Transmission Media

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October 7, 2024

	Guided	Unguided
Guided vs. Unguided Media	Propogates through a physical cable Twisted pair, coaxial, fiber optic	Propogates through air Radio, microwave, infrared

- Electricity
  - Twisted pair cable
  - Caoxial Cable
- Light (fiber optic)
- Radio Signals (Wi-Fi)

Guided Electrical Transmission Signal is formed by modulating voltage through the medium. Requires two wires to form a complete circuit.

Main issue is *electromagnetic radiation.* Can be mitigated in two ways:

1. Twisted Cables
2. Shielding

Advantages	Disadvantages
Cost-effective	Susceptible to interference
Easy to install	Limited length (< 100 m)
Durable	
High-speed	

Twisted Pair

Two wires (usually copper) twist together, one for signal, one for ground. *Twisting* the wires ensures they are *exposed equally* to radiation, minimizing the chance of noise.

Shielding

Twisted pair wiring has problems when:

- Noise is especially strong / close
- Data is transmitted at high frequency

Metal shielding that surroudns the signal wire can protect it from interference.

Optical Fiber

Optical fiber cables are composed of long, thin strands of glass encased in plastic. Data is transmitted as short, well-defined light pulses.

As light travels through the fiber, it can scatter and broaden.

On either end there is

Light emitter (or LED) sends data in the form of light pulses.

Photosensitive detector receives and interprets the light pulses.

Total Internal Reflection can contribute to smearing due to some photons taking longer paths than others.

Advantages	Disadvantages
High speed	Expensive
Less attenuation	Difficult to work with
Security	
High Bandwidth	
Repeatability	

Radio Based Transmission

A form of unguided transmission.

Commonly used for Wi-Fi, Bluetooth, satelliate, etc.

- Low Frequency (LF): 30 kHz - 300 kHz (long-range, maritime signals)
- Very High Frequency (VHF): 30 MHz - 300 MHz (FM radio, TV)
- Ultra High Frequency (UHF): 300 MHz - 3 GHz (Wi-Fi, Bluetooth)
- Microwave: 3 GHz - 300 GHz (satellite, radar)

Governed by the *FCC* in the US.

Advantages	Disadvantages
Ease of use	Security Risks
Flexible	Susceptible to noise
	Limited bandwidth and range