IEEE 802.11 MAC (cont.)

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Lecture 07

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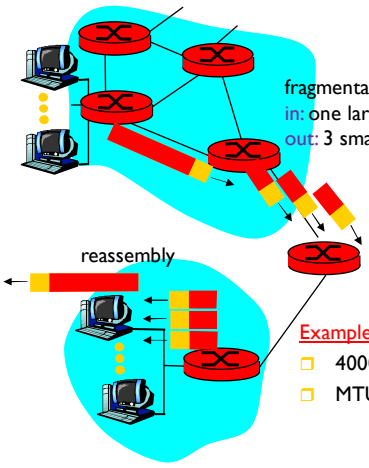
Adapted partially from Mobile Communications, Jochen Schiller, Energy-Efficient Medium Access Control, K. Langendoen and G. Halkes, and AVAYA communication

IEEE 802.11 MAC: Fragmentation

- Bits error rate in WLAN:
  - Several orders of magnitude higher than e.g., fiber optics
  - Any idea?
- Fragmentation:
  - Use short frames
  - Bit error rate is the same, but only short frames are destroyed
- Fragmentation mode in IEEE 802.11:
  - Sender sends the first data frame, *frag1*
    - Including duration
    - Reserve the medium for another transmission

IP Fragmentation & Reassembly: Revisit

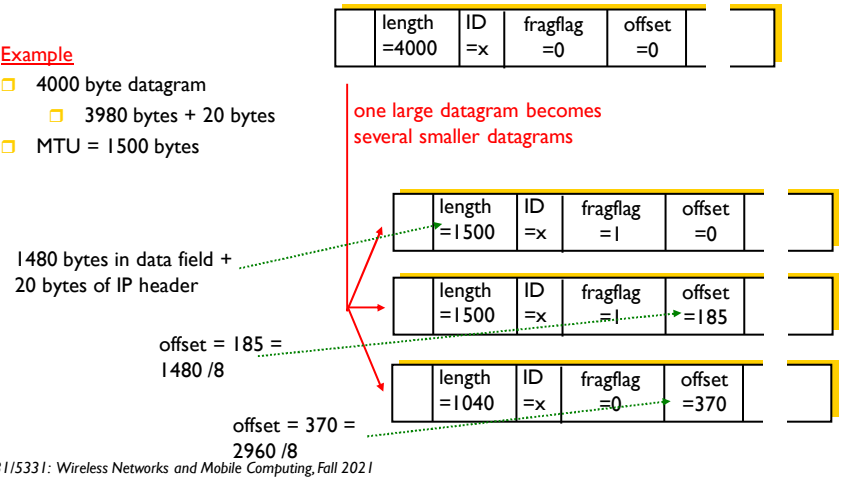
- network links have MTU (max. transfer unit) - largest possible link-level frame
  - different link types, different MTUs
  - e.g., Ethernet – 1,500 bytes
  - e.g., some wide-area link – 576 bytes
- large IP datagram divided ("fragmented") within net
  - one datagram becomes several datagrams
  - "reassembled" only at final destination
  - IP header bits used to identify, order related fragments



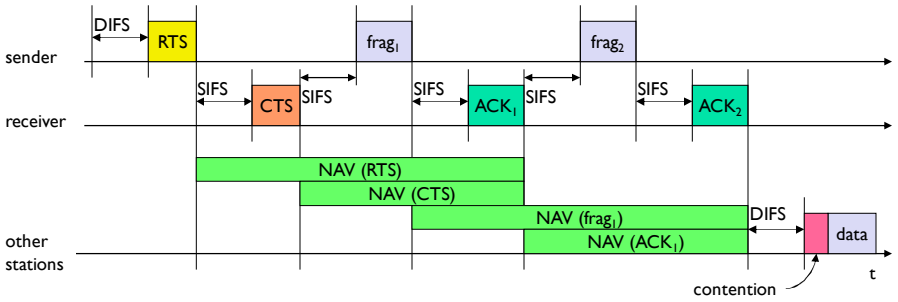
Example
- 4000 byte datagram
- MTU = 1500 bytes

IP Fragmentation & Reassembly: Revisit (cont.)

Example
- 4000 byte datagram
  - 3980 bytes + 20 bytes
- MTU = 1500 bytes



IEEE 802.11 MAC: Fragmentation (cont.)

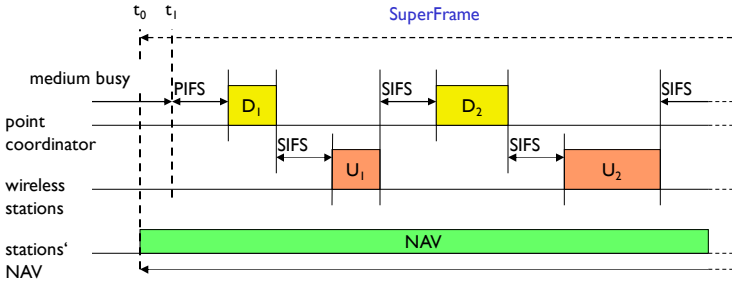


IEEE 802.11 MAC: PCF

- Provide a time-bound service
- Point coordinator:
  - Access point (AP)
  - Split the access time into super frame periods
    - Contention-free period
    - Contention period

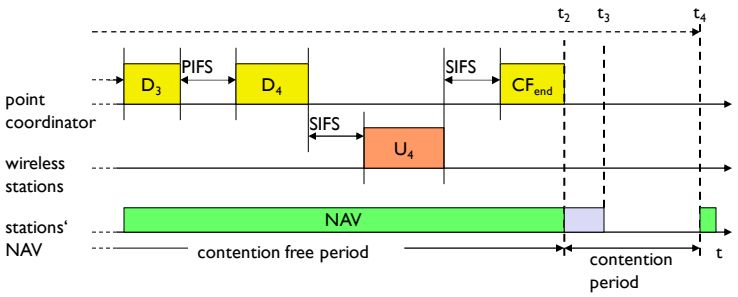
IEEE 802.11 MAC: PCF (cont.)

- The point coordinator has to wait for PIFS before accessing the medium



IEEE 802.11 MAC: PCF (cont.)

- End marker (CF_end)
  - Indicate the contention may start again
  - e.g. Similar to centrally controlled TDMA



IEEE 802.11 - MAC Management

- Synchronization:
  - Try to find a LAN, try to stay within a LAN
  - Timer etc.
- Power management:
  - Sleep-mode without missing a message
  - Periodic sleep, frame buffering, traffic measurements
- Association/Reassociation:
  - Integration into a LAN
  - Roaming, i.e., change networks by changing access points
  - Scanning, i.e., active search for a network
- MIB - Management Information Base:
  - Managing, read, write

IEEE 802.11: Synchronization using a Beacon (infrastructure)

- Each node of an 802.11 network maintains an internal clock.
- AP performs synchronization by transmitting the periodic beacon signal.
  - Beacon: contains a time-stamp and other management info (e.g. power management)
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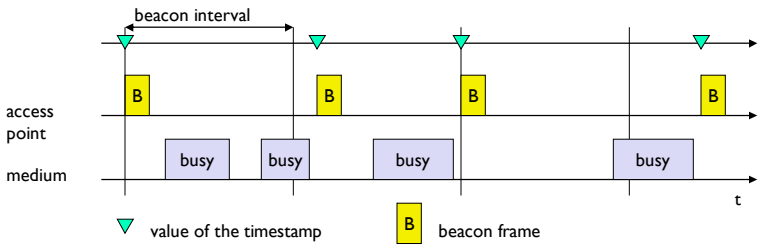
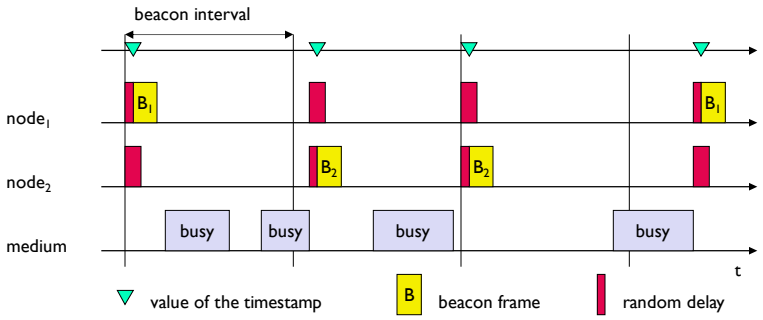


IEEE 802.11: Synchronization using a Beacon (ad hoc)

- Each node maintains its own synchronization timer
- Starts the transmission of a beacon frame after the beacon interval
  - Random back-off algorithm is applied



IEEE 802.11: Power Management

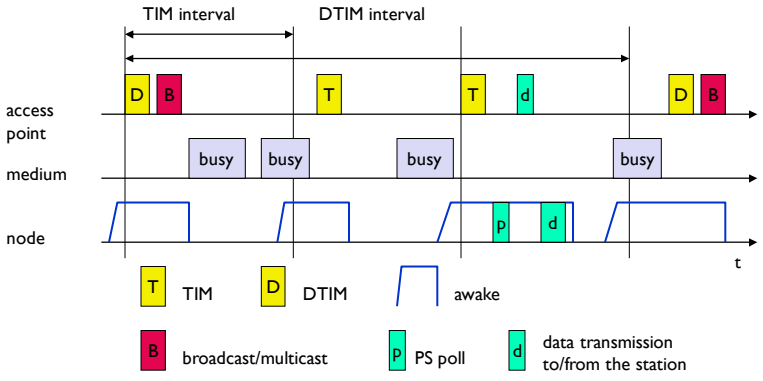
- Idea?
  - Switch the transceiver off if not needed
- States of a node:
  - Sleep and awake
- Timing Synchronization Function (TSF):
  - nodes wake up at the same time

IEEE 802.11: Power Management (cont.)

- Infrastructure:
  - Traffic Indication Map (TIM)
    - List of unicast receivers transmitted by AP
  - Delivery Traffic Indication Map (DTIM)
    - List of broadcast/multicast receivers transmitted by AP
- Ad-hoc:
  - Ad-hoc Traffic Indication Map (ATIM)
    - Announcement of receivers by stations buffering frames
    - More complicated - no central AP
    - Collision of ATIMs possible (scalability?)

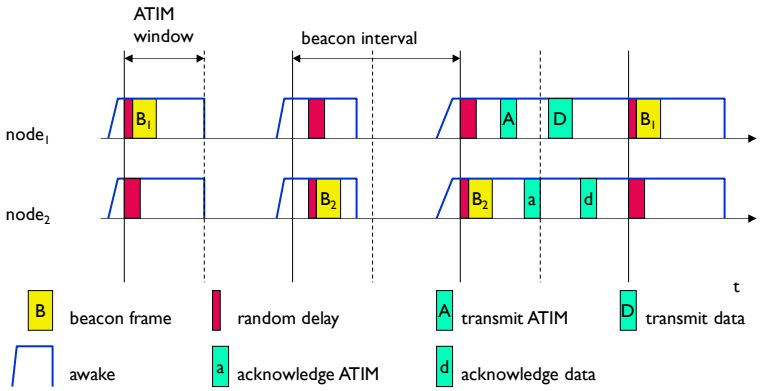
Power Saving with Wake-up Patterns (infrastructure)

- DTIM is always multiple of the TIM interval
- All nodes wake up prior to an expected TIM or DTIM.



Power Saving with Wake-up Patterns (ad hoc)

- Due to synchronization, all nodes wake up at the same time.



IEEE 802.11: Roaming

- No or bad connection?
  - Then perform:
- Scanning:
  - Scan the environment, i.e., listen into the medium for beacon signals or send probes into the medium and wait for an answer
- Re-association Request:
  - node sends a request to one or several AP(s)
- Re-association Response:
  - Success: AP has answered, node can now participate
  - Failure: continue scanning
- AP accepts re-association Request:
  - Signal the new node to the distribution system
  - The distribution system updates its data base (i.e., location information)
  - typically, the distribution system now informs the old AP so it can release resources