In This Issue

We are pleased to introduce the eighth edition of our quarterly newsletter *Time to Sync*—your source for the latest Timing and Synchronization industry news, products, events, and more! *Time to Sync* keeps you updated on the latest news in the timing and synchronization industry and helps you stay connected.

We recently released the all new ePRTC to meet the recently approved ITU standard (ITU-T G.8272.1).

We also recently released the software update for the SyncServer S600 and S650 Network Time Servers. These devices continue to garner more and more interest, especially within the enterprise community.

In this newsletter, we also look at the new regulations driving the financial regulations and the high frequency trading systems. The deadline to implement the timing requirement is drawing closer and the interest towards implementing these requirements is on the rise.

Time to Sync is intended to be informative and educational, and aims at helping you succeed! Please send any comments or questions, including suggestions for future articles, to timing@microsemi.com.

About Microsemi:

Microsemi offers a set of complementary product lines including Power-over-Ethernet (PoE) midspan/injectors, Carrier Ethernet Switches, PHYs, software, and equipment/data link security. We look forward to sharing some of these with you as appropriate while maintaining timing and synchronization news and trends as the focus of this newsletter.

Technology & Product Updates

THE ENHANCED PRIMARY REFERENCE TIME CLOCK (ePRTC)

When looking at the evolution of Primary Reference standards, developed by the ITU, the original requirement was for a Primary Reference Clock (PRC) called G.811. The G.811 required a PRC that delivers 1 part in 10E11 frequency accuracy and is suitable for timing and synchronization of other clocks within a network. As packet timing requirements emerged, ITU developed the Primary Reference Time Clock (PRTC) standard to include the requirements for time and phase for transport over a packet network. This standard is known as G.8272 and was originally published in 2012. The G.8272 standard describes a clock that delivers <100 nS time and phase performance suitable for packet networks.

There is a new ITU standard (ITU-T G.8272.1) with an aim to achieve the following results:

- Increase performance for time and phase to meet the requirements of emerging mobile access network technologies.
- Improve security for protection against GNSS outages.

The new standard is called the Enhanced Primary Reference Timing Clock (ePRTC). This new standard (G.8272.1) calls for performance levels and reliability that will set the foundation for time, phase, and frequency for many years to come.

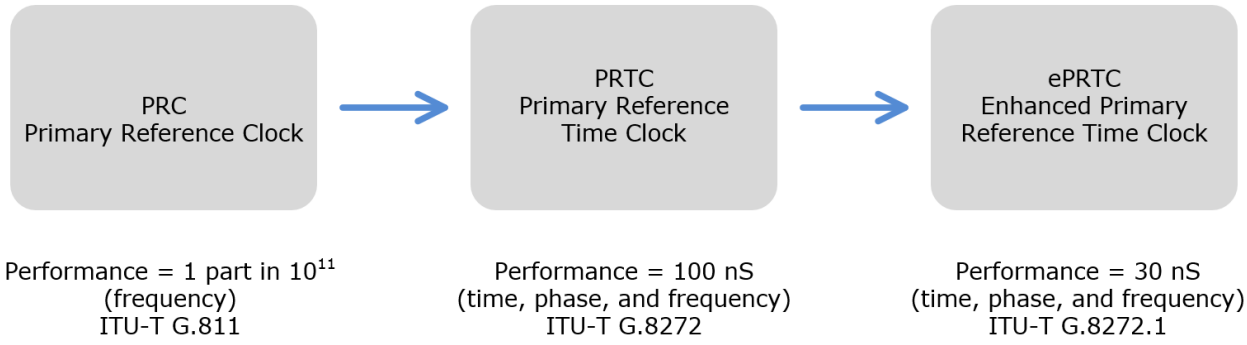

Figure 1: Evolution of Primary Reference Standards

The core components of an ePRTC solution include:

- GNSS
- Atomic clocks (typically cesium or better)
- ePRTC system

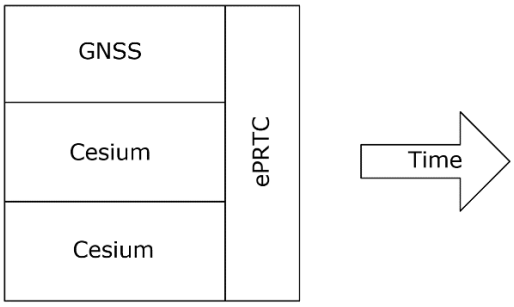

Figure 2: Enhanced Primary Reference Clock (ePRTC)

Key attributes of an ePRTC include:

- Supports a high level of accuracy (<30 ns) and is subject to more stringent output performance requirements as compared to today's PRTC systems.
- An ePRTC is an autonomous source of time that utilizes one or two co-located atomic clocks to provide the required performance for both time and frequency, even when GNSS is completely lost.
- An ePRTC delivers a higher level of operational reliability to ensure operators can maintain the required time and frequency service performance for long periods, regardless of the availability of GNSS.

The objective of the ePRTC solution is to generate time by producing its own autonomous TimeScale. The TimeScale provides time, phase, and frequency that are aligned and calibrated to the GNSS signal over time. The TimeScale is generated and maintained autonomously based on the stability of the atomic clocks. The frequency stability of the atomic clocks serves as a reference for the ePRTC time scale. This is the key distinguishing feature when comparing an ePRTC to a PRTC. In the case of a PRTC, time is essentially coming directly from GNSS. In the ePRTC, a locally generated TimeScale is generated.

Please click here to download the white paper that describes using ePRTC solutions to mitigate GNSS vulnerabilities.

Microsemi's new TimeSource Enhanced PRTC product was recently launched at the ITSF conference in Prague. Please click on this video to view an interview of Greg Wolff from Microsemi about the product launch.

SyncServer S600 and S650 Network Time Servers New Software Release

Version 2 of the SyncServer S600/S650 was released this month! In addition to the best-in-class NTP Server features already present, the new Version 2 adds:

- IEEE 1588 Precise Time Protocol (PTP) Grandmaster operations
- Multi-GNSS Constellation Support for Enhanced Reliability (GLONASS, BeiDou, and SBAS in addition to the standard GPS constellation)
- FlexPort any signal and connector license with more time code output formats
- Increased security features to further security harden the time server
- NTP Reflector™ with its security hardened NTP packet processing now capable of 360,000 NTP requests per second

Click here to learn more about Microsemi's Series S6xx SyncServers or write to us at timing@microsemi.com

Already own a SyncServer S600 or S650? Then visit the Microsemi Online Portal where the version 2.0 software is available for download.

Figure 3 SyncServer S6xx Series Network Time Servers

TimePictra 10.6 – Now Complete Integration with IGM

The growth of reliable packet-based networks requires intelligent management tools that are powerful and dependable. Microsemi's network management solutions provide carrier class control and visibility of the entire end-to-end synchronization network. TimePictra management software is designed from the ground up using scalable and modular architecture to keep pace with the growth and evolution of networks. Fault and remote management, network configuration, performance monitoring, and security management capabilities are all available through a highly visual, map-based interface.

TimePictra is server platform and database independent—allowing cost-effective deployment of the management system using any server or database platform meeting the specified requirements.

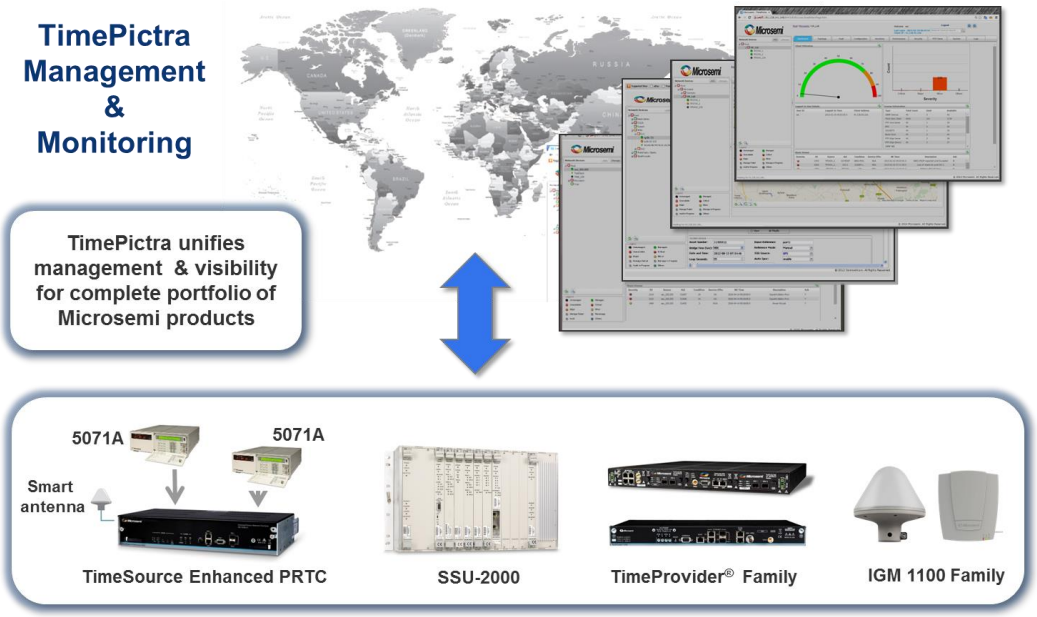

Figure 4 TimePictra unifies "Frequency and Packet Platforms"

Microsemi recently released TimePictra 10.6 with complete support for the Integrated GNSS master (IGM 1100 series). The following are some of the additions:

- IGM
  - Full FCAPS support
  - Standalone AGNSS proxy support
  - Auto discovery

- Auto Create of Radius User
    - Uses the Radius Microsemi Dictionary
    - User Auto Creation
    - User deletion after 60 days of inactivity
- Phase (tie) Plots of SSU2000 inputs
- Security enhancements including customizable password complexity

End Market Corner

Financial Trading-Time Synchronization Requirements

IT organizations in financial institutions are mandated to keep accurate records of all transactions such as when a transaction was initiated and completed along with the real-time date and timestamps for each transaction.

The risk associated with inaccurate time in an organization's network and the impact of this error in such a system may include legal liability. European Union legislators have issued the second instalment of the Market in Financial Instruments Directive (MiFID II). When it comes into effect in January 2018, the directive will require all trades to be timestamped to Universal Coordinated Time (UTC) at a high-level of precision. The timeline for the implementation of the MiFiD II regulations is shown below. The directive will be enforced by the European Securities and Market Authority (ESMA).

Under MiFID II, different trades will require different levels of accuracy.

Levels of Accuracy and Granularity Required for Trading Venues

Environment	Max Divergence from UTC	Timestamp Granularity
Non-HFT	1 millisecond	1 millisecond or better
HFT	100 microseconds	1 microsecond or better

Microsemi's recently launched SyncServer S6xx series of NTP/PTP network time synchronization products with atomic clock accuracy that ensures time is synchronized and accurate throughout the financial enterprise network. Microsemi time servers protect network log-file accuracy, security, billing systems, electronic transactions, database integrity, and many other essential applications needed by financial institutions to claim compliance to regulatory mandates.

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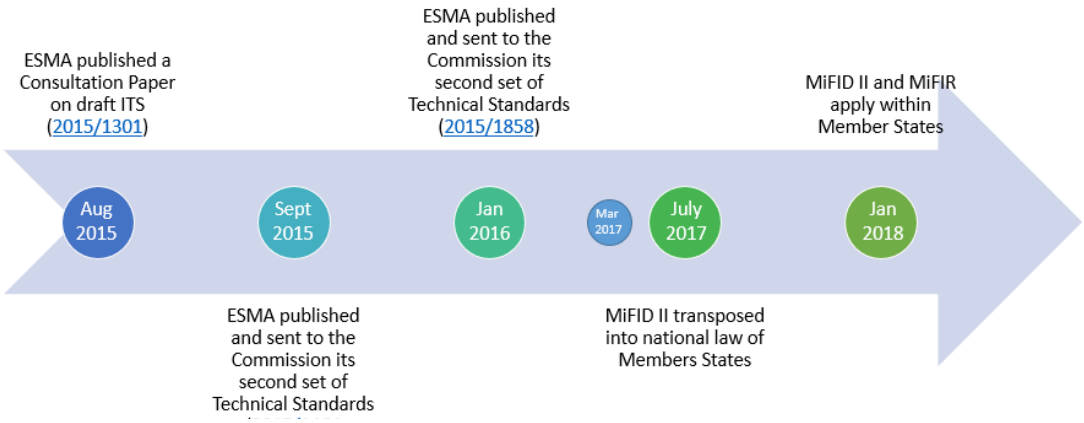

Figure 5: Time Line for MiFID II Implementation

PTP Enterprise Profile

Timing accuracy in many large enterprise IT networks have advanced to levels beyond what can be supported by standard NTP clients. PTP with hardware timestamping and faster message update rates is increasingly being used to meet these accuracy requirements. To ease PTP configuration and facilitate equipment interoperability, the IETF have established the PTP Enterprise Profile.

Key attributes of the PTP Enterprise Profile include:

- Layer 3 mapping (IPv4 and IPv6)
- End-to-end delay measurement method (on-path PTP support not required)
- Mixed unicast and multicast operation for flexible and efficient deployment
    - Multicast for Sync and Announce messages
    - Multicast or unicast modes for delay request and delay response messages

The hybrid nature of the PTP Enterprise Profile allows for the Grandmaster to send a single common multicast sync message to a large number of PTP slave clocks, while also allowing the Grandmaster to respond to individual unicast delay request messages from individual slave clocks with a discrete unicast delay response message to that slave clock only. This allows for highly efficient and scalable deployment of PTP in large enterprise IT networks.

The PTP Enterprise profile is fully supported in Microsemi SyncServer S6xx series Time Servers with software release 2.0. The PTP option can be factory installed or added to any current SyncServer S6xx system in the field.

Click here to learn more about Microsemi's S6xx SyncServers or write to us at timing@microsemi.com

Event Calendar

You can find us at the below events to know more about the products and solutions offered by Microsemi.

- Recent Events
  - PTTI
  - Satellite 2017
  - MiFiD II Conference
  - OFC Conference
  - NIST WSTS

- Upcoming Events
  - EFTF (UK)
  - UFFC Frequency Control Symposium
  - STAC Summit, London

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