Initial Summary of Work Items for 802.1ASbt (802.1AS Amendment)

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Introduction

- This presentation provides an initial summary of the work items needed for the 802.1AS amendment
  - The project is P802.1ASbt
  - The PAR has been approved

List of Features - 1

- The following possible features for the 802.1AS amendment have been discussed at various times in the 802.1 AVB TG (table is continued on next slide)

Feature	Description
1	Support for link aggregation (IEEE 802.AX, IEEE 802.1AXbk, IEEE 802.1AXbq
2	Support for new media types, with corresponding media-dependent layers, e.g., IEEE Std 1901 and WiFi direct
3	Interoperability with one-step clocks on receive (but with no requirement to generate one-step Sync messages
4	Support for redundant paths
5	Enhancements to the determination of asCapable (e.g., longer cable lengths, new media types)
6	Incorporation of the interfaces specified in IEEE Std 802.3bf into the IEEE 802.3 full-duplex media-dependent layer model.

List of Features - 2

- The following possible features for the 802.1AS amendment have been discussed at various times in the 802.1 AVB TG

Feature	Description
7	Improved performance (e.g., improved grandmaster changeover time, longer chains of time-aware systems).
8	Carrying information on alternate time scales (e.g., local time for a respective time zone).
9	Management support for automatic measurement of link delay asymmetry
10	Additional parameter sets for non-Audio/Video applications, e.g., industrial control
11	Carrying of information on accumulated jitter/wander/time synchronization error accumulation and/or any other relevant measures of timing degradation

Feature 1 – Support for Link Aggregation

- Link aggregation is mentioned in 11.2.5 of 802.1AS
- Indicates that link aggregation is not specified; however, if it is used:
  - Sync and Pdelay_Req messages must be part of the same conversation
  - There can be error in time synchronization if Pdelay_Resp uses a different physical link than Sync and Pdelay_Req
    - Error is equal to the absolute value of one-half the difference in the delays in the two directions
- To specify link aggregation, we need a mechanism to ensure that Sync and Pdelay_Req are part of the same conversation, and that Pdelay_Resp uses same physical link as Sync and Pdelay_Req
- Presentation(s) needed on this

Feature 2 – Support for New Media Types

- Need presentation(s) that describe which new media types are to be supported
- If support is to be provided for IEEE Std 1901 and WiFi direct, more detail on these media is needed
  - Need the relevant documents describing these standards

Feature 3 – Interoperability with One-Step Clock on Receive – 1

- This feature is relatively well defined, at least for Sync
- For Sync
  - Allow twoStepFlag to be TRUE in Table 11-4
  - Also in Table 11-4, now must pay attention to twoStepFlag (and not ignore it on receive)
  - In MDSyncReceiveSM state machine (11.2.13 and Figure 11-6), need to add logic for case where twoStepFlag is TRUE
  - MDSyncSendSM state machine does not change, as messages are sent as two-step
- Need to decide what to do regarding the Pdelay messages
  - Both Pdelay_Resp and Pdelay_Resp_Follow_Up messages are used in nearest neighbor rate ratio measurement
  - In one-step Pdelay, only Pdelay_Resp is sent, and it carries difference between its send time and the Pdelay_Req receipt time
    - This is sufficient information for propagation delay measurement, but not for neighbor rate ratio measurement

Feature 3 – Interoperability with One-Step Clock on Receive – 2

- Need to decide what to do regarding the Pdelay messages
  - Both Pdelay_Resp and Pdelay_Resp_Follow_Up messages are used in nearest neighbor rate ratio measurement
  - In one-step Pdelay, only Pdelay_Resp is sent, and it carries difference between its send time and the Pdelay_Req receipt time
    - This is sufficient information for propagation delay measurement, but not for neighbor rate ratio measurement
  - Some possible solutions are
    - Don't handle one-step Pdelay messages on receive (i.e., only handle one-step Sync)
    - Invent a new mechanism for neighbor rate ratio measurement for this case
    - Others?

Feature 4 – Support for Redundant Paths

- Need a presentation to define this feature in more detail
- Right now, redundant paths are supported in the sense that if a link is lost, BMCA is invoked and a new synchronization hierarchy is determined
  - Then, synchronization is restored quickly because propagation delay and neighbor rate ration have been measured persistently on every link
- Does *support for redundant paths* mean that redundant synchronization information is sent, on different paths
  - If so, the details need to be described

Feature 5 – Enhancements to Determine asCapable

- For full-duplex IEEE 802.3, need information (presentation) on the full range of desired cable lengths
- Need presentations to define the mechanism for other media, i.e., 802.11, 802.3EPON, MoCA, and any new media added by Feature 2

Feature 6 – Incorporation of IEEE 802.3bf Interface

- This feature is relatively well defined
- Replace MDTimestampReceive primitive (11.2.9) with appropriate 802.3bf primitives
- Modify MDSyncSendSM, MDSyncReceiveSM, MDPdelayReq, and MDPdelayResp state machines to use the 802.3bf primitives and mechanisms
- May be able to re-use aspects of early v1 drafts (D2.0 and earlier)
  - These used older interface model that had some similarity to 802.3bf model

Feature 7 - Improved Performance

- E.g., improved GM changeover time, longer chains
- Need to define in more detail the performance that is desired
- For timing/synchronization, simulations could be done to see what performance is achievable under v1
- If the achievable performance does not meet the desired performance, would need to describe new mechanism(s) to achieve the desired performance
- Presentation needed on the above, and also on what is desired for GM changeover time

Feature 8 - Alternate Time Scales - 1

- A possible Alternate Time Scale Feature was described in
  - As-goetz-altern-timescale-0311-v01.pdf
- This feature allowed for multiple 802.1AS (gPTP) domains (feature was described for industrial applications)
  - Each domain would have its own timescale, which could have both a different epoch and different frequency
  - One domain could be traceable to TAI, but the other domains might be traceable to a working clock not traceable to TAI
    - The working clocks would have lower quality oscillators, but high accuracy within the domain is needed
  - A TLV would be used to pass information from the domain traceable to TAI to the other domains, so that they could also provide TAI
  - A domain would receive the TLV at its GM node
  - See the above presentation for details

Feature 8 – Alternate Time Scales – 2

- The above scheme encompasses
  - Ability to have multiple 802.1AS (gPTP) domains, with one domain (domain 0) traceable to TAI
  - Ability for the other domains to measure their time and frequency offset relative to domain 0, based on information contained in a TLV
  - Ability for each domain to maintain both its local (i.e., working clock) time and TAI time (GM of each domain transmits this information in a TLV)
  - This scheme generalizes the current IEEE 1588 alternate timescale feature; in that feature the alternate timescale is produced a the GM and distributed only in the domain of that GM
  - Note that the current 1588 scheme identifies the alternate timescale by a key value, but there is no requirement that different vendor's GMs use the same key values for the same timescales
    - This problem does not arise here because the correlation of the timescales is done within gPTP by correlating the working clock and domain 0 times based on the information in the TLV and the corresponding <syncEventIngressTimestamp> at the GM of the working clock domain

Feature 8 – Alternate Time Scales – 3

- Need to decide if the alternate timescale feature will be in accordance with the above presentation
- If so, next step is to work out the details for incorporation into 802.1AS
- If not, or if modifications are needed, presentation is needed to provide more detail

Feature 9 – Mgt Support for Automatic Measurement of Link Asymmetry

- Some approaches for automatic measurement of link asymmetry are described in
  - as-huang-compensation-for-physical-line-asymmetry-0311.pdf
  - asbt-huang-measurement-of-link-delay-asymmetry-1031-v00.pdf
- Need to confirm that these are the mechanisms to be supported
- Need to add managed objects, and associated MIB variables, to support these features
- May need to add related Signaling messages and state machines to support the mechanisms of these features

Feature 10 – Additional Parameter Sets for Non-A/V Applications

- Need presentations that describe the respective parameter sets for the respective applications
  - Industrial control
  - Automotive
  - Others??

Feature 11 – Carrying Information on Accumulated Timing Impairment(s)

- This feature was briefly discussed at the July, 2011 802.1 AVB TG meeting (indicated in that discussion it has been discussed in the IEEE 1722 committee)
  - The description below is based on the author's current understanding, which could change
- Desire is to provide some indication of the timing quality at a time-aware system, based on the actual (i.e., vendor-specific) performance of the time-aware systems in the path
  - Measure of quality could be peak-to-peak jitter accumulation, peak-to-peak wander accumulation, maximum absolute value of time error, etc.
  - Presentations and discussion are needed to define which measures are appropriate (this depends on the applications) and then to define the details of the measures
  - For the desired measure(s), the respective vendor-supplied parameters, for each time-aware system, would be defined, as well as the algorithms for accumulation