IEEE 1588/PTP Option for S300/S350 SyncServer®

PTP Grandmaster and Performance Measurements for Precisely Timed Networks

KEY FEATURES

- IEEE 1588 2008 v2 PTP Grandmaster functionality
- Hardware based time stamping
- Any S300/S350 can upgrade to PTP support with hardware time stamping via easy software upgrade
- PTP Slave Activity monitoring from SyncServer
- PTP Grandmaster internal performance monitoring
- Chart key performance metrics from web interface
- Sync Interval rates up to 64/second
- Up to 4000 Delay_Requests processed per second
- S350: Real-time Time Interval measurements and statistics of PTP slave 1PPS accuracy
- S350: Real-time charting of Time Interval data in time series or histogram formats

KEY BENEFITS

- Support for both PTP and NTP in the same accurate SyncServer
- High sync rates to support enhanced accuracy at PTP slave
- Support hundreds to thousands of PTP slaves
- Clear visibility of grandmaster performance levels on your network
- Easy visualization of performance data over time
- S350: Measure PTP slave accuracy in your network

Symmetricom® makes it easy to add IEEE 1588 Precise Time Protocol (PTP) to any S300 or S350 SyncServer®. All S300/S350 SyncServers are factory ready for high accuracy, hardware based PTP time stamping. When enabled, the PTP Grandmaster functions are very easy to configure via the web interface, and the PTP protocol begins immediate operation.

The PTP features are a superset of the default profile as defined in the IEEE 1588 2008 standard. Additional control is provided over key PTP protocol parameters to accommodate unique network topologies and optimize PTP slave accuracy requirements.

The S300/S350 SyncServer actively monitors PTP slave access and Grandmaster performance thereby removing any uncertainty about slave connectivity and grandmaster loading.

Grandmaster performance metrics provide essential insights into PTP activity load on the SyncServer. Performance charts available from the web interface provide visual insights into the history of key PTP time stamping factors over time. In the event critical thresholds are crossed, alarms and SNMP traps can alert you immediately.

PTP slave accuracy testing is an essential part of any high-accuracy PTP deployment. It's a fact that network induced delays degrade PTP slave accuracy. 1PPS Time Interval measurements built into the S350 will measure in real-time the accuracy of hardware based PTP slaves compared to the S350. The 1PPS output from the slave is connected to the S350 and from there a full range of slave accuracy statistics are computed and displayed via the web interface in real-time.

Real-time charting of slave 1PPS accuracy via time history or histogram is also available via the web interface. While measurements are being made the user-configurable charts will continuously present updated results.

The SyncServer S300/S350 PTP Option is an ideal choice for LAN-based PTP implementations where PTP or mixed PTP/NTP support is required.

The SyncServer S350 in particular provides a unique and expanded set of testing and analysis capabilities of hardware-based PTP slaves. In applications where slave accuracy is critical, the ability to measure that accuracy from the source is essential.
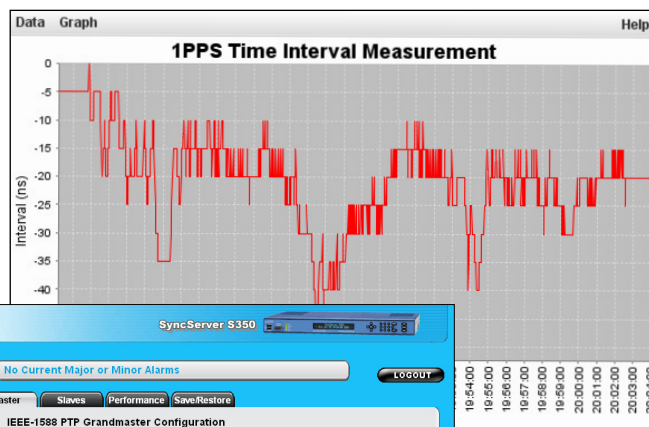
PTP GRANDMASTER AND MONITORING IN S300 & S350 SYNCSERVERS

Easy PTP Configuration Saves Time

PTP grandmaster configuration in the SyncServer is centralized to a single, easy-to-configure web page. Apply the settings and the appropriate details are broadcast to PTP slaves on the network who then automatically configure themselves.

The high accuracy PTP hardware time stamping in the SyncServer is available via the LAN2 port. Every S300 and S350 ever made ships with the time stamping hardware; this option enables it for PTP.

If multiple SyncServers are used on the local network the IEEE 1588 best master clock algorithm automatically determines which SyncServer is the grandmaster and which go to passive mode ready to take over if need be. Save the PTP configuration to a file and easily upload it into other PTP enabled SyncServers or archive it for later use.
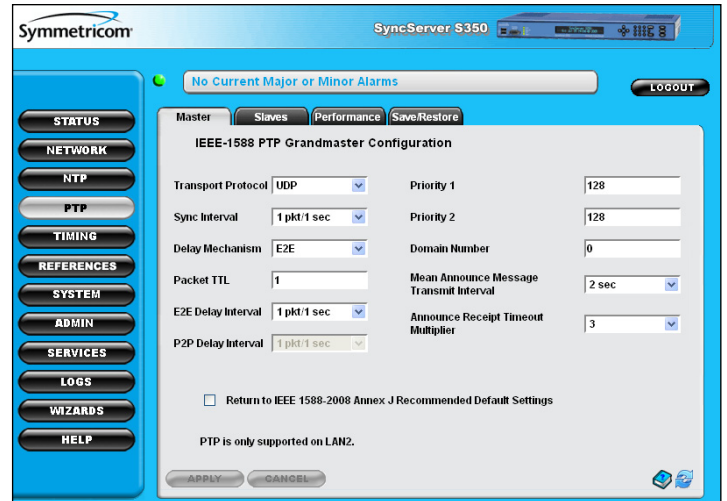
Easy and Intuitive PTP grandmaster configuration web interface
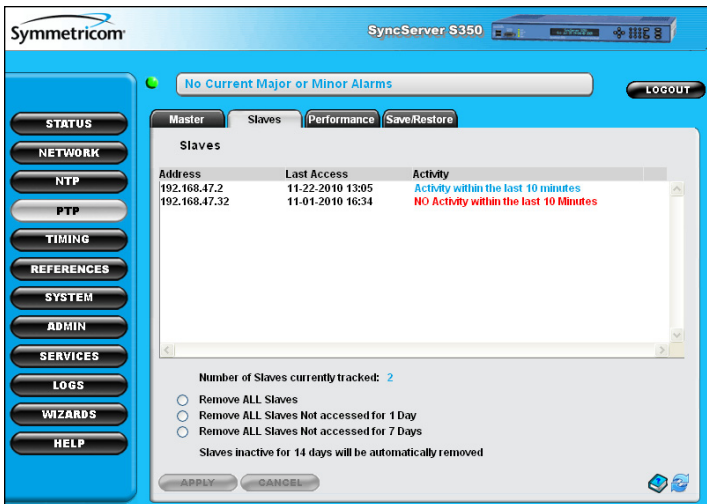
All PTP slave IP address and activity is monitored.
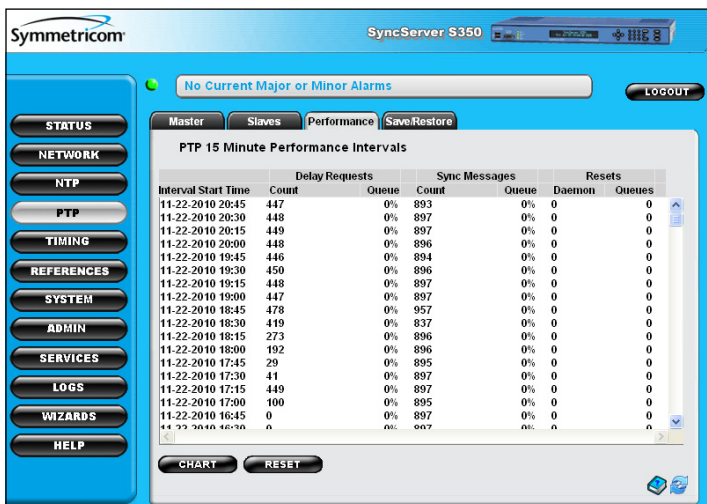
Monitor PTP Sync and Delay_Request activity as well as server loading. Seven different PTP performance parameters can be charted over time.

Monitor PTP Slave Access

An essential part of precise time distribution over a network, particularly for time critical applications, is knowing if the PTP slaves are synchronizing with the grandmaster.

The SyncServer tracks individual PTP slave IP addresses and the time of the last delay request from each slave. A total count of all slaves is provided as well as recent activity information.

This feature is especially helpful when setting up a network for the first time and confirming that the desired slaves are synchronizing with the SyncServer.

See "Precise PTP Slave Accuracy Measurement" below for information on how to gauge slave synchronization accuracy relative to the SyncServer by using S350 Time Interval measurements.

Grandmaster PTP Performance Monitoring

Monitoring PTP message activity inside the SyncServer provides important insights into network activity and loading of the PTP hardware time stamping functions.

The SyncServer regularly accumulates and publishes packet processing information. This is very useful to know that messages are being exchanged and if the SyncServer is nearing its performance limit.

The S300/S350 also monitors received PTP packet quality in the queues and will flush a queue or restart the PTP daemon only if absolutely necessary. In the event of a flush or reset, alarms and SNMP traps can alert you immediately.

Performance data available in chart form via the web interface includes packets processed, received packets errors and queue loading over time.

Precise PTP Slave Accuracy Measurement

Hardware based PTP slaves typically output a 1PPS signal. This signal can be input to the S350 and measured for accuracy against the ultra precise clock inside the SyncServer. Called a *Time Interval Measurement*, it shows how well the PTP slave electronics can synchronize to the SyncServer over the intervening network. The time interval is usually the difference in fractional seconds between the two clocks, called the *offset*.
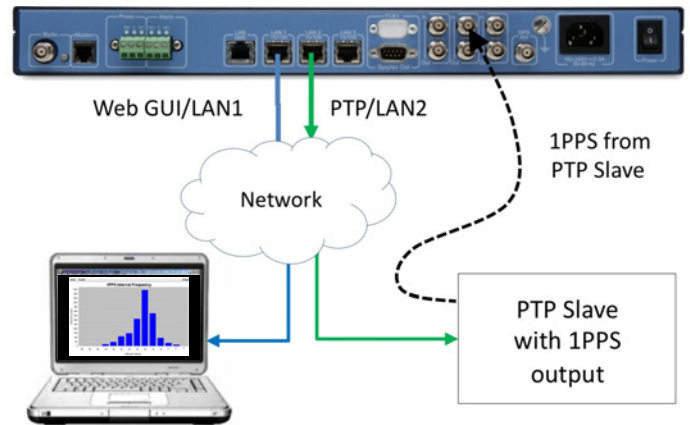
This measurement is essential in understanding the detrimental effects of switches and network traffic on a PTP slave's ability to accurately synchronize to the SyncServer. It is a particularly critical measurement if microsecond or nanosecond accuracy is desired at the slave. Measurements are easy to perform. Just connect the 1PPS output from the PTP slave to the S350 and press the start button on the web interface.

Measure the timing accuracy of a hardware based PTP slave

Real-Time Measurement Statistics and Charting

The PTP slave accuracy statistics relative to the S350 are computed and displayed in real-time via the web interface. The sample count, max, min, mean, standard deviation, median and RMS of the measurement set is continuously updated on the instrument-like web interface throughout the duration of the test. Measurement resolution is 5 nanoseconds.
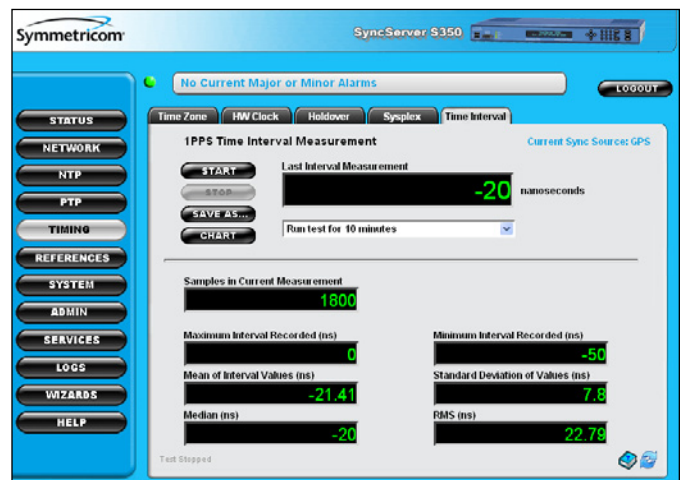
Data can be charted in real-time either as a time series or histogram. The chart continues to update as the measurements are made or charting can be paused and viewed statically while measurements are made in the background. The charting is very flexible with line, scatter, column or histogram formats with a variety of viewing options.

Measurements can be performed unattended and for specified periods of time. Once a test is completed the data can be saved to a local text file.
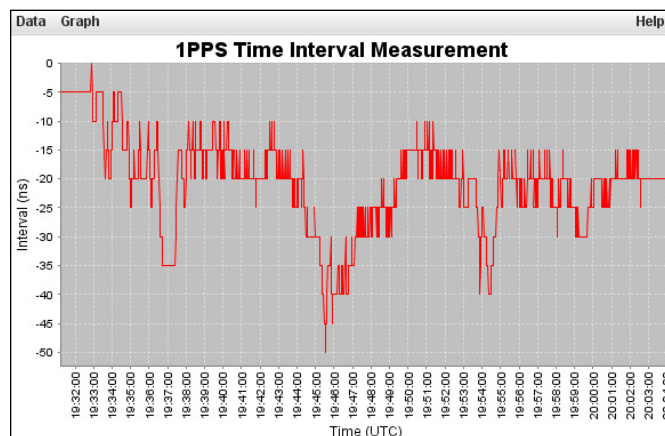

Seven different measurement statistics of PTP hardware slave accuracy are presented in real time during testing

View PTP hardware slave measurements with real time charting with flexible chart types and viewing options.
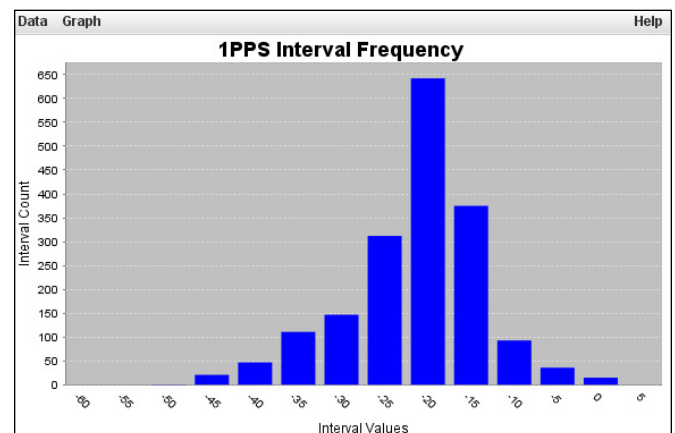
View real time histograms of PTP hardware slave measurements as they are being made.

S300/S350 PTP OPTION SPECIFICATIONS

COMPLIANCE

- IEEE1588 2008
- Grandmaster
- Default profile with parameter extensions
- 2-step clock operation on Sync messages
- Multicast

PTP PERFORMANCE

- PTP Message Capacity: 4000 delay_requests per second
- NTP vs PTP Capacity: PTP is a higher priority than NTP

PTP delay_request messages/second	NTP Requests/second
10	3500
3000	2000
4000	1100

- Time stamp accuracy:
  - Sync packets: 5 nanoseconds relative to timebase in SyncServer
  - Delay_requests packets: 25 nanoseconds relative to timebase in SyncServer
- Time stamp resolution: 5 nanoseconds
- PTP Slave Monitoring: 2000 unique IP addresses

PTP PORT

All PTP hardware time stamping in the SyncServer is via the LAN2 port. Every S300 and S350 ever made ships with the time stamping hardware, this option enables it for PTP. LAN2 is 10/100BaseT Ethernet with an RJ45 connector.

CONFIGURABLE PTP PARAMETERS

- Transport Protocol: UDP or 802.3
- Delay Mechanism: E2E or P2P
- Sync, E2E Delay &
  P2P Delay Intervals: 64 packets / 1 sec
                       32 packets / 1 sec
                       16 packets / 1 sec
                        8 packets / 1 sec
                        4 packets / 1 sec
                        2 packets / 1 sec
                        1 packet / 1 sec
                        1 packet / 2 sec
                        1 packet / 4 sec
                        1 packet / 8 sec
                        1 packet / 16 sec
                        1 packet / 32 sec
                        1 packet / 64 sec
- Packet TTL: 1 to 256
- Priority 1 & 2: 0 to 255
- Domain Number : 0 to 255
- Mean Announce Message
  Transmit Interval: 1, 2, 4, 8, 16, 32, 64 seconds
- Announce Receipt
  Timeout Multiplier: 2, 3, 4, 5, 6, 7, 8, 9, 10

IEEE 1588 / PTP OPTION UPGRADE CHOICES

New Orders: The IEEE 1588/PTP option for SyncServer S300/S350 models can be included with new orders.

Field Upgrades: For S300/S350's in the field, an upgrade to software version 2.6 or later is required. From there the IEEE 1588 PTP Option can be purchased and PTP enabled by entering a license key via the web interface. Contact Symmetricom Sales for full details.

PTP SOFTWARE SLAVES/INTEROPERABILITY

Windows: Symmetricom Domain Time II software for Windows.
Linux: Source forge PTPd for IEEE 1588 2008
           TimeKeeper software for Linux