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Types of guided and unguided transmission media

In order for networks to be effective, the raw flow of data from one device to another must be transported through a medium. Various transmission media can be used for the transmission of data. These transmission media can be of two kinds –

- Led – In guided media** data are sent by cabling system led with a fixed path. For example, copper wires, fibre optic wires, etc.
- Unguided – In unguided media**, transmitted data travels through the free space in the form of electromagnetic signal. For example, radio waves, lasers, etc. Each transmission media has its own advantages and disadvantages in terms of bandwidth, speed, delay, cost per bit, ease of installation and maintenance, etc. Let's discuss some of the most widely used media in detail.

Twisted Pair Cable Copper Wires are the most common wires used to send signals due to good performance at low cost. They are most commonly used in phone lines. However, if two or more wires lie together, they can interfere with each other's signals. To reduce this electromagnetic interference, pairs of copper wires are twisted together in spiral form like a DNA molecule. Such twisted copper wires are called twisted pair. To reduce interference between nearby twisted pairs, the turn rates are different for each pair. Up to 25 twisted pairs can be combined in a protective covering to form twisted pair of cables that form the backbone of phone systems and Ethernet networks.

Advantages of twisted pair of cable twisted pair cable are the oldest and most popular cables around the world. This is due to the many advantages they offer –

- Trained staff readily available
- due to shallow learning curve
- Can be used for both analog and digital transmissions
- Least expensive for short distances
- Entire network does not go down as part of the network is damaged

Disadvantages of twisted pair cable With its many advantages, twisted pair cables offer some disadvantages also –

- Signal can not travel long distances without repeaters
- High error rate for distances greater than 100m
- Very thin and therefore breaks easily
- Not suitable for broadband connections

Shielding twisted pair cable To counter the tendency of twisted pair cables to pick up sound signals, wires are shielded in the following three ways –

- Each twisted pair is shielded.
- Set of multiple twisted pairs in the cable is shielded.
- Each twisted pair and then all pairs are shielded.

Such twisted pairs are called shielded twisted pair (STP) cables. The wires that are not shielded but simply bundled into a protective casing are called unshielded twisted pair (UTP) cables. These cables can have a maximum length of 100 meters. Shielding makes the cable bulky, so UTP are more popular than STP cables are used as the last mile network connection in homes and offices.

Coaxial cable Coaxial cables are copper cables with better shielding than twisted pair cables, so sent signals can travel longer distances at higher speeds. A coaxial cable cable of these layers, from the inner –

- Rigid copper wire as nuclear insulation material around the core
- Closely woven braided mesh of conductive material around the insulator
- Protective plastic casing encased the wire

Coaxial cables are widely used for cable TV connections and LAN's.

Advantages of Coaxial Cables These are the advantages of coaxial cables –

- Excellent sound immunity
- Signals can travel longer distances at higher speeds, for example 1 to 2 Gbps for 1 Km cable
- Can be used for both analog and digital signals
- Cheap compared to fiber optic cables
- Easy to install and maintain

Disadvantages of Coaxial cables These are some of the disadvantages of coaxial cables –

- Expensive compared to twisted pair cables
- Not compatible with twisted pair cables
- Fiberglass
- Thin glass or plastic wires used to transmit data with light waves are called fiber optics.
- Light Emitting Diodes (LEDs) or Laser Diodes (LDs) emit light waves at the source, which is read by a detector on the other side.
- Fiber optic cable has a bundle of such wires or fibers bundled in a protective covering.

Each fiber consists of these three layers, starting with the inner layer –

- Core made of high-quality silica glass or plastic
- Cladding made of high-quality silica glass or plastic, with a lower refractive index than the core
- Protective outer covering called buffer

Note that both core and cladding are made of similar material. However, if the lining's refractive index is lower, any stray light wave trying to escape the core is reflected back due to the total internal reflection. Fiber quickly replaces copper wires in phone lines, Internet communications and even cable TV connections, because transmitted data can travel very long distances without weakening. Single mode fiber optic cable can have a maximum segment length of 2 km and bandwidth up to 100 Mbps. Multi-mode fiber optic cable can have maximum segment length of 100 km and bandwidth up to 2 Gbps.

Advantages of fiber optic fiber is quickly replacing copper wires because of these advantages it offers –

- High bandwidth
- Immune to electromagnetic interference
- Suitable for industrial and noisy areas
- Signals that transport data can travel long distances without degrading

Fiber Despite long segment lengths and high bandwidth, the use of fiber may not be a viable option for everyone because of these disadvantages –

- Fiber cables are expensive
- Advanced technology needed for production
- installation and maintenance of fiber optic cables
- Light waves are one-way, so two frequencies are required for full duplex transmission
- Infrared
- Low frequency infrared waves are used for very short-range communication such as TV remote control, wireless speakers, automatic handheld devices etc.
- Infrared signals can spread in a room, but cannot penetrate walls. However, due to such short distance, it is considered one of the most safe safe Modes.

Radio Wave Transmission of data using radio frequencies is called radio-wave transmission. We're all familiar with radio stations that broadcast entertainment programs. Radio stations emit radio waves using transmitters, which are received by the receiver installed in our devices. Both transmitters and receivers use antennas to emit or capture radio signals. These radio frequencies can also be used for direct voice communication within the assigned range. This range is usually 10 miles.

Advantages of Radio Wave These are some of the advantages of radio wave transmissions –

- Cheap way of information exchange
- No country needs to be acquired for laying cables
- Installation and maintenance of devices is cheap

Disadvantages of Radio Wave These are some of the disadvantages of radiowave transmissions –

- Uncertain communication medium
- Sensitive to weather changes such as rain, thunderstorms etc.
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Slideshare uses cookies to improve functionality and performance and to provide you with relevant ads. If you continue to browse the site, you agree to use cookies on this website. For more information, see our privacy policy and user agreement. In the terminology of data communication, a transmission medium is a physical path between the transmitter and the receiver, i.e. the channel through which data is transmitted from one place to another.

Transmission Media is broadly classified into the following types:

- Guided Media:** It is also referred to as **Wired** or **Bounded** transmission media. Signals that are emitted are directed and restricted in a narrow road using physical links. Features: High Speed Secure Used for relatively shorter distances There are 3 main types of Guided Media: (i) Twisted Pair Cable – It consists of 2 separately insulated guide wires that run over each other. Generally, several such pairs are bundled in a protective shell. They are the most widely used Transmission Media. Twisted Pair is of two types: Unshielded Twisted Pair (UTP): This type of cable has the ability to block interference and does not depend on a physical shield for this purpose. It is used for telephone applications. Benefits: Least expensive Easy to install High Speed Capacity sensitive to external interference Lower capacity and performance compared to STP Short-range transmission due to damping Shielded Twisted Pair (STP): This type consists of a special jacket to block external interference. It is used in fast data-rate Ethernet and in voice and data channels of phone lines. Benefits: Better performance at higher data speed compared to UTP UTP crosstalk Relatively faster Relatively hard to install and produce More expensive Bulky (ii) Coaxial cable - It has an outer plastic covering with 2 parallel conductors each with a separate insulated protection cover. The coaxial cable transmits information into two modes: Baseband mode (dedicated cable bandwidth) and broadband mode (cable bandwidth is split into separate ranges). Cable TVs and analogue television networks make widespread use of Coaxial cables. Pros: High bandwidth Better sound immunity Easy to install and expand Cheap disadvantages: A single cable failure can disrupt the entire network (iii) Fiber optic cable - It uses the concept of reflection of light through a core composed of glass or plastic. The core is surrounded by a less dense glass or plastic covering called the upholstery. It is used for the transmission of large amounts of data. The cable can be one-way or two-way. The Wavelength Division Multiplexer (WDM) supports two modes, one-way and two-way mode. Pros: Increased Capacity and Bandwidth Lightweight Less Signal Damping Immunity to Electromagnetic Interference Resistance to Corrosion materials Cons: Difficult to install and maintain High Cost Fragile (iv) Stripline Stripline is a transverse electromagnetic (TEM) transmission line medium invented by Robert M. Barrett of the Air Force Cambridge Research Centre in the 1950s. Stripline is the earliest form of the flat transmission line. It uses a conductive material to send high-frequency waves, also called a waveguide. This conductive material is sandwiched between two layers of the ground plane that are usually short-circuited to provide EMI immunity. (v) Microstripline In this, the conductive material is separated from the ground plane by a dielectric layer. 2. Unguided Media: It is also called wireless or unlimited transmission media. The transmission of electromagnetic signals does not require a physical medium. Features: The signal is emitted by air less safely used for greater distances There are 3 types of signals emitted via unguided media: (i) Radiowaves - These are easy to generate and can penetrate through buildings. The shipping and reception antennas do not need to be aligned. Frequency range: 3KHz – 1GHz. AM and FM radios and cordless phones use Radiowaves for transmission. Further Categorized as i) Earth and (ii) Satellite. (ii) Microwaves – It is a line of sight transmission i.e. the transmitting and receiving antennas must be aligned well together. The distance travelled by the signal is directly proportional to the height of the antenna. Frequency range: 1GHz – 300 GHz. Distribution. (iii) Infrared – Infrared waves are used for very short-range communication. They can't get through obstacles. This prevents interference between systems. Frequency range: 300 GHz – 400THz. It is in TV remotes, wireless mouse, keyboard, printer, etc. Attention reader! Don't stop learning now. Get all the important CS Theory concepts for SDE interviews with the CS Theory Course at a student-friendly price and get industry ready. Recommended posts: If you like GeeksforGeeks and want to contribute, you can also write an article with contribute.geeksforgeeks.org or email your article to contribute@geeksforgeeks.org. See your article appear on the GeeksforGeeks main page and help other Geeks. Please Correct this article if you find something incorrect by clicking on the Article Improve below. Improved by : Kiran kumar 18, auditoreezio1369, shridhamator shridhamator

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