Company-wide automation,
integrated communication.
PROFINET – the open Industrial Ethernet standard

profinet

SIEMENS

New perspectives in industrial automation ...

Increasing the productivity of your plant has the highest priority. With your investment you want to convert your production more quickly to meet the latest market demands and shorten your time to market. That is why you need a continuous flow of information company-wide – from the first production step to the plant control level right up to the corporate management level – for your strategic decisions. To achieve this, you require efficiency and continuity already for the plant engineering process.

... through PROFINET, the Industrial Ethernet Standard

The increasing significance of vertical integration shows what a decisive role industrial communication plays in modern automation technology as a whole. PROFINET, the open, cross-vendor standard based on Industrial Ethernet, enables direct and transparent access from the corporate management level all the way down to the field level. PROFINET is based on established IT standards and supports TCP/IP without restrictions.

Utilize synergies and secure investments: Simple integration of existing systems

Do you want to continue to use and expand existing systems and plant sections which communicate via PROFIBUS and other fieldbuses in the future? No problem! PROFINET permits the integration of the existing basis without a problem and with a minimum of effort. PROFINET ensures a high degree of investment protection for existing systems and you have the advantages of an innovative standard – now and in the future.

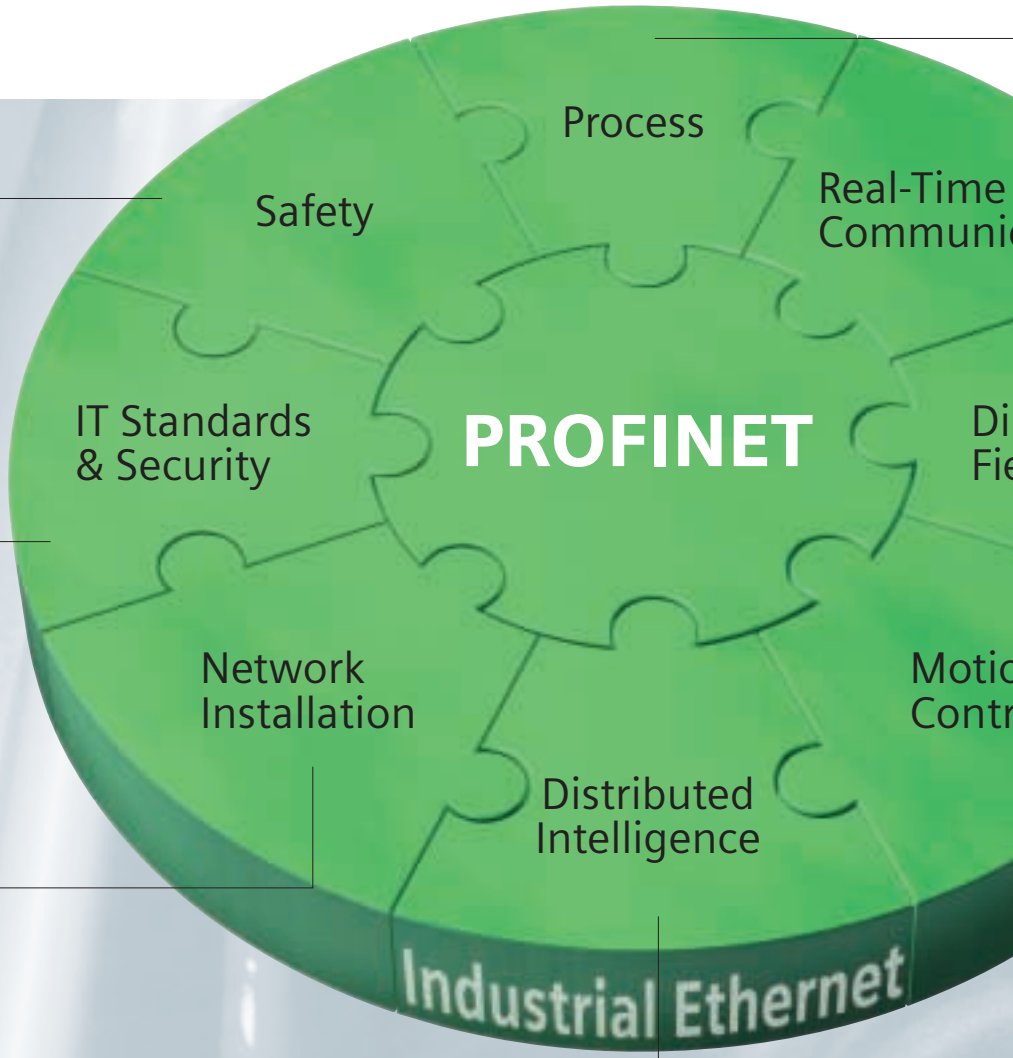
The optimum basis for PROFINET: Industrial Ethernet

Ethernet has established itself as the standard bus system in the office world. Thanks to its huge market acceptance, Ethernet development (e.g. transmission rate improvement) is continuing unabated. Siemens has been offering Industrial Ethernet as a standard-based network within rough industrial environments for more than 15 years now.

PROFINET utilizes this basis to interface devices from the field to the management level, thus combining industrial performance with the uniformity, continuity and transparency of corporate communication.

The solution for every demand: PROFINET, the comprehensive standard for the automation world

Industry-standard installation technology, real-time capability, the integration of distributed field devices, isochronous motion control applications, simple network administration and diagnostics, protection against unauthorized access, efficient, cross-vendor engineering and a high degree of machine and plant availability: all of these demands are fulfilled by PROFINET, the open, cross-vendor Industrial Ethernet standard.



Safety Integrated

PROFINET also meets all necessary requirements for a complete safety concept for personnel, machines and the environment. Using PROFIsafe enables a network for standard and fail-safe communication – all on the same cable.

IT Standards & Security

PROFINET provides all the functions required for optimal configuration and diagnostics. All relevant data can be accessed online from anywhere, worldwide. PROFINET also fulfills the increased requirements for data and network security.

Easy Network Installation

PROFINET is based consistently on 100 Mbit/s switching technology and, in addition to the star topologies commonly used in Ethernet, it also supports line and ring network topologies. This minimizes cabling overhead and ensures maximum availability. Wireless communication opens up new applications in the industry.

Distributed Intelligence

PROFINET offers new potential for implementing distributed automation structures: uncompromising modularization and easy machine-to-machine communication with plant-wide engineering – thanks to Component Based Automation.

Process

PROFINET is designed as a comprehensive standard for all automation tasks. Special requirements for its use in industrial plants and interfacing of process instrumentation and analyzers are currently being dealt with as a part of the overall efforts toward standardization.

cation

stributed
eld Devices

on
rol

Real-Time Communication

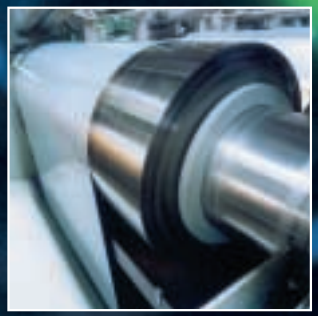
PROFINET fulfills all the real-time demands relevant to the automation world, including isochronous ones. PROFINET is also well-suited for demanding applications, such as those in the area of motion control.

Distributed Field Devices

Distributed field devices may be directly interfaced to Industrial Ethernet via PROFINET. This enables high-speed data exchange between the I/O and controller and permits considerably improved diagnostics.

Motion Control

PROFINET allows you to create extremely fast, isochronous drive control systems for high-performance motion control applications – while using TCP/IP communication at the same time.



PROFINET: New possibilities with Industrial Ethernet

As a part of IEC 61158, PROFINET is based on the international Ethernet standard (IEEE 802.3) as well as Fast Ethernet (100 Mbit/s) and switching technology. PROFINET has the following special features: the integrated use of real-time and TCP-based communication on one line as well as scalable real-time communication for control units, distributed I/O and motion control. Thus, PROFINET permits short response times and continuity from the field level all the way up to the corporate management level.

PROFINET covers the complete range of automation applications and distinguishes between three real-time features:

- TCP/IP and UDP/IP communication
- Real-Time (RT) and
- Isochronous Real-Time (IRT)

TCP/IP and UDP/IP communication

Non-time-critical data transmission with TCP/IP and UDP/IP is the communication basis, for example, for parameterization and configuration.
In the IT landscape, TCP/IP is a de-facto standard.

Glossary

IP

Data transmission using Internet Protocol (IP) is a non-secure packet transmission (datagrams) between an IP source and an IP destination. The 32-bit checksum of the Ethernet packet permits detection of faults in the packet with higher probability.

The following protocols are based on IP:

TCP

Transmission Control Protocol (TCP) ensures fault-free and complete data transmission from the source to the destination in the correct sequence. TCP is connection-oriented, i.e. two stations establish a connection prior to the transmission of the data blocks, and clear it again following the transmission. TCP provides mechanisms for continuous monitoring of the established connection.

UDP

Like TCP, the User Datagram Protocol (UDP) ensures fault-free and complete data transmission from the source to the destination. In contrast to TCP, UDP is connection-free, i.e. each data packet is treated as an individual transmission, and its transport is not acknowledged. Omission of time-out monitoring as well as the establishment and clearance of a connection means that UDP is more suitable than TCP for time-critical applications. The division into blocks and the monitoring of communication implicit with TCP can be carried out at the application level with UDP, for example using RPC (Remote Procedure Call).

PROFINET – a standard in the automotive industry

The Automation Initiative of German Domestic Automobile (AIDA) manufacturers organization has arranged for a common procedure with regard to the subject of Industrial Ethernet: the protocol standard PROFINET with integrated personnel safety features will be used in the future. The aim is to easily and uniformly interface the automation components in use.

Real-Time Communication

Real-Time (RT)

Real-Time is used for time-critical process data, i.e. for cyclical user data or event-driven interrupts. PROFINET uses an optimized real-time communication channel for the real-time requirements of automation engineering. This minimizes cycle times and results in increased performance for updating process data. The performance is comparable with that of fieldbuses, and it permits response times in the range of 1 ms to 10 ms. At the same time, the processor performance required in the device is significantly reduced. Standard network components can be used for this solution.

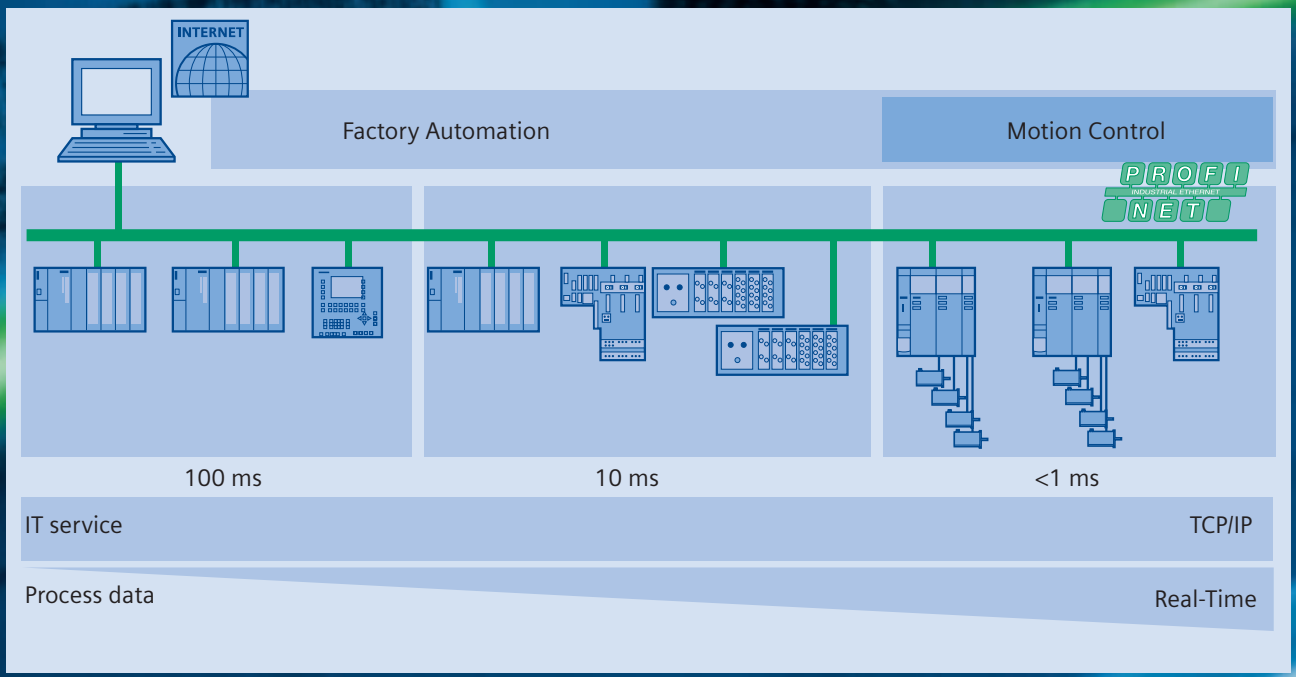
SIMATIC NET switches additionally permit optimized data transfer. The data packets are prioritized according to IEEE 803.1Q for this purpose. The network components control the data flow between the devices based on these priorities. Priority 6, the second highest level, is used as the standard priority for real-time data. This ensures priority treatment compared to other applications which are assigned lower priority levels.

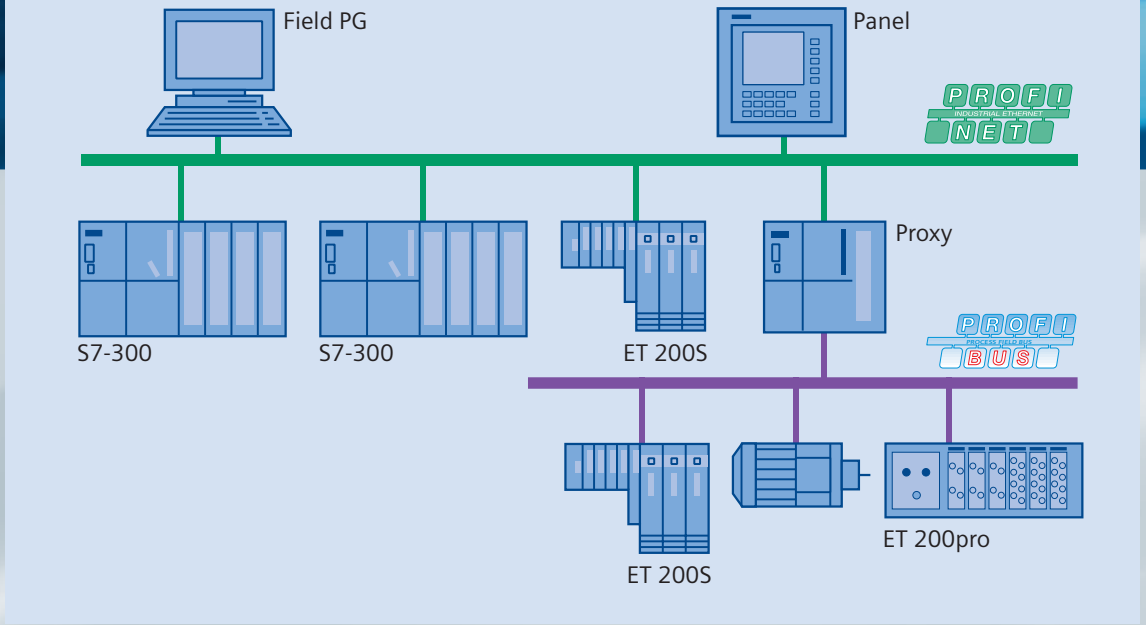
Isochronous Real-Time (IRT)

Isochronous Real-Time (IRT) is available for particularly demanding applications such as motion control. IRT permits a cycle time of less than 1 ms with a jitter accuracy of less than 1 µs. To achieve this, the communications cycle is divided into a deterministic part and an open part. The cyclical IRT telegrams are transmitted in the deterministic channel; the TCP/IP and RT telegrams in the open channel. Therefore, both types of data transmissions exist next to one another without mutual interferences. For example, users can connect a notebook computer to any location in the plant to access the device data without adverse effects on the isochronous control.

The ASIC Enhanced Real-Time Ethernet Controller (ERTEC) supports both real-time features. End-to-end system solutions with PROFINET are based on this technology. ERTEC ASIC is integrated into data terminal equipment and network components.

Real-time communication with PROFINET





Integration of PROFIBUS into PROFINET by means of a proxy. The proxy represents the PROFIBUS devices on the Ethernet. It is a PROFINET station on the Ethernet and a DP master for the devices on the PROFIBUS.

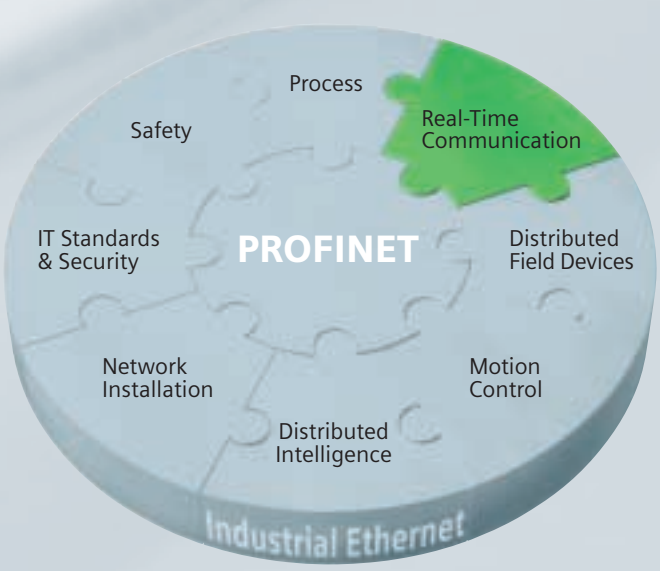
Integration of fieldbuses

PROFINET supports the integration of existing PROFIBUS networks and other fieldbus systems. This allows mixed systems to be set up consisting of fieldbus-based and Ethernet-based subsystems, as well as a step-by-step conversion to PROFINET.

The proxy concept simplifies the integration of existing fieldbus systems – with high transparency. The proxy on the Ethernet represents one or more fieldbus devices (e.g. on the PROFIBUS). It provides transparent transfer of communication between networks (no tunneling of the protocols) and it passes, for example, the cyclical data on to the fieldbus devices.

As a PROFIBUS master, the proxy coordinates data exchange between the PROFIBUS stations. At the same time, it is an Ethernet station with PROFINET communication. Proxies can be implemented as controllers or pure routers.

In addition to hardwired proxies on the Industrial Ethernet, SIMATIC NET also offers proxies with an Industrial Wireless LAN connection.



Distributed Field Devices

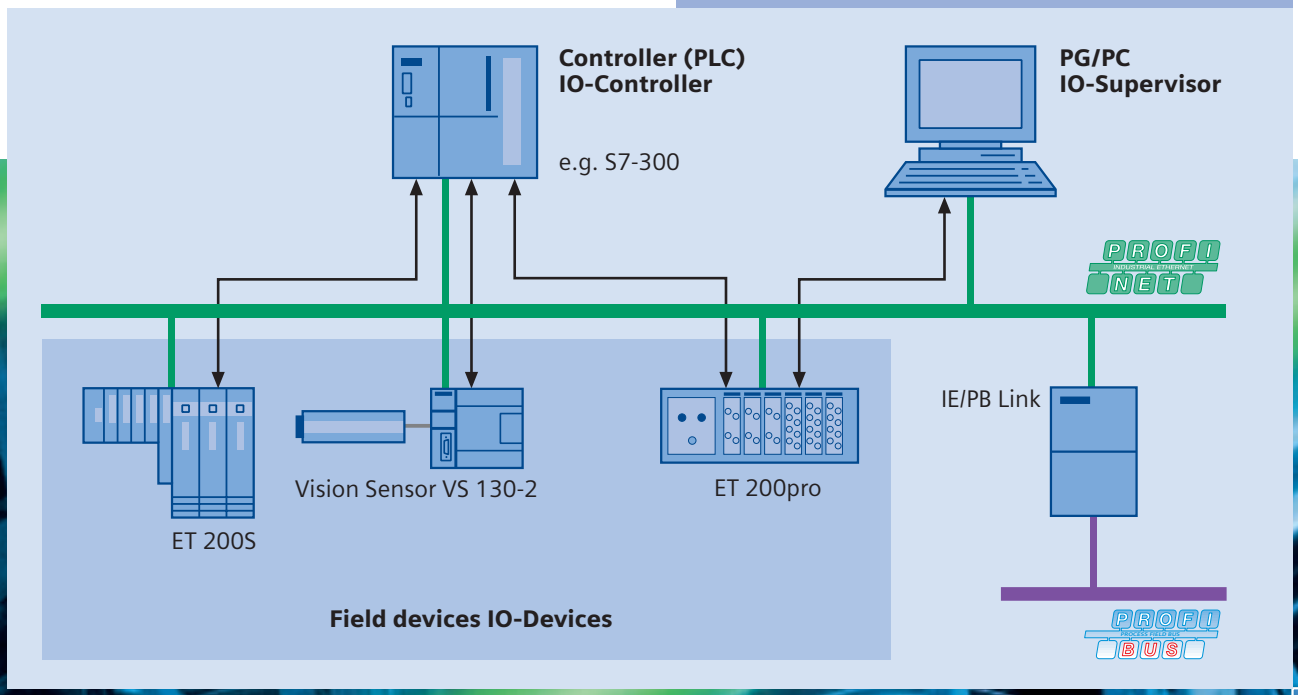
PROFIBUS International defined the PROFINET IO standard for directly interfacing distributed field devices to Industrial Ethernet. Field devices transmit their data cyclically to the process image of the associated control unit via this standard. PROFINET supports 1440 bytes/cycle per field device in this process and exceeds the data volumes transmittable via fieldbus. Furthermore, PROFINET also enables IT services such as online commissioning or network diagnostics via Simple Network Management Protocol (SNMP) to be used for field devices.

PROFINET supports a provider/customer model for the interaction between controllers and distributed I/O. The provider sends its data to the consumer without a request from the communication partner. The consumer processes the data. The assignment of providers to consumers is determined in the configuration.

The following device types are defined for PROFINET IO in the PROFIBUS International standard

- IO-Controller: controller in which the automation program is executed
- IO-Device: distributed field device assigned to an IO-Controller
- IO-Supervisor: programming device/PC with commissioning and diagnostics functions, or HMI device

The IO-Device reads the I/O signals and transmits them to the IO-Controller, which processes these signals and transmits output signals back to the IO-Device.



IO-Device and IO-Controller communicate with each other. The response to the fault goes directly from the controller (PLC) to the IO-Device

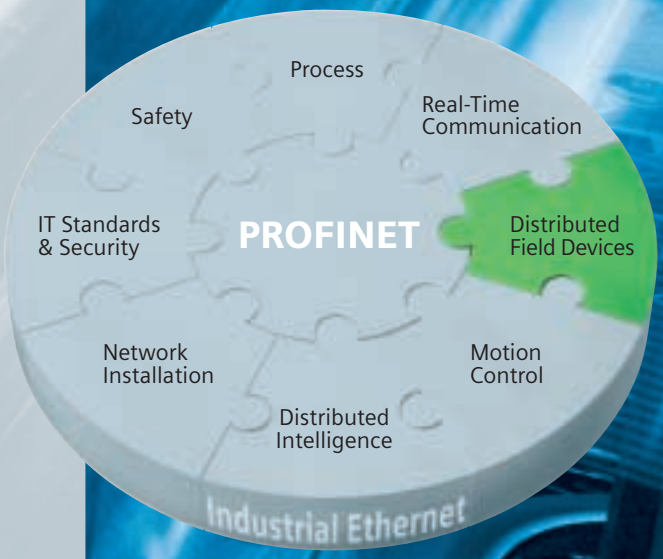
Device description and configuration

Configuration and programming of the IO-Devices correspond to that of distributed I/O devices on the PROFIBUS DP. This is implemented in the usual manner in STEP 7. The devices are described unambiguously by General Station Description (GSD) files. These GSD files are imported into the configuration tool.

Diagnostics

PROFINET IO supports a uniform diagnostics concept for efficient localization and trouble-shooting of possible faults. If a fault occurs, the faulty IO-Device sends a diagnostic interrupt to the IO-Controller. This interrupt calls a corresponding program routine in the user program to initiate a reaction to the fault. Alternatively, the diagnostics information can be read directly from the field device (IO-Device) and displayed on an IO-Supervisor (PG or PC). The IO-Device also generates a diagnostic interrupt if a fault occurs on a channel. An acknowledgement mechanism ensures that sequential fault processing is possible in the IO-Controller.

In the context of Totally Integrated Automation, Siemens offers an integrated system solution for network technology as well: SCALANCE. The new Industrial Ethernet switches are configured with STEP 7 and diagnosed in online mode as with field devices. The diagnostic information is processed in the PLC user program. This integral functionality provides advantages during engineering, commissioning and operation of the plant.



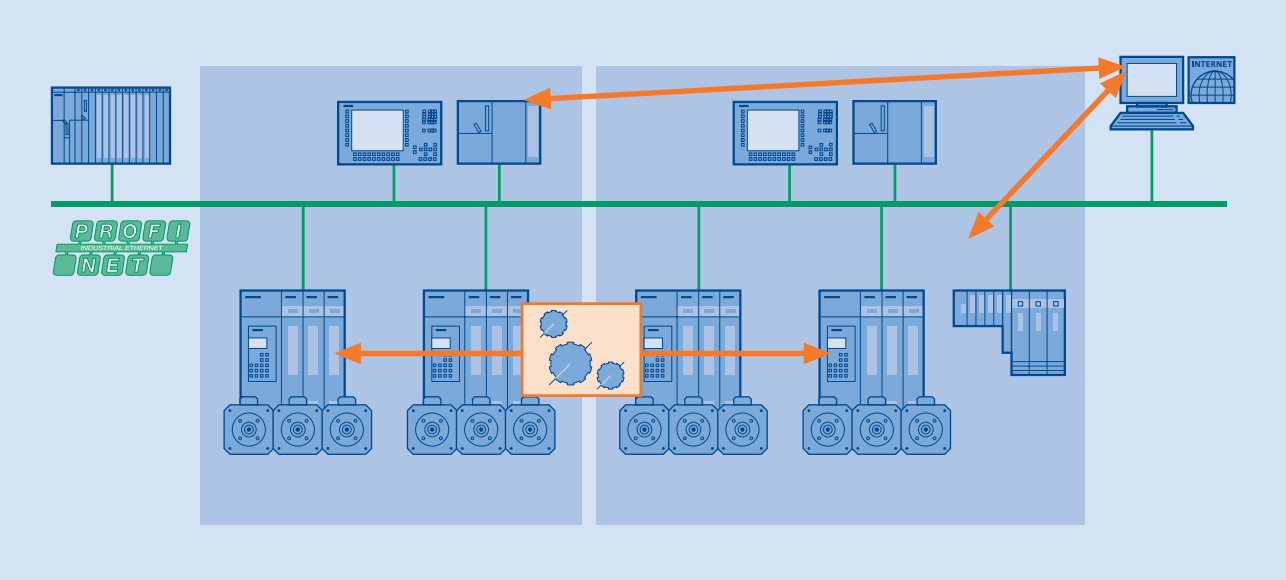
Motion Control

The use of PROFINET facilitates the use of considerably more powerful machines which feature maximum performance, an increasing number of drives, and the shortest response times. In addition to real-time communication, PROFINET always has sufficient reserves available for simultaneous, open IT communication. These can be used, for example, for diagnostics and maintenance functions, which in turn optimizes availability.

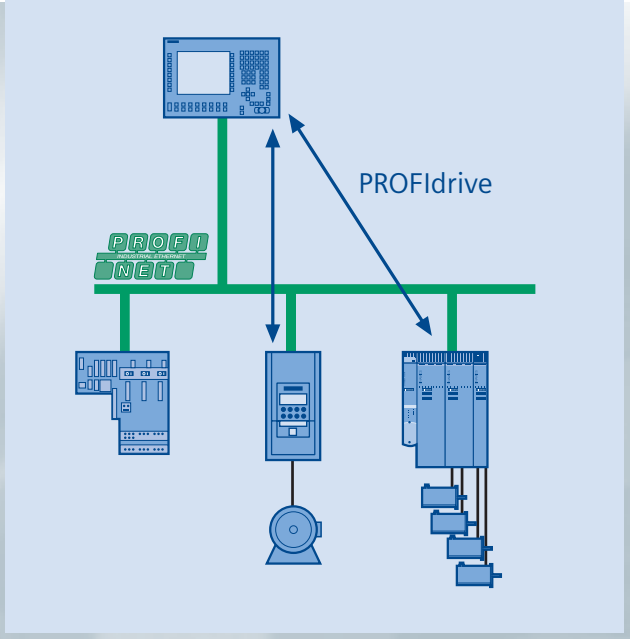
Customized topologies

PROFINET switching technology allows you to flexibly create any network topology and thereby the best possible adaptation to the plant or machine. Switching between various media is also possible, for instance from copper to fiber optic and back. Switching technology enables, for example, a line to be connected to a ring in order to establish media redundancy. The switch over in the case of redundancy also takes place in the isochronous communication channel without interruption.

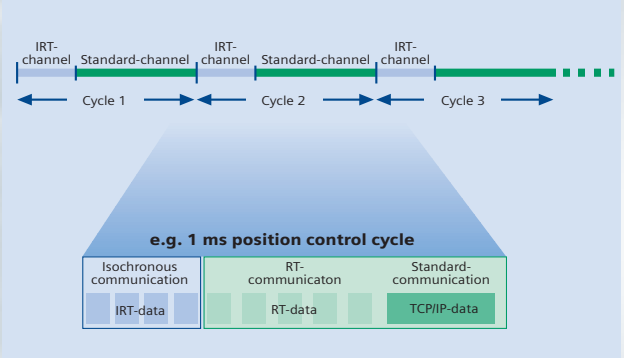
In modular plants, communication between the motion controllers can likewise be implemented isochronously in the isochronous channel using PROFINET. This allows applications with distributed synchronization to be implemented easily, for example, to replace mechanical line shafts.



Hardware support for Isochronous Real-Time: IO-Controllers and IO-Devices are equipped with Asics



Cycle time	1 ms		500 µs
Jitter	<1 µs		<1 µs
Number of stations	70	150	70
Reserves for open communication with IT standard protocols	75%	50%	50%



Motion control with Isochronous Real-Time: separate delay times make sure that the isochronous communication cannot be interrupted by the standard communication.

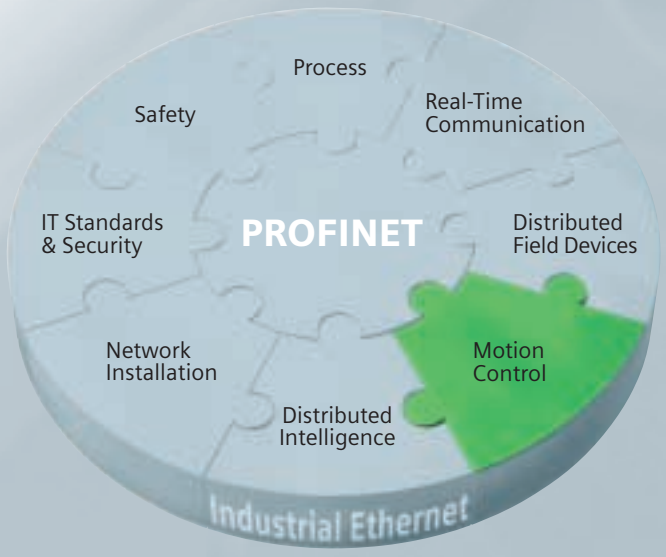
PROFIdrive: the proven drive interface

The functional interface between controllers and drives in PROFINET and PROFIBUS is defined by the PROFIdrive drive profile from PROFIBUS International. PROFINET users already operating drives on PROFIBUS benefit from this. The user program must not be changed when transitioning from PROFIBUS to PROFINET.

Maximum performance

Once again, PROFINET clearly exceeds the already high capacities of PROFIBUS. In principle, the number of stations is not limited. A PROFINET message frame can transport up to 1440 bytes of process data. Data sets can even have a size of up to 4 GB, for example, to transfer images of products to be processed by an image processing system, which calculates the cam disc for the motion based on the product contour.

For the foreseeable future, PROFINET power reserves with IRT are more than adequate. The following example underlines this: at a cycle time of half a millisecond, 70 drives can be operated synchronously and at high performance levels. This leaves 50 % reserves for open communication with IT standard protocols, for example, for engineering, diagnostics, remote maintenance or process data acquisition.

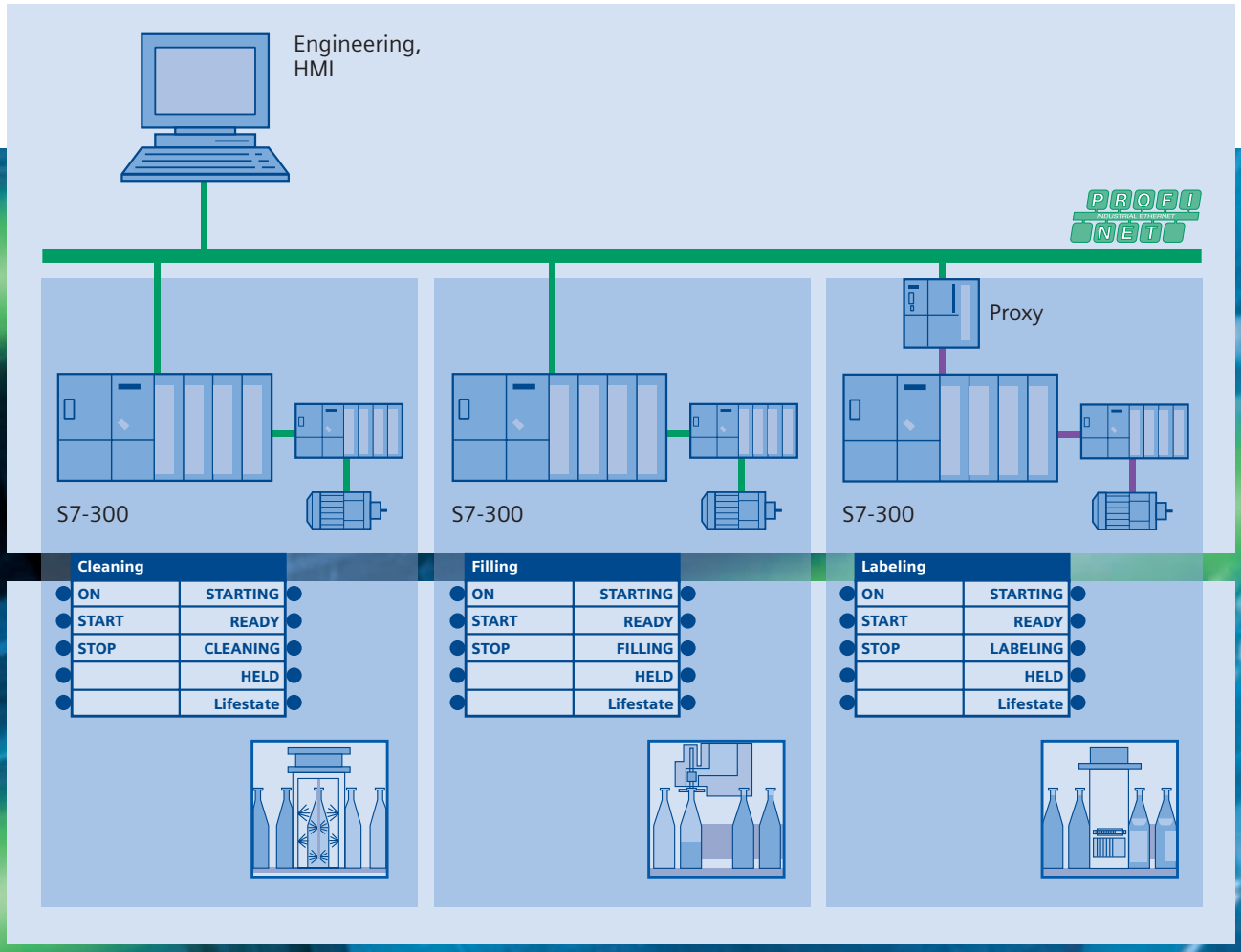


Distributed Intelligence

PROFIBUS International defined a standard for implementing modular plant structures: PROFINET CBA (Component Based Automation). Positive experiences have already been made in machine and plant engineering: parts that are needed more often are prefabricated and can be easily assembled into an individual unit upon receipt of an order. PROFINET CBA enables modularization to also be expanded to the plant's automation technology with the help of software components. The standardized engineering model differentiates between programming the controller logic of the individual intelligent modules, generating components and configuring the entire plant by interconnecting the components.

Flexible software components

Software components consist of encapsulated, reusable software functions. This can include technological functions such as controllers just as well as the user program of an entire machine. Like modules, they may be flexibly combined and easily reused, depending on how they are programmed internally. Software components communicate exclusively via component interfaces. Only the variables required to interact with other components are accessible externally on these interfaces.



Production line with Component Based Automation: The user program of the individual components is not executed on the central controller, but as encapsulated, distributed software components.

Engineering the distributed automation solution

Programming the control logic and component generation

Mechanical or plant engineers generate the components, and they use the relevant vendor-specific tool to program and configure the device, which is STEP 7 in the SIMATIC world. Then the user software is packaged in the form of a PROFINET component. The software must have the associated function for this. This is applicable in STEP 7. During the "packaging", a PROFINET Component Description (PCD) is generated and imported into the library of the interconnection editor. With SIMATIC iMap, Siemens has launched the first vendor-independent, applicable interconnection editor for PROFINET CBA on the market.

Component interconnection

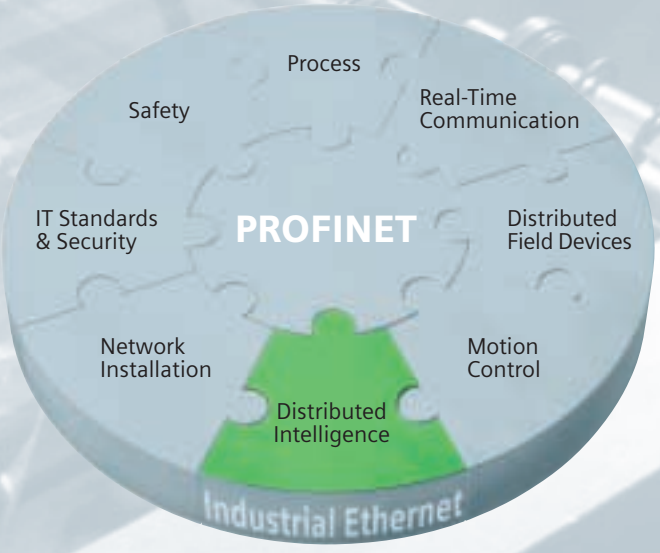
The generated PROFINET components are connected into an application using SIMATIC iMap by means of simple graphic configuration. Thus, complex programming of communication links is a thing of the past. SIMATIC iMap combines the distributed applications throughout the plant, and interconnects PROFINET components from any vendors. The communication links between components are established in this manner. Detailed knowledge concerning integration and execution of communication functions in the device is not required.

Integration of fieldbus applications

PROFINET CBA enables a complete fieldbus application to be mapped as a PROFINET component. This is always important if an existing plant is to be expanded by PROFINET. It is irrelevant which fieldbus was used to automate the subsystem. To permit communication between the existing plant and PROFINET, the master of the fieldbus application to be integrated must be PROFINET-capable. Existing S7-300 or S7-400 controllers can be expanded by the PROFINET functionality using communication processors. Therefore, the existing fieldbus mechanisms (e.g. PROFIBUS DP) are used within the components – and outside the PROFINET mechanisms. This migration facility protects the investments made in existing plants to a high degree.

Clear arguments in favor of Component Based Automation

- Shortens the commissioning phase – initial start-up of various technological units can take place simultaneously.
- Reliable planning – commissioning that is brief and amenable to planning creates reliability for the next operating phase.
- Increased flexibility – easy adaptation and expansion of plants.
- Easy configuration of the machine-to-machine communication.



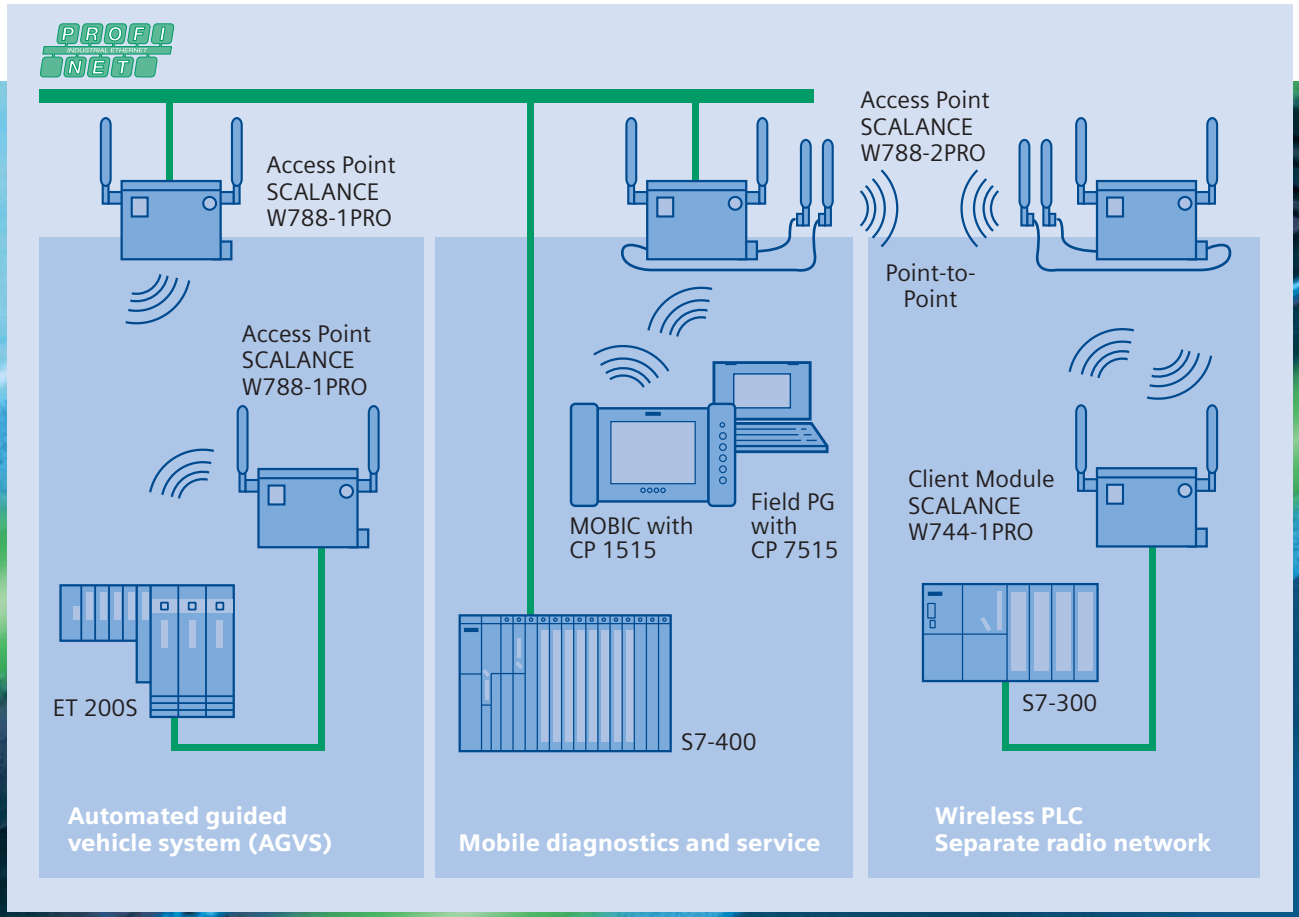
Network Installation

The international standard ISO/IEC 11801 as well as its European equivalent EN 50173 define an application-independent standard IT network. The "Installation Guideline PROFINET" from PROFIBUS International supports plant engineering with the installation of PROFINET networks. Based on fundamental definitions of IEC 11801, it defines industry-compatible cabling for Fast Ethernet while taking specific industry requirements into account in terms of temperature, electromagnetic compatibility (EMC), machine vibrations, humidity or chemical load due to oily or corrosive media.

The Installation Guideline PROFINET contains simple rules for installing Ethernet, and it also allows a non-specialist to set up a functioning network. Furthermore, it explains the correct assembly, storage and transportation of electrical or fiber-optic cables as well as the values for compressive and tensile force and the maximum cable lengths for LAN and WAN applications. You may obtain the Installation Guideline at www.profibus.com/libraries.html.

Switching Technology

PROFINET is based on 100 Mbit/s switching technology. In contrast to other processes, switching technology allows all stations to transmit at any time. There is always an open point-to-point link to the next switch. This is even possible in both directions (sending and receiving) simultaneously, and therefore it has a bandwidth of 200 MB/s. The advantage: stations or network areas which do not need the message frame do not receive it, resulting in reduced load.



Several possible applications for wireless communication

Network topologies

Network topologies are configured according to the requirements of the equipment to be networked. The most frequent structures include star, linear, tree and ring topologies. A plant usually includes mixed structures. They can be implemented using copper or fiber-optic (FO) cables.

Star

A characteristic of the star structure is a central switch with individual connections to all data terminals in the network. Applications for star topologies include areas with high device density and short distances, for example, small production cells or a single production machine.

Tree

The tree structure results from the connection of several stars in one network, possibly with mixing of FO and twisted-pair cabling. This structure is used when dividing complex plants into subsystems.

Linear

A linear structure can be implemented by a switch close to the data terminal to be connected, or by a switch integrated in the data terminal. A linear structure is preferably used in plants with an extensive configuration, for example, conveyor systems, and to connect production cells.

Ring (redundancy)

A ring structure is created when the ends of a line are closed by an additional connection. This is used in plants with high availability requirements – to protect against line breakages or failure of a network component.

Wireless Communication

In addition to the network topologies indicated here, PROFINET also supports wireless communication with Industrial Wireless LAN. Thus, technologies that are naturally subject to wear may be replaced (e.g. contact conductors). Furthermore, automated guided vehicles or customized operator and maintenance devices can be used. Additional advantages of this innovative technology include significantly greater mobility and flexibility of production.

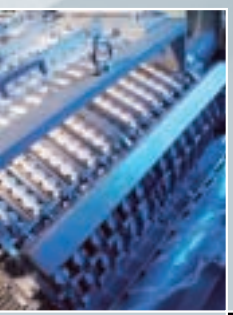
The Industrial Wireless LAN products SCALANCE W are based on the WLAN standards (IEEE 802.11). They stand out thanks to their rugged design and high IP65 rating as well as integrated security functions. In addition, SCALANCE W offers functions with which field devices can be linked to controllers at high-performance levels.

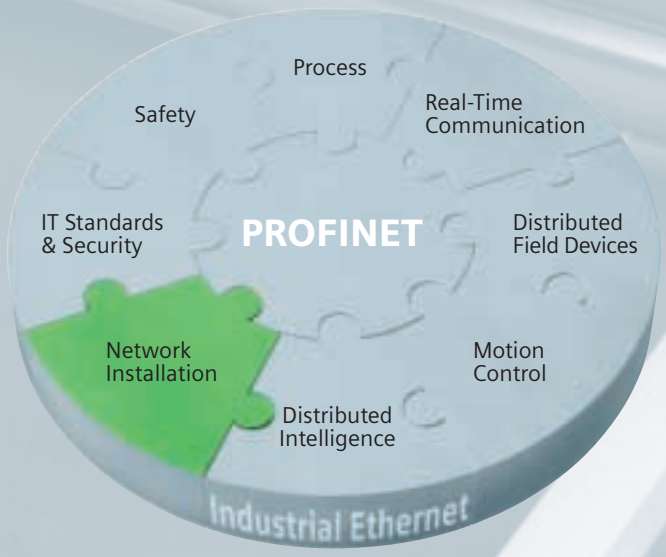
Data Reservation

The bandwidth between an access point and a defined client is reserved. This safeguards high, reliable performance for this client regardless of how many additional clients are operated at the access point.

Rapid Roaming

This function enables movable stations to be rapidly passed on between various access points. These expansions to the standard allow high-performance wireless applications with PROFINET down to the field level.





IT Standards & Security

Trend-setting functions for network management and diagnostics are defined in PROFINET.

Network management

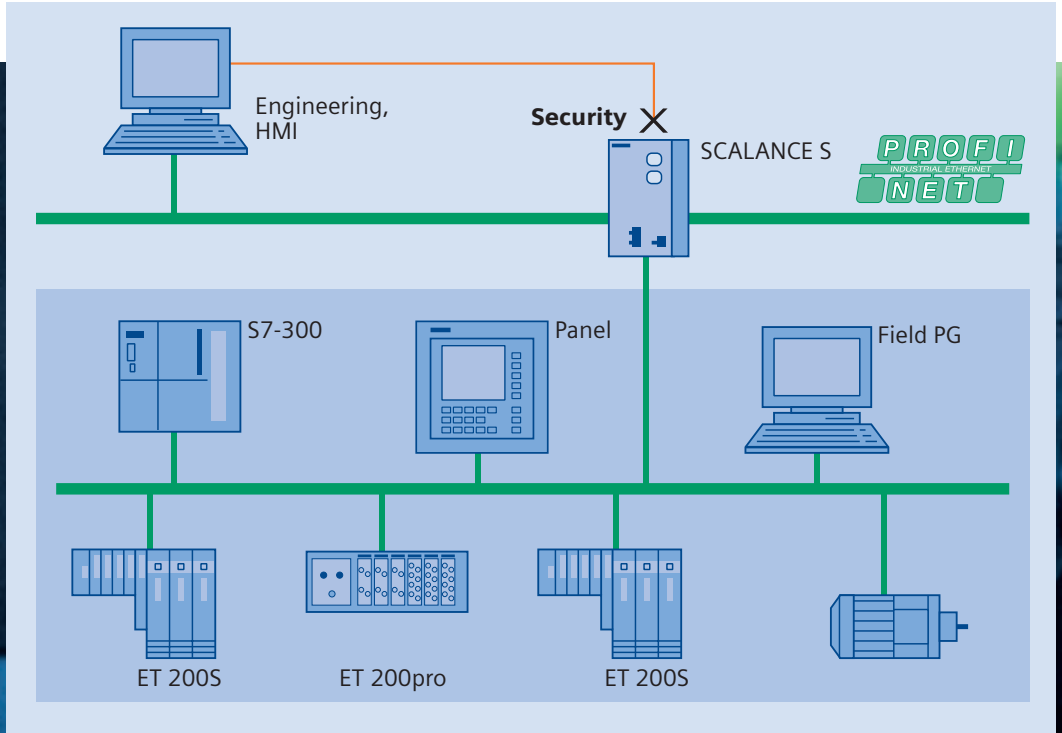
Compared to fieldbuses, Ethernet offers additional opportunities for network management in association with TCP/IP and UDP/IP. Components of integral network management include the network infrastructure, IP management, network diagnostics and time synchronization aspects. Using network management, the administration and management of Ethernet is simplified by the application of standard protocols from the IT world.

Diagnostics management

The reliability of network operation is the top priority of network management. In existing networks, the Simple Network Management Protocol (SNMP) has been asserted as the de-facto standard for the maintenance and monitoring of network components and their functions. SNMP permits both read access (monitoring, diagnostics) and write access (administration) to a device.

Web services

PROFINET can also be accessed using web clients. This takes place based on standard technologies from the Internet sector such as HTTP, XML, HTML or scripting. The data are transmitted in standardized form (HTML, XML) and displayed using standardized front ends (browsers such as Netscape, MS Internet Explorer, Opera, Firefox, etc.). This allows information from PROFINET devices to be integrated into modern, multimedia-based information systems.



Protection of plants against maloperation, manipulation and espionage is based on proven and certified security standards which are scalable and reaction free.

Web integration in the IT sector offers many clear advantages: the use of browsers as uniform GUI, location-independent access to information from any number of clients, platform independence of the clients as well as reduced overhead for installation and updating of client software. These advantages can also be used for PROFINET devices. And it pays off – primarily in testing, commissioning, diagnostics and maintenance.

Industrial Security

PROFINET allows data in the field level to be accessed from the management level. Thus, latent productivity potential can be detected and utilized. However, the security of the network and the data must be ensured.

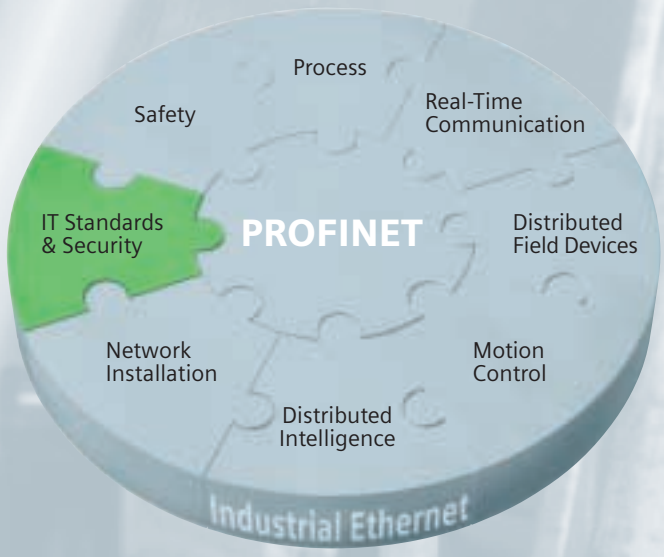
Viruses, Trojan horses, etc., are not the only security risks; faulty addresses within the company must also be ruled out. For example, it must not occur that a robot in hall 2 starts moving unnoticed if maintenance work is carried out on the conveyor belt in hall 1.

Simple and efficient solutions are required to rule out such dangerous situations: With SCALANCE S, Siemens provides network components for industrial data security which support PROFINET. Its graphic operation corresponds to that of the automation components and can be learned intuitively.

The "PROFINET Security Guideline" explains principles and concepts on the topic of "Data security in the industrial environment." Some examples:

- Access control and authorization
- Access levels
- Data security and security standards such as firewalls
- VPN (Virtual Private Network)
- IPSEC (data encryption)

You may obtain the PROFINET Security Guideline at www.profibus.com/libraries.html



Safety

PROFINET uses the PROFIsafe profile for safety-related communication. PROFIsafe is the first communication standard according to the safety standard IEC 61508 which allows standard and safety-related communication on the same bus cable. The advantages include considerably lower cabling overhead and fewer parts. By using the PROFIsafe profile, which has been tried and tested with PROFIBUS, in PROFINET as well, plant expansions are easily possible.

Open standard

PROFIsafe is an open solution for safety-related communication via standard fieldbuses. In the context of PROFIBUS International, many manufacturers of safety components and end users of safety technology participated in the creation of this open vendor-independent standard.

As a part of SIMATIC Safety Integrated, PROFINET with PROFIsafe is certified according to IEC 61508 (up to SIL 3), EN 954 (up to Category 4), NFPA 79-2002, and NFPA 85, thereby fulfilling the highest requirements for the manufacturing and process industries.

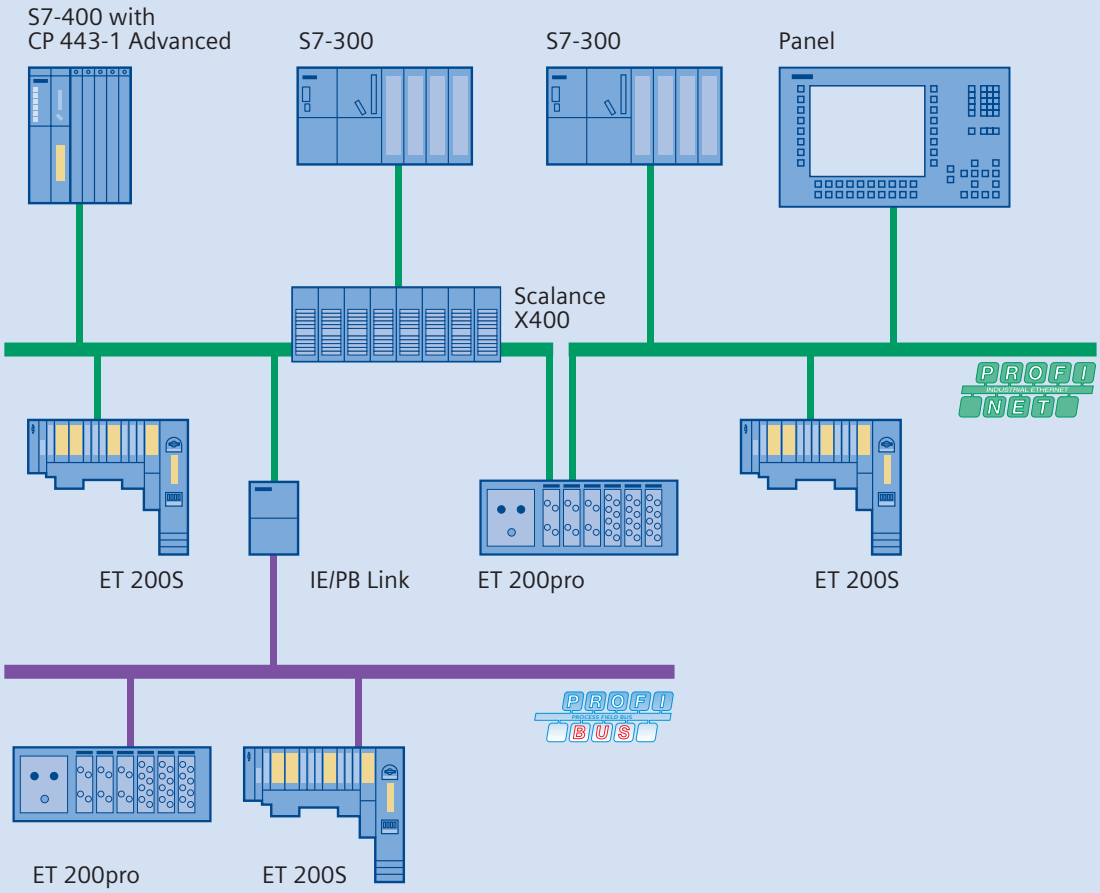
Protection against potential faults

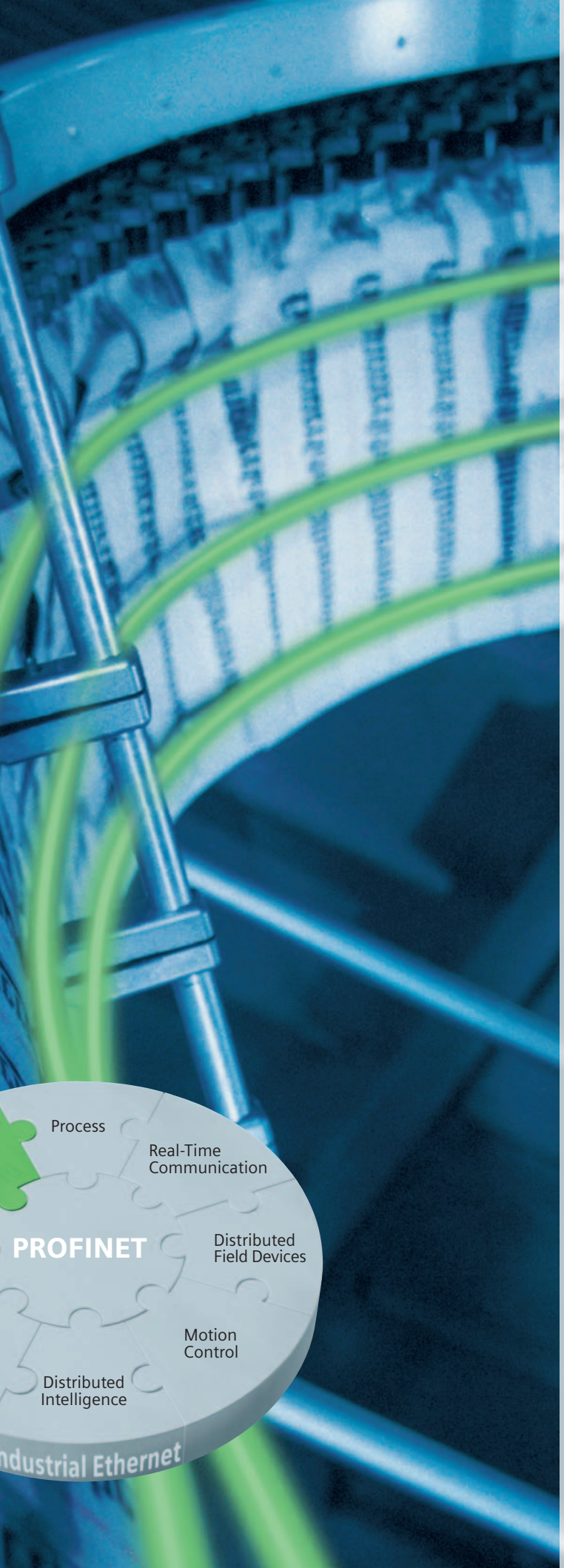
PROFIsafe uses PROFINET Real-Time communication (RT) for fail-safe communication. In addition to user data, status and control information is also exchanged between a fail-safe CPU and a fail-safe field device. No additional hardware is required.

There are various potential sources of error when transmitting messages, such as invalid addresses, loss, delay, etc. PROFIsafe counteracts these with four measures:

- Continuous consecutive numbering of PROFIsafe data
- Time monitoring
- Authenticity monitoring using passwords
- Optimized Cyclic Redundancy Check (CRC) security

Existing solutions can be expanded without changing the cabling.





Support

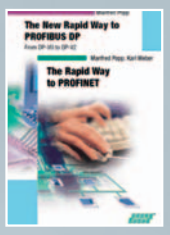
PROFINET is supported by PROFIBUS International. This fieldbus organization – the largest in the world – has more than 1200 members. Among them are the leading providers of automation technology as well as users from both production engineering and sectors of process engineering. Ten working groups that include employees from 50 companies are developing the PROFINET architecture.

Special testing labs have been established to certify the products. A worldwide network of 30 PROFIBUS Competence Centers is available to answer any questions regarding PROFINET.

Siemens Competence Center:

ComDec, Germany, contact: comdec@fthw.siemens.de
PIC, USA, contact: www.sea.siemens.com/pic

The rapid way to PROFINET



Detailed information on the topic of PROFINET can be found in the book "The Rapid Way to PROFINET". Throughout its 235 pages, the reader is instructed how to begin developing and planning a plant by asking specific questions to a team of experts or to precisely assess a PROFINET system as a plant engineer/operator, and to locate and eliminate the main errors by interpreting the message frames.

The book may be ordered through PROFIBUS International at **www.profibus.com/libraries.html**.

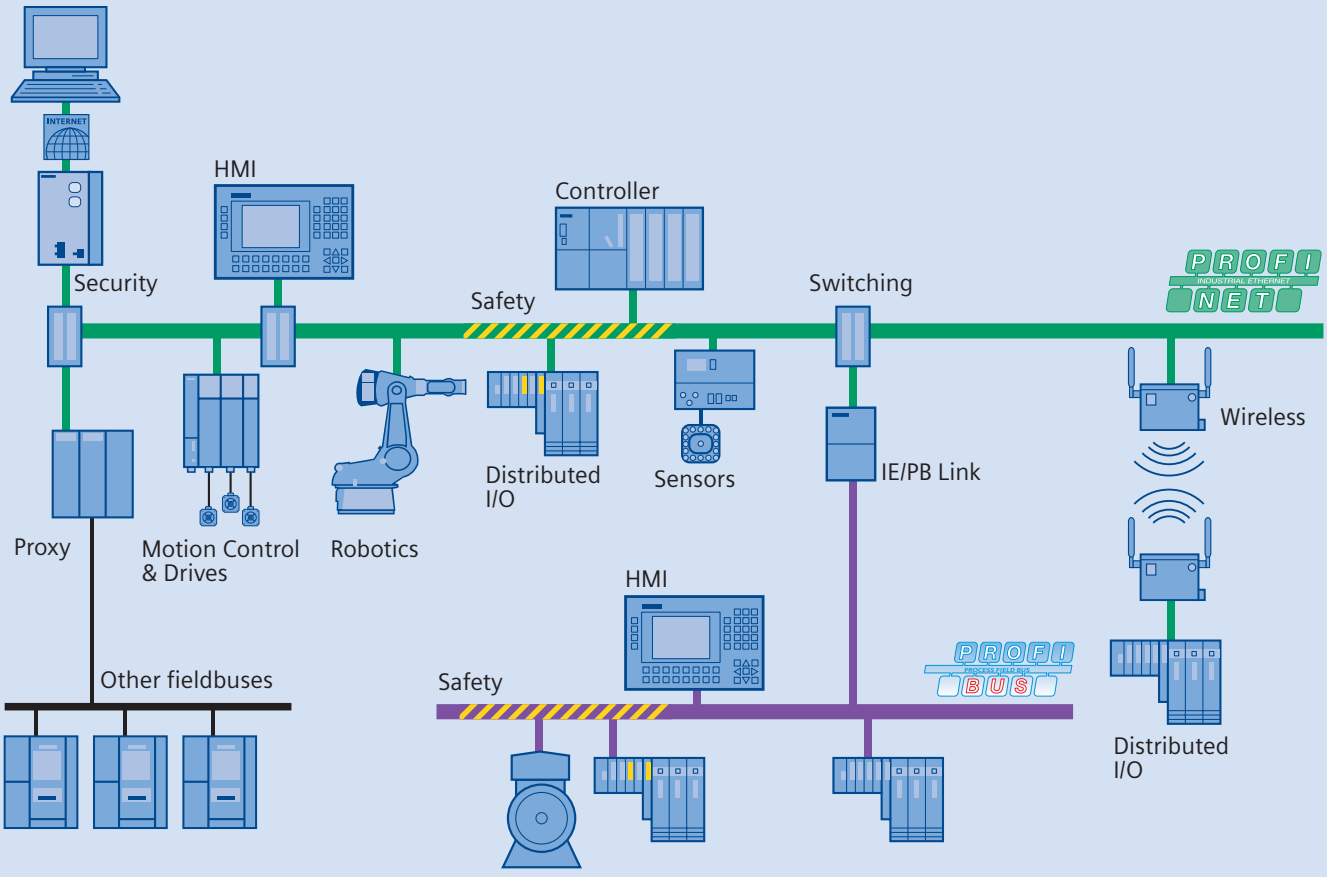
Automating with PROFINET

This book provides an introduction to the new PROFINET technology. Decision-makers, system designers and students receive a compact overview of the concept and principles. Project engineers, start-up engineers and technicians obtain extensive information about the planning and solution of a PROFINET-based automation application. Technical correlations and practical applications are explained using SIMATIC products.

Available October 2005 for purchase: ISBN No. 3-89578-256-4 or at **www.publicis-erlangen.de/books**

Products that make applications with PROFINET easier

Siemens offers an extensive range of products for PROFINET which includes the SIMATIC S7-300 and S7-400 as well as PCs and workstations. Distributed field devices from the SIMATIC ET 200 product line can be directly connected to PROFINET. Existing PROFIBUS devices can also be integrated into a PROFINET solution. The product range is rounded off by a comprehensive range of active and passive network components, security products for the creation of secure Industrial Ethernet networks, and the option of wireless communication with Industrial Wireless LAN.



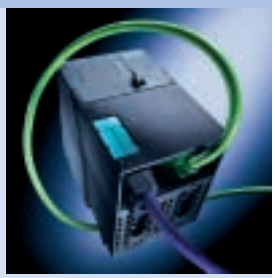
Passive network components

- With the rapid wiring system **FastConnect (FC)** for Industrial Ethernet, the structured cabling of the office environment is qualified for industry-standard use on the factory floor. FastConnect lines can be assembled on site very quickly and easily. RJ45 cabling technology is thus available as both an existing standard as well as an industry-standard version. In addition, a wide range of FO lines is offered.

Industrial Ethernet Switches

- **SCALANCE X** is the graduated portfolio of Industrial Ethernet switches (unmanaged and managed). The SCALANCE X product group consists of three complementary product lines tailored to the respective automation application. SCALANCE X switches can be configured and diagnosed in STEP 7. Furthermore, they provide the possibility to optimally transmit PROFINET real-time frames by prioritizing according to IEEE 802.1Q. Switches with integrated ASIC ERTEC are available for hard real-time requirements (IRT). Siemens offers IP65-rated devices in addition to products with IP 20 degree of protection.

Controllers



- For SIMATIC S7-300, the **CPU 317-2 PN/DP** is available for the upper performance range and the **CPU 315-2 PN/DP** for the mid-level performance range with integrated PROFINET interfaces. Both CPUs have a combined PROFIBUS DP/MPI interface as well as an Industrial Ethernet/PROFINET interface. The central processing units can be operated on PROFINET as IO-Controllers for field devices. Furthermore, as a component of PROFINET CBA, data exchange with other CBA components can be implemented.
- **WinAC Software PLC**
  With this PROFINET option, SIMATIC WinAC Basis can be used as automation component for PROFINET CBA. Thus, WinAC Basis supports data exchange with other PROFINET CBA-capable devices via Industrial Ethernet.

System connection for SIMATIC S7

- Communication processors are available for a connection from SIMATIC S7 to PROFINET. The **SIMATIC NET CP 343-1** is the communication module for Industrial Ethernet to integrate the SIMATIC S7-300 into a Component Based Automation application or to operate as IO-Controller field devices directly on PROFINET. With **SIMATIC NET CP 443-1 Advanced**, all SIMATIC S7-400 controllers can be integrated in PROFINET applications (PROFINET IO and PROFINET CBA).

System connection for programming devices/PCs

- **CP 1616**
  PCI module to connect programming devices/PCs to Industrial Ethernet with integrated ASIC ERTEC 400 and integrated 4-port real-time switch. The module can be employed as IO-Controller and IO-Device in PROFINET applications. Siemens offers a Development Kit to port to other operating systems.
- **SOFTNET PN IO**
  With SOFTNET PN IO field devices can be directly linked as IO-Devices to PCs via Industrial Ethernet.
- **PN CBA OPC-Server**
  Under PN CBA OPC Server you find the PC application interface for communication via Industrial Ethernet with PROFINET components for distributed automation structures.

Engineering Tools

- **SIMATIC STEP 7**
  For configuring PROFINET field devices in the familiar PROFIBUS manner.
- **SIMATIC iMap**
  SIMATIC iMap is a component-based engineering tool for configuring communication in distributed automation solutions. It is used to simply and graphically configure communication between system modules as well as machine-to-machine communication in a production line. SIMATIC iMap considerably reduces the customer's engineering overhead.

Distributed I/O

- **SIMATIC ET 200S**
  With the PROFINET interface IM 151-3 PN, the IP20-rated SIMATIC ET 200S multi-functional I/O system can also be connected to PROFINET. This allows the proven module range to also be used on Ethernet.

- **SIMATIC ET 200pro**
  SIMATIC ET 200pro is the IP65/67-rated modular, multi-functional I/O system, which can be installed directly in the process without the need for a control cabinet. With the interface module IM 15404 PN HF, the ET 200 pro can be connected as an IO-Device directly to PROFINET.

  Both ET 200 systems support standard and safety-related communication via PROFIBUS or PROFINET.

Sensors, test and measurement technology

- **SIMATIC VS 130-2**
  SIMATIC VS 130-2 is the intelligent vision sensor to "read 2D code." The sensor detects and decodes, for example, the data matrix code available on the object according to the ECC200 standard, and can be operated on PROFINET as an IO-Device.

Network transitions

Gateways between Industrial Ethernet and PROFIBUS can be implemented in the form of links, controllers (PLCs) or PCs. Gateways implemented in the form of links pass data seamlessly from one network to another, enabling transparent interfacing of existing PROFIBUS devices to Industrial Ethernet. This makes it possible to transparently link existing PROFIBUS devices to Industrial Ethernet.

- **IE/PB Link PN IO**
  The IE/PB Link PN IO transparently links PROFIBUS DP slaves to PROFINET IO-Controllers.
- **IWLAN/PB Link PN IO**
  With the compact network gateway IWLAN/PB Link PN IO, PROFIBUS DP slaves can be wireless linked to a PROFINET IO-Controller via Industrial Wireless LAN.
- **IE/PB Link**
  The IE/PB link connects PROFINET CBA components which are connected to PROFIBUS to Industrial Ethernet.

Industrial Security

- **SCALANCE S**
  The SCALANCE S security concept provides a security solution specifically for industrial automation technology. SCALANCE S Security Module offer scalable security functionality: a firewall protects automation devices against unauthorized access regardless of the size of the network. Virtual Private Networks (VPN) serve as an alternative or expansion to securely authenticate the communication stations and encode the data transfer. The SOFTNET Security Client provides secure access from PCs/notebooks to automation devices protected by SCALANCE S.

Industrial mobile communication

- Reliable, rugged and secure Industrial WLAN: **SCALANCE W-700**
  The SCALANCE W Industrial Wireless LAN products are based on standards, offer additional "data reservation" and "rapid roaming" functions, which enable, for example, the high-performance connection of field devices to controllers. In addition, SCALANCE W products have a rugged design with high IP65 degree of protection and integral security functions.

PROFINET technology components

- **ERTEC 400 and Development Kit ERTEC 400 PN IO**
  Ethernet Controller ERTEC 400 with integrated 4-port switch, ARM 946 RISC and PCI interface, data processing for Real-Time (RT) and Isochronous Real-Time (IRT) applications with PROFINET. The associated Development Kit supports the development of individual PROFINET IO-Devices.
- **PROFINET IO Development Kit**
  The PROFINET Development Kit allows field device manufacturers to more quickly develop and offer PROFINET field devices (IO-Devices). It includes a CD and a single license, which authorizes both the development as well as production of one field device product line.

HG International – manufacturer of cleaning products, The Netherlands

Requirements

HG International produces special cleaning, protecting and polishing products. At their factory in Almere, this Dutch company manufactures more than 250 different products which are exported to over 45 countries.

For the bottle filling process, a controller is needed to open and close valves very rapidly in the moving part of the machine. The availability of the existing solution did not meet the high requirements. This was due primarily to the disturbances in communication caused by slip ring contact.

Solution

HG International based the new solution on Industrial Wireless LAN with PROFINET using the ET 200S PN. Together with a SCALANCE W Client, it is mounted on the moving part of the machine in order to control the valves.

Benefits

HG International benefits from the reliable and high-performance communication between the S7-300 controller using CPU 317-2 PN/DP and the moving part of the machine using SCALANCE W and ET 200S PN. The cost-effectiveness is another convincing reason for using this kind of solution.

Furthermore, wireless programming can be used for service purposes. And because a weighing unit with SIWAREX CS can be integrated into ET 200S PN at any time, the following is certain: the new solution is highly future-oriented.

Automatic Syd – cement industry, Denmark

Reqirements

Automatic Syd supplies inter alia automation solutions for the cement industry. The conditions in this industry are harsh and extremely dirty. This Danish company wanted to install a wireless network, with which it could also conduct service functions on moving parts at any time. Furthermore, the new solution should be easy to expand and cost-effective.

Solution

Automatic Syd decided for a wireless solution using PROFINET. They were installed on the automated guided vehicles. The wireless communication enables both engineering and diagnostics to be implemented from any location. The following components are used:

- SIMATIC S7-300 with CPU 315-2 PN/DP
- SIMATIC ET 200S PN
- SCALANCE W
- SCALANCE X

Benefits

The new solution met all expectations from the beginning. Because of the reliable IWLAN communication, it features maximum availability. Furthermore, it significantly increased the efficiency of machine service.

Additional advantages of the system include higher flexibility and easy expandability. Automatic Syd could continue to use its existing PROFIBUS know-how.

Electrolux – washing machine manufacturer, Italy

Requirements

The well-known Italian washing machine manufacturer, Electrolux, was looking for an innovative automation solution for its plant in the Northern Italian city of Porcia in order to be able to always flexibly react to current demands in the international market. The most important requirements in this case were the easy integration of various machines, rapid commissioning and uncomplicated maintenance.

Solution

The modularly designed system is therefore based on distributed intelligence with PROFINET CBA. A PROFINET-capable S7-300 serves as the coordinating PLC and controls the complete transportation system. What's more, it communicates with the plant visualization and management system, receives operating commands from the management level and informs management about the status of operational progress. Two additional S7-300s control both spray booths as well as the two spraying robots with the associated drying oven.

Benefits

A new, very technologically advanced paint shop – the company's most modern one – was developed. Thanks to Component Based Automation, Electrolux benefits from a high degree of flexibility: if necessary, washing machine production can be quickly adapted to the current market situation and, for example, converted to different colors.

By easily integrating various modules, configuration costs were reduced to a minimum. Programming of the complete data transfer between the intelligent plant components was not time-consuming, but instead quick and easily configured with SIMATIC iMap. Thanks to the outstanding diagnostic functions, maintenance was also considerably simplified.

PUBLICIS

Information regarding PROFINET at PROFIBUS International:

http://www.profibus.com

Find SIMATIC manuals in the SIMATIC Guide technical documentation:

http://www.siemens.com/simatic-docu

Order additional publications on the topic of SIMATIC at:

http://www.siemens.com/simatic/printmaterial

For a personal consultation, find the SIMATIC contact person in your area at:

http://www.siemens.com/automation/partner

The A&D Mall lets you place direct orders electronically online:

http://www.siemens.com/automation/mall

Information about our current educational and training offers:

http://www.siemens.com/sitrain

www.siemens.com/profinet

Subject to change without prior notice | Order No. E20001-A11-M116-V1-7600 | DISPO 06334 | 41C8992 ml016ds.52507 WS 04056. | Printed in Germany |

Siemens AG

Automation and Drives

www.siemens.com/automation