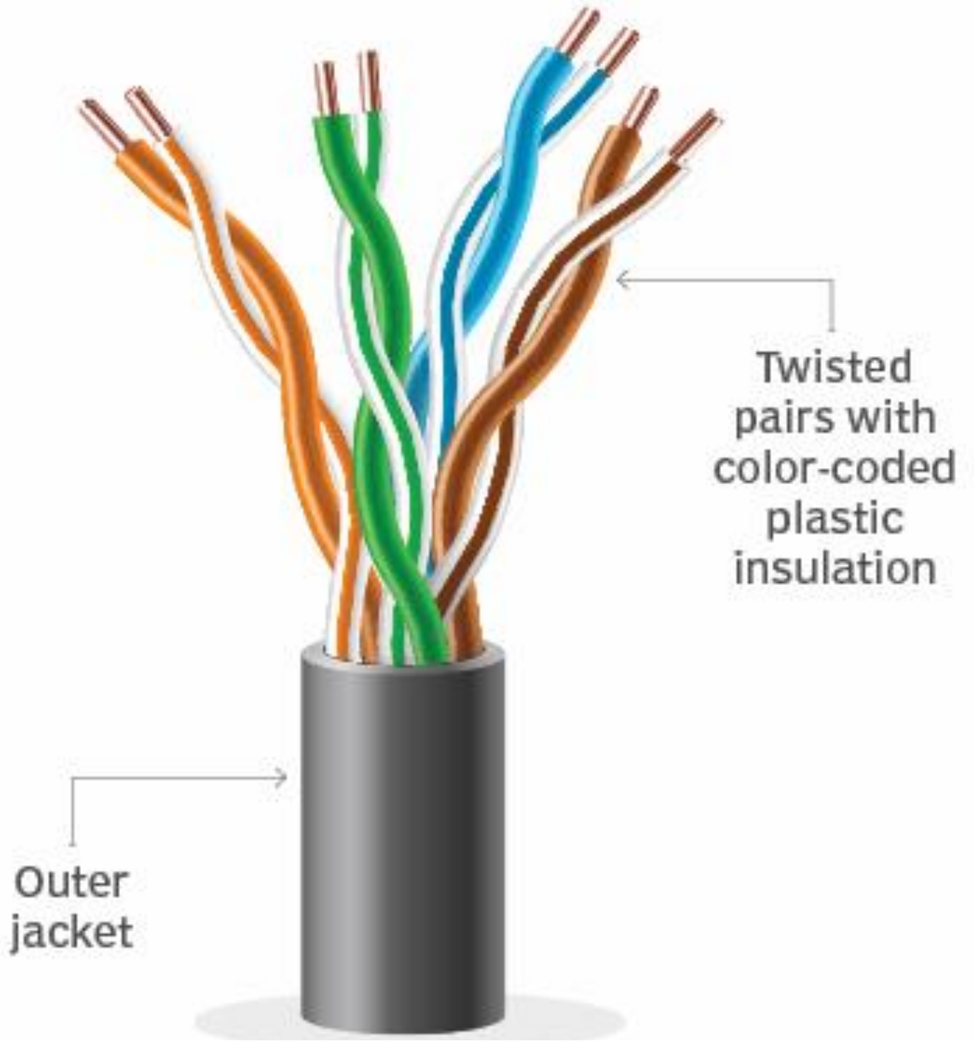
This is known as foil twisted pair (FTP).

- The shield grounds the wires to reduce frequency interference.
- STP cables are more expensive and harder to install than UTP cables, but they're better at preventing signal interference. STP cables are often used in environments where electrical noise is a concern.

TWISTED PAIR CABLING COMES IN TWO TYPES

- UTP cables are made up of pairs of insulated wires that are twisted together to reduce interference.
- UTP cable is a type of copper cable that's most common used for networking since it is low cost and ease of installation.

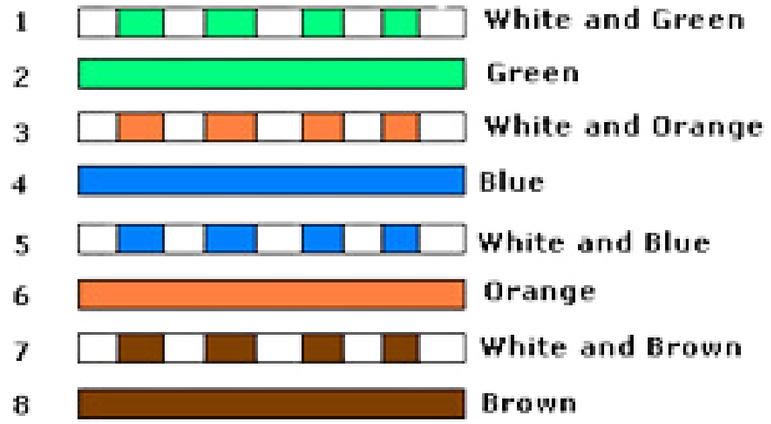
unshielded twisted pair (STP)



CATEGORIES OF TWISTED-PAIR CABLES

The **American National Standards Institute (ANSI)**, **Telecommunications Industry Association (TIA)** and the **International Electrotechnical Commission (EIA)**, part of the **International Organization for Standardization**, established a series of standards, or categories, for twisted pair.

TIA/EIA 568A Wiring



TIA/EIA 568B Wiring

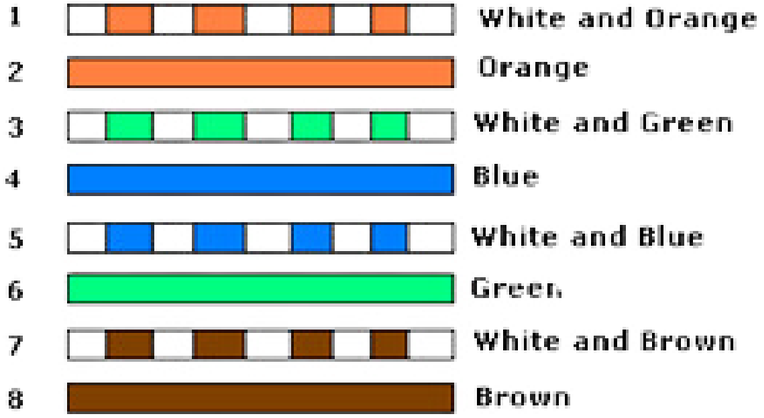
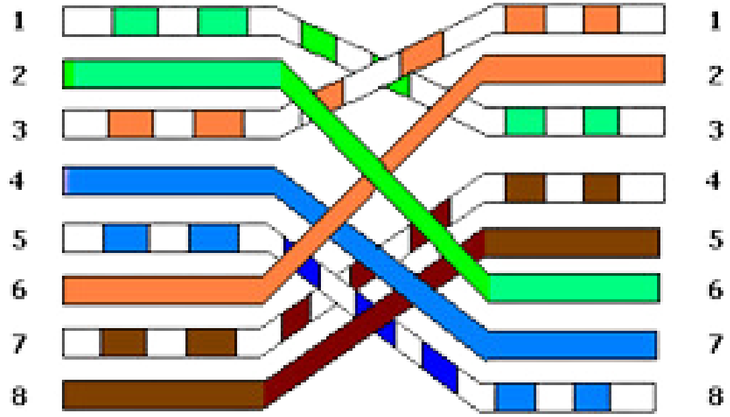


Figure A

TIA/EIA 568A Crossed Wiring



TIA/EIA 568B Crossed Wiring

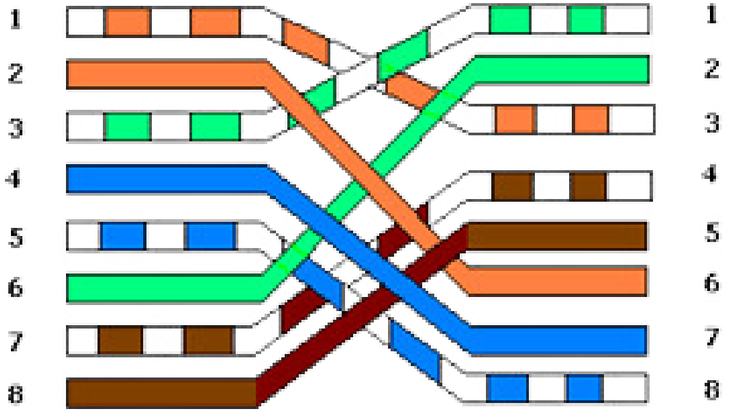
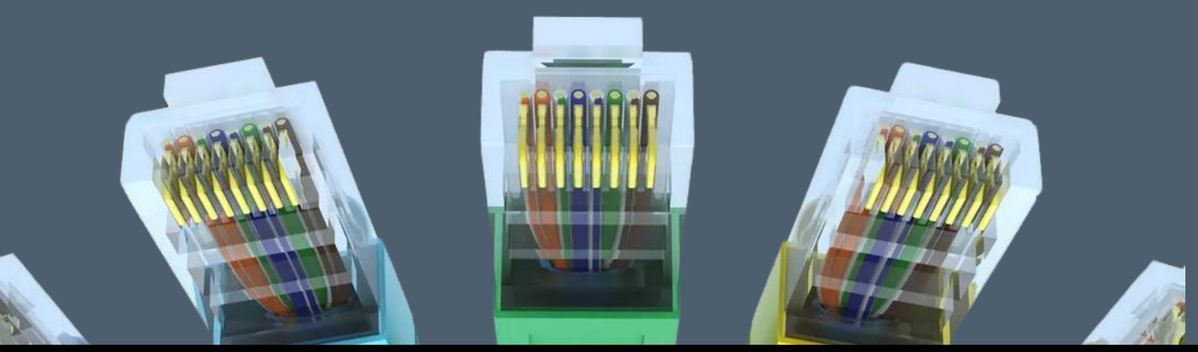
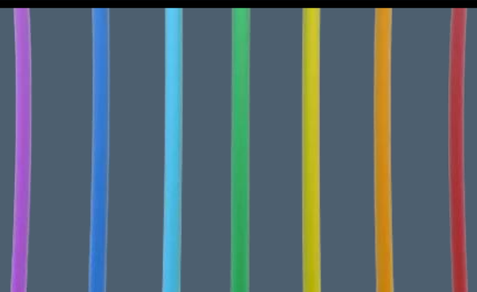


Figure B



Eight (8) categories of cables are currently available



RESIDENTIAL AND COMMERCIAL USE

1. Cat5e (Category 5 Enhanced): Supports up to 1 Gbps, 100 MHz, suitable for residential and small office networks.

2. Cat6 (Category 6): Supports up to 10 Gbps, 250 MHz, commonly used in commercial and industrial settings.

3. Cat6a (Category 6 Augmented): Supports up to 10 Gbps, 500 MHz, offers better performance and longer cable runs

INDUSTRIAL AND HIGH-SPEED APPLICATION

1. Cat7 (Category 7): Supports up to 40 Gbps, 600 MHz, used in high-speed industrial and data center applications.

2. Cat7a (Category 7 Augmented): Supports up to 100 Gbps, 1000 MHz, offers even higher speeds.

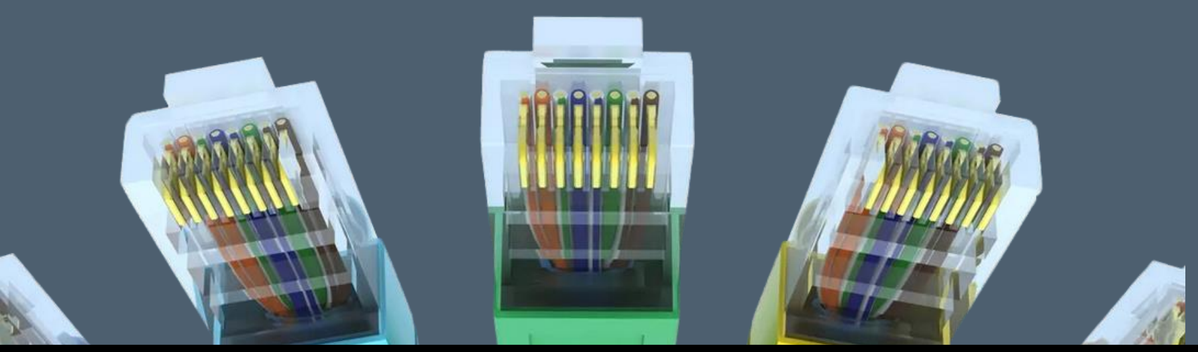
LEGACY AND OBSOLETE CABLES

1. Cat3 (Category 3): Older cable type, supports up to 10 Mbps.

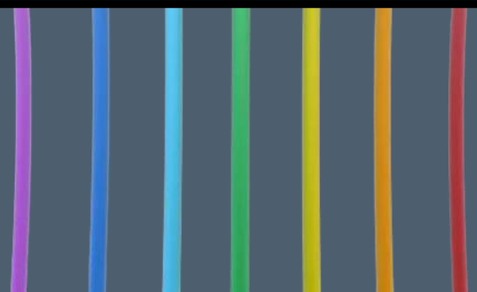
2. Cat4 (Category 4): Rarely used, supports up to 20 Mbps.

3. Cat5 (Category 5): Older version of Cat5e, supports up to 100 Mbps

Category	Speed	Use
1	1 Mbps	Voice Only (Telephone Wire)
2	4 Mbps	LocalTalk & Telephone (Rarely used)
3	16 Mbps	10BaseT Ethernet
4	20 Mbps	Token Ring (Rarely used)
5	100 Mbps (2 pair)	100BaseT Ethernet
	1000 Mbps (4 pair)	Gigabit Ethernet
5e	1,000 Mbps	Gigabit Ethernet
6	10,000 Mbps	Gigabit Ethernet



NETWORKING CONNECTORS

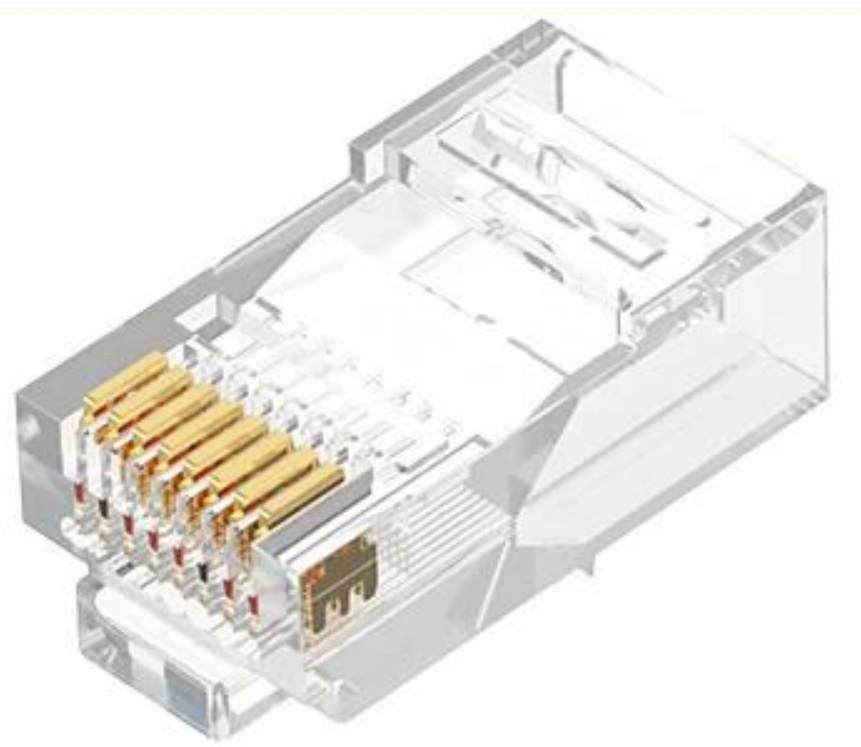


NETWORKING CONNECTORS

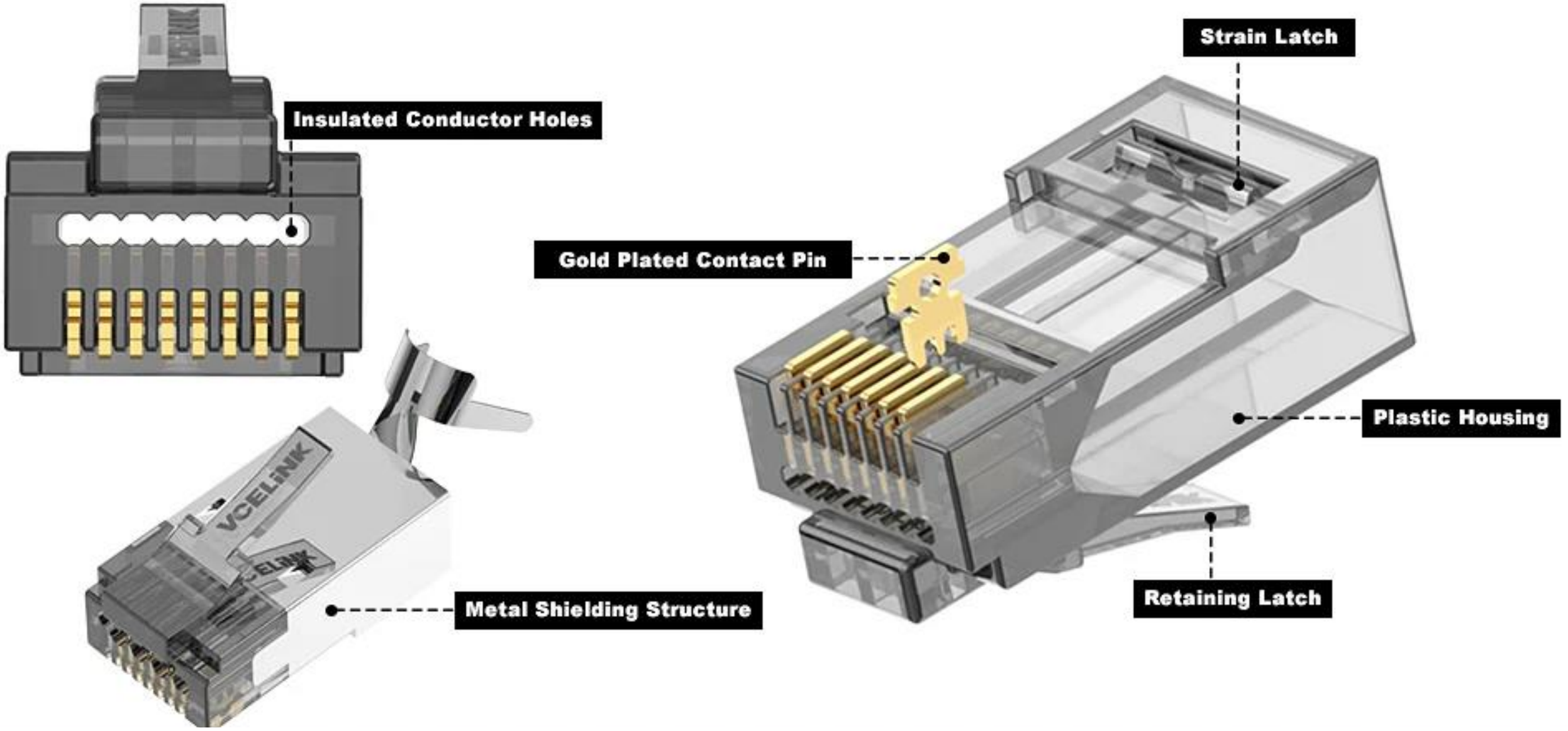
RJ45

Registered Jack-45

The eight-pin RJ45 connector is a standardised interface which often connects a computer to a Local Area Network (LAN).



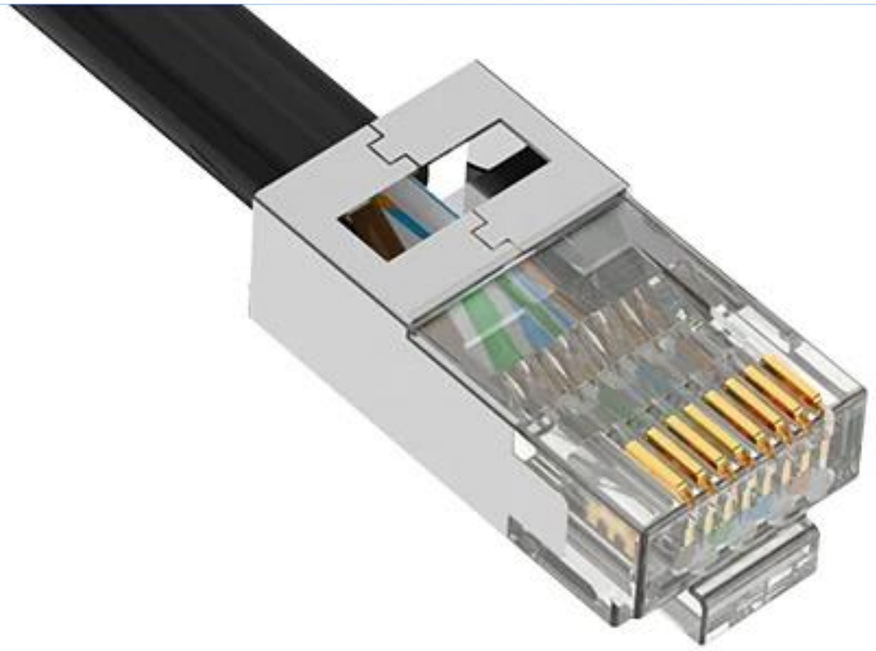
Components of RJ45 connectors



REGULAR AND PASS-THROUGH RJ45 CONNECTORS

PASS-THROUGH CONNECTORS

REGULAR CONNECTORS

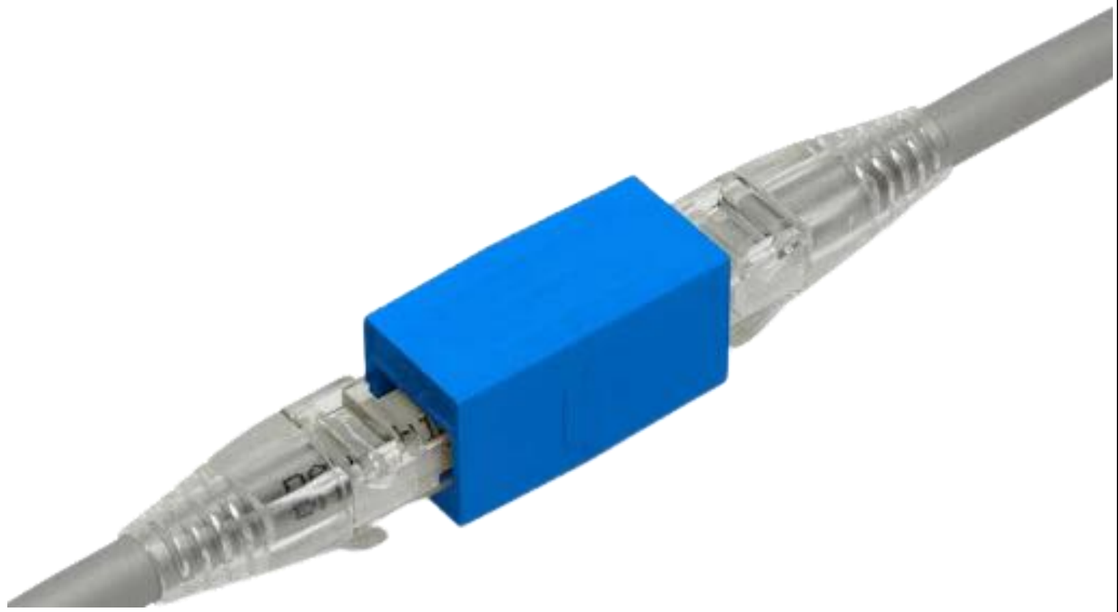


Compared to standard RJ45 connectors, pass-through RJ45 connectors are easy to keep Ethernet cable wires aligned before terminating connectors.

NETWORKING CONNECTORS

UTP COUPLER

The device is intended for connecting and extending unshielded Ethernet cables (UTP). The connector has 2 female sockets for connecting RJ45 connectors.



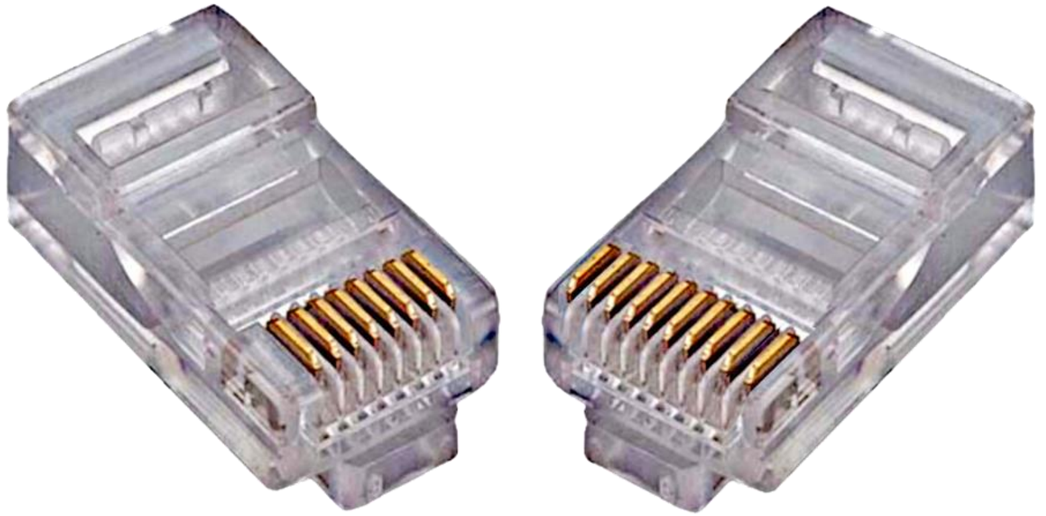
NETWORKING CONNECTORS

RJ48

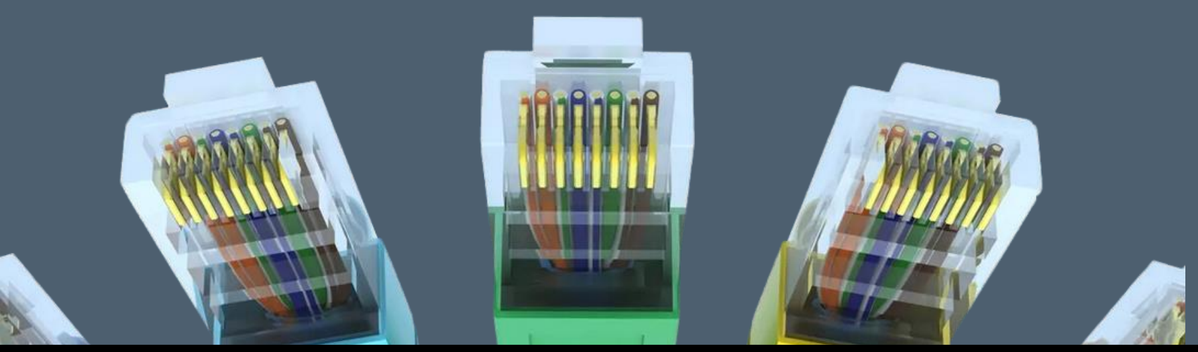
RJ48 wirings use STP or Shielded Twisted Pair cables.

RJ48 is used in other applications, the most common one would be in T1 data lines where the wires can extend longer distances and are often exposed to the environment.

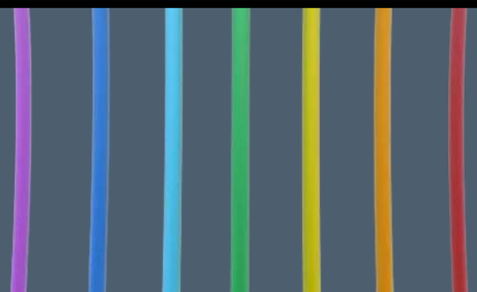
RJ48



RJ45

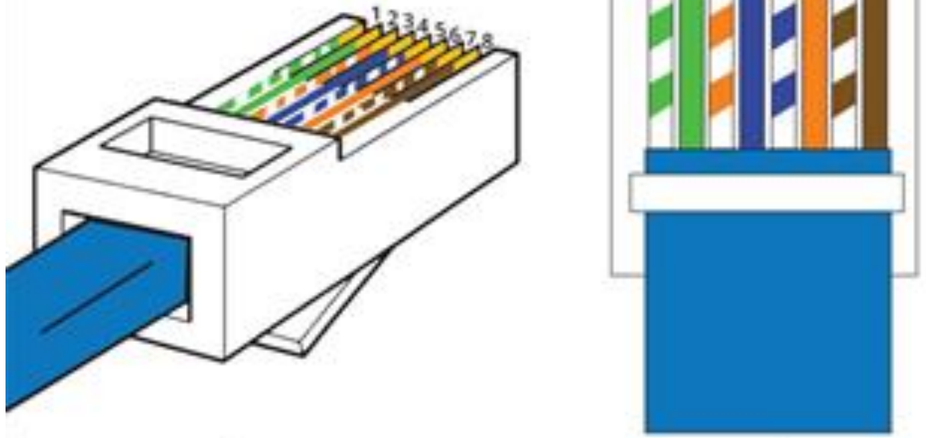


WIRING STANDARD



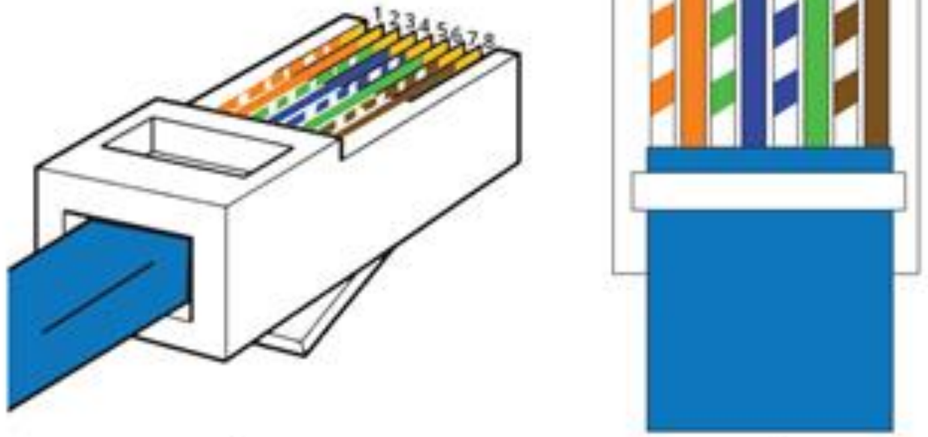
T568A AND T568B WIRING STANDARD BASIS

RJ45 Pinout
T-568A



1. White Green	5. White Blue
2. Green	6. Orange
3. White Orange	7. White Brown
4. Blue	8. Brown

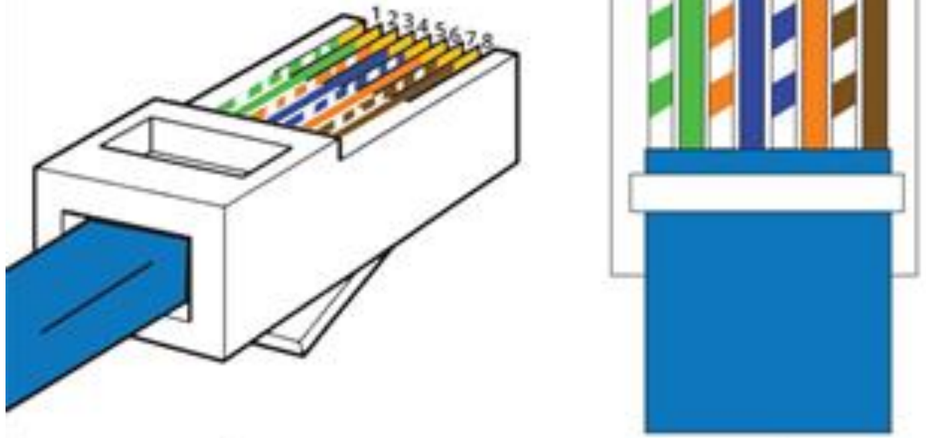
RJ45 Pinout
T-568B



1. White Orange	5. White Blue
2. Orange	6. Green
3. White Green	7. White Brown
4. Blue	8. Brown

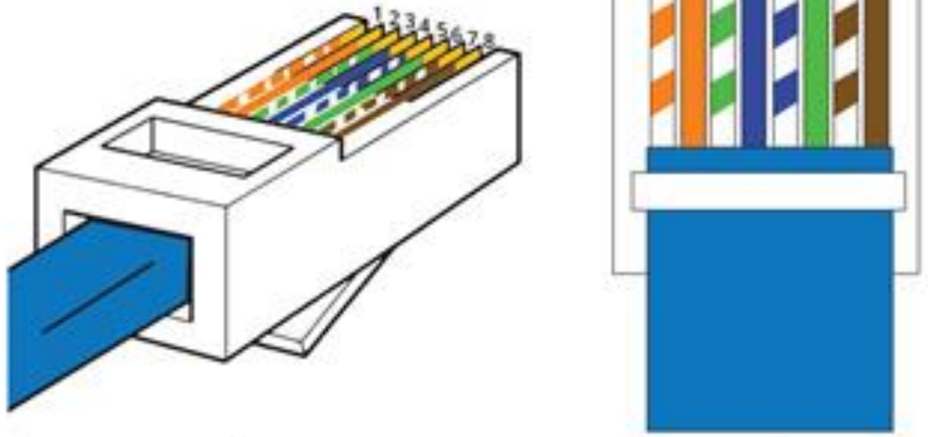
T568A AND T568B WIRING STANDARD BASIS

RJ45 Pinout
T-568A



1. White Green	5. White Blue
2. Green	6. Orange
3. White Orange	7. White Brown
4. Blue	8. Brown

RJ45 Pinout
T-568B



1. White Orange	5. White Blue
2. Orange	6. Green
3. White Green	7. White Brown
4. Blue	8. Brown

straight through cables are primarily used for connecting unlike devices.

Use straight through Ethernet cable for the following cabling:

- Switch to router
- Switch to PC or server
- Hub to PC or server

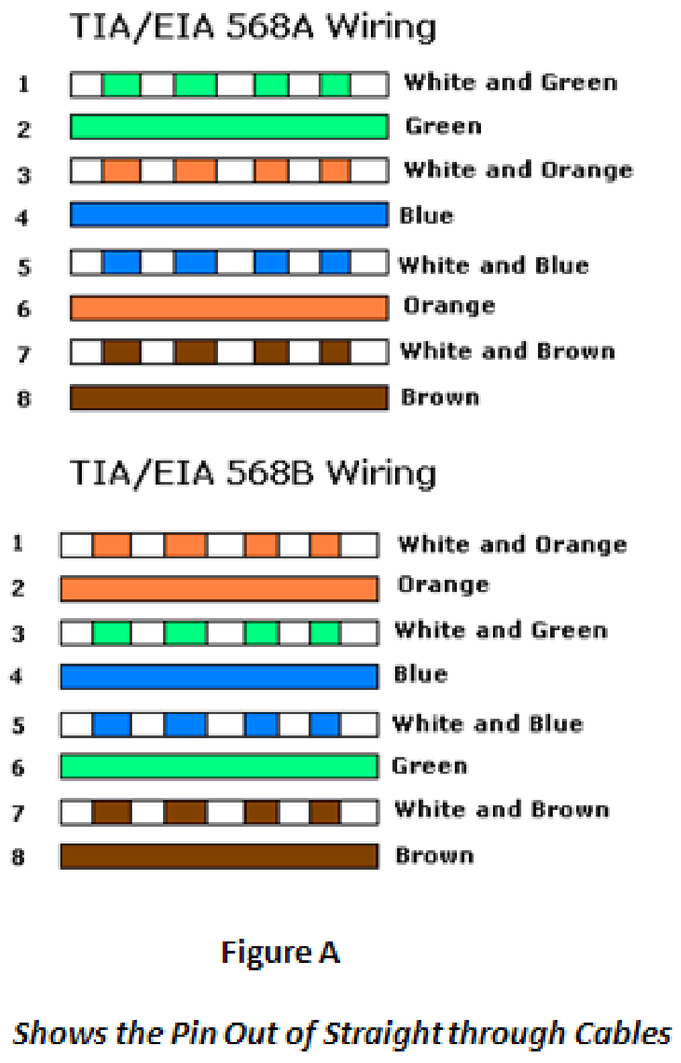


Figure A

Shows the Pin Out of Straight through Cables

crossover cables are use for connecting alike devices.

Use crossover cables for the following cabling:

- Switch to switch
- Switch to hub
- Hub to hub
- Router to router
- PC to PC

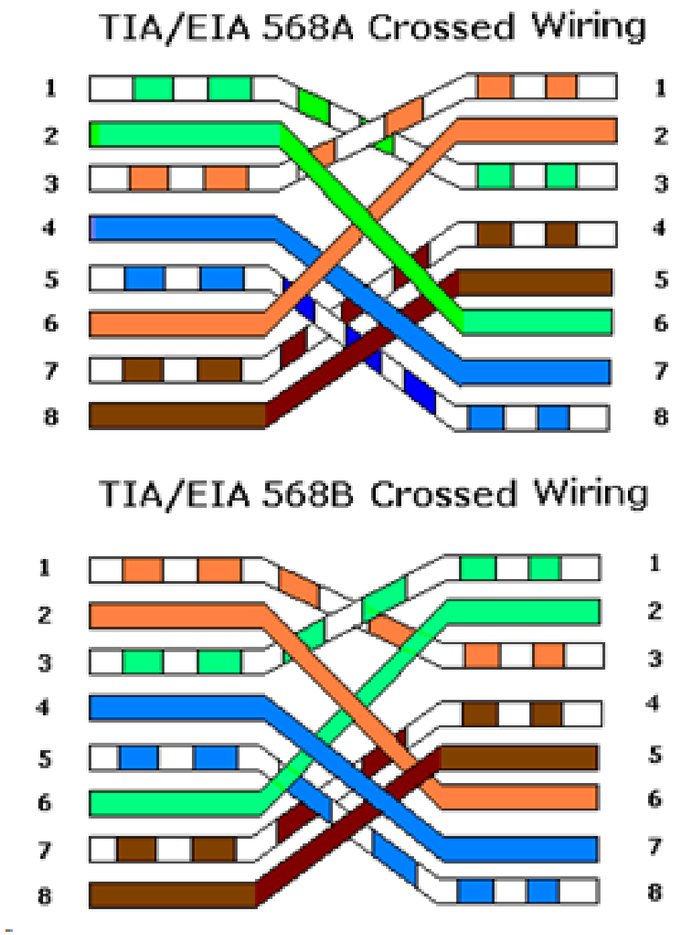


Figure B

Shows the Pin Out of Crossover Cables

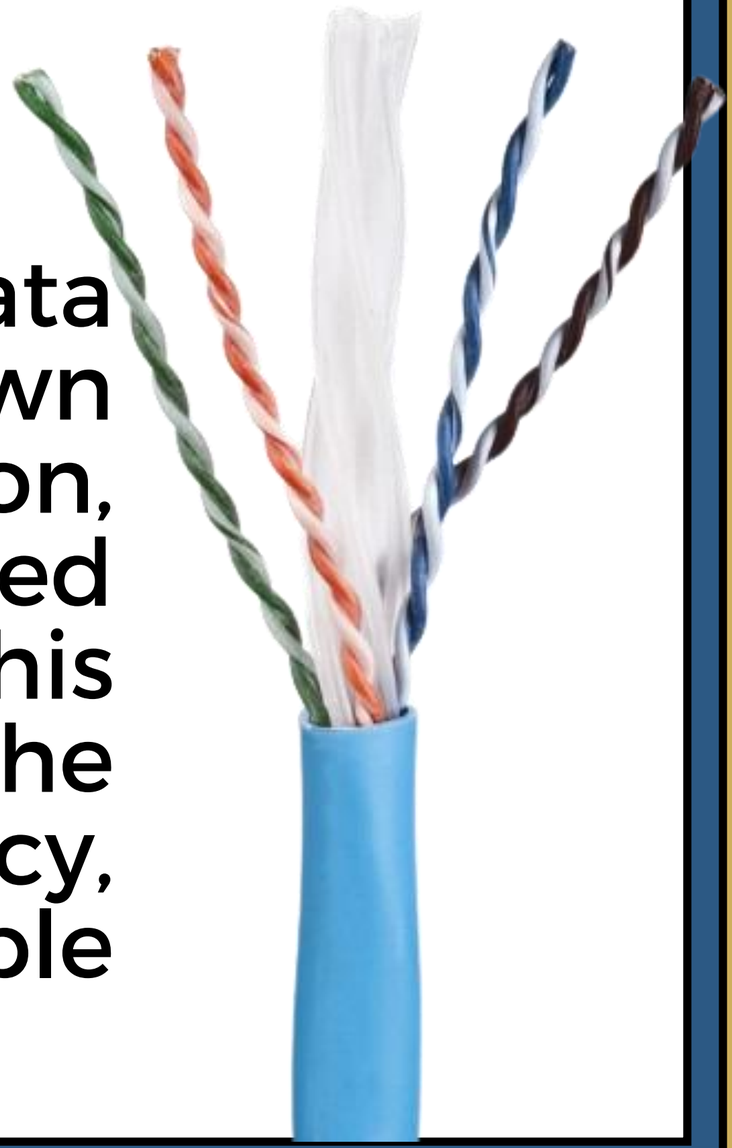
Structure of a Cat6 Cable

Each pair plays a specific role in data transmission and power delivery, particularly in Ethernet and Power over Ethernet (PoE) applications.

Pair Number	Wire Colors	Pin Numbers	Function	Role in Ethernet	Role in PoE
Pair 1	White/Orange and Orange	Pins 1 and 2	Transmitting Data (Tx)	Sends data from the device to the network	Not typically used for PoE
Pair 2	White/Green and Green	Pins 3 and 6	Receiving Data (Rx)	Receives data from the network to the device	Not typically used for PoE

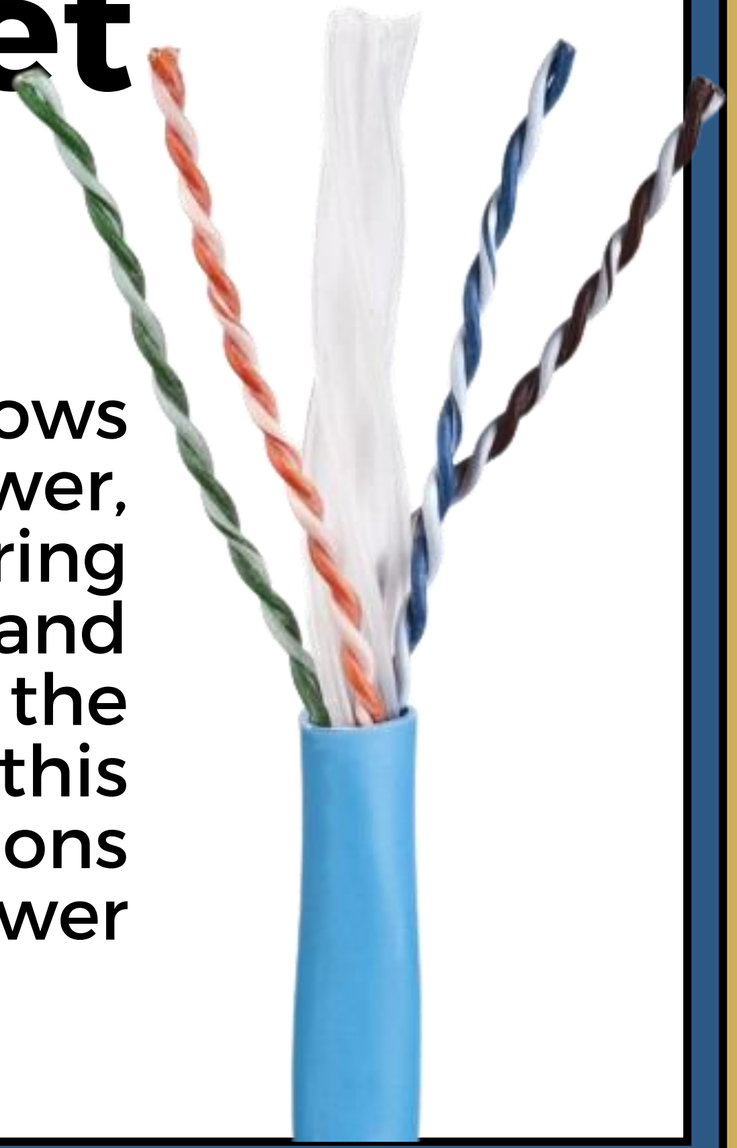
Pair Number	Wire Colors	Pin Numbers	Function	Role in Ethernet	Role in PoE
Pair 3	White/Blue and Blue	Pins 4 and 5	Additional Data Transmission and PoE	Part of bidirectional data in Gigabit Ethernet	Carries power for PoE applications
Pair 4	White/Brown and Brown	Pins 7 and 8	Additional Data Transmission and PoE	Part of bidirectional data in Gigabit Ethernet	Carries power for PoE applications

Utilizing All Pairs

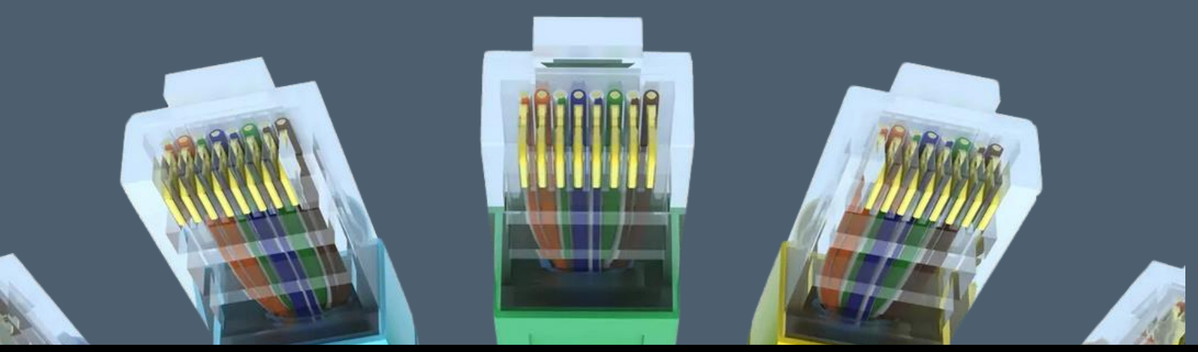


all four pairs are utilized for data transmission. This approach is known as **“full-duplex”** communication, where data is sent and received simultaneously across all pairs. This method significantly increases the network’s bandwidth and efficiency, allowing for faster and more reliable data transfer.

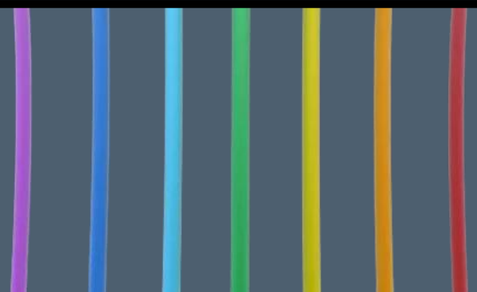
Power over Ethernet (PoE)



Power over Ethernet (PoE) technology allows network cables to carry electrical power, providing a convenient solution for powering devices PoE standards (such as IEEE 802.3af and 802.3at) specify how power is delivered over the Ethernet cables, using pairs 3 and 4 for this purpose. This capability simplifies installations and reduces the need for additional power infrastructure.



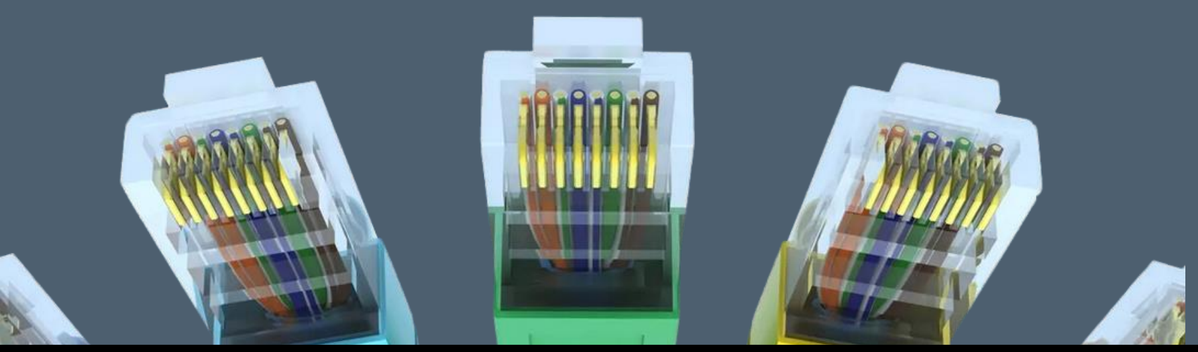
NETWORKING TOOLS



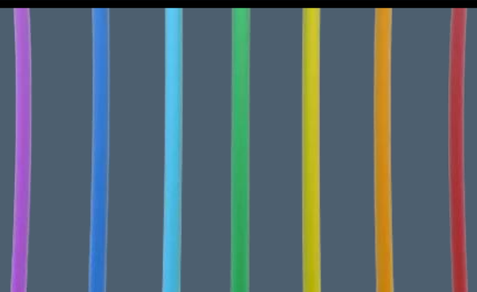
remove the outer insulation from the Ethernet cables and expose the individual wires for termination.

check the integrity of your Ethernet cable.

use to terminate pass-thru and non-pass-thru RJ45 connectors

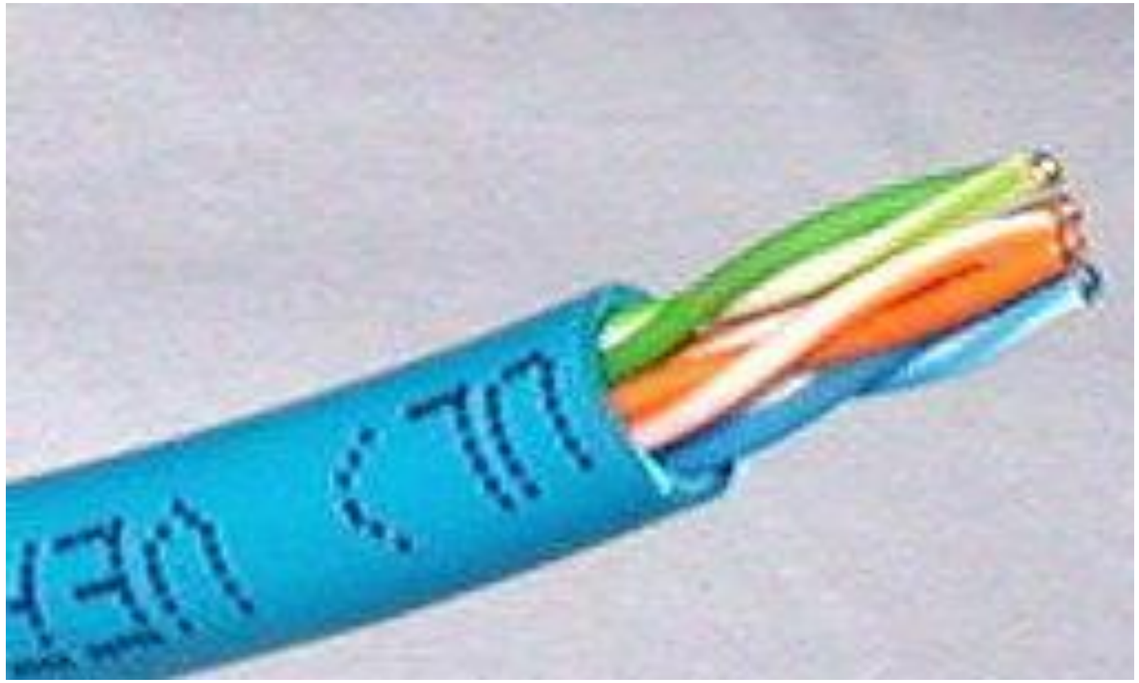


Making connections Steps



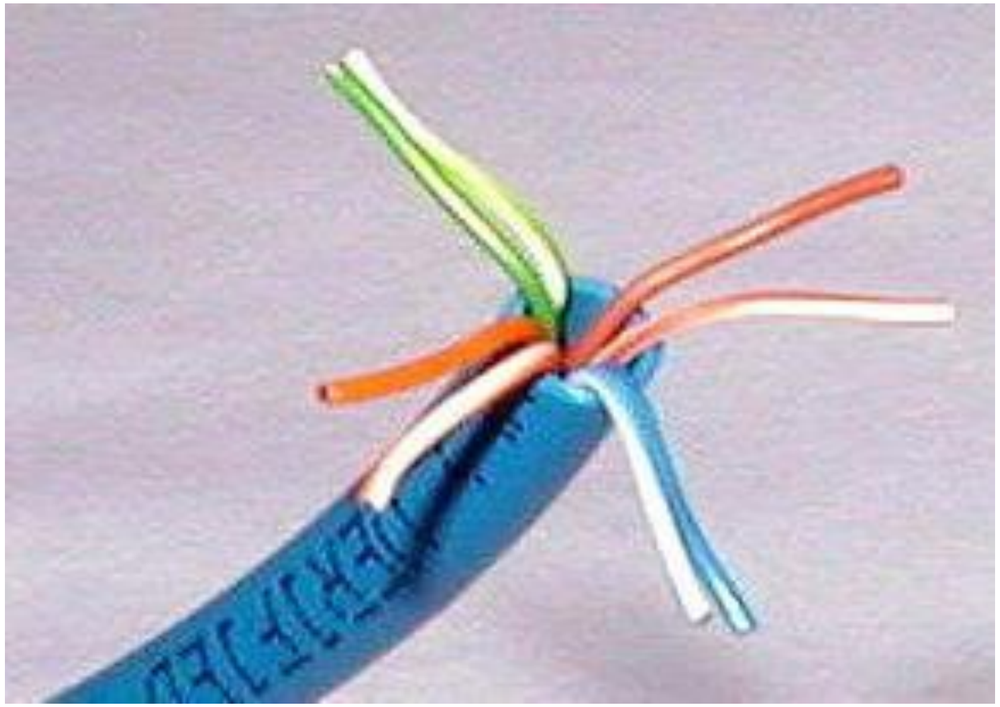
Step 1 – Strip cable end

- Strip 1 – 1½” of insulating sheath
- Avoid cutting into conductor insulation



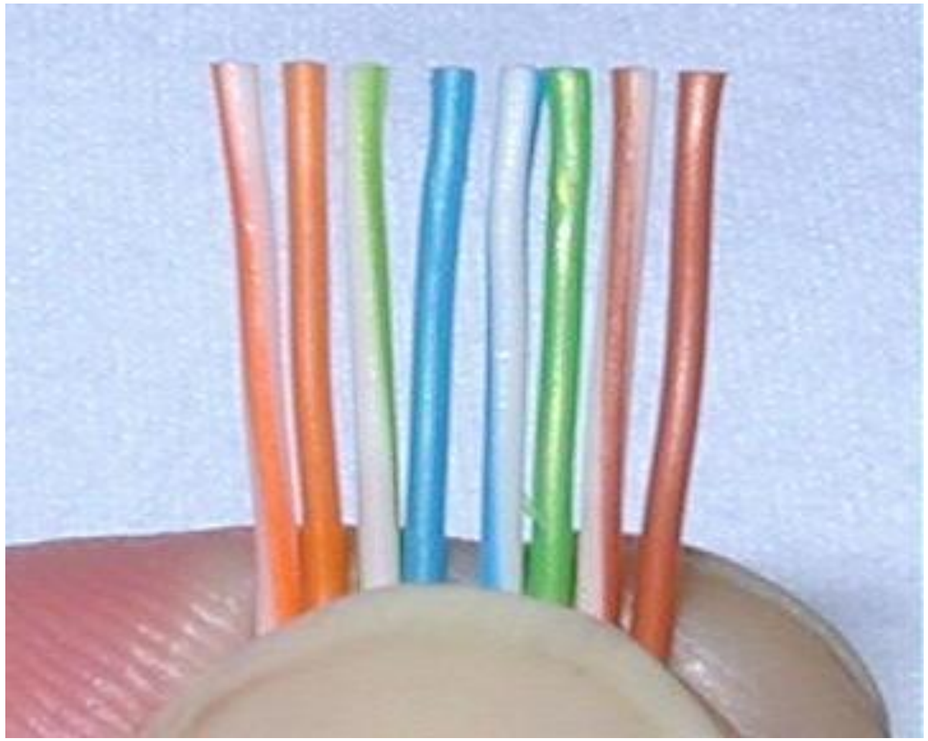
Step 2 – Untwist wire ends

☒ Sort wires by insulation colors



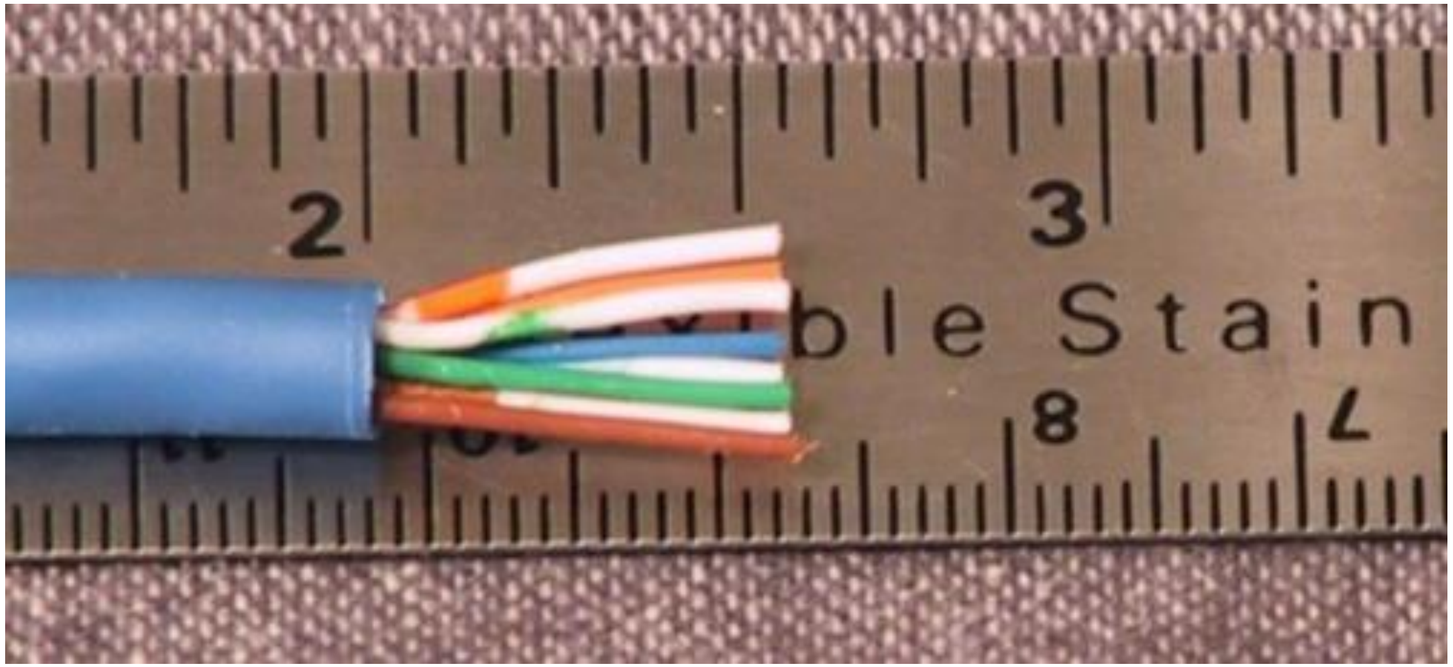
Step 3 – Arrange wires

- TIA/EIA 568A: GW-G OW-Bl BlW-O BrW-Br
- TIA/EIA 568B: OW-O GW-Bl BlW-G BrW-Br



Step 4 – Trim wires to size

- Trim all wires evenly
- Leave about ½” of wires exposed



Step 5 – Attach connector

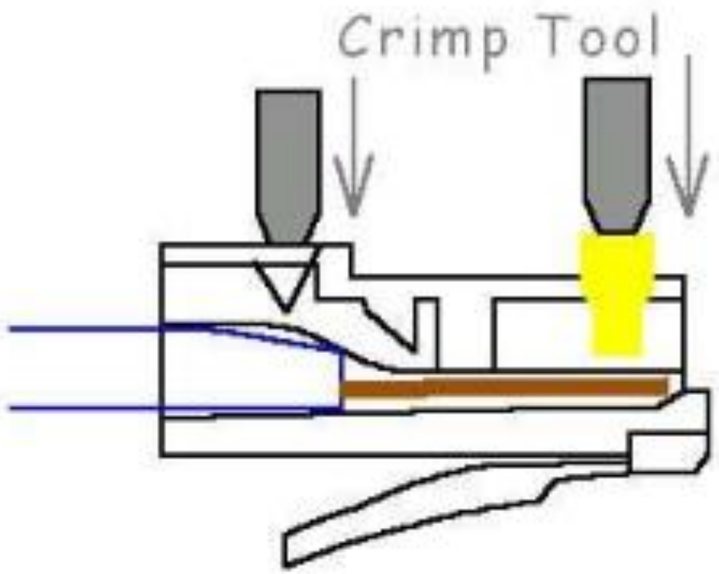
Maintain wire order, left-to-right, with RJ45 tab facing downward

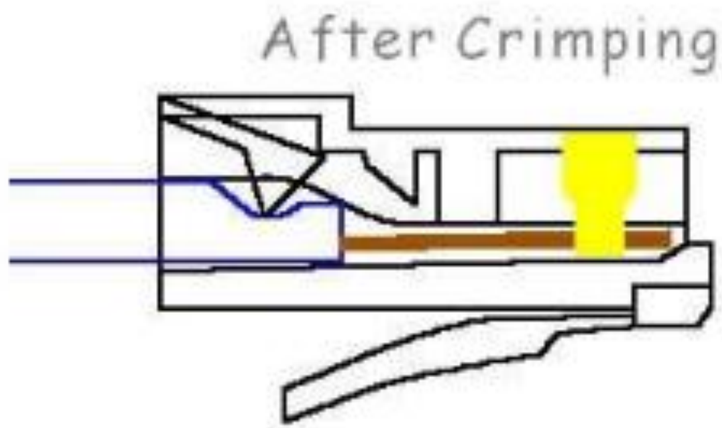
Step 6 - Check

☒ Do all wires extend to end?
☒ Is sheath well inside connector?

Step 7 - Crimp

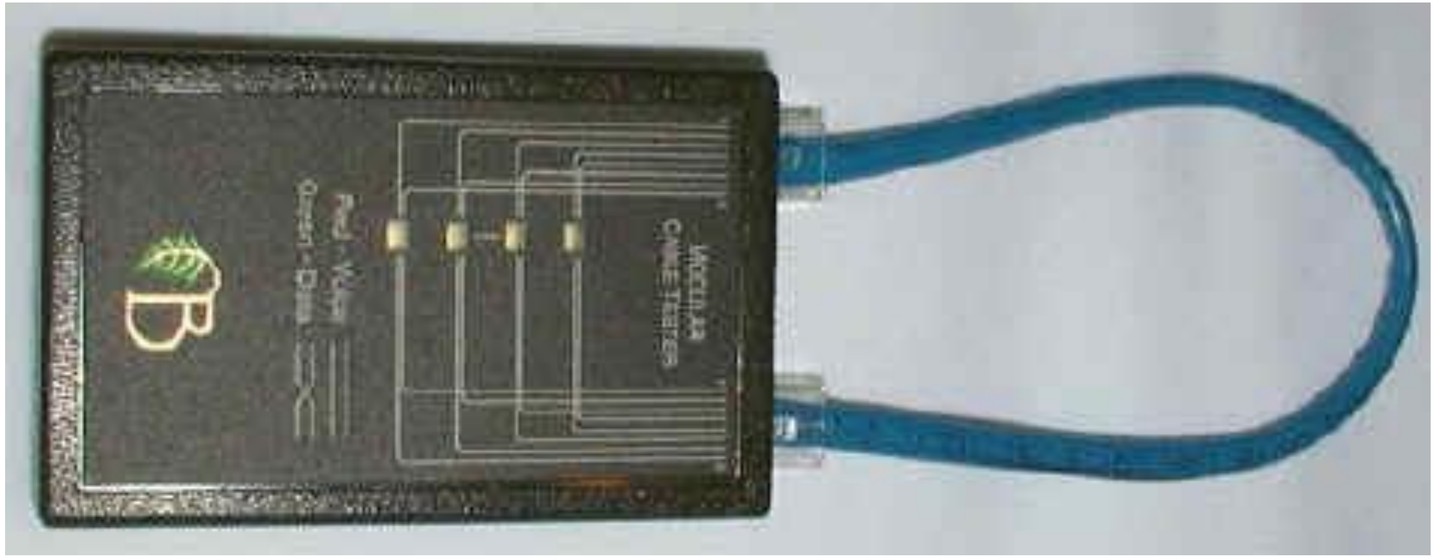
⊠ Squeeze firmly to crimp connecter onto cable end (8P)





Step 8 – Test

☒ Does the cable work?



Straight Through Cable

If crimping is good the led indicators
Will light starts from 1-8 in both ways

Cross Over Cable

If crimping is good the led indicators
Will light from the left start from
1-8
And from the right
3-6-1-4-5-7-8
simultaneous