Five Best Practices for Deploying and Monitoring a virtual Primary Reference Time Clock (vPRTC) Network

Best Practice 5
End to End vPRTC Service Assurance and Monitoring with TimePictra®

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Introduction

The virtual Primary Reference Time Clock (vPRTC) is a highly secure and resilient network-based timing architecture that has been developed to meet the expanding needs of modern critical infrastructures including 5G, transportation, data centers, and power utilities.

The resilient architecture alleviates dependency on satellite-based timing sources such as Global Navigation Satellite Systems (GNSS) by placing autonomous time scale grade atomic clocks in enhanced Primary Reference Time Clock (ePRTC) area timing-hub sites at the core of a fiber-based terrestrial timing distribution network. Secure core-timing sites and fiber distribution are 100% in control of the network operator, and immune to potential jamming or spoofing cyber-attacks on satellite-based timing solutions.

Figure 1. Virtual Primary Reference Time Clock Architecture Providing Resilient Timing for Critical Infrastructure Operators
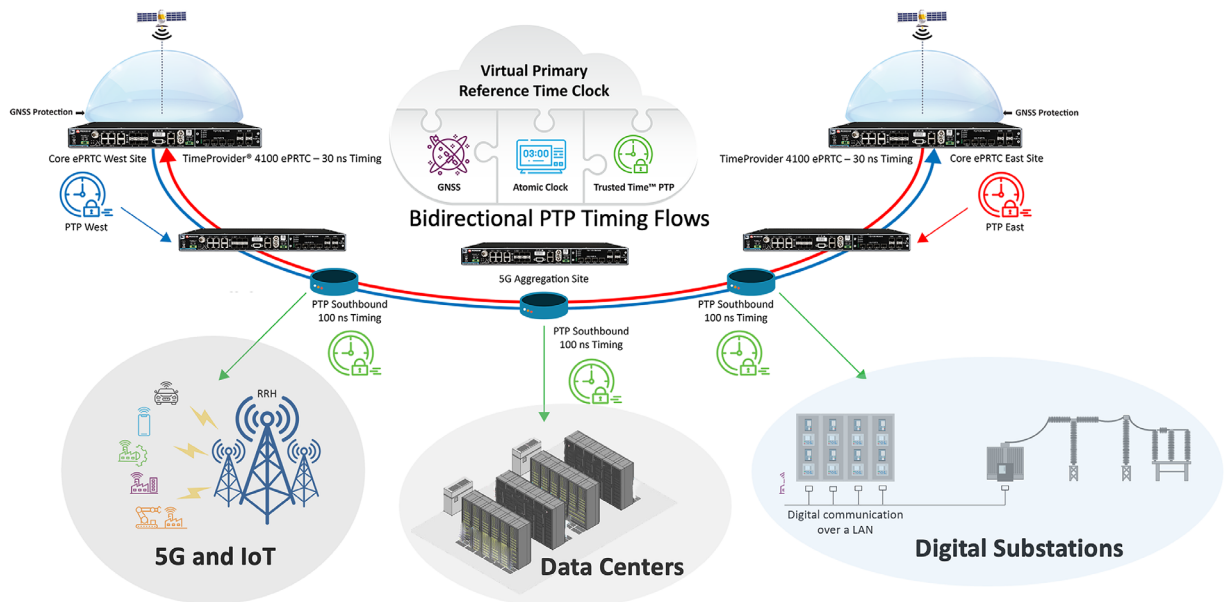
This paper presents the fifth, out of five, key best-practices derived from millions of cumulative hours of operation of the vPRTC timing architecture accross multiple industries.

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Best Practice 5: End to End vPRTC Service Assurance and Monitoring with TimePictra®

The vPRTC architecture has several unique features that are mandatory to deliver deterministic and accurate timing within a network.

These features are:

- Use of PTP between nodes, so that any path can be used, at whatever speed is appropriate.

- Use of PTP between nodes, so that an East and West timing solution can be used on the same path, while maintaining the complete independence of these timing directions.

- Comparison measurement between the East and West timing directions at every node along the sync chain.

- The vPRTC network not only delivers precise time, but the vPRTC network is self-monitoring and self-diagnosing.

The combination of these features means that TimePictra® can monitor every timing chain in a customer's network and confirm that each HPBC is aligned with both ePRTC nodes.

When a vPRTC chain is established, the measurements taken by TimePictra® will show 3 components:

- The difference between the UTC sources at each end of the vPRTC timing chain.

- Static asymmetries that exist along the vPRTC chain.

- Sudden changes in static asymmetries that show there has been a change in fiber or configuration.

In some networks, the customer may only use one ePRTC, choosing to use a standard PRTC-B for the other reference. Figure 1-4 shows East timing coming from the PRTC-B. The blue line shows the noise associated with GNSS over the 18 hours of the graph. The differences show that there is 5 ns difference between the East and West, which is within the limits required.

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*Figure 1-4. East West Between ePRTC and PRTC-B*
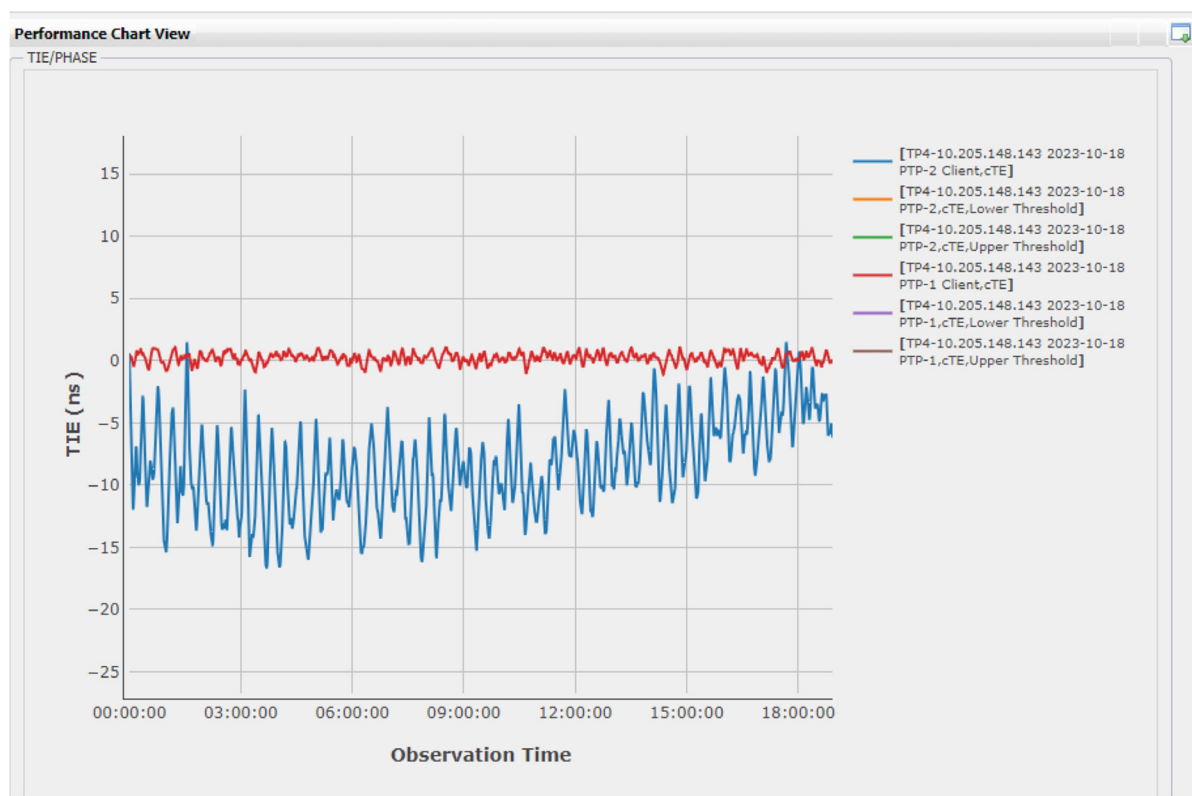
Now compare the graph shown in Figure 1-5, where both East and West come from ePRTC units. A similar offset is seen between East and West; however, there is a large reduction in the noise that comes from GNSS. TimePictra® will raise alarms if the East and the West diverge by any value from 1 ns to 5000 ns. If strict planning rules needed to be followed, the thresholds for the separation of

East and West would be set to 60 ns (2×30 ns), however, a more realistic number would be to set the thresholds to ±20 ns.

The second important metrics to monitor with TimePictra® is the ePRTC availability and holdover available value as shown above in Figure 1-1. These two metrics give the network operations team even more confidence that not only is the network delivering the correct time, but in the event of an outage, the network will continue to run for at least 30 days.

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Figure 1-5. East Site and West Site Between Two Different ePRTC
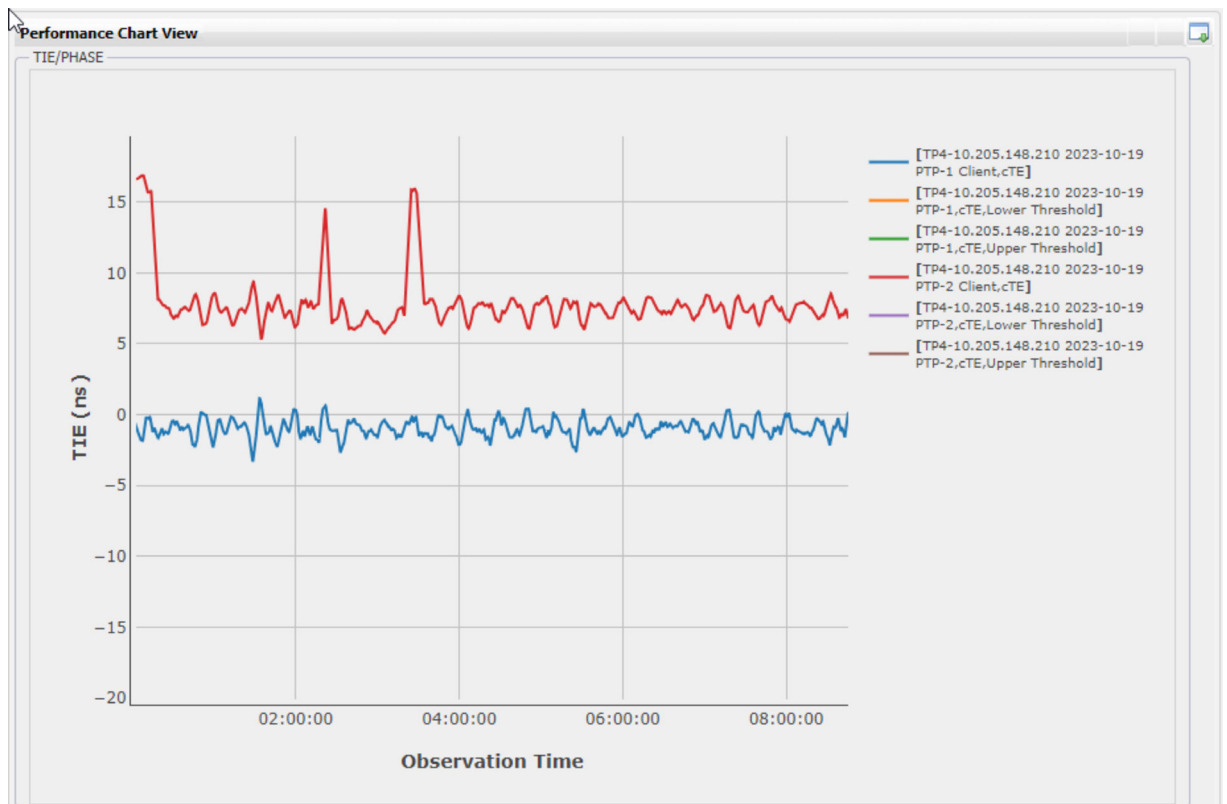
Summary

Assure end-to-end vPRTC service with TimePictra® management to verify the integrity of the timing accuracy at each vPRTC node.

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