

Networking Basics - Cabling

10BaseT/ CAT5/UTP Cable

10BaseT networks will run on CAT5, UTP cable. The category rating of the Unshielded Twisted Pair (UTP) wiring is based on the number of twists per inch the pairs of wires have inside the cable's jacket.

Commercial/Industrial network installations will use 8-conductor (4-pairs) CAT5 cable. CAT5 is also available in a 4-conductor (2-pairs) flavor. 4-conductor CAT5 has everything that ethernet traffic needs.

The advantage of running 8-conductor CAT5, when wired to the correct IEEE standard, is that the same cabling will support many different types of traffic. CAT5 wiring will have certain characteristics including:

- Unshielded Twisted Pair
- 24-gage wire
- 8-conductor cable (available in 4-conductor)
- Plenum Level 3 (i.e. when it burns it will not emit noxious fumes)
- Rated for 100 mbps. traffic.
- Signal degradation occurs at about 300 feet.
- Uses RJ45 connectors. RJ45 is similar to phone cable ends but several sizes larger.

CAT5 typically comes in 1,000' spools and costs about 10 cents per foot. It comes in a variety of jacket colors and looks very much like a thick phone cable.

UTP wire is more fragile than coax cable and costs about 20% less than coax. The manufacture AND the installation of CAT5 cable have certain guidelines/specifications that should be followed.

Per specifications, CAT5 will withstand about 30 lbs. of pull when the wire is being run. This means that the cable should move fairly freely when being pulled through ceilings and walls. Otherwise, the cable will stretch and distort and no longer meet specification when subjected to too much pull.

Specifications also instruct installers to cut back no more than 2 inches of the outer jacket when attaching the line to a punch-down block, instead of a RJ-45 connector. Punch-down blocks come in many sizes. They are made up of groves/slots the individual wires are 'punched' into and look very much like what you will find in telephone closets. Some installers will cut back much more than 2 inches of the cable's jacket to make it pretty in their wiring rack. When they do this, they are installing the wire out of spec and may experience unpredictable communication problems.

This happens when the wires are all inside the jacket and twisted around each other in pairs, they are affected in the same way at the same point by external forces. Our environment is saturated with electromagnetism.

Computers read signals transmitted over the wire pairs by measuring the difference between the value of the signal on each member of the pair. If one member of the pair is subjected to influence that the other member is not, this will affect the reading and distort the signal. For this same reason, CAT5 should **not** be laid directly on fluorescent lighting or parallel to power cables.

Networking Basics – Cabling (cont'd)

10Base2/RG-58/Coax Cable

Coax cabling is typically found in a linear-bus topology network. It is also commonly used as a 'backbone' segment of complex star network topologies. Coax backbones will link 'sub-networks' of a star network over distances less than or equal to 600 feet. RG-58 coax cable, used for network cable, is very similar in appearance to cable TV wire.

Please note that cable TV wire, (RG-59), is built to a very different standard than the **10Base2 (RG-58)** coax cable. The resistance, measured in Ohms, of RG-58 cable is 50 Ohms. **Cable TV wire (RG-59)** has a resistance of 75 Ohms.

In basic terms, this makes it 50% more difficult for data to travel over the coaxial cable used for cable TV. Some devices are more sensitive to this problem and will not communicate at all if the wrong type of cabling was installed.

The reason for mentioning this is that many customers, and even some contractors, make the mistake of installing the wrong type of coax. It makes no difference how much time and money was spent on installing the wrong coax, RG-59 is not network cable and should be replaced if discovered. With that said, IPX/SPX networks (Ex. Novell Netware) will run on RG-59 but they don't run well and sensitive devices (like network printers) won't work consistently.

Coax wiring has a very simple construction providing a two-wire circuit:

- Core: Usually solid copper, but can be made of braided wire. This is the first half of the two-wire circuit.
- Dielectric: Serves to insulate between the core and mesh and gives the cable both form and strength.
- Mesh: Surrounds the dielectric and serves as the second half of the circuit. The metal mesh makes physical contact with the BNC connector or 'end' of the cable.
- PVC Jacket: Surrounds the mesh. Provides strength and mechanical/moisture protection.
- Signal degradation occurs at about 600 feet.
- Uses BNC connectors. BNC connectors have circular ends connecting with a post-and-sliding-slot construction.

10Base5/Coax Cable

10Base5 Coax is an older, thicker, more expensive version of RG-58. It is no longer a widely used material and is mentioned here only to define the term.

Networking Basics – Cabling

Fiber Optic Cable

Fiber cable resembles 10BaseT cable in appearance. Its composition is very different. In simple terms, it has a glass core the light travels over. Fiber is more delicate than other cabling and is still extremely expensive to install.

The major benefit of fiber is the great distances it can cover while still delivering a clear signal. Fiber optic cable can be used as a backbone between sites that are miles apart. Laying fiber cable between sites usually involves contracting the task out to the local telco (telephone company). This paper will not discuss the specifications of fiber cable since there are a variety of types to serve specific applications.

The two main types deal with the transmission mode:

- Single mode transmission: Used for clear transmission over long distances (telcos).
- Multi mode transmission: Used for broad bandwidth (data) transmissions.

The construction of fiber cable includes:

- Core: The transmission medium light travels over.
- Cladding: Denser glass applied directly over the fiber core.
- (Maintains the core's transmission integrity)
- Buffer: Applied directly over fiber core and cladding to give strength.
- Kevlar: Surrounds the buffer for strength and mechanical/moisture protection.
- PVC Jacket: Surrounds the Kevlar for strength and mechanical/moisture protection.

It is now common practice to use twist-on ends for fiber cabling. This is a HUGE improvement over the older way of making ends on fiber cables.

In the past, the process was very much like taking two human hairs, cutting the ends of exactly perpendicular to the central axis, polishing those ends to mirror perfection, and then gluing the two polished ends together in perfect alignment.

Please note, most contractors still buy pre-made fiber patch cables in lieu of making them.