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Wireless Networks

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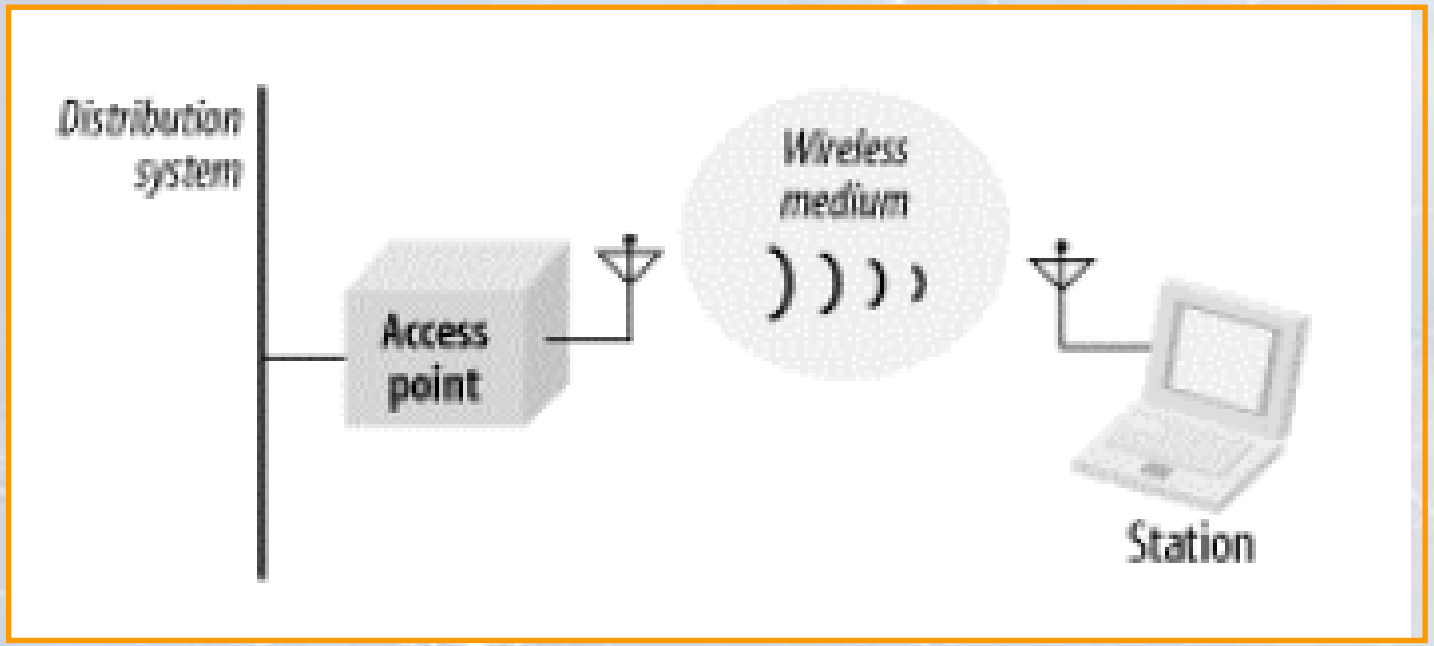
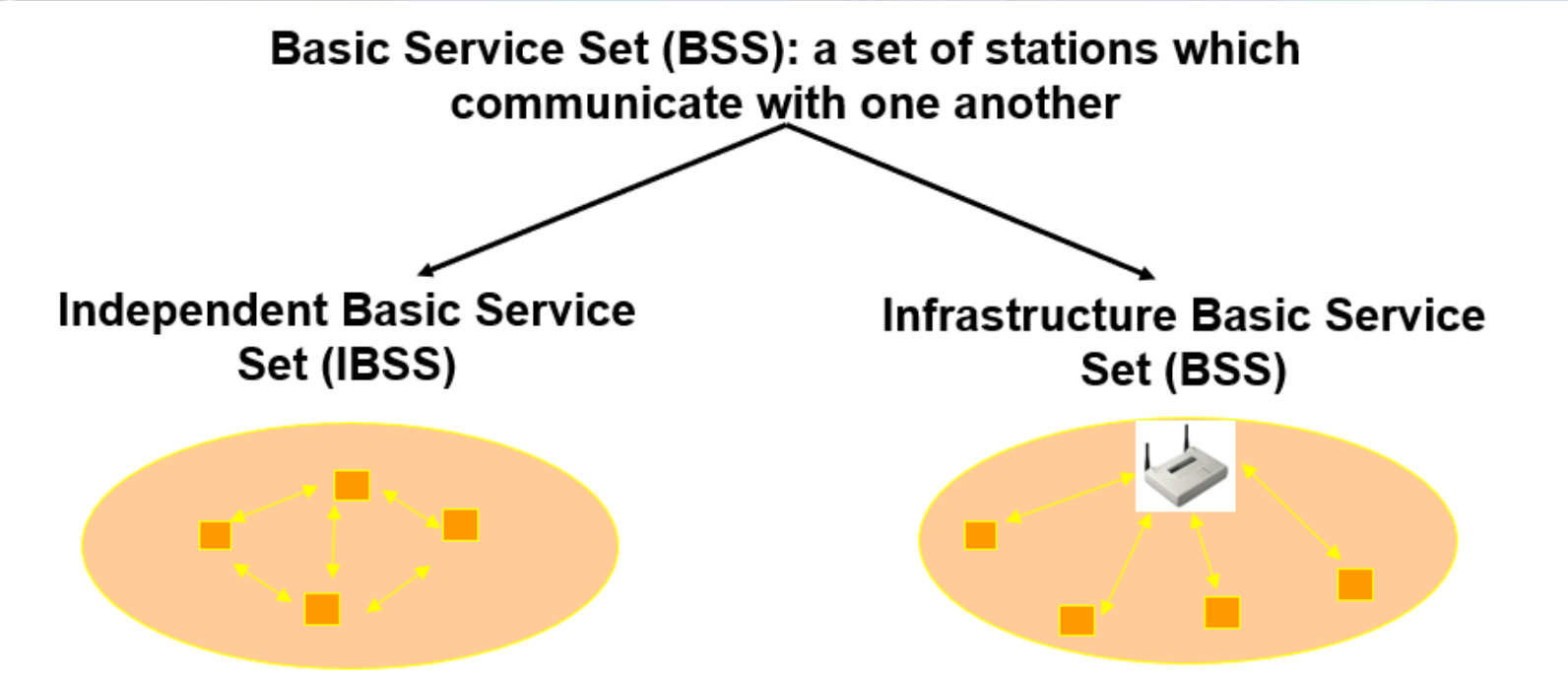
Components of an 802.11 Network: Wi-Fi (IEEE 802.11)

- Access Point (a device that creates a wireless local area network)
- Station
- Wireless Medium
- Distribution System



802.11 System Architecture

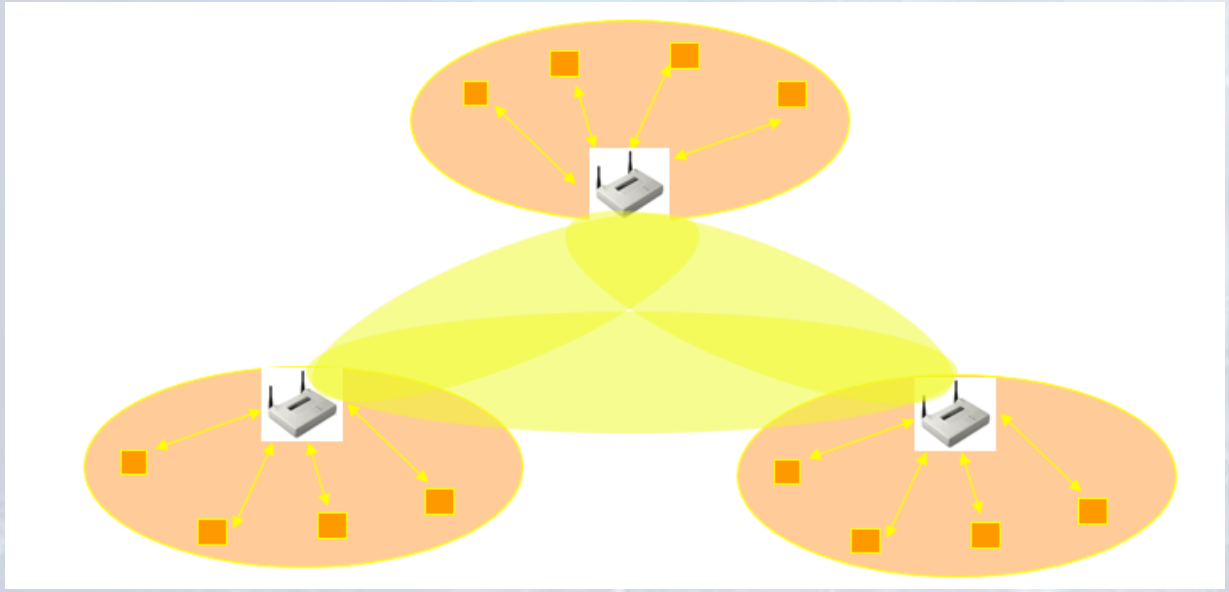


- Called Ad-Hoc mode
- No AP
- Stations communicate directly with each other

- Default
- AP is present
- Stations communicate with each other via AP

Extended Service Set

- ESS: a set of BSSs interconnected by a distribution system (DS)
- DS connects AP’s of different BSS to form ESS

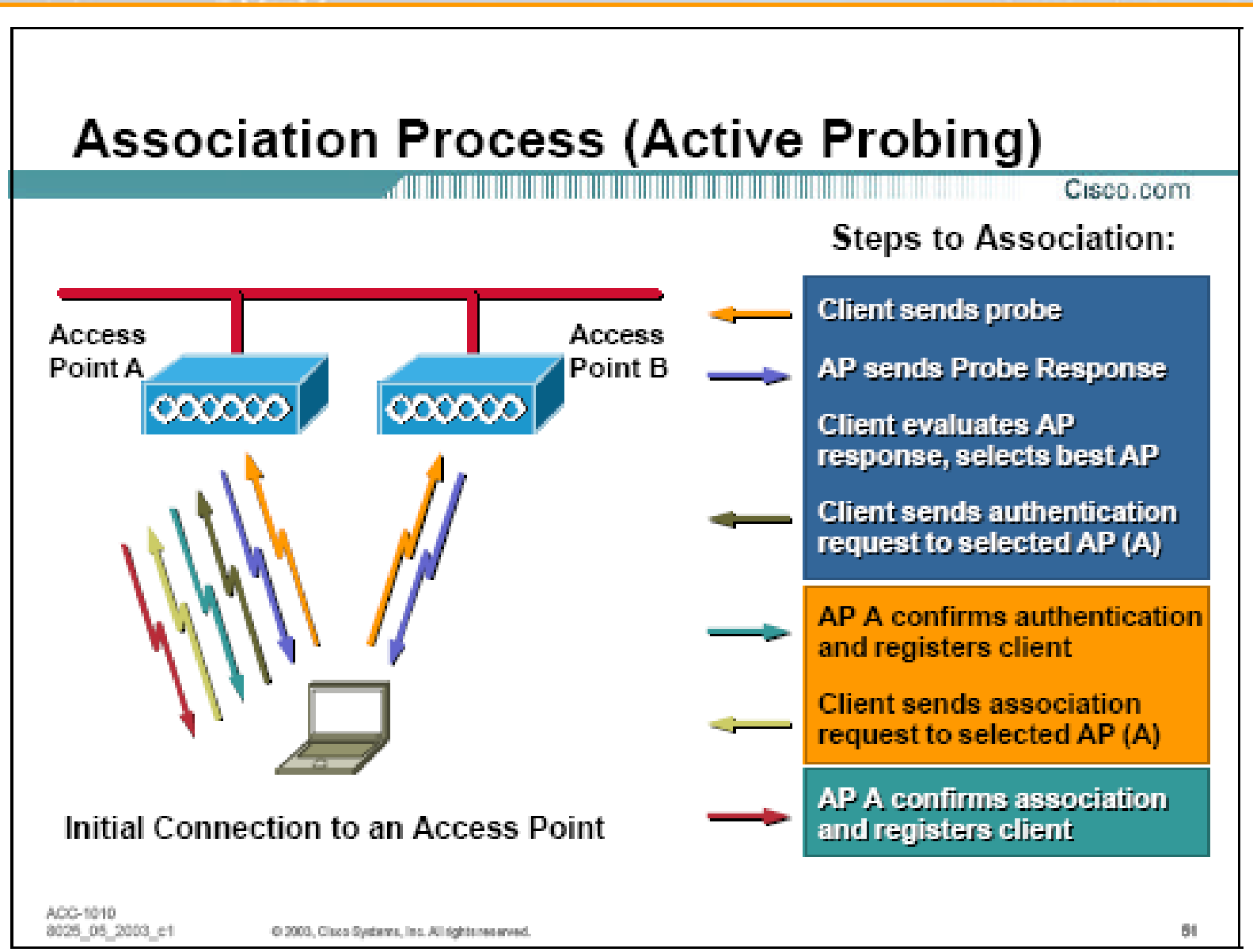


IEEE 802.11 Services

- Station services (similar to wired network)
  - Authentication (login)
  - De-authentication (logout)
  - Privacy
  - Data delivery

- Distribution services
  - **Association**
    - Make logical connection between the AP and the station, the AP will not receive any data from a station before the association (sets the AID).
  - **Re-association** (Similar to the association)
    - Transform to a new AP.
  - **Disassociation**
    - Manually disconnect (PC shutdown or adapter is ejected).
  - **Distribution** (AP forwarding using the DS)
    - Determine how to deliver
      - Internal in the BSS
      - To another BSS or network

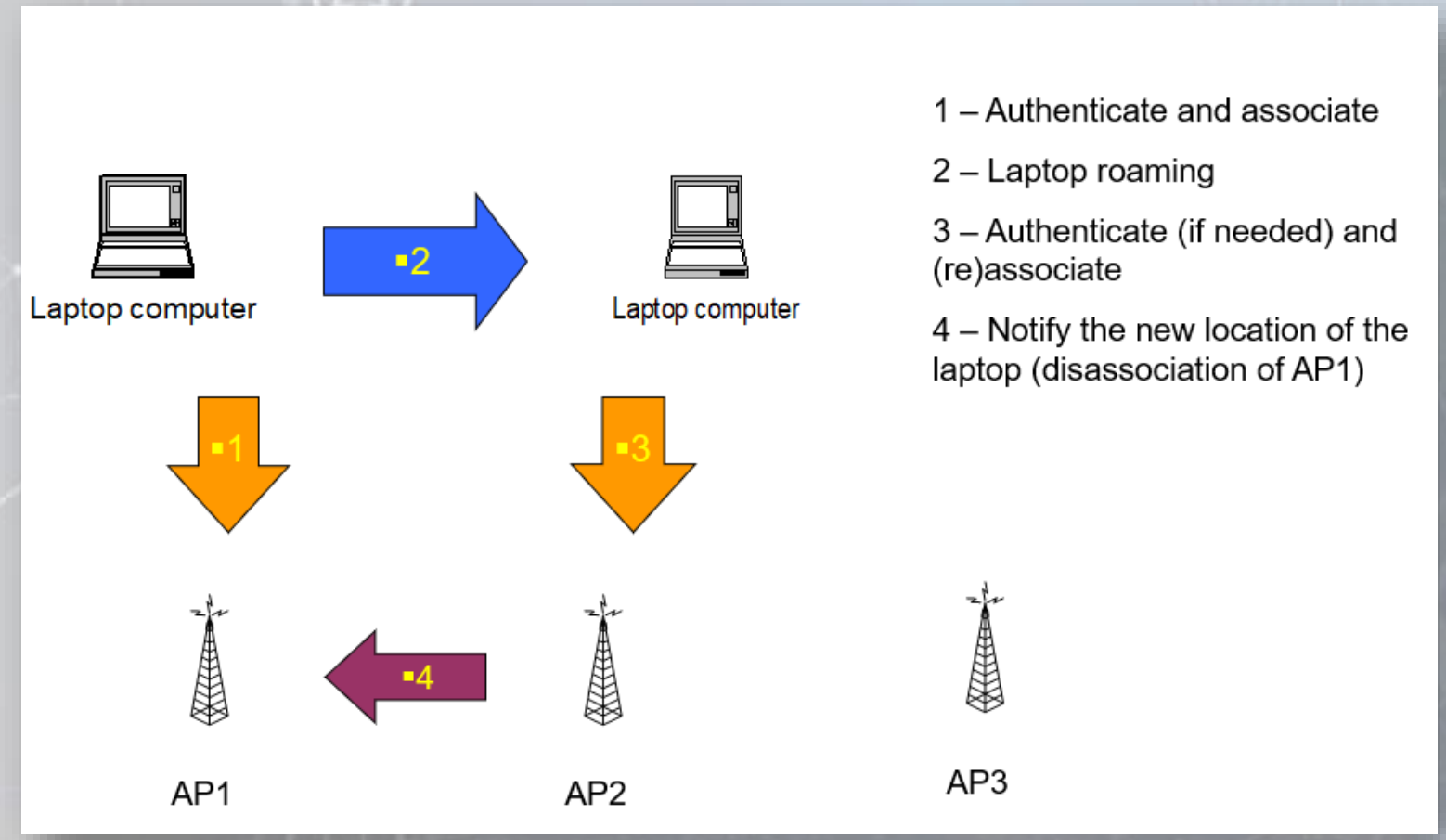
Association



Why Active?

- Since stations search for AP.
- If passive probing then AP periodically broadcasts itself.

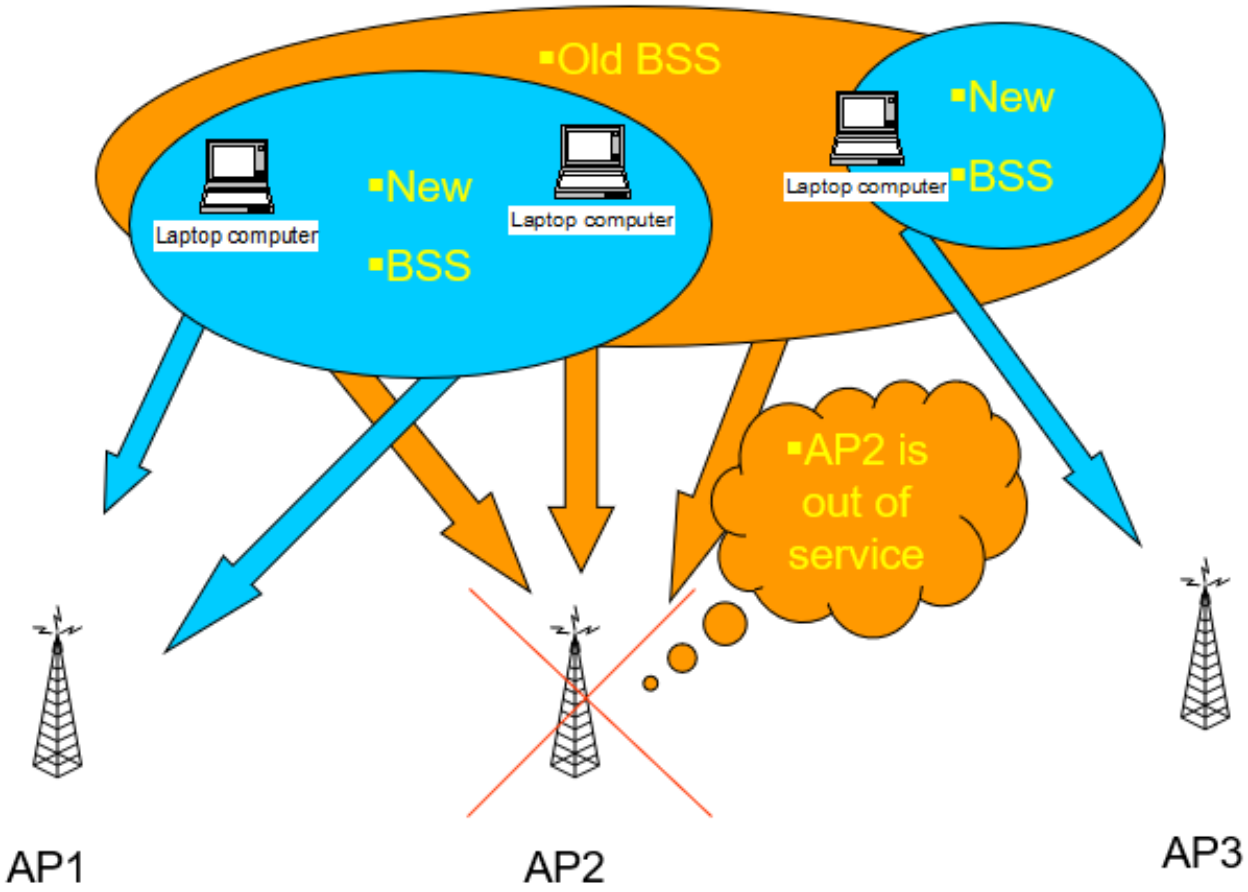
Services Example: Roaming



Why 4)?

- If AP1 has data buffered for the station, it should give it to AP2 to deliver to the station.
- AP1 stops buffering for the station.

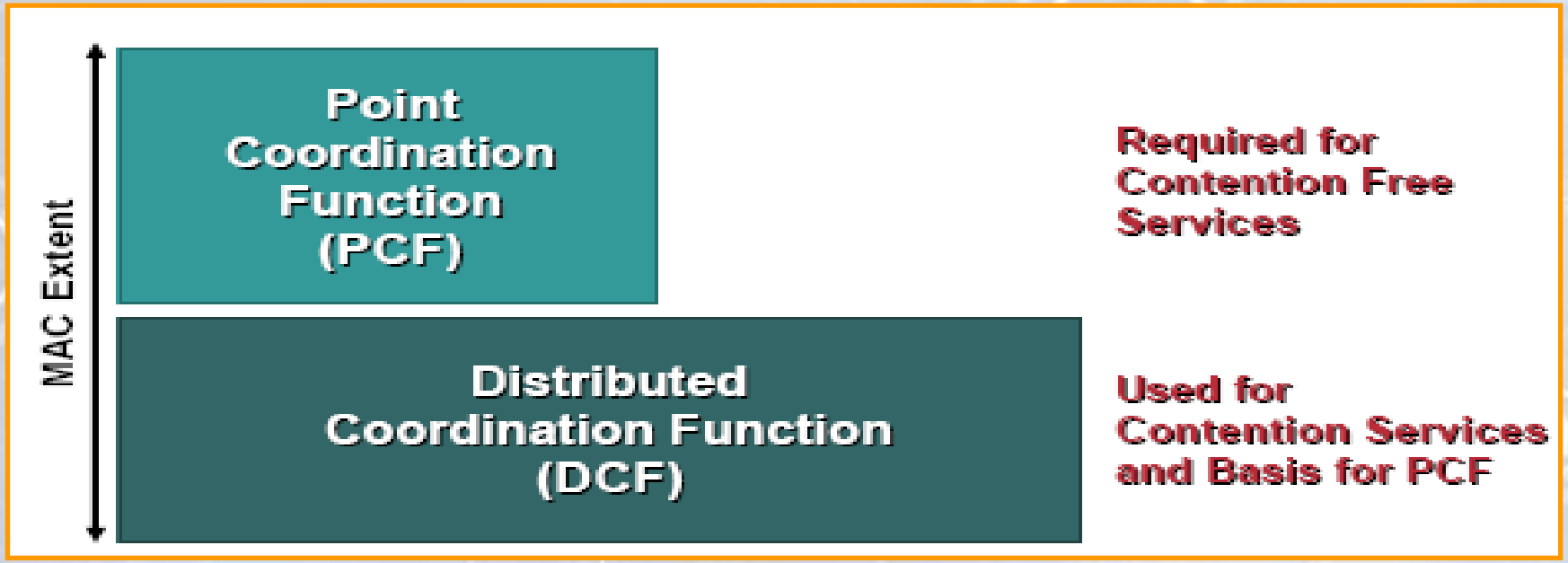
Services Example: Out of Service



Old frames for stations associated with AP2 are lost but at least new frames will be delivered.

MAC Access Modes

- **DCF : Distributed Coordination Function**
  - Ethernet-like CSMA/CA access is provided by the distributed coordination function (DCF).
  - Stations use a random backoff after each frame, may use the CTS/RTS clearing technique to further reduce the possibility of collisions.
- **PCF : Point Coordination Function**
  - Point coordinators ensure that the medium is provided without contention.
  - Point coordinators reside in access points.

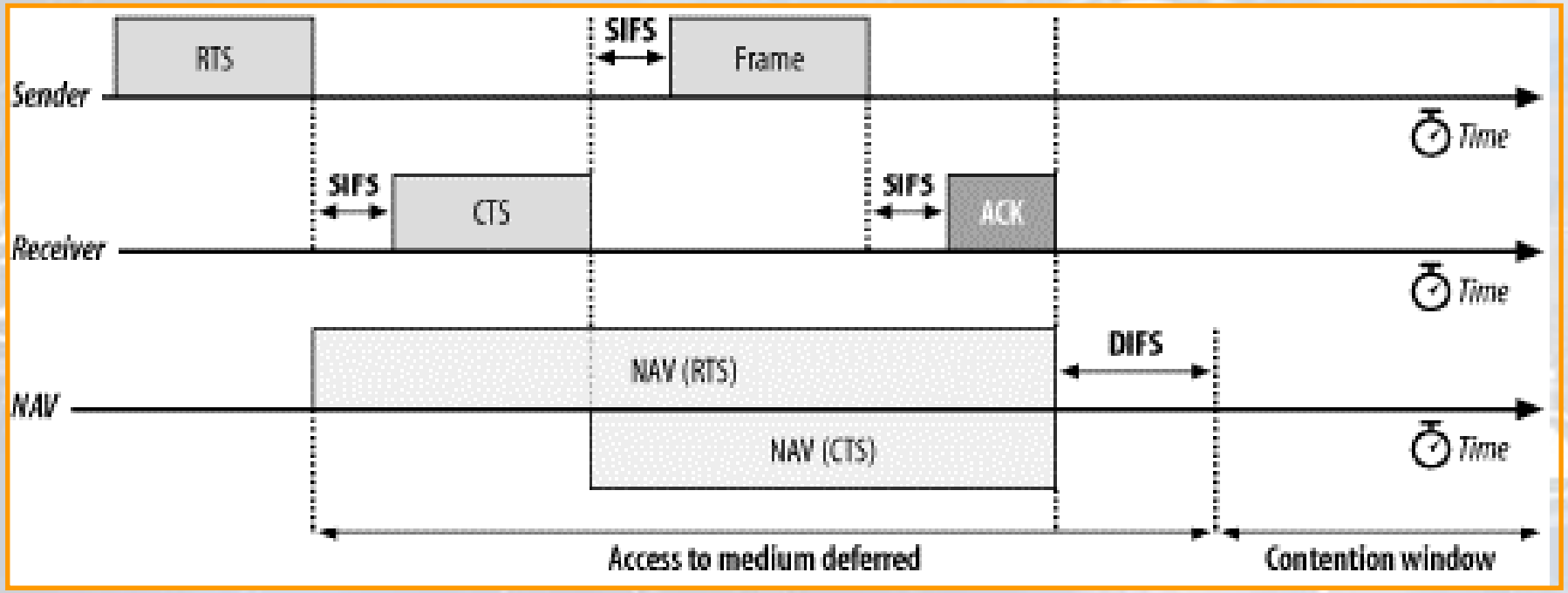


Carrier Sensing and NAV

- Carrier Sensing : detecting when the medium is available

Two types:

- Physical CS (Expensive HW)
- Virtual CS (NAV: Network Allocation Vector)
  - Most 802.11 frames carry a **duration field**, used to reserve the medium for a fixed time period.
  - Station sets NAV field to the duration it will reserve the medium: including RTS/CTS and inter-frame spacing.
  - The NAV is carried in the frame headers on the **RTS** and **CTS**.



Interframe Spacing

- **SIFS (Short Interframe Space):**
  is the shortest Interframe space and is used for separating packets within a single transmission and for the time to be waited before acknowledgement from the receiving station can be sent.
- **PIFS (PCF Interframe Space)**

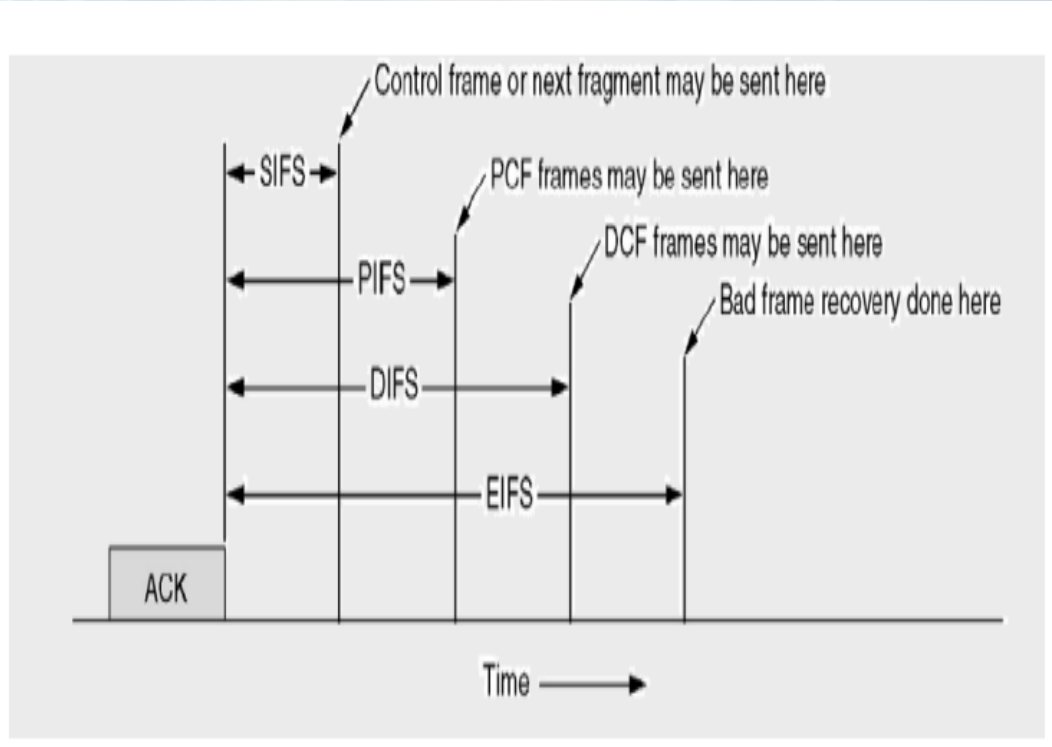
is used by the Access Point (AP) to get prioritized access to the channel before any other stations can claim access.

- **DIFS (DCF Interframe Space)**

is used by stations to gain access to the medium during the contention phase i.e. when the AP does not govern the access to the channel. The time interval that a station should wait before it sends its request frame after sensing the channel idle → can be used for prioritizing stations.

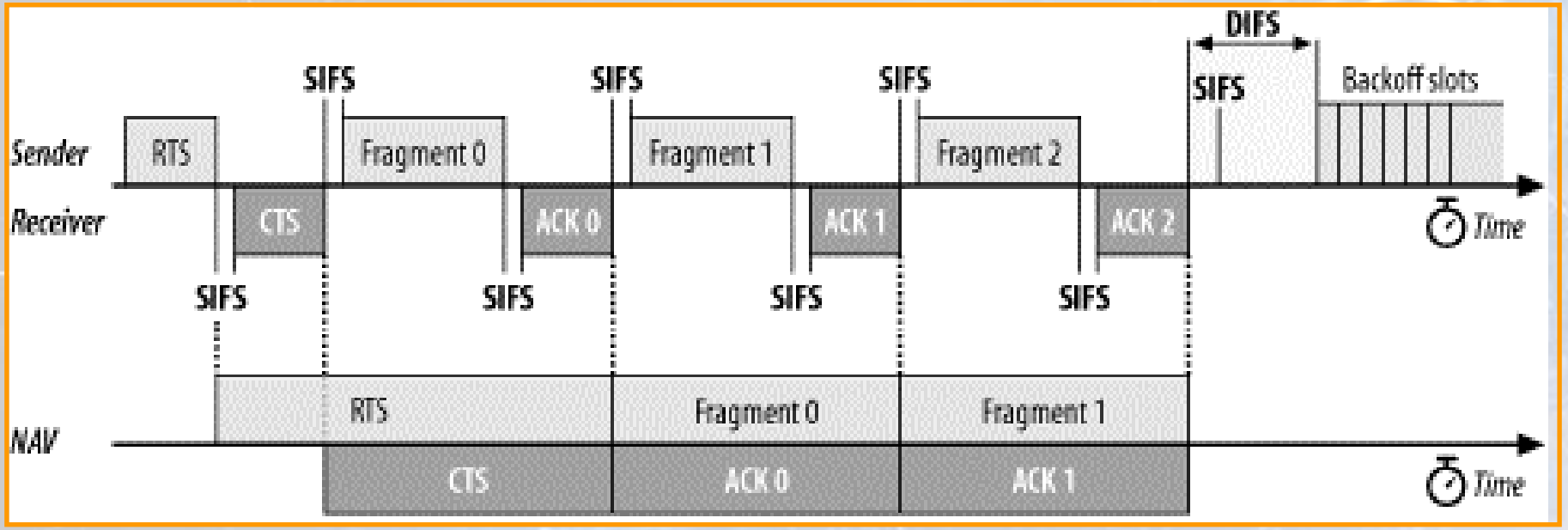
- **EIFS (Extended Interframe Space)**

is used whenever there is an error in transmission. The station that transmitted the frame that was not correctly received (the station concludes this when it does not receive an ACK) must wait for EIFS before trying to transmit again.



Fragmentation and Reassembly

- More reliable transmission.
  - Each fragment is ACKed separately so if error happens only retransmit the fragment not the whole frame.
- Fragments all have the same frame sequence number but have ascending fragment numbers to aid in reassembly.
- Frame control information indicates whether more fragments are coming.



SIFS between fragments not DIFS to prioritize same transmission over new transmissions.


Thank You