Department of Computer Science and Engineering
University of Dhaka

Title:

Study and Testing of Different Types of Transmission Media (Wires) in Data and Telecommunication

CSE 2213: Data and Telecommunication Lab

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Theoretical Background :

Transmission media are the physical pathways that allow data to travel from one device to another. They are mainly classified into two broad categories: wired and wireless media. Wired transmission media use physical cables or wires to carry data signals. They generally offer higher speed, better security, and more reliable connections over short and long distances. For example,twisted pair cables, coaxial cables, and optical fiber cables.

On the other hand, Wireless transmission media use electromagnetic waves to transmit data through the air without physical cables. Common examples are Wi-Fi, Bluetooth, infrared, and satellite communication. Here are some commonly used wired transmission media:

Twisted Pair Cable:

Twisted pair cable is one of the most common types of wired transmission media. It consists of pairs of copper wires twisted together, which helps to reduce electromagnetic interference and crosstalk between pairs.

There are two main types of twisted pair cables:

Unshielded Twisted Pair (UTP):

UTP is the most widely used in Local Area Networks (LANs). It does not have any additional shielding which makes it more flexible and cost-effective. UTP cables are categorized by performance standards such as Cat5, Cat5e, Cat6, and Cat6a. They are commonly used for Ethernet connections and follow wiring standards like T568A and T568B for proper termination with RJ-45 connectors.

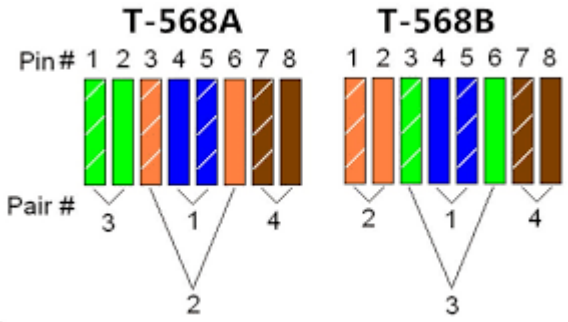


Fig1 :UTP Cable Wiring Standards.

Shielded Twisted Pair (STP):

STP cables are similar to UTP but it includes an additional shielding around the twisted pairs. This extra shield helps further reduce electromagnetic interference and provides better protection in environments with high electrical noise. STP cables are more expensive and less flexible than UTP.

Coaxial Cable:

Coaxial cable is another common type of wired transmission medium. It has a single copper conductor at its center. This central conductor is surrounded by an insulating layer. Around the insulation, there is a metallic shield. The shield blocks external electromagnetic interference. An outer plastic covering protects the entire cable.Coaxial cables have been widely used for cable television (CATV). They were also used in older Ethernet network connections.

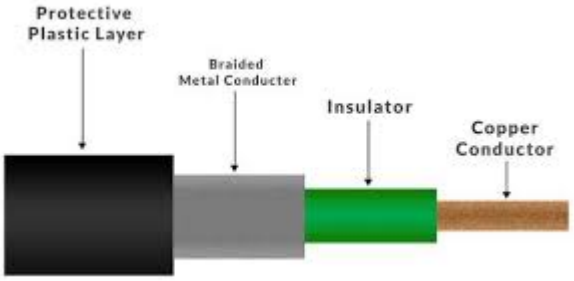


Fig2: Coaxial cable

Optical Fiber Cable:

Optical fiber cables use light signals to transmit data instead of electrical signals. This allows very high data transfer speeds with very little signal loss. Optical fibers can transmit data over long distances without losing quality.

An optical fiber is made up of three main parts. The core is the thin glass or plastic center that carries the light. Surrounding the core is the cladding, which reflects the light back into the core. The entire fiber is protected by an outer jacket.

An optical fiber is made up of three main parts. The core is the thin glass or plastic center that carries the light. Surrounding the core is the cladding, which reflects the light back into the core. The entire fiber is protected by an outer jacket.There are two main types of optical fiber cables. Single-mode fiber is used for long-distance communication. Multi-mode fiber is used for shorter distances, such as inside buildings.

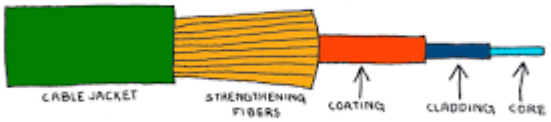
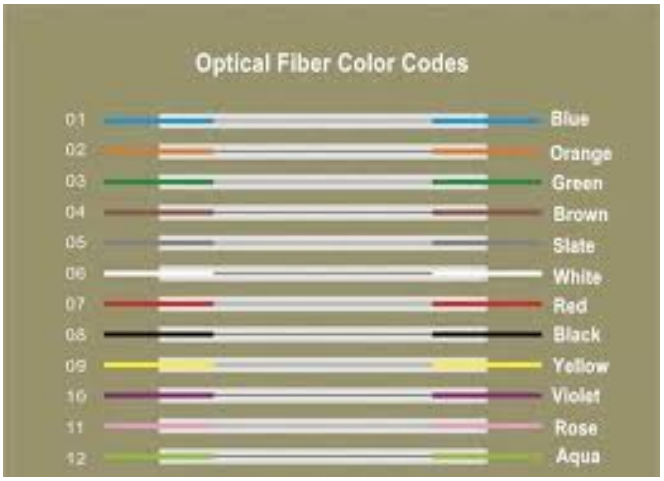


Fig3: Basic structure of optical fiber

Optical fibers are terminated using specific types of connectors, such as SC, LC, or ST connectors. These connectors precisely align the fiber cores to allow efficient transmission of light signals.

Optical Fiber Color Coding :



Optical fiber cables use a standardized color coding system to identify individual fibers inside the cable. The most common system, known as EIA/TIA-598, assigns a sequence of 12 colors to fibers: blue, orange, green, brown, slate, white, red, black, yellow, violet, pink, and aqua.

Objectives:

- To study the structure and function of different transmission media.
- To learn about the wiring standards for UTP cables.
- To test the connectivity and performance of UTP and optical fiber cables.
- To gain practical knowledge of how to handle and test these cables in real-world scenarios.

Apparatus and Materials Required:

- UTP cable
- Optical fiber patch cord
- Cable tester
- RJ-45 connectors
- Crimping tool
- Fiber optic connectors (SC, LC)
- OTDR (Optical Time Domain Reflectometer) or basic fiber tester
- Computer or network switch/router

Experimental Procedure:

UTP Cable:

1. Collected a length of Unshielded Twisted Pair (UTP) cable (e.g., Cat5e or Cat6).
2. Stripped the outer insulation carefully to expose the twisted pairs inside the cable.
3. Arranged the wires according to the T568B wiring standard.
4. Inserted the wires into an RJ-45 connector and used a crimping tool to fix the connector securely.
5. Repeated the same steps for the other end of the cable.
6. Connected both ends of the cable to a cable tester.
7. Checked the tester's display to verify that all eight pins were connected correctly and that there were no wiring faults.

Optical Fiber Cable:

1. Collected a sample optical fiber cable and identified its connectors (e.g., SC or LC).
2. Inspected the fiber cable for any visible damage or bending that could affect signal transmission.
3. Connected a visual fault locator (VFL) or a simple light source to one end of the fiber cable.
4. Observed the other end to check if the light signal passed through the fiber core clearly.
5. Inspected the connectors to ensure they were clean and properly aligned.
6. Confirmed that there was no visible light leakage along the length of the cable, which indicates good fiber integrity.

Experimental Result:

UTP Cable:

The cable tester showed that each pin was connected correctly according to the T568B standard. The continuity test confirmed the cable was suitable for data transmission

Discussion:

During this experiment, we gained practical knowledge about two important types of transmission media used in modern data and telecommunication systems which are Unshielded Twisted Pair (UTP) cables and Optical Fiber cables.

Working with UTP cables showed us how twisted copper pairs reduce electromagnetic interference and why proper wiring standards like T568B are necessary for reliable connections. The color coding inside the UTP cable helps keep the wiring order correct.

Optical Fiber cables are very different from copper cables because they carry data as light signals instead of electrical signals. Testing the fiber with a visual fault locator showed us how light travels through the fiber core, and how a damaged core or dirty connector can weaken the signal. This experiment also highlighted the need for careful handling, as optical fibers are delicate and precise.

Some small challenges were faced while doing this work. Removing the insulation from the UTP cable and organizing the small wires required a lot of patience. Crimping the RJ-45 connectors needed practice to get the wires in the right order. Even a small error in the order could cause the cable to fail the test. With the Optical Fiber, keeping it clean and not bending it too much was difficult at first. Properly cleaning the connectors was also very important.

Dealing with these challenges helped show how careful work and using the right tools can prevent mistakes.Overall, the experiment demonstrated how theory applies to real work and why good wiring and testing are important for safe and fast data communication.

Conclusion:

This lab helped us to understand the basic structure, purpose, and testing methods for different types of transmission media. The work showed the right way to prepare and connect UTP cables by using standard wiring layouts and testing tools. It also showed how Optical Fiber cables need careful handling and proper testing to carry light signals without loss.

The experiment proved that even simple tasks like arranging wires or cleaning connectors are very important for smooth data transmission. Knowing how to test and handle these cables will help build better, safer, and faster networks in the future.