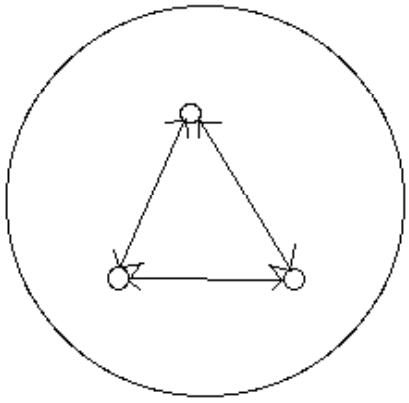
MAC Protocol of 802.11

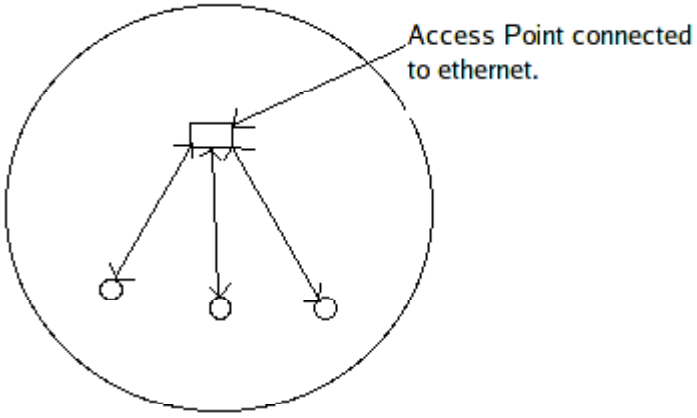
The various types of multiplexing used in 802.11 are TDMA (Time Division Multiple Access), FDMA (Frequency Division Multiple Access), CDMA (Code Division Multiple Access) and STDMA (Space and Time Division Multiple Access). On a different level 802.11 multi-access can be classified into centralized and distributed.

Centralized	Dsitributed
1. Management is easy.	1. Management is difficult.
2. Service differennition is possible. We can give higher priority to more previledged users.	2. Service differentiation is difficult.
3. Single point of failure.	3. No single point of failure.
4. Poor scalability.	4. Scalability is easy.

BSS(Basic service set): A BSS is defined as a set of radios talking to each other in the vicinity of each other. A BSS can be classified as an IBSS (Independant BSS) or and Infrastructure BSS. In IBSS peer-2peer communication takes place in Ad-hoc mode. In infrastructure BSS there exists one access point and all stations communicate to this access point.



IBSS



Infrastructure BSS

In infrastructure BSS the access points are connected to the ethernet. However, another arrangement has been defined, called ESS (Extended Service Set), in which access points themselves may communicate with each other through the wireless network. The network in this situation is called Wireless Distribution Network. When a user moves from coverage area of one access point to the coverage area of second access point it is taken care of by the access points and it is transparent to the user.

There are two MAC protocols defined for 802.11: Centralized and Distributed. The centralized protocol is called Point Coordination Function (PCF) and the distributed protocol is called Distributed Coordination Function (DCF). It is interesting to note that industry equipment usually has only distributed MAC protocol implemented. the DCF protocol is quite similar to the ethernet MAC protocol CSMA/cd(Carrier Sense Multiple Access/Collision Detect). Hence, salient features of CSMA/cd are in order.

Salient features of CSMA/cd:

1. Each station first listens to the channel before transmitting. If the channel is busy it will wait for channel become free.(Carrier Sense)
2. As soon as a station wanting to transmit data finds the channel free it transmits the data with probability 1(called 1-persistent).
3. While transmitting a station also listens to the channel and compares the data that it has transmitted with the data it has received. If the data are different a collision has occurred and the channel discontinues transmitting.(Collision detect)

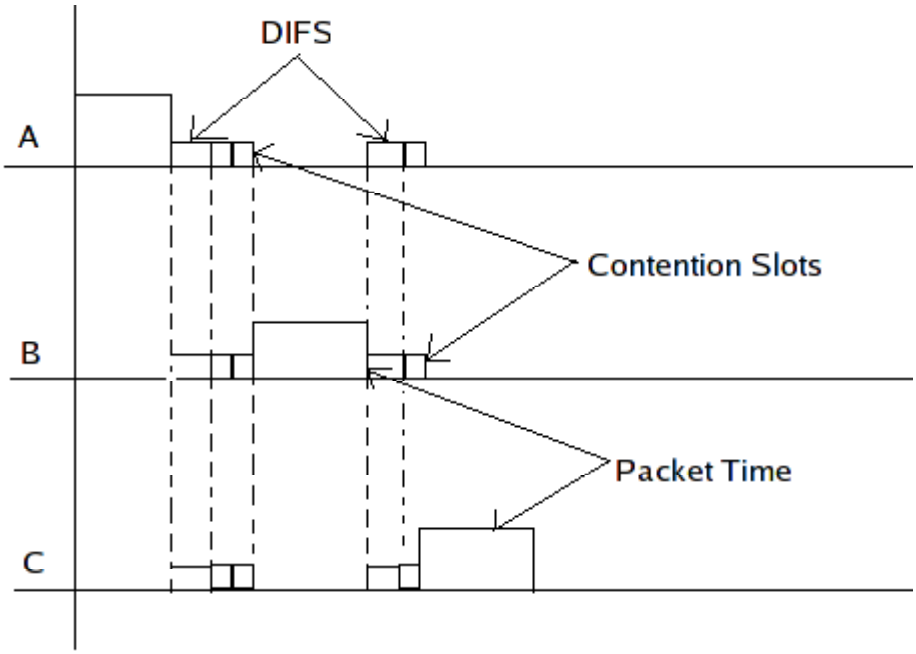
4. When a collision occurs it uses an algorithm called Binary exponential backoff to backoff a random amount of time and retry transmitting data.

DCF Protocol:

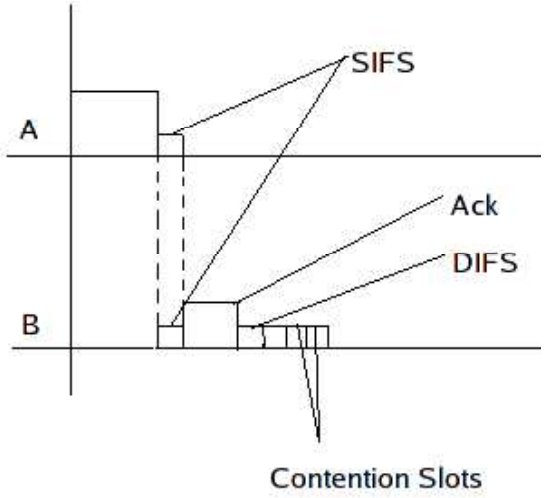
In DCF protocol collision detection cannot be done. The reason for this is that when a station is transmiting data the power of transmition is so high that even if someone is transmitting at that time the power of trasmitted data of the first station will overwhelm the other station's signal and hence the first station will never detect a collision. Because of this stations waiting ofr the channel to become free cannot start transmitting as soon as they sense that the channel is free because if they do so then the probability of collision occurring is very high and they will not even be able to detect it. Hence, DCF protocol uses following rules:

1. Listen before transmission (Carrier Sense)
2. Backoff before transmission.
3. Backoff on collision.

Consider the senario given in the following figure:



After 'A' is done with transmitting its frame there is a small time called DIFS(DCF InterFrame Space). We will talk about this time later. After this 'A', 'B' and 'C' select randomly a number between 0 and their respective contention window variable 'cw'. Let us assume 'A' selected 5, 'B' selected 2 and 'C' selected 3. Then as shown in the figure all three stations wait for DIFS time and then for 2 contention slot time. While waiting for each contention slot time all stations reduce their counters by 1 for each slot time waited. Thus after waiting for 2 slots counter of 'B' becomes 0 and hence it starts transmitting. When any channel starts transmitting all other waiting stations stop decrementing their counters. After 'B' has completed transmission again all stations wait for DIFS time and then start reducing their counters. When 'B' started transmitting the counter value of 'C' was 1. Thus after 'B' completed transmission 'C' waited for one slot and then started transmitting. After transmission is completed the transmitting station again chooses randomly a number between 0 and 'cw' if it wants to transmit data. Minimum value of 'ccw is 32 and its maximum value is 1024.



Initial value of 'cw' is 32. Whenever a collission occurs 'cw' of the colliding stations is doubled. After this the colliding stations again choose randomly a number between 0 and 'cw'. On successful transmission value of 'cw' is reset to 32. Standard contention slot time is 20 microseconds.

The diagram shown above is a little in correct. A more accurate diagram is as shown on the left. After data is sent

there is a short delay due to varios factors. This short delay is called SIFS(Short InterFrame Space). SIFS includes RxRF Delay, PLCP Delay, MAC processing delay and RxTx turnaround delay. After this delay acknowledgement is sent by the receiver. It is after this that DIFS comes into picture.