FAQ • 12/2015

PROFINET IO Communication

https://support.industry.siemens.com/cs/ww/en/view/109479139

This entry is from the Siemens Industry Online Support. The general terms of use (http://www.siemens.com/terms_of_use) apply.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (cell protection concept, for example) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit http://www.siemens.com/industrialsecurity.

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit http://support.automation.siemens.com.

Contents

1 Introduction

Ethernet is the established standard in the IT world for data exchange (IEE 802.3).

PROFINET (Process Field Network) is the open Industrial Ethernet standard of PROFIBUS & PROFINET International (PI) for automation. PROFINET uses TCP/IP and IT standards, is real-time Ethernet compatible and enables the integration of field bus systems.

PROFINET requires 100 Mbit/s full duplex, in other words communication is simultaneous in two directions. However lower baud rates are also accepted with PROFINET; for example, if you increase the update time, PROFINET via WLAN is possible. WLAN has 54 Mbit/s half duplex shared.

PROFINET is always "switched Ethernet".

The network load can always be influenced via the topology.

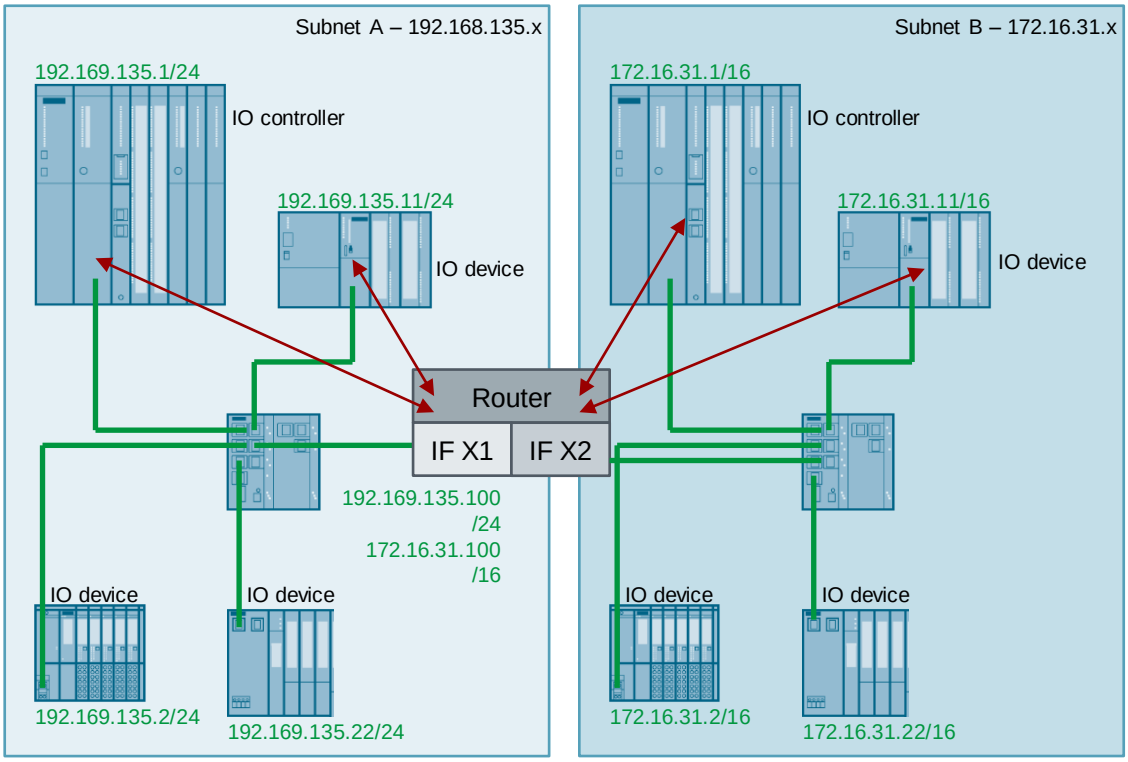
2 PROFINET Networks

This entry shows plant structures in which cross-subnet PROFINET IO communication is possible.

2.1 Cross-subnet Communication via Router

The figure below shows the structure of a PROFINET network in a plant in which two different IP subnets are connected with each other via a router.

Figure 2-1



When you connect two IP subnets with each other via a router, you can use the following communication services for data exchange between Subnet A and Subnet B:

- Open User Communication (OUC): TCP, UDP and ISO-on-TCP.
- S7 Communication.
- IP communication, HTTP, for example.

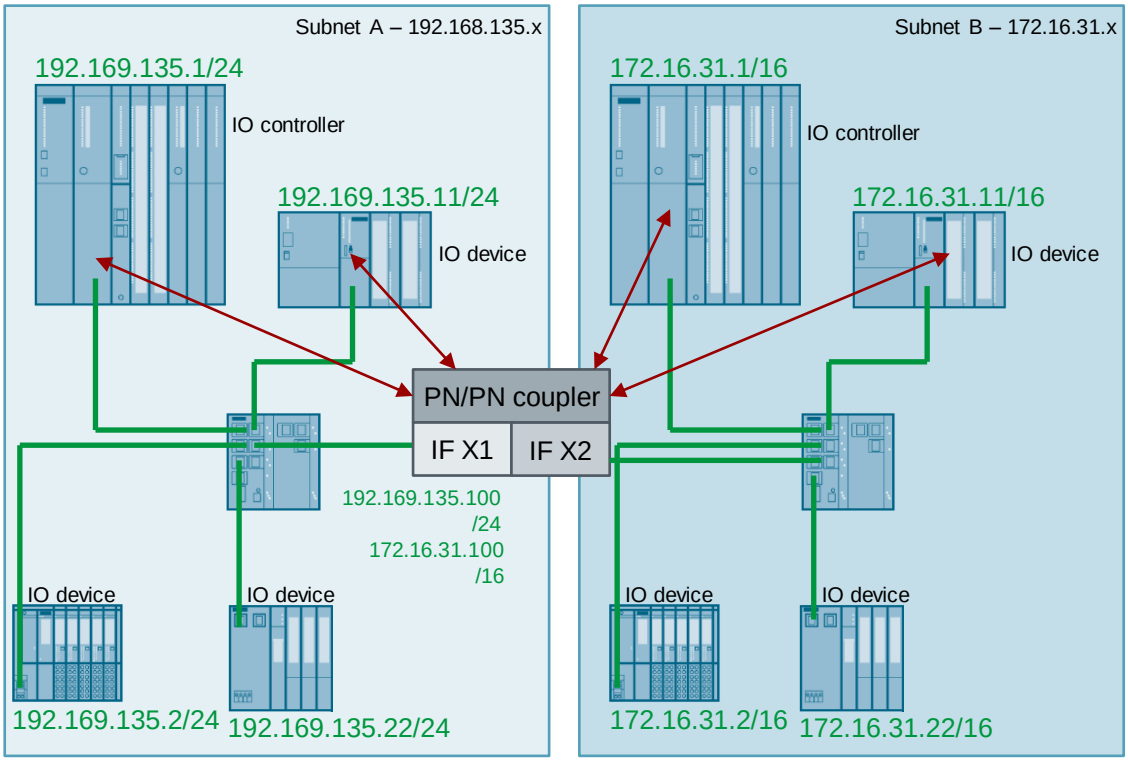
Cross-subnet communication via router has the following restrictions:

- You need special hardware (router).
- PROFINET communication via router is not possible; this means that real-time communication between both IP subnets is not possible.
- A central PG cannot assign IO devices names across subnets.

2.2 Cross-subnet Communication via PN/PN Coupler

The figure below shows the structure of a PROFINET network in a plant in which two different IP subnets are connected with each other via a PN/PN coupler.

Figure 2-2



PROFINET / IE
PROFINET communication
IF: Interface

The PN/PN coupler has two interfaces (IF X1 and IF X2). Each interface has 2 ports. IF X1 and IF X2 can be either in the same IP subnet or in two different IP subnets.

When you connect two IP subnets with each other via a PN/PN coupler, you can use the following communication services for data exchange between Subnet A and Subnet B:

- PROFINET communication up to the PN/PN coupler.

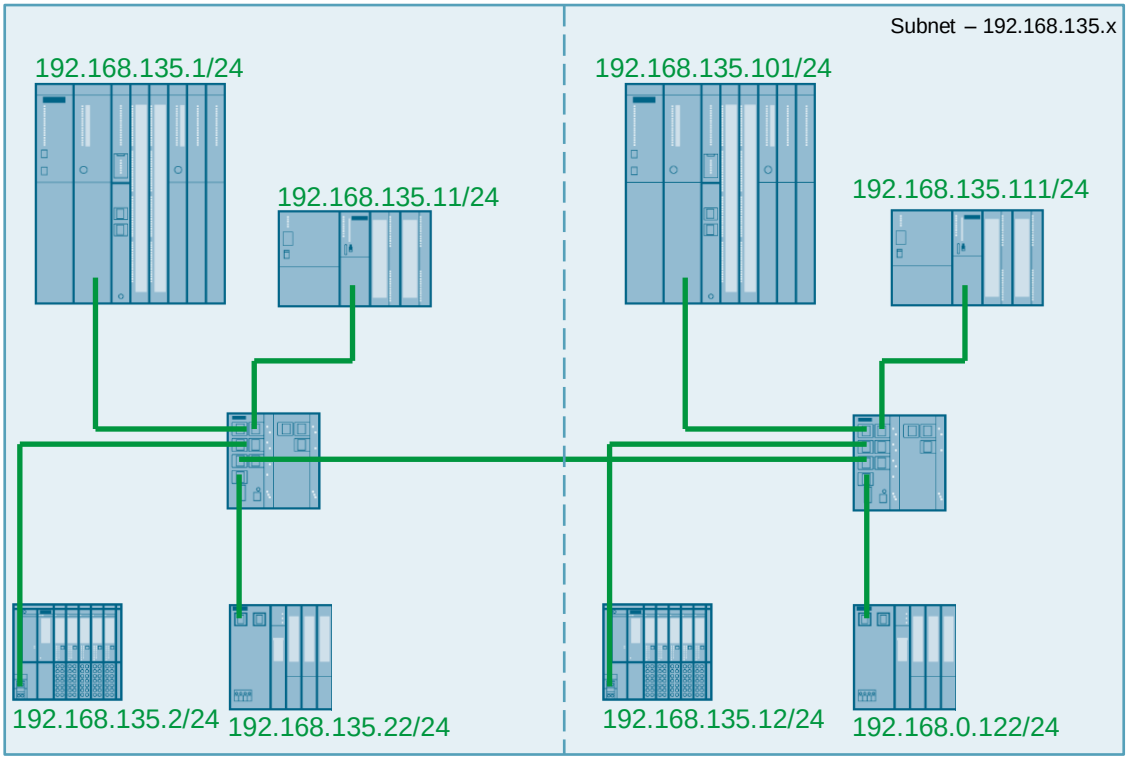
Cross-subnet communication via PN/PN coupler has the following restrictions:

- You need special hardware (PN/PN coupler).
- IP-based communication between the two IP subnets is not possible.
- A central PG cannot assign IO devices names across subnets.
- Controllers, HMIs, Drives, etc. cannot be downloaded or diagnosed via the PN/PN coupler.

2.3 Same Subnet

The figure below shows the structure of a PROFINET network in a plant in which all the devices are in the same IP subnet.

Figure 2-3



If all the devices are in the same IP subnet you can use the following communication services for data exchange between the devices:

- PROFINET communication: supports real time (possible from IO controller to IO device).
- Open User Communication (OUC): TCP, UDP, ISO-on-TCP: does not support real time.
- S7 communication: does not support real time.
- IP communication, HTTP, for example.

Since all devices are connected directly with each other and influence each other, the following holds:

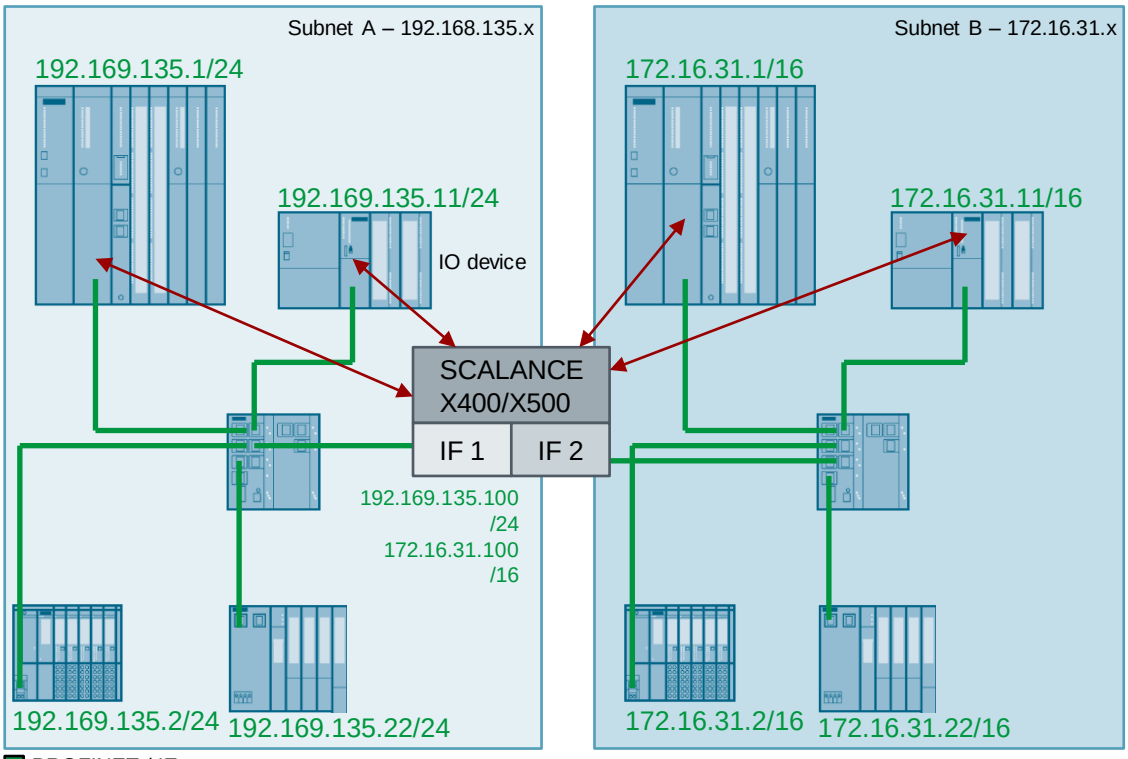
- Incorrect configurations and faults on individual devices directly affect the other plant sections.
- Multiple nodes in an IP subnet cause a high basic load in the network (through ARPs, for example).

2.4 Cross-subnet Communication via SCALANCE XM400/XR500

The figure below shows the structure of a PROFINET network in a plant in which two different IP subnets are connected with each other via a SCALANCE XM-400/SCALANCE XR-500.

With the PG it is possible to access all the devices in Subnet A and Subnet B from Layer 2.

Figure 2-4



When you connect two IP subnets with each other via a SCALANCE X-400/SCALANCE X-500, you can use the following communication services for data exchange between Subnet A and Subnet B:

- Open User Communication (OUC) with TCP, UDP and ISO-on-TCP: does not support real time
- S7 communication: does not support real time.
- IP communication, HTTP, for example.

Cross-subnet communication via SCALANCE XM-400/SCALANCE XR-500 has the following restrictions:

- You need special hardware (SCALANCE XM-400/SCALANCE XR-500).
- PROFINET IO communication and assignment of names to IO devices are not possible via SCALANCE XM-400/SCALANCE XR-500.

3 Basic Information

3.1 Overview

The following figure shows the OSI layer model for structured communication.

Figure 3-1

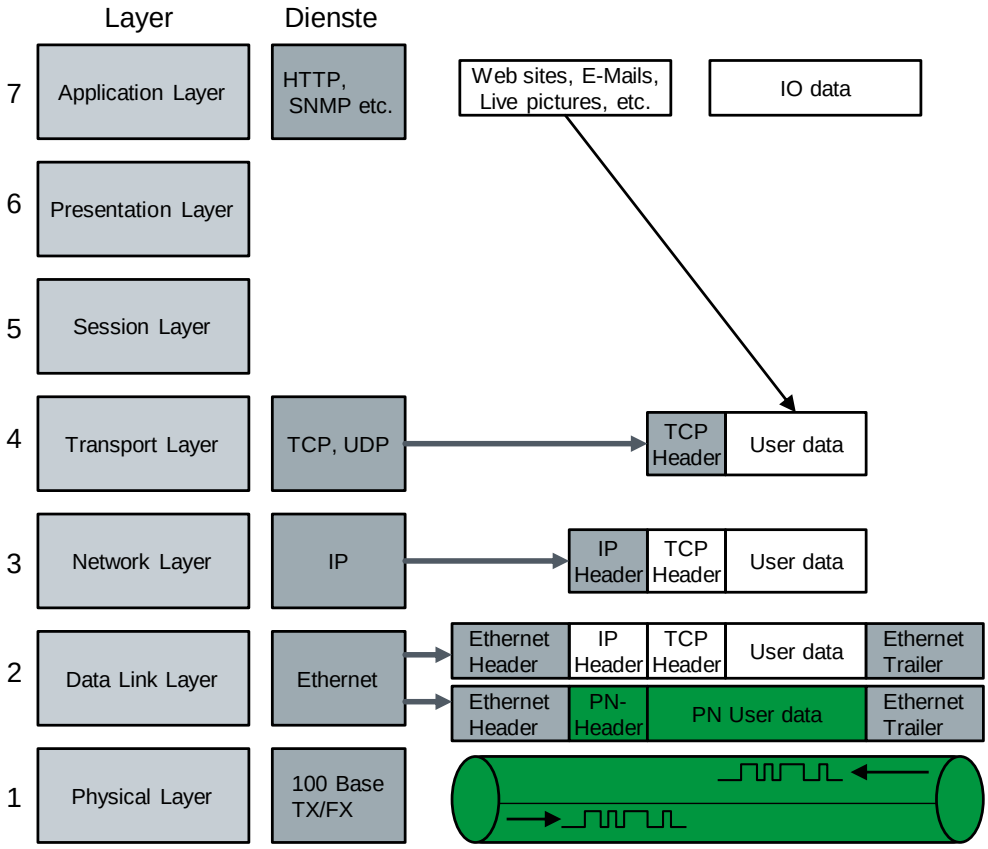


Figure 3-2

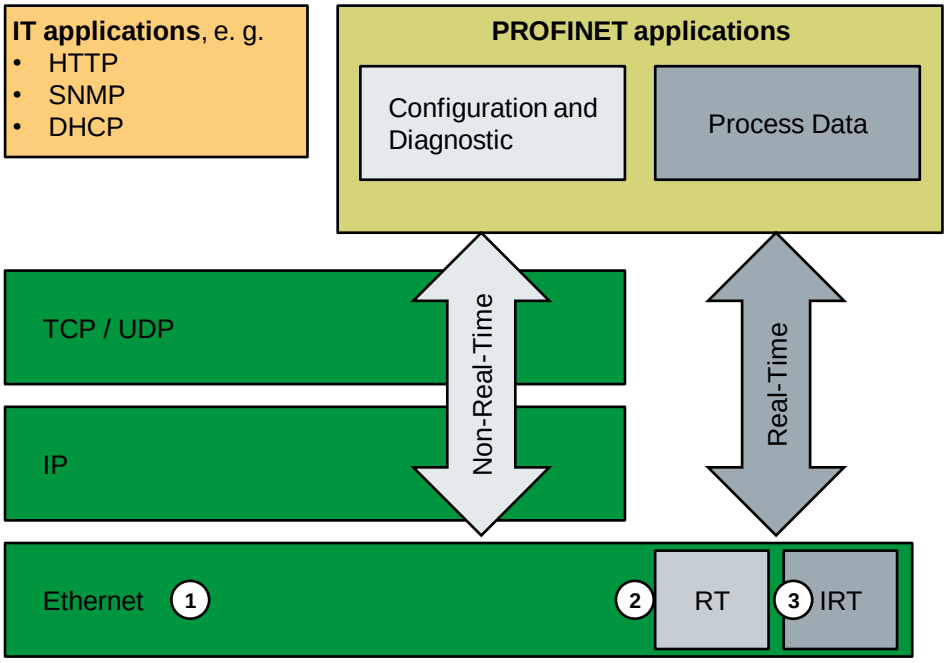


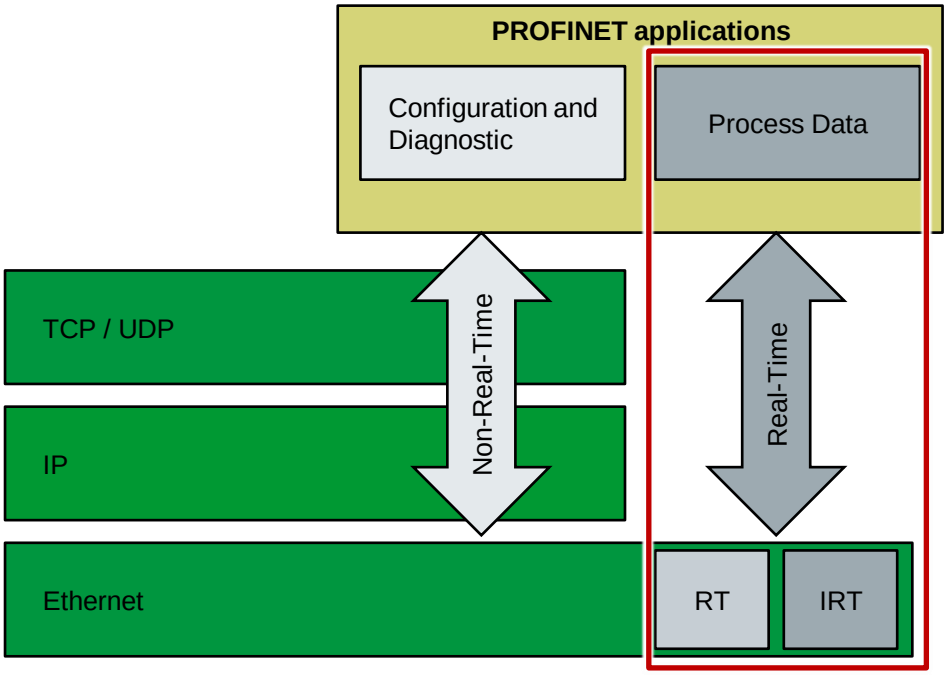
Table 3-1

No.	Service	
1.	TCP/IP	• TCP/IP protocols are for parameterizing and configuring as well as for transferring diagnostics data. • TCP/IP protocols have the transmission permission for the user channel.
2.	Real-Time RT	Real-Time (RT) protocols are for cyclic high-performance transmission of user data. Event-dependent messages/warnings are possible.
3.	Isochronous Real-Time (IRT)	Isochronous Real-Time (IRT) protocols are for synchronous transmission of user data. The hardware supports IRT through ERTEC. Jitter is less than 1µsec.

3.2 PROFINET IO Real-Time Communication

PROFINET IO Real-Time communication is based on Layer 2 (MAC addresses). In this way communication within a network is possible. Here the devices must be in the same IP subnet. Communication via switches is possible. Communication via router is not possible because the devices have to be in the same IP subnet. Since the devices have to be in the same IP subnet, the IP addresses are limited.

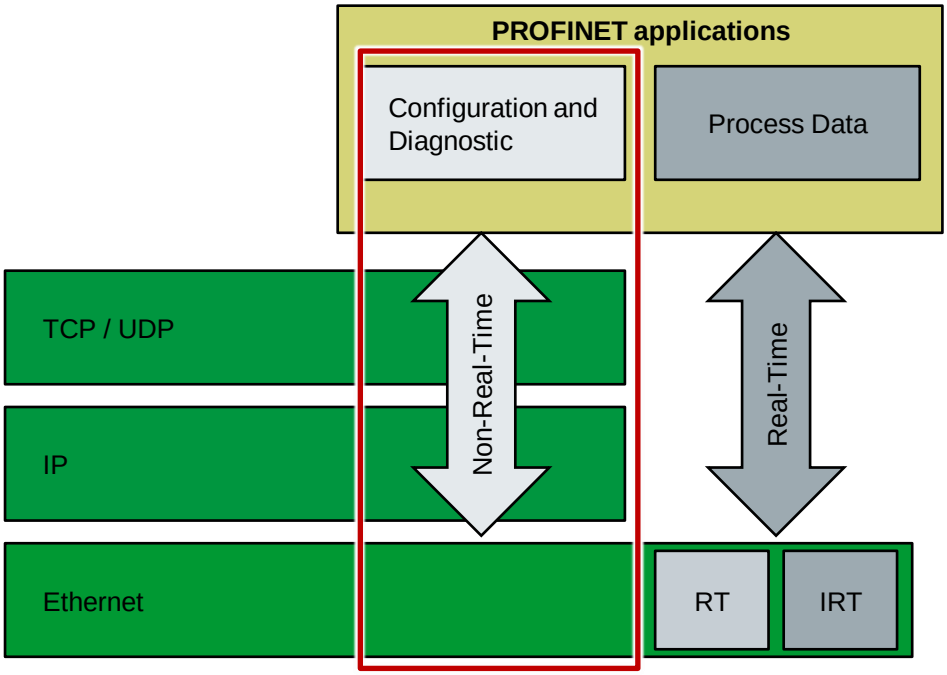
Figure 3-3



3.3 PROFINET IO Device Configuration (at Startup of the IO Device)

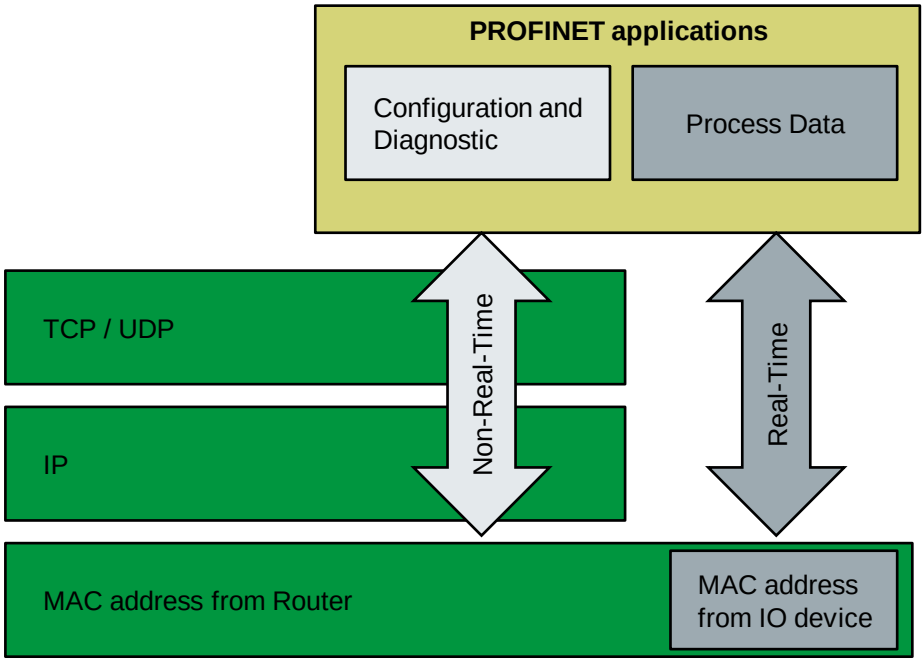
The PROFINET IO device configuration uses TCP/IP. This means that communication across network boundaries is possible. The devices do not have to be in the same IP subnet. Communication via switches and routers is possible. The IP addresses are not limited if they can be reached via routing.

Figure 3-4



3.4 Requirements

1. In the STEP 7 project of the IO controller the IP address of the I device must not be set permanently, because they are checked during compiling.
2. The IO controller communicates between two different MAC addresses to address the same I device:
   - MAC address of the router for IP-based communication
   - MAC address of the I device for IO data



3. Layer 3 switch, for example, SCALANCE XM400, SCALANCE XR500