Wireless LAN 802.11

Wireless LANs (WLANs) are wireless computer networks that use high-frequency radio waves instead of cables for connecting the devices within a limited area forming LAN (**Local Area Network**). Users connected by wireless LANs can move around within this limited area such as home, school, campus, office building, railway platform, etc.

Most WLANs are based upon the standard IEEE 802.11 standard or WiFi.

802.11 Architecture

The 802.11architecture defines two types of services and three different types of stations

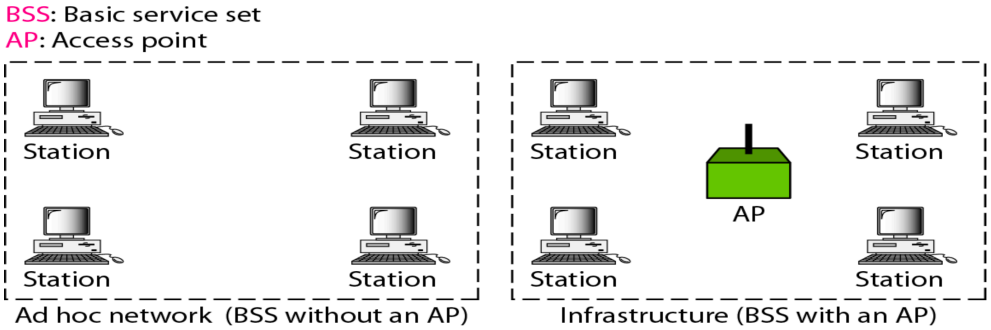
802.11 Services

The two types of services are

1. Basic services set (BSS)
2. Extended Service Set (ESS)

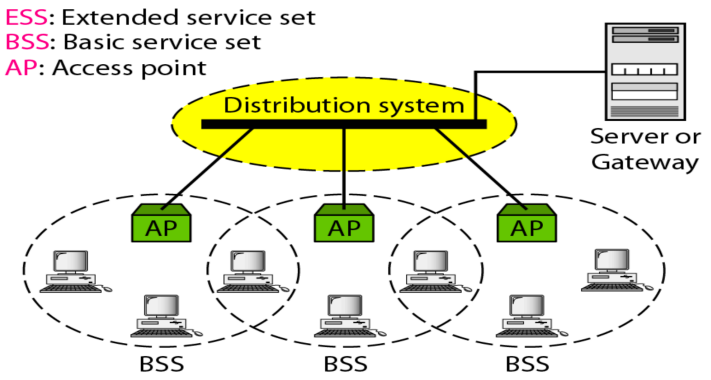
1. Basic Services Set (BSS)

- The basic services set contain stationary or mobile wireless stations and a central base station called access point **(AP).**
- The use of access point is optional.
- BSS cannot send data to other BSSs.
- The BSS in which access point is not present is known as **adhoc network**
- The BSS in which an access point is present is known as an **infrastructure network.**



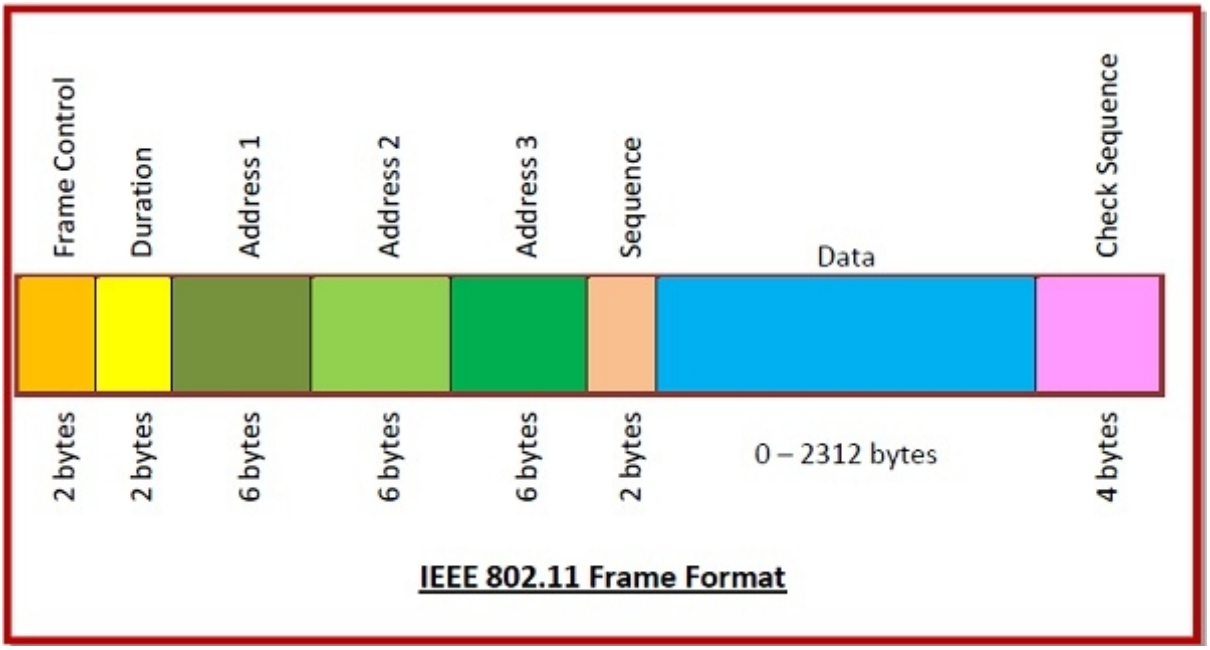
2. Extend Service Set (ESS)

• An extended service set is created by joining two or more basic service sets (BSS) having access points (APs).



Frame Format of IEEE 802.11

The main fields of a frame of wireless LANs as laid down by IEEE 802.11 are –



- **Frame Control** − It is a 2 bytes starting field composed of 11 subfields. It contains control information of the frame.
- **Duration** − It is a 2-byte field that specifies the time period for which the frame and its acknowledgment occupy the channel.
- **Address fields** − There are three 6-byte address fields containing addresses of source, immediate destination, and final endpoint respectively.

- **Sequence** − It a 2 bytes field that stores the frame numbers.
- **Data** − This is a variable-sized field that carries the data from the upper layers. The maximum size of the data field is 2312 bytes.
- **Check Sequence** − It is a 4-byte field containing error detection information.

MAC sublayer Functions

802.11 support two different modes of operations. These are:

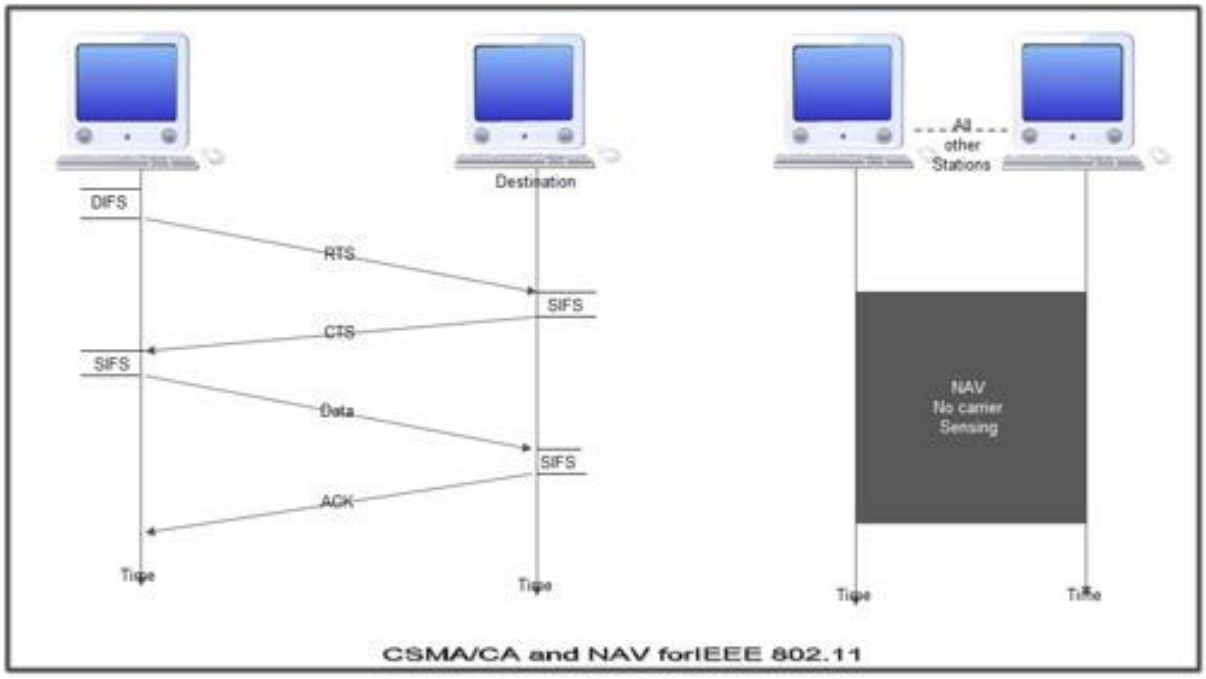
A. Distributed Coordination Function **(DCF)**

B. Point Coordination Function **(PCF)**

1. Distributed Coordination Function

• The DCF is used in BSS having no access point.

• DCF uses CSMA/CA protocol for transmission.



1. When a station wants to transmit, it senses the channel to see whether it is free or not.

2. If the channel is not free the station waits for back off time.

3. If the station finds a channel to be idle, the station waits for a period of time called distributed interframe space (DIFS).

4. The station then sends control frame called request to send (RTS) as shown in figure.

5. The destination station receives the frame and waits for a short period of time called **short interframe space (SIFS).**

6. The destination station then sends a control frame called **clear to send (CTS)** to the source station. This frame indicates that the destination station is ready to receive data.

7. The sender then waits for SIFS time and sends data.

8. The destination waits for SIFS time and sends acknowledgement for the received frame.

Collision avoidance

802.11 standard uses **Network Allocation Vector (NAV)** for collision avoidance.The procedure used in NAV is explained below:

1. Whenever a station sends an RTS frame, it includes the duration of time for which the station will occupy the channel.

2. All other stations that are affected by the transmission creates a timer caned network allocation vector (NAV).

3. This NAV (created by other stations) specifies for how much time these stations must not check the channel.

4. Each station before sensing the channel, check its NAV to see if has expired or not.

5. If its NA V has expired, the station can send data, otherwise it has to wait.

2. Point Coordination Function

• PCF method is used in infrastructure network. In this Access point is used to control the network activity.

• It is implemented on top of the DCF and IS used for time sensitive transmissions.

• PCF uses centralized, contention free polling access method.

• The AP performs polling for stations that wants to transmit data. The various stations are polled one after the other.

• To give priority to PCF over DCF, another interframe space called PIFS is defined. PIFS (PCF IFS) is shorter than DIFS.

• If at the same time, a station is using DCF and AP is using PCF, then AP is given priority over the station.

• Due to this priority of PCF over DCF, stations that only use DCF may not gain access to the channel.

• To overcome this problem, a repetition interval is defined that is repeated continuously. This repetition interval starts with a special control frame called beacon frame.

• When a station hears beacon frame, it start their NAV for the duration of the period of the repetition interval

Advantages of WLANs

- They provide clutter free homes, offices and other networked places.

- The LANs are scalable in nature, i.e. devices may be added or removed from the network at a greater ease than wired LANs.
- The system is portable within the network coverage and access to the network is not bounded by the length of the cables.
- Installation and setup is much easier than wired counterparts.
- The equipment and setup costs are reduced.

Disadvantages of WLANs

- Since radio waves are used for communications, the signals are noisier with more interference from nearby systems.
- Greater care is needed for encrypting information. Also, they are more prone to errors. So, they require greater bandwidth than the wired LANs.
- WLANs are slower than wired LANs.