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Time synchronization with an online NTP server for SIMATIC S7-1500 Controller

SIMATIC S7-1500 / FW 2.9.2 / Time
synchronisation

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1 NTP Client functionality with S7-1500 and Firmware V2.9 onwards

Overview

With TIA Portal V17, several improvements regarding NTP functionality on the SIMATIC controllers have been introduced. Specifically:

1. The ability to use a Fully Qualified Domain Name "FQDN" is to connect to the NTP server instead of its IP address.
2. The ability to use a pool of NTP server addresses. This ensures that the time synchronization will continue even if one or more NTP servers are not reachable anymore. The time will be automatically synchronized using the next available NTP server in the pool.

For this document, NTP Pool Project was used as an example on how to synchronize time with NTP server via internet www.ntppool.org. Any trusted NTP server can be used.

NOTE

FQDN is the complete domain name of a computer, server, or a website on the internet. Each device that has an FQDN also has an IP address. The FQDN is mapped to the IP address of the device by means of Domain Name System "DNS". When the user wants to communicate with a device via FQDN, the request is firstly sent to a DNS server, which returns the IP address of the device to the user.

Requirements

1. S7-1500 from V2.9.2 or higher.
2. Router with internet access.
3. Any trusted NTP server.
4. Engineering Station (PG) with TIA Portal V17 installed.

Benefits

Benefits for users:

- "DNS" mechanism allows to address NTP servers also organised as pools which are located in the internet.
- If one of the NTP servers of a pool fails, the pool will redirect the NTP request from the CPU to another server in the pool instantly.
- The CPU can connect to up to 4 pools at the same time.
This reduces the failure rate of time synchronization.
- Thanks to the name-based resolution it is not necessary in the local plant to work with IP addresses and can use name resolution if a DNS server is available and configured on the CPU.

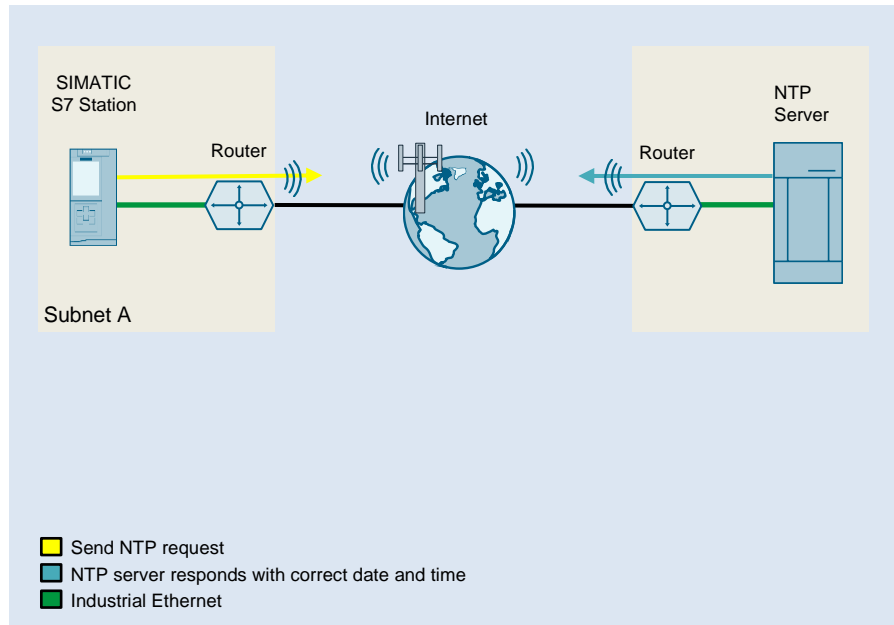
Applicative implementation

1. CPU and router are in the same IP Subnet.
2. CPU must be parameterized with a DNS server and a router.
3. On the router, the NTP traffic of the SIMATIC S7 station must be allowed to pass the firewall.

1 NTP Client functionality with S7-1500 and Firmware V2.9 onwards

4. Functional and trusted NTP servers on the internet.
5. The NTP server will send correct date and time when requested by CPU.

Schematic representation



2 Engineering

There are two possibilities to use an NTP server on the SIMATIC:

1. The use of NTP server FQDN.
2. The use of NTP server IP address.

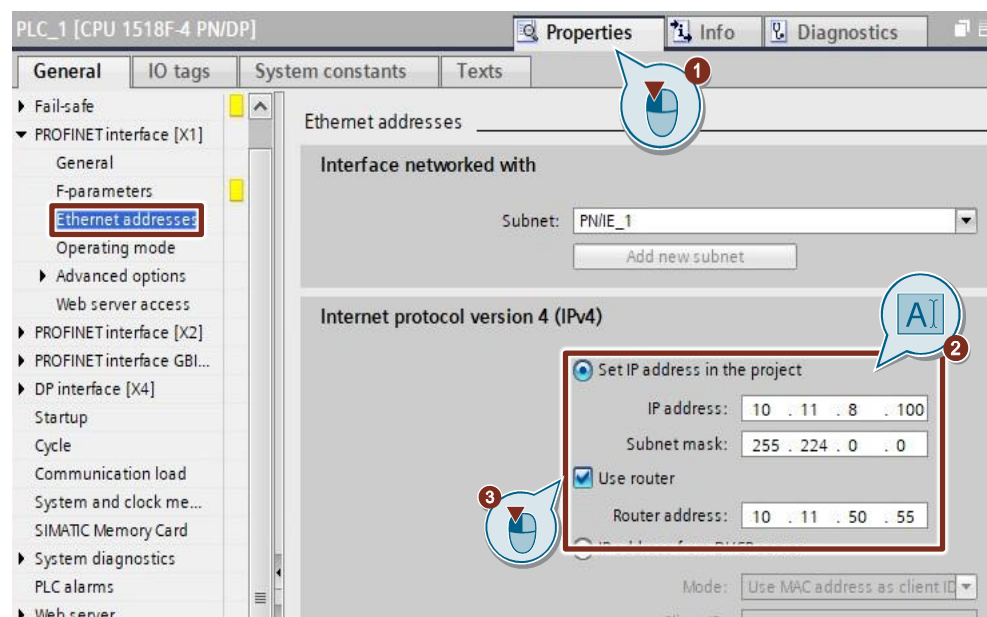
Both methods are explained in the following chapter.

2.1 Configure NTP using FQDN of NTP server

2.1.1 Create TIA Portal Project

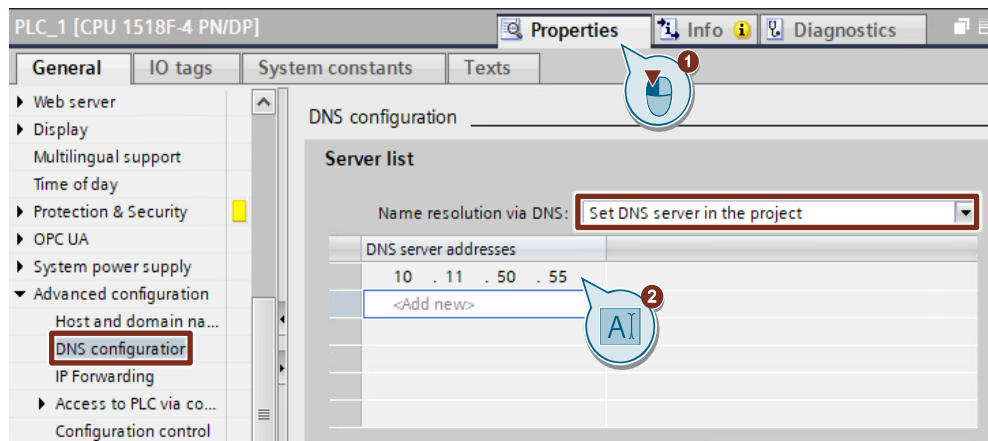
It is required that the PROFINET interface of CPU and router are parameterized.

1. Open the CPU properties menu.
2. Navigate to "General > PROFINET Interface [X1] > Ethernet addresses".
3. Enter the IP address and the Subnet mask of the CPU. Activate the checkbox "use router" and enter the IP address of the gateway.



2.1.2 DNS server parameterization

1. Open the CPU's properties menu and navigate to "General > Advanced configuration > DNS configuration". Navigate to drop down menu of "Name resolution via DNS" and click "Set DNS server in the project"
2. Enter the DNS server address.

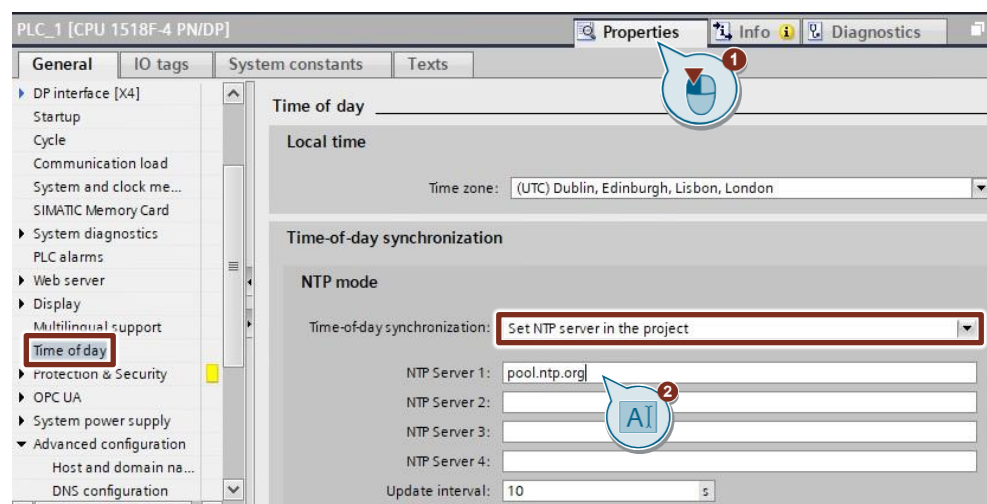


2.1.3 Configure NTP using FQDN

FQDN "pool.ntp.org" is being used as an example, however, any trusted NTP server can be used.

1. Open the CPU's properties menu and navigate to "General > Display > Time of day".
2. Navigate to drop down menu of "Time-of-day synchronization" and click "Set NTP server in the project".

Finally, enter the FQDN of the NTP Server.



3. Compile and download the project into CPU.

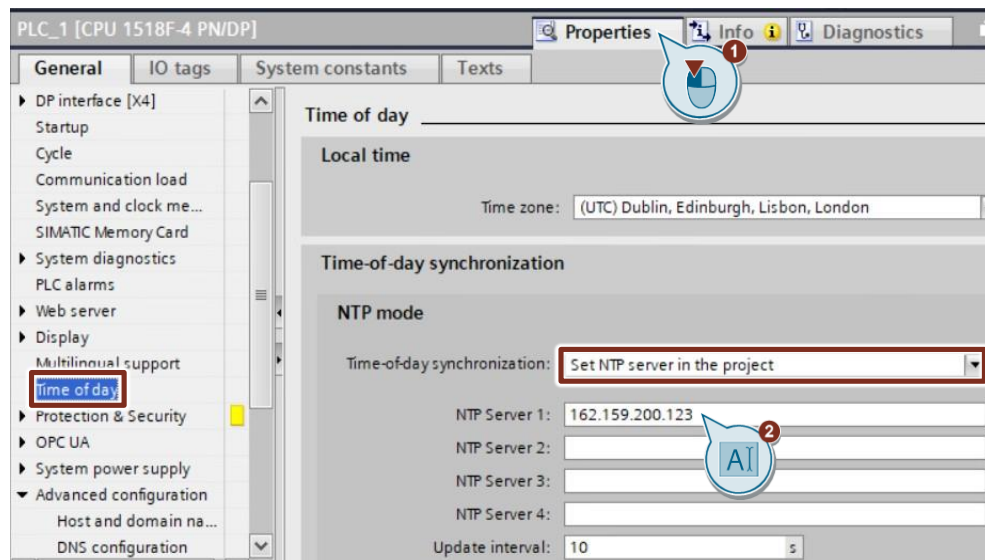
2.2 Configure NTP using IP addresses

Apart from using FQDN of an NTP server, an IP address of an NTP server can be used as an alternative.

It is possible to make use of all 4 NTP servers. This will ensure time synchronization if one of the NTP servers goes offline.

1. Open the CPU's properties menu and navigate to "General > Display > Time of day".
2. Navigate to drop down menu of "Time-of-day synchronization" and click "Set NTP server in the project".

Finally, enter the IP address of NTP Server.

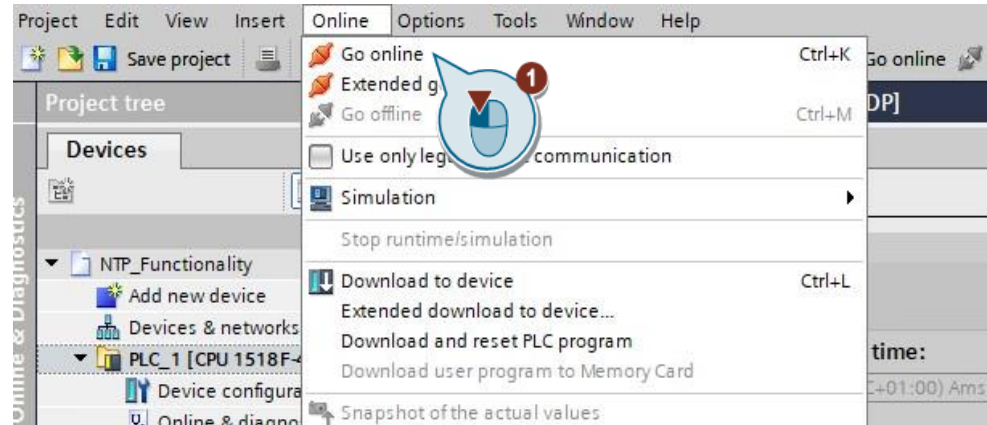


3. Compile and download the project into CPU.

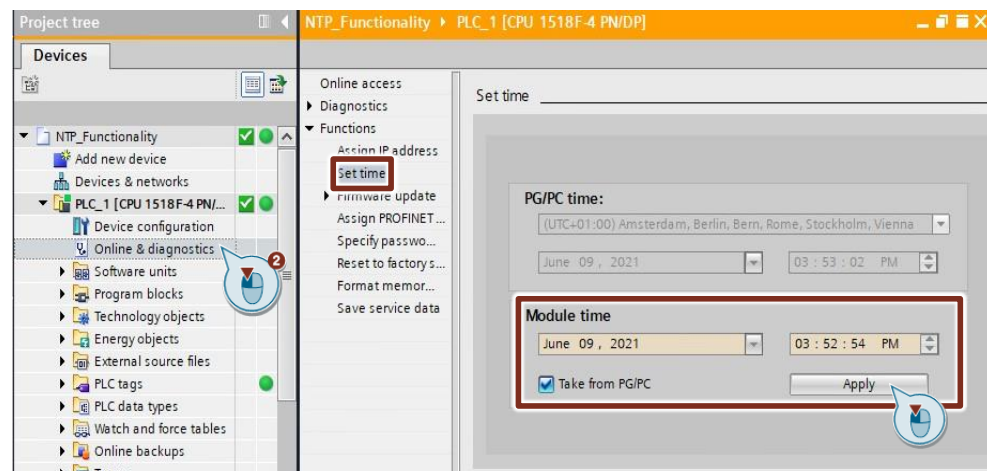
2.3 Test NTP functionality

The goal of this test is to check if the local time of the CPU matches the time obtained from the NTP server.

1. Go online on the CPU.



2. To test functionality of NTP server navigate to "Online & diagnostics" in project tree.
3. "Online & diagnostics > Function > Set time".
4. Set a wrong time, click apply.



5. After the configured NTP update interval of the CPU (in this case 10 seconds), the NTP server will issue the correct time.

NOTE

The Online Function "Set Time" consists of the following parts:

- Programming device / PC time

Here the time zone setting, the current date and the current time setting of your programming device / PC are displayed.

- Module time

Here the date and time values currently read from the module (for example the CPU), are converted to local time and date and displayed.

This means, the CPU synchronizes the time with the NTP server "if configured" then TIA Portal reads the time from the CPU and convert it to the local time zone configured on the PG then displays it.

If the "Take from PG/PC" check box is selected, when you click the "Apply" button, the date and the PG/PC time converted to UTC are transferred to the module.

If the "Take from PG/PC" check box is not selected, you can assign the date and time for the integrated clock of the module. After clicking the "Apply" button, the date and the time recalculated to UTC time are transferred to the module.