

PowerQUICC® and ColdFire® Integrate IEEE® 1588 Time Synchronization

Why Use IEEE® 1588 Time Synchronization?

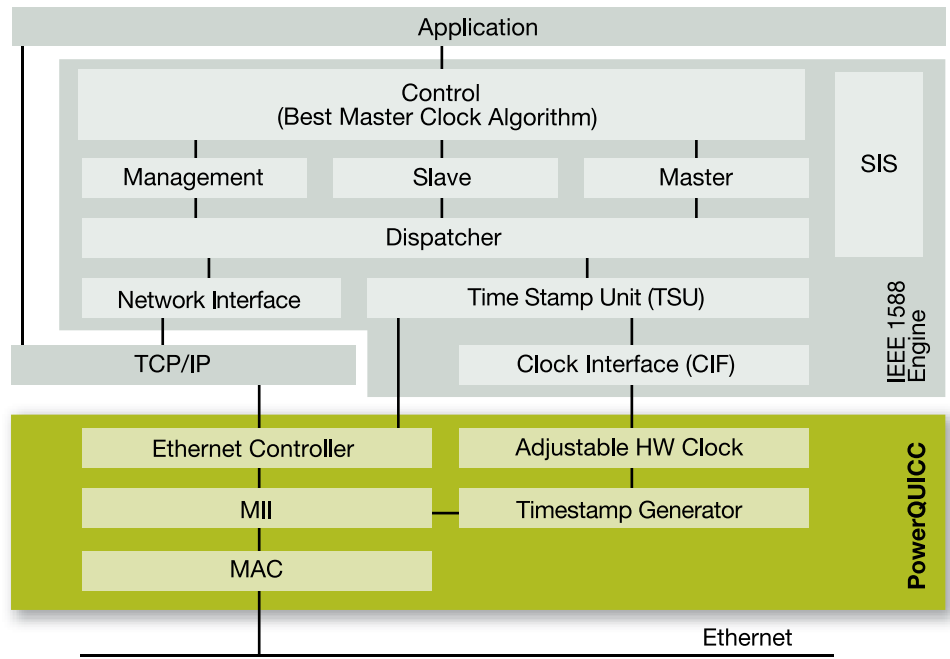
Typical applications for IEEE 1588 time synchronization include:

- Time-sensitive telecommunication services which require precision time synchronization between communicating nodes.
- Industrial network switches which synchronize sensors and actuators over a single wire distributed control network to control an automated assembly process.
- Powerline networks which synchronize across large-scale distributed power grid switches to enable smooth transfer of power.
- Test/measurement devices which must maintain accurate time synchronization with the device under test in many different operating environments.
- Audio or video equipment which must ensure customers don't hear or see the effects of packet delay or loss from Ethernet-connected speakers and monitors.

These applications require extremely precise clock synchronization between devices, with accuracy in the sub-microsecond range. It is a remarkable feature of IEEE 1588 that this synchronization precision is achieved via regular Ethernet connectivity using standard Ethernet frames—which must be assumed to be non real-time capable.

Moreover, this solution allows nearly any device of any performance to participate in high precision synchronized networks that are simple to operate and configure.

Figure 1—IEEE® 1588 Implementation on PowerQUICC® Processors



■ Freescale technology

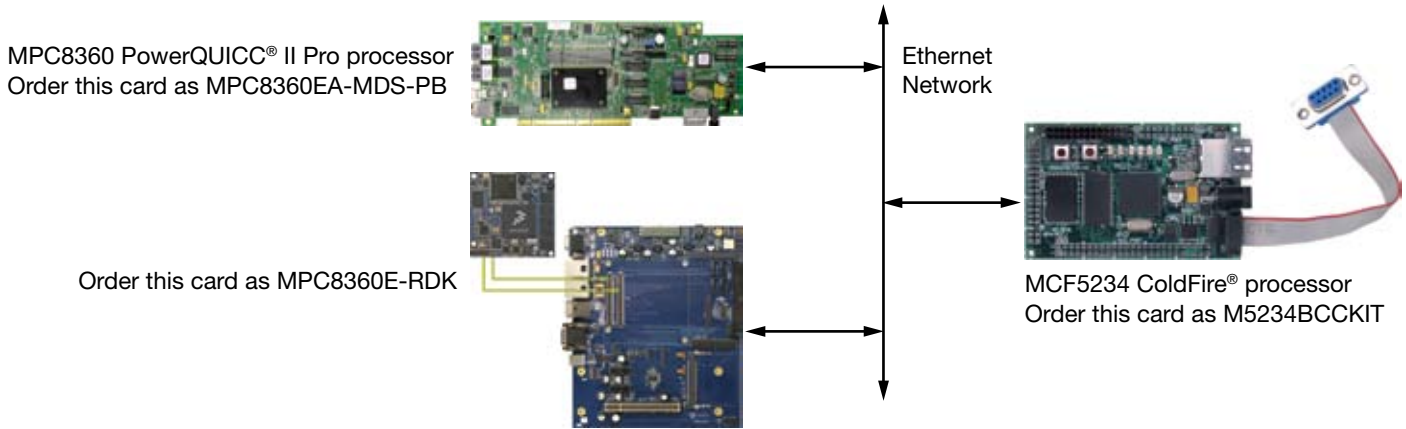
Other key benefits of IEEE 1588 protocol include:

- IEEE 1588 protocol enables rapid convergence (less than a minute) to sub-microsecond time synchronization between heterogeneous distributed devices with different clocks, resolution and stability.
- An IEEE 1588 network configures and segments itself automatically. Each node uses the “best master clock” algorithm (BMC) to determine the best clock in the segment. Every Precision Time Protocol (PTP) clock stores its features within a specified dataset.

These features are transmitted to other nodes within its “Sync” telegrams. Based on this, other nodes are able to synchronize their datasets with the features of the actual master and can adjust their clocks. Due to the cyclic running of the BMC, nodes can also be connected or removed during propagation time (hot swapping).

- Very simple configuration and operation with low compute resource and network bandwidth consumption.

Figure 2—Freescale IEEE® 1588 Evaluation Kits



Timing is Everything

Freescale QUICC Engine™ technology and Enhanced Triple Speed Ethernet Controller (eTSEC) are the first Freescale communications interfaces to optimize IEEE 1588 PTP in hardware. These new interfaces time-stamp Ethernet packets at the physical/datalink layer the instant they enter or leave the device. This results in the highest possible timing accuracy for PowerQUICC® devices that implement the increasingly popular IEEE 1588 protocol. The QUICC Engine and eTSEC are included in a wide range of PowerQUICC devices, such as MPC8360, MPC8313, MPC837x and other communications processors to be announced. These devices are designed to meet low- to high-performance power and price targets for every application that connects devices through Ethernet.

PowerQUICC processors integrate a 32-bit core, built on Power Architecture™ technology, with many popular peripheral interfaces including Ethernet, DDR/DDR2, USB 2.0, PCI, SPI, UART, Local Bus, I²C, security, GPIO, timers and interrupt controllers. Power ranges from one to eight watts. Performance ranges from 400 MIPS to 1250 MIPS. Price ranges from US \$15 to US \$100 in quantities of 10,000 units.

Freescale is collaborating with IXXAT, a leading industrial protocol vendor, to offer pre-configured commercial off-the-shelf total system solutions running the IEEE 1588 protocol.

The combined effort of IXXAT and Freescale provides simpler, more efficient system-level solutions to add time synchronization for networked elements. Figure 1 describes the hardware and software components of this joint solution.

For PowerQUICC or ColdFire® devices that don't yet support the hardware timestamp, customers may connect an IEEE 1588-enabled PHY. This solution is described for the ColdFire MCF5234 in the M5234BCKIT development kit.

What development tools, services and software are available?

Figure 2 describes some Freescale evaluation boards which support IEEE 1588. Customers may evaluate this solution by ordering the appropriate evaluation board, board support package and CodeWarrior® development tools (free* 30-day evaluation software package) from the product page for the desired

processor at www.freescale.com, together with the IEEE 1588 PTP protocol software from IXXAT at www.ixxat.com.

For production use, the IXXAT IEEE 1588 protocol stack can be licensed as full software source code which enables the user to customize the stack modules and interfaces to meet application-specific requirements. In addition, IXXAT offers hardware and software development services for customers who wish to customize IEEE 1588 onto their platform, built on Power Architecture technology, or to implement an entire solution or product using this and other industrial protocols.

IXXAT industrial protocols solutions are widely used in a variety of products from industrial automation leaders. For further information about the IXXAT IEEE 1588 protocol software, please contact Bill Seitz at IXXAT, Inc. at 603-471-0800 ext. 102 or via e-mail at seitz@ixxat.com.

More information about Freescale IEEE 1588 solutions is available at www.freescale.com/IEEE1588.

*Subject to license agreement and registration.

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