IEEE 802.1ASbt and Next Generation Ethernet Time Synchronization

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Agenda

• What is 802.1AS?
• What would we like to improve?
• Time synchronization unification
• Requirements for Ethernet physical layers
• Schedule & status
IEEE 802.1AS is ...

• … both a subset and superset of the IEEE 1588 “Precision Time Protocol”
  – Profile of Std 1588-2008 for Ethernet, a much simplified subset
    • Compatible enhancements for much faster clock locking and easier/ lower cost filtering at endpoints
  – … but a superset of Std 1588-2008 to support 802.11 WiFi, EPON and “coordinated shared networks”
Architectural model

Time-aware higher-layer application

ClockMaster

ClockSlave

SiteSync

LocalClock

PortSync

Media-dependent time-aware system entities

MAC relay (see IEEE 802.1Q)

PHY

MDSyncSend

MDSyncReceive

PortSyncSync

Media-independent

PHY

MAC

LLC

MD

MS

Media-dependent

ISS
IEEE 802.1ASbt

• … is a revision to 802.1AS to
  – Enhanced link support
    • Support for *all* of Ethernet
    • Other layer 2 links of interest
  – Improve performance and usability
    • Responsiveness and reliability
    • Scalable to larger / more difficult topologies
  – Enable protocol unification
    • End the 1588 vs 802.1AS vs NTP confusion
Layer 2 compatibility

• Support for link aggregation (IEEE 802.1AX)

• Work with 802.3 on multi-lane timestamp reference point

• Support for other media:
  – IEEE 1901, WiFi Direct, etc
    • (if changes are needed)
Improved scalability

• One step processing
  – For both synch and peer delay
  – Fully backward compatible with two-step

• More responsive
  – Pre select a failover Grand Master so the selection when needed is faster
  – Support both hot and cold standbys
  – Reduce BMCA convergence time for large network

• Redundancy
  – Short reconfiguration w/redundant paths when one path fails
  – Multiple active Grand Masters for the same domain
Initialization & configuration

• Aid for measurement of link delay asymmetry
  – “reverse links and remeasure”

• Reliably detect buffered repeaters
  – Need an alternate mechanism for long (fiber) links
  – MAC control frames?
Additional features

• Multiple domains with synchronization information
• Accuracy reporting
  – Each bridge to report its worst case Time Stamp accuracy
  – GM-to-ordinary-clock path synchronization reporting
Protocol unification

• Provide L2 timing information for 1588 revision
  – Merge 802.1AS and 1588 architectures

• Work with 1588 to provide end-to-end quality information
  – Common service interface and information exchange

• Move media-independent layer out of 802.1AS?
A unified architecture

Time-aware higher-layer application

ClockMaster

media independent

ClockSlave

Time-Aware System core state machine

LocalClock

Port state machine

media-dependent

Port state machine

media-dependent

PHY

MAC

LLC

MS

Media-dependent state machine

MAC relay
(see IEEE 802.1Q-2005)

ISS

MAC

PHY

Media-dependent state machine

ISS

MAC

PHY

Time of RX/TX at well-known point

media-dependent

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IEEE 802.1 Time-Sensitive Networking TG
A unified architecture

Time-aware higher-layer application

media independent

ClockMaster

Time-Aware System core state machine

LocalClock

ClockSlave

Port state machine

IPv4 shim

IPv4 media dependent

media-dependent state machine

media-dependent state machine

time of RX/TX at well-known point

IPv4 media dependent

1588 transmit

1588 receive

PHY

MAC

LLC

MS

ISS

MAC

PHY
Physical layer requirements

• Need a well known measurement point for “start of frame”
  – accuracy of PTP directly corresponds with the accuracy (repeatability/precision) of the measurements
  – symmetry between directions is important
• Check out the White Rabbit implementation for ideas
Schedule and status

• IEEE 802.1ASbt “assumptions” list almost complete
  – Drafts can start at that time
  – May depend on 1588 schedule

• IEEE 1588 revision just started
  – First web meeting next week
  – First FtF in Lemgo, Germany, Sept 27-28, 2013
    • Just after ISPCS ‘13