IEEE1588 Frequently Asked Questions (FAQs)

LAN Access Division

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Legal

Revisions

Date	Revision	Notes
12/01/2011	1.0	Initial Release (Intel Public).

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Frequently Asked Questions

This document contains a list of Frequently Asked Questions (FAQ) for IEE1588. Entries are not listed in any particular order or priority.

1. *Why should I use IEEE1588/PTP?*

IEEE1588 enables high-accuracy synchronization of clocks over the Ethernet. Other Ethernet protocols offer time synchronization, but not at the accuracies provided by IEEE1588.

2. *What is the difference between PTPv1 and PTPv2?*

PTPv2 introduces many features to IEEE1588 that add flexibility and accuracy to the standard. PTPv2 offers higher effective resolution when communicating time stamps and additional flexibility in communication, by introducing unicast messaging and more flexible sync message rates. Version 2 also adds transparent clock functionality, which enables two devices to synchronize accurately when separated by intermediate network devices.

3. *Does IEEE1588 work without special hardware?*

Yes, but not as accurately. The IEEE1588 standard does not require special hardware, and can be implemented completely in software. These software-only solutions are susceptible to delays and inconsistencies in the timing of time stamps, so its accuracy is severely limited. Under typical circumstances, high accuracy synchronization with IEEE1588 can only be achieved with device that supports hardware time stamps.

4. *What does it mean that my Ethernet device supports IEEE1588*

PTP's high accuracy is enabled by the use of hardware that supports time-stamping PTP packets. To eliminate variability in the delay of timing packets between devices, PTP-compliant Ethernet hardware records the time that PTP packets enter and exit the device and makes these time stamps available to PTP software. This enables the PTP application to use timing packets to accurately synchronize two clocks, without the inconsistent variability introduced by delays in the operating system and software stacks.

5. *How accurate is PTP?*

The accuracy of a PTP implementation is dependent upon several factors. Any number of the following can affect PTP accuracy:

- Accuracy of hardware time stamping, if used
- Algorithms to synchronize the clocks
- Network load
- Network topology and variability - if intermediate devices between synchronization nodes do not support PTP, variable delays in packet routing and queuing will cause inaccuracies in synchronization

6. *I just want time stamps for Ethernet traffic. Will a device that supports PTP work?*

Not necessarily. Some Ethernet NICs that support PTP only time stamp PTP packets and not all Ethernet traffic.

7. *What is the difference between one-step and two-step clocks?*

The number of steps associated with a clock denotes the steps required for the clock to exchange its time-stamp data. One-step clocks are capable of inserting the time-stamp data of outgoing packets into the packet itself, whereas two-step clocks send the time-stamps of packets separately. This is easily seen in sync packet transmission – one-step clocks insert the egress time stamp of sync packets into the sync packet itself, whereas two-step clocks send the egress time stamp of a sync packet in a separate "follow-up" packet.

8. *What are transparent clocks?*

Transparent clocks are a clock conception in IEEE1588 that enables high accuracy synchronization across complicated network topologies. Transparent clocks measure the delay that packets experience as they pass through the device, allowing the synchronization algorithms to account for delay in network devices. In practice, IEEE1588 compliant routers and switches are examples of devices that act as transparent clocks.

9. *Can Intel Ethernet devices be master or slave?*

Yes. Intel devices can be a master or slave. Intel networking devices provide the hardware time stamps necessary for accurate synchronization, but don't execute the protocol algorithms. The determination of master or slave occurs at the software level.

10. *Can Intel Ethernet devices be grandmaster clocks?*

Intel devices can be grandmaster clocks. Intel networking devices provide the hardware time stamps necessary for accurate synchronization, but don't execute the protocol algorithms. The determination of grandmasters occurs at the software level.

11. *What ISV's have you tested with?*

We have partnered with several Independent Software Vendors (ISV) to support Intel devices with several different versions of operating systems. Please contact your Intel representative to determine what company we recommend for your configuration.

12. *What operating systems support PTP?*

Currently, no operating system has full support for PTP similar to support for other protocols such as NTP. The only operating system that has some level of support is Linux, with kernels 2.6.30 and newer. Starting with version 2.6.30, the Linux kernel provided an interface for applications to easily access NIC hardware timestamps. Starting with version 3.0.0, the kernel additionally provided an interface to other PTP functions of NICs such as hardware clock tuning. This support in newer Linux kernels makes PTP application development easier by providing a standard interface to PTP functions in Ethernet hardware, but a PTP application must still be used to operate PTP.

In operating systems other than Linux, the PTP application does not have the programming interface to the hardware, so more software development is required to access hardware PTP functions. But, PTP applications can be developed for any operating system.

13. *I heard that Linux 3.0 includes support for PTP. Do I still need a PTP application?*

In Linux, kernels later than 3.0.0 provide an improved interface for PTP applications to access time stamps from the software device driver, but a PTP application is still necessary.

14. *I use (Windows/Linux), what do I need to use PTP?*

In both operating systems, a PTP application is required to use PTP. The level of the software device driver and operating support determines how deep the PTP application must reach toward the hardware to access time stamps, but PTP applications that use hardware time stamping do exist for both operating systems. PTP Linux applications can take advantage of Linux's interface to PTP hardware clocks, while PTP Windows applications much interact directly with the hardware to obtain time stamps and use other PTP hardware functions.

15. *Do Intel software device drivers support PTP?*

Currently, Windows operating systems provide no support for IEEE 1588, and support in Linux is only emerging. Because of this, the only software device drivers that support IEEE1588 are the Linux drivers for the 82576, 82580, and I350 controllers. These software device drivers provide an interface for the operating system and PTP applications to the time stamping functions in the Ethernet controller, but do not currently provide an interface to tune the internal clock. Driver support for other devices is coming soon.

Although software device driver support does not exist for all devices and all operating systems, PTP applications in any operating system can still use the Intel hardware time stamping functionality in any device by interacting directly with the Ethernet controller. PTP applications for Intel-based NICs exist for both Windows and Linux.