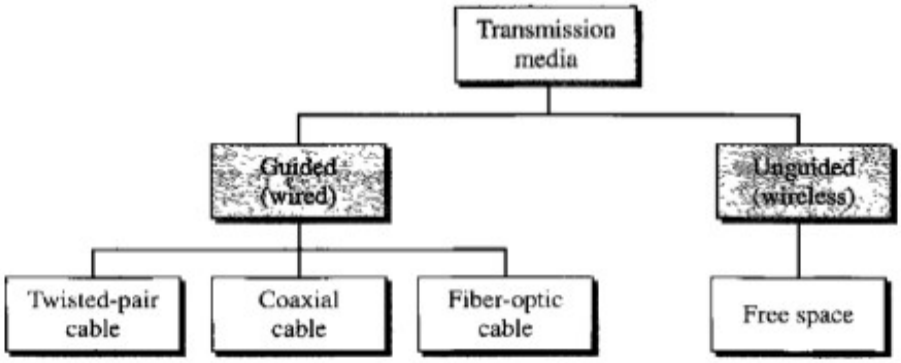
TRANSMISSION MEDIUM

A transmission medium can be broadly defined as anything that can carry information from a source to a destination. For example, the transmission medium for two people having a dinner conversation is the air. The air can also be used to convey the message in a smoke signal or semaphore. For a written message, the transmission medium might be a mail carrier, a truck, or an airplane.

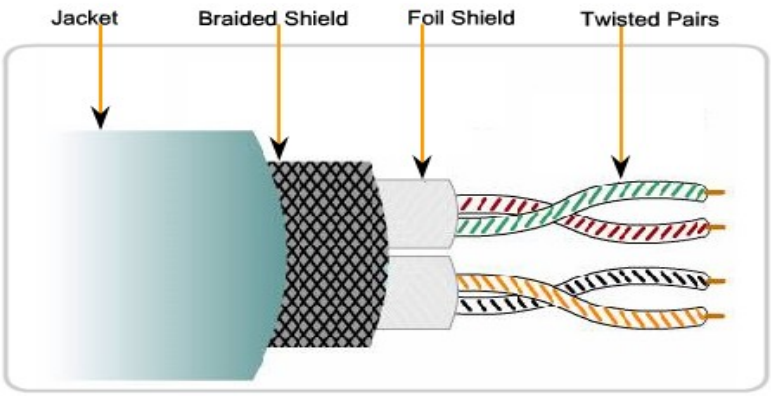
In data communications the definition of the information and the transmission medium is more specific. The transmission medium is usually free space, metallic cable, or fiber-optic cable. The information is usually a signal that is the result of a conversion of data from another form.



Guided Media:
Guided media, which are those that provide a conduit from one device to another, include twisted-pair cable, coaxial cable, and fiber-optic cable. A signal traveling along any of these media is directed and contained by the physical limits of the medium. Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current. Optical fiber is a cable that accepts and transports signals in the form of light.

Shielded Twisted-Pair (STP) Cable

Another type of cabling used in networking is shielded twisted-pair (STP). As shown in the figure, STP uses two pairs of wires that are wrapped in an overall metallic braid or foil. STP cable shields the entire bundle of wires within the cable as well as the individual wire pairs. STP provides better noise protection than UTP cabling, however at a significantly higher price.
For many years, STP was the cabling structure specified for use in Token Ring network installations. With the use of Token Ring declining, the demand for shielded twisted-pair cabling has also waned. The new 10 GB standard for Ethernet has a provision for the use of STP cabling. This may provide a renewed interest in shielded twisted-pair cabling.

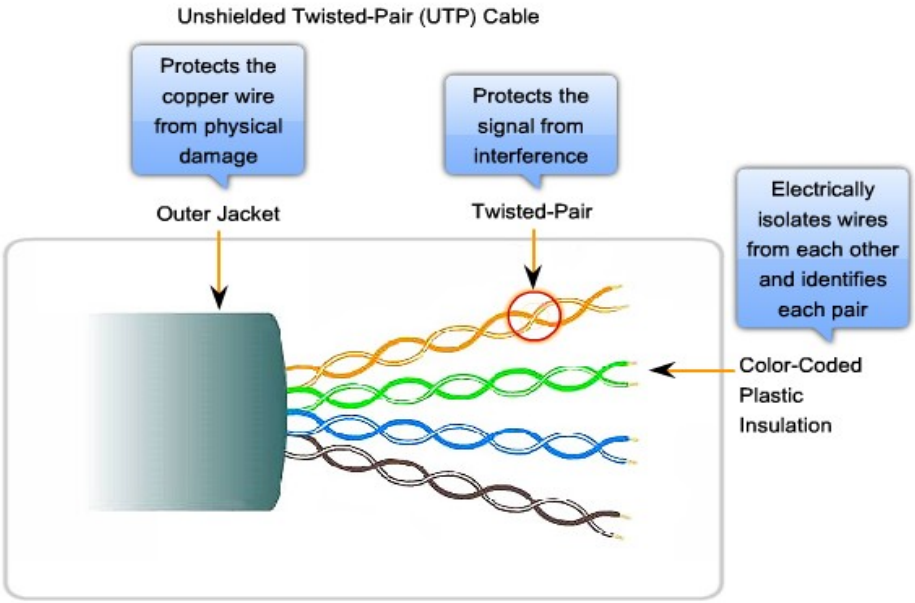


Shielded Twisted-Pair Cable(STP)

Unshielded twisted-pair (UTP)

Unshielded twisted-pair (UTP) cabling, as it is used in Ethernet LANs, consists of four pairs of color-coded wires that have been twisted together and then encased in a flexible plastic sheath. As seen in the figure, the color codes identify the individual pairs and wires in the pairs and aid in cable termination.

The twisting has the effect of canceling unwanted signals. When two wires in an electrical circuit are placed close together, external electromagnetic fields create the same interference in each wire. The pairs are twisted to keep the wires in as close proximity as is physically possible. When this common interference is present on the wires in a twisted pair, the receiver processes it in equal yet opposite ways. As a result, the signals caused by electromagnetic interference from external sources are effectively cancelled.



This cancellation effect also helps avoid interference from internal sources called crosstalk. Crosstalk is the interference caused by the magnetic field around the adjacent pairs of wires in the cable. When electrical current flows through a wire, it creates a circular magnetic field around the wire. With the current flowing in opposite directions in the two wires in a pair, the magnetic fields - as equal but opposite forces - have a cancellation effect on each other. Additionally, the different pairs of wires that are twisted in the cable use a different number of twists per meter to help protect the cable from crosstalk between pairs.

UTP Cabling Standards

The UTP cabling commonly found in workplaces, schools, and homes conforms to the standards established jointly by the Telecommunications Industry Association (TIA) and the Electronics Industries Alliance (EIA). TIA/EIA-568A stipulates the commercial cabling standards for LAN installations and is the standard most commonly used in LAN cabling environments. Some of the elements defined are:

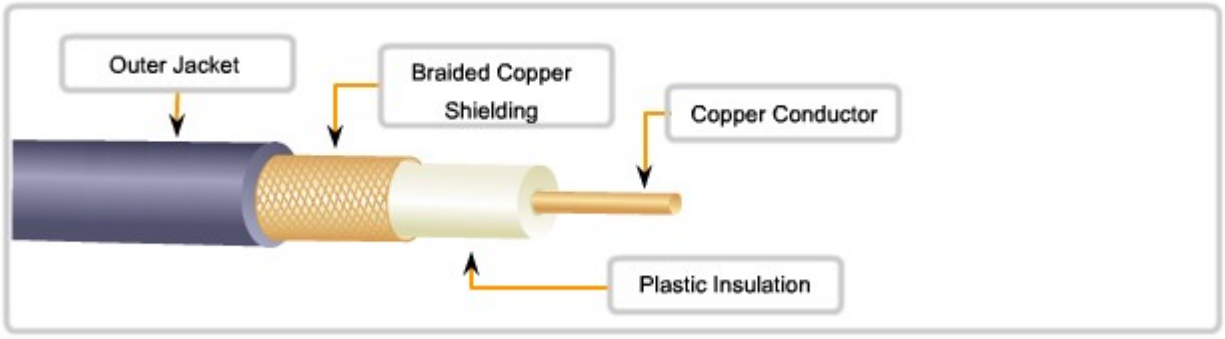
- Cable types
- Cable lengths
- Connectors
- Cable termination
- Methods of testing cable

The electrical characteristics of copper cabling are defined by the Institute of Electrical and Electronics Engineers (IEEE). IEEE rates UTP cabling according to its performance. Cables are placed into categories according to their ability to carry higher bandwidth rates. For example, Category 5 (Cat5) cable is used commonly in 100BASE-TX FastEthernet installations. Other categories include Enhanced Category 5 (Cat5e) cable and Category 6 (Cat6).

Cables in higher categories are designed and constructed to support higher data rates. As new gigabit speed Ethernet technologies are being developed and adopted, Cat5e is now the minimally acceptable cable type, with Cat6 being the recommended type for new building installations.

Co-axial Cable:

Coaxial cable (or coax) carries signals of higher frequency ranges than those in twisted-pair cable, in part because the two media are constructed quite differently. Instead of having two wires, coax has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination of the two. The outer metallic wrapping serves both as a shield against noise and as the second conductor, which completes the circuit. This outer conductor is also enclosed in an insulating sheath, and the whole cable is protected by a plastic cover



All the elements of the coaxial cable encircle the center conductor. Because they all share the same axis, this construction is called coaxial, or coax for short.

Uses of Coaxial Cable

The coaxial cable design has been adapted for different purposes. Coax is an important type of cable that is used in **wireless and cable access technologies**. Coax cables are used to attach antennas to wireless devices. The coaxial cable carries radio frequency (RF) energy between the antennas and the radio equipment.

Coax is also the most widely used media for transporting high radio frequency signals over wire, especially cable television signals. Traditional cable television, exclusively transmitting in one direction, was composed completely of coax cable.

Cable service providers are currently converting their one-way systems to two-way systems to provide Internet connectivity to their customers. To provide these services, portions of the coaxial cable and supporting amplification elements are replaced with multi-fiber-optic cable. However, the final connection to the customer's location and the wiring inside the customer's premises is still coax cable. This combined use of fiber and coax is referred to as hybrid fiber coax (HFC).

In the past, coaxial cable was used in Ethernet installations. Today UTP offers lower costs and higher bandwidth than coaxial and has replaced it as the standard for all Ethernet installations.

Coaxial Cable Connectors

To connect coaxial cable to devices, we need coaxial connectors. The most common type of connector used today is the Bayone-Neill-Concelman (BNC), connector. Three types of connectors: the BNC connector, the BNC T connector, and the BNC terminator. The BNC connector is used to connect the end of the cable to a device, such as a TV set. The BNC T connector is used in Ethernet networks o branch out to a connection to a computer or other device. The BNC terminator is used at the end of the cable to prevent the reflection of the signal.

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