Parkregelung, SCADA und Redundanz mit dem PLCnext IPC

Phoenix Contact – PLCnext IPC

PHOENIX CONTACT

Phoenix Contact GmbH & Co.KG , Stammsitz in Blomberg

We world market leader and highly innovative in electrics and electronics

We create progress with inspring and innovative solutions

Corporate history

1923 Founding in Essen

1928 First “RWE” ceramic terminal block
A modulare system for every connection
World market leader

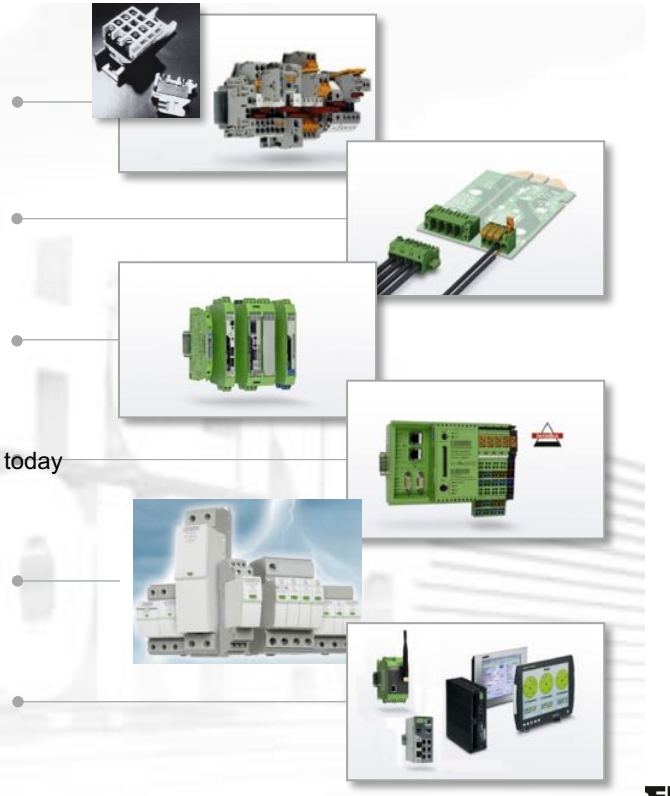
1975 Printed circuit board connectors
Connection technology for industrial electronics
World market leader

1980 Interface
Instrument transformers and signal converters
Technology leader

1984 Fieldbus technology
INTERBUS - the first industrial fieldbus, IEC standard today
Technology leader

1985 Surge- and Lightning protection
and signal quality products for systems and devices
Technology leader

2000 Automation technology
Industrial Ethernet, Industrial Wireless technology,
Control systems and Software
Technology leader



PHOENIX CONTACT Group

PHOENIX CONTACT Electronics GmbH
Bad Pyrmont

PHOENIX CONTACT Feinbau GmbH & CoKG
Lüdenscheid

Phoenix Contact Connection Technology GmbH
Herrenberg

Phoenix Contact-Software GmbH
Lemgo

PHOENIX CONTACT HMI-IPC
Technology GmbH
Filderstadt

PHOENIX CONTACT Cyber Security AG
Berlin

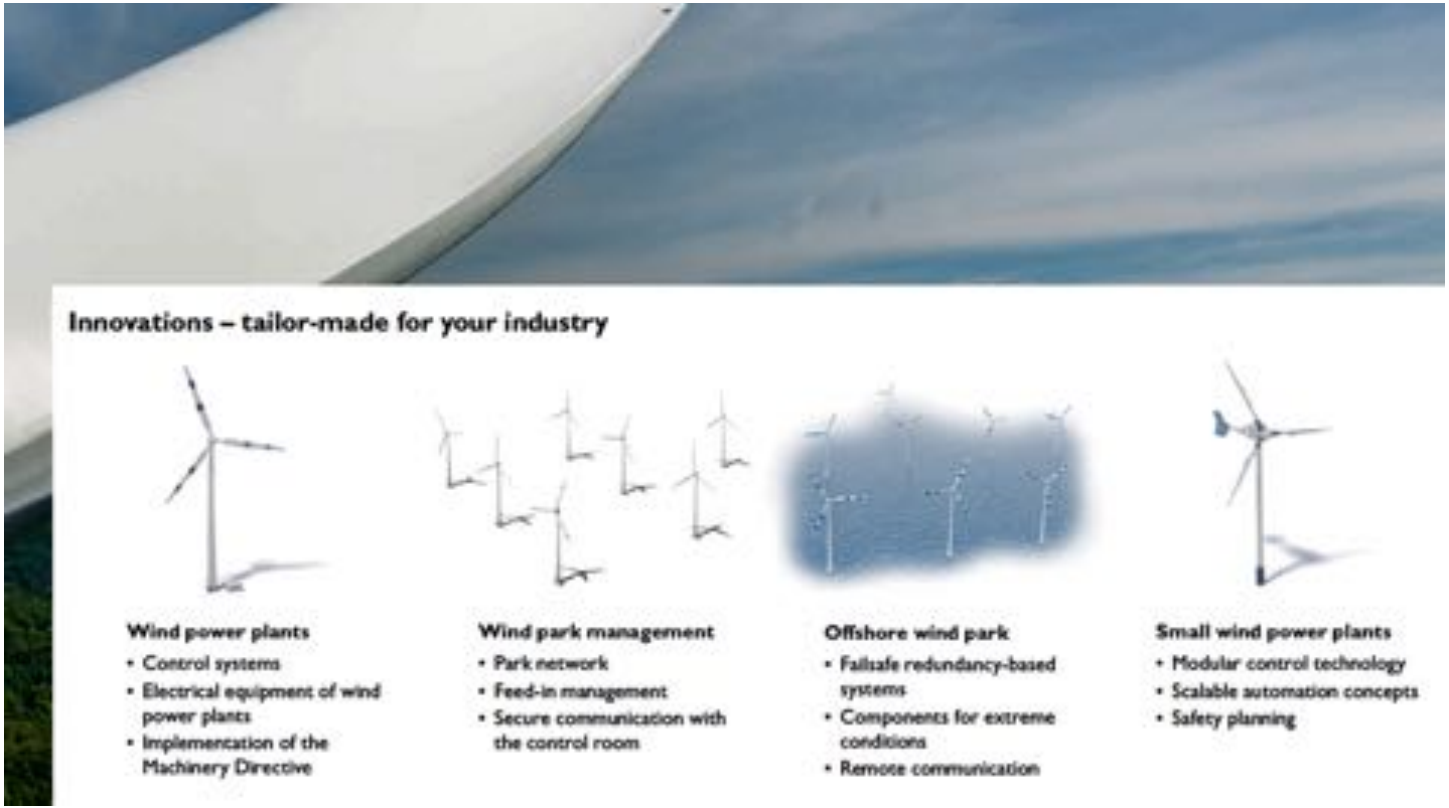
Phoenix Contact Power Supplies
Paderborn

PHOENIX CONTACT US Headquarters
Harrisburg, PA

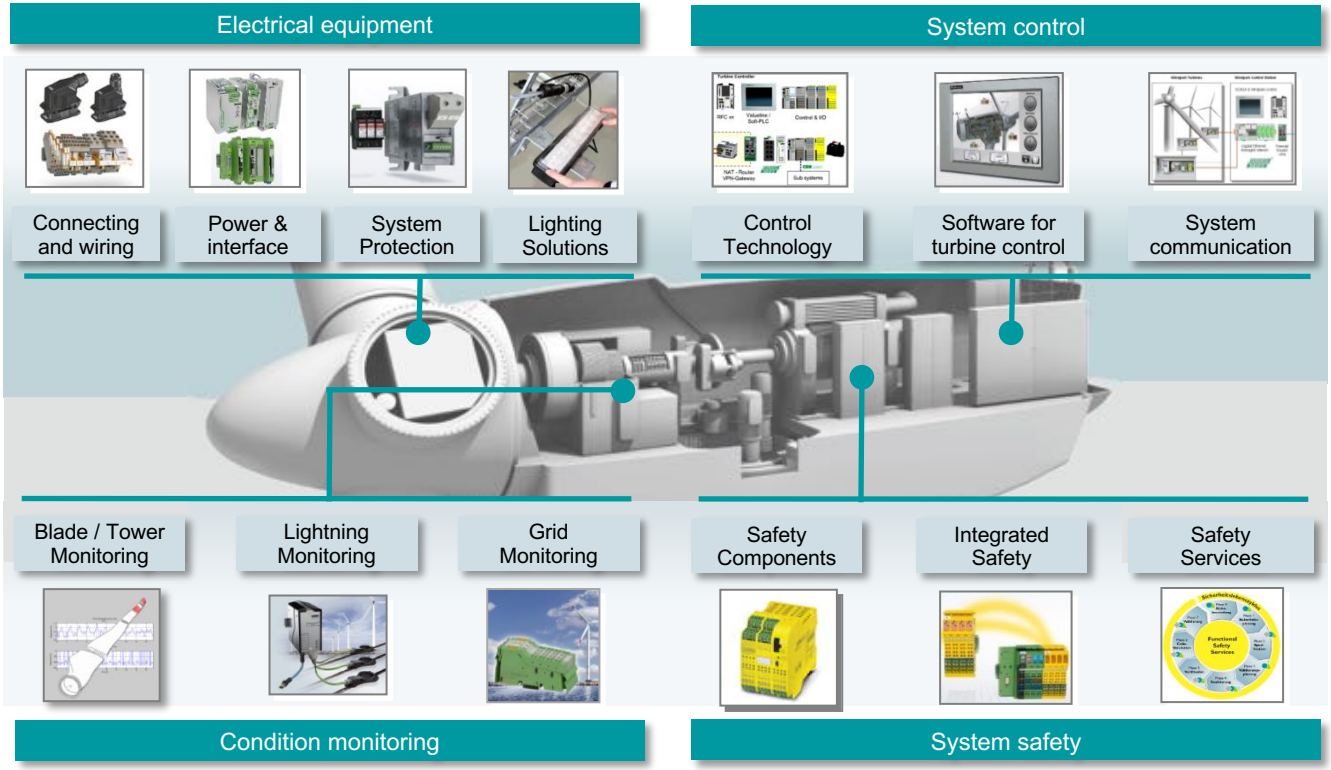
PHOENIX CONTACT China Headquarters
Nanjing

- >16,000 employees worldwide
- turnover 2019 ~ Euro 2.3 bn.
- 14 Production sites worldwide
- 52 subsidiaries
- over 60.000 active products
- appx. 1.500 new product launches p.a.

Our offer to the wind power industry



Solution portfolio for Wind Energy



Wind turbine control in worldwide operation

PLCnext Technology
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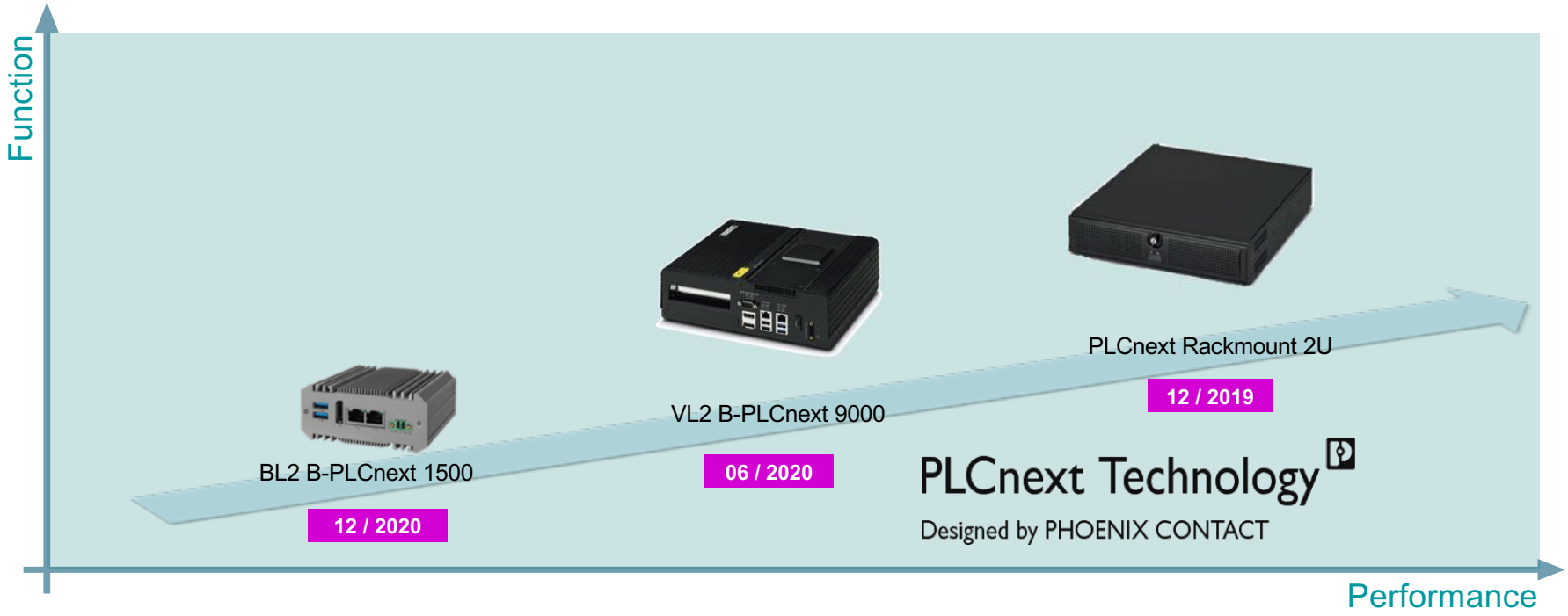
IPC PLCnext Controls Roadmap



PLCnext Controls

BL2 B-PLCnext 1500

PLCnext Technology
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Outlook: 2020

- Intel Celeron N3350 1.1 GHz\2.4 GHz
- 4 GB RAM
- 32 GB eMMC, 1x M.2 SSD
- 2 Gbit ETH-MAC interfaces
- 2 x USB 3.0
- Dimensions 97mm x 97mm x 36mm (basic)
- Real-time clock
- Trusted platform module (TPM) for security
- Temperature range: 0°C up to +50°C

Compact PLCnext IPC Solution

PLCnext Controls

BL2 B-PLCnext 9000

PLCnext Technology
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Outlook: 2020

- Intel Celeron I7-6822EQ
- 16 GB RAM DDR4
- 2 x 512 GB SSD possible
- 2 Gbit ETH-MAC interfaces
- 2 x USB 2.0 / 2 x USB 3.0
- Dimensions 175mm x 100mm x 15mm
- Real-time clock
- Trusted platform module (TPM) for security
- Temperature range: -20°C up to +60°C

High performance PLCnext IPC Solution

PLCnext Controls

PLCnext Rackmount 2U

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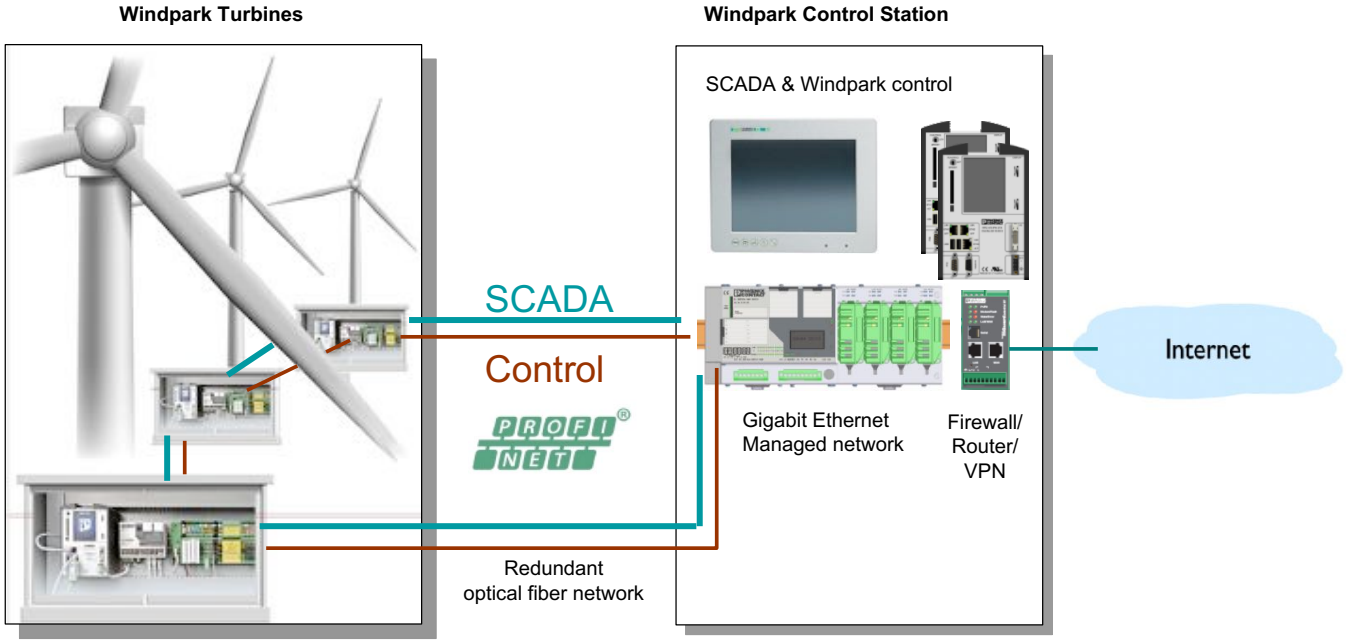
Outlook: 2020

Rackmount PLCnext Solution

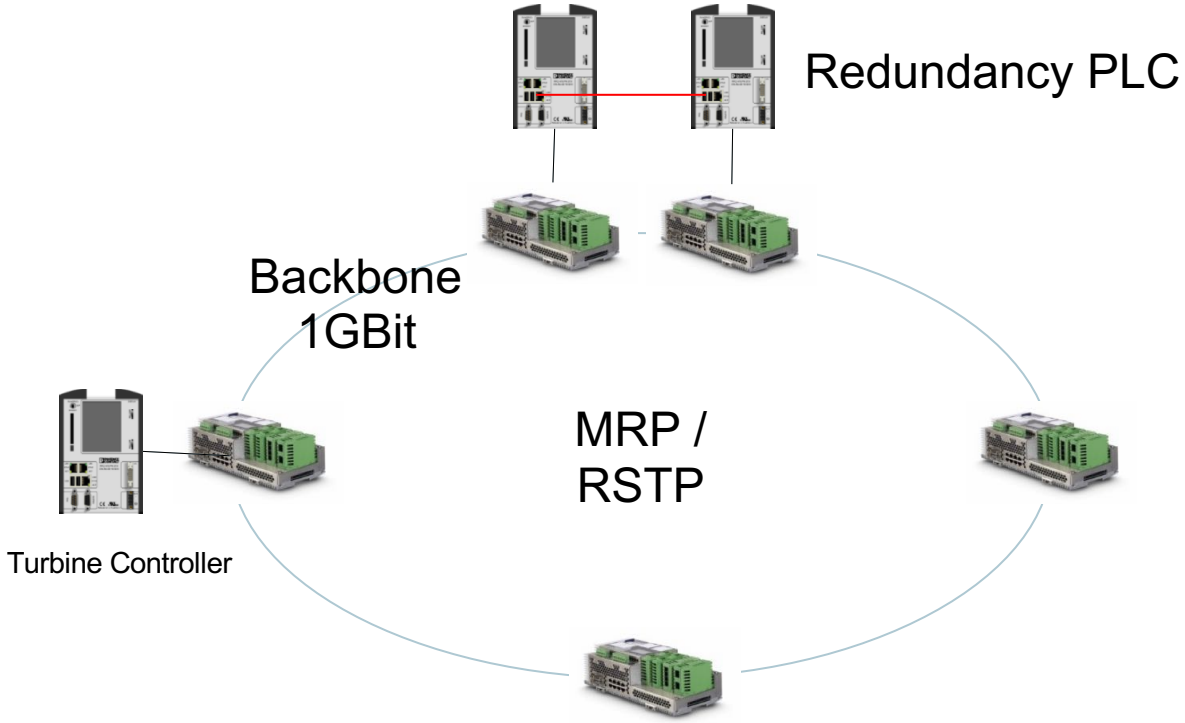
- ☑ Intel Celeron I7-6822EQ
- ☑ 32 GB RAM DDR4
- ☑ 1 x 512 GB SSD / 2 + 1TB HDD
- ☑ 2 Gbit ETH-MAC interfaces I210
- ☑ 4 x USB 2.0 / 2 x USB 3.0
- ☑ Dimensions 482mm x 177mm x 461mm
- ☑ Real-time clock
- ☑ Trusted platform module (TPM) for security
- ☑ Temperature range: 0°C up to +55°C

State of the Art - Windpark network and control with Profinet

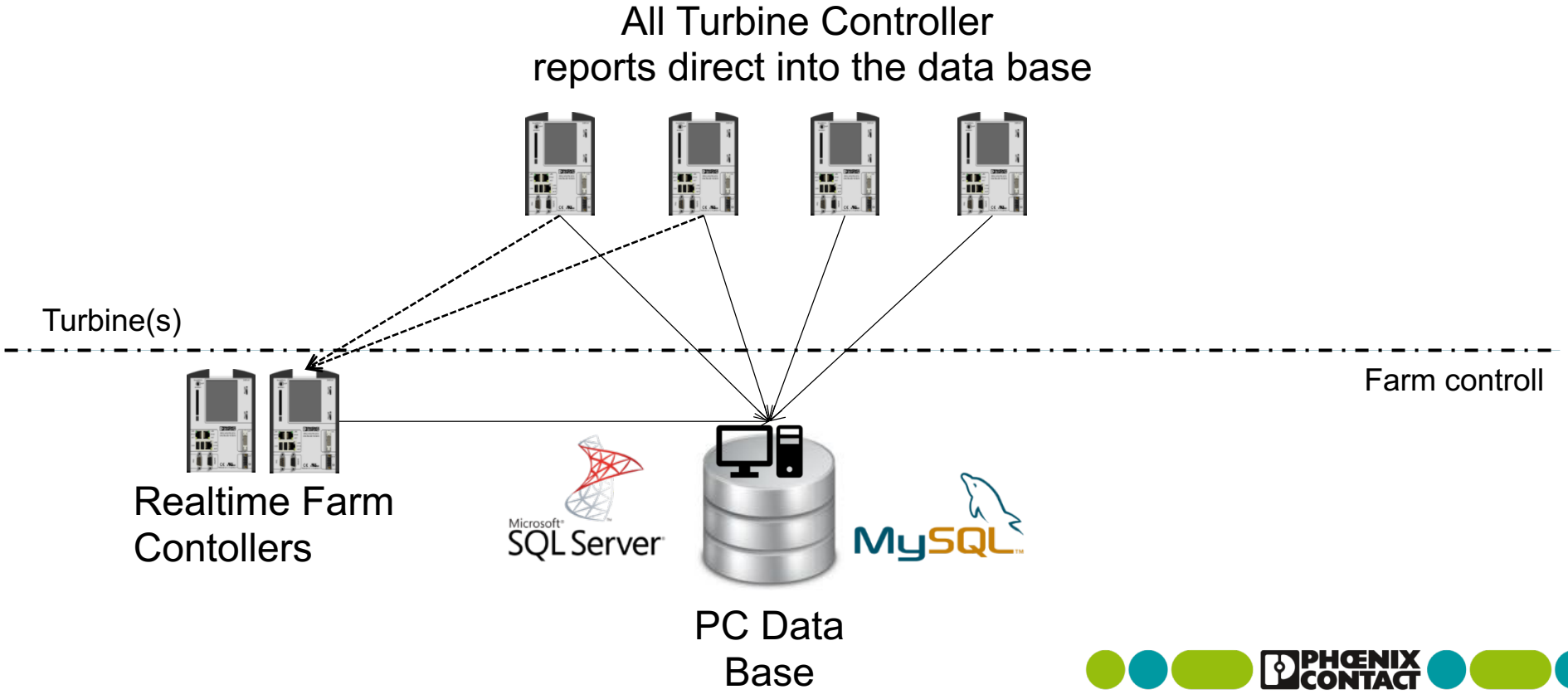


Fast windpark control : > 150 wind turbines within 8 ms update time !

Wind Farm Network Control



Data Management - SCADA



Data Management - SCADA

All Turbine Controller
reports direct into the data base

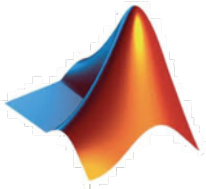
Turbine(s)

Farm controll

SCADA +
Database

Microsoft SQL Server

PLCnext IPC



Realtime Farm
Control

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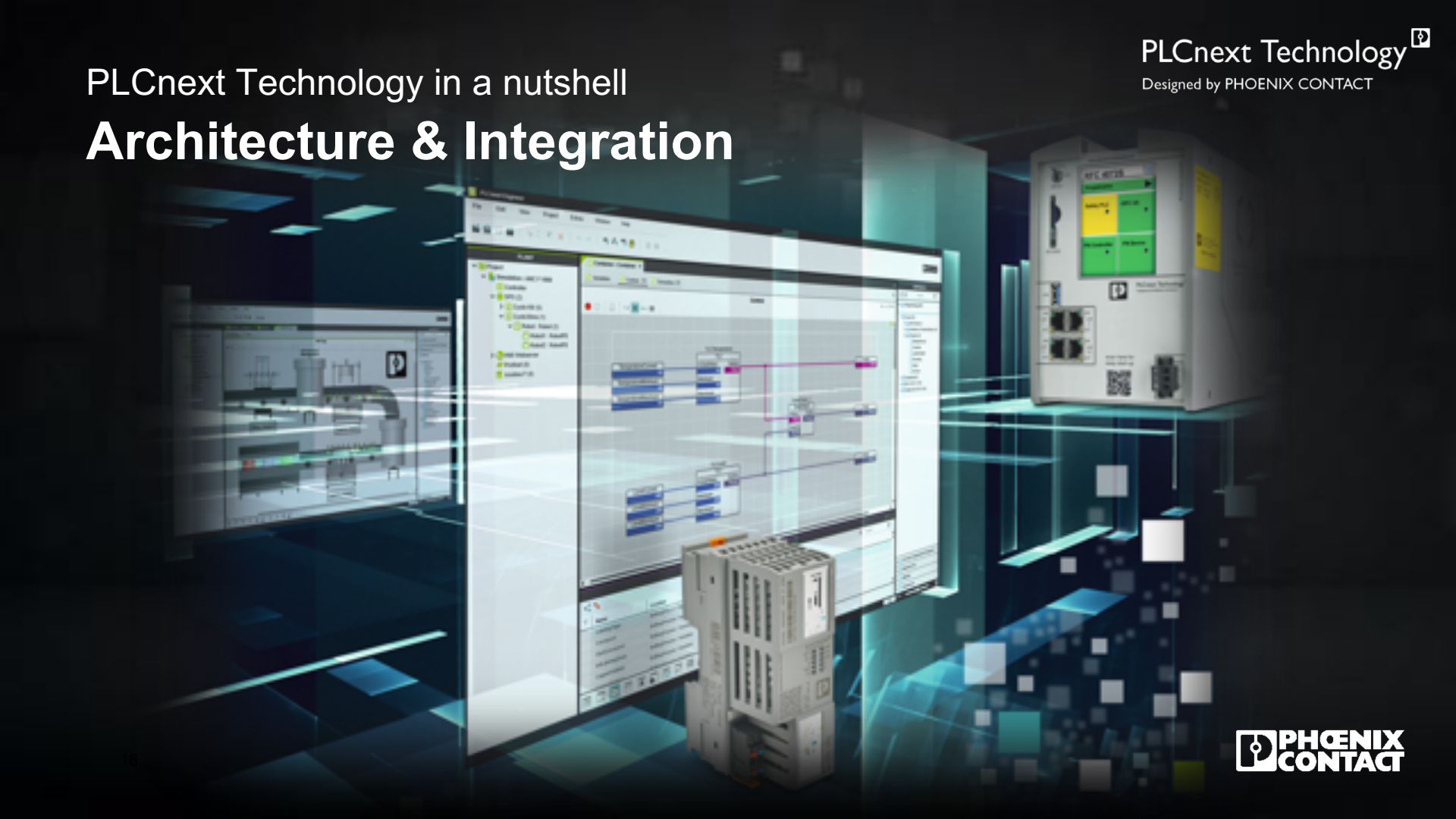
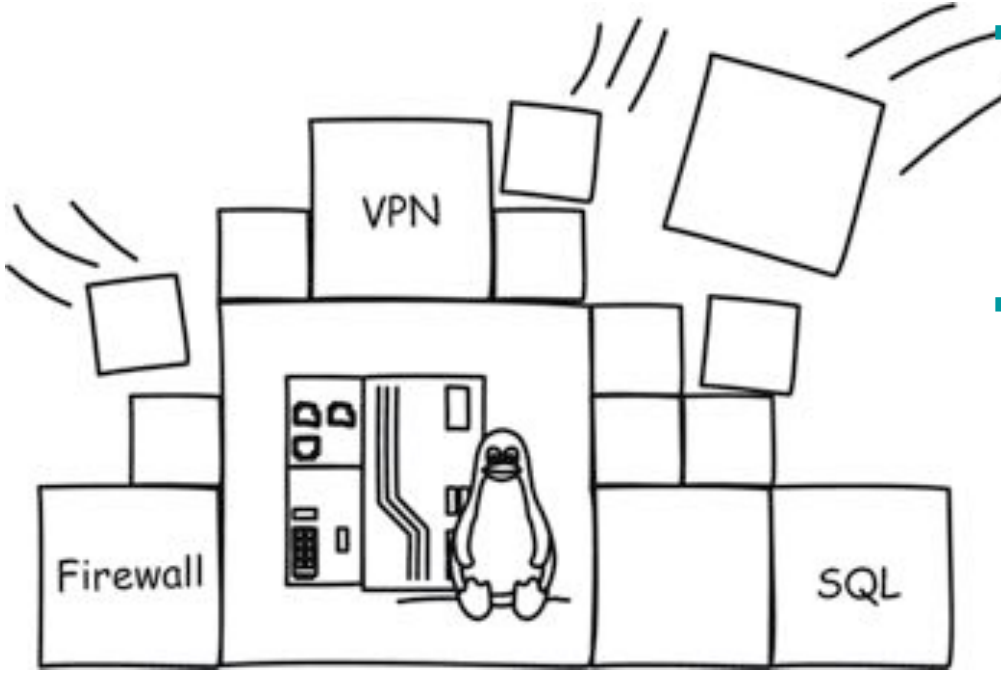
PLCnext Technology in a nutshell

Architecture & Integration



Flexibility of Linux plus the Reliability of a PLC



- **PLCnext Technology is based on Linux…**
  - Open source Linux Packages
- **… but as performant as a “classic” PLC!**
  - Easy task management
  - Precise synchronization
  - Cycle-consistent data exchange
  - No Linux knowledge needed

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IEC 62443: IT-Security for Industrial Automation Control Systems

Authentication
- User accounts
- Authentication of credentials
- Authorization

Integrity
- Principle of least privilege
- Defense in depth
- Network segmentation

Confidentiality
- Use of secure protocols
- Secure remote maintenance
- Cryptography
- Protection of expertise

Availability
- Monitoring und attack detection
- Tamper protection

IEC 62443

Industrial Automation
Basis Standard

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IEC 62443-4-1 Secure Product Development Lifecycle

CERTIFICATE

No. Q4B 029429 0007 Rev. 00

Holder of Certificate: PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstr. 8
32825 Blomberg
GERMANY

Factory(ies): PHOENIX CONTACT Electronics GmbH
Industry Management and Automation
Business Unit Control Systems
Dringenauer Strasse 30, 31812 Bad Pyrmont, GERMANY

PHOENIX CONTACT Software GmbH
Langenbruch 6, 32657 Lemgo, GERMANY

Certification Mark:

Scope of Certificate: Secure Product Development Lifecycle

Applied Standard(s): IEC 62443-4-1:2018
PPP 15002A:2018 (IEC 62443-4-1 Full Process Profile)

The Certification Body of TÜV SÜD Product Service GmbH certifies that the company mentioned above has established and is maintaining a management system which meets the requirements of the listed standards. The results are documented in a report. See also notes overleaf.

Report No.: 18CR015007

Valid until: 2021-07-29

Date, 2018-08-01

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

ID	Requirement	Maturity Level
Practice 1 – Security Management		
SM-1	Development Process	3
SM-2	Identification of Responsibilities	2
SM-3	Identification of Applicability	2
SM-4	Security Expertise	2
SM-5	Process Scoping	2
SM-6	File Integrity	2
Practice 2 – Specification of Security Requirements		
SR-1	Product Security Context	2
SR-2	Threat Model	2
SR-3	Product Security Requirements	2
SR-4	Product Security Requirements Context	2
SR-5	Security Requirements Review	2
Practice 3 – Secure by Design		
SD-1	Secure Design Principles	2
SD-2	Defense in Depth Design	2
SD-3	Security Design Review	2

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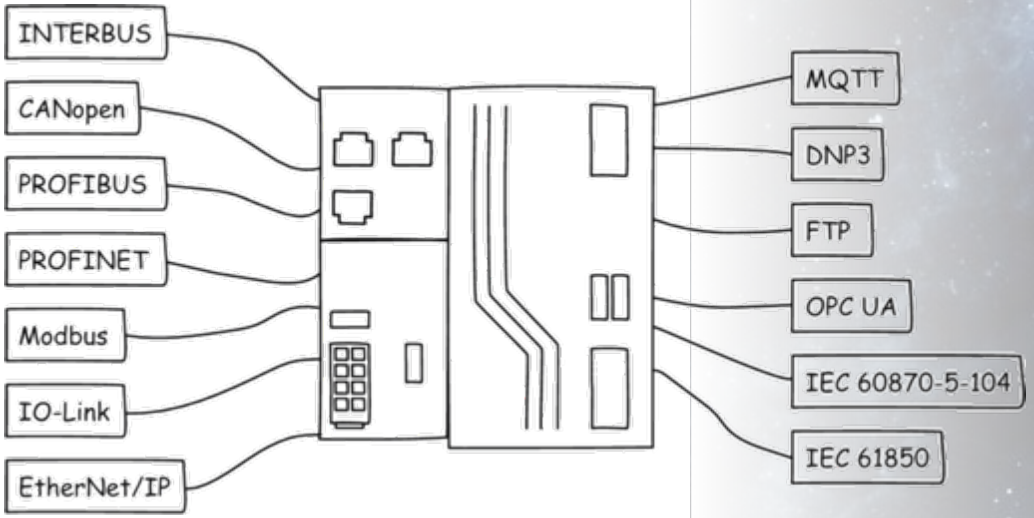
enhanced connectivity

Open interfaces and cloud integration

PLCnext Technology enables the integration of current and future interfaces and protocols for open communication in highly networked automation systems. Implement new IoT-based business models through edge computing and/or direct connection to cloud-based services and databases.

enhanced connectivity – Intelligent Networking

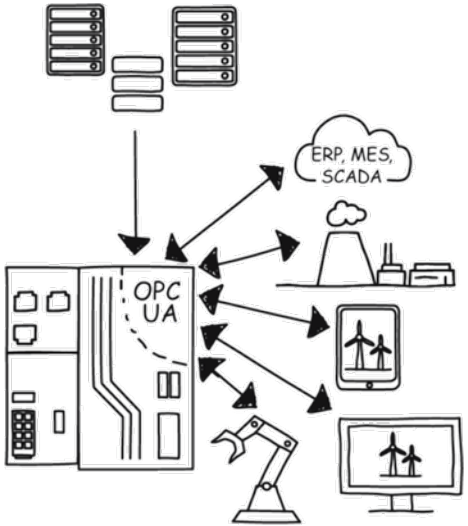
Future-proof Connectivity



PLCnext Technology enables the integration of current and future interfaces and protocols for open communication in highly networked automation systems.

enhanced connectivity – Intelligent Networking

Integrated OPC UA Server



OPC UA

Data Access, Alarms and Conditions, Programs, Historical Access, Global Discovery Server

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enhanced connectivity – Intelligent Networking

PROFICLOUD, Public Cloud, Private Cloud – any Cloud!

PROFICLOUD

Alibaba Cloud

Google Cloud

aws

MindSphere

MQTT based on paho

Azure

IBM Cloud

Implement new IoT-based business models through direct connection to cloud-based services and databases. Benefit from the seamless integration of Phoenix Contact´s PROFICLOUD and a cloud-agnostic strategy where the PLCnext Store delivers cloud connectors for every cloud. PLCnext Technology supports any customer cloud implementation – public, private, hybrid - including AWS, IBM, Azure, Alibaba, and MindSphere.

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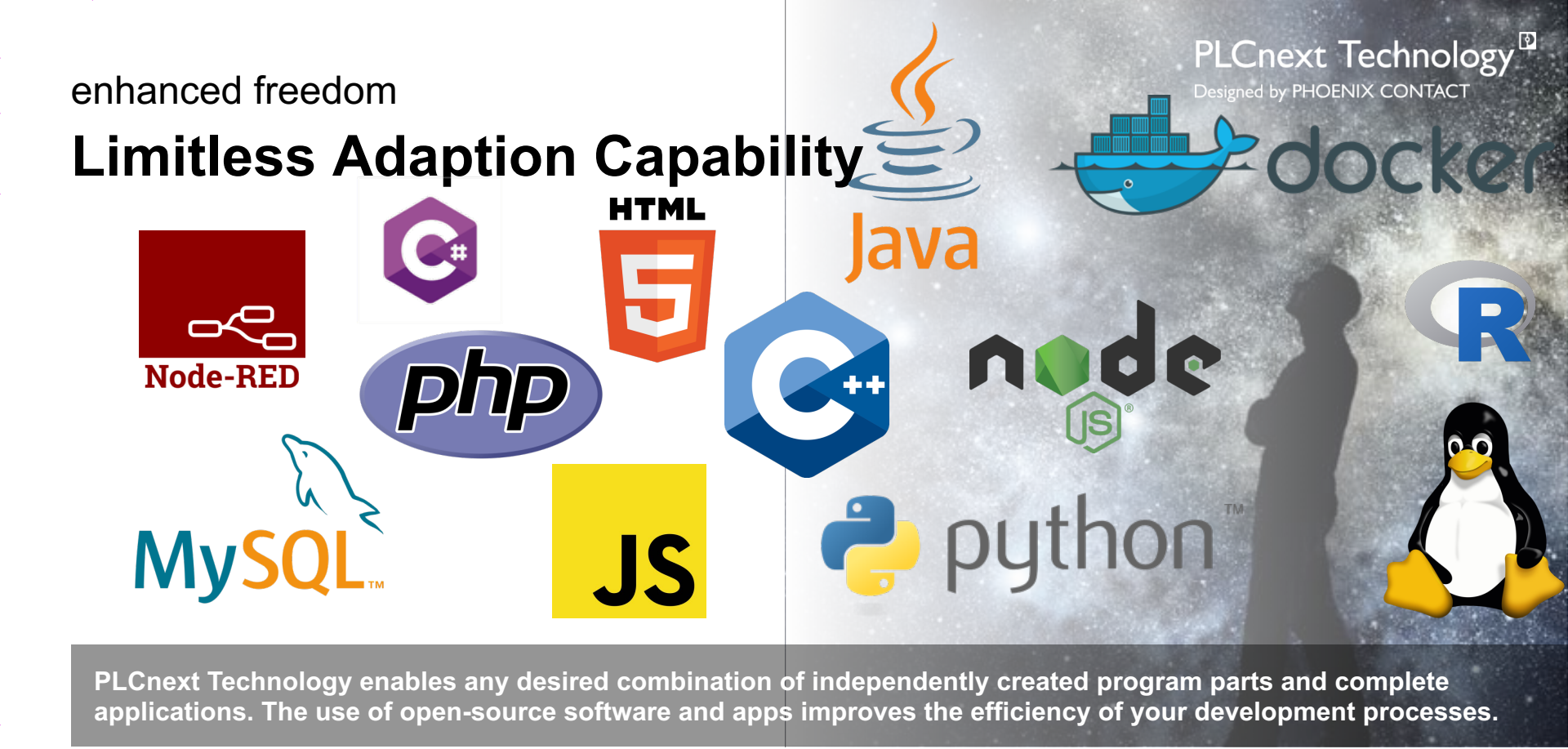
PLCnext Technology enables any desired combination of independently created program parts and complete applications. The use of open-source software and apps, e.g. from our PLCnext Store, improves the efficiency of your development processes. They sky is the limit when it comes to future expansions.

enhanced freedom

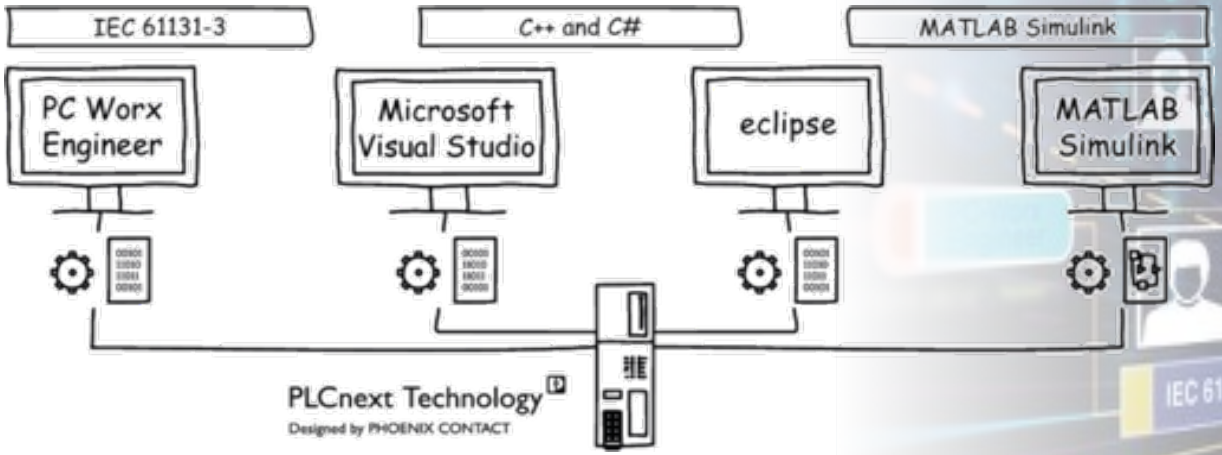
Limitless Adaption Capability



PLCnext Technology enables any desired combination of independently created program parts and complete applications. The use of open-source software and apps improves the efficiency of your development processes.

enhanced development

Convenient Engineering & Application Development



With PLCnext Technology, several developers from different generations, with different skill sets and expertise can work on one controller program, in parallel and yet independently, using different programming languages.

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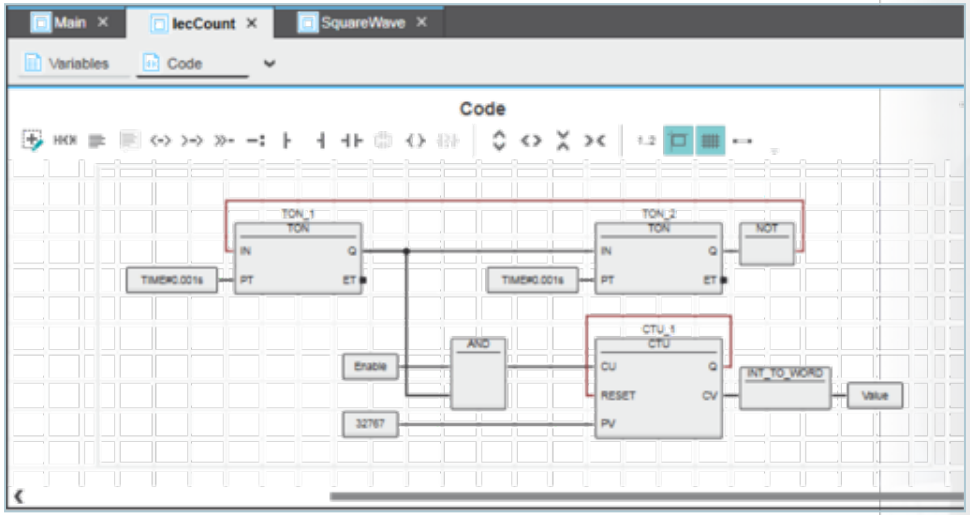
enhanced convenience

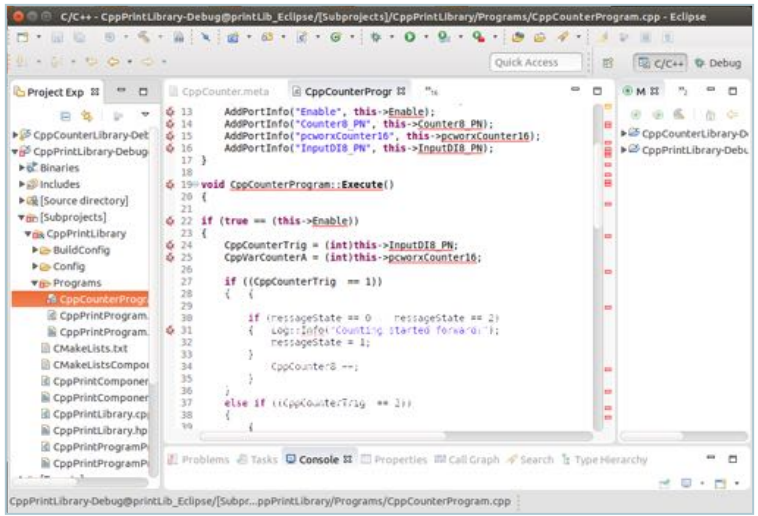
IEC 61131-3 Programming with PLCnext Engineer



Use the innovative and easy to use features of PLCnext Engineer.

enhanced convenience

Programming – C/C++



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eclipse

C/C++ acc. to standard, easy interface to the PLCnext Technology platform, support of remote debugging – use the tool you are familiar with.

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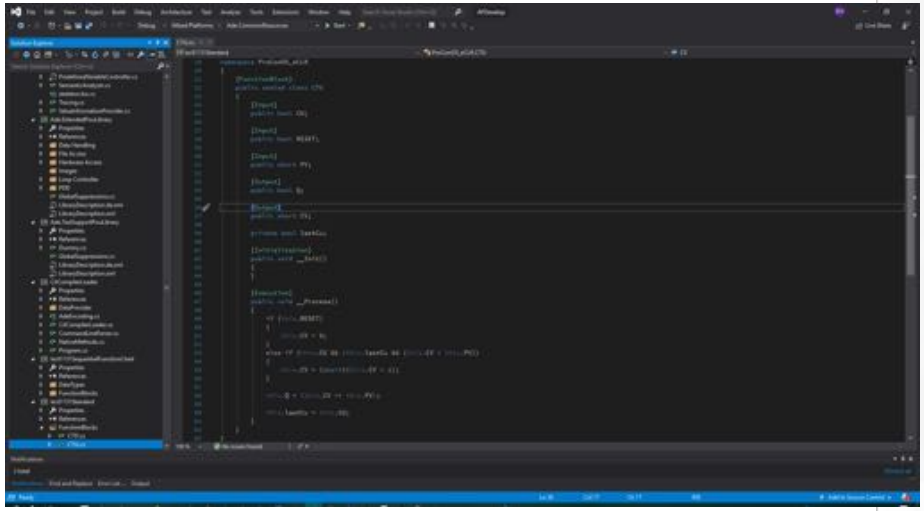
enhanced convenience

C# Function Blocks



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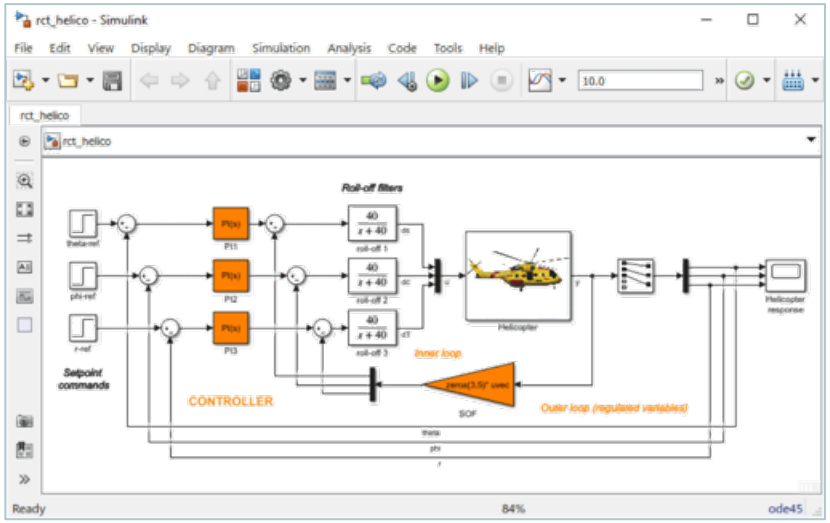
Visual Studio

Development and integration of function blocks with C# with a dedicated plug-in for Visual Studio.
Create IEC 61131 function blocks with C# and execute them in real-time with the eCLR runtime system.

enhanced convenience

MATLAB Simulink



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Seamless integration of model-based design & development with MATLAB Simulink.

PLCnext Technology
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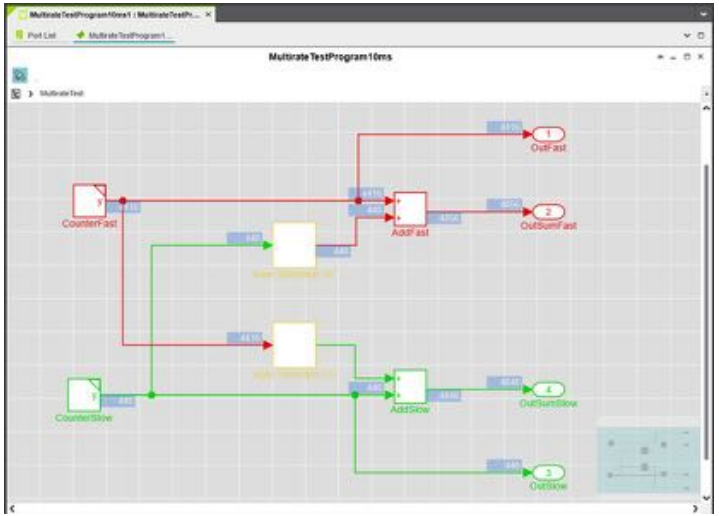
enhanced convenience

MATLAB Simulink & PLCnext Engineer



Seamless integration of model based design & development with MATLAB Simulink and PLCnext Engineer.

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PLCnext Technology
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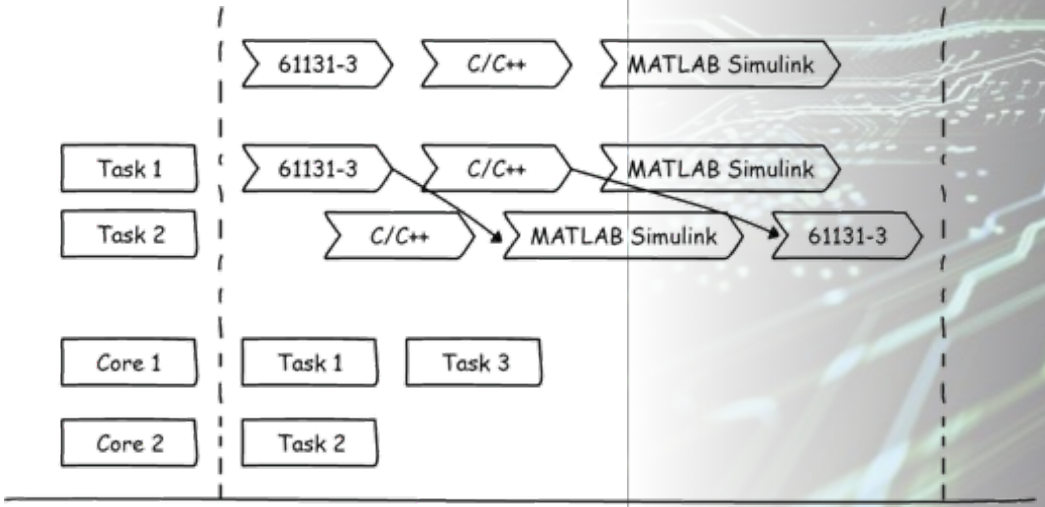
Combine program sequences in different languages into tasks as desired. The task-handling of the PLCnext Technology (patent applied for) lets program routines of different origin run like a classical IEC-61131-PLC-code – Your high-level language programs become automatically deterministic. The platform ensures consistent data exchange and synchronous execution of the program code.
enhanced performance
Real-time execution across different programming languages

enhanced performance – PLC-typical Real-time Performance

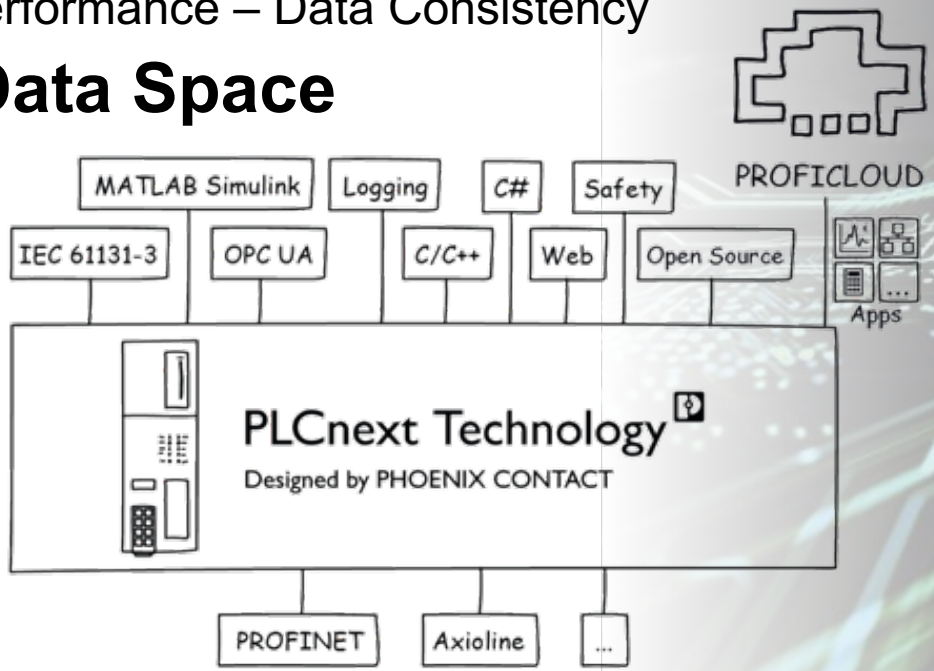
Execution & Synchronization Manager



The patent-applied-for task handling of PLCnext Technology lets program routines of different origin run like classical IEC 61131 PLC code. Your high-level language programs become automatically deterministic.

enhanced performance – Data Consistency

Global Data Space



Fast and consistent data exchange between user programs, fieldbuses, and system programs. Access via Data Logger, HMI, and OPC UA. Security aspects for user management.

Applicative System Redundancy

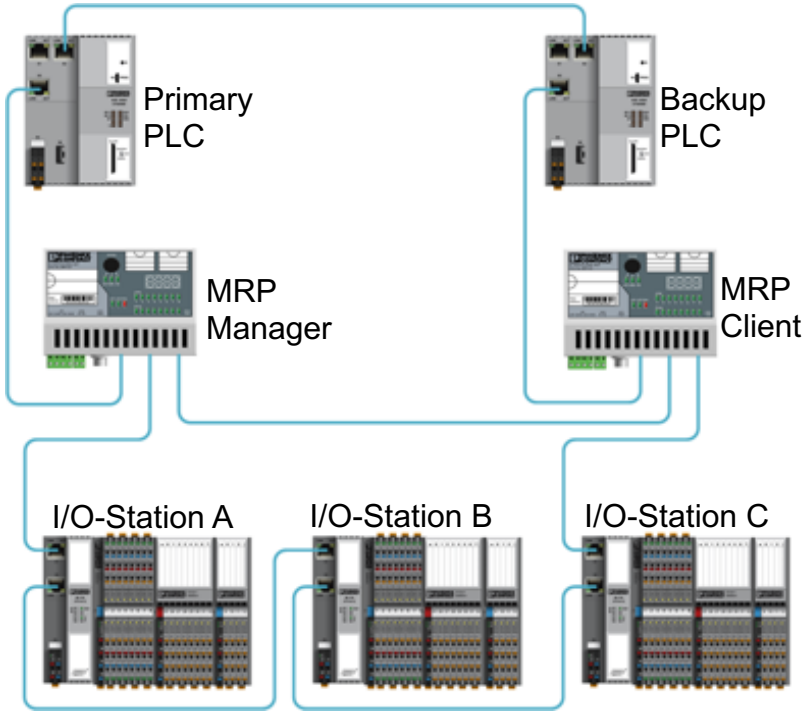
Hardware elements

- PLCs: PLCnext IPC as Profinet IO-controller
- IO-Stations: Axioline bus coupler
  AXL F BK PN as Profinet IO-device.
  + Axioline IO-modules
- Network: Managed switch FL SWITCH SMCS
  as Manager/Client for MRP.

Robust and type approved components

Modular design

Slim network structure

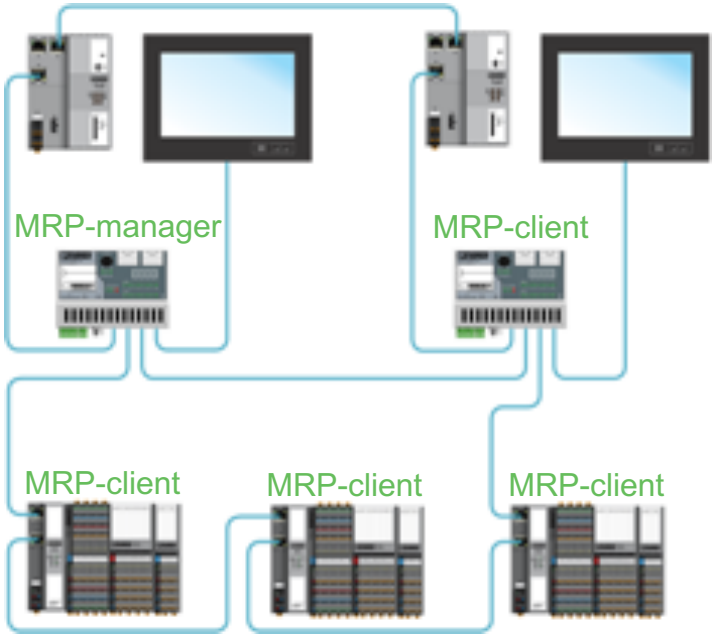


Applicative System Redundancy

Network Redundancy

Media Redundancy Protocol (MRP) according to IEC62439:

- One Switch has the role of the MRP-manager.
- All other devices in the ring structure must support the MRP-client function.
- Switch-over time 200ms.
- All devices without MRP-client function are connected to edge port of the managed switches.

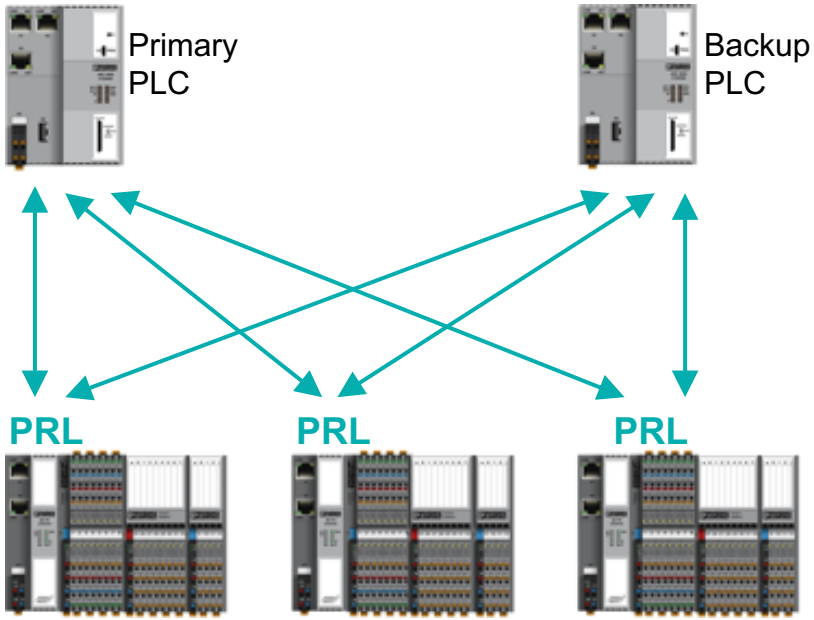


Controller Redundancy

Firmware function “PRL“

Phoenix Redundancy Layer (PRL):

- Both Profinet IO-controllers are connected to all Profinet IO-devices at the same time.
- The IO-device send the input signals to both IO-Controllers. In this way both Controllers have the identical process data of the sensors.
- Only one IO-Controller sends “valid” output data to the IO-Device.

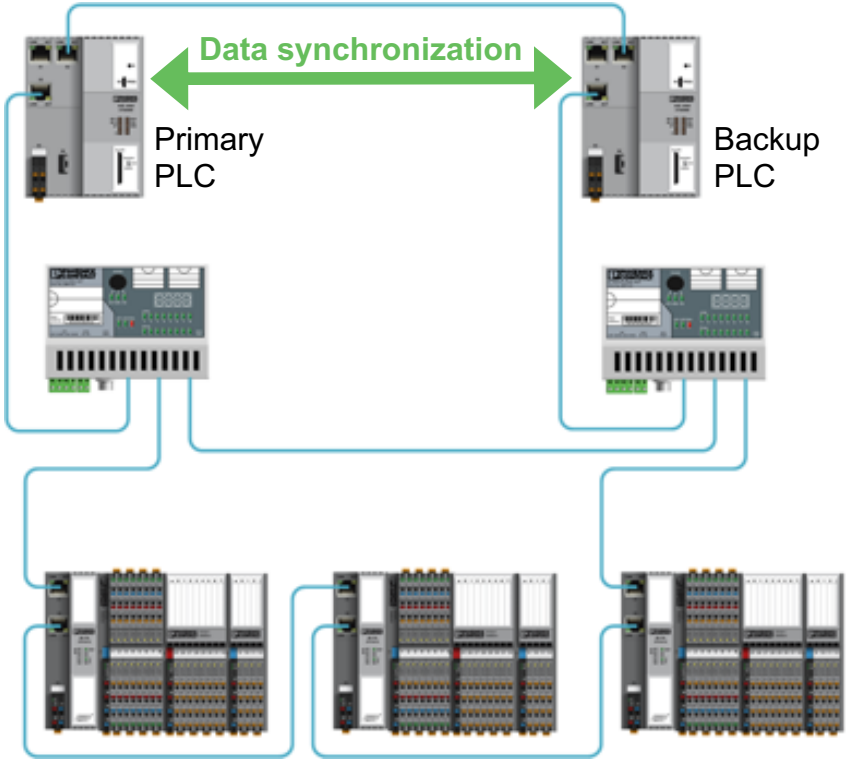


Applicative System Redundancy

Data synchronization

Data synchronization:

- The active controller (Master) sends selected data to the passive controller (Slave).
- This is done via function blocks based on the IP communication capabilities of the PLC.

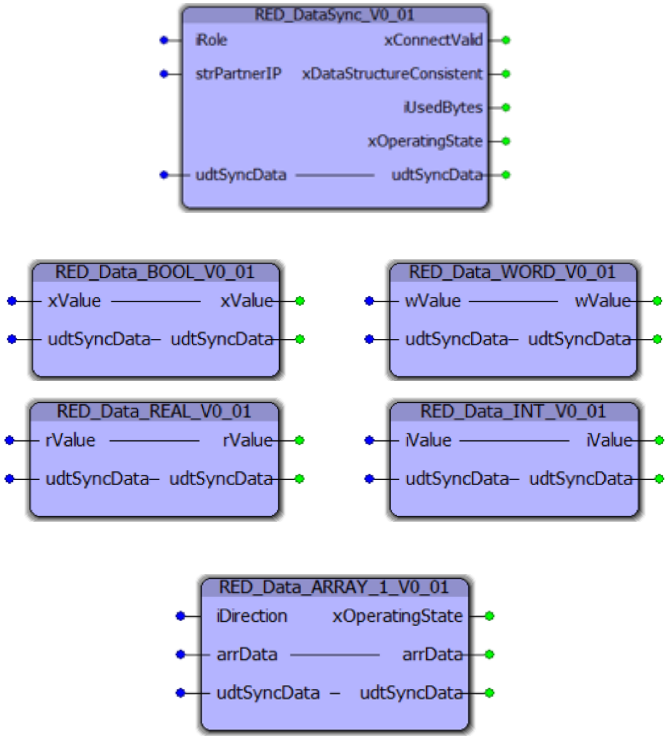


Applicative System Redundancy

Data synchronization

Function blocks for data synchronization:

- Main function block for establishing the communication link between the PLCs.
- Function blocks for standard data types (up to 32kBytes for all variables in total).
- Function blocks for user defined arrays (up to 32kBytes for each variable).



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PLCnext Rackmount 2U

Outlook: 2020

Rackmount PLCnext Solution

Optimize Farm Control and Monitoring Costs

- ☑ PLCnext Architecture
  - ☑ Open RT Linux
- ☑ Realtime Farm Control
  - ☑ E.g. Control 200 WEC via PN @ 8 ms
- ☑ OPC UA SCADA Interface DA/HAD/Events …
  - ☑ Local data storage up to 2 TB
- ☑ Applicative system redundancy

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