

Precision Time Protocol Performance Testing Over Optical Transport Network



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April 2025

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The Center for Alternative Synchronization and Timing (CAST) at Oak Ridge National Laboratory
(ORNL)

**PRECISION TIME PROTOCOL PERFORMANCE
TESTING OVER OPTICAL TRANSPORT NETWORK**

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April 2025

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ABBREVIATIONS

BC	boundary clock
CAST	Center for Alternative Synchronization and Timing
ePRTC	enhanced primary reference time clock
GMC	grand master clock
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IEEE	Institute of Electrical and Electronics Engineers
ITU	International Telecommunication Union
MC	master clock
MTIE	Maximum Time Interval Error
ORNL	Oak Ridge National Laboratory
OTN	Optical Transport Network
PPS	pulse per second
PRTC	primary reference time clock
PTP	Precision Time Protocol
SC	slave clock
WAPA	Western Area Power Administration

ABSTRACT

The US Department of Energy Office of Electricity has partnered with Oak Ridge National Laboratory (ORNL) to find alternative precision timing solutions for the nation's power grid. This effort is in response to the vulnerabilities identified in the Global Navigation Satellite System (GNSS), of which the US Global Positioning System (GPS) platform is a part. Additionally, Executive Order 139055 has highlighted the need for alternative or backup timing solutions. ORNL has established a Timing Lab and has been testing various technologies and timing devices as part of this effort. Precision Time Protocol (PTP), and the off-the-shelf timing devices and network connections that support it, are among the alternatives being tested. This work reports the accuracy of PTP over an Optical Transport Network (OTN) and is part of a series published by the Center for Alternative Synchronization and Timing (CAST).

1. INTRODUCTION

The report provides insight into real-world and baseline performance of PTP over OTNs for electric power distributors, power marketing administrations, and future adopters of PTP [2]. Two OTNs were utilized in this performance testing: (1) an OTN spanning four Western Area Power Administration (WAPA) substations (Loveland, Colorado; Cheyenne, Wyoming; Stegall, Nebraska; and Wayside, Nebraska) and (2) the CAST lab's OTN network at ORNL, where benchmark/baseline measurements were collected.

Two PTP profiles were tested:

- G.8275.1: PTP telecom profile for phase/time synchronization with full timing support from the network [3]
- G.8275.2: PTP telecom profile for phase/time synchronization with partial timing support from the network [4]

The primary objective of the test was to use an enhanced primary reference time clock (ePRTC) system to discipline a boundary clock (BC) or a slave clock (SC), via the PTP protocol over an OTN network, and then measure the time accuracy on the BCs/SCs (and farther downstream, when possible). The ePRTC systems at WAPA and the ORNL lab comprised a grand master clock (GMC) that received a 10 MHz frequency reference from a cesium atomic clock. The GMC is disciplined by 1 pulse per second (PPS) and time of day signals from the GNSS (GPS and Galileo constellations were used). A PTP master clock (MC) on the GMC then propagates time to downstream BCs.

2. PRECISION TIME PROTOCOL OVERVIEW

PTP Version 1 is described in the Institute of Electrical and Electronics Engineers (IEEE) 1588 standard [1]. PTP Version 2 is described in the IEEE 1588-2008 standard [1]. In both standards, a hierarchy begins with MCs that distribute time and ends with SCs that receive time. MCs and SCs are referred to as ordinary clocks because they have a single network interface (meaning they either distribute or receive time, not both). BCs exist in intermediate hierarchy layers and have multiple network interfaces that receive time from above (as a slave to higher clocks) and push time below (as a master to lower clocks). BCs also adjust the received time to correct for the network delay. The GMC is at the root of the entire hierarchy. GMC may be manually configured or elected by all the other BCs and ordinary clocks on that network segment.

In both versions 1 and 2 of PTP, a hierarchy begins with MCs that distribute time and ends with SCs that receive time. MCs and SCs are referred to as ordinary clocks because they have a single network interface (meaning they either distribute or receive time, not both). BCs exist in intermediate hierarchy layers and have multiple network interfaces that receive time from above (as a slave to higher clocks) and push time below (as a master to lower clocks). BCs also adjust the received time to correct for the network delay. The GMC is at the root of the entire hierarchy. A GMC may be elected by all the clocks on that network based on configuration, or it may be manually configured.

Time synchronization using PTP is achieved as shown in Figure 1. In the figure, “Time server” denotes the MC, and “n/w element” denotes a boundary or slave clock.

On the BCs, the following measurements were recorded:

- Comparison of clock time on BCs (disciplined by GMC using PTP), with time received from GNSS. This measurement is the phase offset. It is also referred to as the time error.
- The time taken for the PTP sync message to travel from the GMC to the BC. This measurement is called “master to slave delay.”
- The time taken for the PTP Delay_Req message to travel from a BC to the GMC. This measurement is called “slave to master delay.”
- The difference between master to slave delay and slave to master delay. This measurement is called “network a10.”

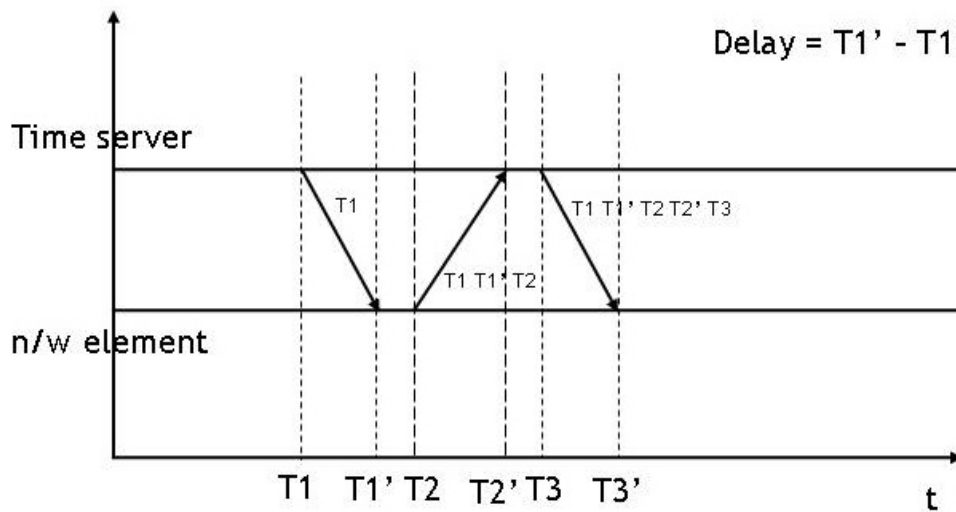


Figure 1. IEEE 1588 synchronization mechanism and delay calculation.

3. OPTICAL TRANSPORT NETWORK OVERVIEW

OTN is a telecommunications industry standard protocol—defined in various International Telecommunication Union (ITU) recommendations such as G.709 [11] and G.798 [12]—that provides an efficient way to transport, switch, and multiplex different services onto high-capacity wavelengths across the optical network. Today, network providers rely on OTN-enabled technology in their optical networks to gain benefits that include increased resiliency, simplified operations, enhanced service-level agreements, extended reach with forward error correction, the ability to efficiently maximize wavelength fill, and guarantee end-to-end service delivery [5].

OTN is commonly called a digital wrapper because it wraps each client/service transparently into a container for transport across optical networks, preserving the client's native structure, timing information, and management information. The enhanced multiplexing capability of OTN allows different traffic types, including IP, Ethernet, storage, digital video, and Synchronous Optical Networking/Synchronous Digital Hierarchy, to be carried over an OTN framing structure—a key reason for the adoption of OTN [5]. A schematic of an OTN is shown in Figure 2.

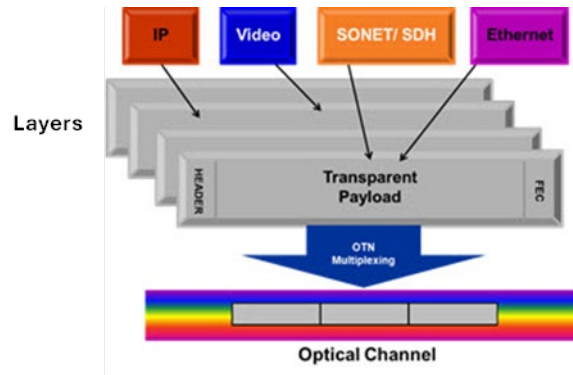


Figure 2. Schematic of an OTN [5].

4. WAPA AND CAST LAB MEASUREMENTS SETUP

The ORNL CAST lab consists of three racks with different clocks (several MCs and BCs). The WAPA setup consists of one MC and one BC at each substation. The following figures illustrate WAPA and ORNL lab architectures in more detail.

The four WAPA substations (Loveland, Colorado; Cheyenne, Wyoming; Stegall, Nebraska; and Wayside, Nebraska) are shown in Figure 3. Figure 4 illustrates the WAPA OTN architecture for the four substations. It shows the distance in kilometers between the stations along with the data transmission speed. Figure 5 shows a WAPA network drawing, detailing how the clocks are connected through router and server. Figure 6 illustrates the CAST lab's OTN setup and shows how the clocks are connected.

Western Area Power Administration (WAPA) Darknet Phase 3



OAK RIDGE
National Laboratory

Figure 3. WAPA's four substations.

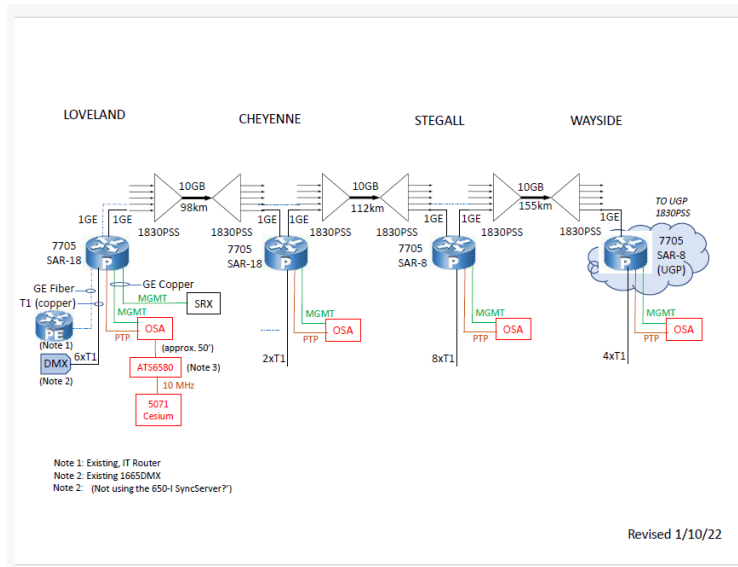


Figure 4. OTN architecture at WAPA.

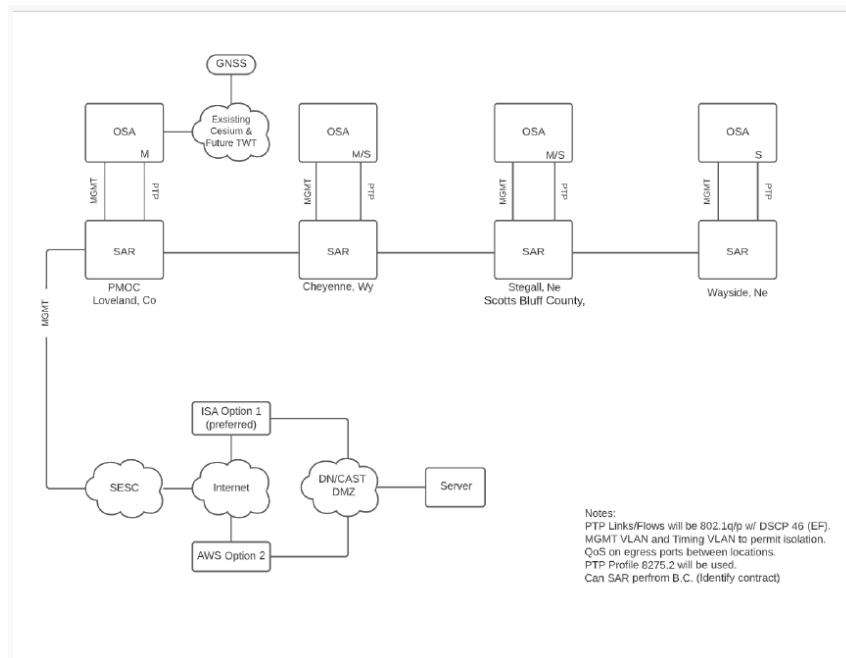


Figure 5. WAPA network drawing.

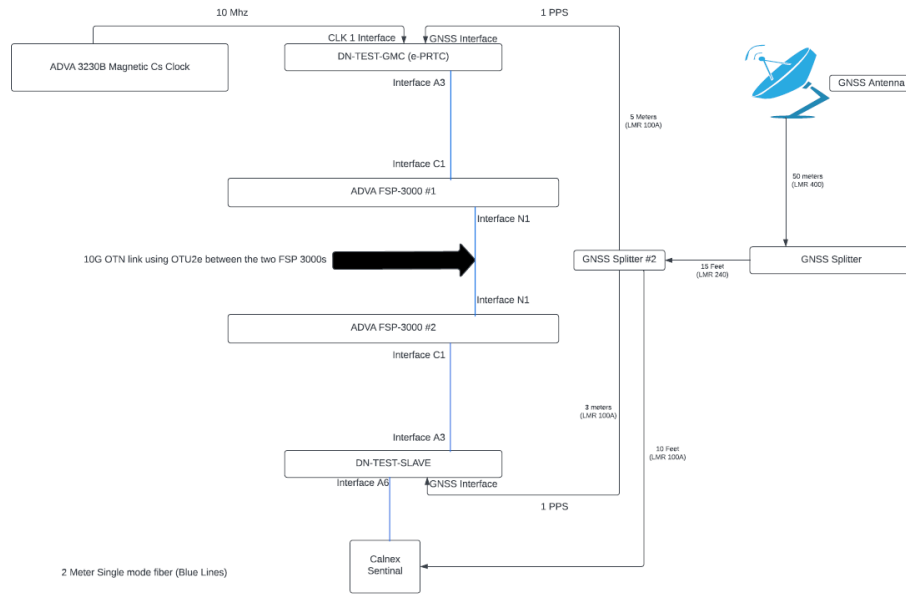


Figure 6. CAST lab OTN.

5. WAPA AND CAST LAB TEST GOAL

5.1 GRAND MASTER CLOCK

The GMC is the pinnacle of timekeeping accuracy and reliability within a PTP network. As the master time source within a PTP network, the PTP GMC provides the reference time to all other devices. It generates precise time signals that synchronize with other network components, optimizing time consistency across the entire network [7].

5.2 BOUNDARY CLOCKS

BCs act as intermediaries within a PTP network. They receive timing information from upstream clocks (and ultimately the GMC) and distribute it to other network devices, optimizing time synchronization across multiple domains or network segments. BCs play a crucial role in large-scale networks where time precision is essential, and multiple subnetworks must be synchronized [7].

5.3 ENHANCED PRIMARY REFERENCE TIME CLOCK

Key attributes of an ePRTC include the following:

- The ePRTC supports a high level of accuracy—within 30 ns when verified against the applicable primary time standard, such as UTC—and is subject to more stringent output performance requirements compared with current primary reference time clock (PRTC) systems.
- An ePRTC is an autonomous source of time that uses one or two co-located atomic clocks to provide the required performance for both time and frequency, even when connection to GNSS is lost.
- An ePRTC delivers a high level of operational reliability to ensure operators can maintain required time and frequency service performance for long periods regardless of the availability of GNSS.

The core components of an ePRTC system include the following:

- GNSS: provide long-term traceability to UTC
- Atomic clocks (typically cesium or better): provide frequency stability and use as reference
- ePRTC system: combined GNSS and Atomic clock, the combination of both technologies provides an accurate, secure, and robust time and frequency

The objective of the ePRTC solution is to generate time by producing its own independent, autonomous timescale. The timescale provides time, phase, and frequency that are aligned and calibrated to the GNSS signal over a long observation period, and the timescale is maintained autonomously based on the stability of the atomic clock(s). The frequency stability of the atomic clocks serves as a reference for the ePRTC timescale. This feature is the key difference between an ePRTC and a PRTC. In a PRTC, time comes directly from GNSS. The ePRTC is a solution for GNSS vulnerability [7].

5.4 TEST GOAL

The primary objective of the test was to use an ePRTC system to discipline a BC/SC, via the PTP protocol over an OTN network, and then measure the time accuracy on the BCs/SCs (and farther downstream, when possible) because each BC/SC needs to be connected to the GMC to get better time accuracy from the reference GMC. The ePRTC system GMC at WAPA at Loveland, Colorado, and the GMC at the ORNL lab have similar setups: they receive a 10 MHz frequency reference from a cesium atomic clock; are disciplined by 1 PPS and time-of-day signals from the GNSS (GPS and Galileo constellations were used); and a PTP MC configured on the GMC then propagates time to downstream BCs.

Two PTP profiles were tested: G.8275.1 and G.8275.2. The G.8275.1 PTP profile is used when all the network elements (e.g., routers, switches) are PTP-aware—the network elements can take on the role of a BC. This setup reduces the time error as the PTP messages traverse the network element.

G.8275.1 is a Layer 211 profile. The G.8275.2 PTP profile is used in networks where not all network elements are PTP-aware. G.8275.2 is a Layer 312 profile. The tests were run for 1 week for each PTP profile at WAPA and at the ORNL lab.

For these tests, the assumption was that the long distances between WAPA stations would decrease time transfer accuracy because transferring the PTP over long distance will take more time.

6. WAPA AND CAST LAB TIMING AND NETWORK GEAR USED FOR MEASUREMENTS

Table 1 lists the timing and network gear used for measurements at WAPA and the CAST lab.

Table 1. WAPA and CAST lab timing and network gear used for measurements.

Location	Clock system operational mode	Clock model	Router	Switch
Loveland, Colorado	ePRTC	Oscilloquartz OSA 5422 PTP GMC with rubidium oscillator and multiband GNSS receiver	Nokia 7705 Service Aggregation Router (SAR) [8]	Nokia 1830 Photonic Service Switch (PSS)
Loveland, Colorado	ePRTC	Microchip 5071A cesium frequency reference source		
Cheyenne, Wyoming; Stegall and Wayside, Nebraska	Boundary clocks	OSA 5422 boundary clocks with rubidium oscillators and multiband GNSS receivers [9]	Nokia 7705 Service Aggregation Routers (SAR)	Nokia 1830 Photonic Service Switches (PSS)
ORNL CAST lab	ePRTC	OSA 5422 PTP grandmaster clock having Rubidium oscillator and multi-band GNSS receiver	OSA Fiber Service Platform (FSP) 3000	
ORNL CAST lab	ePRTC	OSA 3320B Cesium frequency reference source		
ORNL CAST lab	Boundary clocks	OSA 5422 boundary clock having Rubidium oscillator and multi-band GNSS receiver	OSA Fiber Service Platform (FSP) 3000	Calnex Sentinel [10]

7. WAPA AND CAST LAB TEST RESULT

The time on the GMC was compared with the time received from GNSS to detect any large disruptions or anomalies in the GNSS signals. The top of each second was used to generate a 1 PPS signal from both the clock time and the GNSS time. These 1 PPS signals were then compared to calculate the phase offset. The maximum time interval error (MTIE) was also calculated from these measurements.

Table 2 G.8275.1 profile lists the mean and standard deviation for all the measurements recorded for the OTN setup across the four WAPA substations.

Table 2. WAPA G.8275.1 profile results.

WAPA G.8275.1 MTIE result								
	Loveland, Colorado, GMC		Cheyenne, Wyoming, SC/BC		Stegall, Nebraska, SC/BC		Wayside, Nebraska, SC/BC	
	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.
Phase offset	1.07	25.21	-468.38	6.26	6.67	9.86	30.49	9.85
Master to slave delay	n/a	n/a	-2,159.83	6.09	1,540.55	8.71	2,370.82	24.39
Slave to master delay	n/a	n/a	-466.92	6.27	3,054.65	9.90	-13.45	24.51
Network asymmetry	n/a	n/a	-1,692.91	6.26	-1,514.1	8.83	2,384.27	24.38

Figure 7 G.8275.1 profile 1 shows the phase offset between a GNSS 1 PPS signal and a 1 PPS signal generated from the clock time. This clock is the GMC at Loveland, Colorado, substation. This GMC is disciplined by GNSS.

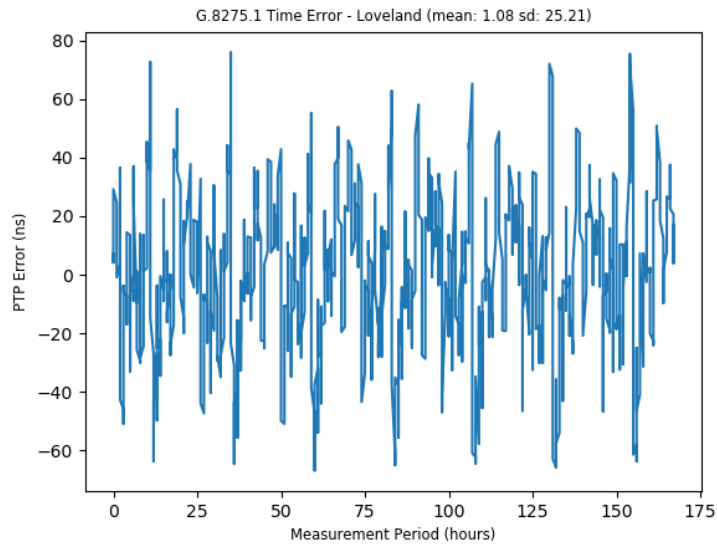


Figure 7. G.8275.1 GMC at Loveland, Colorado: phase offset (GNSS vs. clock time).

Table 3 G.8275.2 profile lists the mean and standard deviation for all the measurements recorded for the OTN setup across the four WAPA substations.

Table 3. WAPA G.8275.2 profile results.

WAPA G.8275.2 MTIE result								
	Loveland, Colorado GMC		Cheyenne, Wyoming SC/BC		Stegall, Nebraska SC/BC		Wayside, Nebraska SC/BC	
	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.
Phase offset	1.11	33.62	-29.66	30.66	-17.23	43.54	-27.21	41.97
Master to slave delay	n/a	n/a	638,670.08	29.63	1,391,879.79	43.96	2,360,525.66	75.01
Slave to master delay	n/a	n/a	640,516.12	46.74	1,394,449.89	60.51	2,359,988.12	83.70
Network asymmetry	n/a	n/a	-1,870.21	23.23	-2,579.10	30.35	515.45	30.26

Figure 8 G.8275.2 profile shows the phase offset between a GNSS 1 PPS signal and a 1 PPS signal generated from the clock time. This clock is the GMC at Loveland, Colorado, substation. This GMC is disciplined by GNSS.

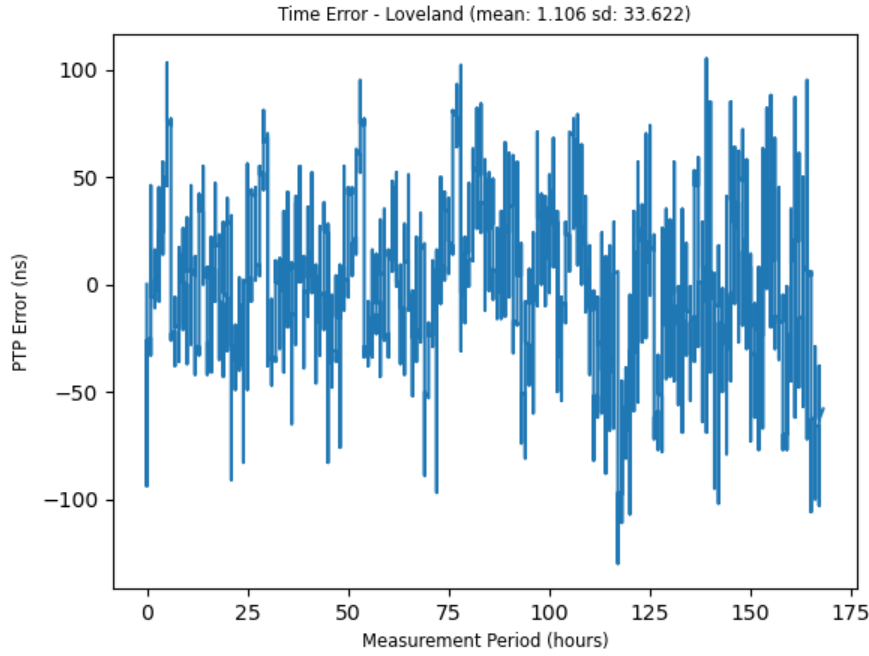


Figure 8. G.8275.2 GMC at Loveland, Colorado: phase offset (GNSS vs. clock time).

Table 4 lists the mean and standard deviation for all the measurements recorded for the OTN setup at the ORNL lab.

Table 4. ORNL G.8275.1 profile results (baseline).

G.8275.1 slave clock at ORNL: phase offset (GNSS vs. clock time)						
	GMC		BC		SC	
	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.	Mean (ns)	Std. dev.
Phase offset	-0.45	5.02	-33.06	4.99	-1.2	11.39
Master to slave delay	n/a	n/a	609.60	4.93	0.53	11.42
Slave to master delay	n/a	n/a	640.90	4.92	-3.27	12.06
Network asymmetry	n/a	n/a	-29.95	4.88	-1.36	2.06

8. VERIFICATION AND VALIDATION OF THE RESULT

Because network asymmetry was applied to the phase offset, the result required verification and validation. The WAPA network was dismantled, so the Netropy 10G1 Emulator was used, as shown in Figure 9. For verification and validation, two OSA 5422 were connected to the Netropy 10G1 Emulator, and the same master-to-slave delay and slave-to-master delay as those obtained in the WAPA network were applied. These delays were injected into the OSA 5422 SC, and exactly the same errors as in the OSA syncjack clock probes plots for the phase errors were obtained. Therefore, applying the network asymmetry to remove these delay offsets from the clock phase offset is a reasonable strategy.

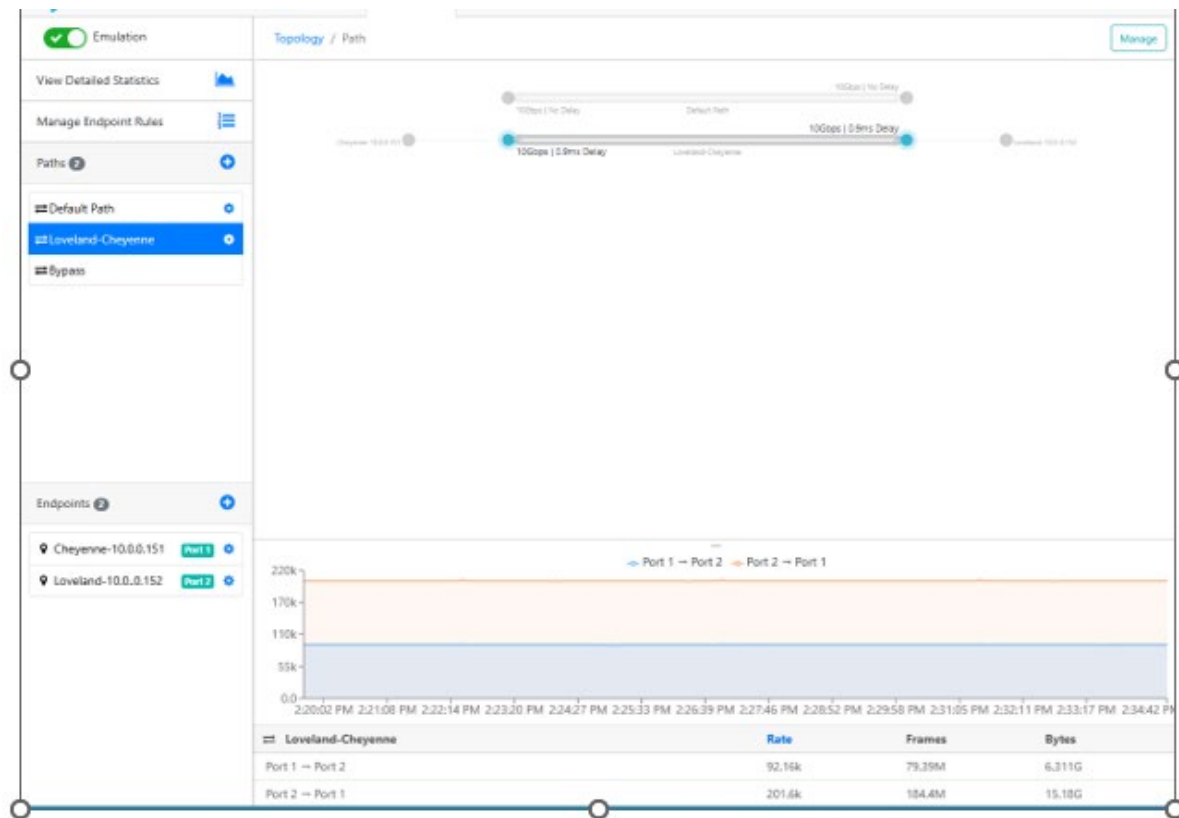


Figure 9. Netropy 10G1 Emulator configuration between Loveland and Cheyenne using network delay.

Figure 10 shows clock probes before the Netropy 10G1 Emulator was used. The phase offset increased to 633,807 ns when the emulator was running and dropped to less than 100 ns after the emulator was stopped.

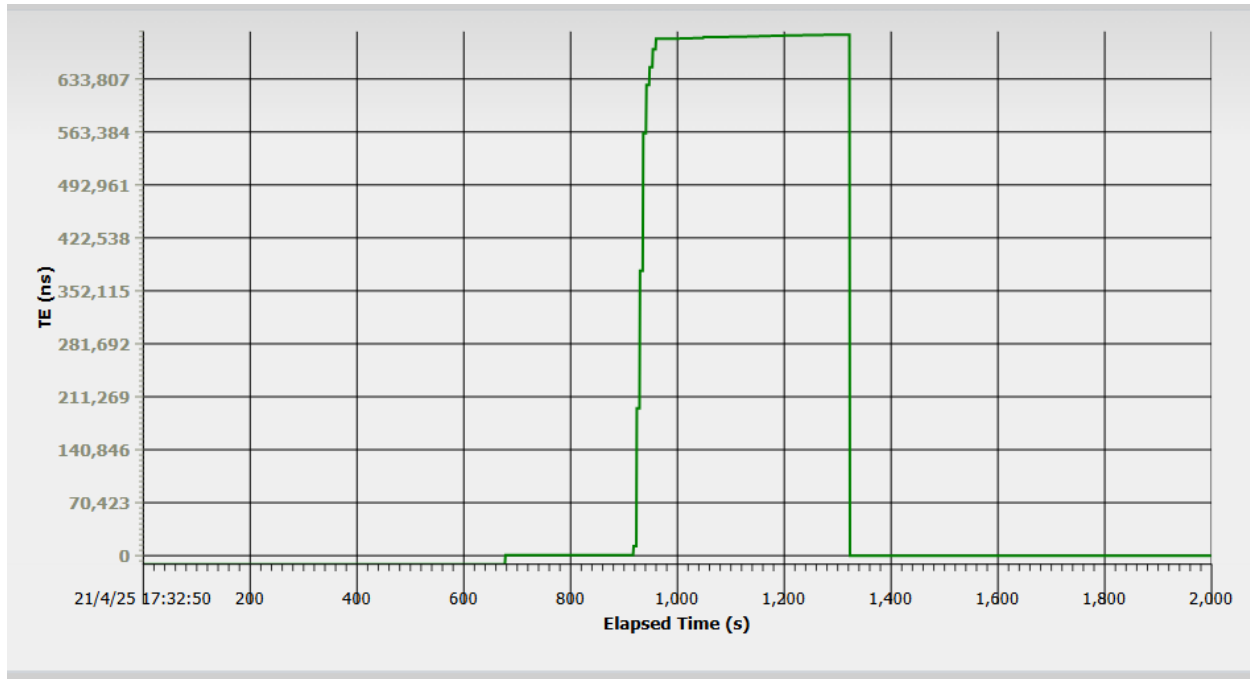


Figure 10. Clock probe phase errors during and after using Netropy 10G1 Emulator.

9. ANALYSIS OF WAPA TEST RESULT

At WAPA, the boundary clocks at the Cheyenne, Stegall, and Wayside substations were disciplined by the ePRTC GMC at Loveland. The testing covered two PTP profiles—G.8275.1 and G.8275.2.

Profile G.8275.1 performed better than the G.8275.2 PTP profile when tested over OTNs, and this we think due to use the Mac's addresses instated of using the IP's. in profile G.8275.1 and G.8275.2 respectively.

The result for the test in the ORNL CAST lab was consistent and acceptable: the average mean error was about 600 ns. The result at WAPA shows different delays for profiles G.8275.1 and G.8275.2. The error was large, most likely due to the large distance between the stations.

As shown in Table 5 (WAPA G.8275.1 profile results), the Cheyenne substation had the worst phase offset, and the Wayside, and Stegall substations had the best phase offsets. This result does not align with the assumption that longer distance from the MC results in worse performance. As shown in Table 3 (WAPA G.8275.2 profile results), the Wayside substation had the best phase offset despite the longer distance. This result was unexpected, and further analysis with more data is needed to investigate the reason for this result. Finally, our hypothesis is consistent with results, but the errors are more independent of distance than expected.

10. CONCLUSION

After applying asymmetry compensation for the phase errors, time-transfer accuracy improved to below 100 ns with the OTN system.

To investigate the OTN network performance, Netropy 10 G1 was used to verify the performance of the PTP over an OTN. Applying a delay to the network using Netropy 10 G1 yielded phase errors in the

testing OSA clock identical to the phase errors in the original WAPA network, improving the accuracy to within 100 ns and confirming that applying asymmetry compensation was the correct strategy.

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- [12] <https://www.itu.int/rec/T-REC-G.798/en>

APPENDIX A. WAPA AND CAST LAB CLOCKS SETTINGS/CONFIGURATIONS

APPENDIX A. WAPA AND CAST LAB CLOCKS SETTINGS/CONFIGURATIONS

WAPA and CAST lab Clocks Settings/Configurations

The following figures show various clock settings and configurations used in the Western Area Power Administration (WAPA) and the Center for Alternative Synchronization and Timing (CAST) lab for this test.

The screenshot displays the ADVA EMS Configuration web interface. The left sidebar shows a tree view of the configuration hierarchy, with 'TIME CLOCK-1-1-1' selected under the 'Synchronization' section. The main content area shows the configuration details for this entity.

Configuration | **Status**

Identification

Entity ID : TIME CLOCK-1-1-1
Alias :

State

Administrative : IS Secondary : ACT
Operational : Normal

Configuration

WTR Time	: 5 minute(s)
Selection Mode	: Priority Mode
Time Holdover Performance (ns)	: 5000
Sync Ref Candidate	: Enabled
Expected QL	: QL-NONE
Time Scale	: PTP
ARB ToD Source	: NA
e-PRTC Mode	: Enabled

Grand master clock (GMC) in enhanced primary reference time clock (ePRTC) mode.

ADVA EMS - Configuration

File Application Configuration Maintenance PM PTP SyncJack NTP

NE-1

- NTEOSA5422
 - PSU-1
 - PSU-2
 - LC-1 (unassigned)
 - LC-2 (unassigned)
 - DISPLAY CARD-1
- Synchronization
 - NE-1
 - NTEOSA5422
 - SYNC-1-1-1-1
 - TIME CLOCK-1-1-1**
 - BITS-1
 - BITS-2
 - CLK-1-1-1-1
 - CLK-1-1-1-2
 - PPS-1-1-1-1
 - PPS-1-1-1-2
 - TOD-1-1-1-1 & PPS
 - TOD-1-1-1-2 & PPS
 - GPS-1-1-1-1 (GNSS)
- Communications
- SNMP
- Administration

Configuration **Status**

Identification

Entity ID : TIME CLOCK-1-1-1-1

Status

Selected Reference : GPS-1-1-1-1
 Clock Mode : Locked
 Leap59 : False
 Leap61 : False
 Time Traceability Status : Time Locked
 UTC Offset : 37
 Current QL : QL-PRC
 Current Time Of Day : 2023-07-06 15:49:12 TAI

User Requests

Request : None
 Target : None

Time Clock Reference List

Time Ref Eid	Priority	Source	Source Status	State	Alias
TIMEREF-1-1-1-1-1	1	GPS-1-1-1-1	Reference OK	Active	GNSS
TIMEREF-1-1-1-1-2	2	CLK-1-1-1-1	Reference Frequency OK	Active	3230B

Cesium clock frequency and Global Navigation Satellite System (GNSS) references on GMC.

ADVA EMS - Configuration

File Application Configuration Maintenance PM PTP SyncJack NTP

System

- NE-1
 - Synchronization
 - NE-1
 - NTEOSA5422
 - SYNC-1-1-1-1
 - TIME CLOCK-1-1-1-1
 - BITS-1
 - BITS-2
 - CLK-1-1-1-1
 - CLK-1-1-1-2
 - PPS-1-1-1-1
 - PPS-1-1-1-2
 - TOD-1-1-1-1 & PPS
 - TOD-1-1-1-2 & PPS
 - GPS-1-1-1-1 (GN)**
 - Communications
 - SNMP
 - Administration

Configuration **GNSS Satellites Data**

Installation Type : Full Sky View
C/No Mask : 28 dB-Hz
Ignore Antenna Condition : Enabled
Advanced Interference Detection : Enabled
Alarms while failure suspend : Enabled
Self Survey Period : 86400 sec
Sat Min1 Threshold : 3 satellites
Sat Min2 Threshold : 2 satellites
Failure Suspend Time : 3 sec

Output Squelch Control

Jamming : ON
Spoofing : ON
Advanced Interference : ON

Status

Survey Progress : 100 %
Satellites Usable : True
PPS Generated : True
PDOP : Not Available
Receiver Type : Single band
Tracking Satellites : 16
Antenna Status : Normal
GNSS TOD : 2023-07-06 16:23:44
AGC : 28 %

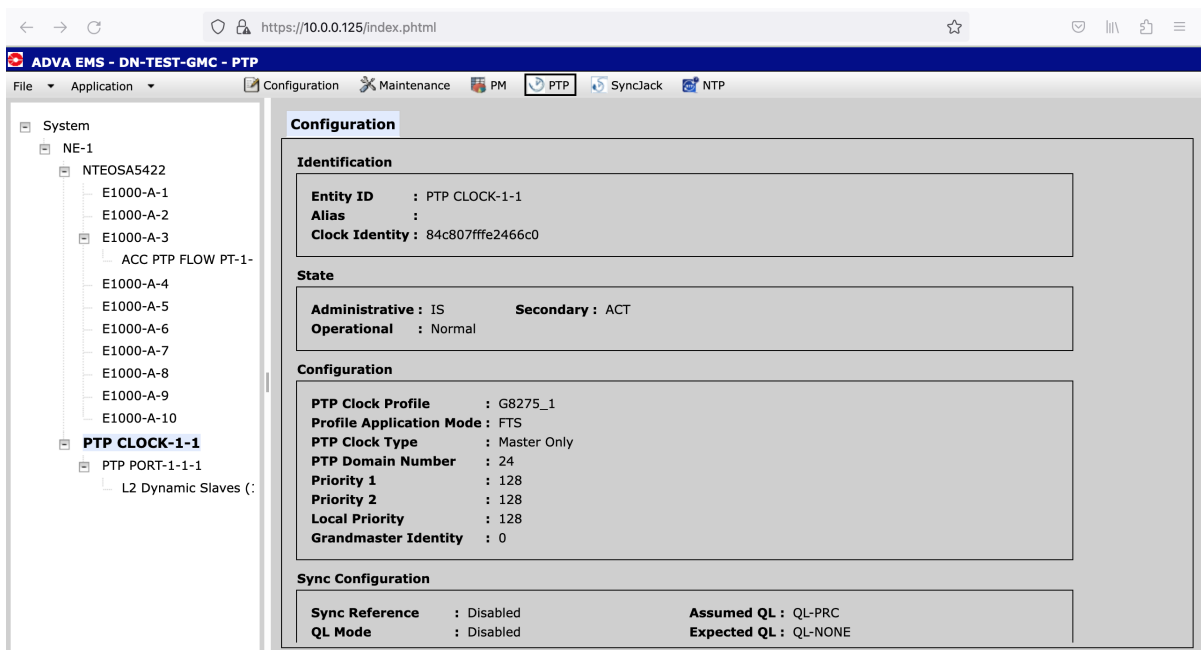
Location

Self-survey : Enabled
Coordinate Latitude : N35:57:19.896
Coordinate Longitude : W84:9:14.558
Coordinate Altitude : 282.8 m (HAE)

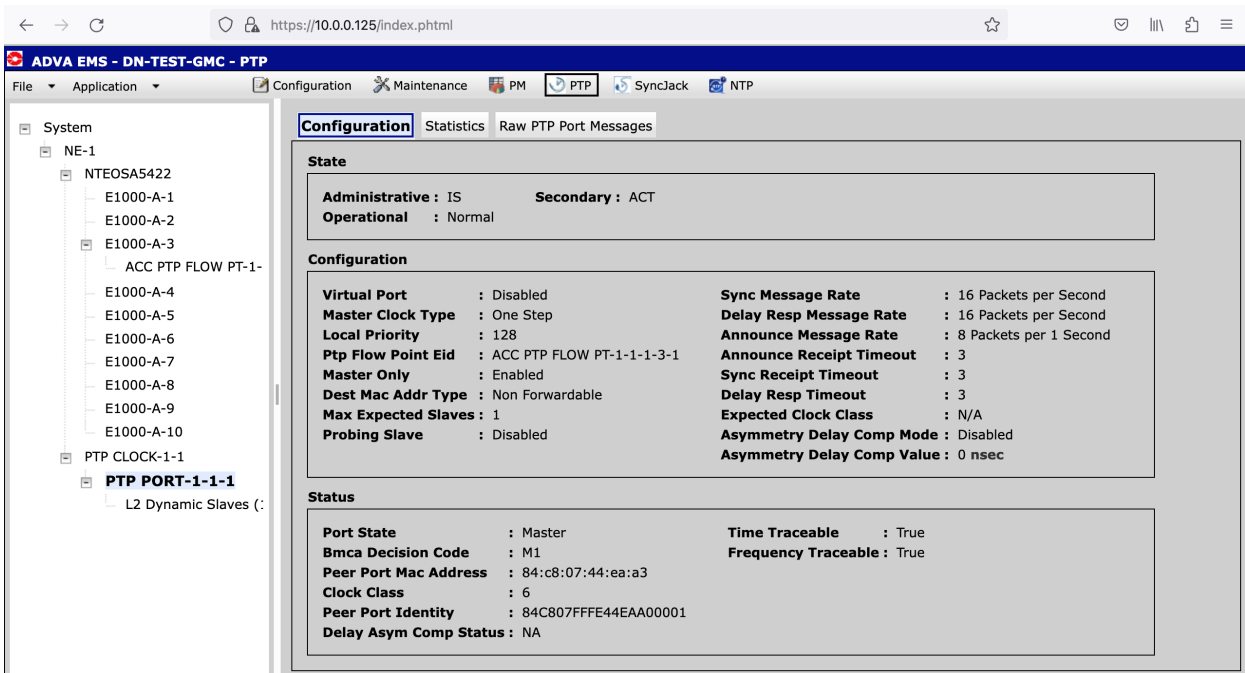
GNSS settings on boundary clock (BC).

WAPA and CAST lab G.8275.1 PTP Clocks Settings/Configurations

The following figures show G.8275.1 Precision Time Protocol (PTP) profile clock settings and configurations used in WAPA and CAST lab for this test.



G.8275.1 PTP master clock on GMC.



G.8275.1 PTP master clock on GMC.

← → ↻ <https://10.0.0.126/index.phtml> ☆ 📄 🗑️ ☰

ADVA EMS - DN-TEST-SLAVE - PTP

File ▾ Application ▾ Configuration Maintenance PM PTP SyncJack NTP

System
NE-1
NTEOSA5422
E1000-A-1
E1000-A-2
E1000-A-3
ACC PTP FLOW PT-1-
E1000-A-4
E1000-A-5
E1000-A-6
ACC PTP FLOW PT-1-
E1000-A-7
E1000-A-8
E1000-A-9
E1000-A-10
PTP CLOCK-1-1
PTP PORT-1-1-1
L2 Dynamic Slaves (
PTP CLOCK-1-2

Configuration

PTP Clock Profile : G8275_1
Profile Application Mode : FTS
PTP Clock Type : Boundary Clock
PTP Domain Number : 24
Priority 1 : 128
Priority 2 : 128
Local Priority : 128
Grandmaster Identity : 0

Sync Configuration

Sync Reference : Disabled	Assumed QL : QL-PRC
QL Mode : Disabled	Expected QL : QL-NONE
Sync ID : None	Received QL : QL-PRC

Network Clock Type : Option 1-SDH Regional Clock

Status

Operational Mode : T Tsc	Clock Recovery State : Normal
Time Source Eid : None	Phase Recovery State : Normal
Clock Accuracy : 20 hex	Time Traceability Status : True
Scaled Log Variance : 4b32 hex	Time Since Time Traceability Changed : 171553
Current Time Of Day : 2023-07-19 14:48:45 TAI	Freq Traceability Status : True
Active Slave Port : PTP PORT-1-1-1	Time Since Freq Traceability Changed : 171175

G.8275.1 PTP slave clock port on BC.

← → ↻ <https://10.0.0.126/index.phtml> ☆ 📄 🗑️ ☰

ADVA EMS - DN-TEST-SLAVE - PTP

File ▾ Application ▾ Configuration Maintenance PM PTP SyncJack NTP

System
NE-1
NTEOSA5422
E1000-A-1
E1000-A-2
E1000-A-3
ACC PTP FLOW PT-1-
E1000-A-4
E1000-A-5
E1000-A-6
ACC PTP FLOW PT-1-
E1000-A-7
E1000-A-8
E1000-A-9
E1000-A-10
PTP CLOCK-1-1
PTP PORT-1-1-1
L2 Dynamic Slaves (
PTP CLOCK-1-2

Configuration

State

Administrative : IS **Secondary** : ACT
Operational : Normal

Configuration

Virtual Port : Disabled	Sync Message Rate : 16 Packets per Second
Master Clock Type : One Step	Delay Resp Message Rate : 16 Packets per Second
Local Priority : 128	Announce Message Rate : 8 Packets per 1 Second
Ptp Flow Point Eid : ACC PTP FLOW PT-1-1-3-1	Announce Receipt Timeout : 3
Master Only : Disabled	Sync Receipt Timeout : 3
Dest Mac Addr Type : Non Forwardable	Delay Resp Timeout : 3
Max Expected Slaves : 0	Expected Clock Class : 247
Probing Slave : Disabled	Asymmetry Delay Comp Mode : Disabled
	Asymmetry Delay Comp Value : 0 nsec

Status

Port State : Slave	Time Traceable : True
Bmca Decision Code : S1	Frequency Traceable : True
Peer Port Mac Address : 84:c8:07:24:66:c3	
Clock Class : 6	
Peer Port Identity : 84C807FFFE2466C00001	
Delay Asym Comp Status : NA	

G.8275.1 PTP slave clock port on GMC.

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ADVA EMS - DN-TEST-SLAVE - PTP

File ▾ Application ▾ Configuration Maintenance PM PTP SyncJack NTP

System
NE-1
NTEOSA5422
E1000-A-1
E1000-A-2
E1000-A-3
ACC PTP FLOW PT-1-
E1000-A-4
E1000-A-5
E1000-A-6
ACC PTP FLOW PT-1-
E1000-A-7
E1000-A-8
E1000-A-9
E1000-A-10
PTP CLOCK-1-1
PTP PORT-1-1-1
L2 Dynamic Slaves (
PTP CLOCK-1-2

Configuration

PTP Clock Profile : G8275_1
Profile Application Mode : FTS
PTP Clock Type : Master Only
PTP Domain Number : 24
Priority 1 : 128
Priority 2 : 128
Local Priority : 128
Grandmaster Identity : 0

Sync Configuration

Sync Reference : Disabled
QL Mode : Disabled
Sync ID : None
Network Clock Type : Option 1-SDH Regional Clock

Assumed QL : QL-PRC
Expected QL : QL-NONE
Received QL : QL-NA

Status

Operational Mode : T Gm
Time Source Eid : TIME CLOCK-1-1-1-1
Clock Accuracy : 21 hex
Scaled Log Variance : 4e5d hex
Current Time Of Day : 2023-07-19 14:51:29 TAI
Active Slave Port : N/A

Clock Recovery State : NA
Phase Recovery State : NA
Time Traceability Status : True
Time Since Time Traceability Changed : 0
Freq Traceability Status : True
Time Since Freq Traceability Changed : 0

G.8275.1 PTP master clock on BC.

WAPA and CAST lab G.8275.2 PTP Clocks Settings/Configurations

The following figures show G.8275.2 PTP profile clock settings and configurations used in WAPA and CAST lab for this test.

The screenshot displays the ADVA EMS - PTP web interface. The left sidebar shows a tree view of the system configuration, with 'PTP MASTER CLOCK-1' selected. The main panel shows the configuration details for this clock.

Configuration

Identification

- Entity ID : PTP MASTER CLOCK-1
- Alias :
- Clock Identity : 84c807fffe2466c0

State

- Administrative : IS
- Operational : Normal
- Secondary : ACT

Configuration

- PTP Profile : G.8275.2
- PTP Domain Number : 44
- Priority1 : 128
- Priority2 : 128
- Time Clock EID : TIME CLOCK-1-1-1-1

Status

- Active Time Reference : GPS-1-1-1-1
- UTC Offset : 37

G.8275.2 PTP master clock on GMC.

← → ↻ <https://10.0.0.125/index.phtml> ☆

ADVA EMS - PTP

File Application Configuration Maintenance PM PTP SyncJack NTP

System

- NE-1
 - NTEOSA5422
 - E1000-A-1
 - E1000-A-2
 - E1000-A-3
 - ACC PTP FLOW PT-1-
 - E1000-A-4
 - E1000-A-5
 - E1000-A-6
 - E1000-A-7
 - E1000-A-8
 - E1000-A-9
 - E1000-A-10
 - PTP MASTER CLOCK-1-1
 - PTP MCI-1-1-1**
 - MASTER VIRTUAL PO
 - Static Slaves (0)
 - Dynamic Slaves (1)

Configuration Statistics

State

Administrative : IS Secondary : ACT
Operational : Normal

IP Interface configuration

IP Version : IPv4 Priority Mode : None
Default Gateway Control : Enabled Priority : 0
IPv4 Address : 192.168.70.70
Subnet Mask : 255.255.255.0
Gateway : 0.0.0.0
Interface Name : MCI1

PTP

PTP Domain Number : 44 Max Announce Message Rate : 1 Packet per 1 Second
Clock Class : 6 Max Sync Message Rate : 32 Packets per Second
Master Clock Type : One Step Max Delay Response Message Rate : 32 Packets per Second
Clock Class Profile : G.8275.2 Max Lease Duration : 300 sec
Master Delay Mechanism : End To End Announce Extension TLV : Disabled
Max Slaves Supported : 32
Max Static Slaves Supported : 0
Slaves Warning Threshold : N/A

G.8275.2 PTP master clock port on GMC.

← → ↻ <https://10.0.0.126/index.phtml> ☆

ADVA EMS - PTP

File Application Configuration Maintenance PM PTP SyncJack NTP

System

- NE-1
 - NTEOSA5422
 - E1000-A-1
 - E1000-A-2
 - E1000-A-3
 - ACC PTP FLOW PT-1-
 - E1000-A-4
 - E1000-A-5
 - E1000-A-6
 - ACC PTP FLOW PT-1-
 - E1000-A-7
 - E1000-A-8
 - E1000-A-9
 - E1000-A-10
 - PTP CLOCK-1-1**
 - L3 PTP PORT-1-1-1
 - PTP MASTER CLOCK-1-1
 - PTP MCI-1-1-1
 - MASTER VIRTUAL PO
 - Static Slaves (0)
 - Dynamic Slaves (1)

Configuration

PTP Clock Profile : G8275_2
Profile Application Mode : PTS
PTP Clock Type : Slave Only
PTP Domain Number : 44
Priority 1 : 128
Priority 2 : 128
Local Priority : 128
Grandmaster Identity : 0

Sync Configuration

Sync Reference : Disabled Assumed QL : QL-PRC
QL Mode : Disabled Expected QL : QL-NONE
Sync ID : None Received QL : QL-PRC
Network Clock Type : Option 1-SDH Regional Clock

Status

Operational Mode : T Tsc Clock Recovery State : Normal
Time Source Eid : None Phase Recovery State : Normal
Clock Accuracy : 20 hex Time Traceability Status : True
Scaled Log Variance : 4b32 hex Time Since Time Traceability Changed : 7508
Current Time Of Day : 2023-07-06 16:26:29 TAI Freq Traceability Status : True
Active Slave Port : L3 PTP PORT-1-1-1 Time Since Freq Traceability Changed : 7508

G.8275.2 PTP slave clock on BC.

← → ↻ https://10.0.0.126/index.phtml ☆

ADVA EMS - PTP

File ▾ Application ▾ Configuration Maintenance PM PTP SyncJack NTP

System
NE-1
NTEOSA5422
E1000-A-1
E1000-A-2
E1000-A-3
ACC PTP FLOW PT-1-
E1000-A-4
E1000-A-5
E1000-A-6
ACC PTP FLOW PT-1-
E1000-A-7
E1000-A-8
E1000-A-9
E1000-A-10
PTP CLOCK-1-1
L3 PTP PORT-1-1-1
PTP MASTER CLOCK-1-1
PTP MCI-1-1-1
MASTER VIRTUAL PO
Static Slaves (0)
Dynamic Slaves (1)

Configuration Statistics Raw L3 PTP Port Messages

Local Priority : 128 Master IPv4 Address : 192.168.70.70

PTP Configuration

Ptp Flow Point Eid : ACC PTP FLOW PT-1-1-1-3-1
Announce Message Rate : 1 Packet per 1 Second
Announce Receipt Timeout : 10 intervals
Sync Message Rate : 32 Packets per Second
Sync Receipt Timeout : 10 intervals
Delay Resp Message Rate : 32 Packets per Second
Delay Resp Receipt Timeout : 10 intervals
Lease Duration : 300 sec

Delay Asymmetry Compensation

Delay Asym Comp Mode : Disabled
Delay Asym Comp Value : 0

Status

Port State : Slave
Bmca Decision Code : S1
Peer Clock Class : 6
Delay Asym Comp Status : NA
Clock Class : 6

G.8275.2 PTP slave clock port on BC.

**APPENDIX B. WAPA G.8275.1 AND G.8275.2 PROFILES GRAPH
RESULTS**

APPENDIX B. WAPA G.8275.1 PROFILE GRAPH RESULTS

