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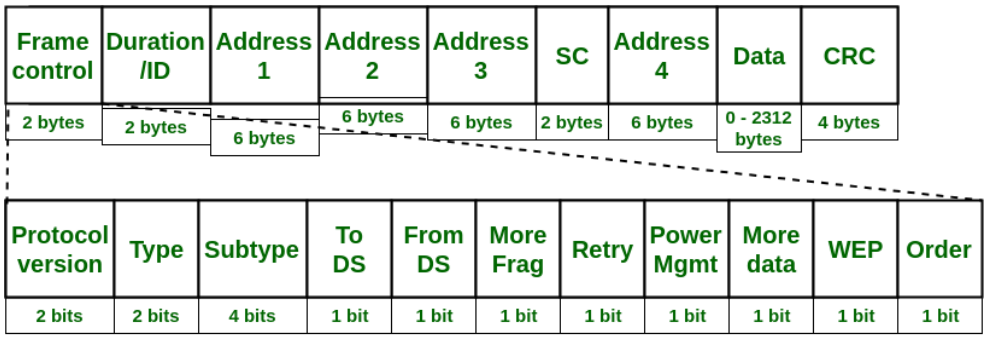
SRIHARI MADDINENI
srihari.maddineni.no1@gmail.com

IEEE 802.11 Mac Frame

Prerequisite – Basics of Wi-fi MAC layer provides functionality for several tasks like control medium access, can also offer support for roaming, authentication, and power conservation. The basic services provided by MAC are the mandatory asynchronous data service and optional time-bounded service. IEEE 802.11 defines two MAC sub-layers:-

1. **Distributed Coordination Function (DCF)** – DCF uses CSMA/CA as access method as wireless LAN can't implement CSMA/CD. It only offers asynchronous service.
2. **Point Coordination Function (PCF)** – PCP is implemented on top of DCF and mostly used for time-service transmission. It uses a centralized, contention-free polling access method. It offers both asynchronous and time-bounded service.

MAC Frame: The MAC layer frame consists of 9 fields. The following figure shows the basic structure of an IEEE 802.11 MAC data frame along with the content of the frame control field.



IEEE 802.11 MAC Frame Structure

- **Frame Control(FC)** – It is 2 bytes long field which defines type of frame and some control information. Various fields present in FC are:
  1. **Version:** It is a 2 bit long field which indicates the current protocol version which is fixed to be 0 for now.
  2. **Type:** It is a 2 bit long field which determines the function of frame i.e management(00), control(01) or data(10). The value 11 is reserved.
  3. **Subtype:** It is a 4 bit long field which indicates sub-type of the frame like 0000 for association request, 1000 for beacon.
  4. **To DS:** It is a 1 bit long field which when set indicates that destination frame is for DS(distribution system).
  5. **From DS:** It is a 1 bit long field which when set indicates frame coming from DS.
  6. **More frag (More fragments):** It is 1 bit long field which when set to 1 means frame is followed by other fragments.
  7. **Retry:** It is 1-bit long field, if the current frame is a retransmission of an earlier frame, this

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8. **Power Mgmt (Power management):** It is 1-bit long field that indicates the mode of a station after successful transmission of a frame. Set to 1 the field indicates that the station goes into power-save mode. If the field is set to 0, the station stays active.
9. **More data:** It is 1-bit long field that is used to indicate receiver that a sender has more data to send than the current frame. This can be used by an access point to indicate to a station in power-save mode that more packets are buffered or it can be used by a station to indicate to an access point after being polled that more polling is necessary as the station has more data ready to transmit.
10. **WEP:** It is 1 bit long field which indicates that the standard security mechanism of 802.11 is applied.
11. **Order:** It is 1 bit long field, if this bit is set to 1 the received frames must be processed in strict order.

- **Duration/ID** – It is 4 bytes long field which contains the value indicating the period of time in which the medium is occupied(in μs).
- **Address 1 to 4** – These are 6 bytes long fields which contain standard IEEE 802 MAC addresses (48 bit each). The meaning of each address depends on the DS bits in the frame control field.
- **SC (Sequence control)** – It is 16 bits long field which consists of 2 sub-fields, i.e., Sequence number (12 bits) and Fragment number (4 bits). Since acknowledgement mechanism frames may be duplicated hence, a sequence number is used to filter duplicate frames.
- **Data** – It is a variable length field which contain information specific to individual frames which is transferred transparently from a sender to the receiver(s).
- **CRC (Cyclic redundancy check)** – It is 4 bytes long field which contains a 32 bit CRC error detection sequence to ensure error free frame.

features of the IEEE 802.11 MAC frame:

Frame Control Field: The frame control field contains information about the type of frame, the data rate, and the power management status.

Duration Field: The duration field specifies the length of time that the channel will be occupied by the transmission.

Address Fields: The address fields specify the source and destination MAC addresses of the Wi-Fi devices involved in the communication.

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Sequence Control Field: The sequence control field is used to identify and manage the transmission sequence of the frames.

Frame Body: The frame body contains the actual data being transmitted between Wi-Fi devices, such as IP packets, TCP segments, or UDP datagrams.

Frame Check Sequence: The frame check sequence (FCS) is used to check the integrity of the data transmitted in the frame and to detect any transmission errors.

Management, Control, and Data Frames: The IEEE 802.11 MAC frame defines three types of frames: management frames, control frames, and data frames. Management frames are used for network management, control frames are used for coordination between Wi-Fi devices, and data frames are used for the transmission of actual data.

Fragmentation: The IEEE 802.11 MAC frame supports fragmentation, which allows large data packets to be divided into smaller fragments for transmission.

Acknowledgments: The IEEE 802.11 MAC frame uses acknowledgments to confirm the successful transmission of frames and to request the retransmission of any frames that were not successfully received.

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