CS 361 Computer Networks Lab

Assignment 5

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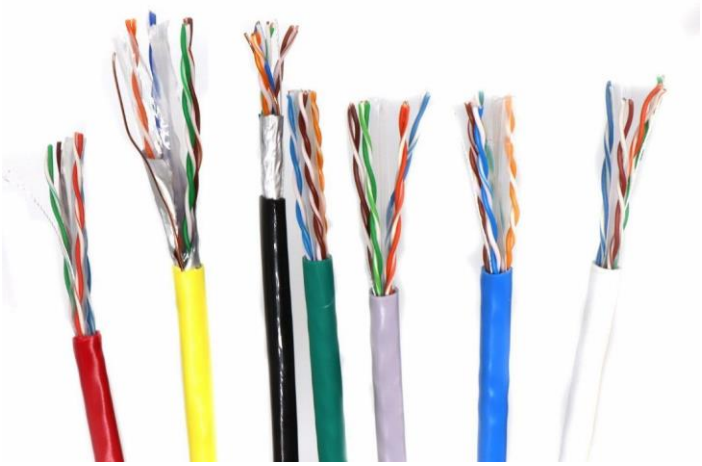
Questions:

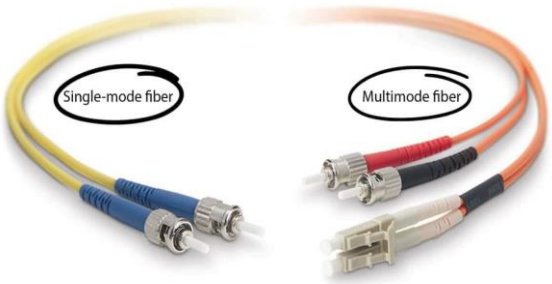
1. **What cable types are available?**

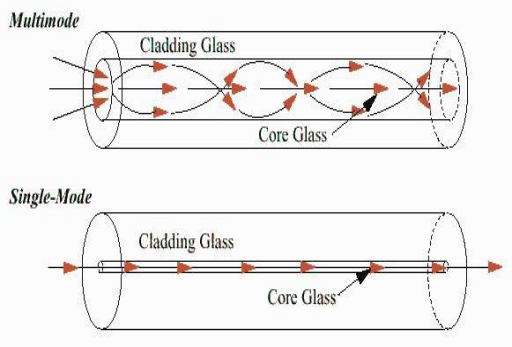
Several types of cables are commonly used in networking to connect devices and establish data communication. The most common networking cables include:

a. Ethernet (UTP) Cables (Cat 5e, Cat 6, Cat 6a, Cat 7, Cat 8): Ethernet cables are the most prevalent for wired network connections. Different categories, such as Cat 5e, Cat 6, Cat 6a, Cat 7, and Cat 8, offer varying speeds and performance levels. Cat 5e is suitable for Gigabit Ethernet, while Cat 6 and above support higher data transfer rates.

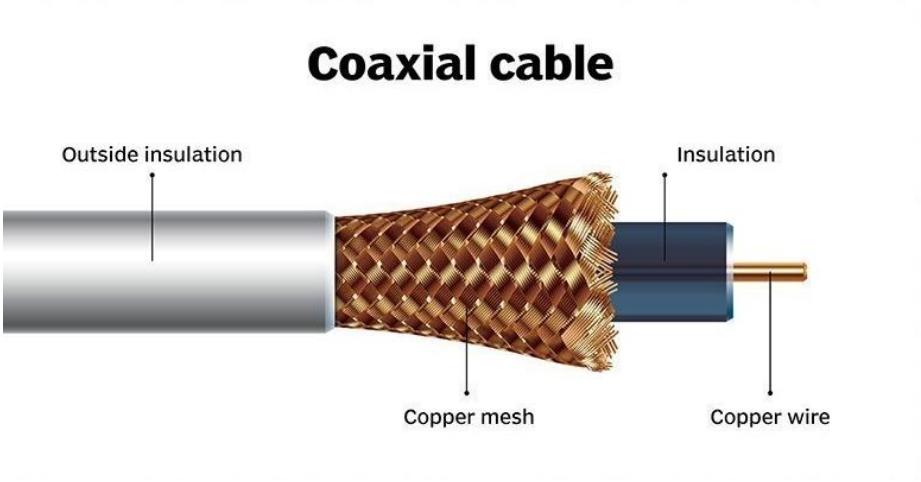


b. Fiber Optic Cables (Single-mode and Multi-mode): Fiber optic cables are used for high-speed and long-distance data transmission. Single-mode fibers are used for long-distance connections, while multi-mode fibers are suitable for shorter distances within data centers.





c. Coaxial Cables: Coaxial cables are used in cable television (CATV) and broadband internet applications. They come in various types, with RG-6 and RG-59 being common choices.



Apart from the cables mentioned above (as well as in the slides), there are several other types of cables as well. They are:

d. Patch Cables (Ethernet Patch Cables): These are short Ethernet cables used to make connections between network devices in a local area network (LAN), such as connecting a computer to a switch or router.

e. Fiber Optic Patch Cables: These short, pre-terminated fiber optic cables are used for connecting networking equipment, such as switches, to fiber optic ports.

f. Power over Ethernet (PoE) Cables: These are Ethernet cables that can deliver both data and electrical power to devices like IP cameras and access points. They are often Cat 5e or better.

g. USB Ethernet Adapters: While not cables in the traditional sense, these adapters can be used to add Ethernet connectivity to devices like laptops that lack built-in Ethernet ports.

h. HDMI over Ethernet (HDMI Extender) Cables: These cables are used to extend HDMI signals over longer distances using Ethernet cables. They are useful in applications like home theater systems.

i. Network Cable Testers: While not used for data transmission, network cable testers are essential tools for checking the continuity and integrity of network cables.

2. How do cables work?

Cables operate on the fundamental principles of electrical conductivity or optical signal propagation, depending on their specific design and application.

a. Electrical Conductivity: Cables intended for electrical signals, such as power or data transmission, are built upon the principle of conducting electricity. The cable's core consists of conductive materials, often copper or aluminum, which allow the flow of electrical current. When voltage is applied at one end of the cable, it generates an electric field, setting in motion the movement of electrons within the conductor. This electron flow constitutes an electric current that carries information or power from the sender to the receiver.

b. Twisted Pairs in UTP Cables: Unshielded Twisted Pair (UTP) cables, widely used in networking, utilize pairs of tightly twisted wires. This meticulous arrangement mitigates electromagnetic interference and crosstalk, common challenges in data transmission. During data transfer, electrical signals manifest as voltage variations between wire pairs. The cable's twisting serves to cancel out any interference, ensuring the fidelity of the transmitted data.

c. Fiber Optic Elegance: In the realm of fiber optic cables, data is transported via the graceful choreography of light pulses. These cables comprise a core made from glass or plastic, characterized by its exceptional reflectivity, enabling light to bounce and travel within. Data transmission is achieved by modulating a light source (typically a laser or LED) to emit pulses of light into the core. These light pulses journey through the core, faithfully carrying information to the receiving end.

d. Signal Encoding: In both electrical and optical cables, data is encoded using specific methodologies. Ethernet cables employ varying electrical voltage levels to represent binary 0s and 1s, while fiber optic cables rely on the presence or absence of light pulses to convey data.

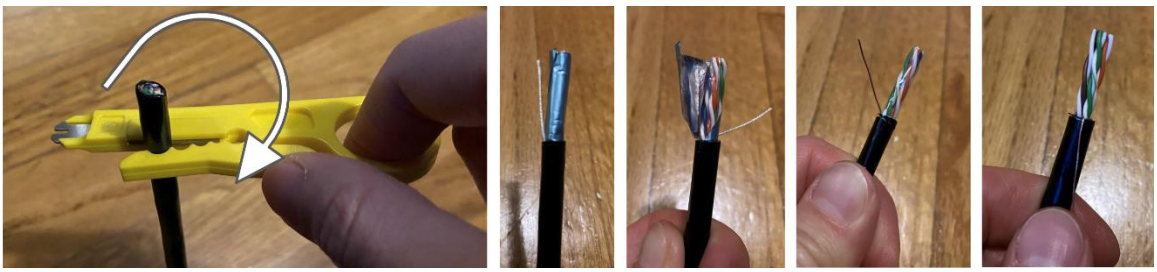
3. **How are cables used in networking?**

Cables play a fundamental role in networking by connecting devices and facilitating the transfer of data within a network. They are the physical pathways through which data is transmitted from one device to another. They provide **the foundation for wired connections**, enabling seamless communication between computers, switches, routers, and servers. **Local Area Networks (LANs)** rely on the high-speed data transfer capabilities of Ethernet cables like Cat 5e and Cat 6, facilitating efficient data exchange within small- to medium-sized network environments. Moreover, these cables play a central role in **delivering internet connectivity to end-users** via coaxial and fiber optic cables, serving as the critical link between homes, businesses, and the broader internet infrastructure. In the dynamic environment of data centers, cables assume an even more significant role. Diverse types, including high-speed Ethernet and fiber optic cables, form the backbone of connectivity, allowing for the **efficient transmission of data between servers, storage systems, and networking equipment**. This infrastructure is paramount for managing vast quantities of data and ensuring data center uptime. In addition, cables play a key part in **point-to-point connections**, linking individual devices like computers, printers, and cameras. They also offer the advantage of **Power over Ethernet (PoE)**, streamlining cabling infrastructure by simultaneously transmitting data and electrical power to devices such as IP cameras and access points.

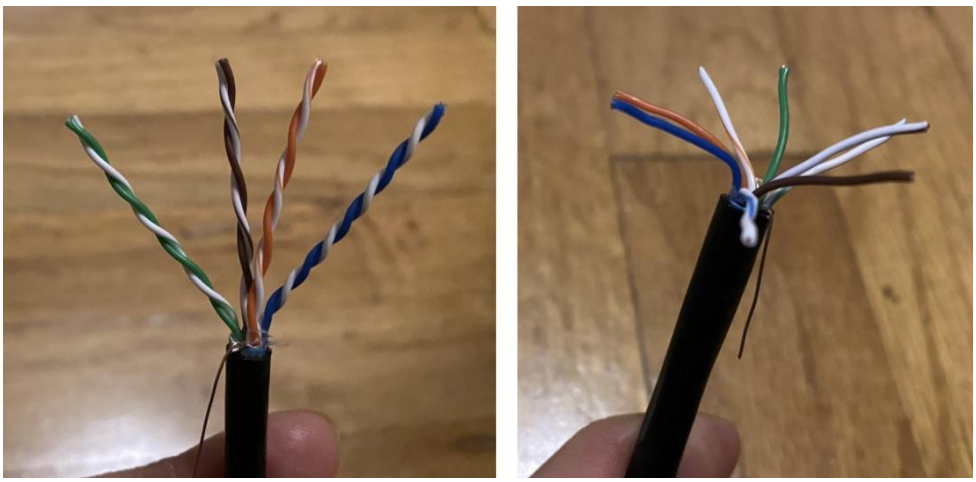
4. How are connections made?

The steps involved in making a connection when using an Ethernet cable:

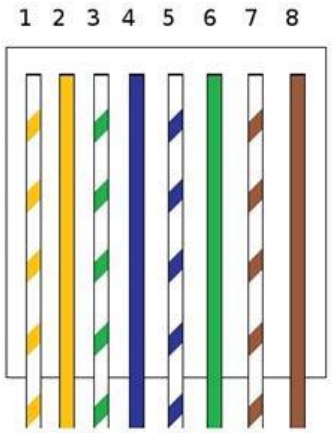
Strip Cable End: Stripping the cable end involves removing the outer insulation or jacket to expose the inner wires. This is typically done using a cable stripper tool or a utility knife. Proper stripping ensures access to the wires for termination.

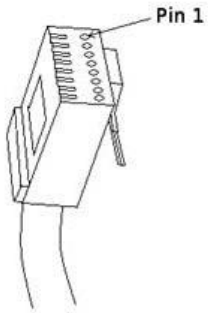


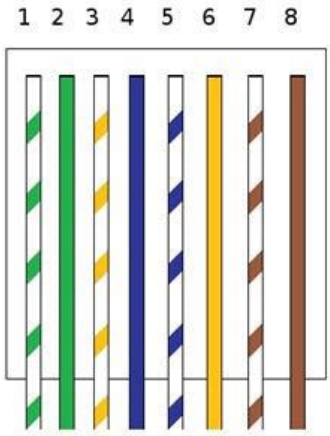
Untwist Wire Ends: If you're working with twisted pair cables, such as Ethernet cables, it's essential to carefully untwist the wire pairs to prepare them for termination. Avoid excessive untwisting, as maintaining some twist is crucial to reduce interference and crosstalk.



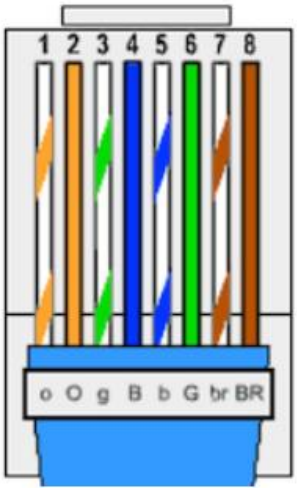
Arrange Wires: Depending on the type of connector you are using, you'll need to arrange the individual wires in the correct order. For example, Ethernet cables typically use T568A or T568B wiring standards, and the wires must be aligned accordingly.







T-568B **T-568A**

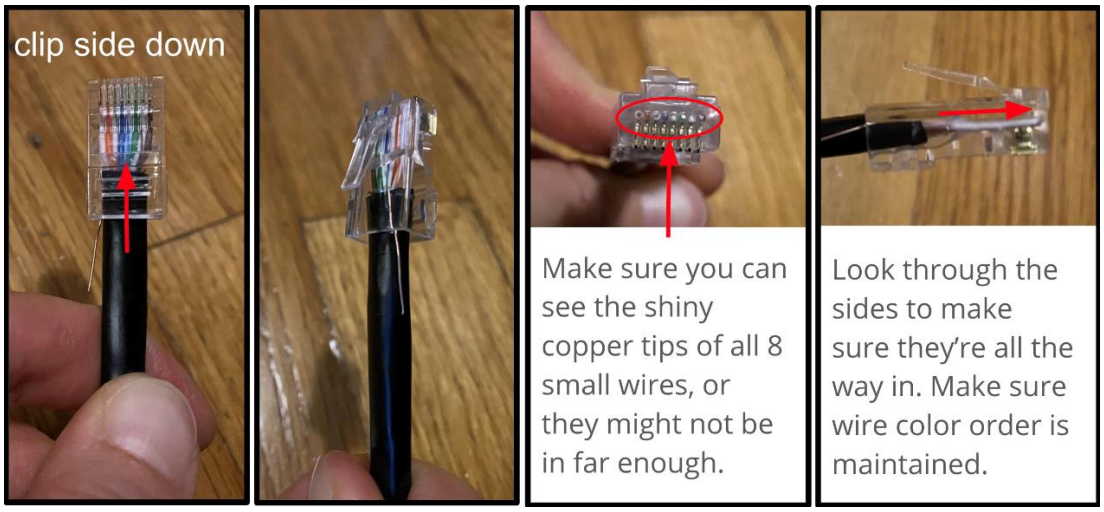


For RJ-45 Plug, the ordering of the wires is Striped orange, Solid orange, Striped green, Solid blue, Striped blue, Solid green, Striped brown, Solid brown.

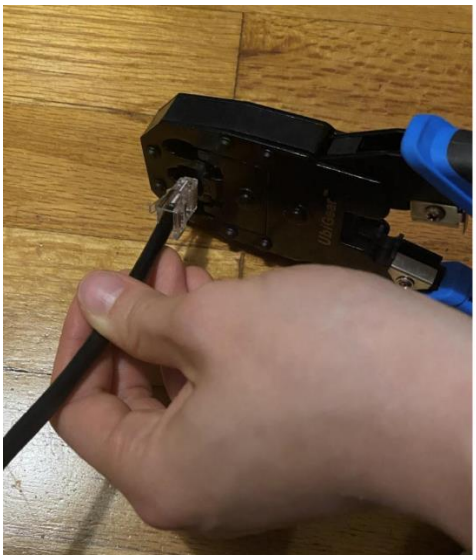
Trim Wires to Size: After arranging the wires, you may need to trim them to the appropriate length to ensure they fit properly within the connector or terminal block. Precision is essential to avoid signal loss or interference.

Attach Connector: This step involves connecting the wires to the appropriate connector or terminal block. This process varies depending on the connector type, whether it's an RJ-45 connector for Ethernet cables, an RJ-11 for telephone cables, or other specialized connectors. A crimping tool may be necessary to secure the wires in place.

Check: Before proceeding further, it's crucial to double-check your work. Ensure that the wires are correctly aligned, that there are no crossed or loose connections, and that the insulation is not crimped or damaged.



Crimp: If a crimping tool is required for your connector type, carefully crimp the connector to secure the wires in place. Be sure to follow the manufacturer's instructions for the specific connector you are using to avoid damaging the cable or connector.



Test: After making the connection, it's essential to test it to verify that it's functioning correctly. For Ethernet connections, this might involve checking for link connectivity and data transfer. For other cable types, you may perform relevant tests to ensure proper functionality.

This a tester, which checks whether all the 8 pins of the RJ-45 plug is working fine, on which 8 green lights will be flashed one after the other