PROFINET

The leading

Industrial

Ethernet

Standard

The Benefits of
PROFINET

PROFIBUS • PROFINET

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

PROFINET offers …

… **more continuity and uniform structures**

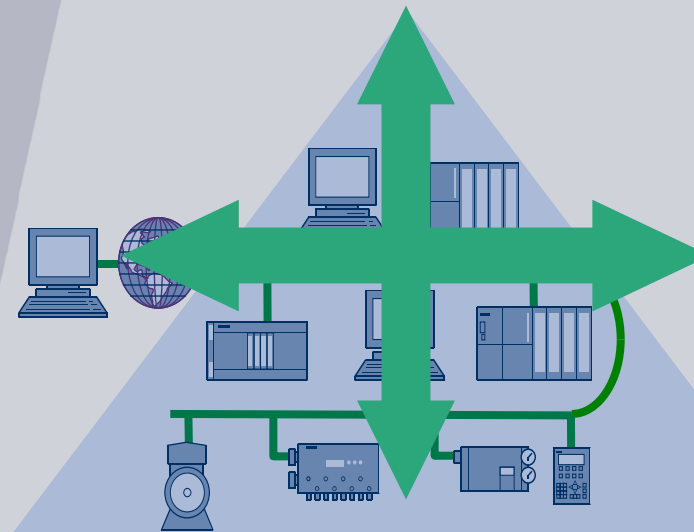… **more nodes and better performance**

… **seamless integration of existing systems**

… **new, innovative applications**

… **continuous enhancements**

PROFINET offers …

… more continuity (uniform structures)

In communication

Initial situation and requirements

Does this sound familiar?

- Different networks in your office and production areas
- Several individual proprietary solutions
- Diagnostics, service and maintenance only possible on site and is long and involved

Your requirements

- Uniform, safe and secure networks without any network transitions
- Uniformity and reliability based on accepted standards
- Plant-wide, uniform engineering
- Access, service and maintenance from anywhere
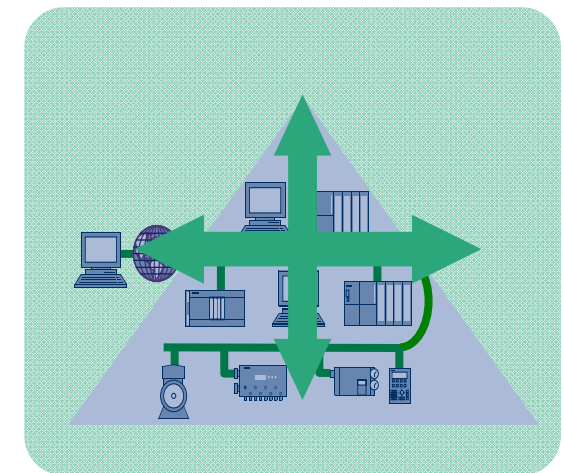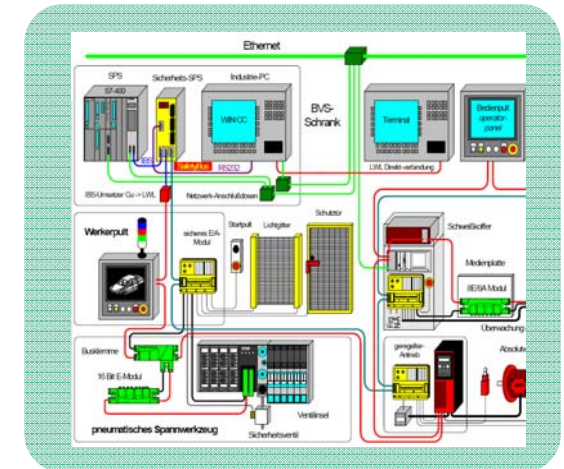
Goal: To cut the cost of engineering, commissioning and live operation

PROFINET Marketing - Benefits

PROFINET – offers the required uniformity

Agenda

Uniform structures

Performance

Integration
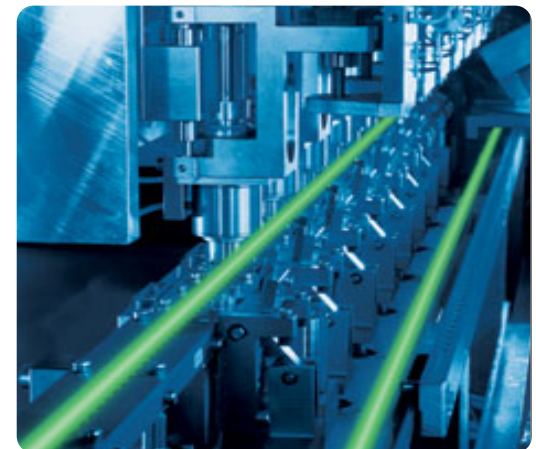
Innovations

Enhancement

Based on ...

- Standard Ethernet

- Real-time communications

... and advanced architecture

- Just one bus for everything

- Flexible network topologies

results to

- Unlimited IT communications parallel to real-time communications
- Easy use and integration of standard Ethernet applications
- Web functionalities in automation components
- Security even in your industrial environment

PROFINET Marketing - Benefits

PROFINET is Standard Ethernet
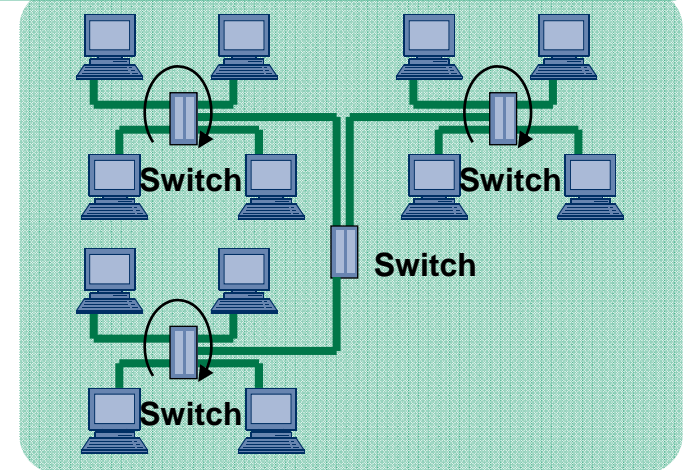
Switching technology

- Simultaneous sending/receiving
- Parallel communications paths
- Unlimited number of devices
- Ultra short response times
- 1,440 bytes per frame
- Intelligent Network device

Parallel communications

PROFINET – innovative and future-proof
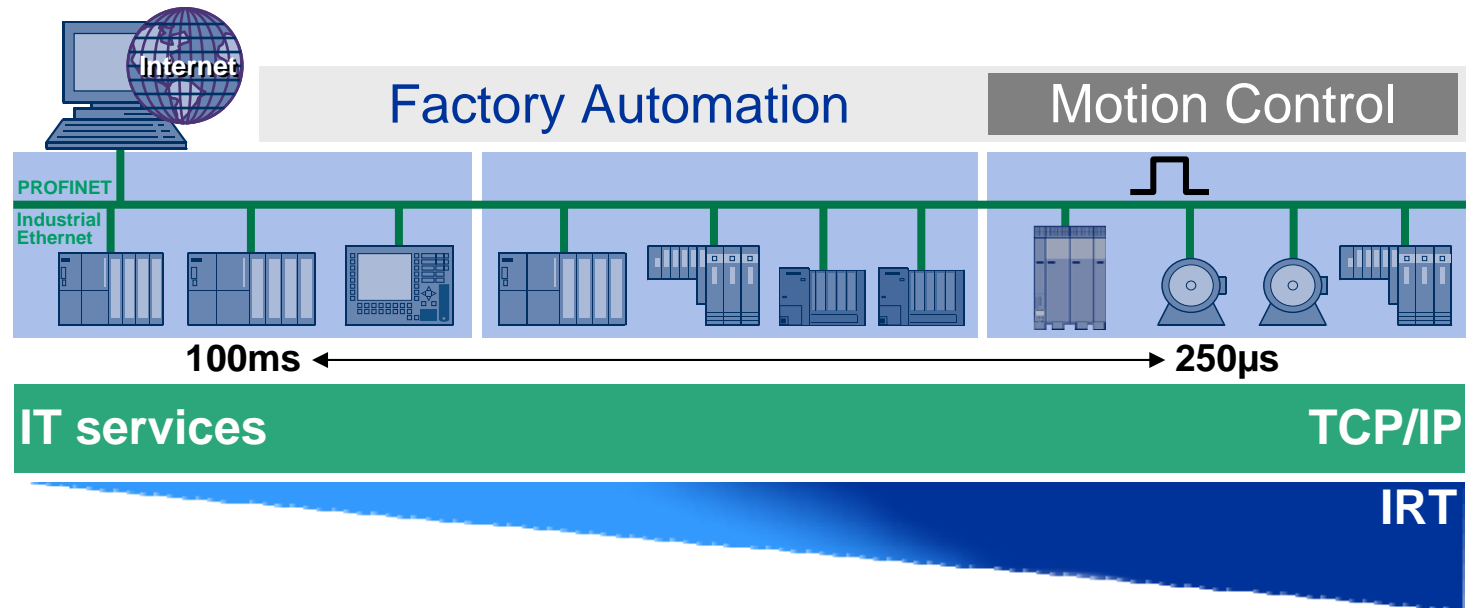
PROFINET is Real-time Ethernet

Internet

PROFINET

Industrial Ethernet

Factory Automation

Motion Control

100ms ← → 250µs

IT services | **TCP/IP**

IRT

Enables all this...

▮ ... direct online access to field devices

▮ ... maintenance and service from anywhere (even remote)

▮ ... lower costs for production/quality data monitoring

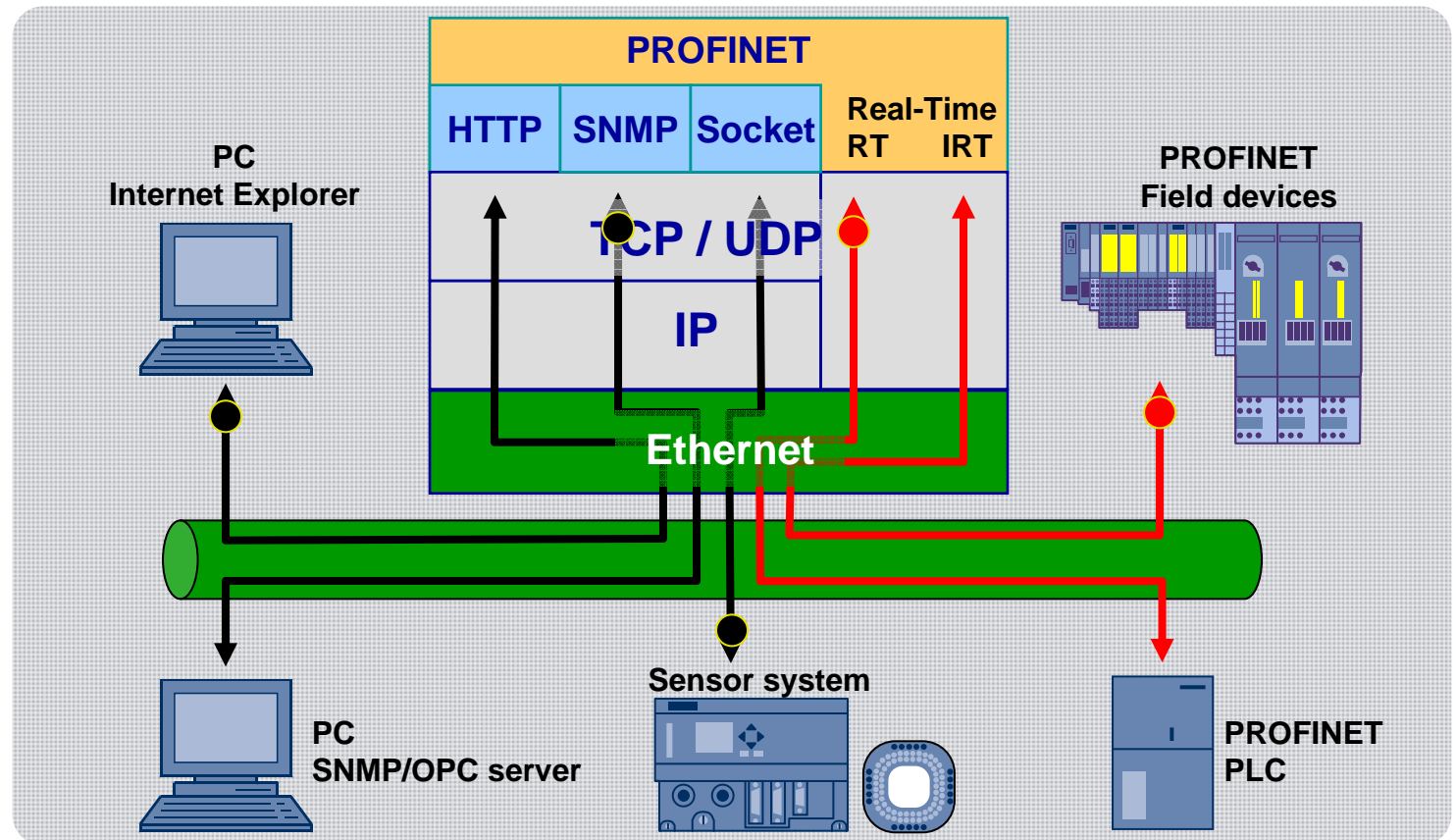**Scalable Real-time for simultaneous, unlimited IT communications**

PROFINET Marketing - Benefits

PROFINET communications

PROFINET features standard TCP/IP communications in compliance with IEEE 802.3 and real-time communications
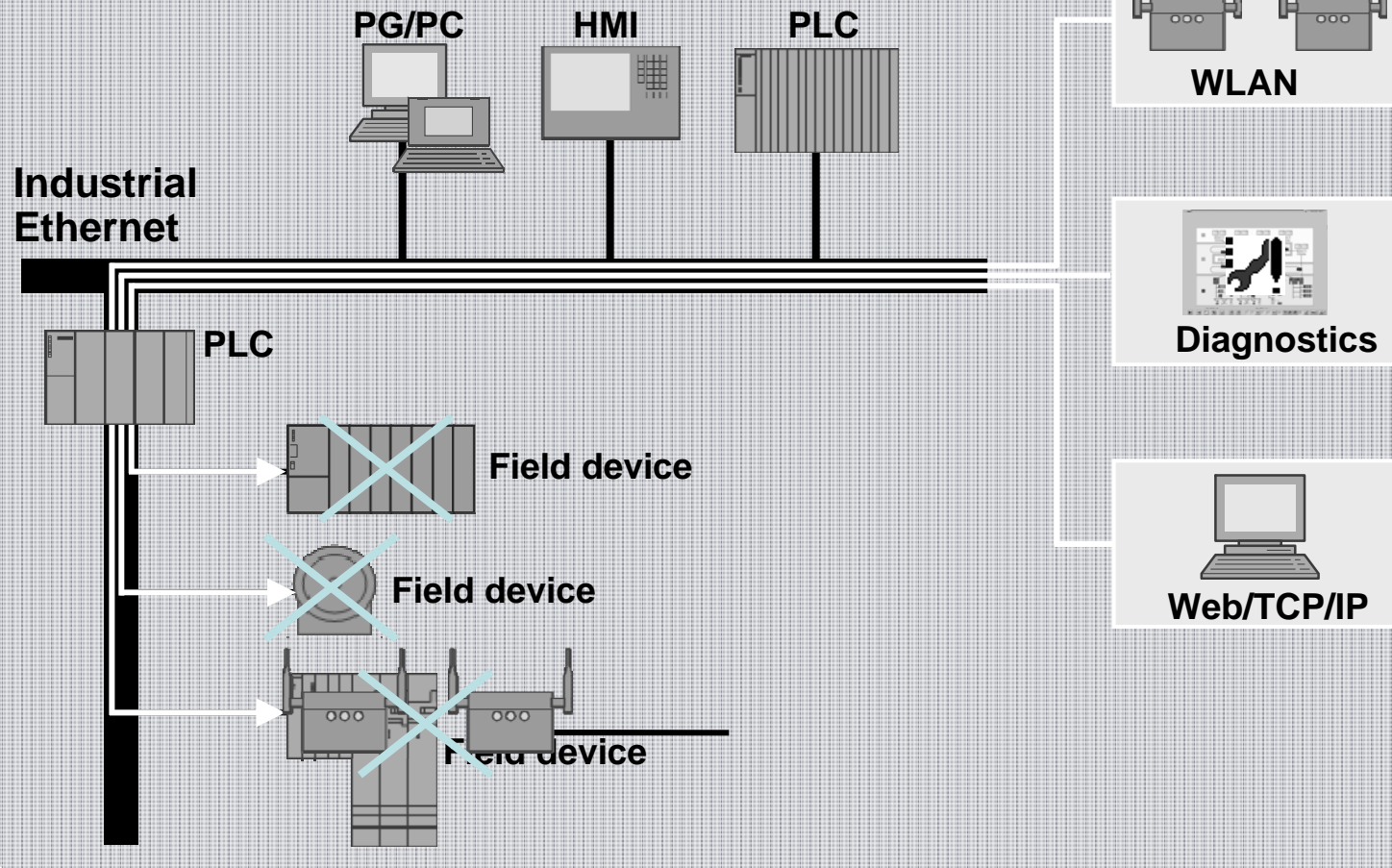
Field busses

Conventional automation topologies with fieldbuses
such as EtherCAT, Ethernet Powerlink, PROFIBUS, Interbus and other

PG/PC　　**HMI**　　**PLC**

Industrial Ethernet

PLC

Field device

Field device

Field device

WLAN

Diagnostics

Web/TCP/IP

PROFINET Marketing - Benefits

PROFINET – use <u>one</u> bus for all your tasks!

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

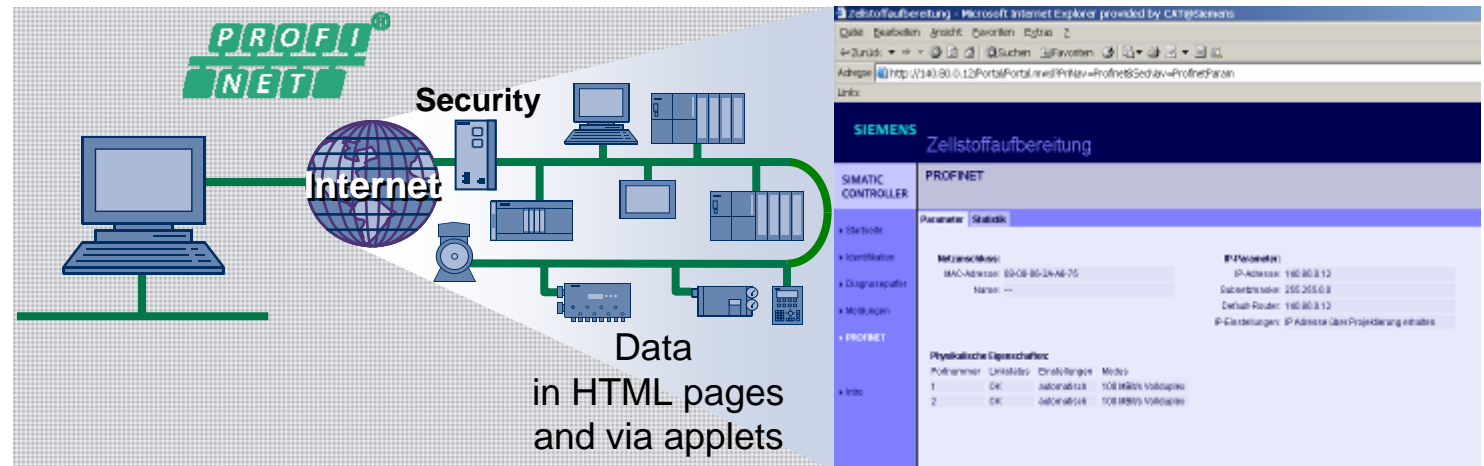**Automation topologies with PROFINET**

PG/PC   HMI   PLC

PROFI® NET

IWLAN

Diagnostics

Drive

Motion Control

Field device

Web/TCP/IP

Access-Point

Field device

PROFINET Marketing - Benefits

Integrated web functionality for diagnostics and service

Data
in HTML pages
and via applets
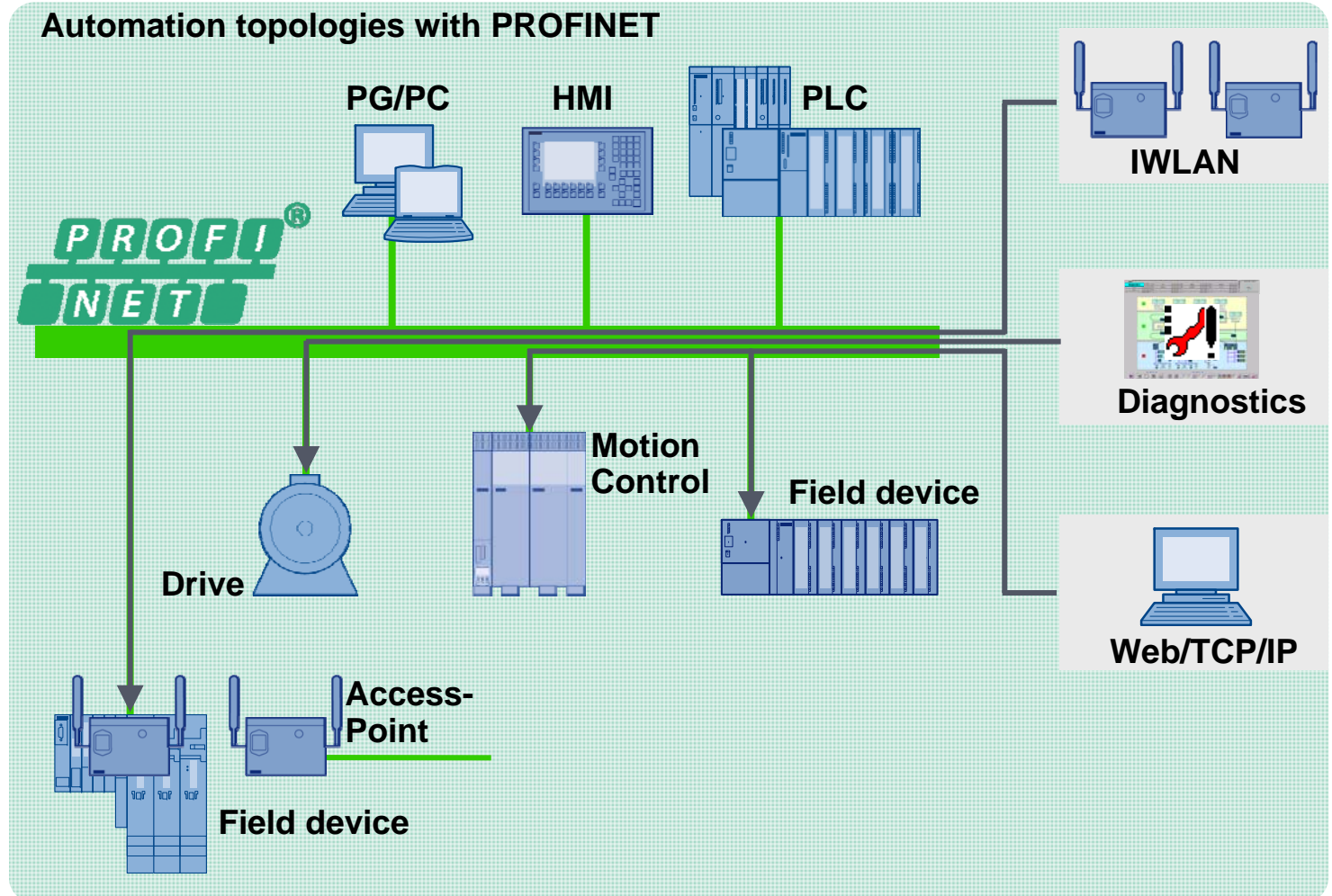
Access to the automation from anywhere in the world

- Via the integrated web server in automation devices
- With a standard Internet browser
- Regardless of your engineering tool
- Easy remote diagnosis and services

Event-driven message dispatched by SMS or e-mail

PROFINET - innovative communications via TCP/IP and the Internet for automation applications, too!

PROFINET Marketing - Benefits

Security with PROFINET

Offers protection from

- Address errors and improper operation
- Unauthorized access
- Manipulation and espionage

Features

- Scalability and reaction-free installation
- Only basic IT knowledge required
- Proven and certified security standards (firewall, VPN)

Enables

- Use of Ethernet at all levels of automation
- Vertical networking
- Increased use of open IT standards in automation

Internet

Security

PROFINET

Industrial Ethernet

Boost security and performance in your production processes!
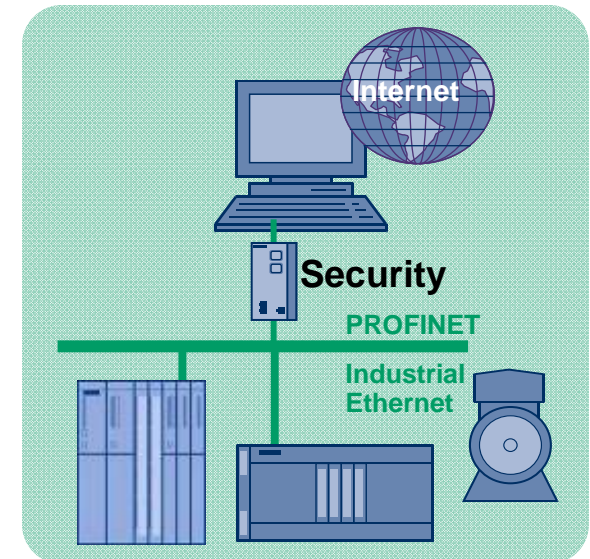
PROFINET Marketing - Benefits

PROFINET – Flexible network topologies

Agenda

Uniform structures

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Enhancement

Ring **Bus**
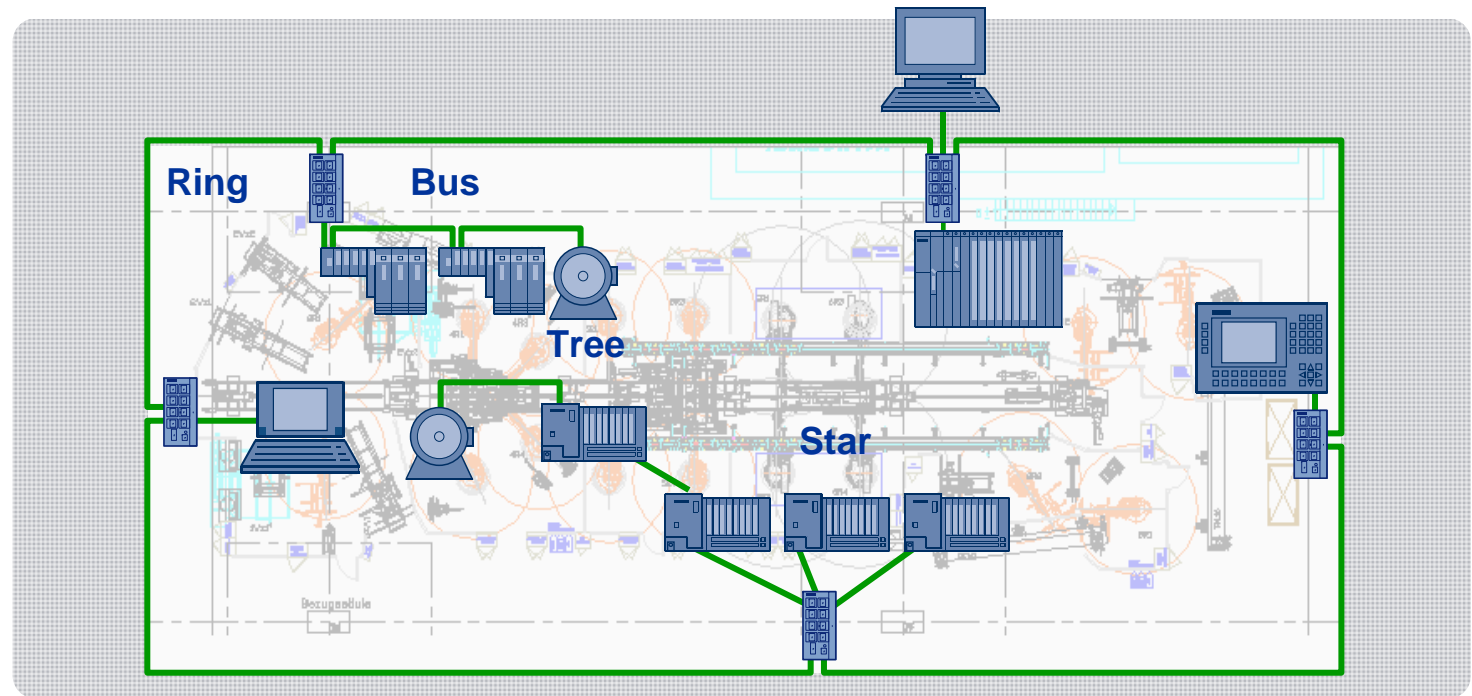
Tree

Star

Benefits and added value for our customers

▰ Bus structure through integration of switch ports in devices

▰ Tree and star topologies for tree'd configurations

▰ Redundant rings with reconfiguration in real time

Cost reduction and more flexibility

High availability

PROFINET Marketing - Benefits

PROFINET – Excellence in Operation

Agenda
Uniform structures
Performance
Integration
Innovations
Enhancement

More uniformity in communications

Building automation

Mineral water – filling & transport

Warehouse logistics

Industrial bakery

Power management in in paper recycling

Sprinkler control

Competitor situation

- Real-time network is separated from the rest by a controller

- When field devices are connected (such as drives) within a real- time domain, their asynchronous communication inhibits network and CPU performance considerably.

- HMI, other controllers, vision systems, wireless segments, and standard PCs are outside the real-domain, since they adversely affect real-time behavior.

- This is "just" a new fieldbus on Ethernet

Non-real-time domain e.g. Ethernet
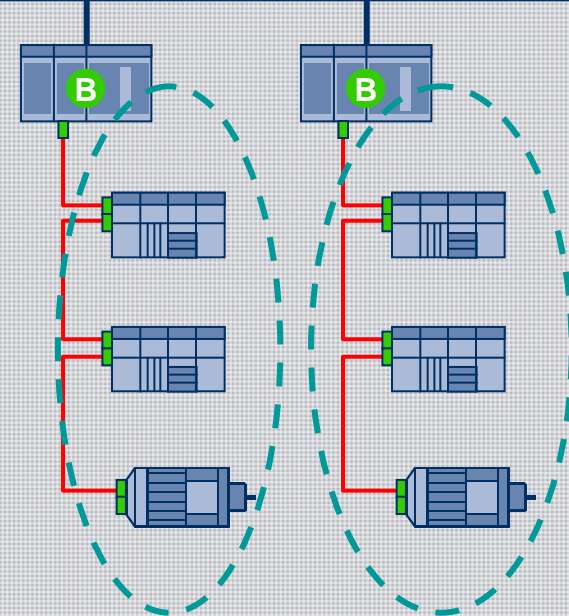
Real-time domains, e.g. EtherCAT, Ethernet Powerlink

PROFINET provides complete flexibility and a real quantum leap since real time and TCP/IP, standard and safety are running over one cable or wireless!

PROFINET – use <u>one</u> bus for all your tasks!!

Agenda

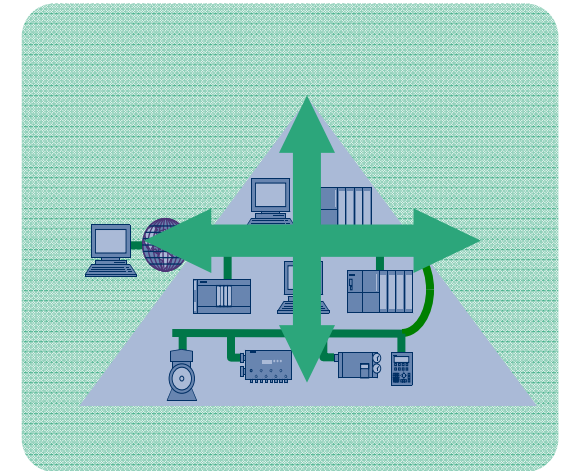**Uniform structures**

Performance

Integration

Innovations

Enhancement

Benefits and added value for customers

- Connect any automation device to any point

- All automation applications run via just one cable; Real-time and TCP/IP

- Standard and failsafe automation via one cable – or even wireless

Summary — **Flexibility and cost reduction for engineering, installation and maintenance**

PROFINET Marketing - Benefits

Configuration – like PROFIBUS

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

PROFINET offers …

… more continuity (uniform structures)

For diagnosis

Requirements for diagnostics

You want...

- Access to your data from anywhere

- To localize faults quickly

- Fault messages in plain text and foreign languages

- Comprehensive diagnostics down to the channel, even across gateways

- To use common IT standards

- A graphical overview of the real topology

- Preventative diagnostics and maintenance
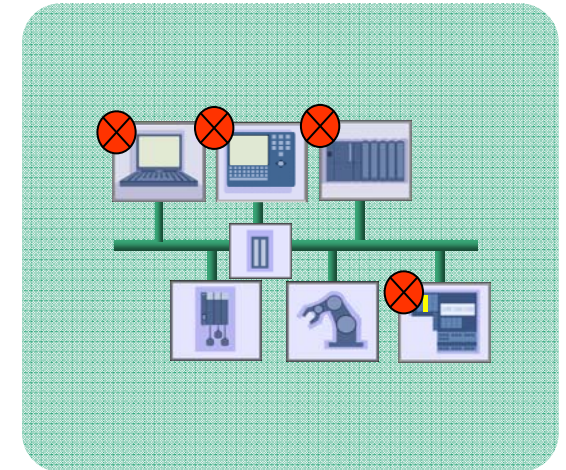
Goal: Fast commissioning and increase in plant availability

PROFINET Marketing - Benefits

Beside

- Proven channel diagnosis known from field busses

- Guaranteed alarm

... usage of standard Ethernet diagnosis

- Established mechanism like SNMP

- Access anywhere

on top

- Easy localization with topology views
- Simple access with web
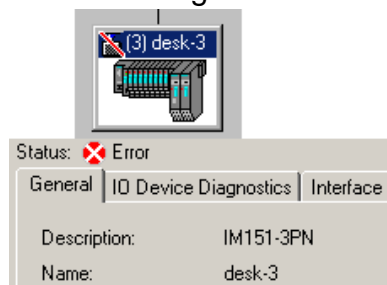
Simple by integrated naming

Comprehensible names of devices

- well defined names for the addressing are also used for diagnostic information, e. g. „desk-3"

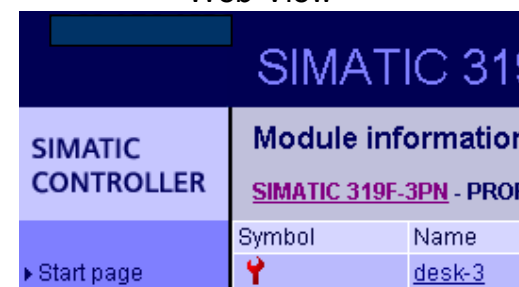Offline-Engineering

Online-Diagnostics

Web-View

Device name: desk-3

Status: ✕ Error
General | IO Device Diagnostics | Interface
Description: IM151-3PN
Name: desk-3

SIMATIC 319
SIMATIC CONTROLLER
Module information
SIMATIC 319F-3PN - PROFI
▸ Start page
Symbol | Name
🔧 | desk-3

Consequent support also of the connectors/wiring naming

Offline-Engineering

Device-Housing

Online-Diagnostics

(3) desk-3

Slot	M..	Order number	
0	desk	6ES7 151-3BA2	
X1	PN-IO		
X1	Port 1		
X1	Port 2		

X1 P2

(3) desk-3

Slot		Module
0		desk-3
X1		PN-IO
X1		Port 1
X1		Port 2
1		PM-E DC24/48

Status: ✕ Error
General | IO Device Diagnostics | Communication Diagnostics

Communication Diagnostics:

Name	Error
✕ Port 2 (X1 P2)	Wrong partner port
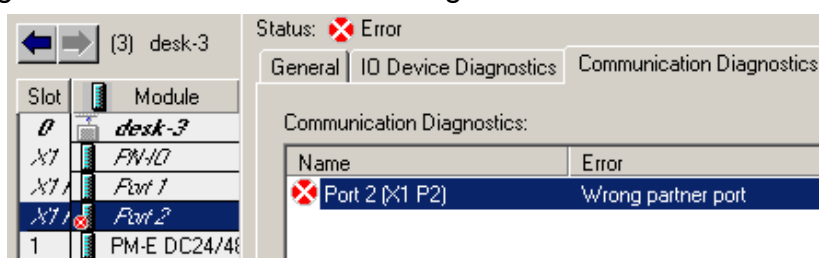
Error prevention
Clear identification of the fault location
Fast repair

PROFINET Marketing - Benefits

Device Diagnostics

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Diagnostic overview

- In levels of detail
  - Device
  - Modul
  - Channel
  - Interrupts

Current fault events

- Acknowledged

I&M (Identification & Maintenance)

High-speed overview
Level of detail according to requirements
Standardized display

Cable diagnostics as for device diagnostics

- Same modeling of Ports as of I/O channels

Representation in standard and topology view

Additionally with POF: Maintenance (plastic optical fiber)

Additionally: Use of standard Ethernet mechanisms (SNMP/MIB2)
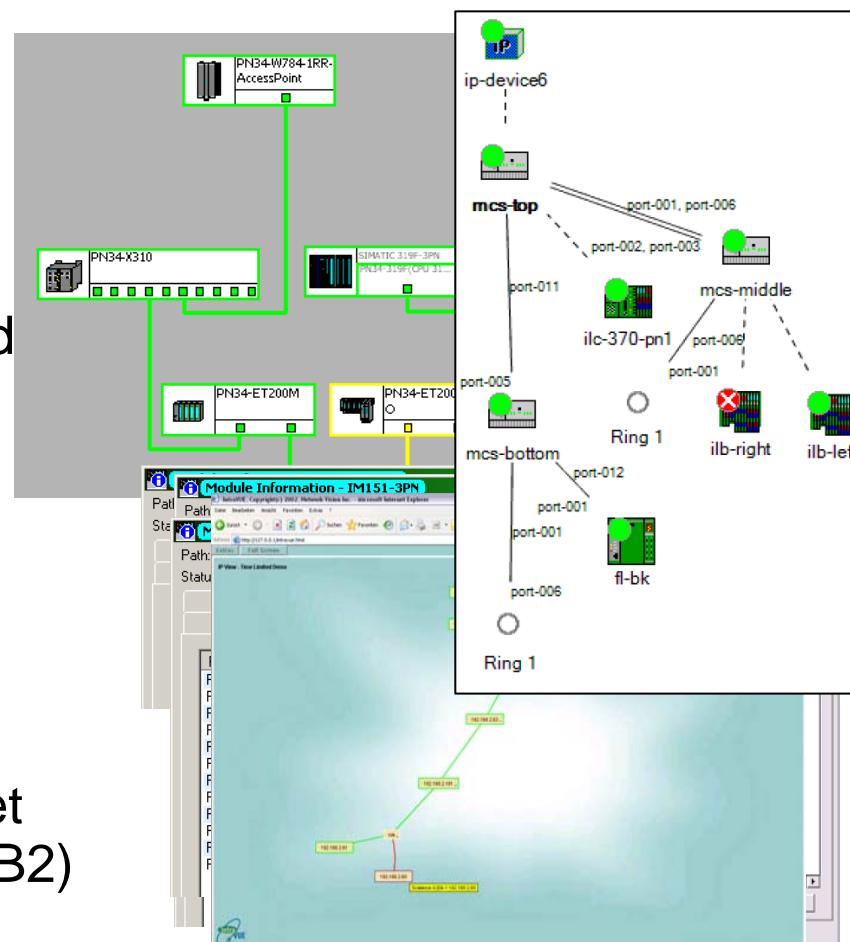
Familiar engineering
Fast and location-related diagnostics
Use also by standard Ethernet diagnostics

Topology view

Engineering view in addition to the actual plant structure

- graphical
- tabular
- offline
- online

- integrated in
  - Engineering
  - Controller
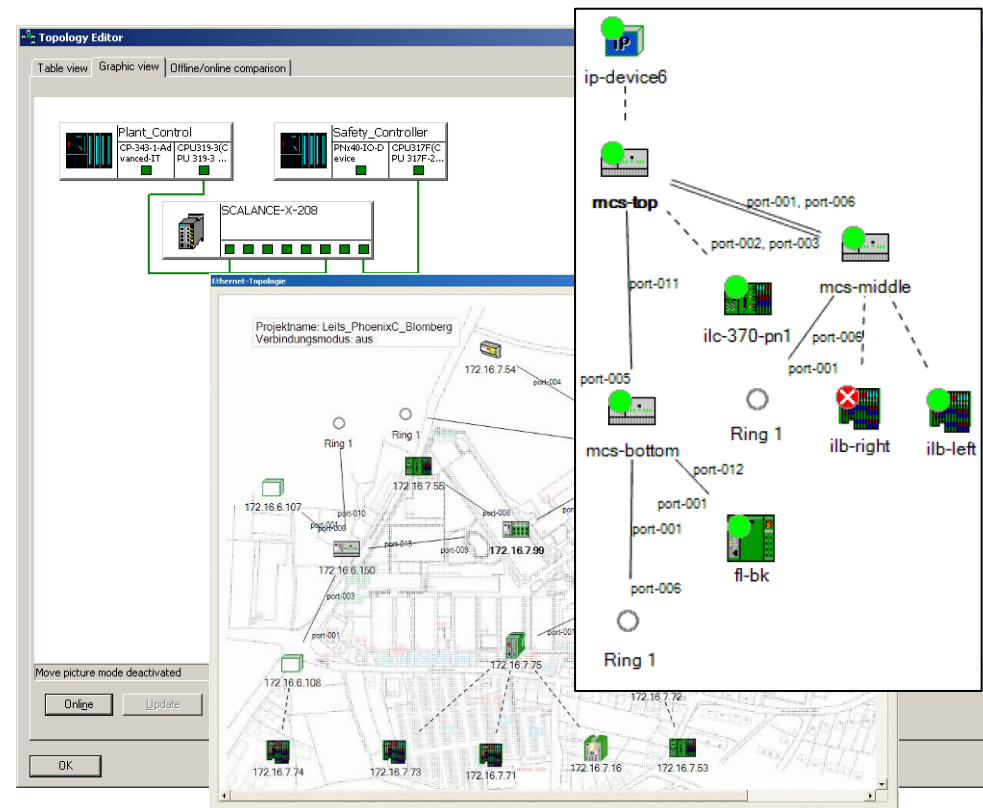
Clear plant overview, documentation
Fast fault location
Fast access to detailed diagnostics

TCI (Tool Calling Interface)

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Calling of vendor-specific device tools for complex devices

Simple user handling

- Automatic assignment of tool
  → associated device

- Use of the existing interface paths

- Standardized behavior of tools,
  e.g. for storage path

- Simple user handling
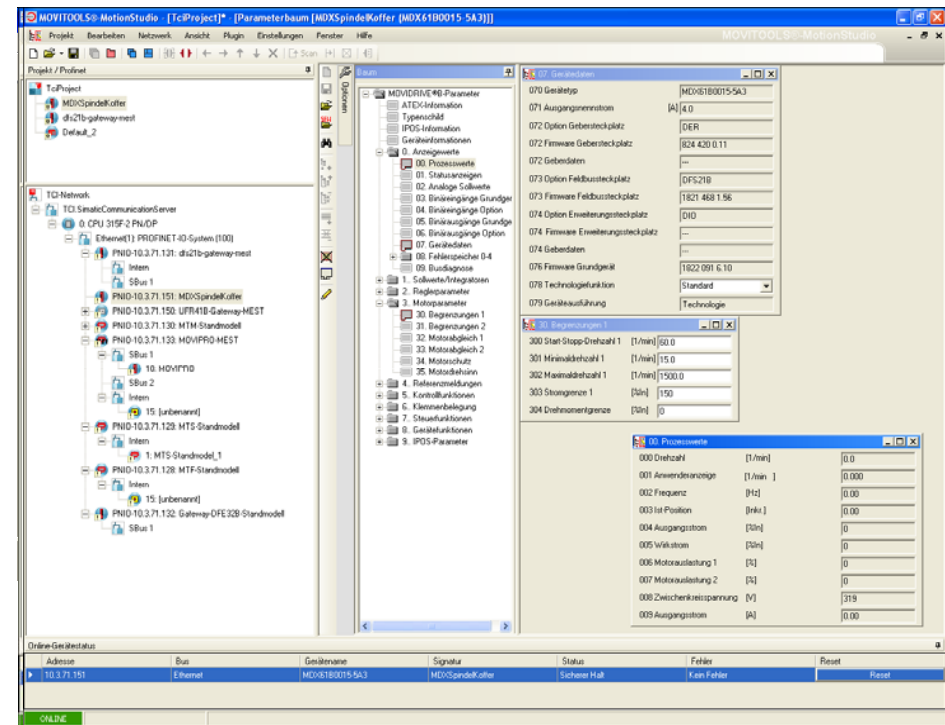
Fast, easy access to device tools
Vendor-specific diagnostics and parameter setting
Use of familiar tools

Web

Presentation of diagnostics and parameter settings

Simple access
Regardless of location, even wireless
No engineering

PROFINET Marketing - Benefits

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Control system for data acquisition

Encapsulated process

Gantry robot system

Gravel extraction
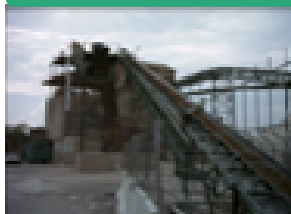
Water treatment

Brine extraction

Coil transport

Staircase production

Warehouse logistics

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Added value for our customers

- Fast engineering
- High plant availability
- Cuts costs of configuration and commissioning
- Diagnostic information worldwide
- Fast localization of faults
- Transparency in the network
- Automatic documentation
- Preventative maintenance
- Data available from anywhere
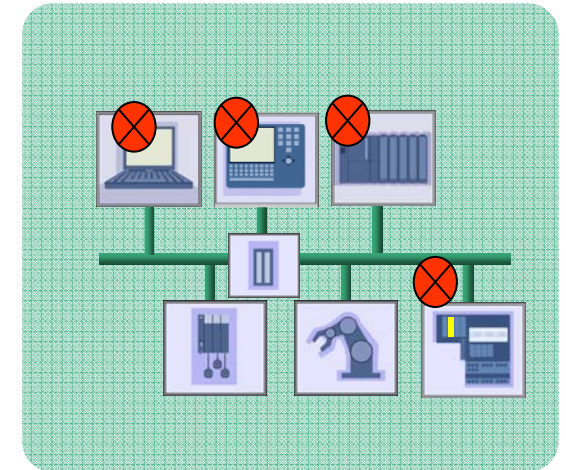
Summary **... Increase of efficiency by fast commissioning and increased plant availability**

PROFINET Marketing - Benefits

PROFINET offers …

… seamless integration of existing systems
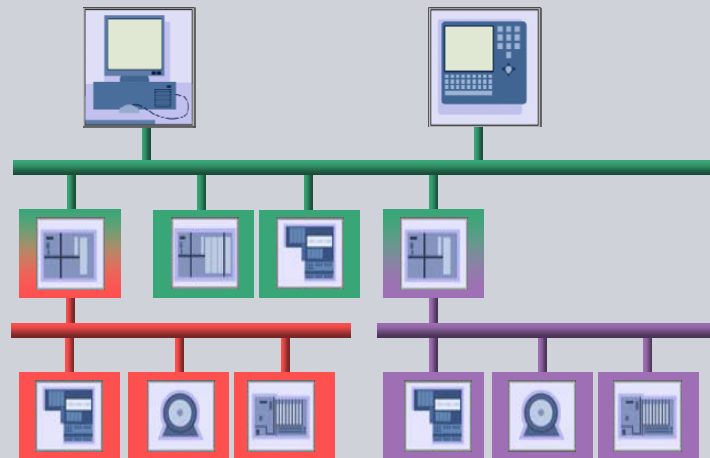
Such as components, fieldbuses and networks

Do you want to...

- Easily integrate existing fieldbus systems?
- Integrate existing Ethernet networks?
- Continue using existing user programs?
- Continue using existing devices?
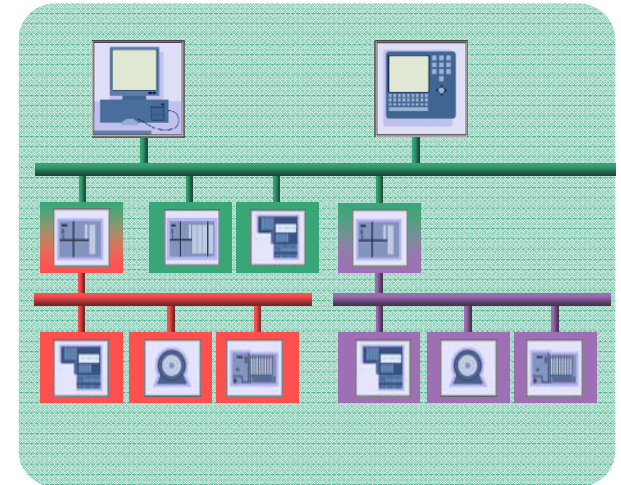
And ...

- Continue using your existing knowledge and tools without a problem?
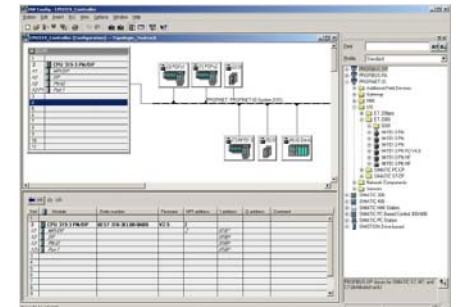
Minimizes the time and expense of setting up your system with or migrating to PROFINET

PROFINET Marketing - Benefits

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

- Integration of existing fieldbus systems
  through proxy technology

- PROFINET is standard Ethernet

- Lets you continue using your user programs

- Makes it easy to convert existing devices

- Engineering – with the same look & feel

Easy integration of existing fieldbus systems through proxy functionality

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement
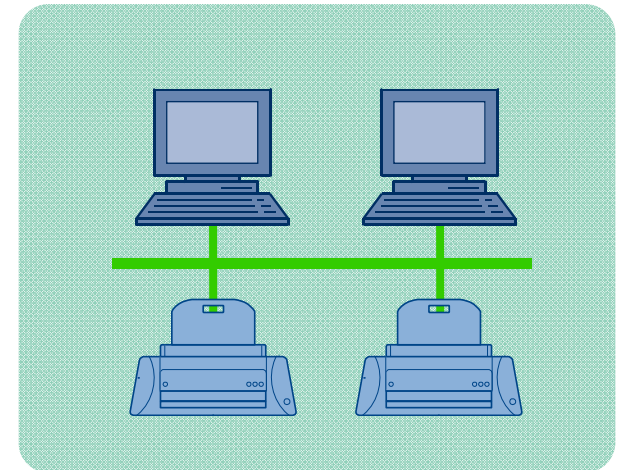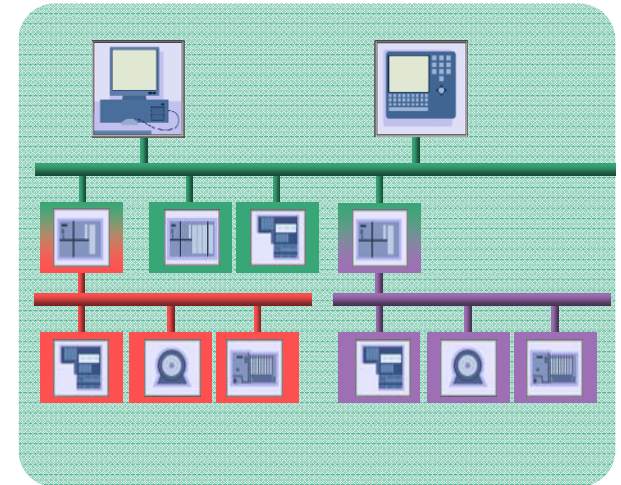
Benefits and added value for our customers

- Including gateways for PROFIBUS, Interbus, AS-Interface and other fieldbuses

- Including controllers with PROFINET and PROFIBUS interface

PROFINET

Proxy

Transparent communications between PROFINET and PROFIBUS

PROFIBUS
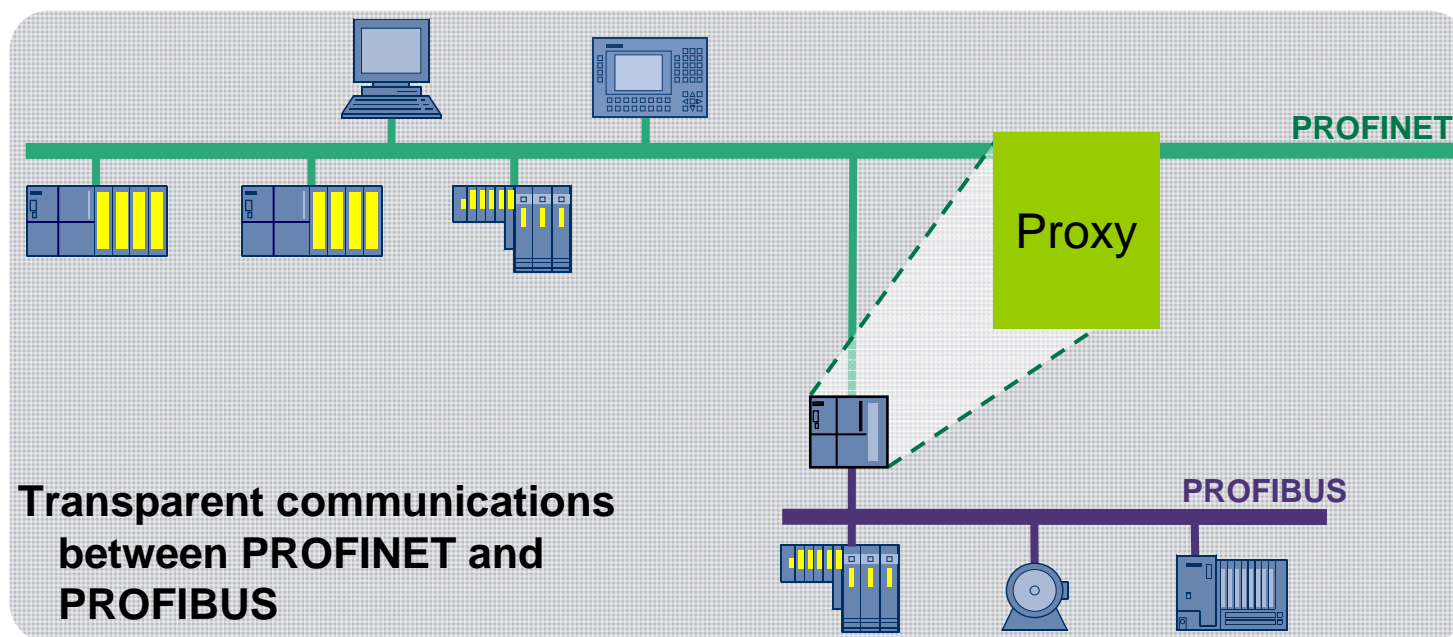
Protects your investment

Transparent integration without programming

PROFINET Marketing - Benefits

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Benefits and added value

- Just reconfigure your hardware...

- ... no reprogramming work necessary

- use the same exact
  tools with the same look & feel

- same system design
  for PROFIBUS and PROFINET

PROFIBUS

PROFINET
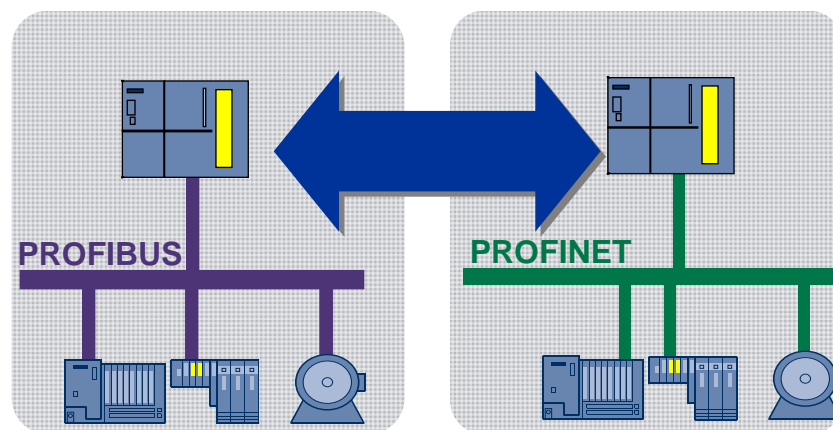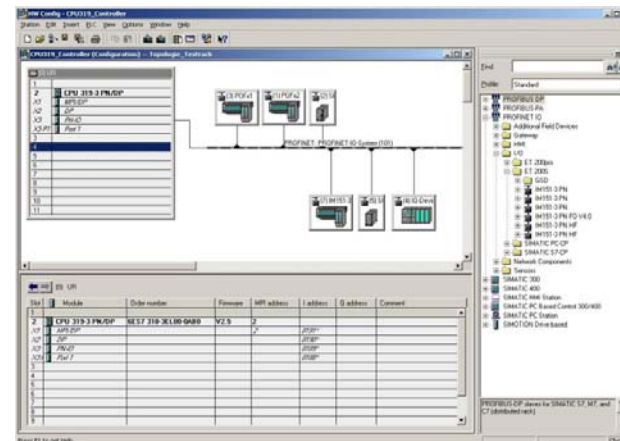
Reduce the time and expense of engineering and testing

PROFINET Marketing - Benefits

Seamless integration of existing systems with PROFINET – Excellence in Operation

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

Plaster production
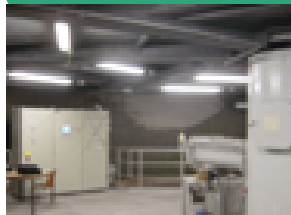
Water treatment

Power management

Building automation

Brick production

Data compilation / Data control

Alarm management

Bio-Ethanol production

PROFINET Marketing - Benefits

The competition

Reuse of existing devices with EtherCAT

▰ EtherCAT function is integrated into the bus connection and in the I/O modules

▰ It may be true that existing "K-Bus" I/O modules can be hooked up to a EtherCAT bus connection but…
→ doing so has negative influence on performance

Ethernet/IP: connecting existing fieldbuses

▰ Only systems with CIP application interfaces can be integrated (DeviceNet, ControlNet)

▰ PROFINET can also integrate DeviceNet through a proxy, as well as:

   ▰ AS-Interface and Modbus TCP

   ▰ and the leading fieldbuses PROFIBUS, Interbus

PROFINET, the comprehensive and leading standard, also for fieldbus integration and migration

PROFINET Marketing - Benefits

Protects your investment

- Seamless integration of existing fieldbuses
- Easy conversion of existing devices
- No additional tools or training needed

Saves costs

- Uses existing Ethernet networks

Uniformity

- Uniform physical network concept

Saves time

- Reduces engineering and testing time
- Cuts time needed for migration
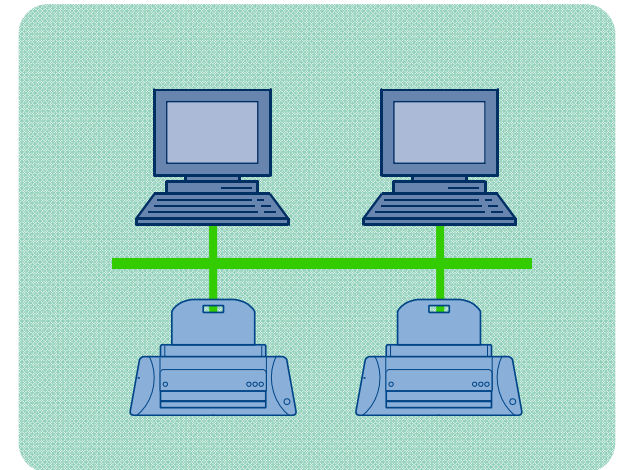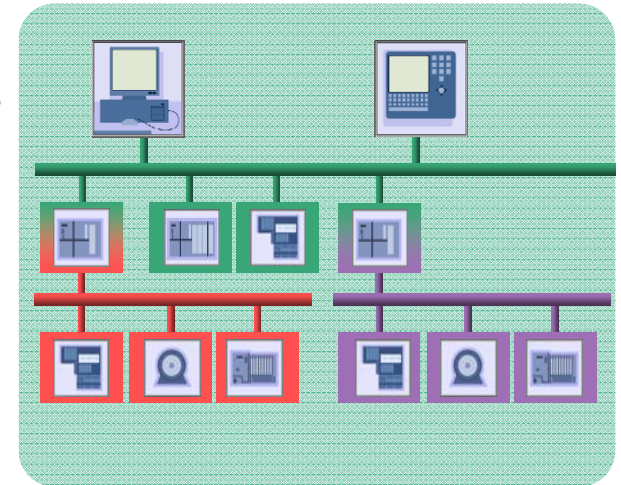
Summary | **Minimizes the time and expense of setting up your system with or migrating to PROFINET.**

PROFINET offers …

… new, innovative applications
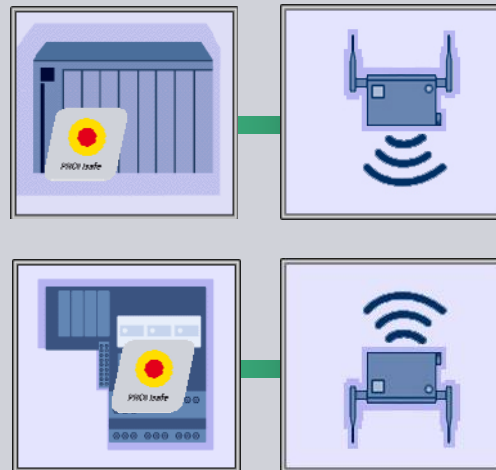
With wireless automation

Does this sound familiar?

Your constraints…

- Expensive slip rings or slip conductors
- Low flexibility & limited space
- High maintenance costs

Your needs…

- An easy networking solution even for hard-to-reach places
- More space & greater flexibility
- Less maintenance costs

Spring the boundaries, increase flexibility!

You also want to …

- Increase availability and boost productivity

- Integrate mobile clients

- Guarantee easy expandability

But need to have ...

- Standardized wireless technology

- No restrictions compared to normal cabling (safety, security)

The answer is: Industrial Wireless LAN with PROFINET

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

PROFINET via WLAN with …

- Standardized technology
- Easy engineering
  (planning, set-up, operation, documentation)
- Network security
- Failsafe communications
  ("Safety Integrated")
- Mobile HMI

- …as reliable, rugged, safe and secure as
  hard-wired systems!
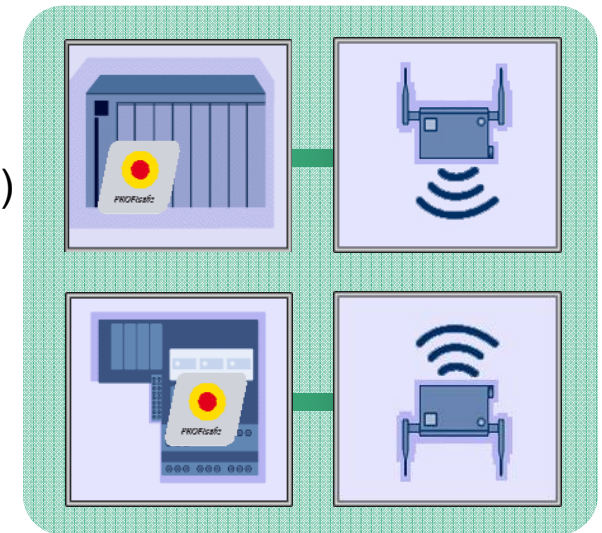
Standardized technology

PROFINET based on standard Ethernet

- Wireless communications in compliance with IEEE standard possible

- Industrial WLAN (IEEE 802.11)

  - cyclic and acyclic data transmission

  - Supervision of wireless connection

  - Redundant wireless operation over 2 separate wave bands for raised availability

  - PROFIsafe over WLAN

- Bluetooth (IEEE 802.15.2)

  - Coexistence with WLAN

- Fast commissioning

- Easy diagnostics
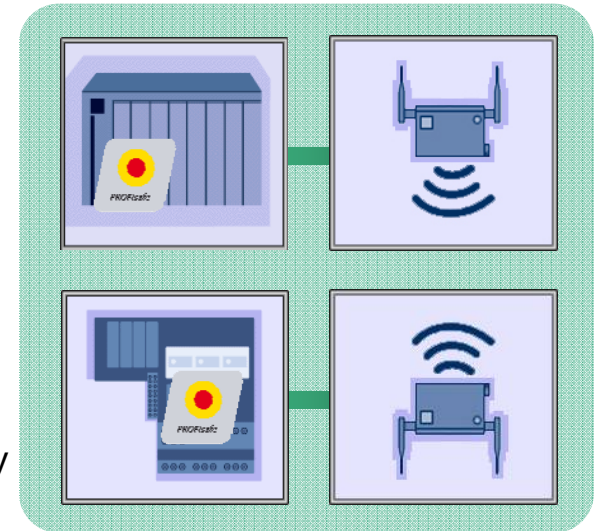
Using established standards for innovative applications

PROFINET Marketing - Benefits

Agenda

Uniform structures

Performance

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Innovations

Enhancement

Plaster production	Machine tools	Coil transport

Transshipment	Staircase production	Warehouse logistics

Brick production	Warehousing	Cement industry

Wireless automation with PROFINET – Excellence in Operation

Agenda

Uniform structures

Performance

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Enhancement

Cement transport	High-bay warehouse	Transport & logistics
Body shop	Mobile fastening controller	Overhead monorail conveyor
Gantry robot system	Water treatment	Air freight
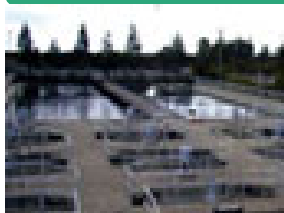
PROFINET Marketing - Benefits

The competition

Only with PROFINET…

- Take advantage of all standard Ethernet have to offer

- Failsafe and standard communications over one medium and also via Industrial WLAN
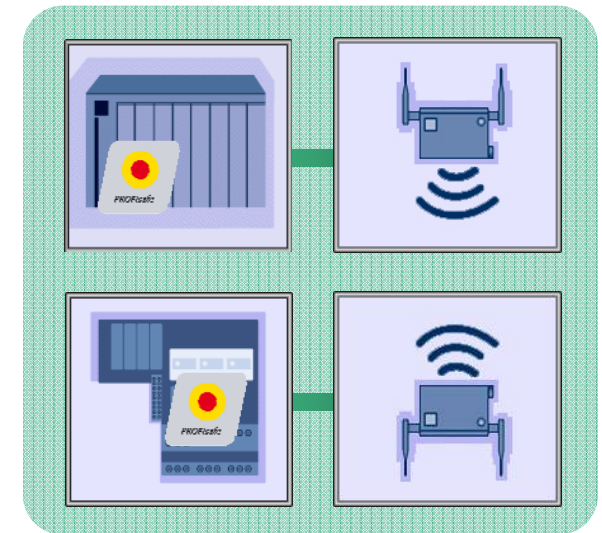
PROFINET – the first open Ethernet standard with wireless, failsafe communications!
Perfect interaction between network components and automation devices from one source!

PROFINET wireless enables…

…Higher productivity based on

- Increased plant availability compared to mechanical solutions (e.g. trailing cables)

…Lower costs thanks to

- Less maintenance & installation work
- Use of standard components even for failsafe communications

…Greater flexibility and mobility

- Communications from any location
- Easy expandability and modification
- Independence from mechanical bounds

Summary ▷ **…greater flexibility and mobility**

PROFINET offers …

… new, innovative applications

PROFIsafe

With integrated safety

The integrated safety solution

Agenda

Uniform structures

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Enhancement

One bus for standard and failsafe automation

- Meets the highest safety categories
- Safety Integrity Level 3 / PL e / Cat. 4
- Uniform diagnostics and uniform user interface
- Reduce the number of types, parts and interfaces

Formerly

„Safety Bus"

Failsafe I/Os

Emerg. Off

Emerg. Off

Standard PLC

Standard I/Os

Failsafe PLC

Fieldbus

Office World via Ethernet

New

Emerg.Off   Emerg.Off

Failsafe PLC

Standard and failsafe I/Os

PROFINET

Emerg.Off

Connection to Office World

Save time, space and money with Safety Integrated!

PROFINET Marketing - Benefits

Failsafe communications – even wireless
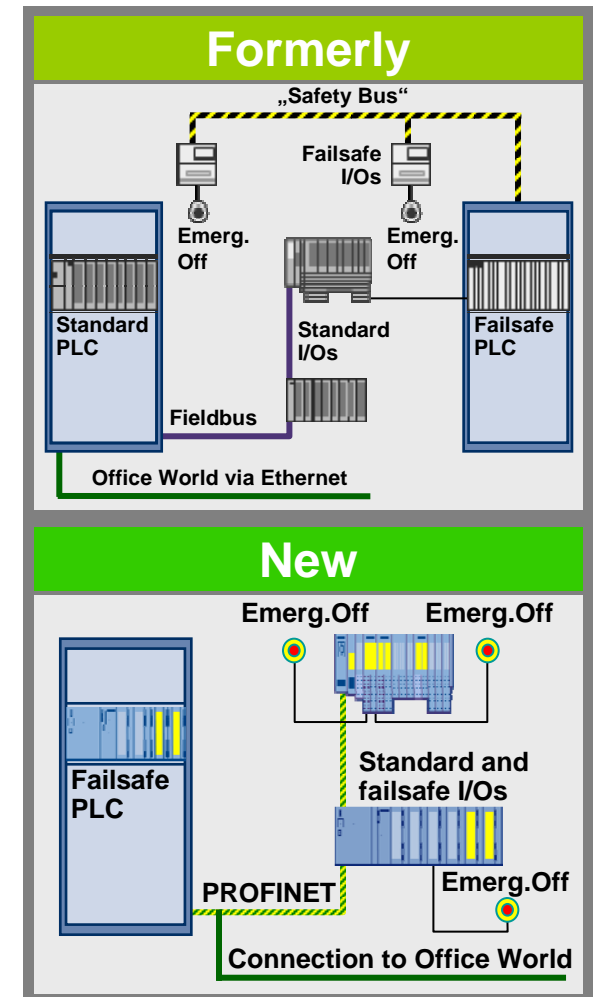
Use of the PROFIsafe profile

▮ Tested and accepted with PROFINET

▮ Standard and failsafe communications
over the same transmission path

▮ Can be used for stationary and mobile
Emergency Stop function

▮ Allows the use of extended safety functions by use of dedicated PROFIsafe devices

Even wireless…

**Failsafe and available,
just like hard-wired!**
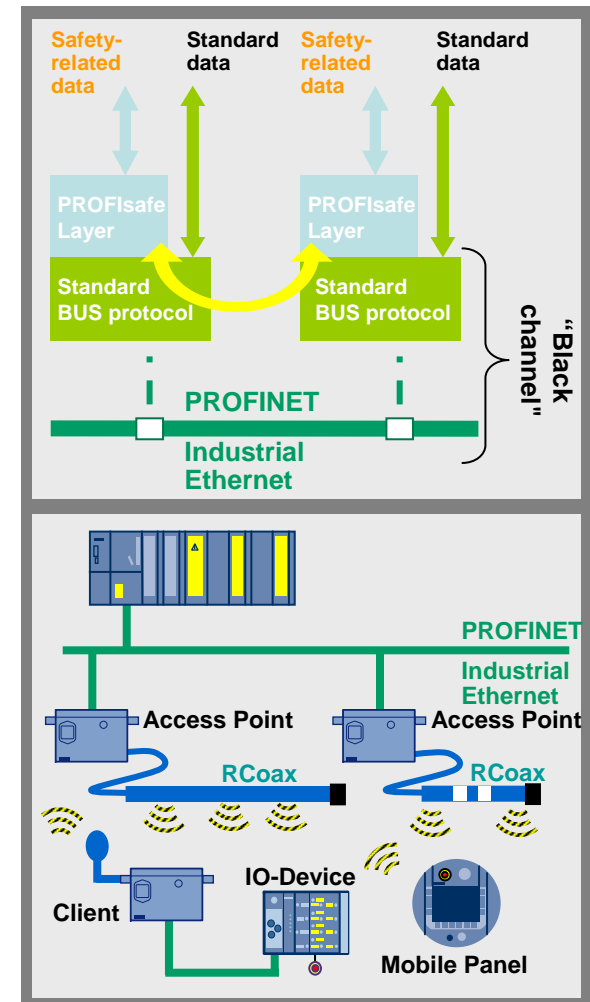
PROFINET Marketing - Benefits

Safety solutions conforming of standards

◢ Using PROFIsafe and PROFINET can satisfy all requirements when it comes to ensuring complete safety for humans, equipment, and the environment.

◢ First communications standard developed in accordance with safety standard IEC 61508

◢ Developed to IEC 61784-3-3, PROFIsafe is the international standard

◢ PROFIsafe handles potential faults (e.g. invalid addresses, delays, data loss) by means of

  ◢ Serial numbering

  ◢ Time monitoring

  ◢ Authenticity monitoring

  ◢ Additional CRC backup

◢ Evaluated by BGIA and [TÜV]

◢ Drive technology also fits in seamlessly here with the integrated safety functions according to IEC 61800-5-2.

PROFINET Marketing - Benefits

Agenda

Uniform structures

Performance

Integration

Innovations

Enhancement

- The basic safety functions …
  - „Safe Torque Off "
  - „Safe Stop 1"
  - „Safe Brake Control"
  - … always leads to a **safe disconnection** of the energy feed to the motor when selected, e.g., in a hazard situation.

- The advanced safety functions …
  - „Safe Operating Stop"
  - „Safe Stop 2"
  - „Safety-Limited Speed"
  - „Safe Speed Monitor"
  - … allow **reliable monitoring** of the drive during operation or when a temporary exceptional situation, such as setup or maintenance work, occurs. .

- It is possible to carry out maintenance work conveniently and safely, which significantly reduces machine and equipment downtimes.

PROFINET Marketing - Benefits

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Only with PROFINET…

- Wireless available
- Benchmark for the safety communication in the IEC standards
- Established as open standard
- 10 years experience
- More as 100 000 plants in many branches:
  - Factory
  - Process
  - Train
  - Cable car
  - Fun rides
  - Nuclear
  - ….
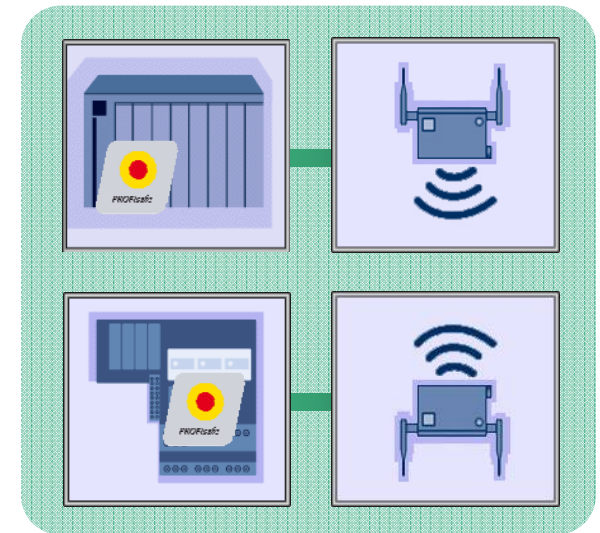
PROFIsafe, the proven and established market leader

Agenda

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Safety for humans and machines

▰ Safety and standard data over one connection, within one station

▰ PROFIsafe via PROFIBUS and PROFINET
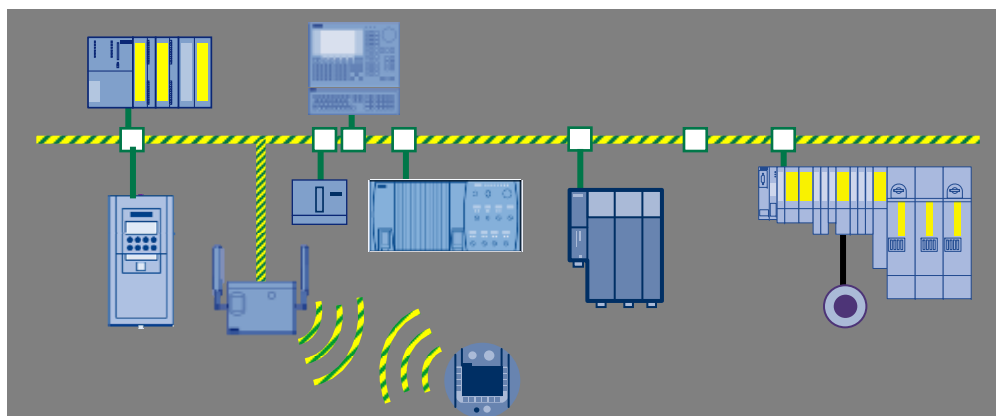
Summary ▸ **Save space, time and money with PROFIsafe**

PROFINET Marketing - Benefits

PROFINET offers …

… continuous enhancement

Process industries

PROFINET in Process Automation

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ERP

MES

Ethernet backbone

DCS

- Plant wide data exchange between Field, DCS and IT level
- Integration of various fieldbusses via proxies

PROFIBUS PA

PROFIBUS DP

PROFINET

HART

FF H1

PROFINET PROXY

PROFINET Marketing - Benefits
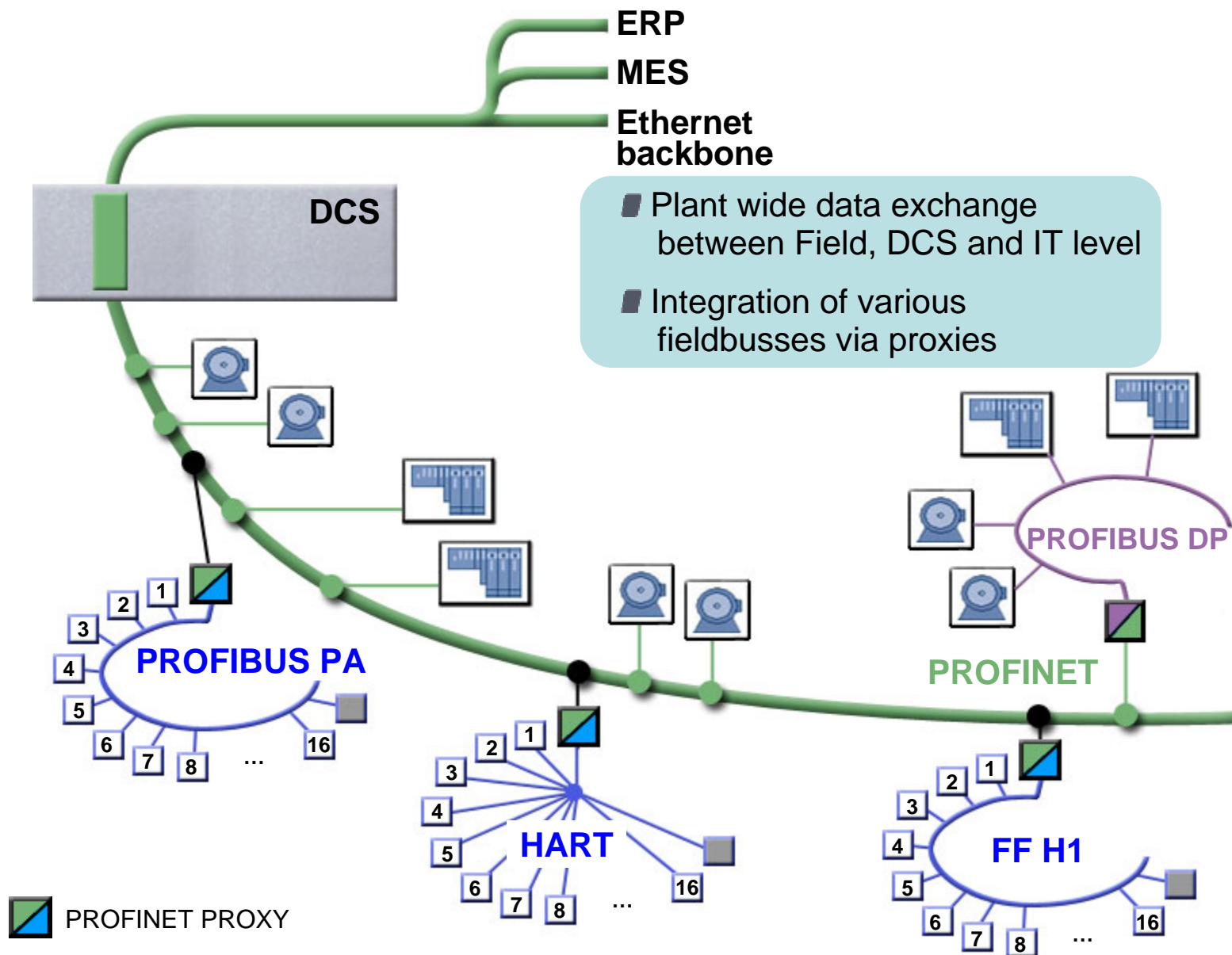
Key Functions for Process Automation

Fieldbus integration

DCS

DeviceNet

PROFIBUS DP

PROFIBUS PA

PROFINET

HART

FF H1
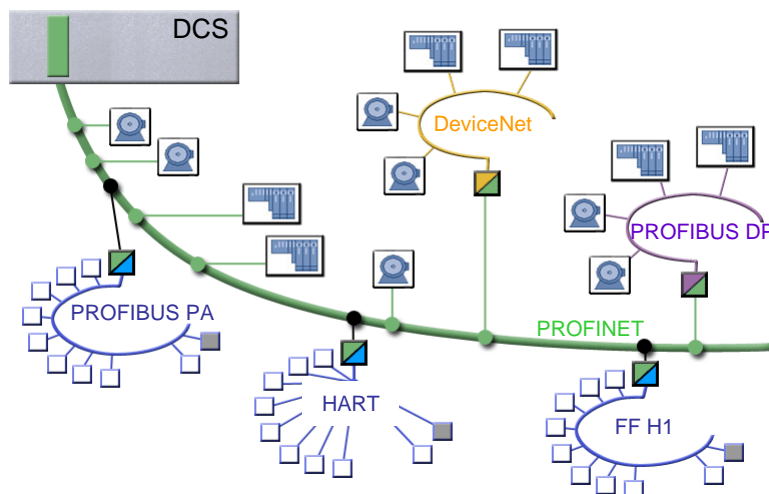
Configuration in Run (CiR)

DCS

Remote I/O

Proxy

Time sync / time stamping

System Master Clock
(GPS, DCF77, …)

Controller 1

Controller 2

Backup
Clock Master

Controller 3

Proxy

Device

Device
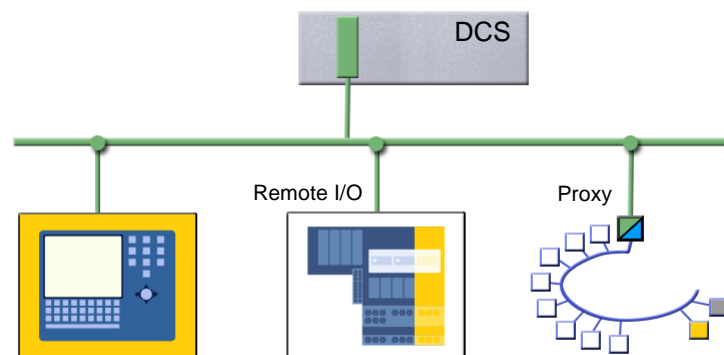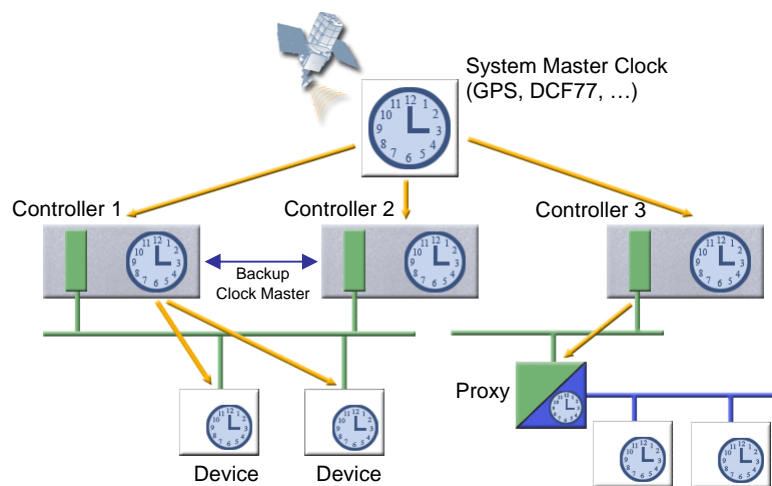
PROFINET Marketing - Benefits

Scalable Redundancy

Redundant Controller

Primary

Backup

Redundant Network

Device with
redundant
connectivity

Device with
singular
connectivity

Agenda

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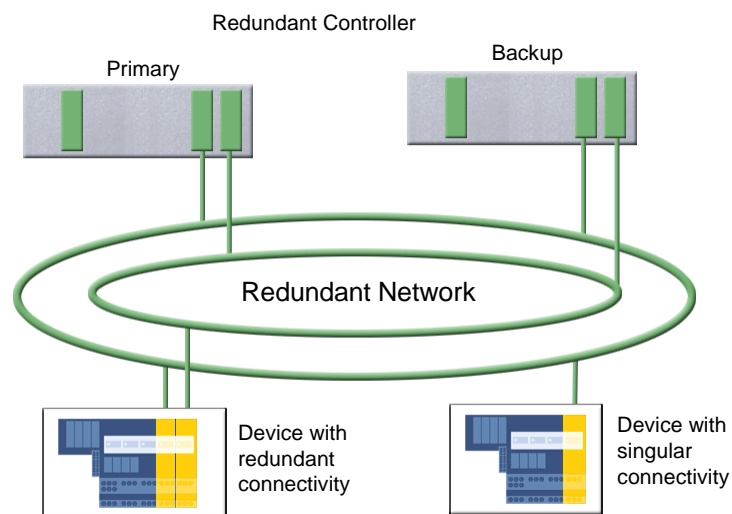
Enhancement

PROFINET offers …

… continuous enhancement

PROFIenergy

What's in for me?

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- PROFINET is the first field bus worldwide with a standardized profile for efficient energy management.

- PROFINET is a synonym for innovation. Requirements from customer side are taken seriously and implemented very fast.

- PROFIenergy generates additional value to your products and safes your business in the long term.
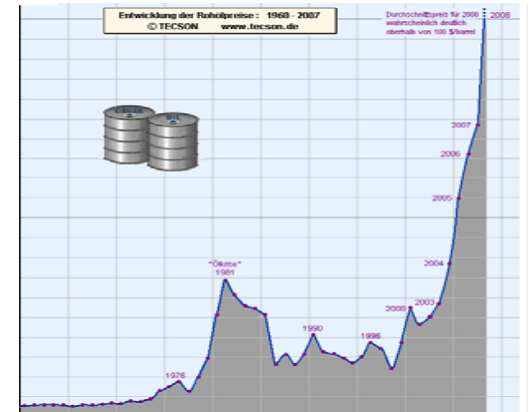
Use PROFIenergy, to save energy and costs!

An example from the Automotive Industry

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Typical Energy Consumption (kWh, 15min)

Weekend

Weekend

Energy consumption in breaks appr. 60%

With PROFIenergy up to 80% savings!
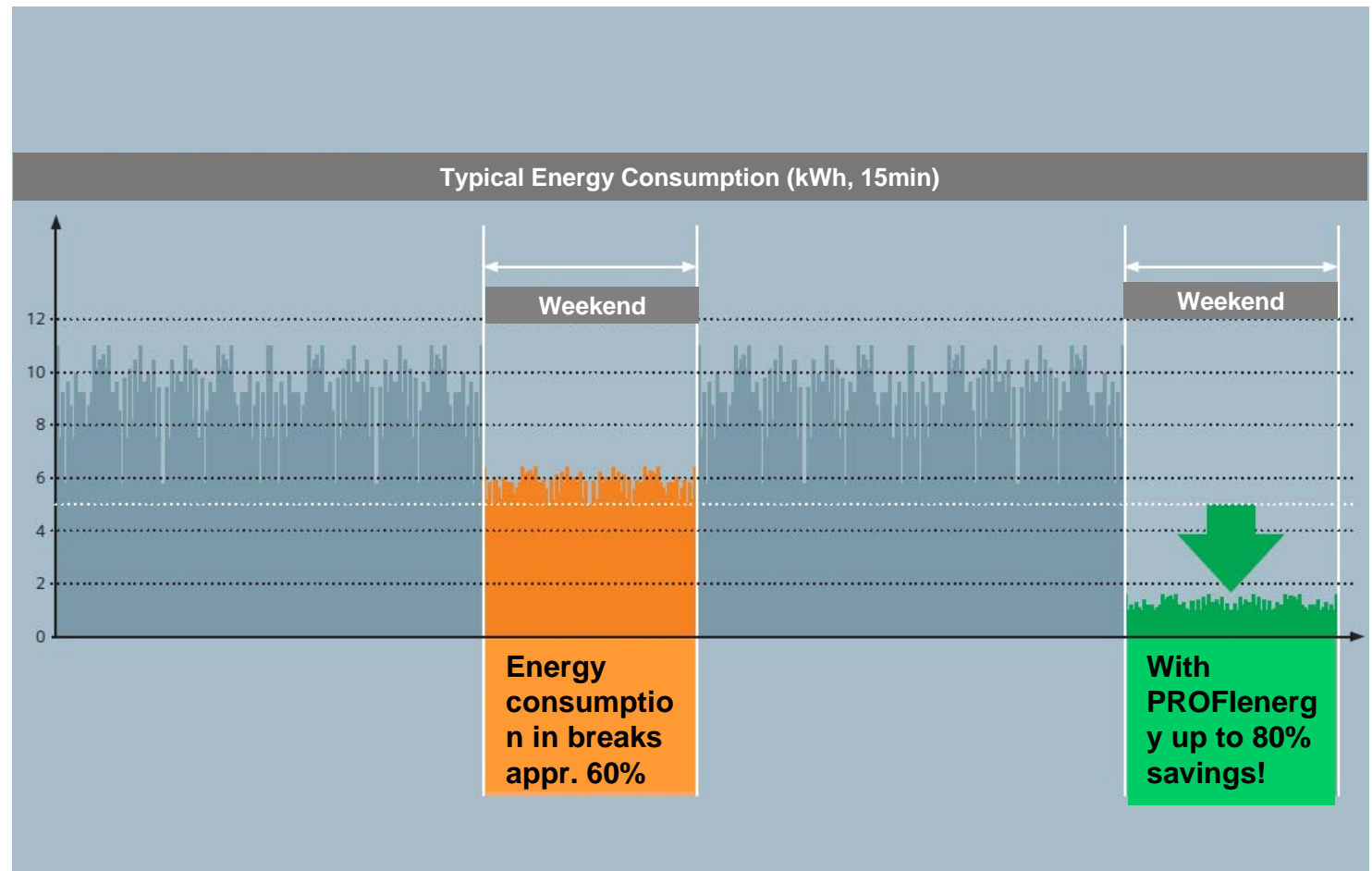
Energy consumption during breaks appr. 60%!

PROFINET Marketing - Benefits

Weaknesses of current solutions

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Controller

HMI

Supplementary hardware

Distributed I/O

Motion Control & Drives

DC24V
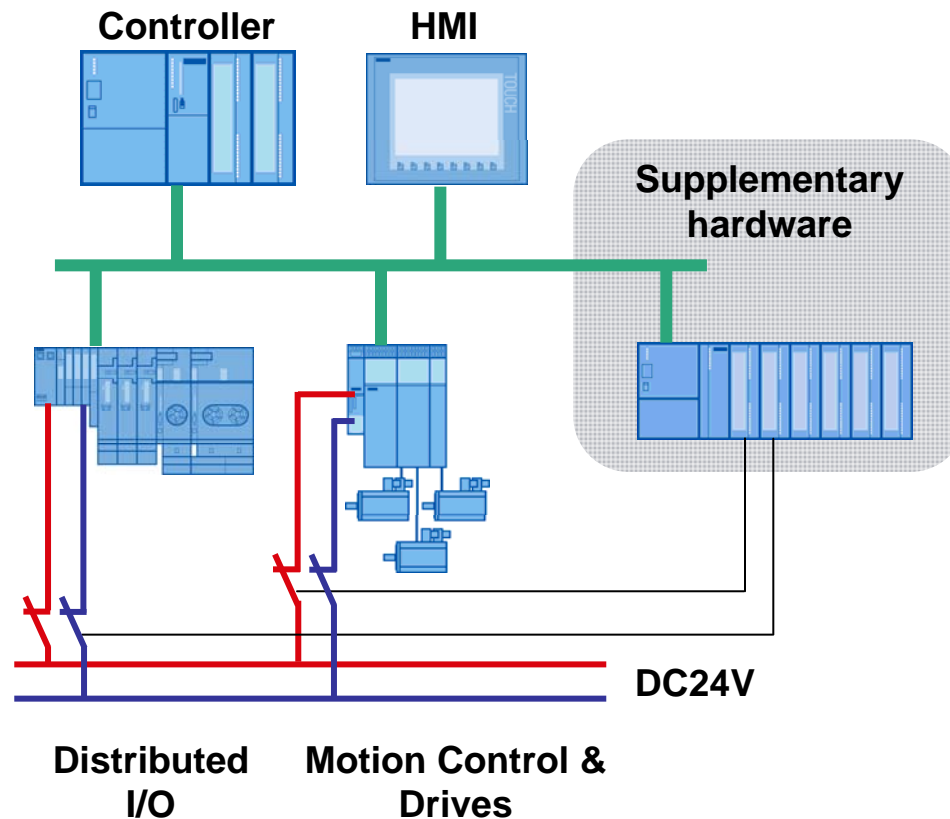
Manual switching:

- Time-consuming
- Start-up unreliable
- Frequently only one main switch

Use of external hardware

- Requires space and money
- Engineering and maintenance required
- Individual program

**Discrete solutions are rarely accepted.
Saving potential during the breaks is not used.**

PROFINET Marketing - Benefits

Five good reasons for PROFIenergy

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HMI

PROFIenergy

Distributed I/O

Motion Control & Drives

DC24V
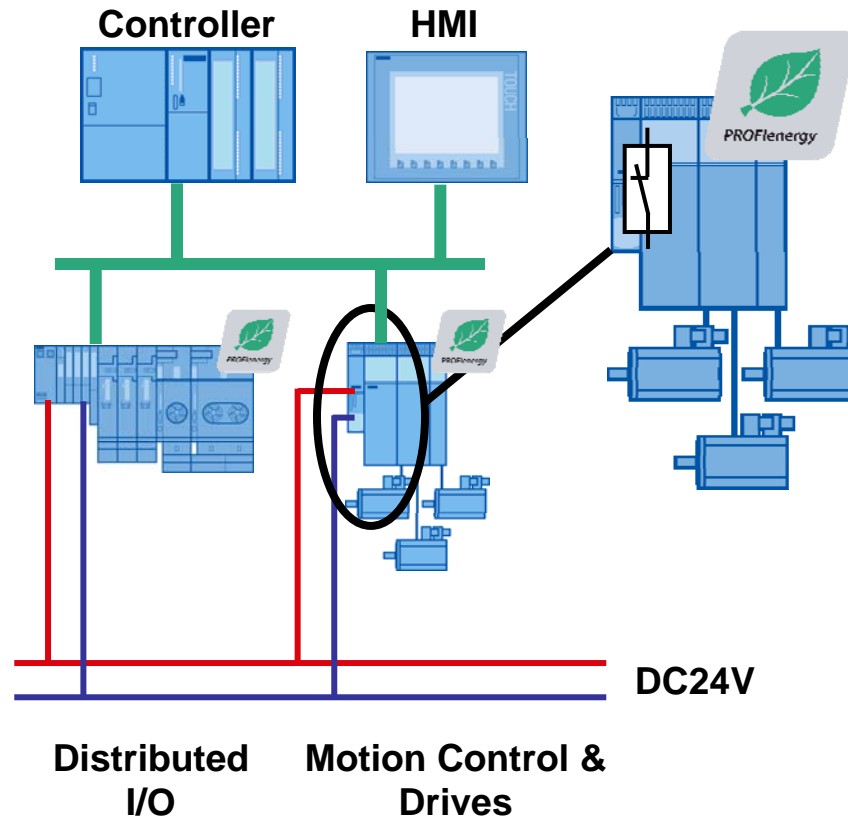
Cost savings through omission of external hardware

Energy saving even in short pauses thanks to granular switching

High system reliability through coordinated switching

Investment safeguarding through simple reaction-free integration into existing standards

Free selection of device through vendor-independent standard

PROFIenergy permits energy saving in breaks through switching-off of non-required loads!

PROFINET Marketing - Benefits

Basic Principle

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Controller

Trigger request

WR_REC

➕

RD_REC

Read response / fetch data

⬇ =

PROFIenergy Command

Device

Execution of command / processing of data

Fast implementation through use of existing PROFINET mechanisms

Compatible upgrading of existing programs through mapping on records

Uniform user handling through same operations for control commands and information functions
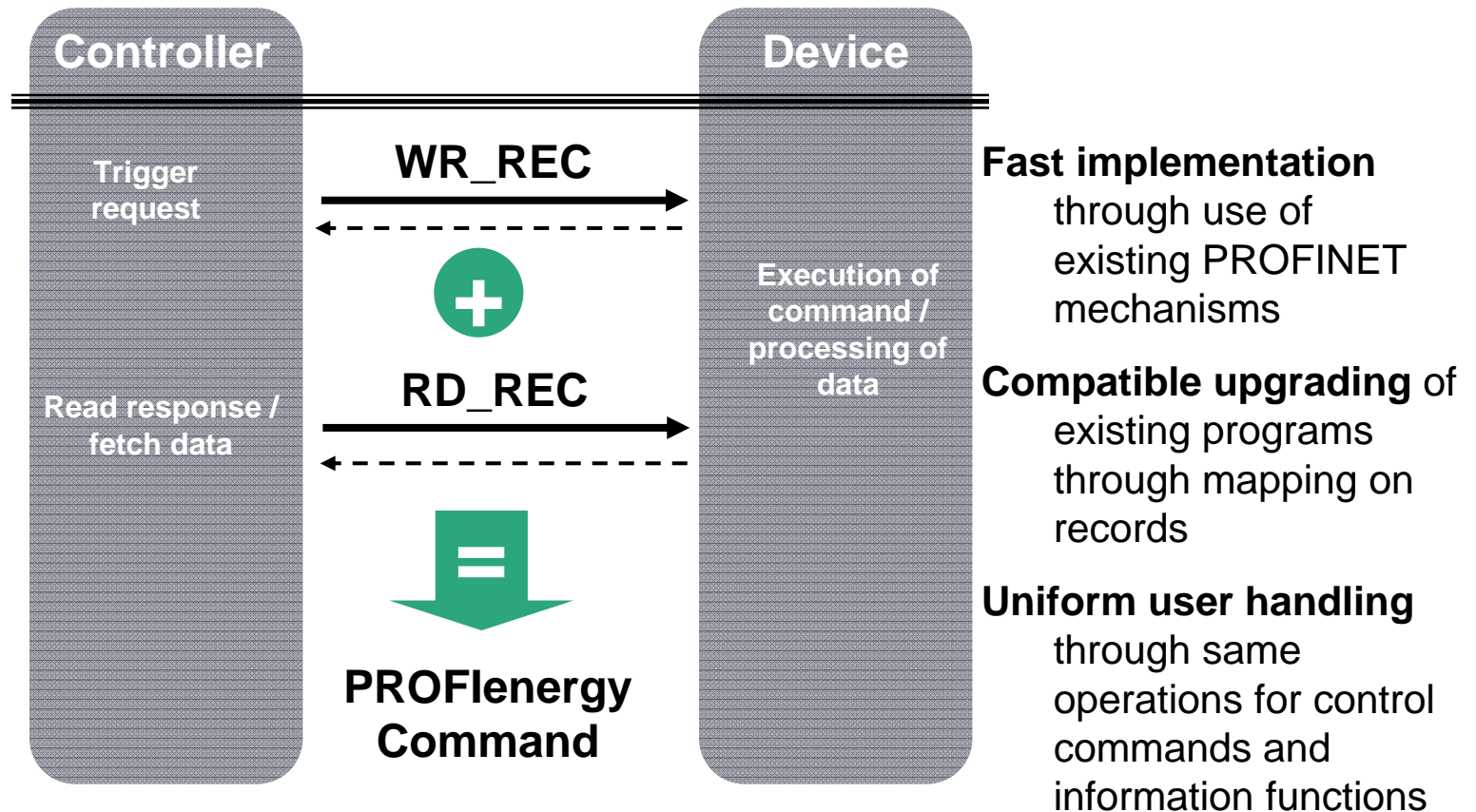
System and device vendors offer corresponding blocks which conceal the protocol.

PROFINET Marketing - Benefits

Customer Benefit

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Competitive advantage …
… through marketing of low-energy machines

Investment safeguarding …
… through simple expansion of existing programs

Low programming requirements …
… through reloadable function blocks

Fast commencement …
… through integration into known product families and use of existing mechanisms

Free choice of manufacturer and devices ...
... through manufacturer independent standard

Environmental protection …
… through lowering energy consumption and CO2 emissions

PROFINET Marketing - Benefits

More information

More informations

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Internet

▪ www.sea.profinet.com

Flyer

▪ PROFINET Flyer
▪ PROFINET System description

Support

▪ local PROFINET-Compentence Center

PI – PROFIBUS/PROFINET International

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Summary

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Uniform structures

Performance

Integration

Innovations

Enhancement

PROFINET offers …

… **more continuity and uniform structures**

… **more nodes and better performance**

… **seamless integration of existing systems**

… **new, innovative applications**

… **continuous enhancements**

What is PROFINET?

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Uniform
structures

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PROFI®
NET

- The fieldbus based on Ethernet for all applications

- Covers the key markets and key technologies in automation – both today and in the future

- Supported by the greatest automation organization for communication solutions

Thank you for your attention!

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