

Time Synchronization



APPLICATION NOTE

How the TimeSynch option provides time synchronization for XenaBay and XenaCompact test chassis.

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One-way testing of an Ethernet path through a network with two test instruments at each end of the path gives useful information on the tested parameters split by direction. This makes it easy to see differences in performance and characteristics for the two directions. One of the relevant parameters to test is the latency, and this measurement represents a challenge in the case of the one-way testing. The latency measurement requires that the clocks of the two instruments are synchronized: To measure latency one instrument sends a test packet with information on the time the packet left the instrument. The receiving instrument can calculate the difference between the time in the packet with its own, current time. If the clocks of the two instruments are synchronized the calculated difference is the one-way latency, otherwise the result is unpredictable.

One-way latency testing is not the only test application where synchronization of clocks in test instruments is required. For multi-site protocol analysis it is essential that time stamps in captured protocol packets are synchronized as this makes it possible to follow the information flow through the network. The same applies when synchronized traffic start on a number of test instruments is required.

Several solutions exist for synchronizing the clocks in the two instruments. Each instrument can be equipped with a Global Positioning System (GPS) receiver, which can give precise, synchronized time information to the two instruments. Alternatively time synchronization can be based on the following protocols: The Precision Time Protocol (PTP) or the Network Time Protocol (NTP).

Time Synchronization of Teledyne LeCroy Xena testers

Time synchronization of your Xena testers is very flexible and can be configured as follows:

- One tester may act as a time server that provides the time reference to the other testers (and other devices in your network) using PTP and/or NTP (figure 1)
- Each tester may obtain its own time from an external PTP, NTP or GPS source (figure 2)

Communication for NTP/PTP synchronization is handled through the Management interfaces (Mgmt) in the testers.

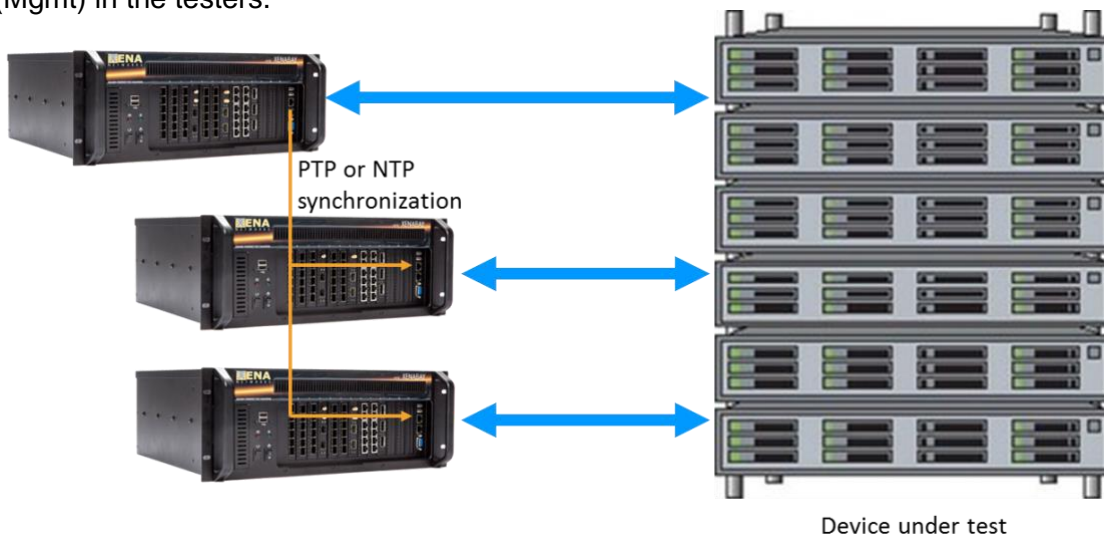


Figure 1: Lab scenario: One test chassis synchronize time in other test chassis

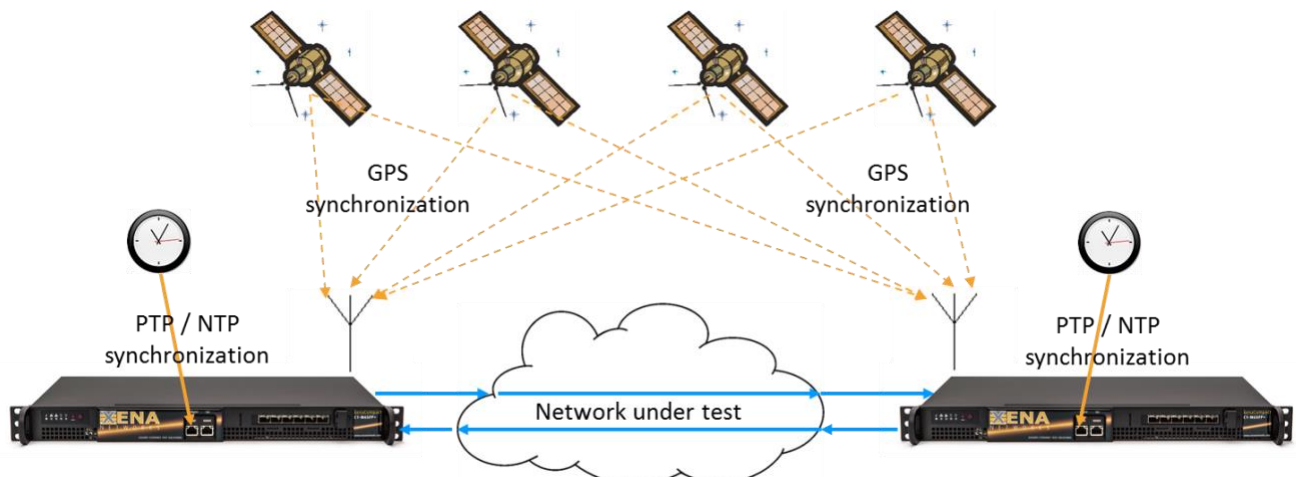


Figure 2: WAN scenario: Test chassis synchronize time using GPS signals and/or NTP/PTP servers

FSMLabs TimeKeeper

TimeKeeper is an advanced time synchronization solution from FSMLabs. The XenaTimeSynch option uses the TimeKeeper to keep the local time on each Teledyne LeCroy Xena test chassis synchronized. The TimeKeeper solution must be installed on each Teledyne LeCroy Xena chassis that require the time synchronization. The TimeKeeper runs as a separate service on the Teledyne LeCroy Xena chassis but is configured and monitored through the XenaManager.

Licensing

Each Teledyne LeCroy Xena chassis running the TimeKeeper solution will require a software license. The license is time-limited and must be periodically renewed for the TimeKeeper solution to continue to work.

The TimeKeeper license comes in two types: A *client-only license* that only allows the Teledyne LeCroy Xena chassis to synchronize its time from an external source and a *full license* (aka. a *server license*) that in addition allows the Teledyne LeCroy Xena chassis to serve time to other chassis.

Contact [Xena Sales](#) for details on the availability and pricing of the TimeKeeper licenses.

License Scenarios

Local Datacenter Scenario

If you have a number of co-located Teledyne LeCroy Xena chassis in the same physical location and connected to the same local network you can use one of the chassis as a time server (see figure 1). This chassis can then serve time to the rest of the network, including but not limited to the other Teledyne LeCroy Xena chassis. The best results will be obtained by using PTP between the Teledyne LeCroy Xena chassis.

If you have N chassis you will need:

- One full TimeKeeper server license
- Optionally: One SpectraTime GPS module to be installed in the time server plus one antenna
- N-1 client-only TimeKeeper licenses

If it is important that the chassis are synchronized to the actual time-of-day, you can configure the time server to synchronize to a public NTP server. If a very accurate local time is needed you can optionally equip the time server chassis with a SpectraTime GPS module and an antenna to synchronize to the GPS.

Note that the SpectraTime GPS module must be purchased and installed through Teledyne LeCroy Xena

Remote Networked Scenario – NTP Synchronization

If you have two or more Teledyne LeCroy Xena chassis in remote locations which are connected to the Internet you can then use a public NTP service to synchronize each of the chassis. Please note that using a public NTP server will most likely be less accurate than the other solutions.

If you have N chassis you will need:

- N client-only TimeKeeper licenses.

Remote Scenario – GPS Synchronization

If you have two or more Teledyne LeCroy Xena chassis in remote locations without access to a public NTP server or you need more accurate time synchronization than what you can get from the NTP server, you can equip each chassis with a GPS module plus an antenna and synchronize the time to the GPS.

If you have N chassis you will need:

- N client-only TimeKeeper licenses
- N GPS modules to be installed in each tester plus N antennas.

Note that the SpectraTime GPS module must be purchased and installed through Teledyne LeCroy Xena

GPS Module

To get GPS synchronization you will need the SpectraTime GPS module installed in each chassis. When this module is installed the chassis will be equipped with a SMA connector for the GPS/GNSS antenna signal input. The antenna is needed to receive the GPS signal and input it to the GPS module.

Note that the SpectraTime GPS module requires a TimeKeeper Client or Server license to become operational

Note that the SpectraTime GPS module must be purchased and installed through Teledyne LeCroy Xena

Note that the antenna is not included and must be purchased separately.

The antennas that can be used with the SpectraTime GPS module are:

- [DLGPS-E2](#) from Dolin Electronics (patch antenna)
- [TW3012](#) from Tallysmann (rooftop antenna)

TimeKeeper Client Configuration

The TimeKeeper configuration is accessed as part of the chassis resource property page. If the TimeKeeper Client solution is installed on the chassis you can access the **Time Service Configuration** page (figure 3).

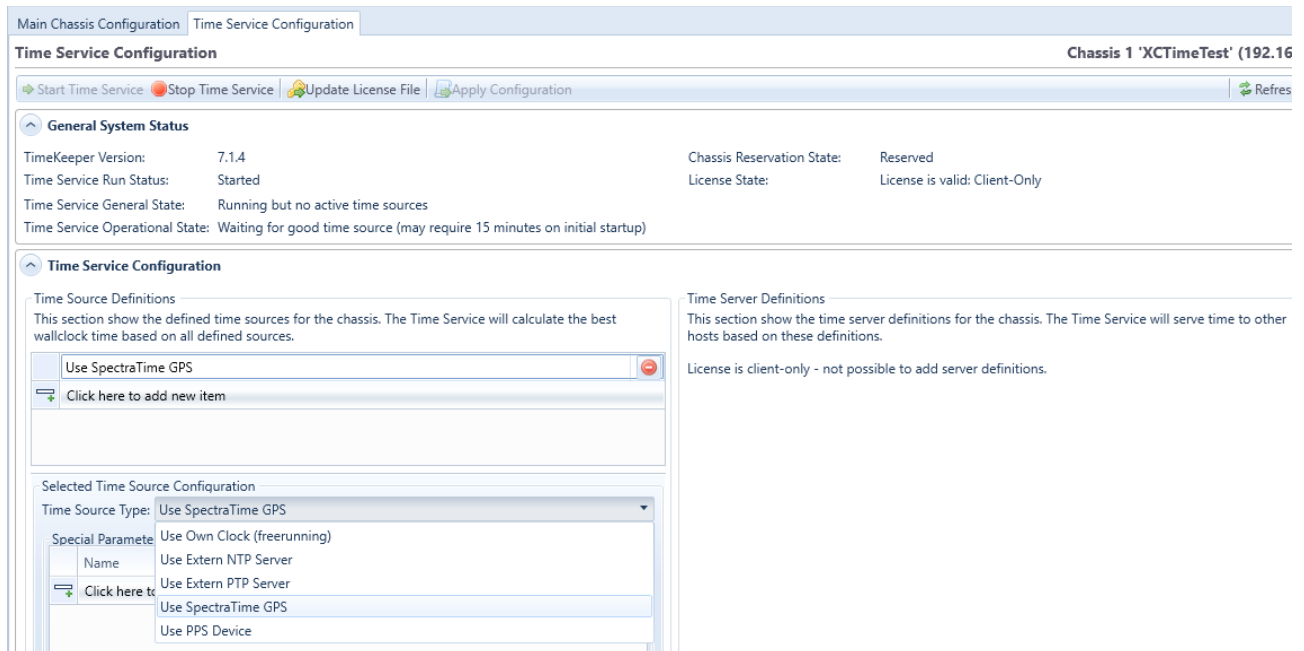
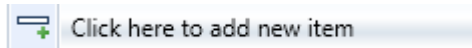


Figure 3: Time Service Configuration for a TimeKeeper client configuration

To get to the Time Service Configuration page:

- Start the XenaManager
- Add the chassis if required
- Select the chassis in the XenaManage Testbed explorer window, right-click on it and Reserve Chassis
- Select the Resource Properties tab
- Select the Time Service Configuration tab; you will now see the Time Service Configuration page
- In the section “Time Source Definitions” you can add time sources as required by clicking:



When a time source is added it will default to “Use Own Clock (freerunning)”. This can be changed in the “Selected Time Source Configuration” section. As you can see in figure 3 the following time sources can be selected:

- Use Own Clock (freerunning)
- Use external NTP server
- Use external PTP server

- Use internal SpectraTime GPS module (i.e. the optional GPS module mentioned above)
- PPS Device – is not supported

Once the desired new time source has been selected, parameters relevant for the selected time source (like addresses for NTP/PTP servers) can be entered in the “Selected Time Source Configuration” section.

TimeKeeper Server Configuration

If the TimeKeeper Server solution is installed on the chassis you can access the **Time Service Configuration** page, which can look as shown in figure 4.

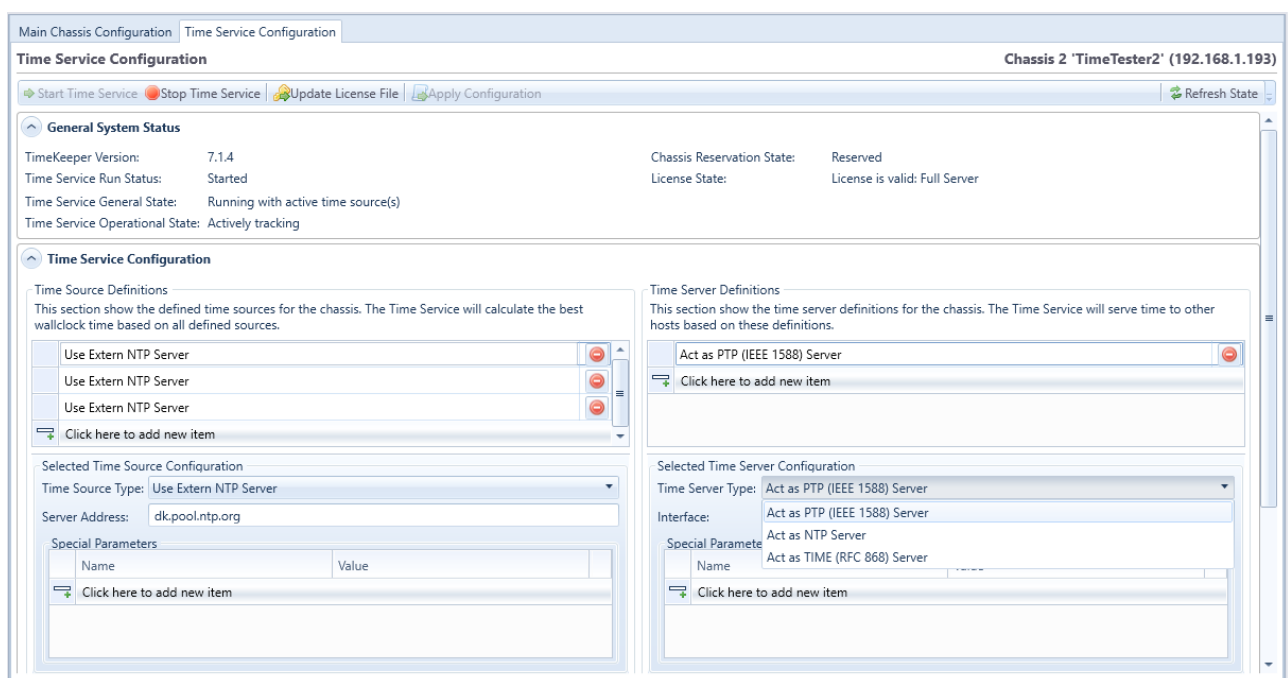


Figure 4: Time Service Configuration for a TimeKeeper server (and client) configuration

In Time Service Configuration page you can define the server settings. In the “Time Server Definitions” section you can add definitions. In the “Selected Time Server Configuration” section you can choose the “Time Server Type” as one of the following:

- Act as PTP (IEEE 1588) Server
- Act as NTP Server
- Act as TIME (RFC 868) Server

As you can see in the “Time Source Definitions” Section the chassis in this case also act as a client: It synchronizes its clock signal to 3 external NTP servers.

Test Module Configuration

By default each test module will use its own internal clock for latency timestamps and scheduling traffic start. The internal module clock is synchronized with the general clock on the chassis but two or more chassis will of course not share the same clock.

Enabling External Clock Sync

Perform the following steps to enable each test module to synchronize to the TimeKeeper clock:

- Reserve the test module you want to configure.
- Select the Resource Properties tab
- In the “Timing Configuration” section set “Timing Source” to “Lock to External Time”

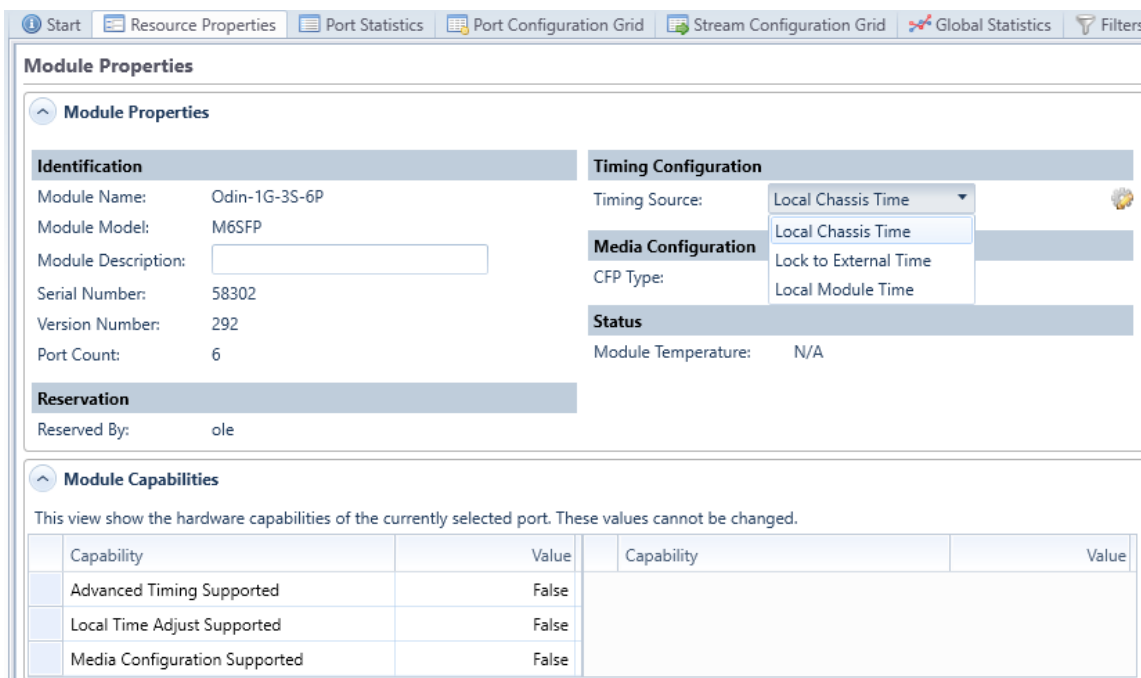


Figure 5: Select “Timing Source” in the “Timing Configuration” section

When “Lock to External Time” is selected, the “Timing Configuration” section now includes information with which you can monitor the clock synchronization accuracy.

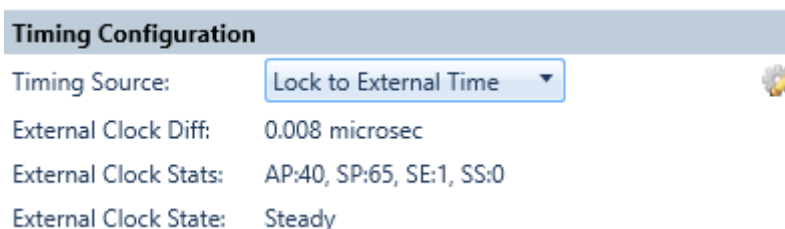


Figure 6: Clock synchronization accuracy monitoring

Name	Explanation
External Clock Diff	The currently measured difference between the TimeKeeper time and the local module time
External Clock Stats	Statistics counters: <ul style="list-style-type: none">• AP: Number of polls when in “Adjusting” state.• SP: Number of polls when in “Steady” state.• SE: Number of state transitions to “Steady” state.• SS: Number of “spikes” seen when in “Steady” state.
External Clock State	One of the following: <ul style="list-style-type: none">• Adjusting: The module clock is adjusting to the TimeKeeper time• Steady: The module clock has been within +/- 500 nsec from the TimeKeeper time for the last 5 seconds

Table 1: Clock synchronization accuracy monitoring parameters