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Role of Transmission Media in Communication Channel

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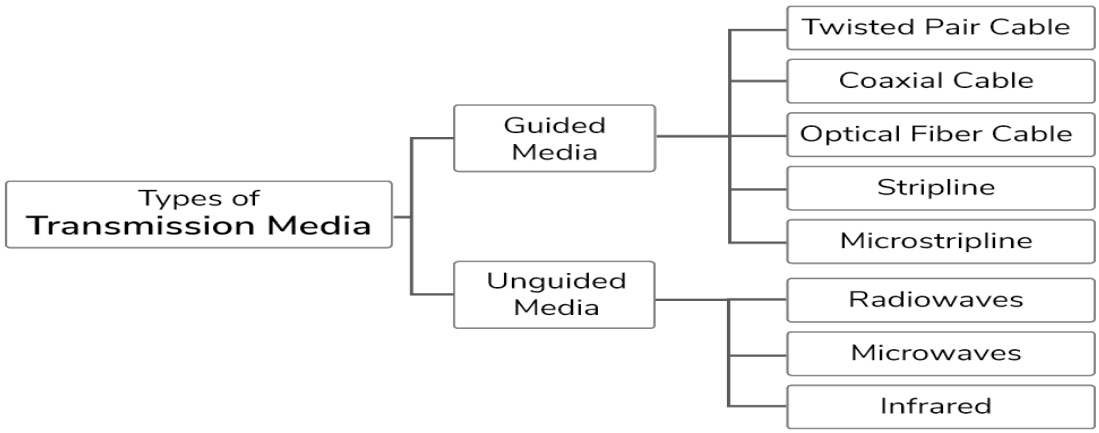
ABSTRACT
The physical medium used to transfer data between devices in a network is referred to as transmission media. Both cable and wireless media are possible. A number of variables, including speed, distance, and interference, influence the choice of media. We shall talk about the transmission media in this article. We will examine transmission media types in detail in this post.

KEY WORDS
Transmission, Media, Cable, Pair, Fibre, Channel, Signal.

INTRODUCTION
Transmission Media in Communication Channel is that process in which the Data is sent from one device to another via a channel, which is a physical path that connects the transmitter and the receiver. The following categories can be used to broadly classify transmission media, given below-



Media Guidance
Wired or bounded transmission media are other names for guided media. Physical linkages are used to guide and confine sent signals in a limited path. Qualities of this are secure, high Speed, utilized over relatively short distances. Three main categories of guided media exist, which are-

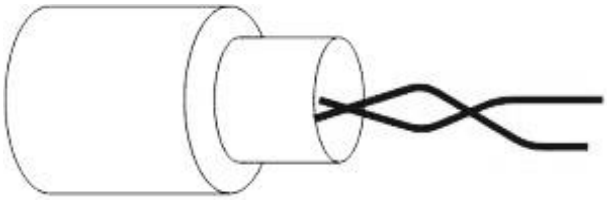
A Twisted Pair With Cable
It is made up of two conductor wires that are individually insulated and looped around one another. Usually, a protective sheath encases many pairs of them. The most popular transmission media are these. There are two kinds of twisted pairs, which are given below.

Unshielded Twisted Pair

Unshielded Twisted Pair

Two insulated copper wires twisted around one another make up an unshielded twisted pair (UTP). This kind of cable can block interference and does so without the need for a physical barrier. Telephonic applications make advantage of it. There are three main unshielded twisted pair benefits, which are the least costly, simple installing and high-speed capability. Also unshielded twisted pair has some drawbacks which are reduced performance and capacity compared to STP, and transmission over short distances because of attenuation.

Shielded Twisted Pair

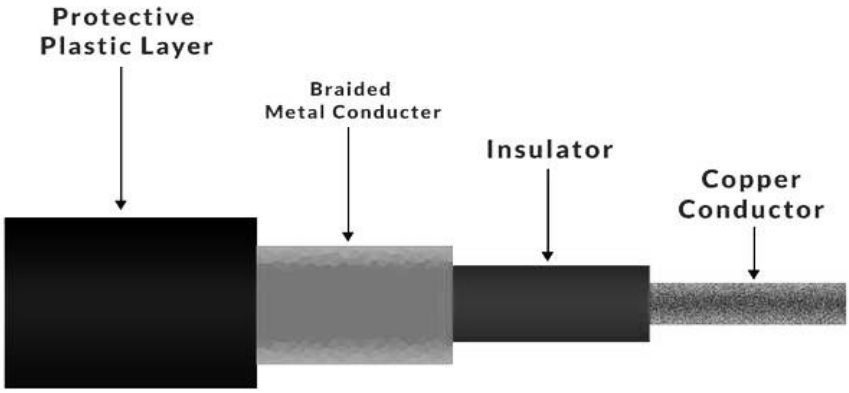


Shielded Twisted Pair

To prevent interference from outside sources, Shielded Twisted Pair (STP) cables are covered with a foil shield or a copper braid. It is utilized in telephone lines' voice and data channels as well as fast-data-rate Ethernet. It is have some benefits, those are superior performance over UTP at a higher data rate, removes crosstalk and faster comparatively and also have some drawbacks, those are somewhat challenging to create and install, and bulky is more pricy.

Coaxial Wiring

Coaxial cables have two parallel conductors, each with its own insulated protection cover, and an outer plastic covering with an insulating layer of Teflon or PVC. Baseband mode (dedicated cable bandwidth) and broadband mode (cable bandwidth divided into distinct ranges) are the two modes in which the coaxial cable transmits data. Coaxial cables are commonly used in cable TVs and analogue television networks.

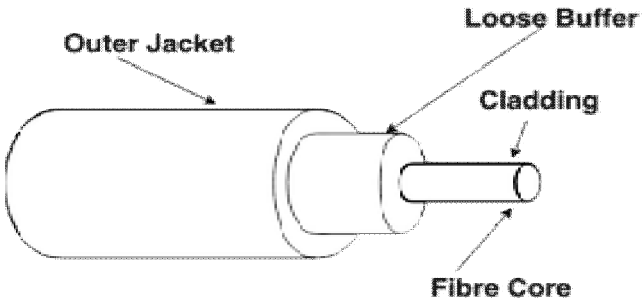


Benefits of Coaxial Cable are the bandwidth of coaxial wires is considerable, simple installing, have greater durability and dependability, Less impacted by electromagnetic inference, noise, and crosstalk, and also multiple channels are supported with coaxial connections.

Negative aspects of coaxial cable are that these wires are very costly, to avoid crosstalk coaxial cable needs to be grounded; its heavy because of their many layers, hackers may damage the coaxial wire and connect a "t-joint," which would jeopardise the data's security.

Optical Fibre With Cable

The idea of 100% internal reflection of light via a glass core is used in optical fibre cables. The coating is a less dense layer of glass or plastic that envelops the core. Large amounts of data are transmitted using it. Both unidirectional and bidirectional cables are possible. Both unidirectional and bidirectional modes are supported by the Wavelength Division Multiplexer (WDM).



There are many benefits of optical fibre cable which are more bandwidth and capacity, not heavy, reduced attenuation of signals, resistance to electromagnetic interference and, the ability to withstand caustic substances. This cable also have some drawbacks, are installing and maintaining of it, which challenging the expensive.

There are some applications of Optical Fibre Cable in many areas like medical, defence, for communication and also for industrial uses. Which are found in a variety of medical devices, it's applied to data transmission in aircraft, Internet cables are primarily formed using this and, applied to lighting and safety features while designing cars' exteriors and interiors.

Media Without Guidance

other names for it include wireless and unbounded transmission media. Electromagnetic signals can be transmitted without a physical medium. There are some characteristics of Unguided Media which are the signal is sent by air, not as Safe and it is for longer distances, uses. Three different kinds of signals are sent over unguided media, which are given below-

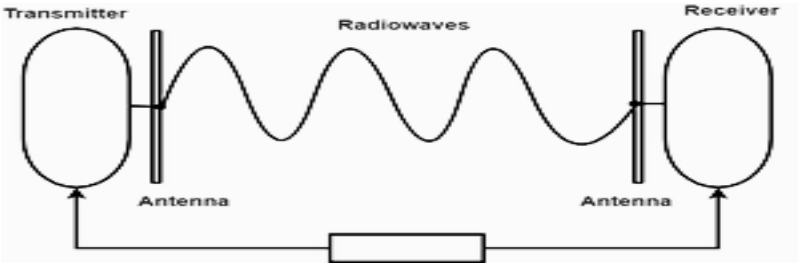
Waves of Radio

Buildings can be penetrated by radio waves, which are simple to produce. It is not necessary for the sending and receiving antennas to line up. Range of Frequencies is from 3KHz to 1GHz. Radio waves are used for transmission in cordless phones, AM and FM radios.

Types of Radio Wave -

1. Short Wave: AM Radio Parts.
2. VHF (Very High Frequency): FM Radio/TV.
3. UHF (Ultra High Frequency): TV Radio Wave.

The transmitter is in charge of signal encoding. Decoding the signal is the receiver's responsibility.



MICROWAVES

Since it's a line of sight communication, the sending and receiving antennas must be correctly orientated. The height of the antenna has a direct correlation with the signal's range. Range of frequencies: 1 GHz to 300 GHz. Microwaves are mostly utilized for television distribution and cell phone communication.

Advantages:

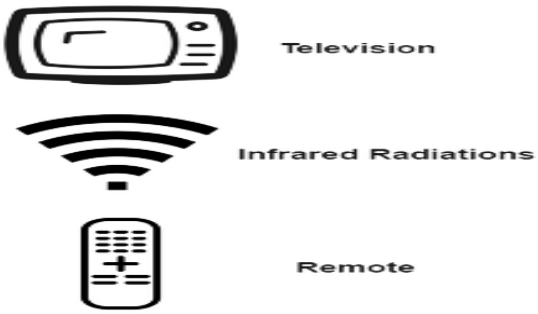
1. Less expensive than using cables
2. Not having to buy land
3. Communication eases in challenging environments
4. Interaction across oceans

Drawbacks:

1. Communication that is not secure.
2. Signal that is out of phase.
3. Subject to weather fluctuations.
4. There is a limit to bandwidth.
5. High maintenance, implementation, and design costs.

The Infrared

For communication across very short distances, infrared wavelengths are employed. They are unable to go beyond barriers. Interference between systems is avoided as a result. Range of Frequencies: 300 GHz to 400 GHz. TV remote controls, wireless mice, keyboards, printers, and other devices use it.



Considerations Made When Designing the Gearbox Media

1. Bandwidth: A signal's data transmission rate increases with a medium's bandwidth, assuming all other factors stay the same.
2. Impaired Transmission: Transmission when the broadcast and received signals are different, impairment takes place. Transmission impairment will affect the quality of the signal.
3. The process of disrupting a signal while it is passing across a communication media by adding an unwanted signal is known as interference.

Applications of Transmission Media in Computer Communication Channel

1. Unshielded Twisted Pair (UTP) - Local Area Networks (LAN), telephones.
2. Shielded Twisted Pair (STP) - Industrial networks, environments with high interference.
3. Optical Fiber Cable - Long-distance communication, internet backbones.
4. Coaxial Cable - Cable TV, broadband internet, CCTV.
5. Stripline - Printed Circuit Boards (PCBs), microwave circuits.
6. Microstripline - Antennas, satellite communication, RF circuits.
7. Radio - Wireless communication, AM/FM radio, mobile phones.
8. Infrared - Remote controls, short-range communication.
9. Microwave - Satellite communication, radar, long-distance links.

CONCLUSION

Transmission media, which can be categorized as either unguided (wireless) or directed (wired), are essential means of data transfer in networks. Coaxial cables, optical fibres, and twisted pair cables are examples of guided media that offer reliable, quick, and safe data transfer over short distances. With trade-offs between security and attenuation, unguided media—such as radio waves, microwaves, and infrared—offer wireless communication over a range of distances. Transmission degradation, interference, and bandwidth all influence the choice of transmission material.

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