

WN Sheet 5 Sol.

WI-FI

1) Compare BSS and IBSS?

Solution

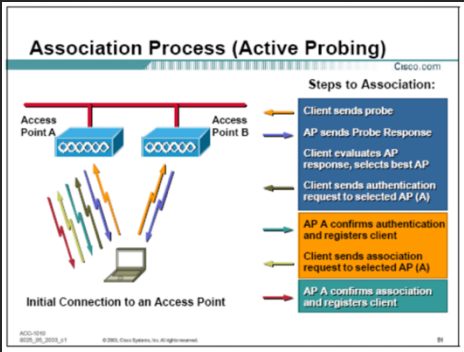
A **basic service set** is a **set of stations** that can communicate with **one another**

BSS (Infrastructure Basic Service Set)	IBSS (Independent Basic Service Set)
Ad hoc Mode	Infrastructure Mode (Default)
No AP	Has APs
Stations communicate with each other directly	Stations communicate with each other via AP

2) Explain the Association Process

Solution

- Client sends a **probe** to **all nearby APs** (to discover **networks** in the range); this is known as **active probing**
 - APs** in range send a **probe response** to the **client** (contains basic info such as network name)
- Client evaluates **AP responses** and **selects best AP**
- Client sends **authentication request** to **selected AP**
 - AP confirms authentication** and **registers client**
- Client sends **association request** to **selected AP**
 - AP confirms it** and **registers client** by setting for it a unique association ID
 - This makes logical connection between the **AP** and the **station**; now **data can transmit** from station to **AP**.



In summary, probe req/response, **selection**, **authentication** req/response, **association** req/response

3) What are the Interframe spaces used in NAV?

Solution

○ *DIFS* (*DCF* Interframe Space)

- Time interval that must be waited before beginning transmission while sensing an idle channel
- Can be used to prioritize stations
 - ⇒ If a station has smaller *DIFS* than another one, and both finish backoff in the same time then only the one with smaller *DIFS* will be able to transmit
- When the network uses both *DCF* and *PCF*, this is used in the contention phase where the *AP* does not govern access to the channel

○ *PIFS* (*PCF* Interframe Space)

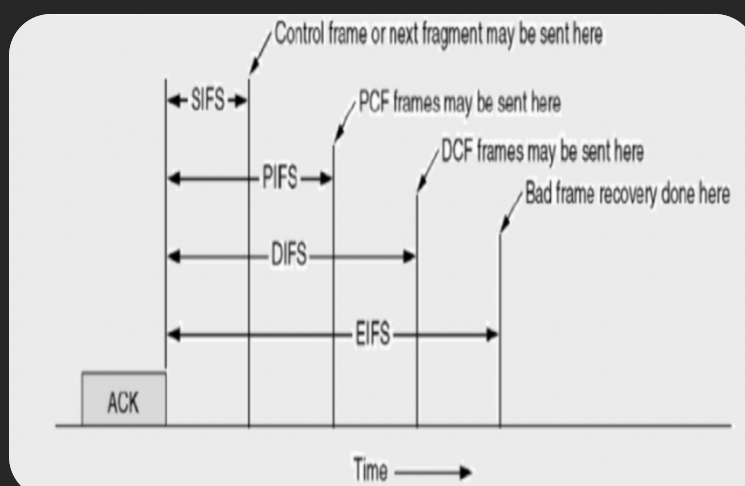
- Used by access point to get prioritized access ($DIFS > PIFS$) of the channel before any other station can claim access.

○ *EIFS* (Extended Interframe Space)

- Suppose a station transmitted a frame that was erroneously received (known by absence of acknowledgement)
 - ⇒ Then the next time it senses the channel as free to retransmit, it will have to wait (keep sensing) for *EIFS* rather than *DIFS* where $EIFS > DIFS$. The long duration may help the transmitter to recover from what could have caused the error.

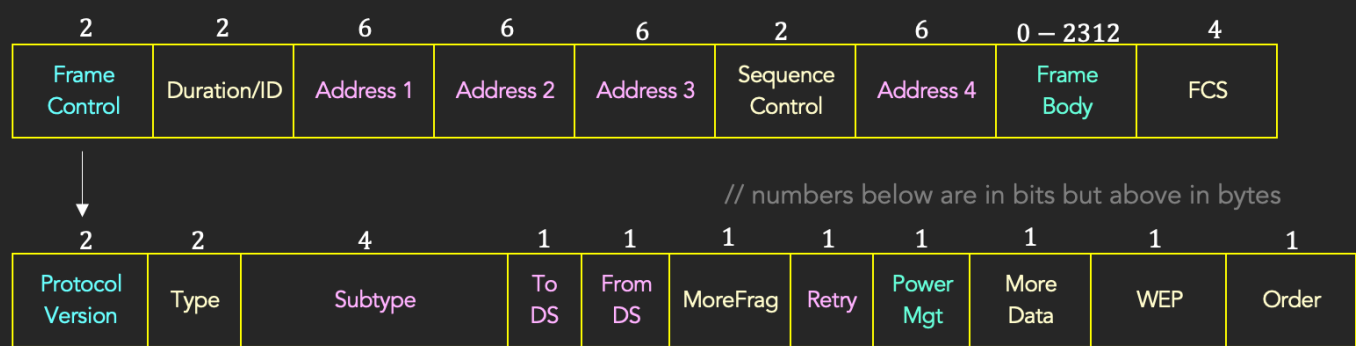
○ *SIFS* (Short Interframe Space)

- Shortest interframe space
 - ⇒ Thus, $EIFS > DIFS > PIFS > SIFS$
- Between any two frames in the same transmission between sender and receiver and for the time to be waited before acknowledgement from the receiving station can be sent
 - ⇒ A transmission takes the form $RTS \rightarrow CTS \rightarrow Data \rightarrow Ack$



4) How is fragmentation handled in 802.11?

Solution



Each fragment is a **frame** that carries the ordinary **802.11 header**. However, **all fragments** will have the **same sequence number** but **incrementing fragment numbers** specified in *SequenceControl*. **All fragments** except for the last will set *MoreFrag* of *FrameControl* as 1. Thus, they can be reassembled into the **message** at the **receiver**.

Each **fragment** is acknowledged separately and thus, if **an error** occurs to a **message** only the **corresponding fragment** will have to be **resent**.

5) What are the **frame types** in **802.11**? Give **one example** of each

Solution

- **Type**
 - The type of the frame (data, control, management)
 - **Data** when **sending data** (10)
 - **Control** when **sending control frames** (01)
 - » For example: *RTS, CTS, ACK*
 - **Management** when **engaging** in *IEEE 802.11* services and power saving (00)
 - » For example: Probe Req/Resp, Association Req/Resp, Authentication, etc.

6) What is the use of **"To Ds"** and **"From Ds"** frame bits in 802.11 frame?

Solution

- **To/From DS**
 - Recall, DS is distribution system (**network** of *APs*)
 - Hence, if **From/To DS** is **1** then the **frame** comes **from/will go to AP**
 - If its 0 then that's equivalent to **From/To STA**

→ Conclusively,

<i>From DS</i>	<i>To DS</i>	<i>Meaning</i>
0	0	Data frame goes from station to station in the independent basic service set (ad-hoc mode where there are no APs)
0	1	Data frame destined to DS (AP) and coming from Station
1	0	Data frame destined to Station and coming from DS (AP)
1	1	Data frame being distributed from one AP to another in the wireless distribution system (WDS)

// Will assume to be memorized in the exam

→ The fields are not used (set to zero) if the frame is not a data frame (management or control).

7) What kind of error detection is used in 802.11?

Solution

Error detection via *CRC (Cylic Redunancy Check)*. In particular, in the trailer there is a *FrameCheckSequence (FCS)* 32 – bit field which is obtained using long division while involving all fields in the header and the body of the frame