In This Issue

We are pleased to introduce the fourth edition of our quarterly newsletter, *Time to Sync* — your source for the latest timing and synchronization industry news, products, events, and more!

In addition to our Timing and Synchronization products, Microsemi® offers 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 when it is relevant while maintaining timing and synchronization news and trends as the focus of this newsletter.

We recently introduced the all new SyncServer S600 and S650 devices, which set a new benchmark in security, reliability, and accuracy of time services. We also introduced the extended IGM family — Outdoor IGM and IGM with external antenna — at the Mobile World Congress (MWC) held in Barcelona, Spain. Read on for more information about these products.

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.

Technology and Product Updates

Microsemi Introduces Security-Hardened NTP Timing and Synchronization Platform

In January, Microsemi Corporation (Nasdaq: MSCC) announced its new SyncServer S6xx series of network time protocol (NTP) servers that provide a highly secure, accurate, and flexible timing and frequency platform for synchronizing network elements and mission-critical electronics systems in enterprise IT applications (such as IP telephony and physical security) as well as government instrumentation applications (such as satellite communications and defense operational infrastructure).

The new SyncServer raises the bar for accurate time synchronization with hardware-based timestamp support that significantly reduces jitter and latency in the time served without losing accuracy. Installation is also much more flexible compared to any other GPS/GNSS unit available in the market. The new SyncServer series is for anyone who needs dependable, high-quality NTP timestamps.

The new series includes the SyncServer S600, a security-hardened NTP time server with Microsemi's NTP Reflector™ technology for robust security, accuracy, and reliability of network time services, and the SyncServer S650, a highly versatile timing and frequency system with Microsemi's unique FlexPort™ technology for multiport, user-definable output signal configuration. The SyncServer S600 is designed for enterprise IT customers managing corporate networks in industries such as financial services and healthcare, while the SyncServer S650 is ideal for electronics systems engineers synchronizing mission-critical, system-level instruments.

Figure 1 · **SyncServer S6xx (Front Panel)**

About the SyncServer S600

Microsemi's SyncServer S600 is the industry's only network time server with security-hardened NTP Reflector technology, supporting extremely high-capacity, ultra-accurate NTP server operations in a multiport, dedicated network time appliance. Easily integrable into existing, future, and cloud network topologies (including SDN, software-defined networking), it is designed for IT network administrators and architects who rely heavily on server log files for network management.

SyncServer S600 uniquely comes with four 1-Gigabit Ethernet (GbE) LAN ports, each equipped with hardware timestamping, multiplying the network configuration possibilities. All ports are equipped with high-resolution hardware timestamping, and the S600 is both NTP- and precision time protocol (PTP)-ready in a multiport PTP configuration. A simple software update and license purchase/installation will be available in a future software release. Other benefits include interoperability, ease of use, extensive security choices, and a modern web interface that provides the best possible user experience.

Figure 2 · **SyncServer S600**

Key features of SyncServer S600 are:

- NTP hardware timestamping standard with nanosecond accuracy
- NTP Reflector technology for improved security, NTP throughput, and accuracy
- Comprehensive suite of security protocols

About the SyncServer S650

A superset of Microsemi's SyncServer S600, the SyncServer S650 provides all the features of the SyncServer S600 but with additional offerings. Leveraging the company's unique and advanced FlexPort timing technology, it delivers unprecedented flexibility in very precise time and stable frequency synchronization at a price-competitive commercial off-the-Shelf (COTS) solution.

FlexPort timing technology efficiently and cost-effectively adds the innovative "any signal, any connector" capability through software configuration, eliminating the wasted space inherent to legacy style modules with fixed signal types. Specially designed for system and instrumentation engineers in electrical, system, metrology, communications, and defense markets looking to easily output a variety of accurate and stable time and frequency signal types in a cost-effective manner, the device also provides unmatched network-based timing features with software upgrades to completely security-harden the system.

The GPS-referenced SyncServer S650 is built for modern electronic systems and networks that require best-in-class synchronization performance that is easily adaptable to a wide range of applications. Microsemi's FlexPort configurations eliminate the need for distribution chassis, saving time and costs in addition to providing an easy-to-use system. Other benefits include high accuracy and signal quality, as well as environmental design robustness.

Figure 3 · **The Two Available Variants of SyncServer S650**

Key features of SyncServer S650 (in addition to those of SyncServer S600**) include:**

- Clock accuracy typically better than 10 nanoseconds to universal time
- Standard timing I/O card that meets most popular timing output requirements, eliminating the need to purchase multiple plug-in modules
- Optional FlexPort technology feature for "any signal, any connector" flexibility

Product Availability

Microsemi's new SyncServer S600 and SyncServer S650 are both available for purchase now. For more information, click here.

To request a product datasheet or further product details, email sales.support@microsemi.com.

Microsemi Broadens Grandmaster Timing Options for Network Edge Deployments and Expands IGM Portfolio

Microsemi recently announced two new additions to the Integrated Grandmaster (IGM) product portfolio: IGM-1100o (outdoor version) and IGM-1100x (indoor version with external antenna support). These products were showcased at the World Mobile Congress and received an overwhelming response from customers.

IGM-1100i (indoor version), an existing product, has also been upgraded to support sixteen clients (improved from eight clients in the previous model). These offerings broaden outdoor and indoor deployment options for mobile network operators who require a cost-effective, precise timing master for small cells and backhaul to eNodeBs in wireless service delivery operations at the LTE network edge.

Click **here** to download the 1588 PTP GrandMaster portfolio product datasheets.

Figure 4 · **IGM PTP Grandmaster Product Portfolio**

The expanded IGM portfolio flexibly addresses indoor and outdoor deployment models for mobile service providers, increasing network-edge capacity and coverage to deliver advanced wireless connectivity to indoor enterprises, retail settings, as well as small, micro, and pico-cell clusters.

- **IGM-1100i (indoor version):** With its integrated GPS antenna, the IGM-1100i operates indoors without the need for a dedicated antenna and associated cabling and installation hurdles. In addition to its increased capacity (from eight PTP 1588 clients sixteen clients), the IGM-1100i now also includes support for Telecom 2008 profiles, default 1588 profiles, and for CLI over SSH. Click here to download the datasheet.
- **IGM-1100o (outdoor version)**: Complementing the IGM-1100i in outdoor wireless deployment scenarios where extended temperature range and ruggedization are critical factors is the IGM-1100o, which integrates the PTP 1588 master and an outdoor GPS antenna in a single device. It can simply be installed at an outdoor location (for example, on a roof top or alongside other eNodeBs antenna installations). The IGM-1100o Power-over-Ethernet (PoE) capability makes rooftop deployment much simpler than over coax. Click here to download the datasheet.
- **IGM-1100x (indoor version with external antenna support)**: The small-form factor IEEE-1588 IGM Grandmaster with integrated GNSS receiver and external antenna delivers precise time in scenarios where a GNSS antenna is already deployed or where the IGM-1100x would be cost-effective to deploy (such as in a small single-story building, rack, hut, or cabinet). A single Ethernet connection is used for automatic configuration management, and for PoE-to-IGM and PTP grandmaster operations to precisely synchronize the eNodeBs. The IGM-1100x is the ideal solution for IEEE 1588 deployments of up to 16 clients with existing GPS antennas (use with the TimeProvider® 2700 for support of up to 512 clients). Click here to download the datasheet.

End Market Corner

Miniature Atomic Clock Applications

Rubidium oscillators are used as primary and secondary frequency standards due to their excellent tilt and vibration, stability, and re-trace performance. Rubidium applications have evolved over time and increasingly require smaller size and lower power devices that can maintain traditional performance standards. The miniature atomic clock (MAC) supports these requirements for performance, size, and power where larger traditional oscillators may not.

The MAC is primarily used in two applications:

- Phase and frequency holdover in the event of a disruption to a primary reference clock
- Precise free-running frequency reference

Time Error During Holdover

The local clock is continuously compared and disciplined to its reference (for example, GPS) and steered to eliminate any phase or frequency difference. "Holdover" is what happens to the local clock when it is no longer disciplined. Some applications need to know the amount of frequency drift that occurs during holdover, referred to as "Allan deviation" over the short term and as "aging rate" over the long term. Other applications need to quantify the amount of phase drift that occurs during holdover, known as "time error." Said another way, time error denotes how far the rising edge of the clock pulse would drift when the clock is no longer disciplined to its reference.

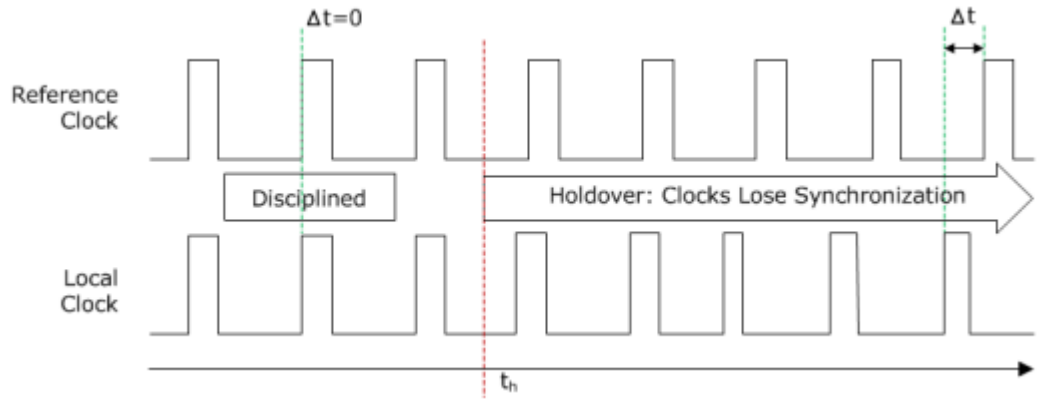


Figure 5 · **Local Clock Disciplined to a Superior Reference Clock**

Time error is modeled mathematically and is represented as a quadratic equation impacted by such parameters as fractional frequency offset at t = 0 and clock aging rate (Allan deviation) at the sampling rate (τ).

Precise Free-running Frequency Reference

Manufacturers of LTE-TDD equipment typically sell the equipment with an option that requires frequency accuracy of 1E-9 per year. They also provide an option that supports a 1E-10 monthly aging rate, which allows end-users to have a one-year calibration cycle. Test equipment manufacturers are shrinking the size and power of test equipment. Reduction of power allows users to reduce or eliminate fans. The MAC allows manufacturers to mount the frequency reference on a PCBA without heat sinks or fans.

Some of the end applications that mitigate GNSS vulnerability by maintaining timing accuracy are applications used in:

- Cellular and wireline infrastructure
- Defense infrastructure and weapons systems

- Secure communications infrastructure
- Power utility and smart grid systems
- Public safety infrastructure
- Digital video infrastructure

Atomic clocks are selected for their excellent performance on parameters such as tilt/vibration, stability, and re-trace performance, in addition to their small size, weight, and power consumption. Some other factors favoring rubidium MACs are:

- The latest rubidium MACs are the same size and form factor as the OCXO devices used for holdover, making them easy to embed in equipment designs.
- Innovation has yielded lower power consumption, and power performance continues to improve over the years.
- The cost of rubidium clocks has decreased dramatically over the last five years, and the downward trend continues today.

Microsemi's MAC SA.3Xm is designed for applications where an economical solution for frequency stability is required. Requiring little power and able to operate across a wide spectrum of temperatures, the SA.3Xm is an ideal choice for wireless base stations, telecom networks, and test and measurement devices requiring the precision of a rubidium oscillator.

Figure 6 · **MAC SA 3Xm**

Click here to download the complete white paper on MAC Holdover.

For any additional queries, click here or write to us at timing@microsemi.com.

GPS Signal Reception Anomaly

On January 25, 2016, customers experienced difficulty with GPS-based synchronization systems. The issue was immediately addressed by Microsemi and worked on with the highest level of priority. The initial understanding of the situation was that the issue was caused by an anomaly in the GPS signal. This understanding was based on observations using Microsemi time and frequency systems (located in San Jose, Boulder, Beverly, and Munich) and the inaccuracies we were able to detect while using these systems to receive and measure GPS signal reception.

While performing this monitoring, Microsemi began to see corrections in the GPS signal the next day, which indicated that the problem was being corrected. We continued to monitor the improvement in the GPS signal quality and validate that the problem had been resolved. We have now confirmed that the GPS signal anomaly is cleared and all Microsemi systems designed to receive GPS have resumed normal operation.

On January 27, 2016, there was an official press release by the United States Air Force providing details of the cause of the incident. As described in the Air Force press release, the anomaly centered on a time offset of 13 microseconds relative to UTC time that infected the time as transmitted by the GPS satellites. Fortunately, Microsemi systems use intelligent input-selection algorithms, atomic oscillator technology, advanced packet timing distribution, and robust network synchronization management and monitoring mechanisms to discern between valid and faulty timing references. However, with the proliferation of GPS (and other GNSS systems) as a primary reference source across tens of thousands of nodes in a mobile network, this event is an example of the magnitude that GPS/GNSS vulnerabilities can cause without secure backup.

Fortunately, there was not a single critical network outage reported by Microsemi customers. Although concerns were reported from major network operators and government institutions that utilize Microsemi timing and synchronization systems, network operations across the globe remained in full service, with no disruptions.

Recommended Actions During a Signal Reception Anomaly

Customers should allow their systems to self-correct. In most cases, it is likely that the anomaly is temporary, and systems would automatically return to normal operations. For example, in the GPS signal reception anomaly that occurred on January 25, 2016, most reported incidents involved the Microsemi SSU-2000 system (the most broadly deployed timing system worldwide), and in all cases, the SSU-2000 either intelligently rejected the faulty GPS signal and switched to an alternate input source or entered holdover mode. This situation highlights why rubidium is a recommended and preferred configuration for telecom/mobile applications.

If a customer's Microsemi system does not correct itself within 24 hours, then the customer should contact our Technical Support staff for further assistance.

Microsemi will continue to monitor the GPS signal through our technical staff at our laboratory locations in North America, Europe, and Southeast Asia. If a new incident occurs and/or a GPS signal anomaly of any kind is detected, we will inform our customers immediately and provide assistance and resolution.

In case of specific queries, feel free to write to us at timing@microsemi.com.

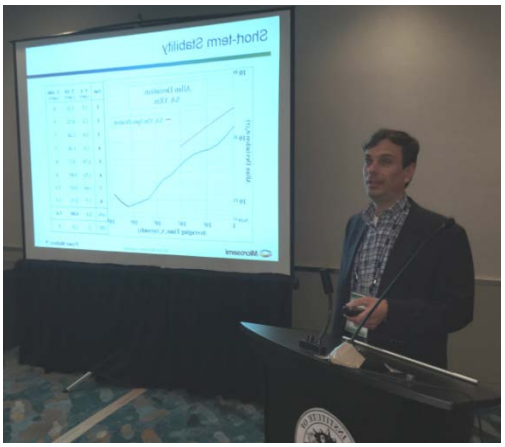
Event Calendar

Recent Events

Precise Time and Time Interval Systems and Applications (PTTI): Monterey, California

The Precise Time and Time Interval Systems and Applications (PTTI) meeting is an annual conference sponsored by the Institute of Navigation (ION) with a technical program designed to disseminate and coordinate PTTI information at the user level; review present and future PTTI requirements; inform government and industry engineers, technicians, and managers of precise time and frequency technology and its problems; and allow for an active exchange of new technology developments.

We took this opportunity to introduce our recently launched SyncServer S650. The modular Microsemi S650 combines the best of time and frequency instrumentation with unique flexibility and powerful network/security-based features. The presentation was very well received.



CISCO Live: Berlin, Germany

Cisco Live is Cisco's premier education and training destination for IT professionals worldwide. The event offers unparalleled opportunities to learn about Cisco products and solutions through in-person events, live webcasts, and on-demand learning opportunities. This was the best Cisco Live event for Microsemi to date, particularly for the PoE and frequency and timing (FTD) divisions.

From PoE, we had a demo pole with an outdoor PoE switch, which, once developed, will feed an outdoor Cisco AP and an outdoor Axis camera. Along with this, we displayed a 10G midspan and a ruggedized (industrial) midspan.

We also demonstrated the new SyncServer S600. The SyncServer with security-hardened NTP Reflector technology in particular gained a high level of interest.

Mobile World Congress: Barcelona, Spain

The GSMA Mobile World Congress is the world's largest exhibition for the mobile industry and includes a conference featuring prominent executives representing mobile operators, device manufacturers, technology providers, vendors, and content owners from across the world.

Microsemi used this platform to release and demonstrate the recently launched IGM series. The instruments demonstrated at the booth drew a large crowd due to their new designs and their ability to address previously challenging applications.

Upcoming Events

OFC Conference (Anaheim, California): March 22–24, 2016

The Optical Fiber Communication Conference and Exhibition (OFC) is the largest global conference and exhibition for optical communications and networking professionals. For over 40 years, OFC has drawn attendees from all corners of the globe to meet and greet, teach and learn, make connections, and move business forward.

OFC attracts the biggest names in the field, offers key networking and partnering opportunities, and provides insights and inspiration on major trends and technology advances impacting the industry. OFC is a one-stop shop for events including technical presentations, coverage of the latest market trends, and industry predictions.

Visit us at booth #2257 to get a first-hand experience of our product range, including the all-new SyncServer S600!

Space Symposium (Colorado Springs, Colorado): April 11–14, 2016

For more than 30 years, the Space Symposium has brought together space leaders from around the world to discuss, address, and dream about the future of space.

We will present a white paper at this conference titled “Precision Commercial off-the-Shelf (COTS) Quartz Oscillators for Space Applications.” We will also demonstrate our products that are suitable for operation in space.

IFCS (New Orleans, Louisiana): May 9–12, 2016

The International Frequency Control Symposium (IFCS) consists of tutorials and focus sessions, as well as regular sessions covering technical aspects related to timing. With an expected attendance of over 300 industry-leading scientists and technologists as well as 20 international vendors, the conference provides a unique opportunity for close interaction between exhibitors and attendees, with the exhibition forming a significant part of the overall conference experience.

IMS2016 (San Francisco, California): May 24–26, 2016

IMS2016, organized by the IEEE Microwave Theory and Technique Society (MTT-S), is the premier conference for the latest information in the RF and microwave industry. IMS2016 will be held at the prominent Moscone Center in downtown San Francisco.

The mission of IMS2016 is to facilitate a rich attendee experience by providing a forum for presenting technical papers on state-of-the-art RF and microwave-related topics, exhibiting the latest products and technology solutions, and networking opportunities with peers and industry experts.

EFTF (York, United Kingdom): April 4–7, 2016

The European Frequency and Time Forum (EFTF) is an international conference and exhibition providing information on recent advances and trends of scientific research and industrial development in the fields of frequency and time.

At this forum, we will demonstrate the new SyncServer S600 with security-hardened NTP Reflector technology for all enterprise solutions.

Upcoming Webinars and Whitepaper Presentations

Webinar

ThinkSmallCell

Laying the foundations for phase timing

March 23, 2016

Click here to register

White Paper Presentation

Topic: Precision Commercial off-the-Shelf (COTS) Quartz Oscillators for Space Applications

Space missions are evolving and now span a wide range of orbits and mission lifetimes that require different levels of mitigation for radiation. Some missions now leverage commercial electronics that allow for state-of-the-art performance at costs appropriate for the programs.

This presentation will describe Microsemi's COTS quartz oscillators and atomic clocks, and the results of radiation testing to 100 krads (Si). In addition, background information regarding single event effect (SEE) radiation susceptibility of quartz oscillators to more severe environments that contain neutrons and heavy ions will be reviewed. Context will be provided for the decision to use COTS products in comparison to radiation hardening by design.

Latest Collateral

White Paper — Miniature Atomic Clock (MAC) Holdover

Microsemi recently released a white paper on the largest application for MAC Holdover. The paper describes the time-error performance of Microsemi's Miniature Atomic Clock product line. It defines "holdover" and reviews a time-error model used for prediction purposes. It contains information on the MAC's performance in a steady state and with aggressive temperature oscillations. It also provides design recommendations for more sophisticated timing solutions.

Click here to download the complete white paper.

Microsemi in the News

- Microsemi Broadens Grandmaster Timing Options for Network Edge Deployments
- Microsemi Introduces 4+1 Outdoor Power-over-Ethernet Switch Enabling Connection of Four Powered Devices up to 60 Watts per Device
- Microsemi to Present at Goldman Sachs Technology and Internet Conference
- Microsemi Adds New Ultralow Jitter Network Synchronizers to its IEEE 1588 Product Portfolio
- Microsemi Introduces Security-Hardened NTP Timing and Synchronization Platform

Microsemi new product press releases can be viewed at http://investor.microsemi.com/releases.

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