60802 Time Sync Ad Hoc Status Update

David McCall – Intel Corporation

Version 2

Content

- Goals
- Timeline
- Subject Areas
- Interim Meeting Agenda

Goals

- Requirement of 1us time sync accuracy over 64 hops
  - Goal of 1us time sync accuracy over 100 hops
  - Worst case, including all errors, at application level (ClockSource, ClockTarget)
- Normative requirements for an IA-station
  - Parameters for interoperability
  - Error **generation** limits to achieve system-level performance
  - Possibly, error **tolerance** requirements to achieve system-level performance
    - Will be required if system-level performance is expected to be achieved, to some extent, via reducing the effect of incoming errors
- Informative text for how error generation limits (and error tolerance requirements) can be reasonably met
  - Reasonable cost; existing silicon.

Timeline

- Goal is to have complete contribution text ready for review during 802 Plenary in November

Subject Areas

1. Messaging & Algorithms
2. Clock Filters & Control Loops
3. Sync Message Timestamping
4. Rate Ratio Measurement
5. Normative vs. Informative
6. Unified Proposal

1. Messaging & Algorithms

- Best settings for the various parameters
  - pDelay Interval, Sync Interval, etc...
- How to model errors, including frequency offset
  - Temperature curves, etc...
- Algorithmic compensation for errors
  - Using older pDelayResp timestamp information
  - Aligning pDelayResp with Sync
  - Clockdrift measurement and compensation (NRR & RR)
- Summary: how good is the information a device gets from the time sync messaging?
  - GM and Local Clock; not ClockSource, ClockTarget, ClockMaster, ClockSlave

2. Clock Filters & Control Loops

- Clock Source, Clock Master, Clock Slave & Clock Target filtering and control loops.
- Summary: how well does the accuracy at the messaging level translate to accuracy at the application level?

3. Sync Message Timestamping

- Is it better to use a synchronised ClockSlave for message timestamping?
  - 802.1AS relies on syntonisation, i.e. precisely measuring the difference in frequencies between clocks and compensating for it via RR and NRR
  - Siemens' existing implementation for Working Clock relies on synchronisation and, once synchronised, does not compensate for any (minor) variations in frequency

4. Rate Ratio Measurement

- Is it better to measure Rate Ratio directly from Sync messaging?
  - 802.1AS measures Rate Ratio (RR) via an accumulation of Neighbor Rate Ratio (NRR).
    - Neighbor Rate Ratio is measured via multiple pDelayResp messages.
  - Siemens' existing implementation measures Rate Ratio via multiple Sync messages

5. Normative vs. Informative

- What Normative Requirements are necessary?
  - How should error generation (and possibly error tolerance) be measured?
  - Must be a testable requirement
- What Informative Text should be included?
- Initially will be a conversation about the structure & approach
- Eventually will be about specific text based on the four subject areas above

6. Unified Proposal

- Text for contribution and review during November Plenary
- A lot of the text will come from 5, but probably not all of it

Interim Meeting Agenda – 60802 Time Sync

- **Monday 10:30am – 12:30pm**
  - P802.3cx Introduction – Jingfei Lv, Silvana Rodrigues – Huawei
  - Status update on time sync discussions – David McCall – Intel
- **Wednesday**
  - **10:30am – 12:30pm**: Further 60802 Time Sync Simulation Results using Offset Compensation Factor – Geoff Garner – Huawei
  - **4pm – 6pm** : Time Sync – David McCall
    - Review of error sources, equations and behaviours (based on Monte Carlo analysis)
    - Discussion of acceptable balance for solution, between complexity of implementation and other factors such as pDelayInterval, SyncInterval, residenceTime, etc...
- **Thursday 1:30pm – 3:30pm**
  - Time Sync – David McCall
    - Continued discussion, if required
    - Next steps for each subject area – short conversation; most discussion will take place in ad hoc group.
    - ~~If there is still time: Normative Requirements – how should error generation be measured?~~

Deleted in favour of more time for comment resolution.

Interim Meeting Agenda – Other Time Sync

- **Tuesday**: TSN – P802.1DP/AS6675
  - **10:30am – 12:30pm**: (2nd topic) Time Sync simplification - Safety considerations – David Modrono – SoCe
  - **1:30pm – 3:30pm**: (1st topic) Time Sync Integrity – Abdul Jabbar – GE Research

Thank you