# Computer Networks-Lab 02

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### CL30001 – Computer Networks-Lab

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NATIONAL UNIVERSTIY OF COMPUTER AND EMERGING SCIENCES, FAST- PESHAWAR CAMPUS
Department of Computer Science & Software Engineering

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# OBJECTIVES OF THE LAB

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In this lab, we will cover the following:

- What Is CISCO Packet Tracer?
- Introduction to Transmission Media
    - Wired (guided)
    - Wireless(Unguided)
- Build a Category 6 (CAT 6) Straight-Through Ethernet network cable.
- Build a Category 6 (CAT 6) Cross-Over Ethernet network cable.
- Test both cables for good connection using Cable Tester.
- Connecting Computers via Switch using Straight Through Cable
- Connecting two computers directly via Cross Over Cable
- Introduction to Network Devices
    - Hub, Switch ,Router, and Modem
- Performed Simulation of Hub and Switch with different scenarios on Packet tracer.

# Computer Networks Lab 02

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## Objective

The objective of this lab is to enable students to gain practical experience in various aspects of computer networking, including transmission media, cable construction, cable testing, and network device configuration. Through the use of CISCO Packet Tracer, students will gain practical knowledge of different transmission media.

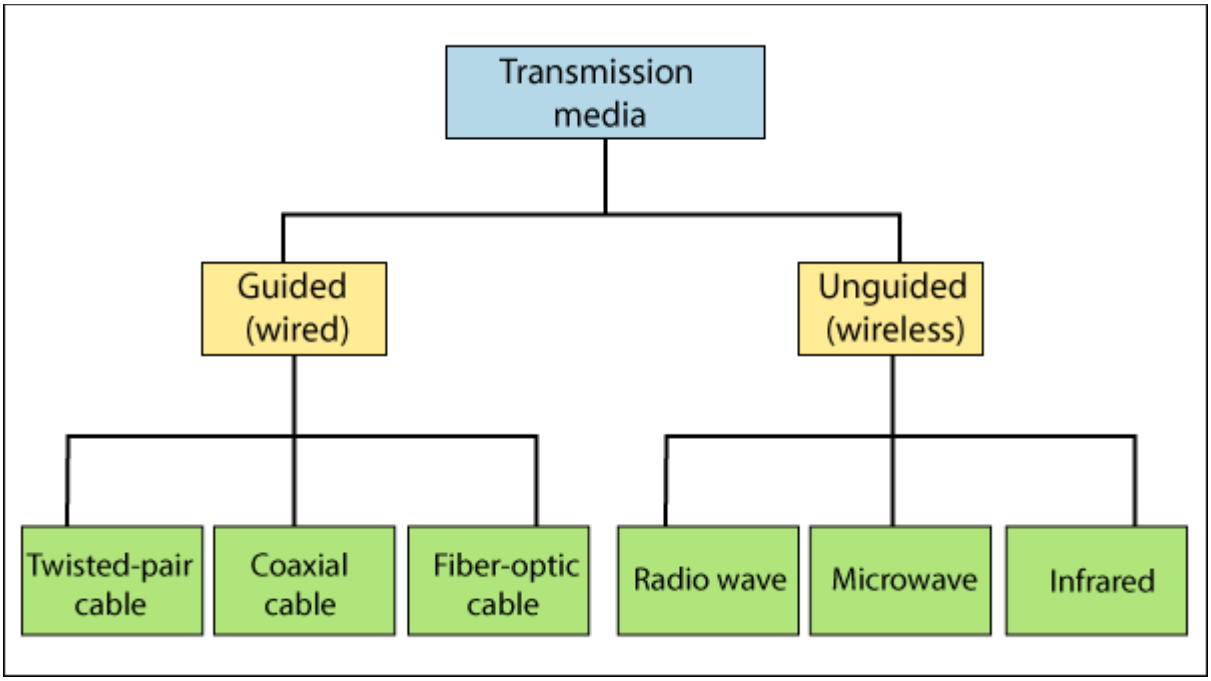
## Learning Outcomes

By the end of this lab, students will be able to:

- Explain the concept of transmission media and differentiate between wired (guided) and wireless (unguided) media.
- Building and Testing Ethernet Network Cables
- Connect two computers directly using a cross-over cable in Cisco Packet Tracer

# TRANSMISSION MEDIA

The transmission media is nothing but the physical media over which communication takes place in computer networks. The transmission of data over transmission media may be unguided (wireless) or guided (wired).




## WIRELESS

Wireless transmission is a form of unguided media. Wireless communication involves no physical link established between two or more devices, communicating wirelessly. Wireless signals are spread over in the air and are received and interpreted by appropriate antennas.

When an antenna is attached to electrical circuit of a computer or wireless device, it converts the digital data into wireless signals and spread all over within its frequency range. The receptor on the other end receives these signals and converts them back to digital data.

## WIRED

In wired communication a physical link is established between two devices. The link may be of different types. Alternatively referred to as a cord, connector or plug, a cable is one or more wires covered in a plastic covering that connects a computer to a power source or other device.

Networking cables are used to connect one network device to other network devices or to connect two or more computers to share printer, scanner etc. Different types of network cables like Coaxial cable, Optical fiber cable, Twisted Pair cables are used depending on the network's topology,

protocol and size. The devices can be separated by a few meters (e.g. via Ethernet) or nearly unlimited distances (e.g. via the interconnections of the Internet).

### COAXIAL CABLE

Coaxial lines confine the electromagnetic wave to area inside the cable, between the center conductor and the shield. The transmission of energy in the line occurs totally through the dielectric inside the cable between the conductors. Coaxial lines can therefore be bent and twisted (subject to limits) without negative effects, and they can be strapped to conductive supports without inducing unwanted currents in them and though.

The most common use for coaxial cables is for television and other signals with bandwidth of multiple megahertz. Although in most homes coaxial cables have been installed for transmission of TV signals, new technologies (such as the ITU-T G.hn standard) open the possibility of using home coaxial cable for high-speed home networking applications (Ethernet over coax).

**Figure 3.2. Coaxial Cable**

### TWISTED PAIR CABLE

A cable made by intertwining two separate insulated wires. There are two twisted pair types: shielded and unshielded. A Shielded Twisted Pair (STP) has a fine wire mesh surrounding the wires to protect the transmission; an Unshielded Twisted Pair (UTP) do not. The use of two wires twisted together helps to reduce crosstalk and electromagnetic induction. While twisted-pair cable is used by older telephone networks and is the least expensive type of local-area network (LAN) cable, most networks contain some twisted-pair cabling at some point along the network.

e.g. CAT6 (Category 6 UTP Cable (computer networks)).

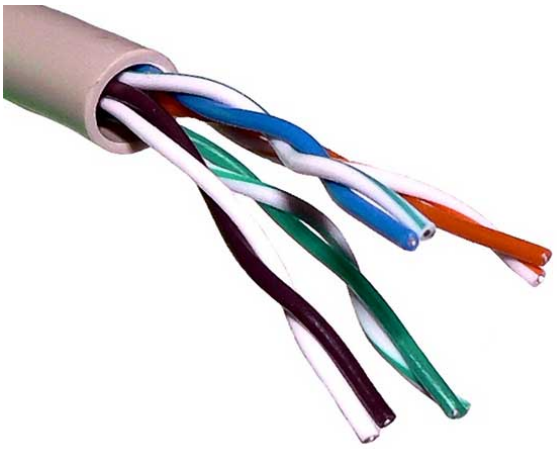


**Figure 3.3. CAT6 Twisted pair cable**

**Q: Write note on** CAT2, CAT3, CAT4, CAT5, CAT5e, CAT6, CAT7.

## FIBER OPTICS

Fiber Optic works on the properties of light. When light ray hits at critical angle it tends to refracts at 90 degree. This property has been used in fiber optic. The core of fiber optic cable is made of high quality glass or plastic. From one end of it light is emitted, it travels through it and at the other end light detector detects light stream and converts it to electric data.

Fiber Optic provides the highest mode of speed. It comes in two modes, one is single mode fiber and second is multimode fiber. Single mode fiber can carry a single ray of light whereas multimode is capable of carrying multiple beams of light.

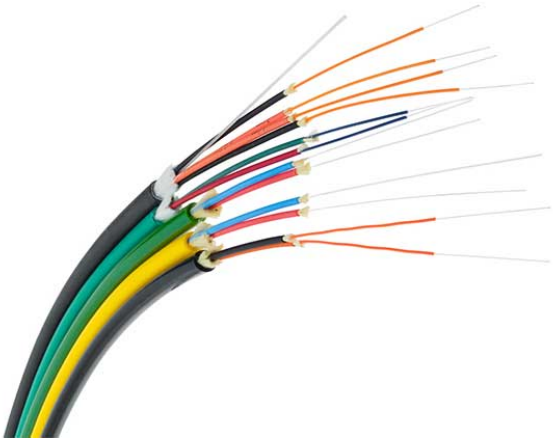


**Figure 3.4. Fiber optic**

Fiber Optic also comes in unidirectional and bidirectional capabilities. To connect and access fiber optic special type of connectors are used. These can be Subscriber Channel (SC), Straight Tip (ST), or MT-RJ.

## STRAIGHT-THROUGH CABLE

A straight-through network cable is just what the name suggests, a cable that passes data straight through from one end to another end. These cables are used for a variety of connections, for instance, connecting a computer to a hub or switch, connecting a computer to a cable/ISDN/DSL modem, and linking switches and hubs together. One such cable connection is shown in Figure 2.1.

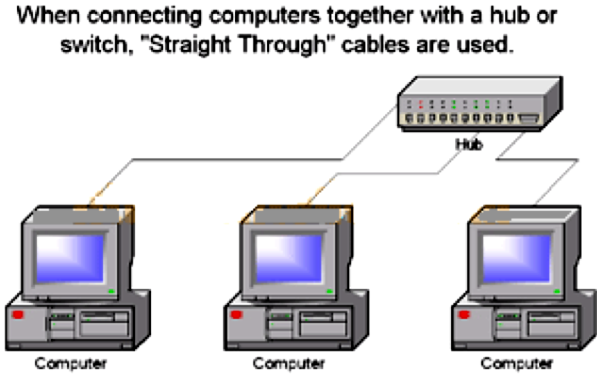



**Figure 3.5. Straight-through Cable**

Typically the ports on a hub are MDIX ports that allow the machine at the other end to utilize its MDI Port without the need for a crossover cable. Through these ports, hub automatically performs the crossover functions, which are required to properly align the cables with each other. When no hub or switch is used, cable itself must physically perform these crossover functions.

**About Cabling**

The two most common UTP (Unshielded Twisted-Pair) network standards are the 10 Mbps (10BASE-T Ethernet) and the 100 Mbps (100BASE-TX Fast Ethernet). In order for a cable to properly support 100 Mbps transfers, Category 5 (or CAT 5) twisted pair cable must be used. This type of low loss extended frequency cable will support 10 Base-T, 100 Base-T and the newer 100VG-AnyLAN applications. Other types of cabling include Category 3 that supports data rates up to 16 Mbps, and Category 1 that only supports data rates up to 1Mbps.

**Tools Required**

The tools required to do this lab are:

- CAT 6 network cable
- RJ-45 Connectors
- Cable Cutter
- Crimping tool, &
- Cable tester.

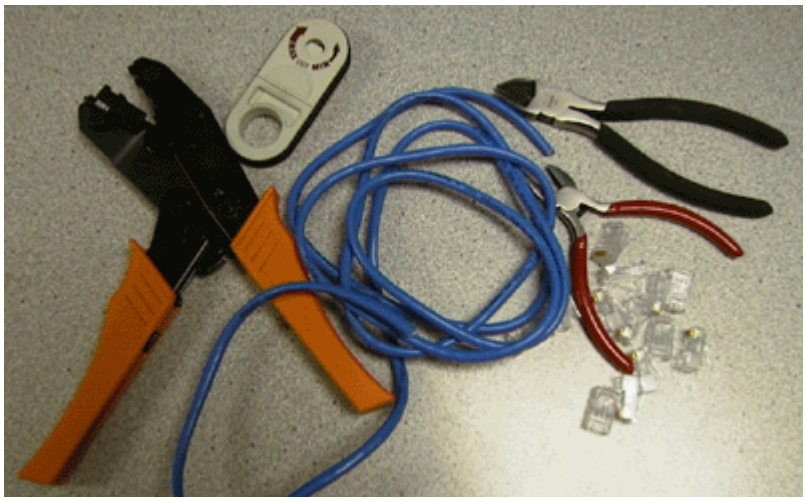


**Figure 3.6. Tools Required for Cabling**

**Procedure**

Well, the wire has two sides. Let's call one side … Side A and the other side … Side B. Do the following steps with Side A of the wire.

1. Remove the plastic cover from the cable up to two inches. You will see 4 twisted pairs (total 8 wires). In each twisted pair, one wire will be colored and the other will be white. For example, one will be Green and the other will be White having Green marks. The latter is called Green-White. Similarly there will be Brown wire twisted with Brown-White, Blue wire twisted with Blue-White, Orange twisted with Orange-White. This can be seen in Figure 2.3.

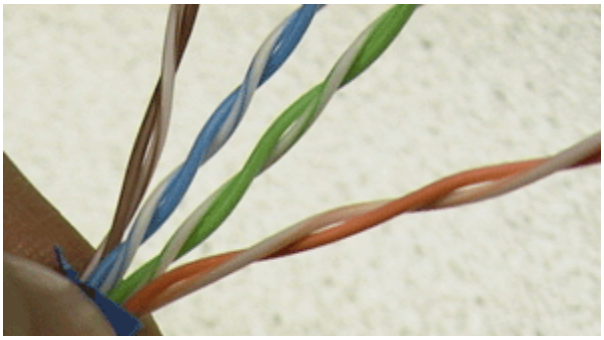
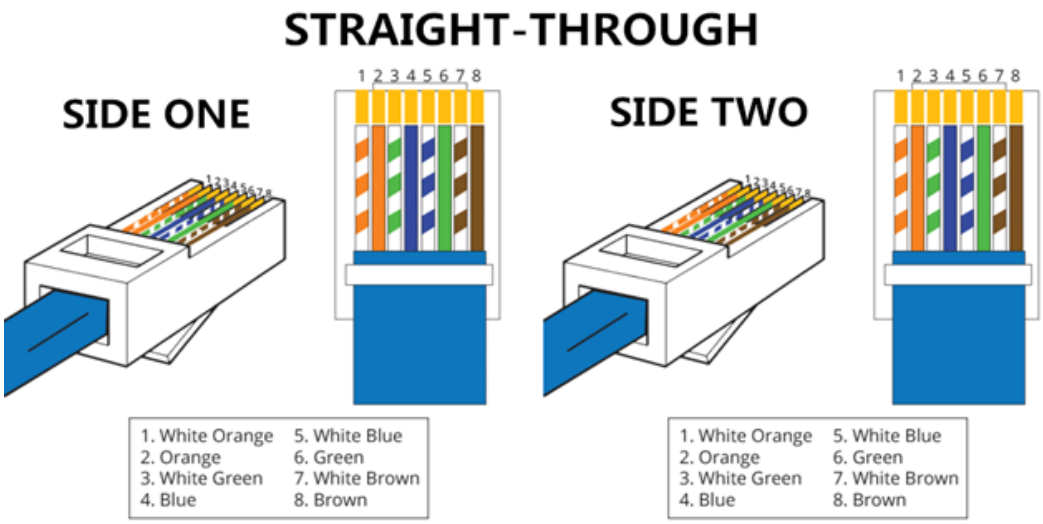


**Figure 3.7. Cable Pairs**

2. Untwist the wires and make them smooth (don't remove the plastic covers from the metal wires).
3. Arrange the wires in the order: Orange-White, Orange, Green-White, Blue, Blue-White, Green, Brown-White, and Brown. The order is important since there is a wiring standard defined by the Telecommunications Industry Association (TIA) [http://www.tiaonline.org].
4. It's called the EIA/TIA-568 Commercial Building Telecommunications Wiring Standard, and you can find more information on it here: http://www.digitaldelivery.com/Standards.htm#s5

5. Cut the wires in straight fashion and insert in the RJ-45 Jack.
6. Using the Crimping tool, punch it properly. Perform Step 1-5 for Side B.




## CROSS-OVER CABLE

A cross-over network cable is used to connect two computers directly. It is also used when you connect two hubs/Switches with a normal port on both hubs/Switches. (In other words, the cross cable is used relatively in a rare case.). It is used to connect similar devices.

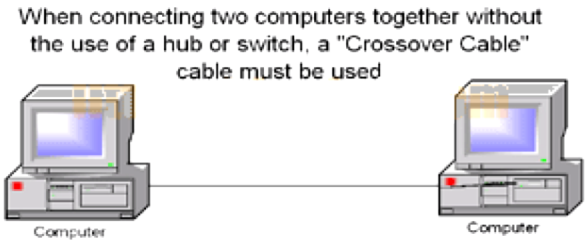



**Figure 3.8. Cross-Over Cable**

### Tools Required

Same as used for making Straight-Through Cable.

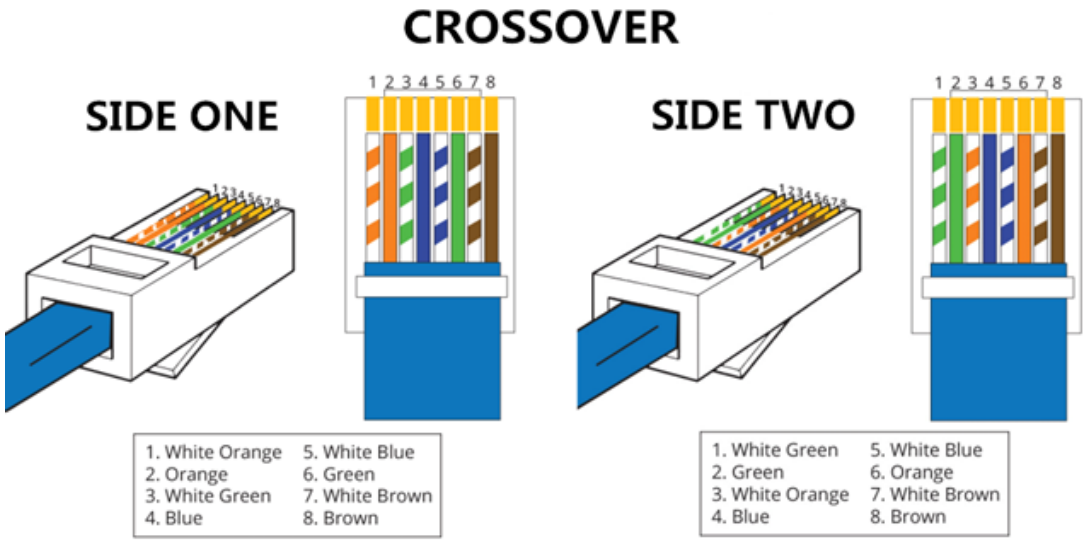
## Procedure

### Side A

Perform Steps 1-5 mentioned above for making straight-through cable.

**Side B**

Arrange the wires as: green-white, green, orange-white, blue, blue-white, orange, brown-white, and brown. And punch it properly.




***For Straight cables*** ***For Cross cables***

| **Pin #** | **Side A** | **Side B** | **Pin #** | **Side A** | **Side B** |
|---|---|---|---|---|---|
| **1** | orange-white | orange-white | **1** | orange-white | green-white |
| **2** | Orange | Orange | **2** | Orange | green |
| **3** | green-white | green-white | **3** | green-white | orange-white |
| **4** | Blue | Blue | **4** | Blue | blue |
| **5** | blue-white | blue-white | **5** | blue-white | blue-white |
| **6** | Green | Green | **6** | Green | orange |
| **7** | brown-white | brown-white | **7** | brown-white | brown-white |
| **8** | Brown | Brown | **8** | Brown | brown |

**Table 3.1 Straight-Through & Cross-Over Cable Connections**

## TESTING CABLES

Once both cables are ready, test it to make sure it works by means of a cable tester. Insert the two ends of the cable into the jacks on the tester and watch the lights. If they all light up, wire has a good connection and ready to use.

## CABLE TESTER

A cable tester is a device that is used to test the strength and connectivity of a particular type of cable or other wired assemblies. There are a number of different types of cable testers, each able to test a specific type of cable or wire (some may be able to test different types of cables or wires). The cable tester can test whether a cable or wire is set up properly, connected to the appropriate source points, and if the communication strength between the source and destination is strong enough to serve its intended purpose. The picture is an example of a cable tester from TRENDnet.


**Figure 3.9. TRENDnet Cable tester**

# Lab Tasks

**Experiment 1**: Building a Category 6 (CAT 6) Straight-Through Ethernet Network Cable

**Experiment 2:** Building a Category 6 (CAT 6) Cross-Over Ethernet Network Cable

**Experiment 3:** Testing Cable Connections using a Cable Tester