

# 60802 Time Sync Ad Hoc 24<sup>th</sup> October Meeting

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Version 1

# 60802 Time Sync Ad Hoc – Next Steps

**Key:**  
Can progress now  
Contribution required  
Dependant on other items

- **Messaging & Algorithms**
  - **Align pDelay & Sync messaging; reduce variability of  $T_{pdelay2pdelay}$  &  $T_{sync2sync}$**  – investigation of possible mechanism
    - Contributions requested
  - **NRR & RR drift measurement & compensation** – Monte Carlo & Time Series simulations to determine efficacy and robustness
- **Clock Filters & Control Loops**
  - **Continued discussion** based on latest Time Series simulation results
- **Sync Message Timestamping** (using synced ClockSlave to timestamp)
  - **Assessment (simulations?)** based on results of Clock Filters & Control Loops discussion.
- **Rate Ratio Measurement** (best method – via NRR accumulation or direct via Sync messaging)
  - **Analysis** of Rate Ratio measurement via Sync messaging, similar to [2]. Subsequent Monte Carlo **simulation** and assessment.
- **Normative vs. Informative**
  - **Discussion** on normative requirements for error generation
    - Possible **discussion** of normative requirements for error tolerance if NRR and/or RR drift measurement & compensation is adopted.
  - Everything else is informative. Some will be obvious. Others may require **discussion**.
- **Unified Proposal**
  - Dependant on progress of above subject areas.

# Messaging & Algorithms

- Analysis and Monte Carlo simulations progressing.
  - Best way to calculate mNRR values using past pDelayResp timestamps
  - Measuring NRR drift rate
  - Measuring RR drift rate (more complicated)
- Will be ready to present on Friday; hope to have some contributions posted mid-week

# Messaging & Algorithms

- Reducing variability of...
  - $T_{pdelay2pdelay}$
  - $T_{pdelayTurnaround}$
  - $T_{residenceTime}$
  - $T_{nrr2sync}$
  - $T_{sync2sync}$ ?
- Initial feedback from Intel engineering is that 1ms accuracy may should be feasible for...
  - $T_{pdelay2pdelay}$
  - $T_{pdelayTurnaround}$
  - $T_{residenceTime}$
  - $T_{sync2sync}$
- Alignment of pDelayResp messaging and Sync ( $T_{nrr2sync}$ ) requires new mechanism
  - Discussion?

# Normative vs. Informative

- Non-controversial Normative Requirements?
  - syncInterval (target with AS defined variability of  $T_{\text{sync2sync}}$ )
  - pDelayInterval (target with AS defined variability of  $T_{\text{pdelay2pdelay}}$ )
  - pDelayTurnaround (maximum value of  $T_{\text{pdelayTurnaround}}$ )
  - residenceTime (maximum value of  $T_{\text{pdelayTurnaround}}$ )
  - Clock Accuracy ( $\pm$  ppm over a manufacturer defined temp range)
  - Clock Drift ( $\pm$  ppm/s over a manufacturer defined temp range and variability, i.e.  $\pm$  °C/s)

# Possible Additional Normative Requirements

- Limits on variability of...
  - $T_{\text{sync2sync}}$
  - $T_{\text{pdelay2pdelay}}$
  - $T_{\text{pdelayTurnaround}}$
  - $T_{\text{residenceTime}}$
- Error added to Correction Field & Rate Ratio field
  - Discussion?

# Backup

# Time Sync Ad Hoc

- 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