802.1AS Time Synchronization discussion for 802.11 and .3/.11 Layering

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Objective

Goals

- Ensure 802.1AS enables AVB-application-relevant time synchronization across 802.3 and 802.11 networks with minimal complexity and cost.
- Propose 802 layering and Service Interface extensions allowing proper layering for the 802.1AS specification over 802.3 and 802.11 MACs

Considering 802.11

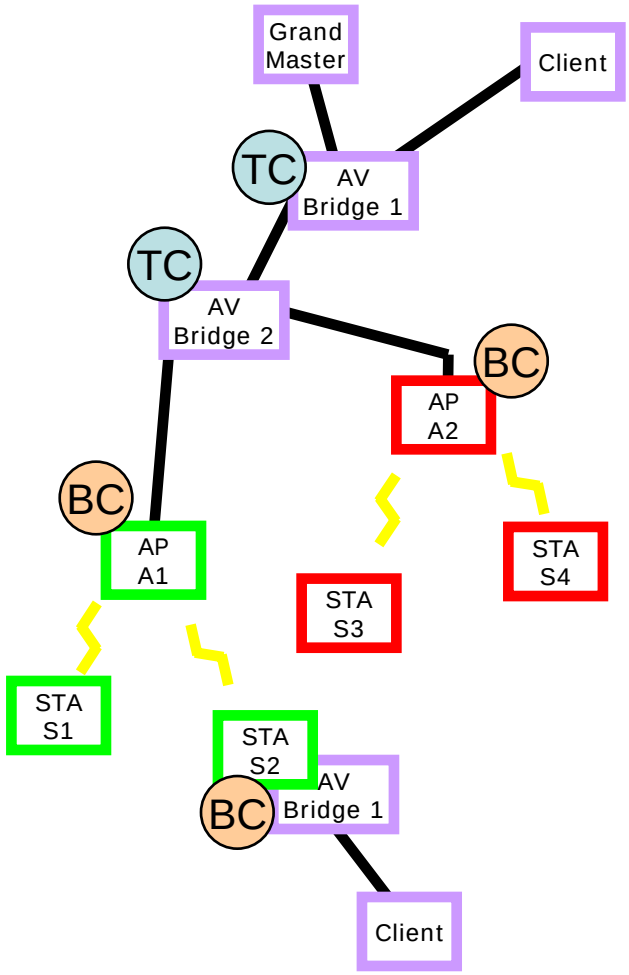
The 1:N problem

- The 1:N problem – Are we OK?
  - It is OK to multicast SYNC
  - And we'll use 802.11v to get link delay

Considering 802.11

Boundary or Transparent Clock at AP?

- If AP is Boundary Clock (BC):
  - Advantages:
    - Sync interval can be media specific
    - Some media types could choose to implement BC throughout
- If AP is p2p Transparent Clock (TC)
  - Advantages:
    - No servo loop end-to-end
    - Uniform protocol end-to-end



Considering 802.11

Grand Master selection?

- GM is permitted to be in either LAN
  - A single LAN may be present
- Wireless oscillator has better PPM
  - But more transmission jitter (from retransmissions), varying bandwidth available
- A very accurate time in 802.3 LAN doesn't help the application stations if they're all 802.11 STAs

Considering 802.11

802.11 TG-V

- Need to timestamp SYNC message
- If Boundary Clock
  - Need to ALSO timestamp Delay_Req?

Considering 802.11

Clock tree

- Assumptions
  - Infrastructure mode ONLY – no ad hoc
- Today
  - Station associated to one AP
  - Only APs do “Bridging”. Station bridges problematic.
- Tomorrow
  - DLS – stations talk to stations with AP permission
    - These links will not be part of a clock hierarchy
  - 802.11s mesh of forwarders
    - Multiple spanning trees (similar to 802.1aq)
    - Similar to 802.1aq but separate (.1aq sees mesh as pruned tree)
    - Should we assume AP-only meshing, or also station meshing?

Layering

- Simplifying Assumptions:
  - Assume follow-up messages (no on-the-fly)
  - Retransmissions are possible
  - Dropped packets are possible

Comments from George

- Roaming or migrating STA's that associate with one of many AP's. This may occur based on AP proximity.
  - How do we allow fast migration? Need to have link delays already available.
- Blocking sync messages from external sources.
  - How do we identify our preferred house clock?
- AP extends network into more wired infrastructure.
  - [KBS: AP<->STA link connects two bridged/wired LANs]
- AP nodes need to be more dynamic on changing the sync interval based on available bandwidth.
  - How can we bound the clock quality in this environment?
  - Crowded spectrums may impair media flows. Some sources are external and uncontrolled (unlicensed bandwidth).
- In some cases, wireless may be the only local network.