Type dependent (Smart) DIFS.

By: Wim Diepstraten

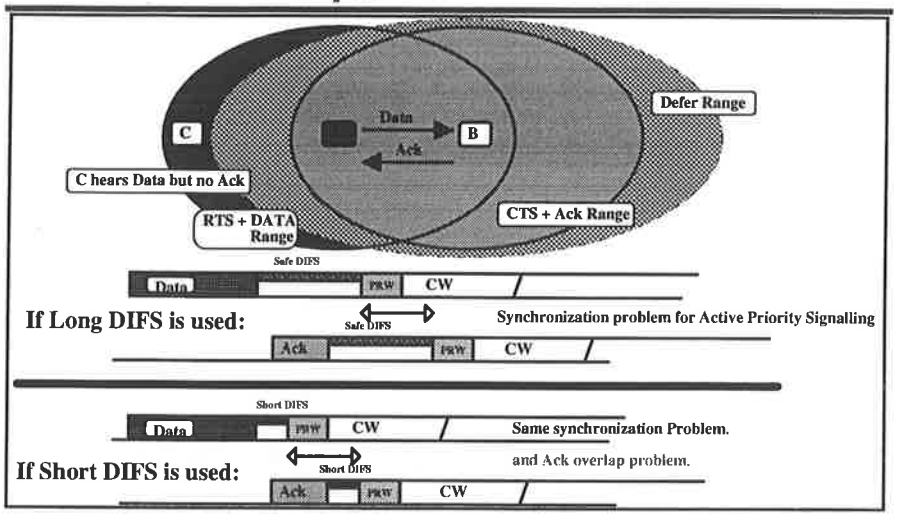
History:

- Basic assumption was:
  - DIFS is approx. one slot longer then the PIFS.
- A number of problems have been identified based on the above assumption:
  - Ack may be clobbered by a "Hidden node".
  - Ack for subsequent fragments may be clobbered by a "Hidden node" when Data is send at a Extended rate.
  - Ack will be clobered by a "Hidden node" when active priority signalling is used to support DTBS.
  - "Hidden nodes" will not be properly synchronized for an priority resolution, causing "leakage" between priority levels.
- A single longer DIFS will not resolve all identified problems.

How to specify the DIFS IEEE P802.11-94/257

Slide 3

Problem Description:



How to specify the DIFS IEEE P802.11-94/257

Slide 4

Hidden node problem effects:

- Hidden Stations may affect the Ack integrity unless DIFS > 2*IFS + Ack length (Safe DIFS).
  - Ack can be overjammed by a station that is Hidden from the Ack generating station.
    - » This can happen on frames not send with RTS / CTS (like all frames shorter then RTS_Threshold).
    - » When fragmented data is send at an extended rate.
    - » When RTS collides (in part of the network), so that not all stations can decode the RTS duration.
- Hidden station problem will also affect the Active priority signalling synchronization.
  - This will result in "Leakage" between priority levels"
  - Needs long DIFS to prevent consistent Ack failure due to jamming by the PaS signal.

Long DIFS effects:

- A Long DIFS will prevent the Ack overlap.
  - DIFS > 2*SIFS + Ack length.
  - This reduces the medium efficiency.
    - » Actual IFS could be much shorter after an Ack.
  - It does not resolve the PaS synchronization mismatch in the Active priority mechanism.
- Solution:
  - A more intelligent DIFS specification is needed.
  - The DIFS length should be dependent on the Type of the preseding frame.

Type dependent DIFS specification:

- DIFS definitions:
  - DIFS-1 = 2*SIFS + Ack duration
  - DIFS-2 = PIFS + Slot time
- Proposed Algorithm:
  - If preceding frame is identified as an Ack then DIFS = DIFS-2, else DIFS=DIFS-1.

How to specify the DIFS IEEE P802.11-94/257

Slide 7

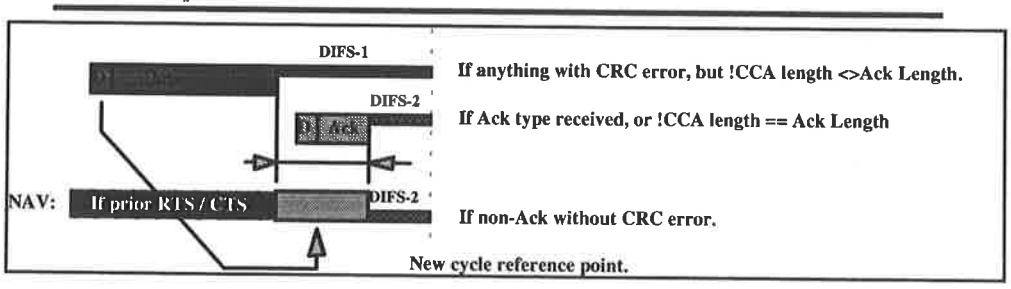
Mechanisms to identify an Ack:

- If within "Data detection" range and CRC is correct:
  - Type field will identify the frame as an Ack
- If outside "Data detection" range (CRC error) but within CCA detection range.
  - Monitor the length of !CCA (Busy medium), and identify the type by monitoring the Busy medium duration.

How to specify the DIFS IEEE P802.11-94/257

Slide 8

Example:



- Type dependent DIFS length assures proper Ack protection against hidden node effects.
  - Improves efficiency, otherwise DIFS-1 would be always needed.
  - Nodes waking up in the middle of a Data frame will likely wait the appropriate long time.
  - End of frame reference is indicated by !CCA drop.

Conclusion:

- Type dependent DIFS is highly preferred.
- It resolves Ack vulnerability issue in an efficient way.
  - Only Long DIFS needed when in Hidden Station situation.
  - Also effective if Data rate was not supported by the receive station (CRC error).
- It resolves the synchronization mismatch due to the same hidden Station problem during active priority signalling.
  - Reduces / eliminates the priority leackage problem.
- It also works for the situation where the "Defer range" is beyond the "Data Range", and when there are CRC errors.

State Machine changes needed:

{Extra slide to show the state Machine changes}

How to specify the DIFS IEEE P802.11-94/257

Slide 11

Motion:

- **Move:**

  To adopt the Smart DIFS mechanism as described in this contribution.