MAC Specification Issues

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Weight Field and Timing Synchronisation

- There are many references in 20b3 to a *Weight* field, but no specification of how it is used
- A mechanism is needed for timing synchronisation
  - Trivial in infrastructure networks
  - More difficult in ad-hoc networks . . .

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Ad-Hoc Timing Synchronisation

- Forming an ad-hoc network
- Joining an ad-hoc network
- Steady State ad-hoc network
- Merging two ad-hoc networks

Form an ad-hoc network

- Covered by section 7.1.3.6 of 20b3
- Set status to "Synchronised" and start beaconing
- A small delay whilst this station checks that there is no existing network
  - Then synchronised beaconing will start

Join an Ad-Hoc Network

- Covered by section 7.1.4
- An unsynchronised station adopts a synchronised time-stamp and becomes synchronised itself
- Start to send beacons

Steady State Ad-hoc Network

- All stations are synchronised and take it in turn to send beacons
- Received time-stamps in beacons may not equal local value of time
- Need a distributed, stable algorithm
- Propose that
  - Take the average
  - New Time = (Old local time + Received time stamp) / 2

Re-merging an Ad-hoc network

- **BSS IDs are unique**
  - **Therefore, can only get two identical BSS IDs by a split**
- **Re-merging may cause stations to change timing references by a large amount**
  - **No clever algorithm can avoid this**
- **Sleep-wake patterns will be disrupted**
  - **Stations should not stay in power saving mode if they continue to miss beacon transmissions**

Conclusion

- **There is no benefit if stations transmit time-stamps (in beacons and probe responses) before they are synchronised**
- **Synchronisation can be gained by adopting a time-stamp**
- **Synchronisation can be maintained by sticking to an average value**
  - **Re-merging of a split BSS can be achieved**

Estimate of Power Saving Status

- In an infrastructure network an AP must track the Power Saving Status of Stations
  - Probably possible
  - The AP is Continuously Awake
- In an ad-hoc network a Station must track the Power Saving Status of other Stations
  - Probably not possible
  - The Station is NOT (necessarily) Continuously Awake
  - Errors will occur . . .

Bad Estimate of PS Status

- If the transmitter thinks that a receiver is awake it will continue to retry a packet . . .
- If a receiver is not awake when a packet is transmitted, or retransmitted, it will fail and refail and refail and refail and . . .
- Result:
  - Every bad estimate will often result in the maximum number of retries followed by a failure

- Expect bad estimates of power saving status
- Allow a station to change its estimate
- Use failed retries as an indication of failure

- To guarantee that a probe is received there must be at least one node awake in a network at any given time, this node is the *probe responder*
- In an infrastructure network this must be the AP
- In an ad-hoc network there must be at least one STA awake . . .

Ad-hoc Network Probe Responses

- The station that sent the last beacon stays awake
- The station that (thinks it) sent the last beacon sends probe responses
  - Note there may be more than one, if not perfect connectivity
- No longer any need to cancel queued probe responses

Motion (Synchronisation)

"That no station shall be allowed to transmit a time-stamp field before it is synchronised.

That unsynchronised stations may adopt a received time-stamp to become synchronised.

That timing synchronisation be maintained in an ad-hoc network by adjusting a synchronised timing reference to be the average of itself and any time-stamp received from another station in that network

That the weight field be removed from the specification".

Motion (Power Saving Status)

"That the estimated power saving state of another station is based on the power management information transmitted by that station and on additional information available locally (such as history of failed transmission attempts) which may be deemed relevant".

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Motion (Probe Responder)

"That in an network there shall be at least one node that is awake at any given time to respond to probes.

In an ad-hoc network probe responses shall be sent by the station that sent the beacon.

Stations do not need to cancel a pending probe response transmission if they observe a successful probe response from another station in the same network".

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