

# 1-step for 802.1AS Details

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Michael Johas Teener  
[mikejt@broadcom.com](mailto:mikejt@broadcom.com)

# Agenda

- **Review of current proposal**
- **Media independent (Clause 10)**
- **Media dependent for Ethernet (Clause 11)**
- **Coordination with 1588**

# Review

- **Most changes in Clause 11 (full-duplex point-to-point) media dependent layer**
  - port can be “oneStepCapable” (per port global variable array)
  - if so capable, a master port can be in “oneStepOperation” (port global)
    - slave port operation updated to support 1step, but no mode change, just a “oneStepSync” flag set in the MDSyncReceive data.
  - a master port in “oneStepOperation” can operate like a TC
    - meaning not updating some sync fields
    - which can happen only if the current slave port is in “oneStepOperation” and the sync rate is the same
    - ***not required*** ... it’s OK if a master port does update all fields
- **Intention is that media independent layer is almost the same**
  - existing path unchanged
  - use Signaling to communicate “oneStepCapable”
  - need to propagate some of the unprocessed received fields
- **Notes and annex to explain implications of mixed 1step/2step networks**

# Media independent

- **Clause 10 state machines unchanged except**
    - master ports (sending sync) get some extra information propagated from the slave port (receiving sync)
      - perhaps always propagate the received sourcePortIdentity
    - Add TLV to Signalling message to communicate “oneStepCapable”
  - **Clause 10 data structures:**
    - Separate PortSyncSend and PortSyncReceive
    - MDSync<x> and PortSync<x> have new fields
      - rxSequenceld - holds sequenceld from the current slave port
      - oneStepSync - set if slave port received a one step sync
    - <y>SyncSend have new fields:
      - rxSourcePortIdentity - received on the current slave port
      - rxCumulativeRateOffset - received on the current slave port
- <x> is “Send” or “Receive”, <y> is “MD” or “Port”

# Move info TLV to sync

- 802.1AS uses the Follow\_Up to carry useful information
  - move it to the Sync if oneStepOperation is true

Table 11-10—Follow\_Up information TLV

Bits								Octets	Offset
8	7	6	5	4	3	2	1		
tlvType								2	0
lengthField								2	2
organizationId								3	4
organizationSubType								3	7
cumulativeScaledRateOffset								4	10
gmTimeBaseIndicator								2	14
lastGmPhaseChange								12	16
scaledLastGmFreqChange								4	28

# MDSyncReceiveSM

- **No changes for one step except:**
  - populating the MDSyncReceive structure from the Sync event message
    - including the TLV
  - set the oneStepSync flag if appropriate
  - include the sequenceId value

# MDSyncSendSM

- **If port is operating in one step mode:**
  - if oneStepOperation[rcvdPSSyncPtr] && (syncInterval[rcvdPSSyncPtr] == syncInterval[txPSSyncPtr]) && TCOperation[[txPSSyncPtr] then “transmit like a TC”
    - we know the slave port is one step and using the same synch rate, so we can operate like a 1588 transparent clock
    - **not required**, unless the group decides that it should be
  - if !!oneStepOperation[rcvdPSSyncPtr] || (syncInterval[rcvdPSSyncPtr] != syncInterval[txPSSyncPtr]) || !!TCOperation[[txPSSyncPtr] then “one step, not TC”
    - we operate just like a 802.1AS port except we send a one step synch (one step master)
  - details follow
- **If a port is not operating in one step mode:**
  - no changes from 802.1AS-2011

# MDSendSynchSM #1

(“transmit like a TC”)

- **Build sync from MDSendSync structure**
  - uses the upstreamTxTime and egress timestamp (and other latency info) to add the residence time to the correction field
  - uses rxSequenceld for the sequenceld
  - uses rxSourcePortIdentity for sourcePortIdentity
  - cumulativeRateOffset must be updated \*unless\* the device on a slave port does not compute the neighbor rate ratio calculation (sets it to 1.0)
    - using signaling to set “computeNeighborRateRatio” to false
    - then the rxCumulativeRateOffset could be repeated



# **MDSendSynchSM #2**

**(“transmit like a TC”)**

- **Requirement that send synch happen “as soon as possible after receive synch”**
  - not certain how this can be specified
  - worst case residence time is one variable for a “time fidelity report”

# **MDSendSynchSM**

**("one step, not TC")**

- **Slave port is two step or different sync rate, so we need to synthesize the one step event message**
  - or we just don't want TC-like operation
- **Build sync from MDSendSync structure**
  - uses the upstreamTxTime and egress timestamp (and other latency info) to add the residence time to the correction field (same as before)
  - uses sequenceld for the sequenceld
  - uses sourcePortIdentity for sourcePortIdentity
- **In other words, same values as used in two step**

# residence time error

- If we don't adjust residence time using rateRatio, there is an error
  - $(\text{ratio error}) \times (\text{residence time})$  or

	ratio error	200ppm	100ppm	50ppm
residence time				
250 $\mu\text{s}$		50ns	25ns	10ns
100 $\mu\text{s}$		20ns	10ns	5ns
25 $\mu\text{s}$		5ns	2.5ns	1ns
10 $\mu\text{s}$		2ns	1ns	0.5ns

- this might be OK, it would be a *\*cost\** of using TC mode

# Two-step pDelay

- **pDelay is infrequent**
  - 1 per second, NOT duplicated for domains (or at least it shouldn't be)
  - low processing load
- **pDelay is NOT relayed**
  - processing is local anyway, hardly anything to be gained with one-step

# "Legacy" compatibility

- (something about Signaling being between peer devices)
  - FtF discussion on Signaling robustness TBD
- One-step ***receive*** capability included in the Signaling message
  - Hmm. I notice that we never define when Signaling messages are sent.
    - I also note that sometimes it's "Signaling" and sometimes it's "Signalling"
- Use new TLV in announce message
  - one field in TLV is "1stepCapable"
  - If 1stepCapable is true in an announce message, then the port sending it can ***receive*** one-step sync

announce transmitter announce receiver	1stepFlag false (only accept two step)	1stepCapable true (can receive one step)
two step only (802.1AS-2011 or 802.1AS-REV two step only)	ignored, will send back only two step <b><i>1stepOperation = false</i></b>	ignored, will send back only two step <b><i>1stepOperation = false</i></b>
one step rx OK (802.1AS rev one step capable)	accepted, will send back only two step <b><i>1stepOperation = false</i></b>	<b>accepted, will send back one step ONLY if capable</b> <b><i>1stepOperation = true</i></b>

# Notes on hybrid operation

- “Hybrid operation” means the path back to the GM includes both TC-like and two step links.
- There are three fields in sync/follow-up that now have possibly different meanings:
  - sequenceId
  - sourcePortIdentity
  - cumulativeScaledRateOffset

# sequenceID

- **as far as I can tell, sequenceID is not relevant end-to-end, it's just a link parameter**
  - only used to correlate sync with corresponding follow-up
- **for a “TC path” through a TAS, sequenceID is repeated ...**
  - never tested or validated
    - consider the case of transition from TC-like to non-TC-like and vice-versa
  - but always incrementing at nearest upstream TAS (non-TC path) or GM

# cumulativeScaledRateOffset

- for a “TC path” the cumulative rate ratio **\*may\*** be unchanged
  - requires that the downstream device not compute neighbor rate ratio
    - use signaling message to do that
  - need to understand the effect on downstream TAS operation ... need the “clock fidelity distortion”
    - off-topic, but important, is to validate clock accuracy
- **clearly, it’s OK if the cumulative rate ratio is updated**



# sourcePortIdentity

- the sourcePortIdentity is the identifier of the closest upstream GM or BC
- for 802.1AS-2011, all TAS's are BCs
- for 802.1AS-rev, I propose that a “TC path” is NOT a BC
  - meaning that sourcePortIdentity is just like the 1588 meaning
- it's possible we could redefine sourcePortIdentity for 802.1AS-rev
  - it could be “grand master identity”
  - but that would be breaking 1588, perhaps

# 1588 implications

- **1588 has no concept of different ports in a TC doing different things**
  - like one step and two step in the same device
  - but then they don't define ethernet and wifi ports, either
- **Port capabilities in announce or signaling messages?**
  - help their plug-and-play, they were thinking about things like this for profile interoperation
- **We will have to go to them with this idea as part of their new layered structure**
  - they might actually like the idea

# All done!

## document history

v1	2015-04-07	initial version, TSN call 2015-04-08
v2	2015-04-08	separate out "TC" mode, fix names, agenda
v3	2015-05-03	updates to for final discussion on AS call 2015-05-04
v4	2015-05-07	effect of not computing cumulative rate ratio, requirements for that, and note about loss of accuracy if rate ratio not used for residence time correction