

60802 Time Sync – Monte Carlo Simulations to Match Recent Time Series Simulations

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Version 1

(No results for Monte Carlo “802.1AS Classic”)

References

[1] Geoff Garner “New 60802 Time Domain Simulation Results for Cases with Drift Tracking Algorithms and PLL Noise Generation”, 60802 contribution, September 2023

Overview

- [1] Provided filtered and unfiltered $\text{Max}|dTE_R|$ results for 36 cases.
- In 24 cases the filtering is the only difference vs other cases; there are 12 unique unfiltered cases.
 - Unique filtered cases: 1 to 8 and 5a to 8a
 - Cases 9 to 28 are repetitions of cases 1 to 8 with different filtering.
 - Cases 25a to 28a are repetitions of cases 5a to 8a with different filtering.
- This presentation provides results of Monte Carlo simulations to match the unfiltered cases.
 - Same parameters and assumptions.
 - The Monte Carlo simulations can only produce output equivalent to the unfiltered Time Series simulation results. It does not fully simulate the passage of time necessary to simulate the effect of filtering.

Unique Unfiltered Cases – 100 Hops

Case	GM Drift	Drift Comp NAP	mNRR Smoothing NA	Time Series Max dTE _R (ns)	Monte Carlo Max dTE _R (ns)	ns Difference TS → MC	% Difference TS → MC
1	0	8	4	403.2	613	+209.8	+52%
2		8	8	362.1	596	+233.9	+65%
3		-	4	426.8	813	+386.2	+90%
4		None (Classic 802.1AS)		2353.5			
5	1	8	4	512.8	658	+145.2	+28%
6		8	8	539.6	641	+101.4	+19%
7		-	4	967.4	882	-85.4	-9%
8		None (Classic 802.1AS)		3427.9			
5a	0.5	8	4	421.7	636	+214.3	+51%
6a		8	8	434.2	614	+179.8	+41%
7a		-	4	616.6	847	+230.4	+37%
8a		None (Classic 802.1AS)		2881.6			

Table Headings

- GM Drift – Same as “GM noise magnitude relative to non-GM PTP Instances” in [1]
- Drift Comp NAP – Same as “mNRRcompNAP” in [1]
- mNRR Smoothing NA – Same as “mNRRsmoothingNA) in [1]
- Time Series Max|dTE_R| – Same as “Unfiltered max|dTE_R| Node 101”
 - Time Series simulation recovers the clock at every node, so this is the maximum absolute dTE_R looking at all nodes during the all replications (latest results are only 1 replication for each case)
- Monte Carlo Max|dTE_R| – Maximum absolute dTE_R looking at all runs
 - Monte Carlo simulation only recovers the clock at the last node (Node 100; GM is Node 0).
- % Difference TS → MC – Percentage difference of Monte Carlo Max|dTE_R| vs Time Series Max|dTE_R|

Notes on Drift Comp & mNRR Smoothing

- Drift Tracking & Compensation – mNRRcompNAP – 8
 - Initial NRR calculation looks back 8 Sync (or Pdelay_Resp) messages
 - Measurement A averages 8 most recent calculations
 - Uses data from 16 most recent Sync messages; 2 s of data for 125 ms Sync Interval
 - Measurement B averages next 8 most recent calculations
 - Uses data from another 16 most recent Sync messages, i.e. 32 messages total; **4s of data**
- mNRR Smoothing – 4 or 8
 - Initial NRR calculation looks back 4/8 Sync (or Pdelay_Resp) messages
 - mNRR measurement averages 4/8 most recent calculations
 - Uses data from 8/16 most recent Sync messages; **1 or 2 s of data** for 125 ms Sync interval

Parameters & Configuration

- Same as [1] except...
- 100,000 runs per case
 - Random configuration values for each run, so more variety than Time Series
- Applies error correction for RRdrift at End Station
 - Assumes applicable RR is calculated at mid-point of interval between receipt of Sync messages.
 - For Time Series, the equivalent would be to modify measured RR by measured RRdrift x (Sync Interval / 2)
- “Classic 802.1AS” Monte Carlo simulation uses older version of simulation that uses simple % reduction of error due to meanLinkDelay rather than simulating multiple previous calculations and averaging them.
 - Time Series simulation does include meanLinkDelay averaging in its “Classic 802.1AS” simulations

Thank you!