PROFIBUS • PROFINET

PROFINET
The leading communication system

Proven and future-oriented

PROFINET® PROFIsafe PROFIenergy PROFIdrive Use IO-Link Universal · Smart · Easy

PROFINET

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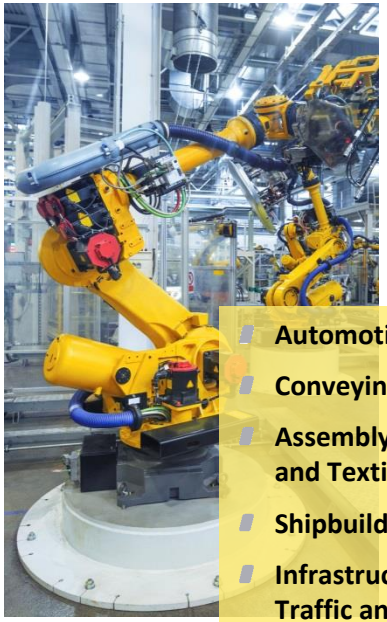
PROFINET fits in all markets

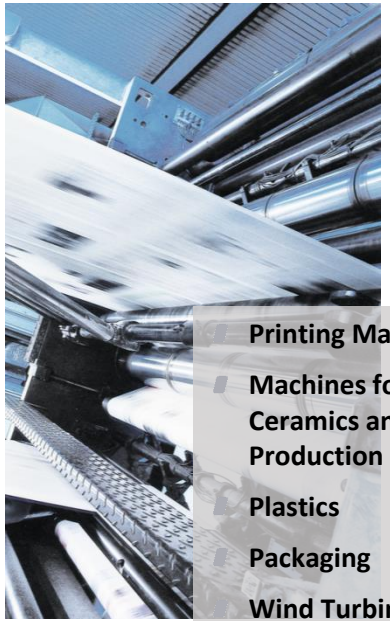
- Oil & Gas & Energy Industries
- Power Generation
- Chemical and Medial Industries
- Mines und Metal
- Food & Beverage

Process Automation



- Automotive
- Conveying Systems
- Assembly Machine and Textile Industry
- Shipbuilding
- Infrastructure Traffic and Railway

Factory Automation



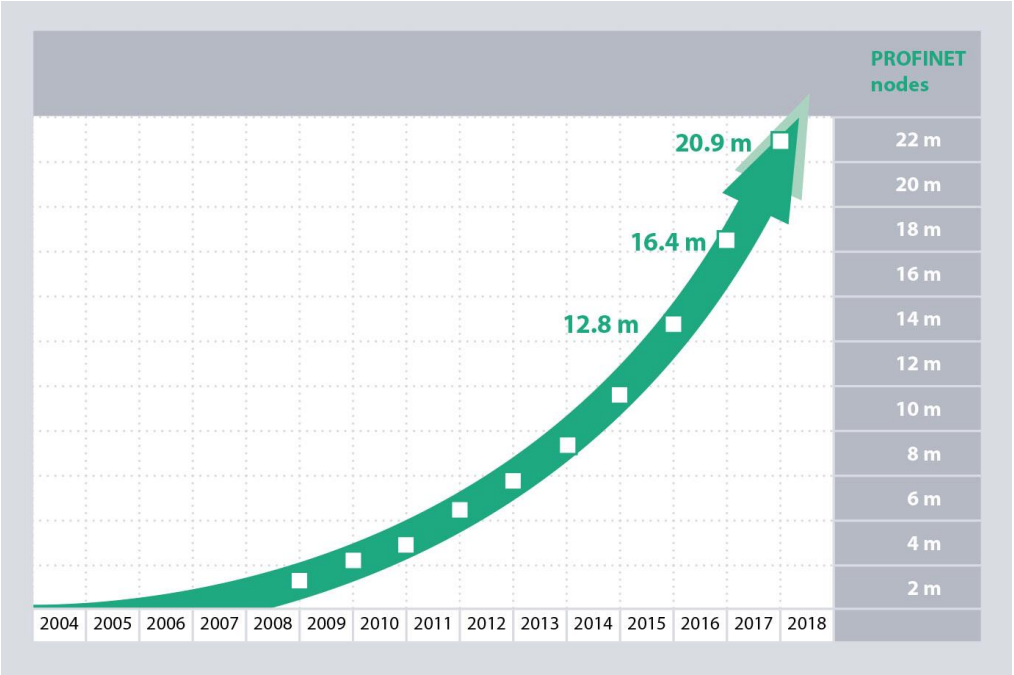
- Printing Machinery
- Machines for Wood, Ceramics and Glass Production
- Plastics
- Packaging
- Wind Turbines….

Motion Control

Installed PROFINET nodes

- PROFIBUS & PROFINET International
  P R E S S R E L E A S E, April 23, 2018

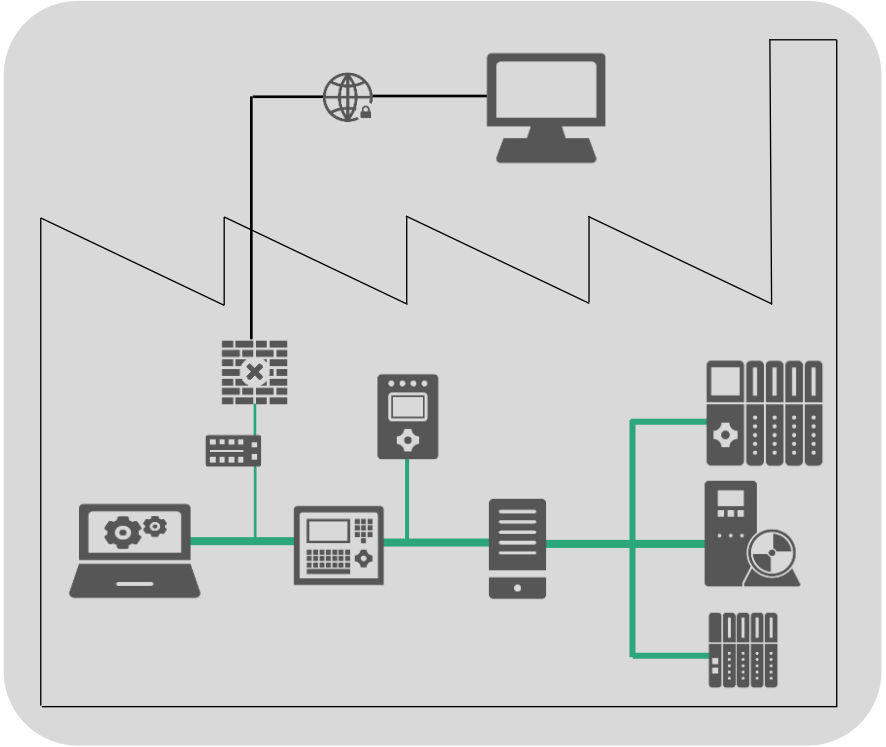
- With PROFINET, the 4.5 million devices brought to market in 2017 represent an increase of 25% over the previous year. At the end of 2017, approximately 21 million PROFINET devices were working to automate production.



PROFINET

Communication requirements

- 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
  - Detailed diagnostics
  - Reduced costs for engineering, commissioning and live operation

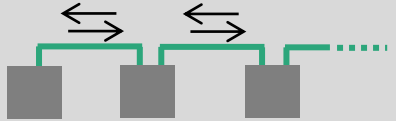


Plant-wide communication

PROFINET is switched Ethernet

- PROFINET basics
  - Standard Ethernet IEEE802.3
  - Switching technology IEEE802.1Q
  - Wireless LAN IEEE 802.11
  - Bluetooth IEEE 802.15.1
  - Flexible network topologies
  - Switch integration into the devices
  - Physical Port-to-Port communication (Copper 100m, FO up to 80 km)
  - PROFINET and Standard-Ethernet devices mixed in one network

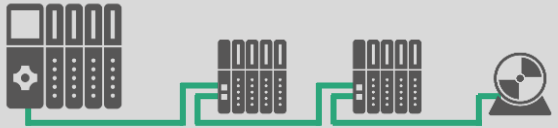
PROFINET is "switched Ethernet“
(no need for repeater)



Switches connected into a line

➔ **The topology follows the production process**

PROFINET is switch integration

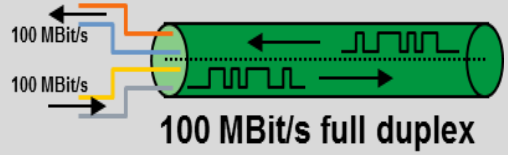


➔ **Reduced network costs**

PROFINET is Standard Ethernet and more

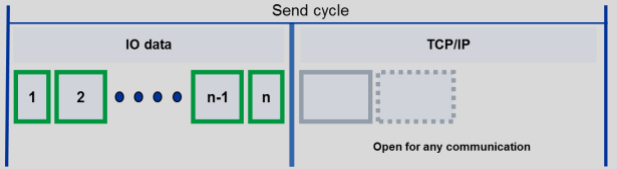
- PROFINET basics
  - Simultaneous sending/receiving
  - Usually 100MBit between Controller/Devices
  - More than 64 kbyte cyclic input and output data per Device possible, typical 20 – 1440 Byte
  - Acyclic data volume almost unlimited
  - Logical controller-2-device communication
  - IT communications parallel to real-time communications
  - Easy use and integration of standard Ethernet applications

PROFINET uses full duplex communication



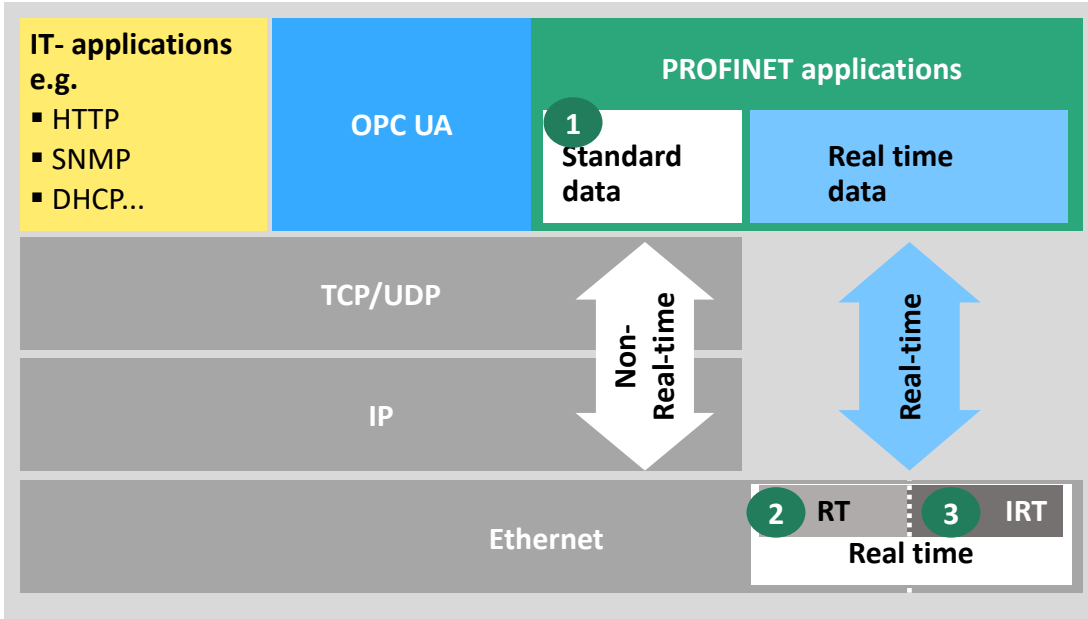
➔ **More applications on one cable**

Separate channels for IO data and TCP/IP



➔ **No extra network for TCP/IP needed**

PROFINET communication channels



1 Standard channel

- Parameterization and configuration
- Reading diagnostic data

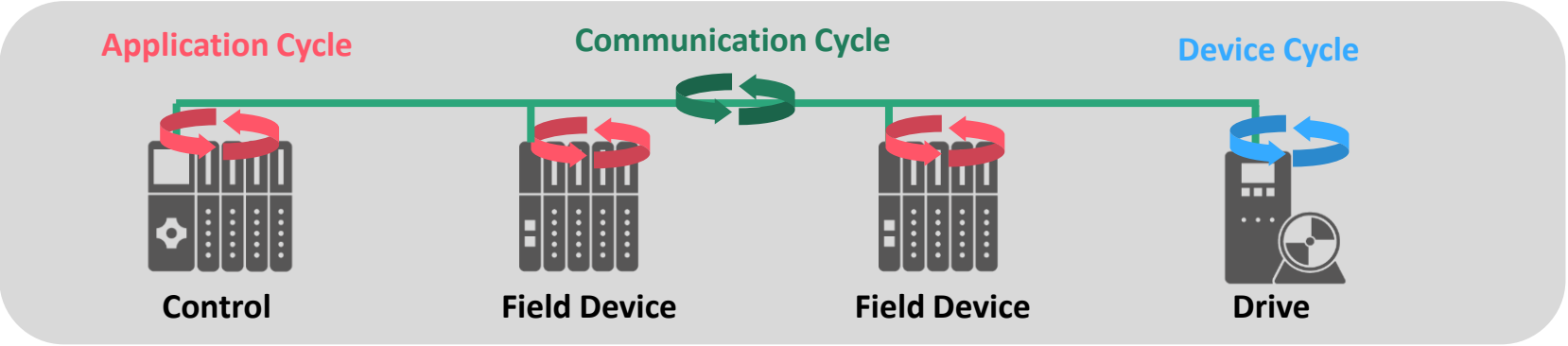
2 Real time channel

- Cyclical communication
- Alarms

3 IRT channel

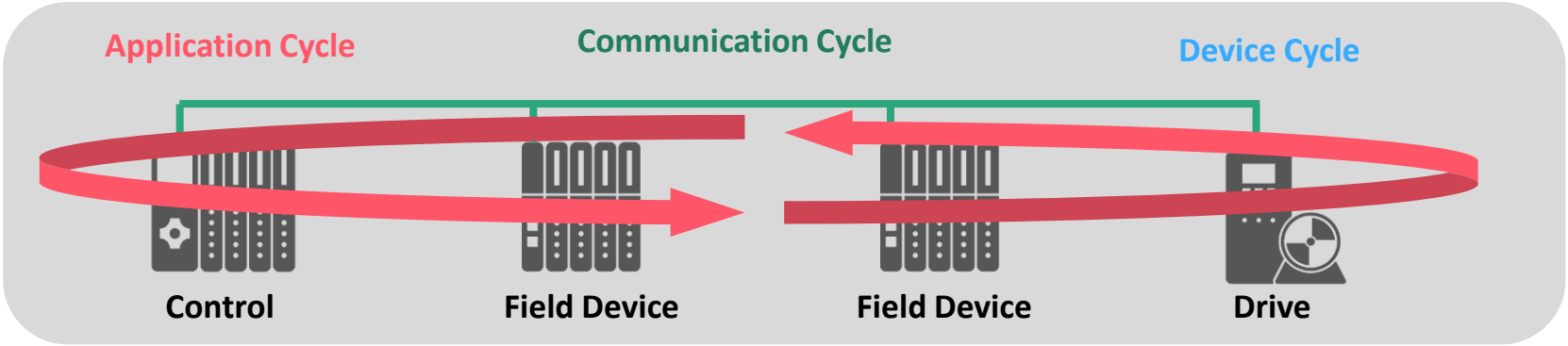
- Cyclical, synchronous communication
- Communication Jitter <1µsec

Operating Mode RT



- PROFINET RT
  - Cycle time down to 1ms
  - Suitable for over 80% of all automation applications
  - Different non-synchronous cycles
  - Application, data transmission and field devices have their own processing cycles

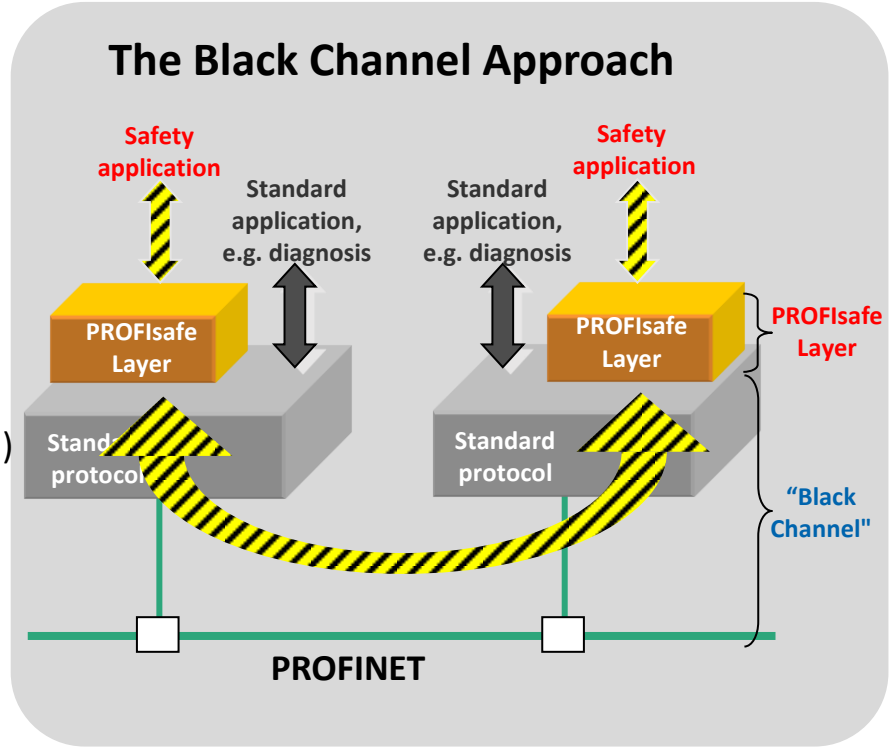
Operating Mode IRT



- PROFINET IRT
  - For motion control applications and synchronous IOs
  - Cycle time down to 31,25µs with performance upgrade
  - Application, data transmission and device cycle are synchronous with jitter accuracy <1µs
  - Deterministic data & internet protocol at the same time

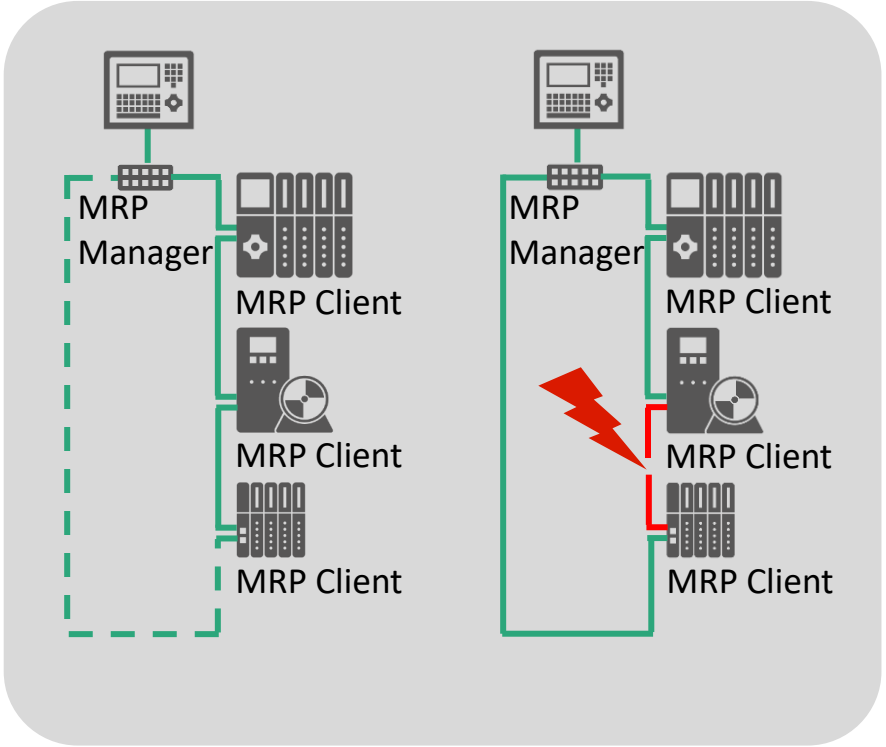
The PROFIsafe concept

- Black channel principle
  - F-messages between F-host (safety control) and its F-device are transported as payload in PROFINET frames
  - Guarantees functional safety of the complete path including backplane systems
  - Additional safety measures of the F-messages
    - Consecutive numbering of F-messages ("Sign-of-life")
    - Time expectation with acknowledgment ('Watchdog")
    - An identifier between sender and receiver ("F-address")
    - Data integrity check ("F-CRC = cyclic redundancy check")



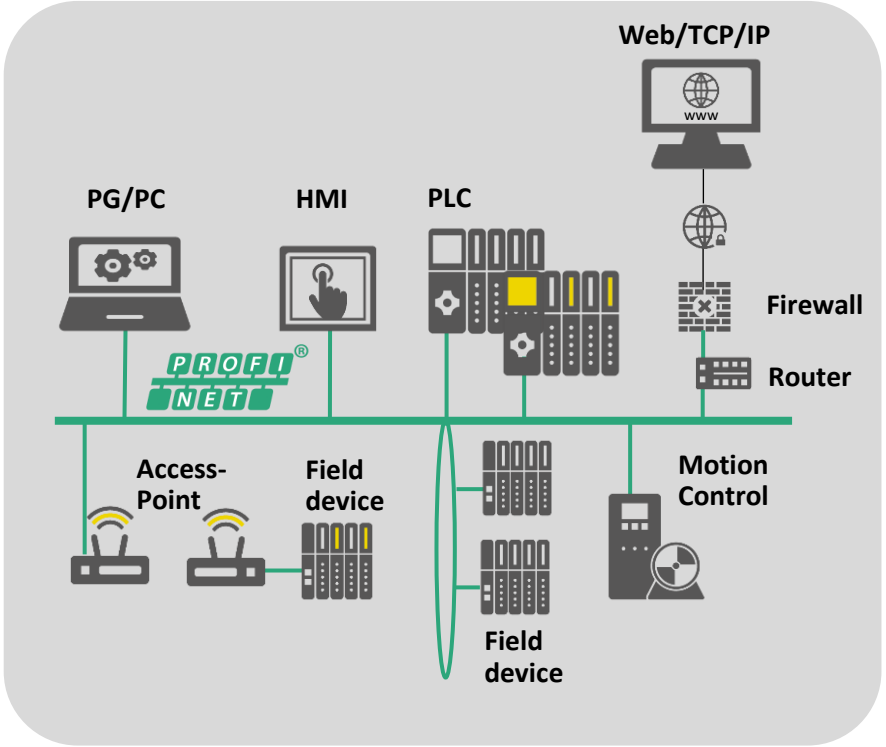
PROFINET Media Redundancy

- Media Redundancy Protocol (MRP) Concept
  - In normal operation the ring topology is reduced to a line
  - One ring port of the MRP manager is blocked
  - In case of failure the blocked ring port of the MRP manager change to forwarding
  - The network reconfigures in short time
  - The ring topology is reduced to a line again
  - Automanager for redundant MRP manager
- MRP performance
  - ≤ 200 ms reconfiguration time
  - Max. 50 nodes in the ring



PROFINET – offers the required uniformity

- PROFINET core functionality
  - Real-time communication with simultaneously TCP/IP
  - IT communication, access to the automation from anywhere in the world
  - Standard and failsafe communications over the same transmission path
  - Proven and certified security standards (firewall, VPN)
  - Media Redundancy and System Redundancy
  - Standardized wireless technology with no restrictions compared to normal cabling (safety, security)



PROFINET

10 Reasons for PROFINET

User Friendly

Flexible Installation

Best Diagnostics

Safety Integrated

Synchronicity for Motion integrated

High Availability

Secure IT-integration

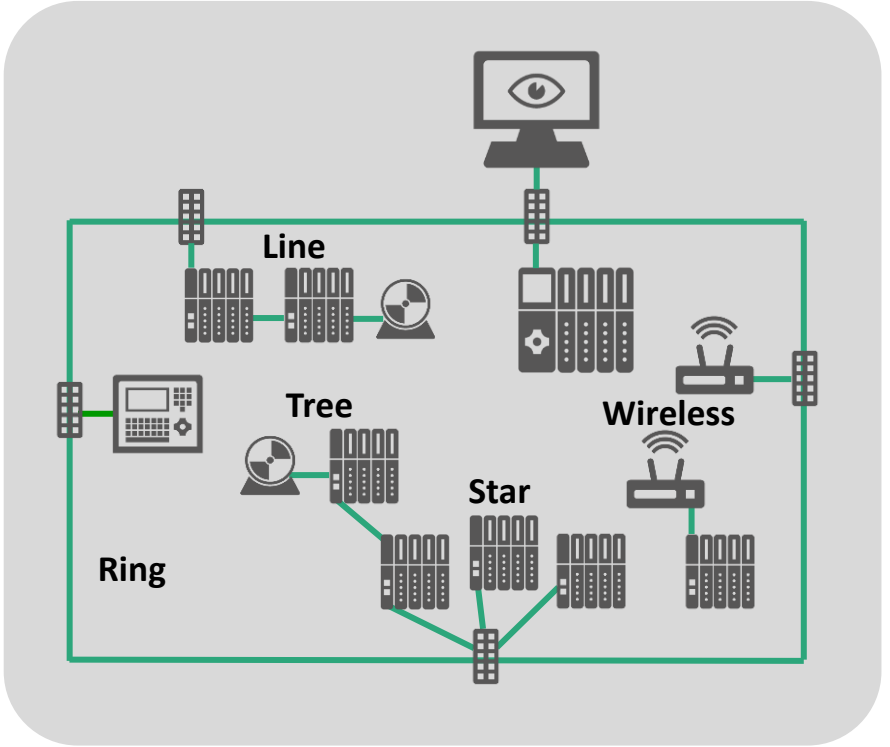
Energy Efficiency

IO-Link integration

Huge Organisation and Support

#1 Flexible Topology and Media

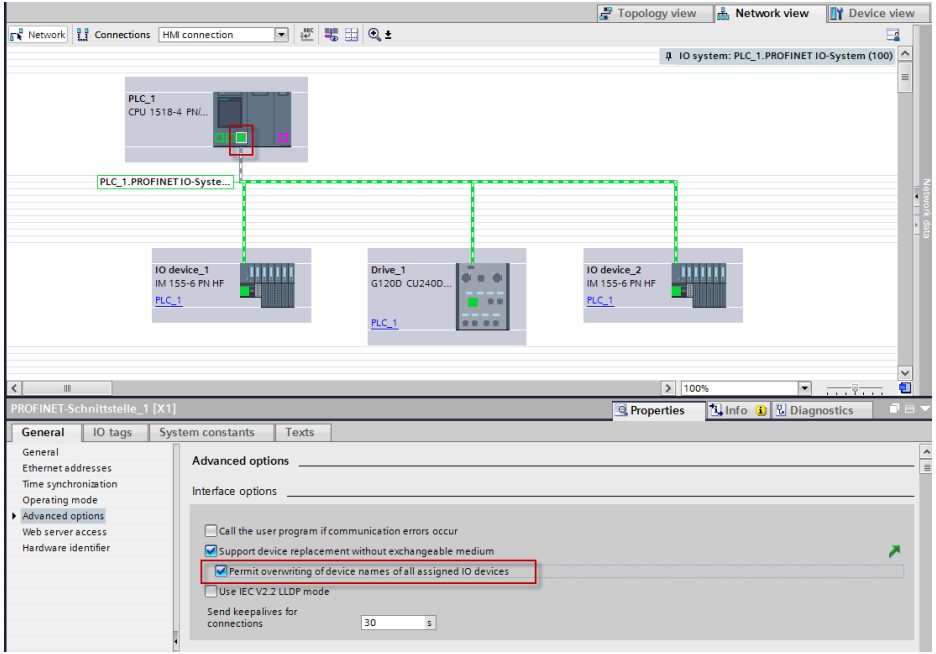
- Plant orientated topology
  - The topology follows the plant structure
  - Line structure through integration of switch ports in devices
  - Tree and star topologies for plant orientated configurations
  - Redundant rings with reconfiguration in real time
  - Wireless (WLAN, BLUETOOTH), copper or fiber optics transmission where you need it
  - Easy combination of different topologies



Plant with different topologies

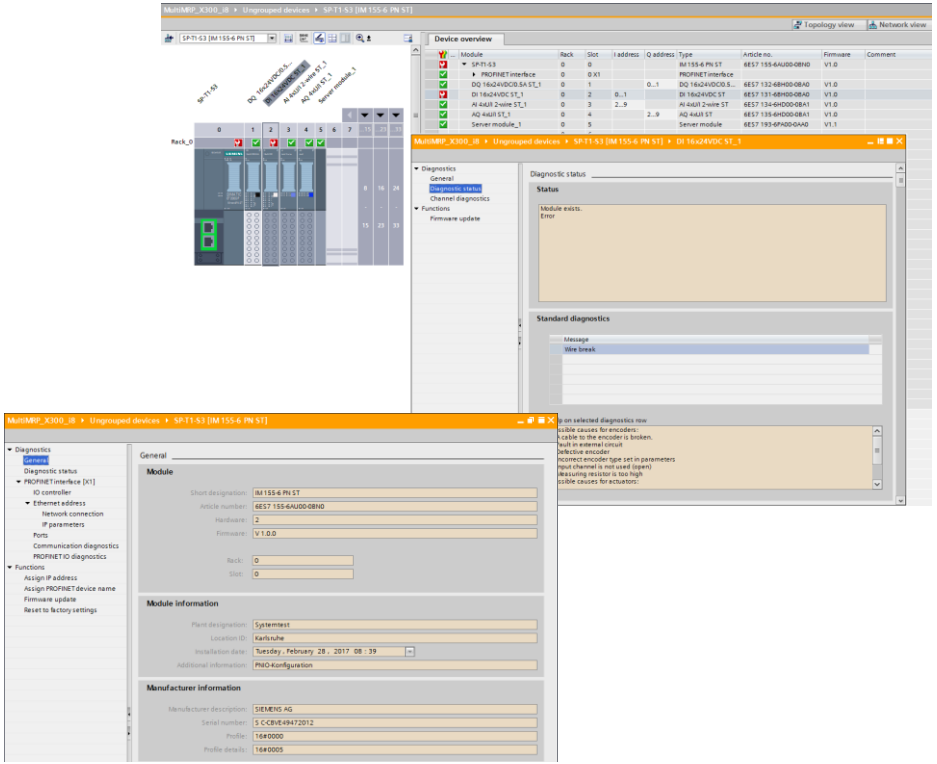
#2 User Friendly - Fast Commissioning

- Diagnostics and topology recognition
  - Online scan of connected devices
  - Automatic assignment of IP address and device name
  - Transparency in the network topology by comparing planned topology to real topology
  - Comparison of module configuration (modules, serial no. , firmware,…)
  - Simulation of network loads caused by data traffic
  - Automatic device and network documentation



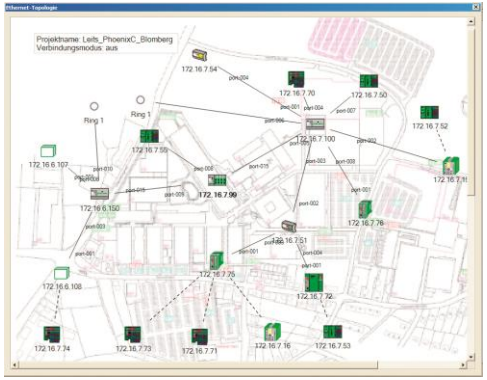
#3 Device Diagnostics and Asset Information

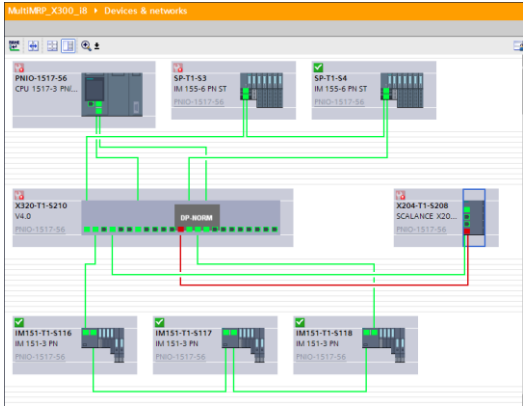
- Flexible Device diagnostics down to a channel
  - Guaranteed alarm mechanism with 4 priority levels (Fault, Maintenance required, Maintenance demanded, Advice)
  - Alarm text specified by PI or by the device supplier in the GSDML file
  - Signaling of data validity
- Asset information
  - I&M (Identification & Maintenance)
  - Hardware, firmware version
  - Article, serial number



#3 Powerful network diagnostics

- Integration in network management tools via SNMP
  - MIB 2 for device information and port based statistics
  - Neighborhood information through LLDP MIPs
- Error localization with topology views and port based information via PROFINET
  - Topology neighborhood information
  - Port statistics, port media information, cable length
- Online scan und verification of existing plants

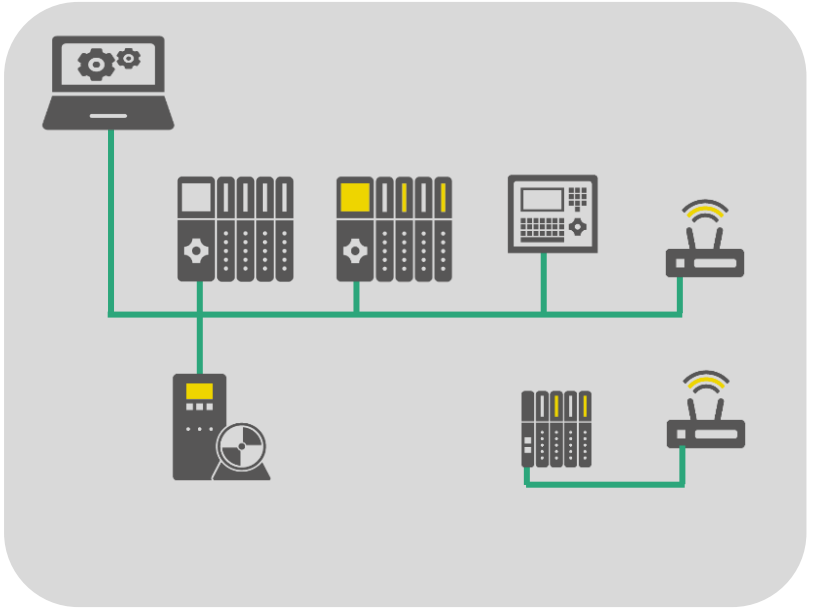




#4 The integrated safety solution

- Meets the highest safety categories Safety Integrity Level 3 / PL e / Cat. 4

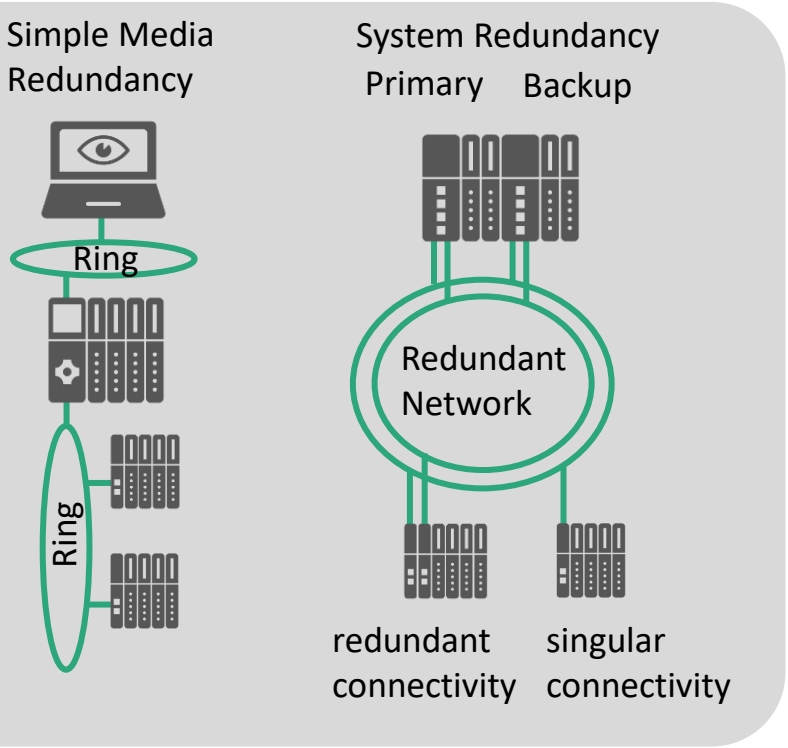
- Fully integrated and scalable safety functions
  - In engineering, controller, drives and IO-systems
  - Uniform diagnostics, device parameterization and uniform user interface
  - One controller for standard and failsafe applications
  - One network for standard and failsafe automation with flexible topologies and wireless communication
  - Reduce the number of types and parts



PROFIsafe

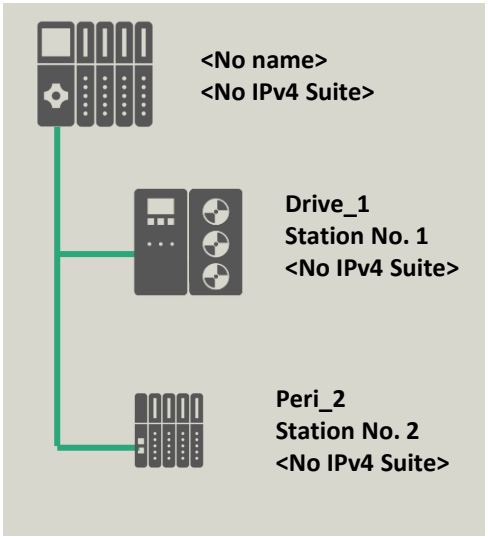
#5 Scalable Redundancy

- Highly available & cost efficient
  - With the Media Redundancy Protocol and managed ring architectures
  - Standardized in IEC 62439-2
  - Less costs, because of less required components
- System Redundancy
  - By primary and backup mechanism in PROFINET controllers
  - With single or double network interfaces in PROFINET Device
  - Dynamic Reconfiguration allows changes during plant operation

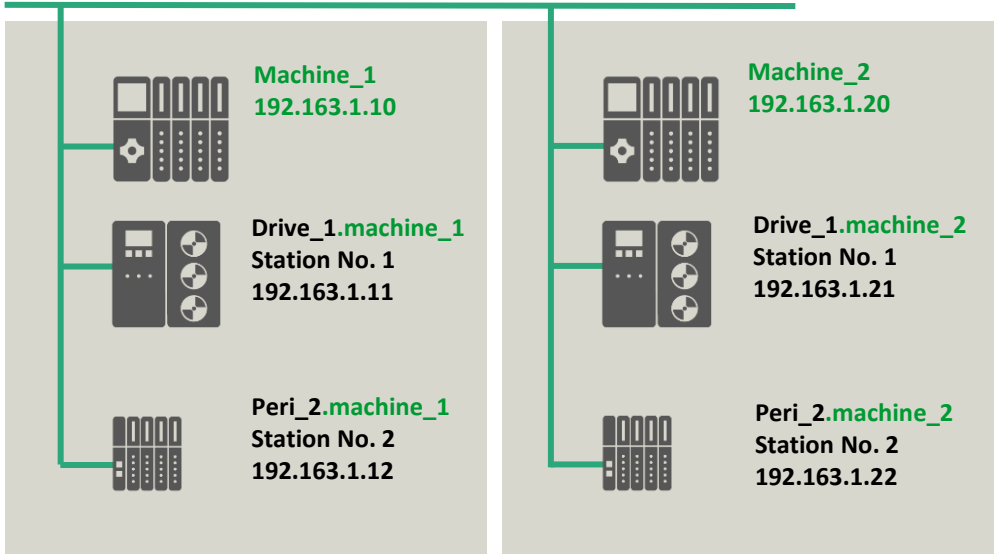


#6 Motion Control

- Modular machine concepts increase flexibility & customer orientation



Master project for multiple machine modules

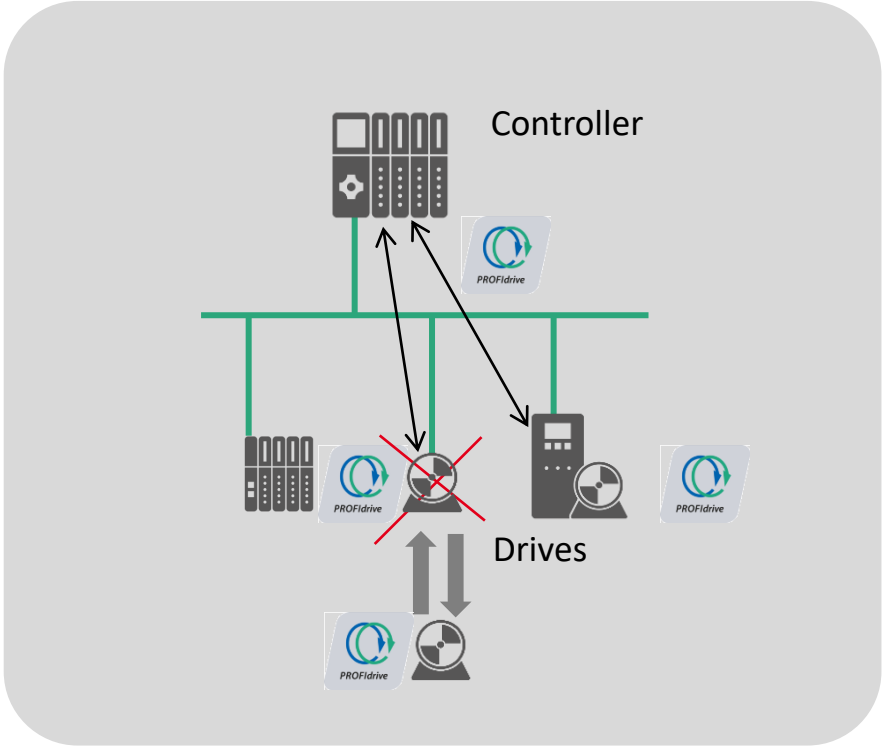


Configuration
Address assignment at a later point in time

Commissioning / operation
Flexible address – Automatic adjustment via the controller address

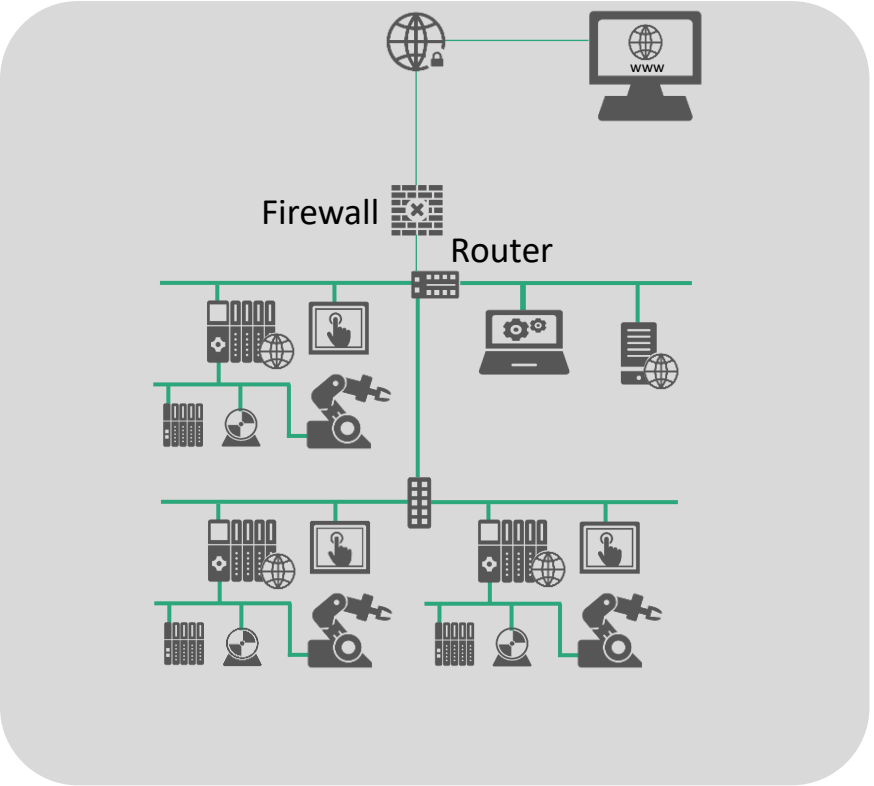
#6 PROFIdrive profile

- PROFIdrive
  - The PROFIdrive application profile offers users an interoperable application interface
  - Provides the possibility to operate drive devices of various manufacturers with one control application
  - Allowed that a drive from one vendor can be exchanged with one from another vendor without costly changes to the software
  - The PROFIdrive profile also offers an interoperable interface for the control of safety functions
  - Reference implementations available for free



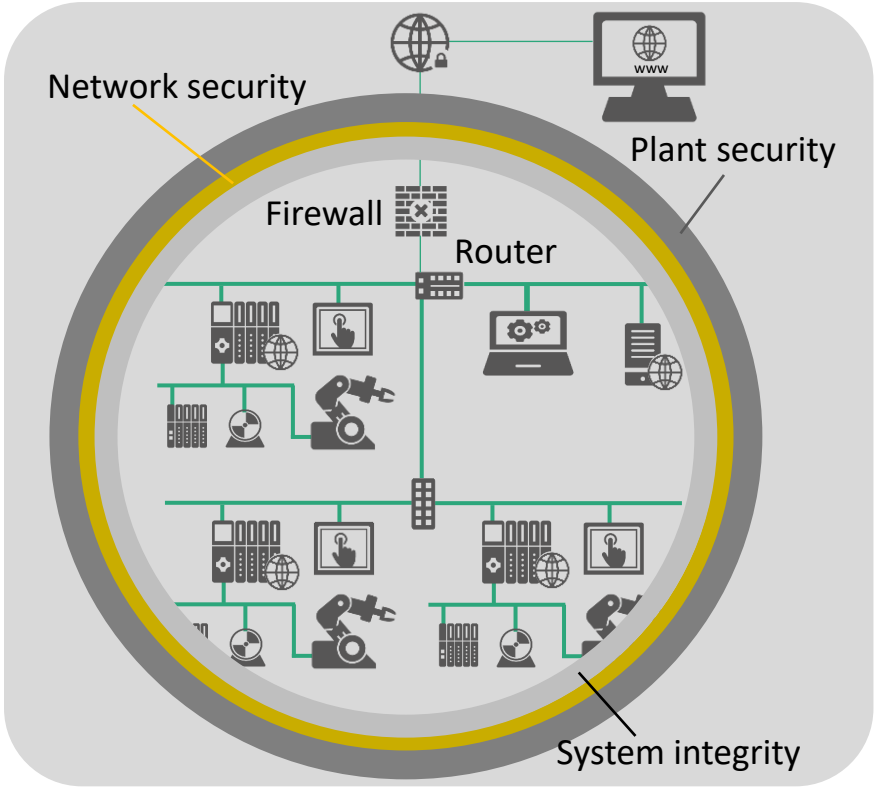
#7 IT-Integration One System for All

- IT-Integration
  - PROFINET supports well known network structuring using Routers and Bridges
  - Using standard IT mechanism for easy access to production
  - Integration of Web servers in PROFINET devices
  - Direct access to diagnostic information using standard Web browser
  - Individually adaptable maintenance concepts thanks to user-defined Web pages



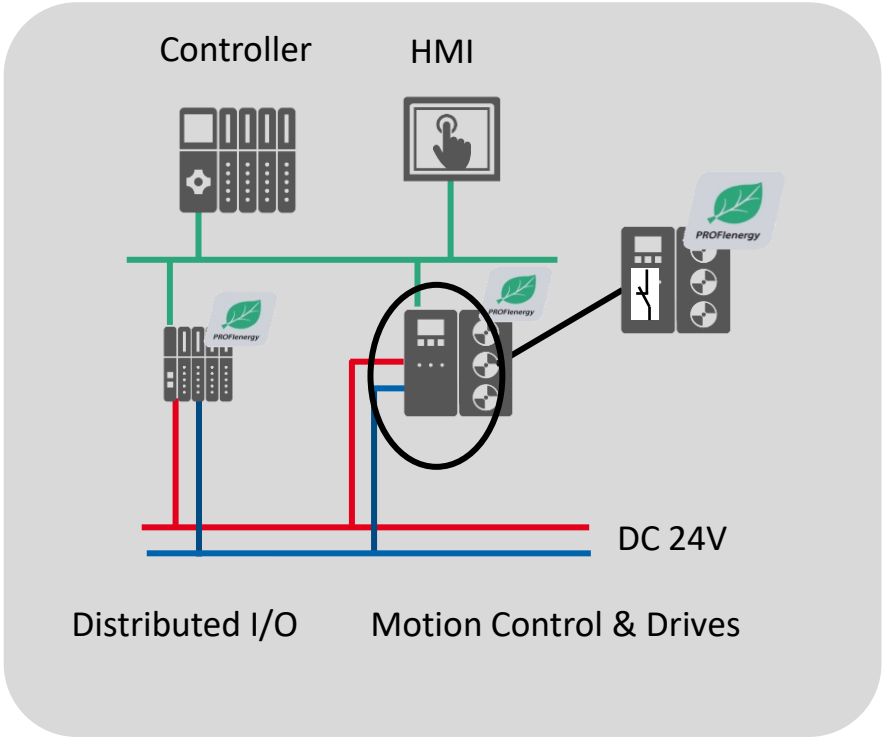
#7 IT-Integration and security

- Defense-in-Depth
  - PROFINET Networks and applications can be protected using the defense-in-depth approach according to IEC 62443 (cybersecurity for industrial installations
  - PROFINET Security Guideline contains important recommendations and best practices
- Security Test
  - Security Level 1 test is an integral part of the PN certification, PN devices are tested for high robustness against network faults
  - Certified PN products are robust against every netload and stay always in a definite state

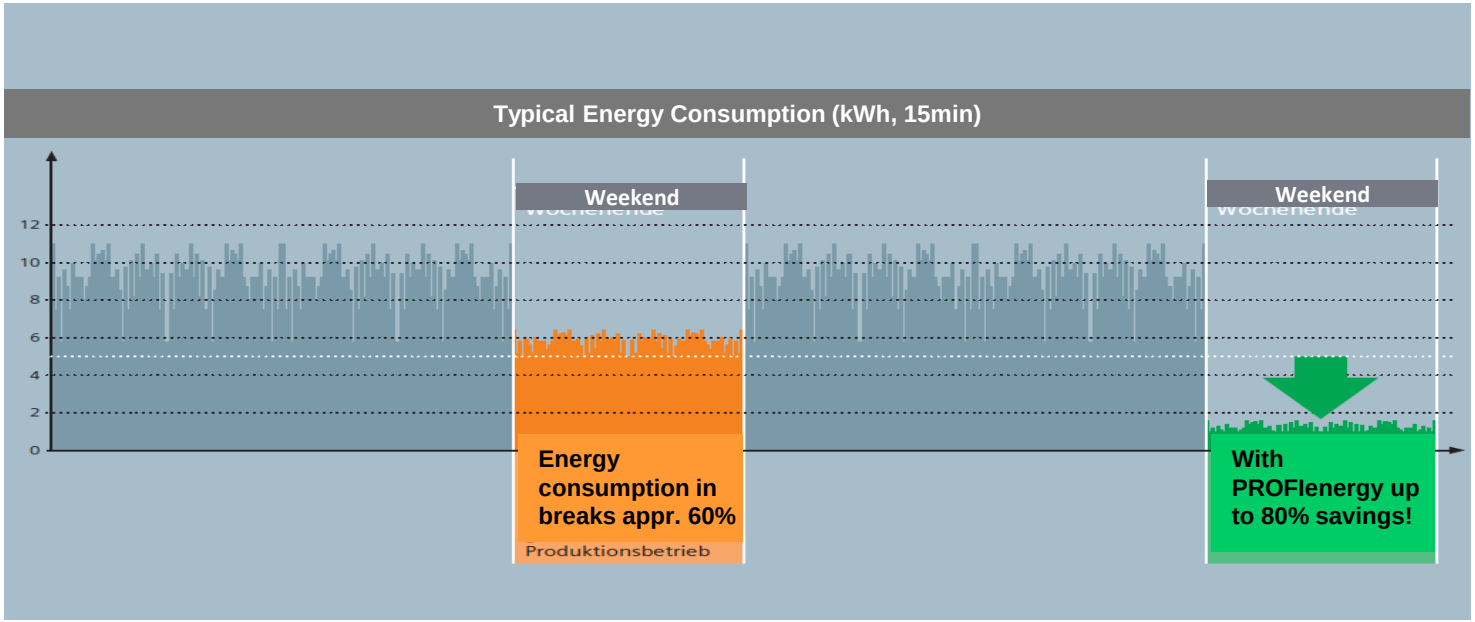


#8 Good points for PROFIenergy

- PROFIenergy
  - Measure the consumption in the devices
  - 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 integration into existing standards



#8 An example from the Automotive Industry

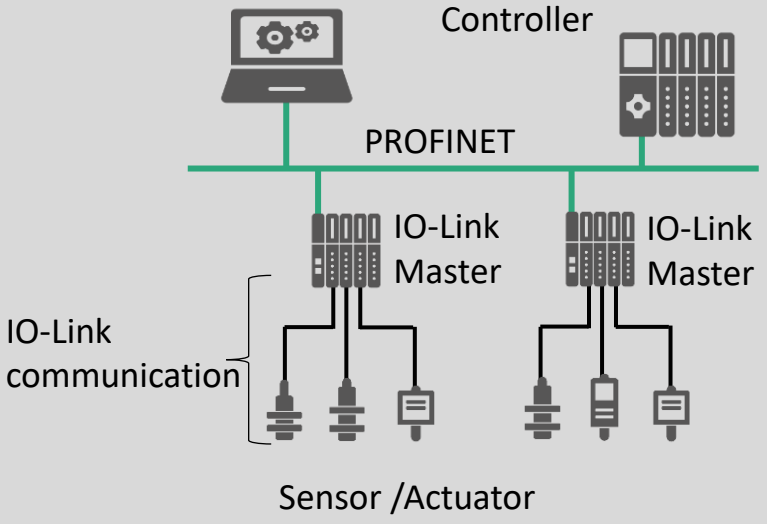


- Knowing the consumption is the first step

#9 IO-Link

- IO-Link
  - Standardized uniform interface for sensors and actuators

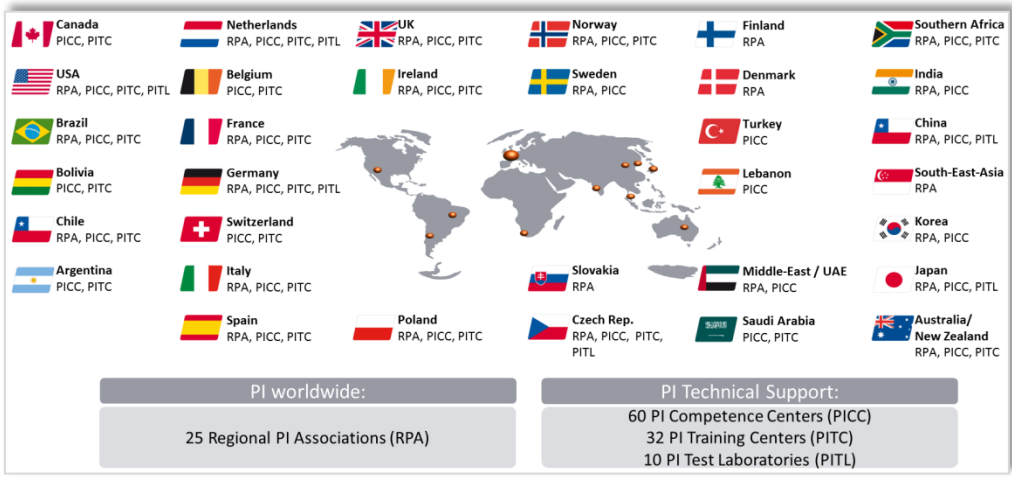
- IO-Link communication
  - Excellent integration into PROFINET
  - Consistent communication between sensors/actuators and the controller
  - Consistent diagnostic information down to the sensor/actuator level
  - Automatic parameter reassignment for device replacement during operation



Architecture with IO-Link

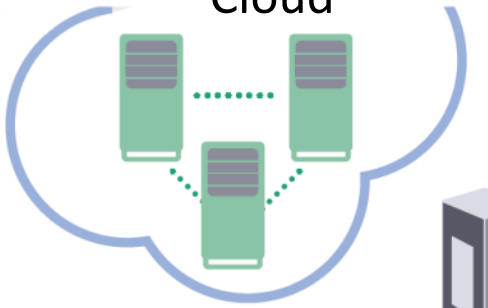
#10 Huge Organization and Support

- Worldwide organized
- Defining technology by specifications and white papers
- Know-How Transfer by trainings and implementation seminars
- Test specification and device certification
- Guidelines for installation, security, profiles,…
- For more information see PI website
- http://www.profibus.com/



PROFINET

Industrie 4.0 requires a powerful communication system



New Production Technology

Digitalization

Individualized Products

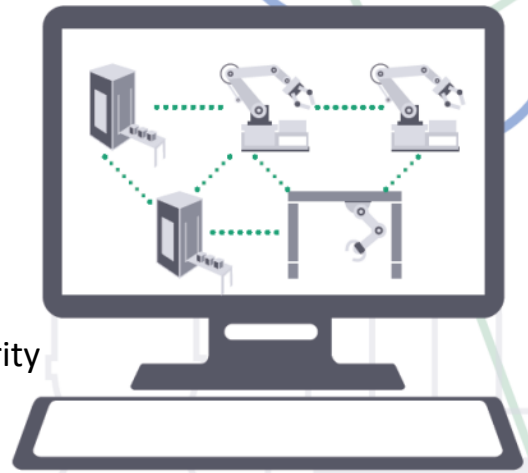
Interconnected Production

Lot Size 1

New Business Models

Standardization

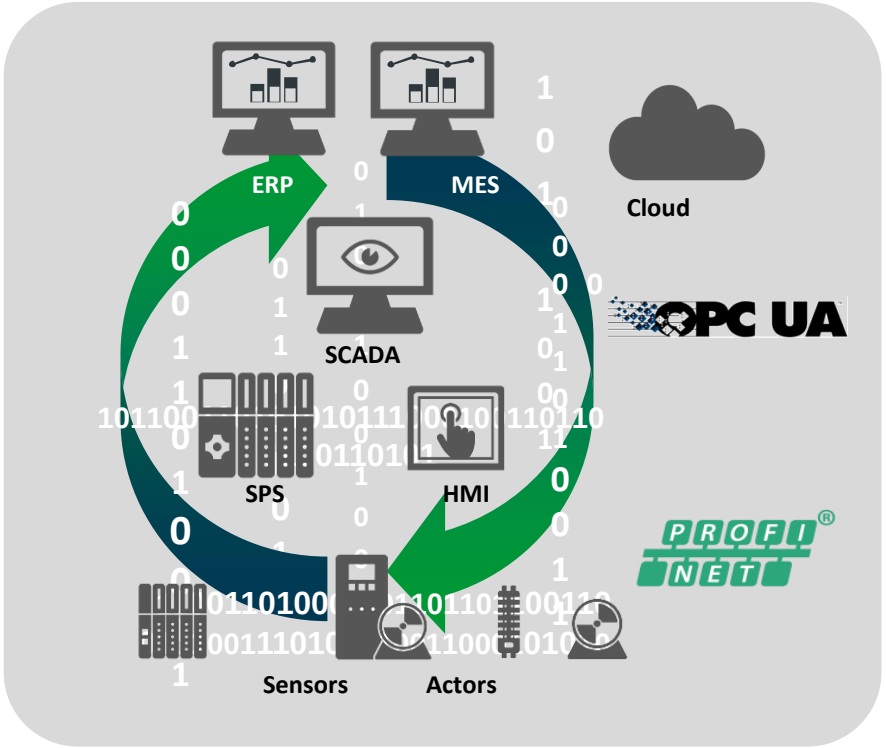
Security



Self Optimization

Ethernet based network for Industrie 4.0

- PROFINET
  - Future proof due to use of IEEE-standards
  - Parallel operation of variant protocols PROFINET, OPC UA, TCP/IP, HTTP,…
- OPC UA
  - Open standard for communication concepts within Industrie 4.0
  - Vendor & platform independent
  - … offers as an addition to PROFINET a comfortable interface to 3rd party devices
  - Future base for vertical and horizontal communication



Focused on the future since 25 years