Wireless Communication Methods

Bluetooth

We're all used to wireless communication by now, even if we don't always realize it. Radio receivers and television sets pick up programs beamed in radio waves hundreds (possibly even thousands) of km/miles through the air. Bluetooth is a similar radio-wave technology, but it's mainly designed for communicating over short distances less than about 10m or 30ft. Typically, you might use it to download photos from a digital camera to a PC, to hook up a wireless mouse to a laptop, to link a hands-free headset to your cellphone so you can talk and drive safely at the same time, and so on. Electronic gadgets that work this way have built-in radio antennas (transmitters and receivers) so they can simultaneously send and receive wireless signals to other Bluetooth gadgets.

Bluetooth sends and receives radio waves in a band of 79 different frequencies (**channels**) centered on 2.45 GHz, set apart from radio, television, and cellphones, and reserved for use by industrial, scientific, and medical gadgets.

Bluetooth devices automatically detect and connect to one another and up to eight of them can communicate at any one time. They don't interfere with one another because each pair of devices uses a different one of the 79 available channels. If two devices want to talk, they pick a channel randomly and, if that's already taken, randomly switch to one of the others (a technique known as **spread-spectrum frequency hopping**). To minimize the risks of interference from other electrical appliances (and also to improve security), pairs of devices constantly shift the frequency they're using—thousands of times a second.

Advantages of Bluetooth communication:

- It creates connection immediately without any wires. Connection establishment is very quick. User only needs to pair the bluetooth PAN connection between two devices.
- It has low power consumption.
- It can pass through walls.
- It has a range better than Infrared communication.
- It is used for voice and data transfer.
- The technology is adopted in many products such as head set, in car system, printer, web cam, GPS system, keyboard and mouse.
- Due to the availability of bluetooth headphones, calls can be taken on phone even while driving and doing some other activity simultaneously. This hands free operation relieves great strain.

- Bluetooth devices are available at very cheap cost.
- It has less interference compared to other wireless technologies.

Disadvantages of Bluetooth communication:

- One of the big disadvantages of bluetooth is security. This is due to the fact that it operates on Radio frequency and hence can penetrate through walls. It is advisable not to use it for critical business or personal data transfer.
- As Home RF technology operates on same frequency, it has interference from it.
- The bandwidth is lower compare to WiFi.
- Battery usage is more compared to the condition when bluetooth is powered OFF.

Wi-Fi

Wi-Fi is one of the most important technological developments of the modern age. It's the wireless networking standard that helps us enjoy all the conveniences of modern media and connectivity.

The term Wi-Fi stands for wireless fidelity. Similar to other wireless connections, like Bluetooth, Wi-Fi is a radio transmission technology. Wireless fidelity is built upon a set of standards that allow high-speed and secure communications between a wide variety of digital devices, access points, and hardware. It makes it possible for Wi-Fi capable devices to access the internet without the need for actual wires.

Wi-Fi can operate over short and long distances, be locked down and secured, or be open and free. It's incredibly versatile and is easy to use.

Although Wi-Fi is typically used to access the internet on portable devices like smartphones, tablets, or laptops, in actuality, Wi-Fi itself is used to connect to a router or other access point which in turn provides the internet access. Wi-Fi is a wireless connection to that device, not the internet itself. It also provides access to a local network of connected devices, which is why you can print pictures wirelessly or look at a video feed from Wi-Fi connected cameras with no need to be physically connected to them.

Instead of using wired connections like Ethernet, Wi-Fi uses radio waves to transmit information at specific frequencies, most typically at 2.4GHz and 5GHz. Each frequency range has a number of channels which wireless devices can operate on, helping to spread the load so that individual devices don't see their signals crowded or interrupted by other traffic.

The typical range of a standard Wi-Fi network can reach up to 100 meters in the open air. Buildings and other materials reflect the signal however, making most Wi-Fi networks far narrower than that, typically 10-35 metres is more common. Often talked about in conjunction with Wi-Fi,

802.11 or IEEE 802.11, is a set of protocols that specifies the sort of communications that can occur on a Wi-Fi network on various wireless frequencies.

Advantages of WiFi communication:

- It is easy to add or move wifi clients or wifi stations to the wifi network created by AP (Access Point).
- Installation is very quick and easy. It does not require technical knowledge of wifi or wlan system and its protocols.
- Access to the wifi network can be availed from anywhere within the wifi AP (Access point) coverage range.
- WiFi enabled USB dongles are available at very affordable rates from TP-Link, D-Link, Tenda etc.
- Latest wifi standard versions such as 11n and 11ac deliver fast data connection rates e.g. 300 Mbps and higher.
- As it is easy to integrate wifi functionality in the mobile computing devices; it is now being used by millions of people using various devices such as PCs, laptops, PDAs, Printers, Cameras, Games, MP3 players, smartphones etc.

Disadvantages of WiFi communication:

- Data transfer rate decreases (to individual computer) when number of clients or computers connected with wifi network increases.
- Full security is difficult to achieve due to wifi connection being wireless in nature. It requires proper security authentication protocols and configurations.
- Wifi devices operate in full functionality and without any interruptions when they are within the range of AP and receiving good signal strength. WiFi access is limited to about 30 to 100 meters (i.e. 100 to 300 feet).
- In case wifi connection does not work, minimal troubleshootings are needed. This requires one to understand basics of wifi device from user manual provided by the manufacturer.
- Before using wifi device, one need to install software from the CD provided by the manufacturer in the desktop or laptop.

Radio

Radio frequency (RF) refers to the rate of oscillation of electromagnetic radio waves in the range of 3 kHz to 300 GHz, as well as the alternating currents carrying the radio signals. This is the frequency band that is used for communications transmission and broadcasting. Although RF really stands for the rate of oscillation of the waves, it is synonymous to the term "radio," or simply wireless communication.

Radio frequency is being used in a lot of fields, but in the context of information and communications technology it refers to the frequency band at which wireless telecommunications signals are being transmitted and broadcast. The frequency band is being divided into different parts, which are then assigned to different technology industries. This is known as the radio spectrum. For example, the VHF (very high frequency) band, which ranges from 30-300 MHz, is being used for FM radio, TV broadcasts, and amateur radio and its counterparts. For a lot of electronic communication devices, the ultra-high frequency (UHF) band is being used. This is the space used by mobile phones, wireless LAN, Bluetooth, and TV and land radio.