Wi-Fi

- The term WiFi is a contraction of ***"wireless fidelity"*** and commonly used to refer to wireless networking technology.
- WiFi is a universal wireless networking technology that utilizes radio frequencies to transfer data.
- WiFi allows high-speed Internet connections without the use of cables.
- It is almost 10 times faster than a regular dial-up connection.
- WiFi networks operate in the unlicensed 2.4 radio bands, with an 11 Mbps (802.11b) or 54 Mbps (802.11a) data rate, respectively.

- **Communication Stack:**

  - Wi-Fi is part of the IEEE 802 protocol family.
  - The data is organized into 802.11 frames that are very similar to Ethernet frames at the data link layer, but with extra address fields.
  - MAC addresses are used as network addresses for routing over the LAN.
  - Wi-Fi's MAC and physical layer (PHY) specifications are defined by IEEE 802.11 for modulating and receiving one or more carrier waves to transmit the data in the infrared, and 2.4, 3.6, 5, or 60 GHz frequency bands.
  - In addition to 802.11 the IEEE 802 protocol family has specific provisions for Wi-Fi. These are required because Ethernet's cable-based media are not usually shared, whereas with wireless all transmissions are received by all stations within the range that employ that radio channel. While Ethernet has essentially negligible error rates, wireless communication media are subject to significant interference. Therefore, the accurate transmission is not guaranteed so delivery is, therefore, a best-effort delivery mechanism.
  - Because of this, for Wi-Fi, the Logical Link Control (LLC) specified by IEEE 802.2 employs Wi-Fi's media access control (MAC) protocols to manage retries without relying on higher levels of the protocol stack.

- For internetworking purposes, Wi-Fi is usually layered as a link layer (equivalent to the physical and data link layers of the OSI model) below the internet layer of the Internet Protocol. This means that nodes have an associated internet address and, with suitable connectivity, this allows full Internet access.

- **Modes:**
  - **Infrastructure:**

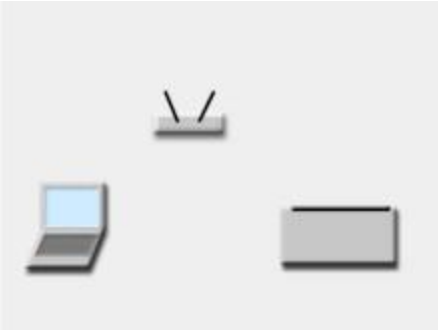

Fig: *Depiction of a Wi-Fi network in infrastructure mode. The device sends information wirelessly to another device, both connected to the local network, to print a document.*

- In infrastructure mode, which is the most common mode used, all communications go through a base station.
- For communications within the network, this introduces an extra use of the airwaves but has the advantage that any two stations that can communicate with the base station can also communicate through the base station, which enormously simplifies the protocols.

  - **Ad hoc and Wi-Fi Direct:**
    - Wi-Fi also allows communications directly from one computer to another without an access point intermediary. This is called *ad hoc* Wi-Fi transmission.
    - Different types of ad hoc networks exist. In the simplest case network nodes must talk directly to each other. In more complex protocols nodes may forward packets, and nodes keep track of how to reach other nodes, even if they move around.

- **Multiple Access Points:**

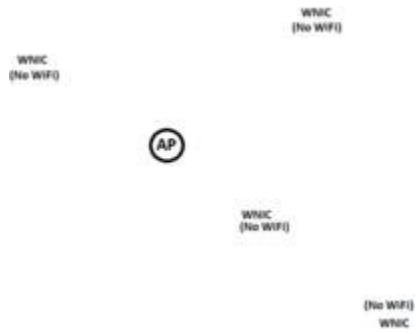

Fig: *Access points send out beacon frames to announce the presence of networks.*

- An Extended Service Set may be formed by deploying multiple access points that are configured with the same SSID and security settings.
- Wi-Fi client devices typically connect to the access point that can provide the strongest signal within that service set.
- Increasing the number of Wi-Fi access points for a network provides redundancy, better range, support for fast roaming, and increased overall network-capacity by using more channels or by defining smaller cells.
- Except for the smallest implementations (such as home or small office networks), Wi-Fi implementations have moved toward "thin" access points, with more of the network intelligence housed in a centralized network appliance, relegating individual access points to the role of "dumb" transceivers. Outdoor applications may use mesh topologies.