



Department of Computer Science and Engineering
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Laboratory Report

CSE 4412: Data Communication and Networking Lab

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Title: Introduction to different transmission media and crimping of RJ45 Connector to UTP cable

Objective:

1. Introduction to different guided media such as UTP, Coaxial Cable, Optical fiber.
2. Internal arrangement of UTP cables.
3. Different Wiring pattern Standard such as T568A or T568B.
4. Different types of cabling for UTP such as straight through, crossover and roll over, and their usage.
5. Procedure to crimp RJ45 connector to UTP cable.
6. Procedure to check the connection.

Devices Used in the experiment:

- Ethernet Cable or UTP Cable (CAT6/CAT5e)
- RJ45 Crimp able Connectors
- RJ45 Crimping Tool
- Cable Tester

Theory:

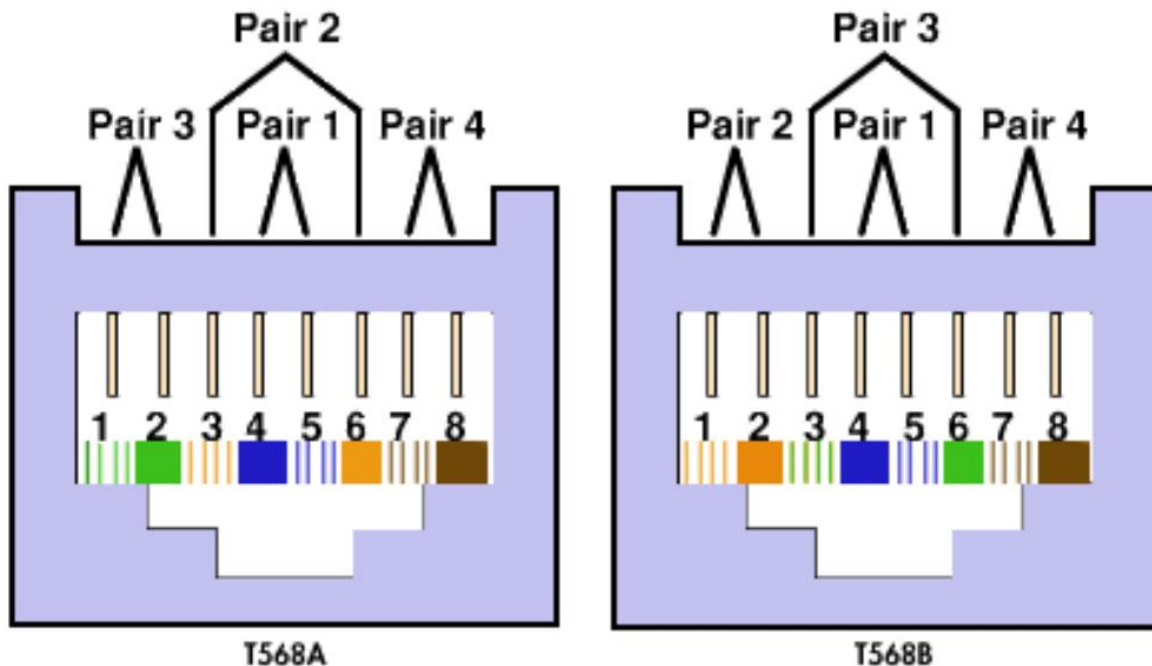
Straight-through, cross-over, roll-over, these are the different types of cabling that's used in networking and other related topics. There are two types of twisted pair cable: Unshielded (UTP) and Shielded (STP).

Every UTP pair has an outer jacket and has a color-coded plastic insulation. Inside those, there's a solid copper conductor. On the other hand, STP has pair shields and an overall shield. Although UTP is the most common twisted-pair cable used in Ethernet networks.

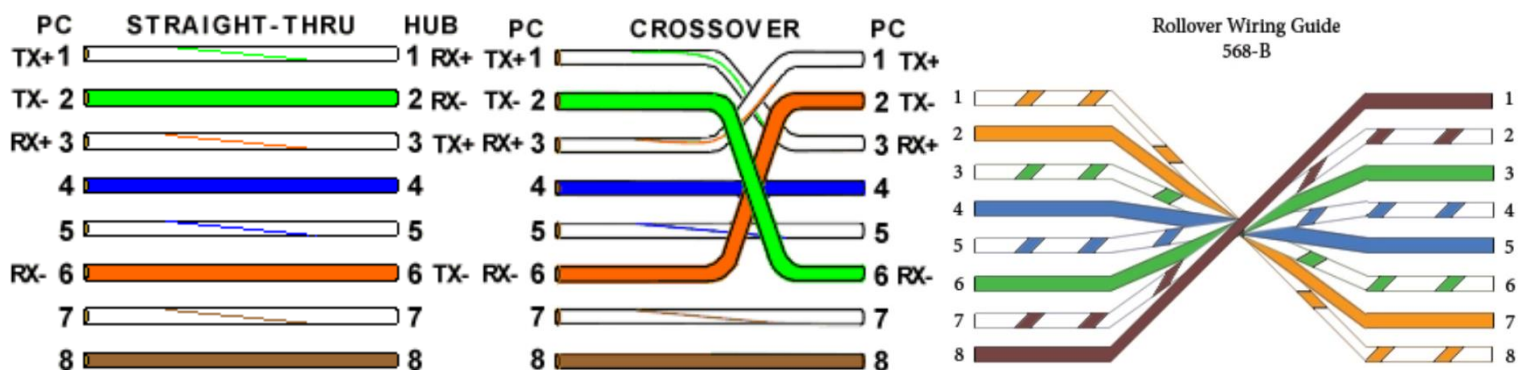
There are seven different types of UTP categories and, depending on what one wants to achieve, one would need the appropriate type of cable. There's a picture given below, giving an overview of all the different types of UTP cables.

UTP Categories - Copper Cable				
UTP Category	Data Rate	Max. Length	Cable Type	Application
CAT1	Up to 1Mbps	-	Twisted Pair	Old Telephone Cable
CAT2	Up to 4Mbps	-	Twisted Pair	Token Ring Networks
CAT3	Up to 10Mbps	100m	Twisted Pair	Token Ring & 10BASE-T Ethernet
CAT4	Up to 16Mbps	100m	Twisted Pair	Token Ring Networks
CAT5	Up to 100Mbps	100m	Twisted Pair	Ethernet, FastEthernet, Token Ring
CAT5e	Up to 1 Gbps	100m	Twisted Pair	Ethernet, FastEthernet, Gigabit Ethernet
CAT6	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (55 meters)
CAT6a	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (55 meters)
CAT7	Up to 10Gbps	100m	Twisted Pair	GigabitEthernet, 10G Ethernet (100 meters)

We are now going to look at how UTP cables are wired. There are two popular wiring schemes that most people use today: the **TIA/EIA-568A** and **TIA/EIA-568B**. These differ only in which color-coded pairs are connected: pairs 2 and 3 are reversed. The RJ-45 color codes has also been shown here.



Straight-through cable is a type of connection which has RJ-45 connectors at each end, and each has the same pin out. It doesn't matter whether the cable follows EIA-568A or EIA-568B because in both cases, the same color wire connects to the same pin at either end. This type of twisted-pair cable is used in LAN to connect a computer or a network hub such as a router. It is one of the most common types of network cable.



A **Crossover** cable is a type of connection which has one T568A configuration at one end and T568B configuration at the other end. In this type of cable connection, Pin 1 is crossed with Pin 3, and Pin 2 is crossed with Pin 6.

Crossover cable is used to connect two or more computing devices. The internal wiring of crossover cables reverses the transmission and receive signals. It is widely used to connect two devices of the same type: e.g., computers to computer or switch to switch.

Rollover cables simply reverse the pin order of each wire in a cable. The wire that connects to pin 1 at one end goes to pin 8 at the other end, the wire that goes to pin 2 and the first end goes to pin 7 at the other end. In the middle of the connector pins 4 and 5 are reversed. These are most commonly used to connect to a device's console port to make programming changes to the device. Unlike crossover and straight-wired cables, rollover cables are not intended to carry data but instead create an interface with the device.

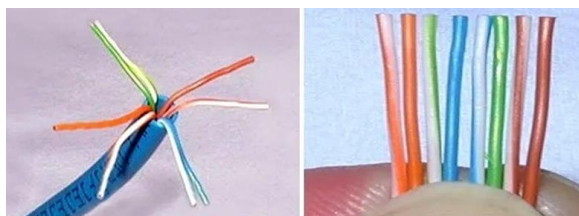
Straight-through cables are mainly used for connecting non-similar devices, while crossover cables are mostly used for connecting similar devices.

Straight-through cable connects a computer with a DSL modem, while Crossover cable connects Router to Router and Computer to Computer.

Working Procedure:

- Stripped the outer jacket of the UTP cable about 1.5 inch from the end.
- Separated the four pairs apart.
- Untwisted the wires and then aligned them in T568A or T568B orientation.
- Made sure that the wires were straight so that proper connection with RJ-45 could be made.
- Put the wires into the crimping tool and cut the wires as straight as possible with the help of the "single blade" (about 0.5 inch above the end of the jacket)
- Inserted the wires into the RJ-45 connector. Made sure the wires and pins followed the proper orientation (T568A or T568B)
- Pushed the connector into one of the voids (8P) of the crimping tool and squeezed the crimper all the way down.
- Repeated the whole process for the other end of the wire.
- Made one end of T568A orientation and the other end was of T568B orientation.
- A cable tester was used to make sure the whole procedure was done properly.

Demo pictures of the experiment:



Observation:

Twisted pair cables are used to prevent noise, minimize electromagnetic radiation and resists signal interference and crosstalk during transmissions. These twisted cables reduce the strength of noise signals and cancels out external waves, it provides better noise immunity and lower signal attenuation.

In a pair, one wire is used to transmit data and the other is the ground reference. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The tighter the twisting, the higher the supported transmission rate and the greater the cost per foot.

In this scenario 4 wires namely 1,2,3,6 will be used as Active link for communication whereas 4,5,7,8 will be used as backup link.

All in all, the main purpose is to avoid loss of data during data transfer.

Challenges:

Had some problem figuring out the correct orientation of T568A, T568B just by looking at the RJ-45 connector.

Took me a bit of time to figure out on how to use the crimping tool for different tasks.