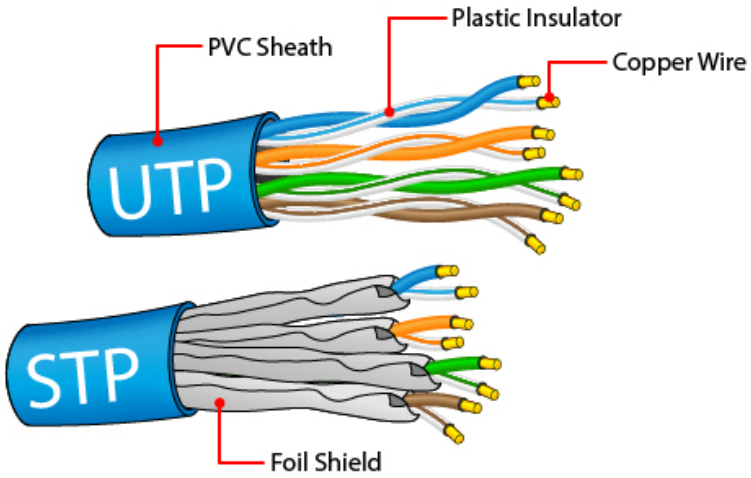
6.3.3 Twisted Pair Facts

Twisted pair cables support a wide range of fast, modern network standards.

Twisted pair cabling is composed of the following components:



- Four pairs of copper wires carry the data signals (one wire in the pair carries a positive signal, the other carries a negative signal). Wires are twisted into pairs to reduce the effects of electromagnetic interference and crosstalk.
- PVC plastic insulation surrounds each copper wire.
- An outer plastic sheath bundles the wires together and protects them.
  - Unshielded twisted pair (UTP) has only an outer plastic sheath. UTP cables are easier to work with and are less expensive than shielded cables.
  - Shielded twisted pair (STP) has a grounded outer copper shield around the entire wire bundle or around each wire pair. STP provides additional EMI protection, but costs considerably more than UTP.

Twisted pair cable has the following advantages and disadvantages:

Advantages	Disadvantages
▪ Inexpensive compared to other media types ▪ Easy to install and manage ▪ Very common (media and tools are easy to obtain) ▪ The most common (and most supported) network medium	▪ Very susceptible to EMI ▪ Cables are easily damaged ▪ Vulnerable to eavesdropping

The table below describes the different unshielded twisted pair (UTP) cable categories:

Category	Connector	Speed	Frequency	Description
Phone cable	RJ11	10 Mbps	N/A	Used to connect a modem to a phone jack in a wall outlet to establish a dial-up internet connection Has two pairs of cable (a total of 4 wires).
Cat 5	RJ45	100 Mbps	100 MHz	Supports up to 100 Mbps Ethernet.
Cat 5e	RJ45	1000 Mbps	100 MHz	Similar to Cat 5 but provides better EMI protection. Supports gigabit Ethernet (gigabit connections require the use of all four twisted pairs)
Cat 6	RJ45	10 Gbps	250 MHz	10 Gbps speeds are limited to cable lengths less than 55 meters.
Cat 6a	RJ45	10 Gbps	500 MHz	10 Gbps speeds are limited to cable lengths less than 100 meters. Provides additional shielding and tighter cable twists than standard Cat 6, which reduces (alien) crosstalk and makes it less susceptible to EMI.
Cat 7	RJ45	10 Gbps	600 MHz	Has the strictest specifications for crosstalk and noise.

The table below describes the two types of connectors used with twisted pair cables:

Connector	Description
RJ11 	▪ Has 4 or 6 connectors ▪ The RJ-11 wiring standard supports up to 2 pairs of wires (one phone and one power) ▪ Uses a locking tab to keep a connector secure in an outlet ▪ Used primarily for telephone wiring ▪ The RJ-14 and RJ-25 wiring standard support additional phone lines using the same jack
RJ45 	▪ Has 8 connectors ▪ Supports up to 4 pairs of wires ▪ Uses a locking tab to keep a connector secure in an outlet ▪ Used for Ethernet networks

Always use a special crimping tool to attach connectors to UTP cable.

Keep the following in mind when working with twisted pair cables:

- Even though different cable categories may look physically similar, they are electrically different. Higher cable categories use different wire gauges and have more wire twists per inch than lower cable categories, which allows for much faster transmission speeds.
- Some cables use plenum plastic as an insulator. Plenum wires are fire resistant and non-toxic when burned. These types of cables are rated to be run in the plenum (the space above a ceiling or below a floor) or a building.
- Each type of UTP cable can be substituted for any category below it, but never for a category above. For example, Cat 6 can be substituted for a task requiring Cat 5e; however, neither Cat 5 nor Cat 3 should be used for this particular task.
