



IEEE 1588 PTP

IEEE 1588 PTP Introduction

The IEEE 1588 standard is known as "Precision Clock Synchronization Protocol for Networked Measurement and Control Systems" or "PTP" for short. PTP defines a procedure allowing many spatially distributed real-time clocks to be synchronized through a "package-compatible" network (normally Ethernet). The technology behind the standard was originally developed by Agilent and was used for distributed measuring and control tasks. The challenge was to synchronize networked measuring devices with each other in terms of time so that they are able to record measured values and provide them with a precise system time stamp. Based on this time stamp, the measured values can then be correlated with each other.

Synchronization principle

In Ethernet systems, unpredictable collisions due to the CSMA/CD procedure may lead to time packages being delayed or disappearing completely. For this reason, IEEE 1588 defines a special "clock synchronization" procedure.

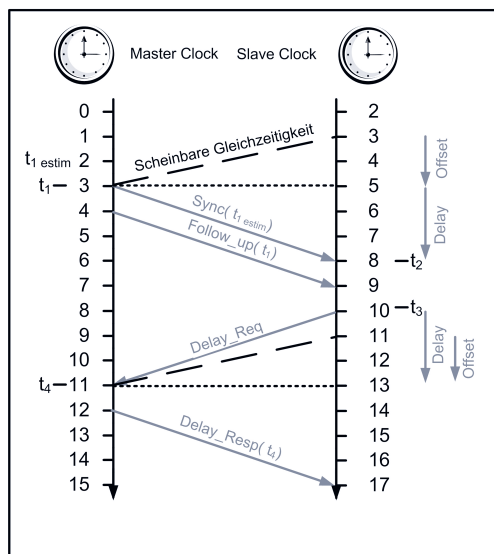
First, one node (master clock) transmits a "Sync" telegram, which contains the estimated transmission time. The exact transmission time is captured by a clock and transmitted in a second "Follow Up" message. Based on the first and second telegram and by means of its own clock, the receiver can now calculate the time difference between its clock and the master clock. To achieve the best possible results, the time stamps should be generated in hardware or as close as possible to the hardware.

The telegram propagation time is determined cyclically in a second transmission process between the slave and the master ("delay" telegrams). The slave can then correct its clock and adapt it to the current bus propagation time.

Configuration

A PTP network configures and segments itself automatically. For this, each node uses the "best master clock" algorithm (BMC) in order to determine the best clock in the segment. Every 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 accordingly. Due to the cyclic running of the BMC, nodes can also be connected or removed during propagation time (hot plugging).

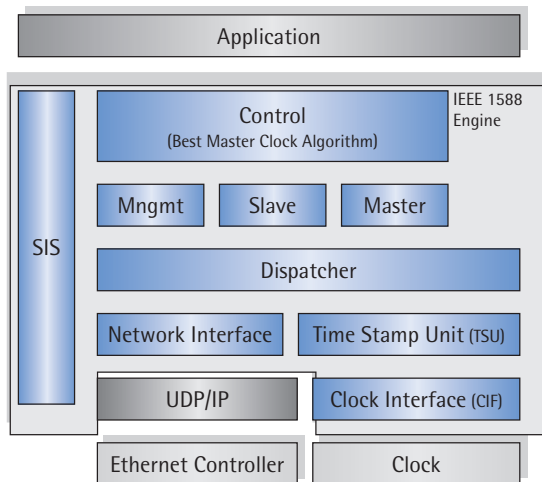
No distinction is made in the protocol between a software clock and a hardware clock. However, to be able to work with synchronism in the nanosecond range, hardware support is required. Generally, the synchronization errors – caused by software jitter – cannot be eliminated. With a pure software solution (e.g. Windows systems), the error may actually be in the micro- or milli-second range.





IEEE 1588 PTP Protocol Software

The IEEE 1588 protocol software enables simple, rapid development of IEEE 1588 compliant devices. Developed by IXXAT, the IEEE 1588 protocol software has a modular structure, insuring fast integration into the target system. For access to the UDP/IP socket, the interfaces to the target platform are compiled in a separate adaptation layer (network interface), considerably simplifying porting to the target system.



The software is completely independent of the operating system and therefore, can also be used in applications without an operating system (superloops). The only requirement is a multicast-compatible UDP/IP stack.

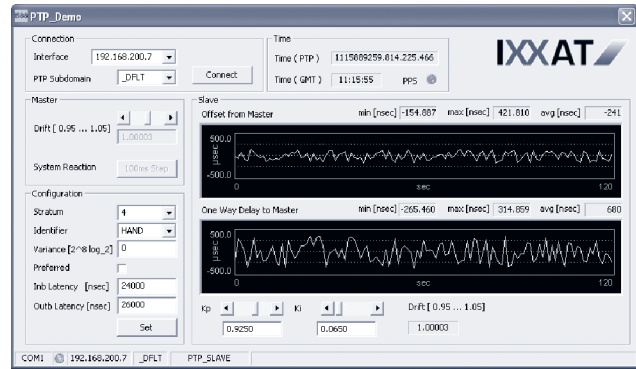
FUNCTIONALITY

The IEEE 1588 software package includes a full implementation of the standard for Ethernet with the following functionality:

- Ordinary clock
- Boundary clock
- Best master clock algorithm
- Configuration and scaling via central configuration file
- Management API

WINDOWS DEMO IMPLEMENTATION

Included in the software package is a demo implementation of a software-only solution that can be run directly under Windows. The demo implementation provides the basis for the IEEE 1588 Windows demo, which can be downloaded for free from the IXXAT webpage. System time, time delay and other relevant information are displayed with the Windows demo program.



SAMPLE IMPLEMENTATION FOR LINUX

The content of delivery also includes a sample implementation on a target with IEEE 1588 hardware support. The target is a MPC8360 from Freescale with PowerQUICC technology. The PowerQUICC MPC8360 has 2 eTSEC (Enhanced Triple Speed Ethernet Controller). By capitalizing upon its hardware integrated time unit and system clock, a nano-second time precision can be achieved with a CPU workload of less than one percent. Furthermore, the MPC 8360 has input/output trigger ports and a PTP based timer, allowing each application to use this precise time base on a nano-second level.

CONTENT OF DELIVERY

- Source code
- Software license
- Manual
- Demo implementation for Windows 2000/XP
- Sample implementation for PowerQUICC MPC8360 (with hardware support)
- Windows demo program
- Technical support

ADDITIONAL SERVICES

(not included in the content of delivery)

Maintenance agreement

As a supplement to the software package, IXXAT offers a maintenance agreement that includes the provision of the following services for the term of the agreement:

- Free updates and troubleshooting
- Adaptation to the latest standard
- Technical support

Code introduction

IXXAT also offers a one-day introduction to the code that focuses on interfaces, processes and data flows in the IEEE 1588 software. Specific questions concerning the adaptation can also be answered while direct adaptations to the code can also be carried out.

Implementation support

As an additional program offering, IXXAT can also handle the adaptation, implementation and testing of the IEEE 1588 software on your system.