PTP Boundary Clock Testing of Artel's Quarra switch

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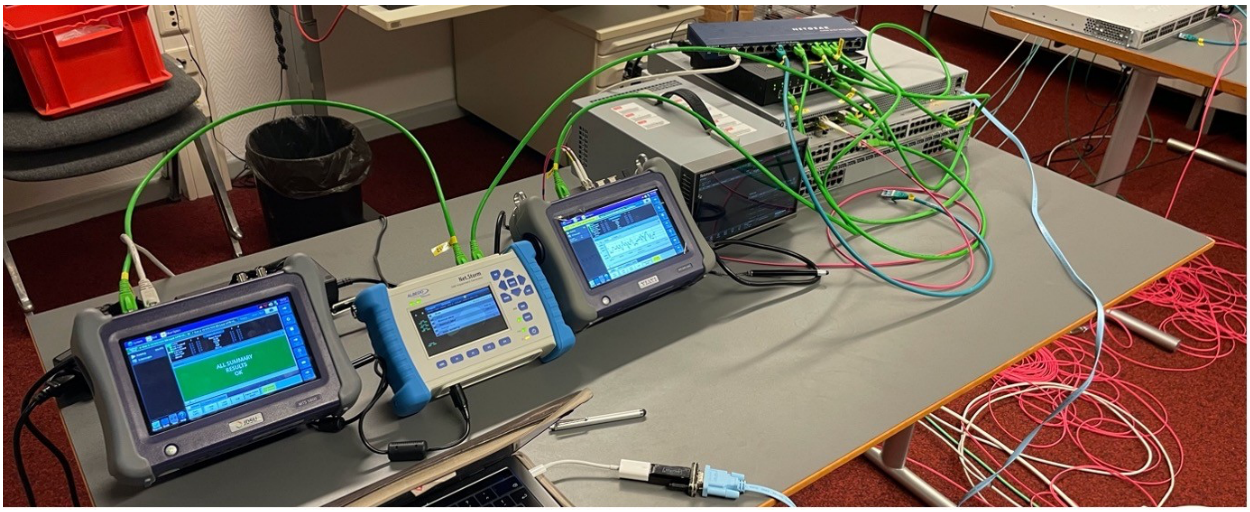
Have you ever wondered how PTP jitter is reduced in a PTP boundary clock implementation?

Simplexity has investigated the behavior of various switch models in terms of smoothing out incoming packet jitter (Packet Delay Variation, PDV). Jitter tends to occur in many networks, especially when WAN connections are involved. This report describes if and to what degree boundary clock switches reduce such jitter by the use of an internal filter or oscillator.



From left to right: MTS-5800 (PTP-Server) -> WAN emulator -> distribution switch -> Boundary Clock switches under test

Boundary clock switches were generally expected to reduce jitter through an internal filter/oscillator, but it was virtually impossible to find vendor documentation about this. Simplexity specializes in all kinds of investigations and support of network environments regarding their real-time media behavior. Hence, we decided to perform our own measurements of PTP jitter reductions. This report focusses solely on findings regarding jitter reduction and does not encompass all aspects of PTP behavior of a switch. Following are the results of tests executed on Artel's Quarra PTP switch.

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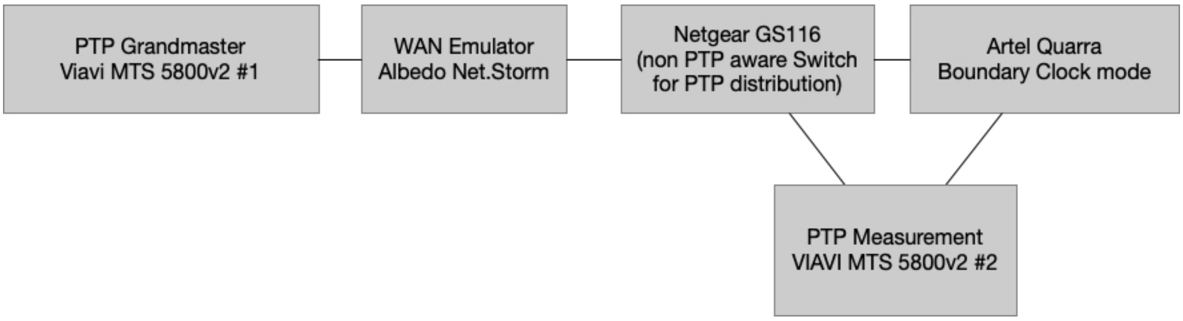
Simplexity Test Setup

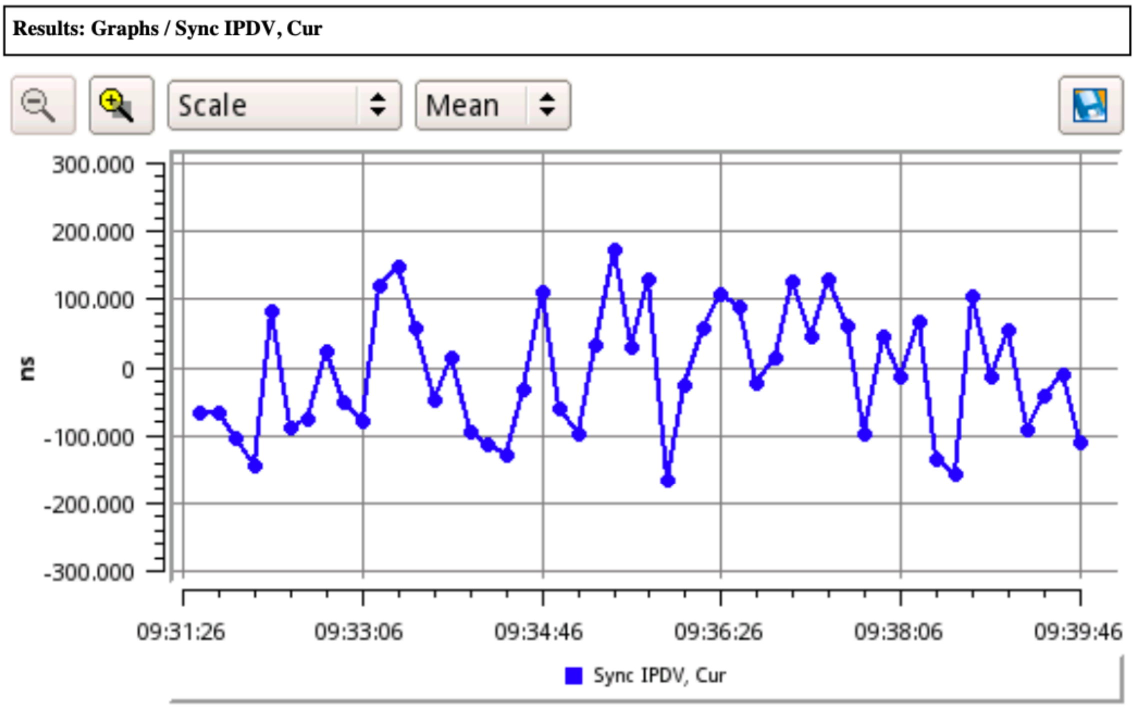
- PTP Grandmaster: Viavi MTS5800 running profile SMPTE ST 2059-2
- Jitter generated by Albedo Net.Storm WAN Emulator
- Jittery packets distributed to “switch under test” via an unmanaged multicast capable switch (Netgear GS116)
- A second Viavi MTS5800 was used to measure Packet Delay Variation (PDV, “Jitter”) of boundary clock switch output. It acted as a reference PTP follower, since it works on a highly stable internal oscillator.



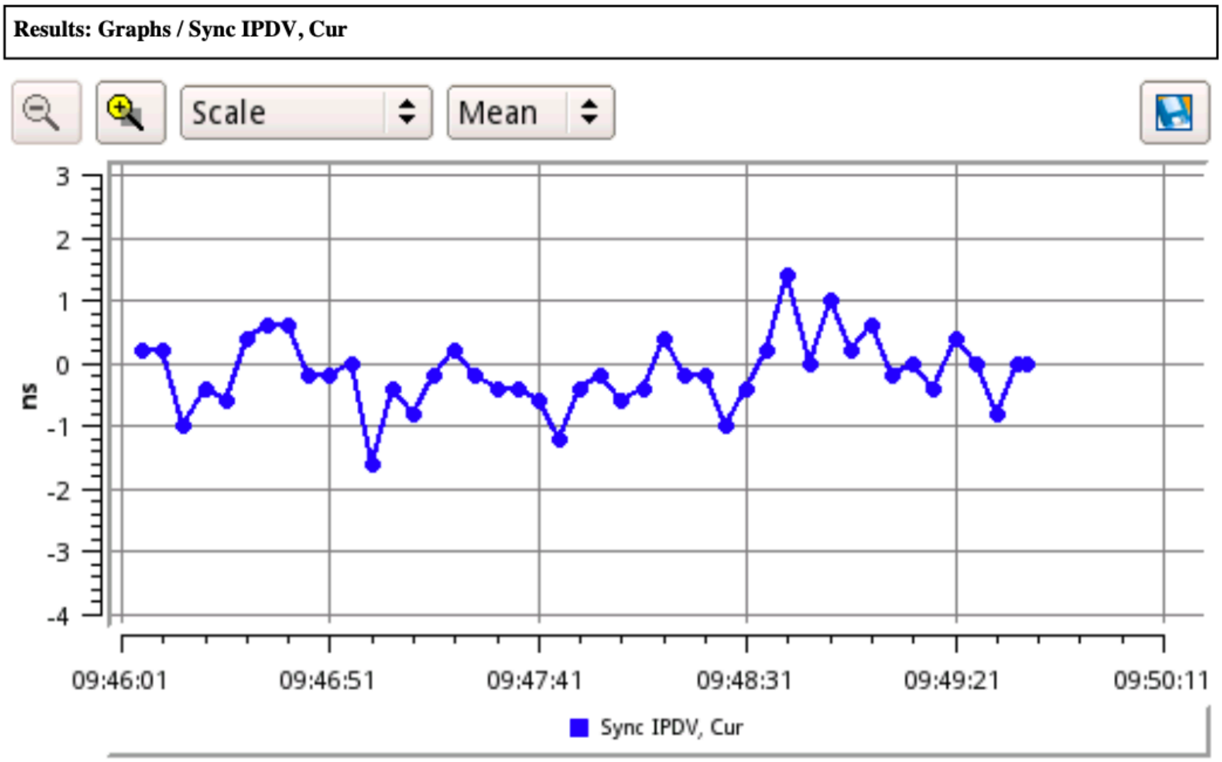
The Quarra switch was locked and stabilized over several minutes. Its proper lock status to the PTP grandmaster was verified by analyzing its announce messages using Wireshark. Additionally, the re-distributed PTP time the switch under test was compared to GPS as the global reference.

Reference measurement

As illustrated below, the jitter hitting the switch is in the range of ±180µs. This was measured directly coming from the Netgear switch. Hence, this is the challenging high-jitter PTP the Quarra switch is supposed to smooth out.



Artel’s Quarra Switch results



Result: Artel’s Quarra switch reducing the jitter down to ±2ns (reduction by 99.999%)
Note: Be aware of autoscaling in graph

Conclusion

Stabilizing jitter within a boundary clock is important when dealing with high-jitter PTP. But capabilities vary greatly amongst switch vendors and models. Simplexity has found that Artel’s Quarra switch does an extra-ordinary good job by reducing the jitter all the way down to ±2ns. This corresponds to a reduction by 99.999%.

Having high-jitter PTP in a network does not necessarily mean that followers cannot lock to it. But it poses much bigger challenges to manufacturers of PTP follower devices to achieve stable internal clock and therefore provide high quality audio and video respectively. Keeping PTP jitter generally low in a network is therefore important in order to minimize unexpected behavior of devices as well as the overall system.