In This Issue

We are pleased to introduce the fifth 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.

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.

We recently introduced two new variations to the IGM family that are ready for shipment: the IGM1100o (weatherproof IGM suitable for outdoor installations) and IGM1100x (for indoor installations with an external antenna).

The SyncServer S600 and S650 continue to garner more and more interest, especially within the enterprise community. New collateral is available for the SyncServer family.

We have also actively participated across several roadshows and conferences in the globe and generated interest from customers across multiple segments.

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

Security Features with Denial of Service (DoS) Protection

The SyncServer S6xx Series implements real-time, hardware-based network packet processing in tandem with accurate hardware-based NTP timestamping, general packet limiting, and alarming. The hardware-based network packet processing protects the SyncServer CPU from excessive network traffic Denial of Service (DoS) attacks, and provides extremely high-bandwidth, high-accuracy NTP operations.

The NTP Reflector™ is a real-time, hardware-based NTP packet identification, and timestamping engine. The high-capacity packet processor uses the exceptionally accurate S600 series clock to deliver the best possible NTP timestamps.

At 1 GbE line speed, NTP client packets are identified, the precise and accurate T2 and T3 timestamps are added, and packets are returned to the requesting NTP client. As all operations are processed in hardware, operating at 1 GbE line speed, the NTP packet capacity is in excess of 120,000 NTP packets per second.

The SyncServer S6xx Series CPU is protected by two layers of hardware-based, network packet-limiting filters, and has extremely robust IP table rules. The two-layer protection is an optional feature. The first hardware layer is established on a per-LAN port basis. Unique rate limits can be set per port on the number of network packets being directed to the CPU. If the set limit is reached on any port, an SNMP trap alert is sent. Excessive packets beyond the set limits are dropped on a port-by-port basis. The next layer of protection is established in the hardware, where the sum of network packets being directed to the CPU across all LAN ports is not allowed to exceed a fixed, Microsemi-defined (non-user adjustable) limit. In addition, the robust software firewall configurations limit the kinds of packets allowed to reach the CPU. Disallowed packet types are immediately dropped.

The advantage of multilayer protection is that it protects the S600 Series server from many of the effects of a DoS attack. This does not mean that a service-affecting DoS attack cannot be directed at the SyncServer; excessive traffic from illegitimate clients can result in reduction of service to legitimate clients. What it means is that if unexpectedly high levels of packet loading occur beyond user-defined levels, a notification is sent and the excess packets are dropped. If the SyncServer sends an alarm, the user should examine the legitimacy of the traffic loads directed at the server.

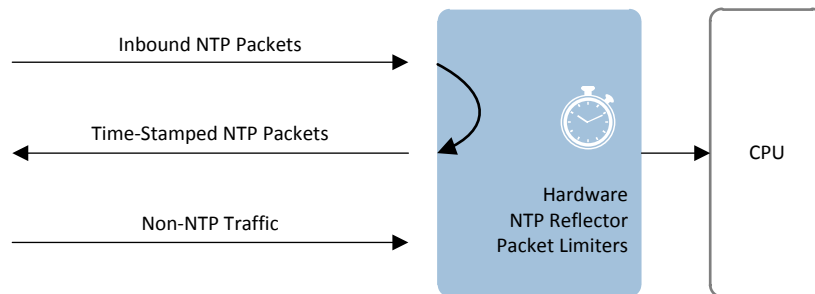For more information about the NTP Reflector™ technology, click here.

Figure 1 · **SyncServer S6xx (Denial of Service) Protection**

Enhanced IEEE 1588 Solutions for Partial Timing Support

Microsemi recently announced the availability of a phase-compliant embedded solution enabling IEEE 1588 across a wide variety of applications.

International Telecommunication Union (ITU) is the specialized agency of the United Nations for Information and Communication Technologies (ICTs). It has defined two Precision Time Protocol (PTP) telecom profiles for time and phase distribution:

- **G.8275.1**—Full Timing Support, which is intended for new-build networks and requires a boundary clock at every node in the network.

- **G.8275.2**—Partial Timing Support, which is intended for existing networks, and recommends boundary or transparent clocks at strategic locations to reduce noise but does not make them mandatory.

Some features of **G.8275.2** include:

- Operation over existing switches and routers using unicast IP

- Use of boundary or transparent clocks where necessary to clean up time signal when passing through the network

- Support for multiple active Grandmasters for redundancy

The API 4.7 release of Mirosemi's software suite adds support for the ITU-T G.8275.2 PTP profile for timing and phase with partial timing support. This is complemented by new enhancements to Microsemi's TimeProvider® series TP2700 and TP5000 PTP Grandmaster system product lines. The new updates provide significant benefits to customers, allowing them to implement phase synchronization in switches and routers in networks that are not completely phase-aware without having to replace unaware nodes or making any other major changes to the network infrastructure, thus reducing costs and improving time-to-market.

The new software release leverages Microsemi's synchronization expertise to provide a complete, high-performance synchronization solution enabling IEEE 1588 across a wide variety of equipment and applications. Target applications include carrier/edge routers and wireless backhaul, for which Microsemi's IEEE 1588 solutions have been deployed with all major tier 1 communications equipment manufacturers since the standard's inception in 2008.

Microsemi's TimeProvider series PTP Grandmaster systems are deployed in over 300 networks worldwide to support packet-based synchronization requirements in mobile networks. The new ITU-T G.8275.2 PTP profile for timing and phase with partial timing support is designed to be compatible with existing carrier networks and synchronization assets to add the additional time and phase support needed for evolving LTE requirements. With these devices, customers can leverage and expand their existing deployed solutions for PTP frequency synchronization to meet the new needs for time and phase synchronization.

End Market Corner

Improving Mobile Service Availability using Rubidium Holdover

Precise synchronization and timing are essential to mobile communication networks to ensure successful call-signal handoff, proper transmission between base stations, transport of real-time services, and compliance with radio frequency regulations. In traditional Time Division Multiplex (TDM) digital telecommunication networks, sync was maintained by employing two types of synchronization elements—Primary Reference Clocks (PRC) and distribution clocks—to provide synchronization over a physical path. The PRC use either a cesium oscillator or the Global Positioning System (GPS) to provide a reference signal for synchronization of other clocks within the network.

Regardless of the primary technology used to synchronize packet-based networks, rubidium technology can perform a critical function within the specified requirements of the base stations to support 4G/LTE services. To ensure continuous network operations, it is recommended that service providers deploy rubidium to ensure a holdover signal for GPS- and PTP-synced networks in case of a loss of communication with the reference signal. Holdover duration capability can range from several hours to several days depending on the oscillator technology (crystal or rubidium), environmental factors (temperature and temperature variation), and quality of the implementation (algorithms that account for and adapt to the effects of aging).

However, holdover requirements depend on the type, complexity, and operator requirements of the network architecture. The following table lists the synchronization requirements across different types of networks.

Table 1 · Types of Networks

Application	Frequency Transport/Air Interface	Phase
GSM	16 ppb/50 ppb	None
UMTS	16 ppb/50 ppb	None
CDMA2000	16 ppb/50 ppb	± 3-10 µs
LTE FDD	16 ppb/50 ppb	None
LTE TDD	16 ppb/50 ppb	± 1.5 µs

Under similar environmental conditions and within the price-to-performance ranges targeted for base stations, rubidium provides holdover performance significantly better than Crystal Oscillators (OCXO). Other important factors favoring rubidium holdover technology are:

1. The latest rubidium miniature atomic clocks are the same size and form factor as that of OCXO devices used for holdover, making it easy to embed in equipment designs.
2. Innovation has yielded lower power consumption, and power performance continues to improve.
3. Cost for rubidium clocks (though more expensive than OCXO) are on a steep decline: five years ago, the prices were double what they were two years ago, and technical innovation ensures continuation of the downward trend in prices today.
4. Rubidium has superior aging (5E-11/mo). This is the greatest contribution to holdover performance in a static environment.

Evolution of mobile networks demands better phase, and clocks play an important role in meeting this requirement. To meet the phase requirements of 1.5 µs and ensure continuous network operations, rubidium atomic clocks are required to deliver network holdover and protect the network when the sync signal is lost. Performance, power, and ease of implementation have come together to make rubidium atomic clocks an increasingly attractive option for base transceiver stations.

Potential GPS Outages due to GPS Testing

The Federal Aviation Administration (FAA) has issued an advisory warning that GPS was and will be unreliable on six days this month, primarily in the southwestern United States, due to GPS testing. The testing is expected to take place between 9:30 am and 3:30 pm Pacific Time on June 7, 9, 21, 23, 28, and 30.

The interference testing is centered on China Lake, California. The potential GPS interference stretches hundreds of miles in each direction, reaching the farthest at higher altitudes. Details of the FAA advisory can be found here.

The details of the interference testing are not publicly known. A customer's deployment of Microsemi systems mentioned in this newsletter provide redundancy and fault tolerance to protect a system's timing reliability in case of GPS reference loss. With rubidium, if GPS interference causes a Microsemi product to reject the GPS signal as a reference source, the system switches to an alternate input source or enter the holdover mode. This makes rubidium a recommended and preferred configuration for telecom and mobile applications. If a Microsemi system is affected by the interference testing and the system does not autocorrect (regain lock onto the GPS signal) after the testing period, the customer should contact our Technical Support staff for further assistance.

Microsemi systems use intelligent input selection algorithms, atomic oscillator technology, advanced packet timing distribution, network synchronization management, and monitoring to discern between the valid and faulty timing references.   With the proliferation of GPS (and other GNSS systems) as a primary reference source across tens of thousands of nodes across a mobile network, this kind of event is an example of the magnitude that GPS/GNSS vulnerabilities can cause without a secure back-up.

Microsemi continues to monitor the GPS signal using our technical staff and laboratory locations located 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.

If there are any questions regarding this anomaly and the recommended corrective action, please contact Technical Support or use the toll free number +1-888-367-7966 (select option 1).

Event Calendar

Recent 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 ranging from technical presentations to coverage on the latest market trends and predictions.

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 demonstrated the new SyncServer S600 with the security-hardened NTP Reflector for all enterprise solutions.

Space Symposium (Colorado Springs, CO): 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 presented a white paper at this conference titled "Precision Commercial of the Shelf (COTS) Quartz Oscillators for Space Applications," and also demonstrated the space-related applications of our products.

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

The International Frequency Control Symposium (IFCS) program consists of tutorials and sessions covering technical aspects related to timing. The symposium was attended by over 300 scientists and technologists who are leaders in the field, plus 20 international vendors. The conference was a unique opportunity for a close interaction between exhibitors and attendees, with the exhibition forming a significant part of the overall conference experience.

Small Cell World Summit (London, United Kingdom): May 10–12, 2016

SCWS is the only event that brings together the entire small cells ecosystem to share trial and deployment experiences, build lasting business relationships with qualified industry stakeholders and provide a platform for exciting new product launches and technological developments. The event is exclusively endorsed by the Small Cell Forum.

Microsemi showcased the IGM 1100i at the event. The product generated a lot of interest specifically because of the ease of installation and deployment.

MiFiD II Conference, (London, United Kingdom): May 26, 2016

Microsemi was a part of the MiFiD II Conference recently held in London. We presented a talk on "Challenges of Delivering High Quality Time," the aim of which was to address the stringent time and phase requirement for financial institutions.

SynCan 2016 (Toronto, Canada): May 26, 2016

SynCan is an event conducted by Microsemi and Empowered Networks (Microsemi's exclusive partner) to promote network synchronization in Canada. This year's agenda included discussion on:

- Design and implementation guidelines for PTP (IEEE 1588)
- Mitigating GPS vulnerabilities through Cesium and PTP asymmetry correction
- New integrated Grandmaster solutions for indoor and outdoor small cells

NIST Time and Frequency Seminar (Boulder, Colorado): June 2–10, 2016

NIST Time and Frequency Division's annual seminar covers clocks, oscillators, atomic frequency standards, rf and optical synchronization, optical oscillators, quantum information, optical cooling and heating; making precise frequency, time, phase-noise, and jitter measurements; and establishing measurement accuracy and traceability.

Microsemi was present at the event with a booth and showcased the entire range of products: both clocks and synchronization systems. All the products of SyncServers were received with special interest from customers.

WSTS 2016 (San Jose, California): June 13–16, 2016

The 25th Annual Workshop on Synchronization and Timing Systems (WSTS), sponsored by NIST and ATIS, is a vendor-neutral technology workshop that addresses evolving sync requirements as well as the

roll-out of new sync systems and standards and how this affects network operators and equipment manufacturers.

The IGM 1100i was on display at the event, generating a lot of interest from customers like Sprint and Softbank. The ease of deployment in existing buildings and location was a major point of interest for the customers. The newer variants of the IGM – IGM 1100o (outdoor installations) and IGM1100x (IGM with an option for external antenna) also drew a lot of interest, and are now available for shipment.

In addition to being a part of the presentations, Microsemi was the reception sponsor at the event. Topics presented included:

- Measuring and characterizing network time
- Enhanced PRTC (ePRTC) operating in the real world
- Update on PTP time transfer through United States Commercial Optical Telecommunications Network

Upcoming Events

ION GNSS (Portland, Oregon): September 12–16, 2016

ION GNSS+ is the world's largest technical meeting and showcase of GNSS technology, products, and services. This year's conference will bring together international leaders in GNSS and related positioning, navigation, and timing fields to present new research, introduce new technologies, discuss current policy, demonstrate products, and exchange ideas.

ISPCS (Las Cruces, New Mexico): October 12–13, 2016

The aim of the International IEEE symposium on Precision Clock Synchronization for Measurement, Clock, and Communiation (ISPCS) is to provide a forum for researchers and practitioners from the industry, academia, and governments involved in precise clock synchronization using IEEE 1588 or similar techniques and protocols to exchange ideas.

Latest Collateral

Application Note: Security-hardened NTP Reflector and Packet Limiting/Monitoring

Microsemi recently launched an application note detailing the security features of SyncServer S600 and S650. The NTP Reflector is an innovative design that provides excellent security by delivering the best possible NTP timestamps. The intent is to protect the SyncServer CPU from excessive network traffic Denial of Service (DoS) attacks in the process of providing extremely high-bandwidth, high-accuracy NTP operations.

Click here to download the application note.

Application Note: FlexPort Technology - SyncServer S6xx Series

Microsemi also released an application note on the innovative FlexPort technology in the new SyncServer S650 that allows on-the-fly configuration of input/output (I/O) signal types (such as IRIG time codes, pulse rates, and sine waves) for a bank of BNC connectors.

Click here to download the application note.

Microsemi in the News

- Epson and Microsemi Team Up to Deliver Compliant Network Synchronization Solutions for IEEE 1588-2008 and SyncE for Use in the Rapidly Expanding Packet Network Infrastructure

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