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PROFINET Innovations 2010

"A whole new world of added value"
PROFINET innovations 2010

2010 saw the introduction of a whole collection of innovations for the PROFINET protocol. This set of new functionalities is the result of a strictly coordinated development and release process that is focused on providing maximum benefit to the user, says Siemens specialist Mirko Funke:

"What we see now is something that literally opens up a whole new world of added value to our customers. These are all functionalities that were not available for PROFINET, that have a significant and positive effect on the cost-effectiveness and performance of the communication system, and that complement each other for maximum user benefit."

The main targets of the innovations were simpler engineering, reducing the number of network and system components needed, and reducing cabinet space requirements. Benefits include:

• A simpler system configuration, for example in failsafe applications
• Leaner and more versatile topology architecture even with multiple networked controllers, and
• Higher plant availability and simplified maintenance

These targets are well aligned with current trends in machine and plant engineering, Funke continues: "There is a clear trend towards modular, flexible machine and plant concepts. Our customers want to strip down their design complexity, their engineering effort, and of course, they want less communication complexity in their machines and plants. With the new functionalities, we help them get there. Moreover, we have combined the results of our development process so that our customers get a comprehensive, solid, and tested package."

Mirko Funke graduated in electrical engineering from the Leipzig University of Applied Science (HWTK). He has been working for more than 10 years with Siemens in different areas and has a broad expertise in automation technology. Since 2004, he has been working in Customer Support, where he designs concepts for customers and supports the know-how transfer into the regions with a focus on industrial communication and PROFINET.

Sharing the experience: Shared Device

What is the Shared Device functionality?

With the Shared Device functionality, two controllers can use the same PROFINET IO device, e.g. SIMATIC ET 200 remote station or SINAMICS drives, resulting in a simplified and more economical system configuration (figure1).

How does it work?

Shared Device enables accessing one IO device from two controllers via one PROFINET interface. This reduces the number of PROFINET interfaces needed in an application. The Shared Device functionality is engineered by simply copying the configuration of the IO device in STEP 7 and assigning it to the second controller as Shared Device – done. The assignment is highly modular and can be configured individually. Learn more about the technology facts and benefits by watching the video!

Where can I use this?

In principle, Shared Device will result in immediate benefits wherever you have a standard CPU and a fail-safe CPU as separate controllers. This includes applications in the process industries, in metalforming, or in machine building.

Example:

A motion control system and a safety controller can share an IO device. One interface is sufficient for both clock-synchronous control of the drive and fail-safe communication.

That way, the safety controller can perform a safe shutdown of the unit. In this case, the motion control system does not handle safety tasks, the safety controller does not handle motion control tasks. System performance is increased besides the potential to save on hardware and cabinet space.

The benefits:
• Reduced number of remote devices
• Reduced engineering cabling and installation costs
• Flexible assignment of modules to each of the two CPUs
• Integration of different functions in the separated CPUs increases system performance
• Easy integration of fail-safe functions in a non-safety application (such as robot controllers)
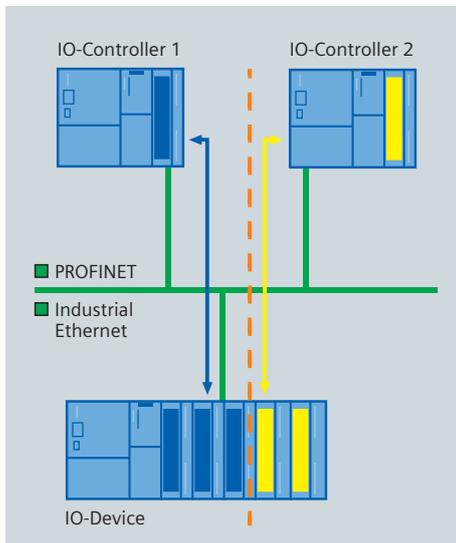

Figure 1:
Two controllers can use the same PROFINET IO device with the Shared Device functionality

Figure 2:
I-Device enables simple and fast controller-controller communication

Get smart: The I-Device functionality

What is the I-Device functionality?

The I-Device is short for "Intelligent CPU as IO-Device". With this functionality, PROFINET not only permits communication with subordinate devices as an IO controller, but also IO communication with other higher-level or central controllers as an IO device (figure 2).

How does it work?

I-Device enables very simple and fast controller-controller communication that can take place at the same time and on the same bus. I-Device allows accessing the IO address image with the PROFINET IO protocol without the use of PN-PN Couplers, and allows a full system access throughout the entire network. Learn more about the technology facts and benefits by watching the video!

Where can I use this?

The I-Device functionality is beneficial in all automation solutions with several networked controllers.

Example:

In a monorail conveyor system, each trolley has a CPU as I-Device. A dedicated CPU is used as the central controller for all trolleys. All trolleys in the system can then be engineered using an identical hardware configuration with individual addressing of each trolley.

The communication to the dedicated PLC is done with the I-Device functionality just by instancing the trolleys in hardware configuration. So each trolley is addressed in the network with an own unique device name and from the dedicated CPU with unique IO-address ranges.

This helps to save time for engineering and commissioning costs, because only two independent hardware configurations and user programs are needed – one for the trolleys and one for the dedicated CPU.

If the systems are using PROFIenergy (see p. 7), complete machine or plant units can be switched off through the I-Device functionality.

The benefits:
- Leaner and more flexible topology architecture design
- Simple connection of controllers from different projects
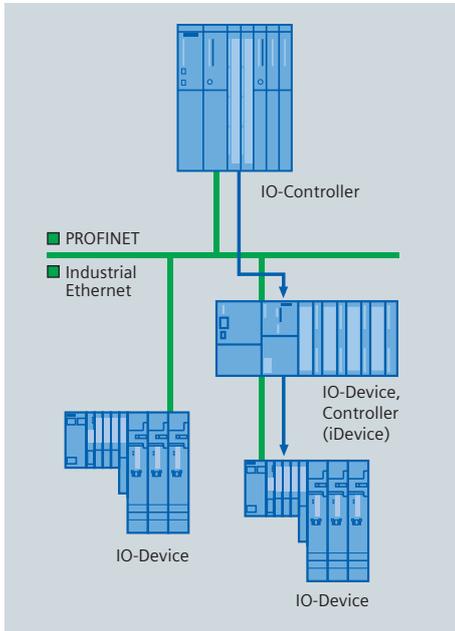- Integration of Siemens controllers and third party controllers in a single communication network (using GSD files)

A clever combination: I-Device plus Shared Device

What is this mixed scenario?

The mixed scenario combines the advantages of both I-Device and Shared Device in the same configuration.

How does it work?

A distributed controller, for example a SIMATIC ET 200 CPU, can communicate to a higher-level controller as an IO device with I-Device functionality. At the same time it is also a Shared Device so that specific modules of this ET 200 can be accessed separately and directly by (different) higher-level controllers (figure 3).

Where can I use this?

The mixed scenario is especially beneficial wherever you need modular and flexible control architecture, for example in series machine building.

Example:

In a modular machine, a distributed failsafe CPU can contain both safety modules and standard modules. The standard modules can be accessed from a higher-level controller. This helps reduce the costs, as the required performance can be achieved with a distributed CPU and low-cost integration of standard modules.

The benefits:
• Powerful yet simple combination of features
• Increased flexibility for modular and safety configurations
• Reduced wiring
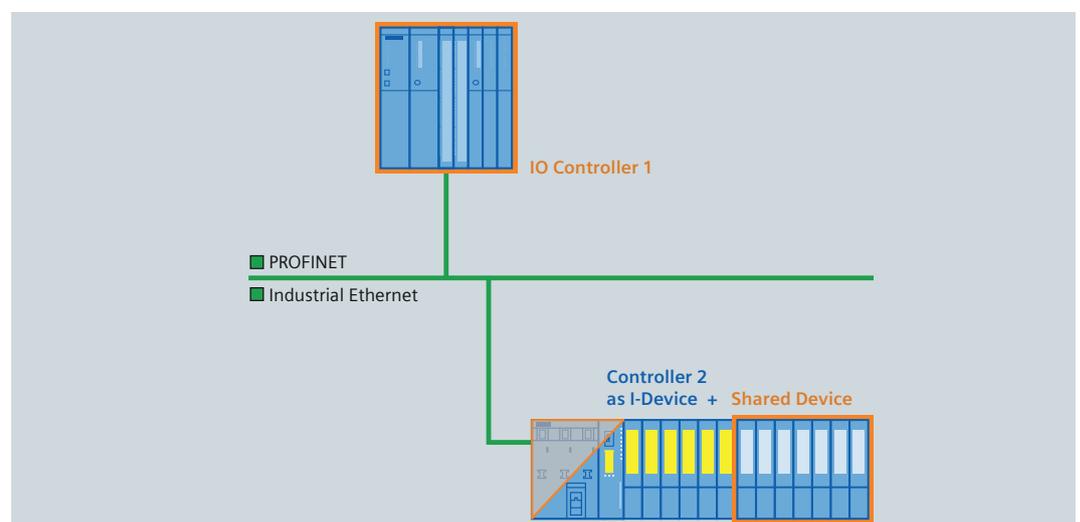• Reduced hardware overhead
• Simpler engineering

Figure 3:
In the mixed scenario, a distributed controller can have both I-Device and Shared Device functionality

Round and round: the Media Redundancy Protocol

What is the Media Redundancy Protocol?

The Media Redundancy Protocol (MRP) enables implementing a redundant PROFINET communication through ring topology without the need for switches (figure 4).

How does it work?

MRP uses the basic principles of the Hiper ring. This ring redundancy protocol was developed by Hirschmann and Siemens and first presented in 1999. Since 2008, MRP is defined in the IEC 62439 standard. Now, MRP is integrated into the PROFINET devices, so that no additional switches are needed.

MRP can compensate an individual failure in a PROFINET / Industrial Ethernet in a simple ring topology. As meshed networks are not supported, MRP is both simple and deterministic. MRP in PROFINET networks can achieve reconfiguration times of just 200 ms.

Where can I use this?

MRP is beneficial for networked systems that require a high level of communication availability for safety reasons or where communication disruption will result in loss of product or productivity.

Example:

In a production line, the entire communication is implemented with a PROFINET network. By using MRP, this plant will enjoy a significant reduction in downtimes caused by eventual damage to the communication wiring – for example, a line break caused by a forklift accident. Communication can continue and the production can continue even if the line break is not fixed immediately. This takes time-pressure of emergency repairs as well as planned maintenance.

The benefits:
• Higher communication availability
• Reduced plant downtimes
• Reduced number of network components
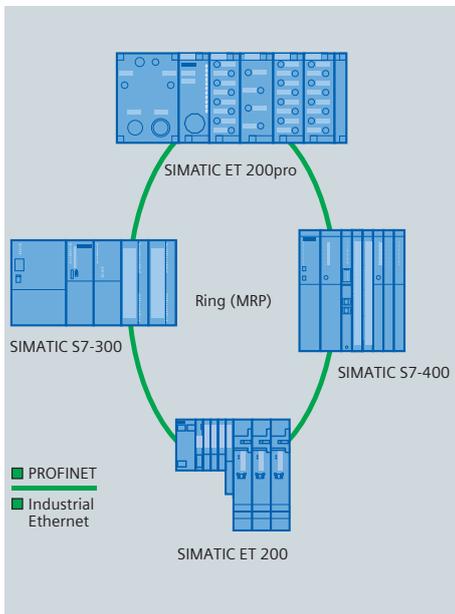• Simpler engineering
• Easier maintenance and repair

Figure 4:
Example of a ring topology with Media Redundancy Protocol

Just switch it off: the PROFIenergy profile

What is the PROFIenergy profile?

PROFIenergy helps to save energy by means of switching off loads that are idle during standby periods in a coordinated way.

How does it work?

PROFIenergy is a vendor- and device-neutral data interface based on PROFINET that permits a coordinated, centralized shutdown of devices during standby periods. All the functions required for switching off components are shifted to the control component itself. They can be operated by a higher-level controller via a uniform protocol, regardless of whether the component is a simple I/O device or a complex machine tool or robot.

Where can I use this?

Wherever you have a break in continuous production – due to batch operations, due to weekends, or due to regular breaks during the workday – PROFIenergy can provide a means to save energy that is unnecessarily consumed.

Example:

In a robot cell, the plant or systems engineer implements an energy-saving routine based on switch-off and switch-on times and minimum dwell times. This also permits the definition of a minimum length of the standby period for this unit. Dependencies between production units or devices can also be coordinated. Based on these
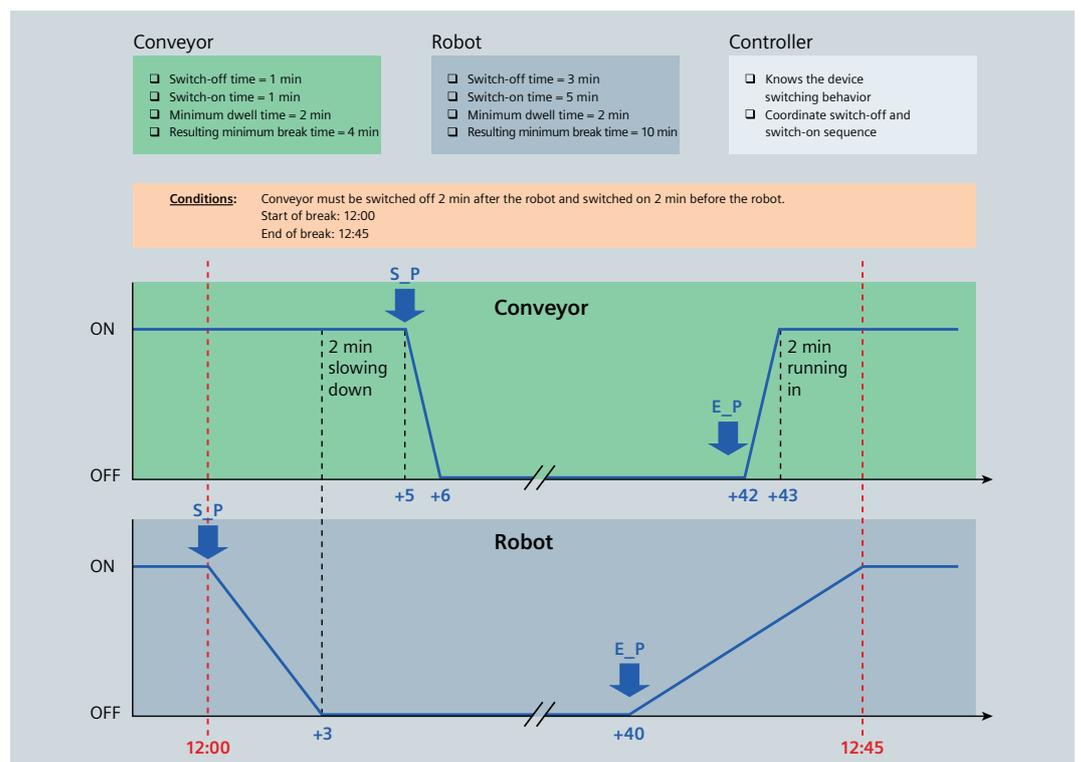

Figure 5:
Robot cell application example:
Switch-off and switch-on sequence

parameters, an appropriate switch-off and switch-on sequence can be defined for the individual systems as well as a minimum pause time for the overall unit. Switch-off of the entire cell is then performed centrally and automatically by the controller.

If the systems are using the I-Device functionality (see p. 4), complete machine or plant units can be switched off just as easily.

The benefits:

• Easy integration of energy-saving mechanisms into machines and plants

• Simple, straightforward engineering

• Significant savings by avoiding idle energy consumption in standby-periods

• Significant savings in energy costs

• Compliance with environmental regulation, going green automation

• Improved eco-footprint

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