Summary of Assumptions for Further Simulations of Time Error Performance for Transport over an IEC/IEEE 60802 Network

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Introduction - 1

- Reference 1 below describes updated assumptions for new simulations of time error performance for transport over an IEC/IEEE 60802 network
- These new assumptions resulted from discussions during the July 802.1 virtual meetings of simulation results to date (given in presentations in March, May, and July 2020)
- The purpose of the new simulations is to determine the requirements needed to meet the objective of 1 μs for max|TE| over 64 hops, and over 100 hops if possible
- The current presentation summarizes the assumptions of [1] in tabular form, for convenience (both when referencing the assumptions and when discussing them)

1. Gűnter Steindl, *IEC/IEEE 60802 Synchronization requirements and solution examples*, Update after July 2020 plenary, Presentation to 802.1, July 2020.

Assumptions Common to All Simulation Cases – 1

Assumption/Parameter	Description/Value
Hypothetical Reference Model (HRM)	101 PTP Instances (100 hops; GM, followed by 99 PTP Relay Instances, followed by PTP End Instance
Timestamp granularity	2 ns
GM maximum frequency offset	± 50 ppm
GM maximum frequency drift rate	3 ppm/s
PTP End/Relay Instance maximum frequency offset (Local Clock)	± 50 ppm
PTP End/Relay Instance maximum frequency drift rate (Local Clock)	3 ppm/s
GM and Local Clock frequency variation	sinusoidal
Relative phases of GM and Local Clock frequency waveforms	Chosen randomly from a uniform distribution over [0, 2π] rad at initialization
Relative frequencies of Local Clock frequency waveforms	Choose randomly at initialization by allowing waveform amplitude to be random over a range [50 - ε, 50] ppm; choose ε = 5 ppm, so that the waveform frequency varies over a 10% range
Computed performance results	$\max\lvert dTE_{R(k,\,0)}\rvert$ (i.e., maximum absolute relative time error between node k ($k > 0$) and GM

Assumptions Common to All Simulation Cases - 2

Assumption/Parameter	Description/Value
Use syncLocked mode for PTP Instances downstream of GM	Yes
Window size for successive Sync messages method, when used	7 (take difference between respective timestamps of current Sync message and 7^{th} previous message)
Compute median for successive Sync messages method, when used	Yes
Endpoint filter parameters	K_pK_o = 11, K_iK_o = 65 (f_{3dB} = 2.6 Hz, 1.288 dB gain peaking, ζ = 0.68219)
Simulation time	1050 s; discard first 50 s to eliminate any startup transient before computing max|$dTE_{R(k, 0)}$|
Number of independent replications, for each simulation case	300
GM rateRatio and neighborRateRatio computation granularity	0
Mean link delay	500 ns
Link asymmetry	0

Assumptions Common to All Simulation Cases - 3

Assumption/Parameter	Description/Value
Dynamic timestamp error for event messages (Sync, Pdelay-Req, Pdelay_Resp) due to variable delays within the PHY	±8 ns; for each timestamp taken, a random error is generated. The error is + 8 ns with probability 0.5, And – 8 ns with probability 0.5. The errors are independent for different timestamps and different PTP Instances.
Window Size for mean link delay averaging (i.e., how many mean link delay samples are averaged over, assuming a sliding window)	16

Summary of Simulation Cases (parameters that are different for each case)

Case	Method of computing GM rateRatio	Residence time (ms)	Pdelay turnaround time (ms)	Mean Sync Interval (ms)	Mean Pdelay Interval (ms)
1	Accumulate neighborRateRatio	1	1	0.125	31.25
2	Accumulate neighborRateRatio	4	4	0.125	31.25
3	Accumulate neighborRateRatio	10	10	0.125	31.25
4	Use successive Sync messages	1	10	31.25	1000
5	Use successive Sync messages	4	10	31.25	1000
6	Use successive Sync messages	10	10	31.25	1000

Thank you