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Comment 88 to 802.1ASdm d0.5

Scope of the LocalClock entity

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LocalClock entity Definition in IEEE 802.1AS

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In IEEE 802.1AS-2020, the term *"LocalClock entity"* is used with two different scopes:
per PTP Instance or **per time-aware system** (detailed references on the last slide)

- 3.16 (definition of local clock, not LocalClock entity) is very generic
- 8.6.2.2 (definition of Clock Class) states the LocalClock entity exists per PTP Instance
- 10.2.5.7 and 10.2.5.8 (global variables neighborRateRatio and meanLinkDelay) use "the LocalClock entity of the time-aware system"
- 11.1.2 (PropagationDelayMeasurement with CMLDS) states explicitly that NRR is the ratio of the frequency of the LocalClock entities of two neighbored time-aware systems and thus domain independent.

- 8201.ASdm d0.5 states (in the note at the end of paragraph 17.3), that the LocalClock entities can be traceable to the same oscillator or to different oscillators
  - This will result in different rate ratios to the LocalClock of the neighbor time-aware system if CMLDS is used (Example see next slide)

- The Rate Ratio used for correction field calculation is: RateRatio = $\mathrm{GMRateRatio} + \sum_{UpstreamLinks}(NRR - 1)$

Two Instances A,B with LocalClock entity from different oscillators
Instance A: domain 0, Instance B: domain X

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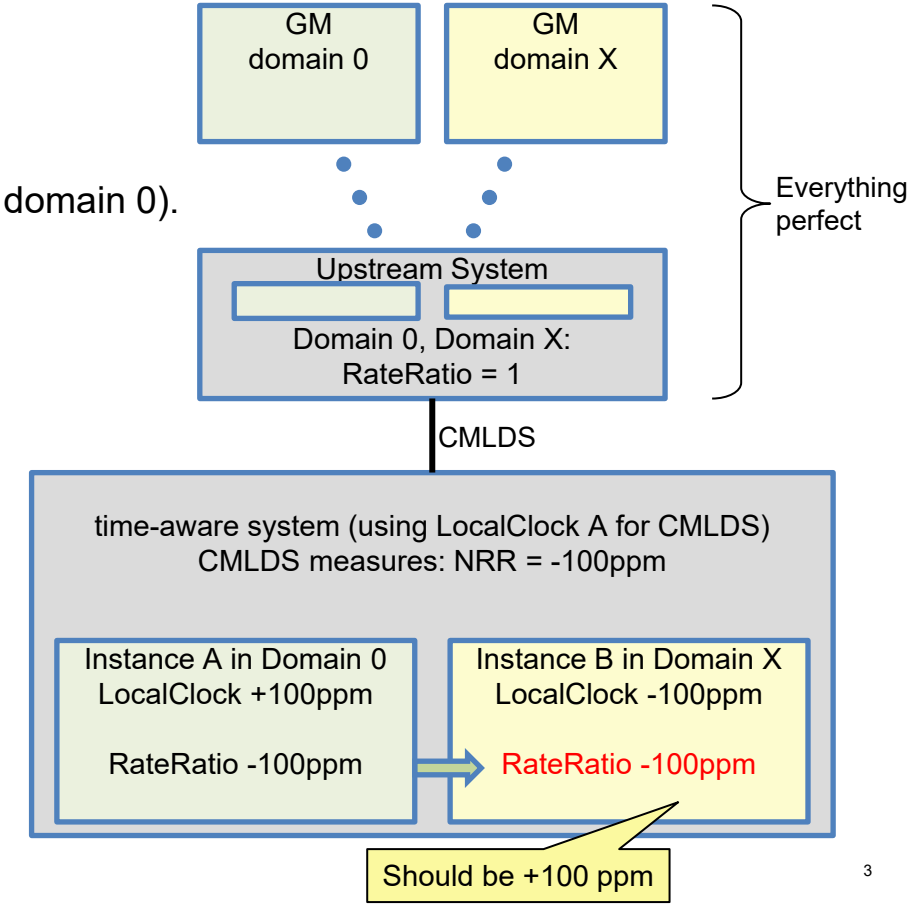
- LocalClock A +100ppm relative to GM
- LocalClock B - 100ppm relative to GM

All upstream clocks and time-aware systems perfect.
Link Delay measurement with CMLDS and LocalClock A (for domain 0).

Let the true residence time be 10 ms, LinkDelay is ignored

	Domain 0	Domain 1
LocalClock Rate	+100ppm	-100ppm
NRR (from CMLDS)	0.9999 (-100 ppm)	**0.9999 (-100ppm)**
Calculated Rate Ratio	0.9999 (-100 ppm)	**0.9999 (-100ppm)**
"True" RateRatio	0.9999 (-100 ppm)	1.0001 (+100ppm)
Measured Residence Time	10.001 ms	9.999 ms
Scaled with RR, added to Correction Field	10.000 ms	**9.998 ms**
Error	0	**2 µs**



Proposed Resolution (different from comment 88)

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- **Align the definitions and define there is one LocalClock entity per time-aware system**
- **Requires changes in 8.6.2.2 of 802.1AS-2020 and the note in 802.1ASdm d0.5**
  - **This definition is already present in the media-independent definitions (10.2.5.7, 10.2.5.8)**
  - **In 802.1AS-2011 there was only one instance with domain 0, so in practice there was always only one LocalClock in a time-aware system**

Alternatively (minimum change, in case the existence of LocalClocks per Instance is there for good reasons):

- Change the note in 17.3 of ASdm as follows:
  In case of CMLDS, the LocalClock Entities of all PTP Instances that do not operate on a disjunct set of Link Ports must be syntonized"
- Change 10.2.5.7. and 10.2.5.8 in 802.1AS-2020 to "... LocalClock entity of the PTP instance at ..."
- Add an explanation to the second section of 11.1.2 (CMLDS) that with CMLDS, syntonized LocalClocks have to be used for the PTP Instances sharing the Link Port

A remark to "syntonized":
For real implementations, it is hard to see why one would implement two different time stampers on a single Ethernet interface. It is, however, possible to convert the time stamps of a single timestamping unit to different syntonized timescales for calculation of the residence time and to determine the various timeouts in the state machines from those timescales.

Detailed References

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- **3.16 local clock:** A free-running clock, embedded in a respective entity (e.g., PTP Instance, CSN node), that provides a common time to that entity relative to an arbitrary epoch.

- **8.6.2.2 Clock Class**
  NOTE—The PTP Instance has a LocalClock entity, which can be the free-running quartz crystal that just meets the IEEE 802.3 requirements, but could also be better (...)

- **10.2.5.7 neighborRateRatio:** The measured ratio of the frequency of the LocalClock entity of the time-aware system at the other end of the link (...)

- **10.2.5.8 meanLinkDelay:** The measured mean propagation delay (see 8.3) on the link attached to this port, relative to the LocalClock entity of the time-aware system at the other end of the link (...)

- **11.1.2 Propagation delay measurement**
  Since the propagation delay measurement is made using timestamps relative to the LocalClock entities at each port at the ends of the PTP Link and the resulting mean delay is expressed in the responder timebase (see 11.2.19.3.4), there is no need to measure the mean delay for the PTP Link in each domain because the mean delay is the same in each domain. In addition, the quantity neighborRateRatio (see 10.2.5.7) is the ratio of the responder to requester LocalClock frequency and is also the same in all domains. Therefore, the propagation delay and neighborRateRatio measurements are domain-independent.

- **802.1ASDm d0.3 / Clause 17.3 / p61 lines 51/523 and p62 line 1:**
  There is one LocalClock entity for each PTP Instance. Therefore, Figure 17-1 shows two LocalClock entities.
  NOTE - The LocalClock entities can be traceable to the same oscillator or to different oscillators.