

# Information Communications

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## Introduction

This poster outlines a variety of technologies, which use waves as a means to transfer information. These are both waves in the conventional sense of electromagnetic radiation, as well as the particle/wave duality sense of neutrinos.

## Adaptive Frequency Hopping

**What Is Frequency Hopping?** Adaptive Frequency Hopping (AFH) is a technique where rather than using one single radiofrequency to transfer data, the frequency is constantly changing between a number of channels. This allows for both faster transfer speeds, and makes it harder for intruders to interfere with the signal. **Why Is It Adaptive?** The transmitting device is constantly monitoring the different channels to make an estimate of how good quality they are. For example, if one frequency is currently busy or being jammed, then it will simply use another channel.

## Neutrino Messaging

**History** A hypothetical form of communication that is currently undergoing research. The presence and absence of neutrino pulses are represented as 1 and 0 respectively to encode messages. This was experimentally verified in 2012. **Advantages** Unlike traditional forms of communication which rely on electromagnetic radiation, neutrinos are affected only by the weak force and gravity; they can pass messages through virtually anything. This can be utilised to transmit information across vast expanses in space, or for a more present-day application, to send messages to nuclear submarines, as seawater can obstruct electromagnetic radiation. **Disadvantages** The uninteractive nature of neutrinos causes them to be difficult to detect. Neutrinos also oscillate between 3 flavours - electron, muon, and tau. This can be represented by a neutrino switching between waves of different frequencies as it travels through space, which can be a problem for detection.

## Conclusion

These technologies have changed the world as we know it, allowing for us to be interconnected to a much greater extent than any time before. Many people's livelihoods, and some of the largest industries on the planet, revolve around the use of waves for communication.

## References

idk if we need this

- [1] Christopher C Davis. Fiber optic technology and its role in the information revolution. *Retrieved June, 5:2014, 2013.*
- [2] R Paschotta. article on 'Rayleigh Scattering'. *RP Photonics Encyclopedia*, 2019. Retrieved on November 8, 2019.
- [3] S Smiley. NFC facts and applications that will broaden your mind. *RFID Insider*, 2015. Retrieved on November 8, 2019.

## Wi-Fi

**Principles** Wi-Fi is defined as any "wireless local area network (WLAN) products that are based on the IEEE 802.11 standards." It is usually a wave of frequency between 2.4GHz to 5GHz. **Uses** Networks are created through Wi-Fi where multiple devices can connect to one source of Wi-Fi and thus access the internet as well as communicate with other devices connected to the network. **Advantages**

- Remote access for convenience
- Can support multiple simultaneous connections

**Disadvantages**

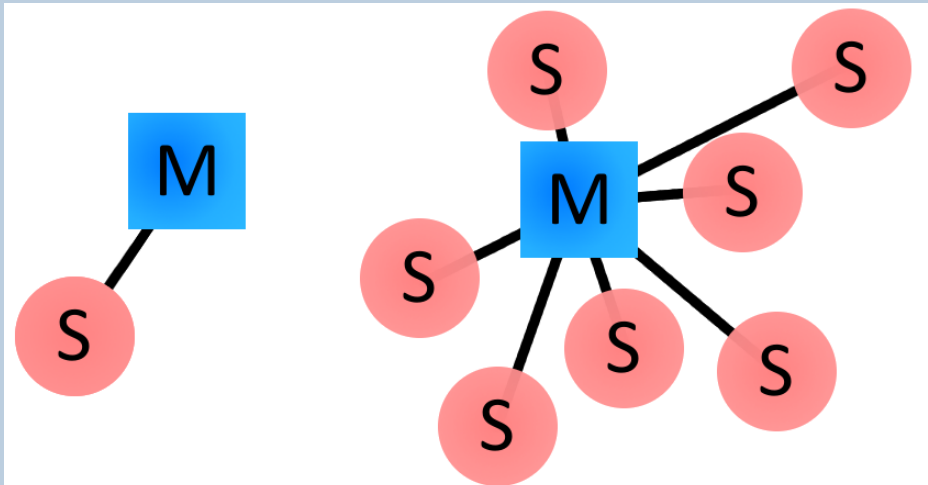
- Limited by router location
- Subject to interference
- Slow speed compared to wired connection

## Optical Fibres

**Introduction** Optical fibres utilise total internal reflection to confine light rays within its core. Modern fibre technologies are limited by physical phenomena of light travelling in an optical medium. **Residual Absorption** Fundamental vibration frequencies of the particles that make up the glass absorb light with matching frequencies. **Dispersion** Dispersion is an optical phenomenon where light of different frequencies travel at different velocities through an optical medium. In optical communications, data is coded in binary form and transmitted as pulses of light. As a laser pulse emits more than a single frequency of light, it is critical that the gap in time at the receiving end is not greater than the time period of the wave group, otherwise the original data would be lost. **Rayleigh Scattering** An atom or molecule reradiates incident light in any direction except the incident direction. This effect is magnified at shorter wavelengths, and is increased by imperfections in the composition of the silica glass on a molecular level.

## Bluetooth

**History** Bluetooth was developed by the Swedish telephone company Ericsson AB in 1990 **Master/Slave Topology** Bluetooth follows a master/slave topology where there is a master device broadcasting data to a maximum of seven slave devices. This network of 8 devices is known as a piconet. The master will always default to being the device which initialised the connection, however master and slave roles can be exchanged given that both devices agree upon this. **AFH** Bluetooth uses a technique known as AFH, which is explained on the left side of this poster.



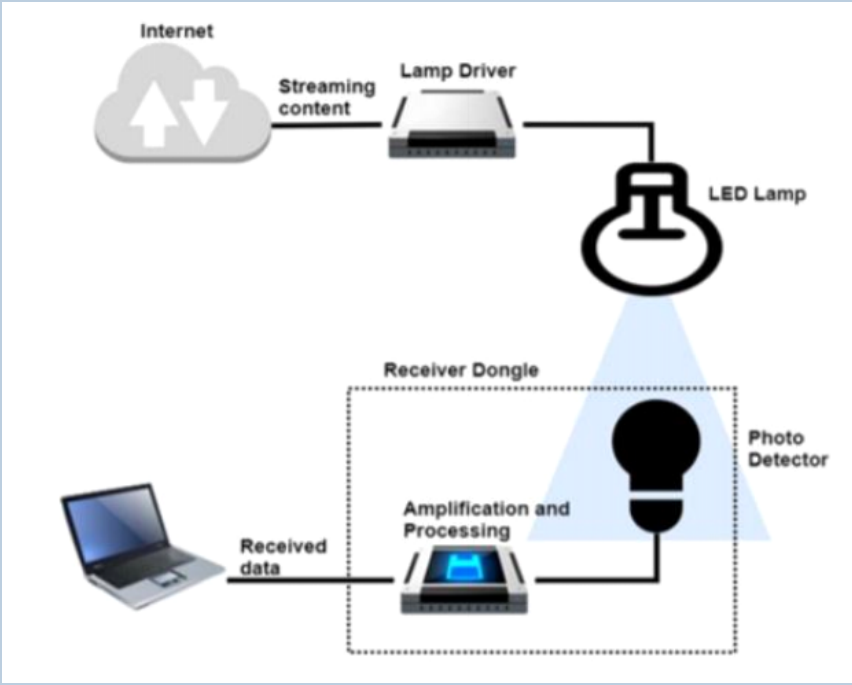
## Li-Fi

**Principle** A light emitter modulates light intensity while a photo detector receives the signal and converts it back to an electrical data stream. **Advantages**

- Faster, safer and more efficient transmission of data
- Bandwidth of the visible spectrum is 10,000 times more than that of the radio spectrum
- Implementation and maintenance costs are minimal compared to Wi-Fi
- Elimination of health problems
- Enabling of the Internet of Things on a large scale

**Challenges**

- Light can't pass through objects
- Interference from other light sources can cause interruption in communication
- Communication is limited to point-to-point transfer when implemented at very high frequencies.



## Near Field Communication

**How It Works** Near Field Communication (NFC) uses small chips to enable data transfer between active and passive devices. Active devices are powered externally and can both send and receive data. Passive devices do not require a power source and can only send data. In close proximity, active devices will induce small currents in passive ones. **Stats**

- Max Range = 20cm
- Max Speed = 424kbit/s
- Transmission Frequency = 13.56MHz

**Advantages**

- Power Efficiency
- Control and Security
- Convenience

**Disadvantages**

- Low transfer speed

