# Welcome

## Webinar

## PLCnext Control

## nueva tecnología de plataformas de control

Antonio Gordillo IMA Septiembre - Diciembre 2020

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Webinars

# Agenda

- Fundamentos de la plataforma PLCnext Control
- Plataforma abierta  - modelos
- Integración de Seguridad Funcional
- Seguridad por diseño IEC 62433
- Links a videos de inicio con  PLCnext Control
- Starterkit  PLCnext Control
- Sistema  Ecosystem PLCnext Technology

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PLCnext Technology

enhance your automation thinking

# PLCnext Technology

## PLCnext Control

PLCnext Technology in a nutshell

# Open Control Platform

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PLCnext Contr

## Open Control Platform

PLCs in various performance classes including
PLCnext Runtime System and accessories for PLCnext Technology

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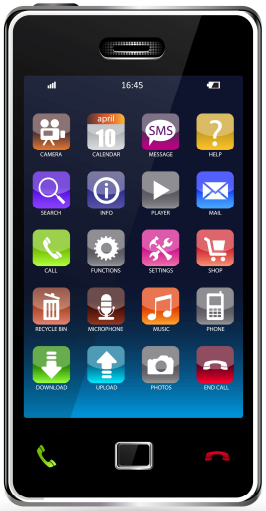
# PLCnext Technology

The reliability and robustness
of the classical PLC world

## enhances

with the openness and flexibility
of Smart Devices.



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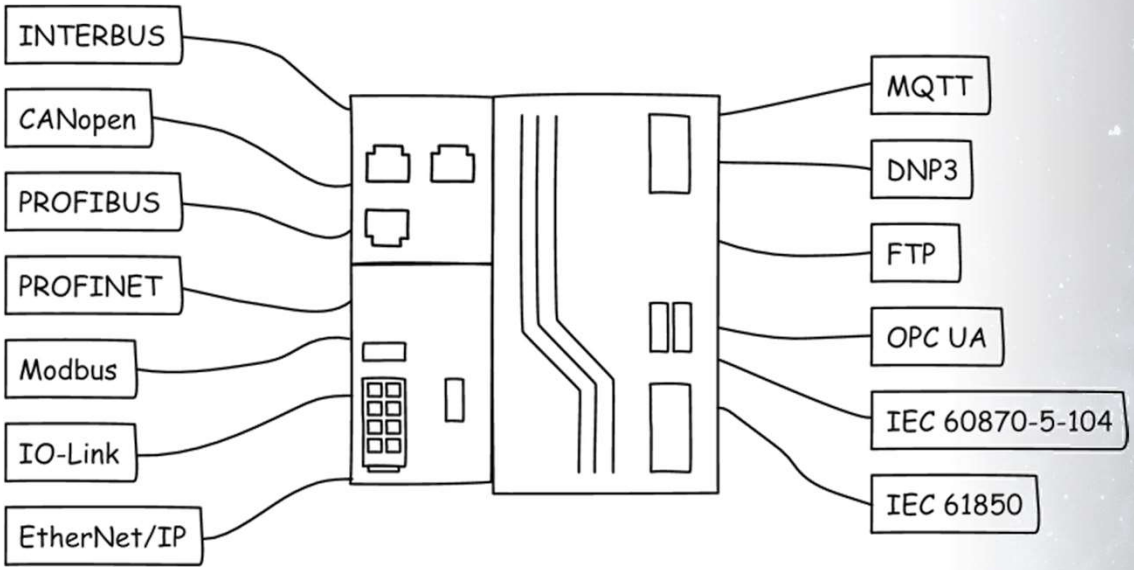
enhanced connectivity – Intelligent Networking

# Future-proof Connectivity




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



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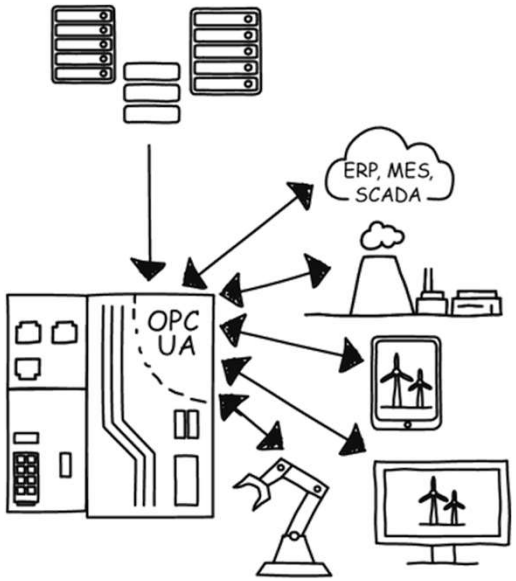
enhanced connectivity – Intelligent Networking

# Integrated OPC UA Server




OPC UA

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



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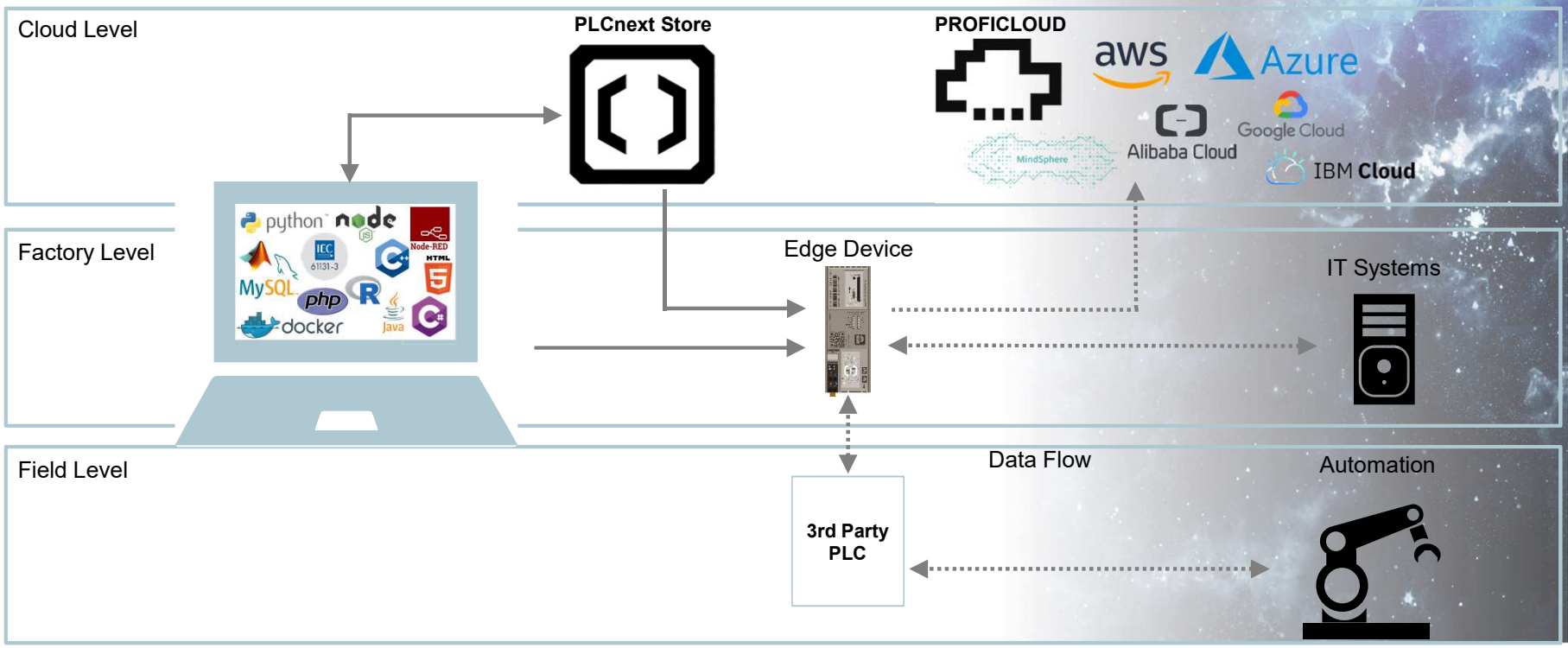
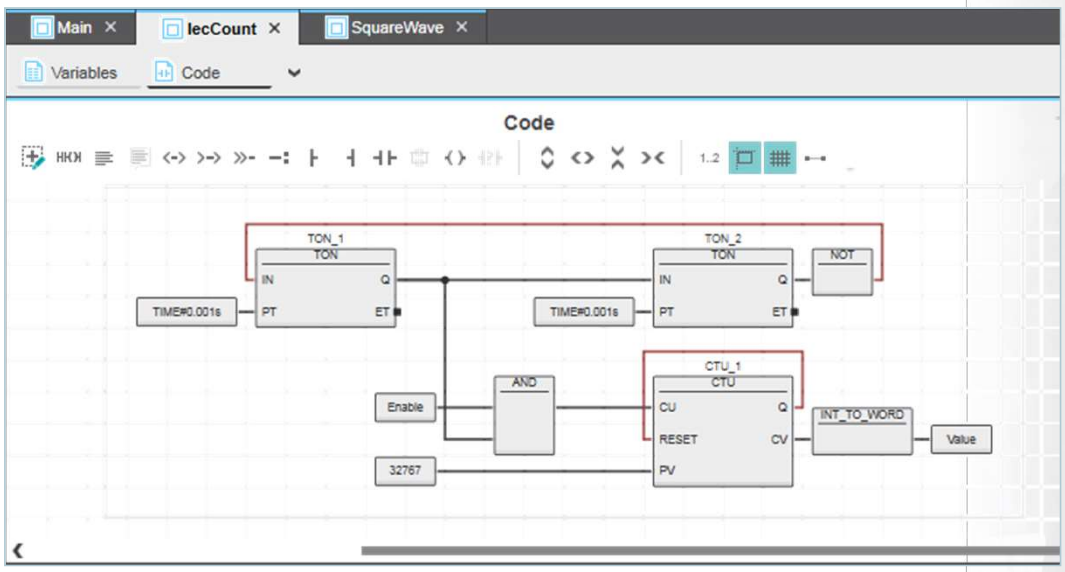
enhanced connectivity – Edge Device or PLC connecting all Levels

# PLCnext Control as Edge Device



enhanced convenience

# IEC 61131-3 Programming with PLCnext Engineer



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



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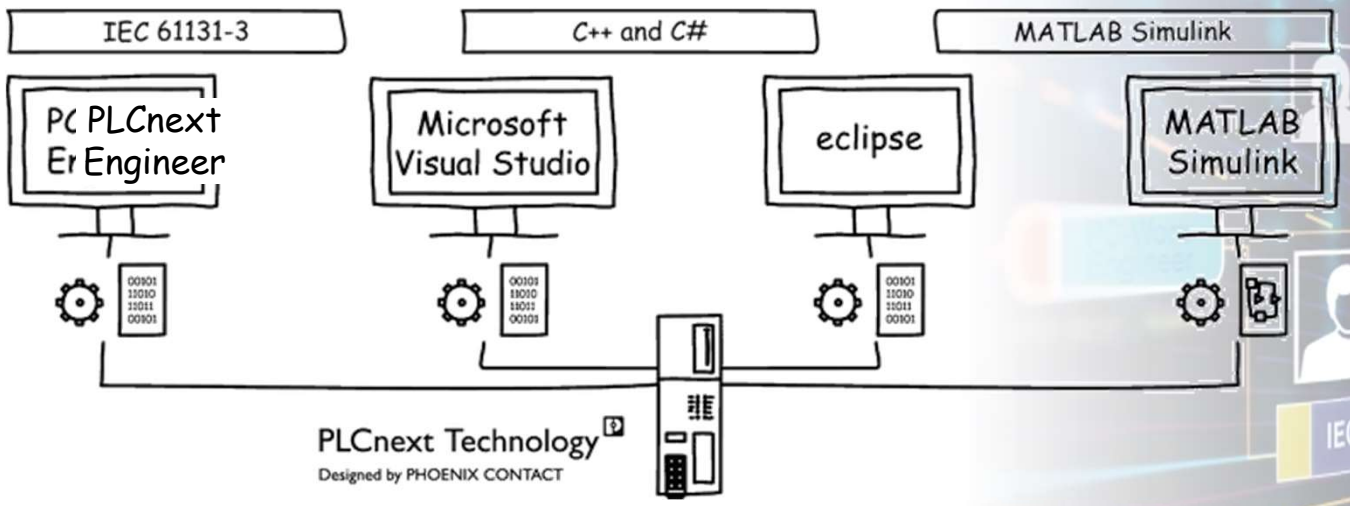
enhanced development

# 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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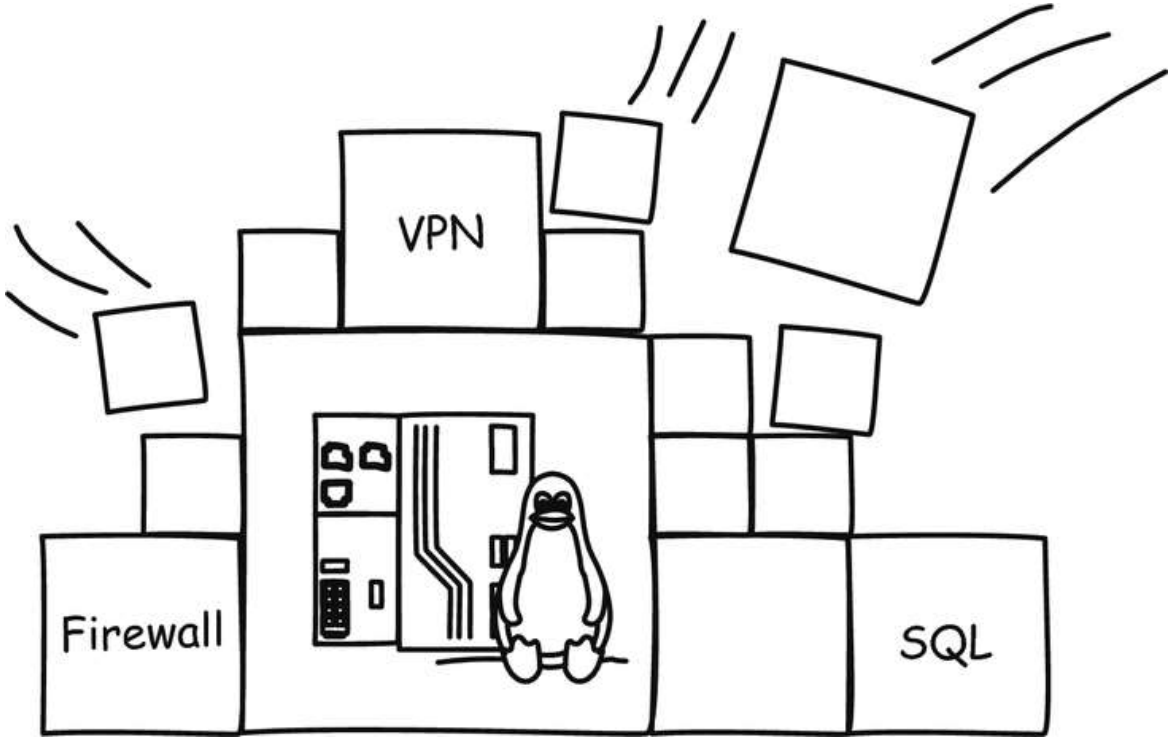
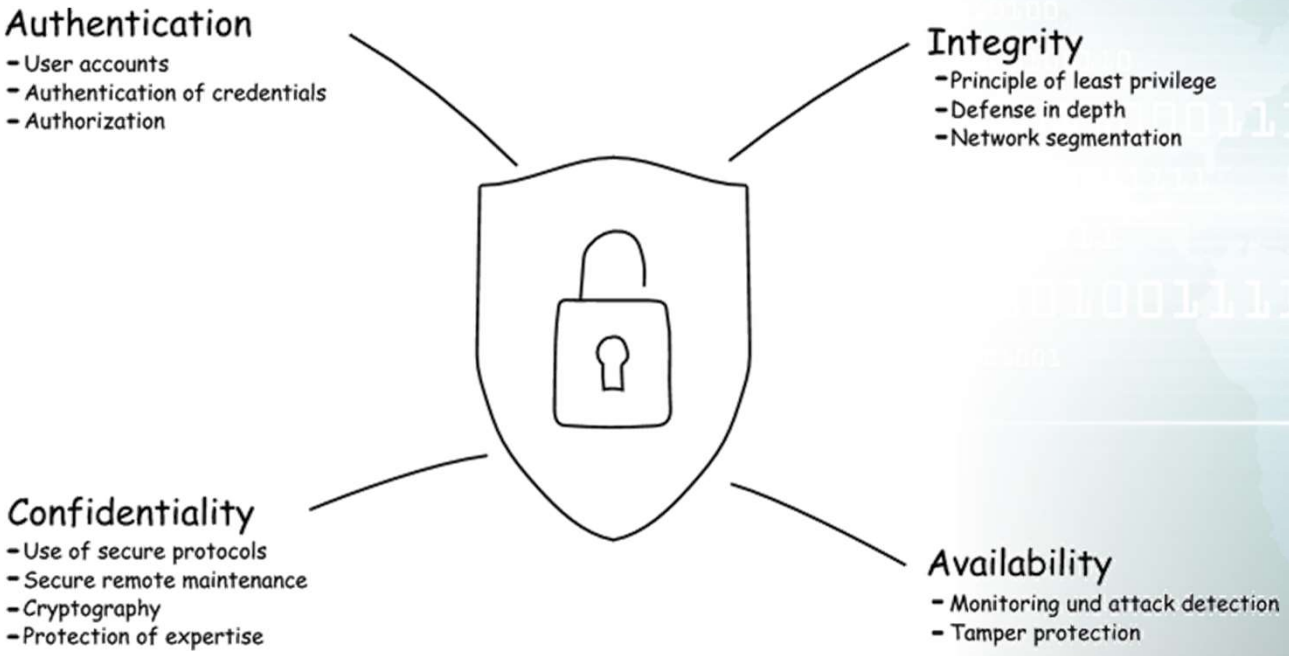
# Flexibility of Linux plus the Reliability of a PLC




- **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

# IEC 62443: IT-Security for Industrial Automation Control Systems

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IEC 62443

***Industrial Automation***
***Basis Standard***



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# Typical Application Scenarios for PLCnext Technology

## PLC Applications

**PLCnext Benefits**

- OPC UA
- Cloud Connection
- Code Generation
- Automation Modules
- PLCnext Engineer
- Security

## PLC + PC Applications

**PLCnext Benefits**

- High Level Languages
- Realtime and Non Realtime
- Cost Efficiency

## IOT Applications

**PLCnext Benefits**

- Open Source
- Raspberry PI
- Edge Gateway
- Linux
- PLCnext on IPC
- Industrial PLC Hardware and IOs



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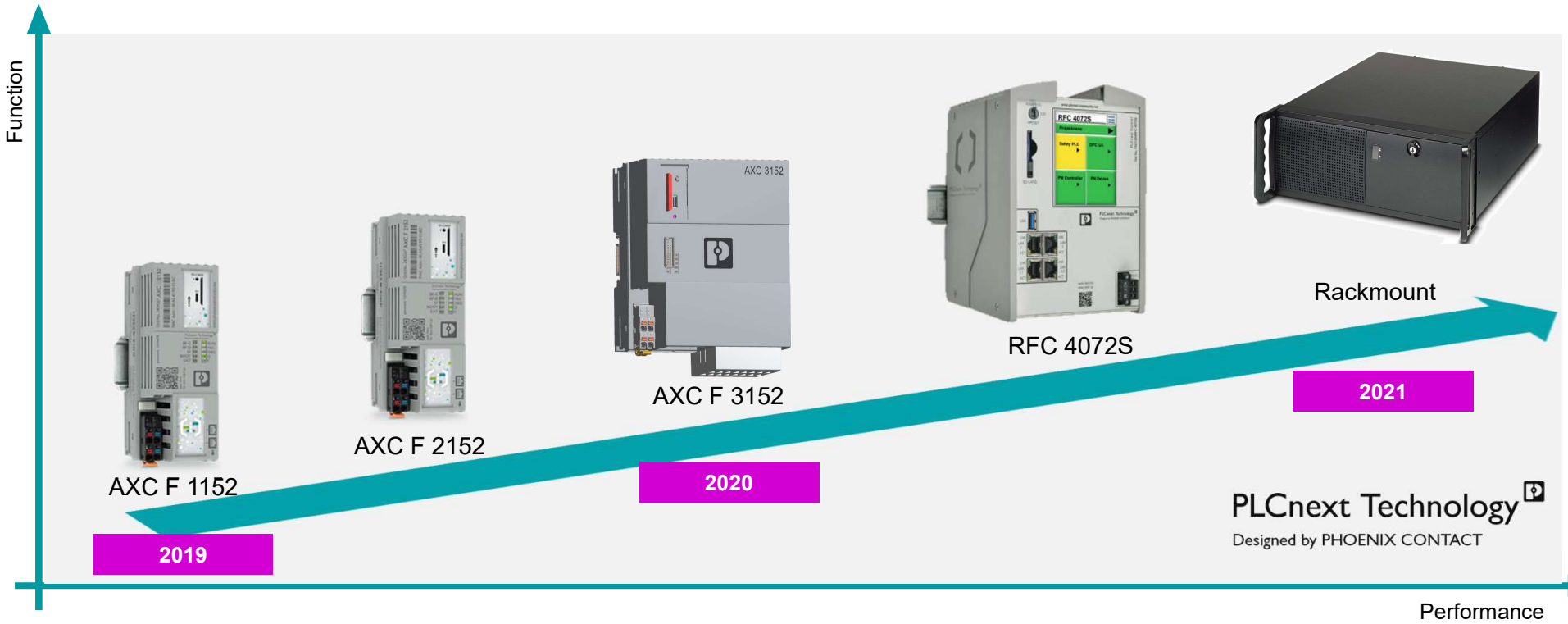
# PLCnext Control Portfolio Overview



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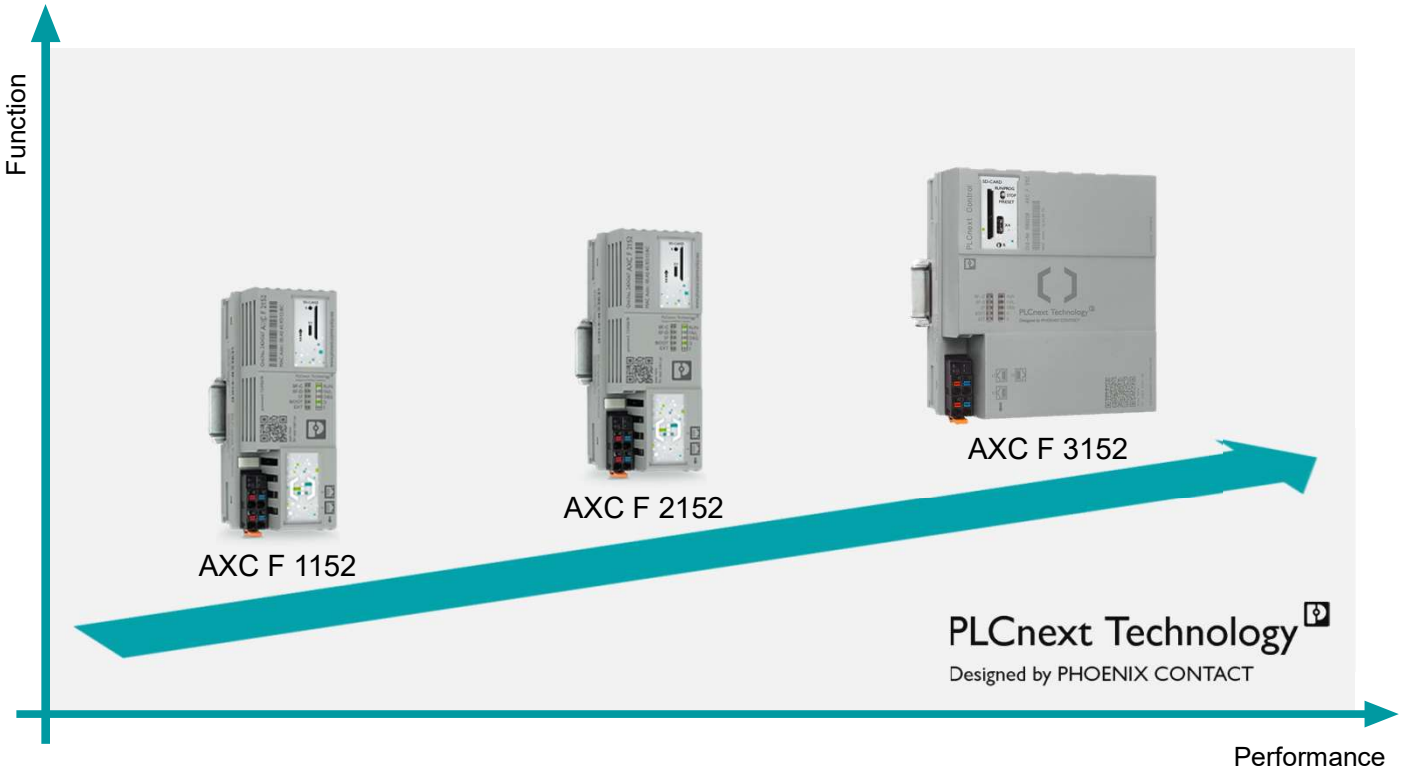
# Modular Hardware Platform



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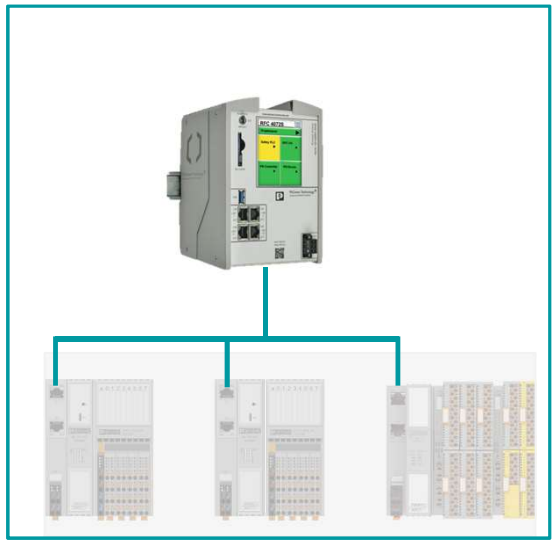
# Centralized Applications with decentralized IOs





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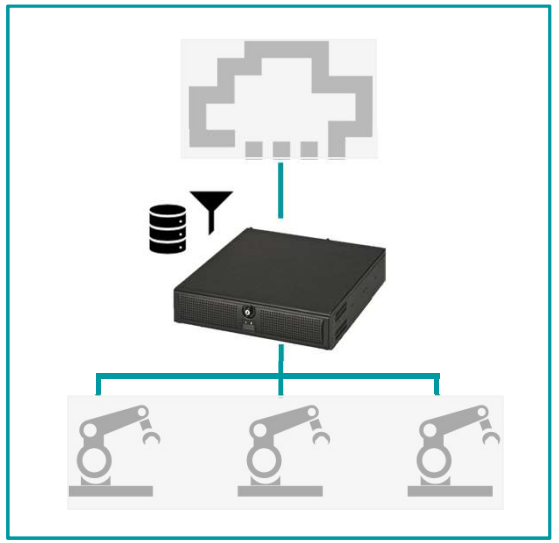
# Edge Computing





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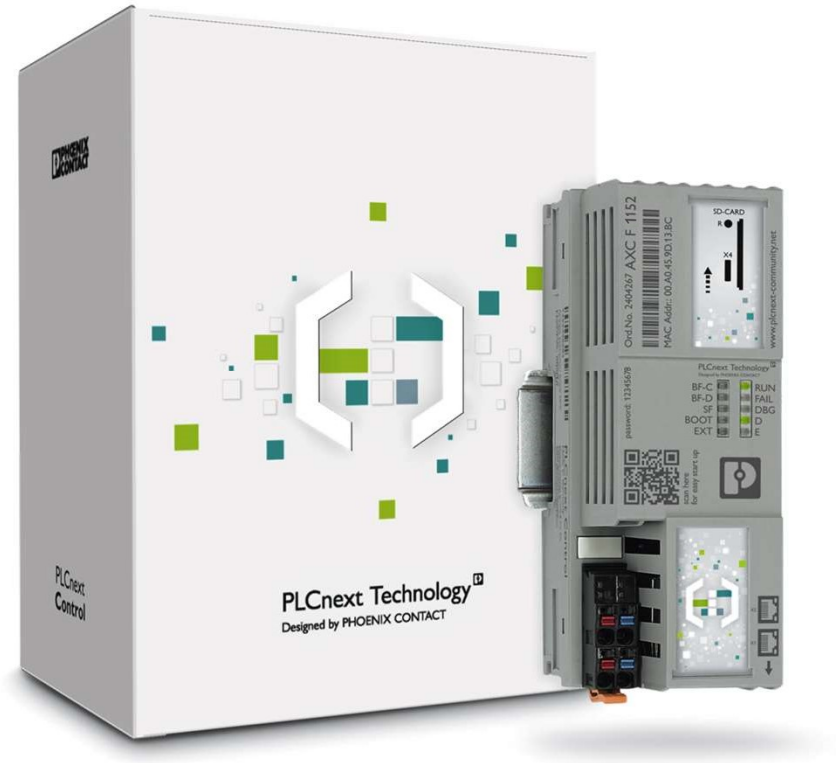
# Entry Level – PLCnext Control AXC F 1152




- Cyclone 5 with ARM Cortex-A9 CPU 1 x 800 MHz
- Number Control-Tasks (IEC 61131): 8
- Min. cycle time (IEC 61131): 5 ms
- Profinet Controller & Device with 16 ARs
- 512 Mbytes RAM
- SD Flash card slot
- 1 x ETH-MAC interface (2 x 10/100 Mbit) switched
- Real-time clock
- Supports INLINE and AXIOLINE I/O modules
- Trusted platform module (TPM) for security
- Temperature range: -25°C up to +60°C



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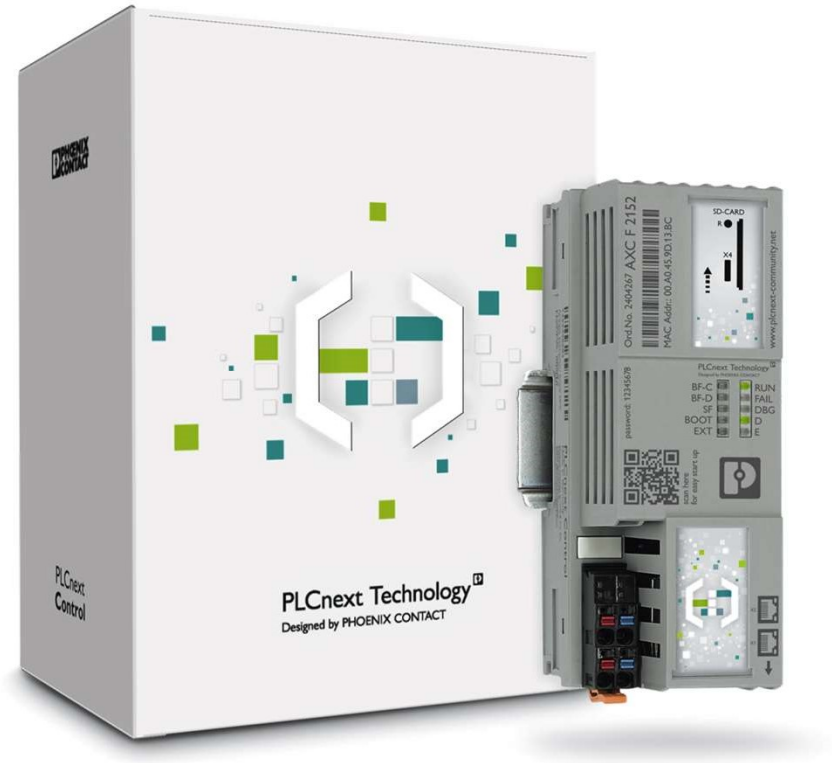
# 1st PLCnext Control: AXC F 2152




- Cyclone 5 with ARM Cortex-A9 CPU 2 x 800 MHz
- 512 Mbytes RAM
- SD Flash card slot
- 1 x ETH-MAC interface (2 x 10/100 Mbit) switched
- Micro-USB type C
- Real-time clock
- Axio field bus for up to 63 modules
- Left side extension capability
- Supports INLINE and AXIOLINE I/O modules
- Trusted platform module (TPM) for security
- Temperature range: -25°C up to +60°C



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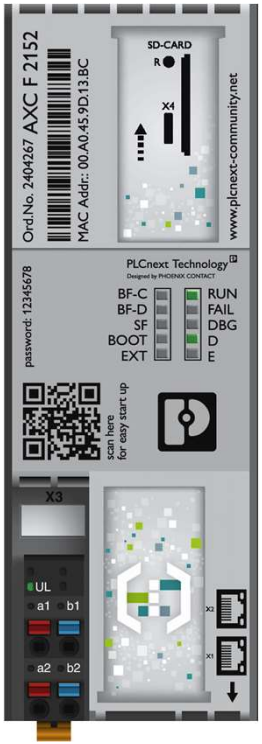
# Integrated Web-based Support and Tutorials



**PLCnext Control**

Many thanks for choosing a controller with PLCnext Technology. Discover the advantages of this open control platform, which provides completely new levels of your freedom for automation.

**Easy start-up:**

Click here for the web-based management of the PLCnext Control AXC F 2152.

**PLCnext user community:**

Many application examples, instructions for use, instructional videos, and FAQs or software and firmware downloads are also available to you in our user community. Become a member of this community and discuss your personal experiences, ideas and questions with other users.

**PLCnext Technology on the Web:**

Also visit also our PLCnext website. There you will find more information about the PLCnext Technology.



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# Feature Set Differences – AXC F 1152 vs. AXC F 2152

| Feature | AXC F 1152 | AXC F 2152 |
|---|---|---|
| **CPU** | Cyclone 5 with ARM Cortex-A9<br>1 x 800 MHz | Cyclone 5 with ARM Cortex-A9<br>2 x 800 MHz |
| **Approvals** | UL, CE | UL, CE, Marine, ATEX |
| **Max. number of control tasks** | 8 (1 x 8) | 32 (2 x 16) |
| **PLCnext extension support (left-hand side)** | No | Yes |
| **PROFINET Features** | Controller & Device<br>with max. 16 ARs | Controller & Device<br>with max. 64 ARs |
| **Min. task cycle time** | 5 ms | 1 ms |



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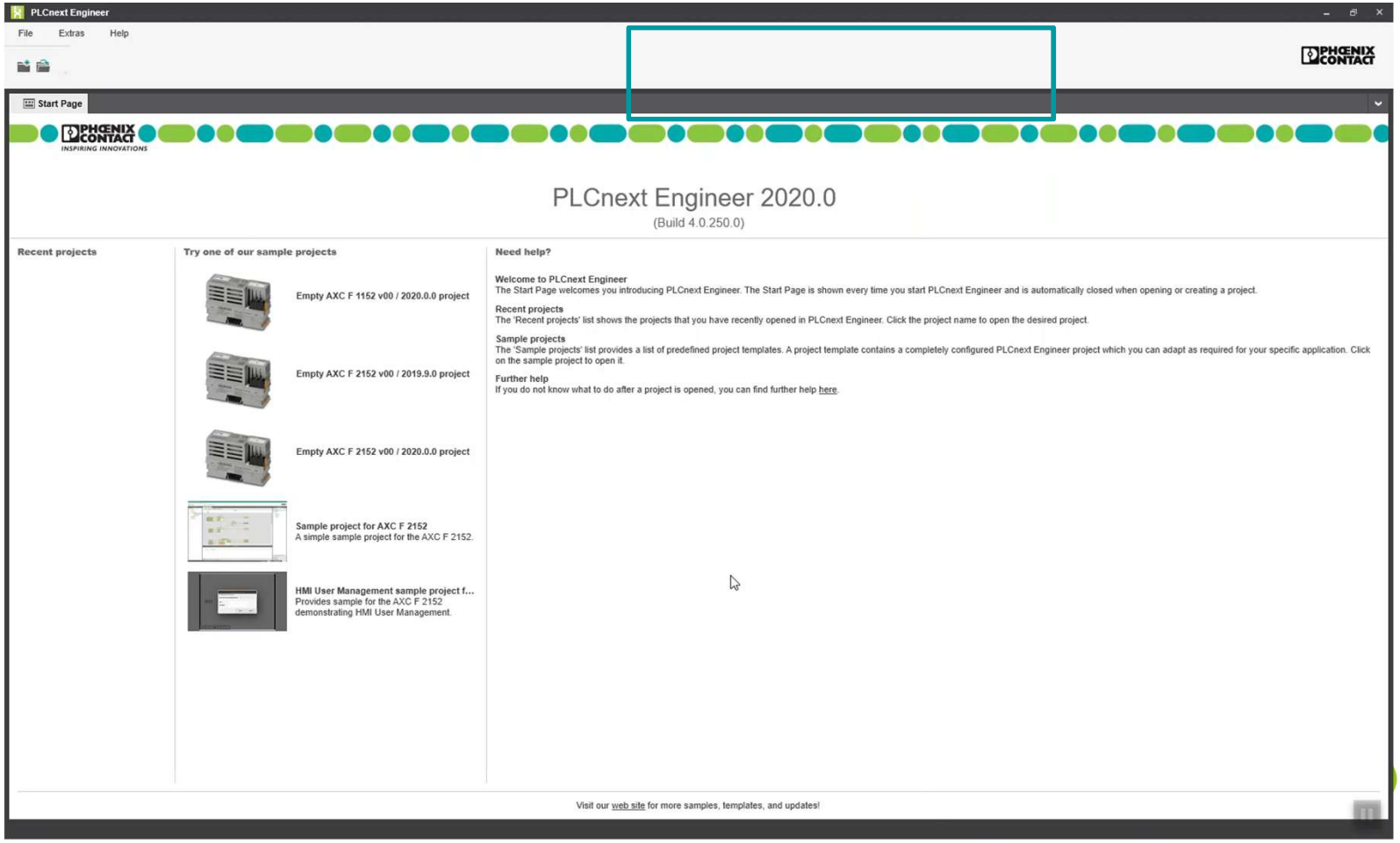
# Creating Projects in  PLCnext Engineering

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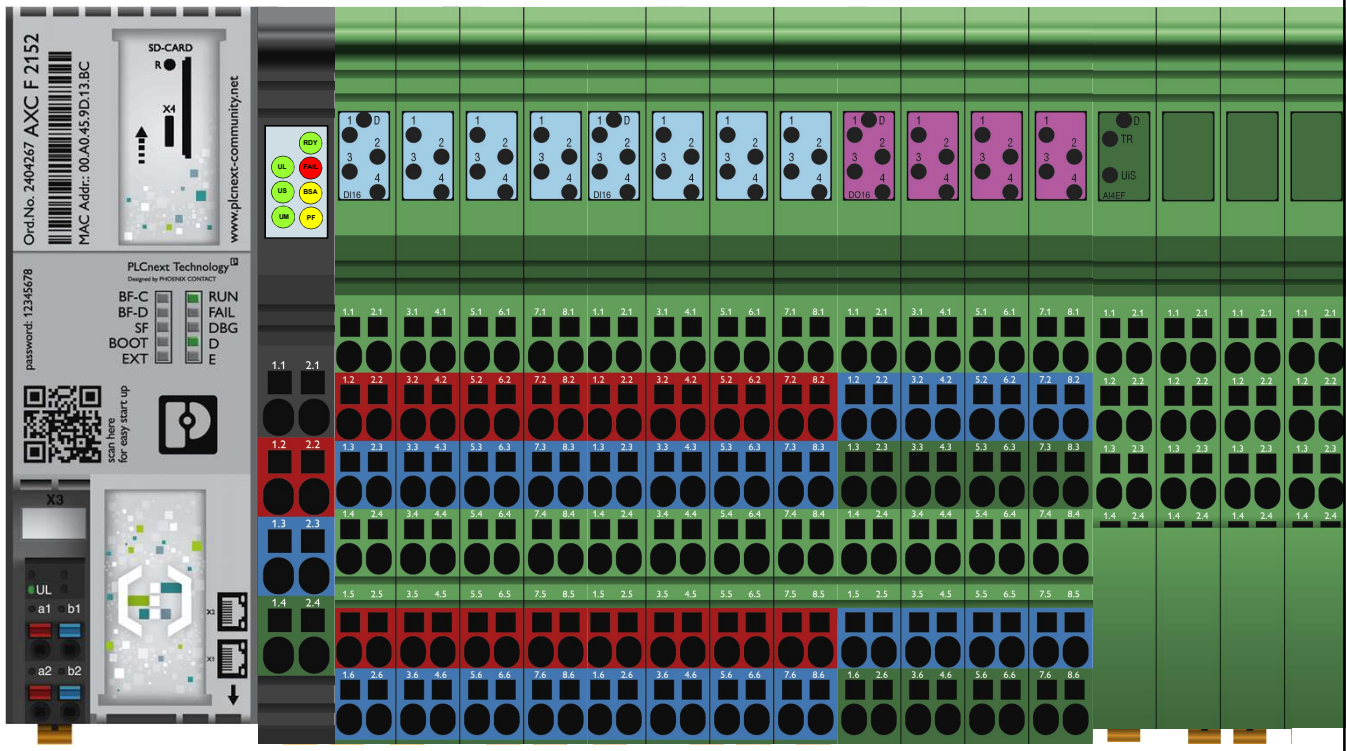
# PLCnext Technology with the Inline I/O System

- Inline IO system enhanced by features of PLCnext Technology, performance and cloud technology
- Wide range of functions due to the great variety of the Inline I/O portfolio
- Powerful PLC for the Inline I/O system
- Economic combination of the Inline I/O system and PLCnext Control



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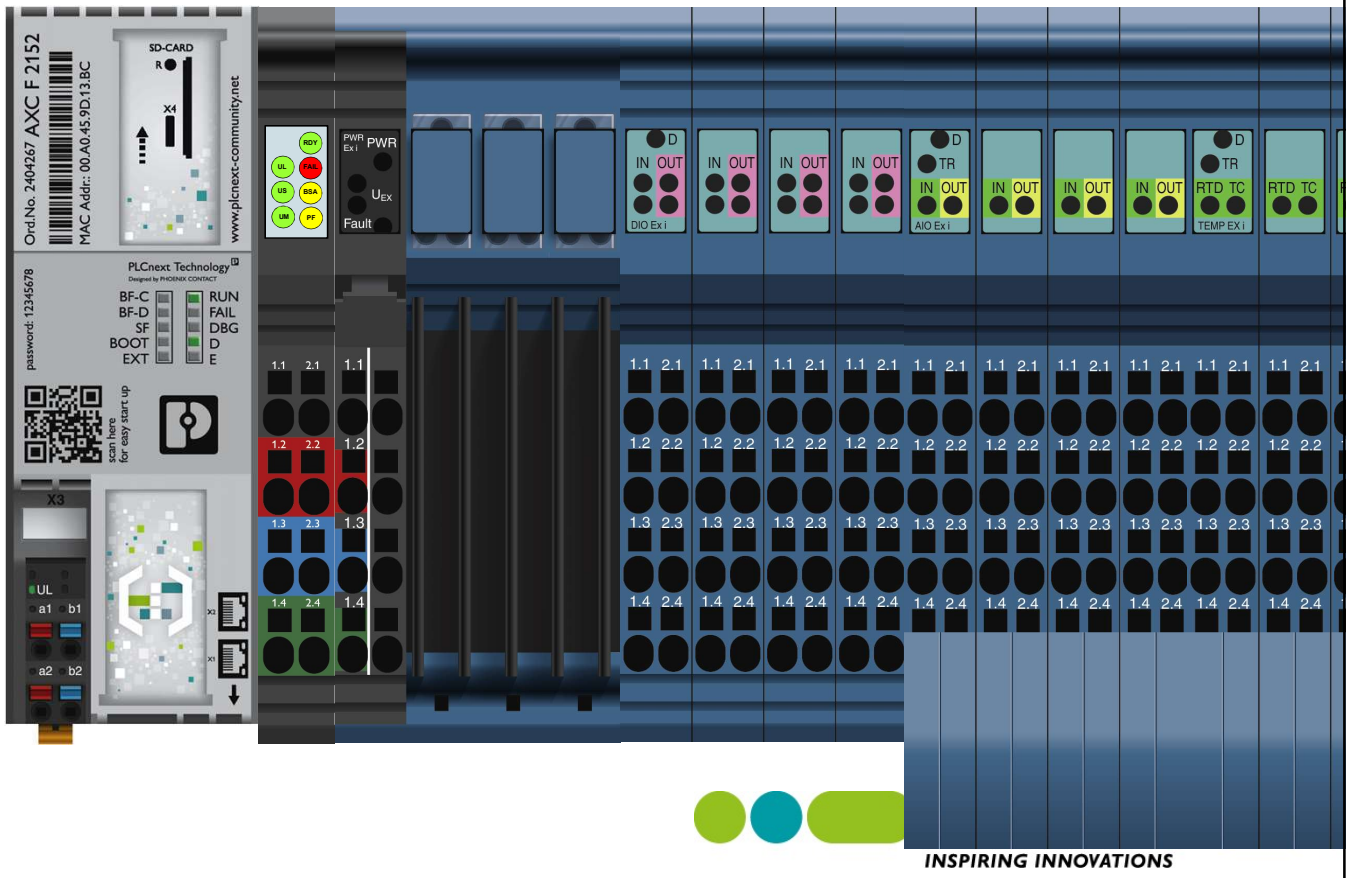
# PLCnext Technology with Intrinsically Safe I/O Modules

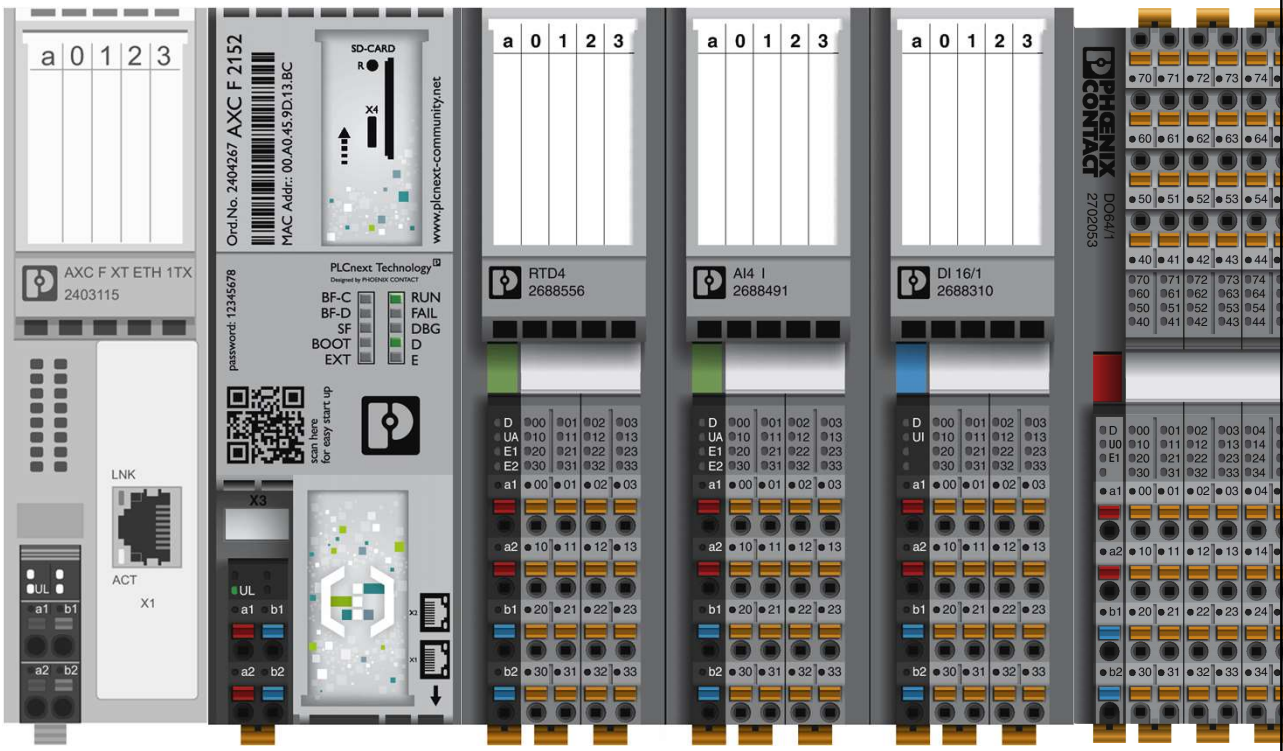
- Intrinsically safe I/O for the safe zone installation
- Allows PROFINET & PROFICLOUD connectivity
- Up to 10 intrinsically safe modules with up to 40 I/O points
- Universal digital I/O and analog I/O modules
- Connectivity to Zone 0, 1 & 2 devices
- PLCnext Engineer function blocks for all 3 module types
- Module width: 48 mm each



Hardware Extensions

# AXC XT ETH 1TX

- Left-hand side pluggable Ethernet interface extension
- 2nd MAC address
- Enhanced network functions
  - Separate PROFINET Control & Device interfaces
  - Separate Ethernet-based & PROFINET interfaces



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# More Performance – PLCnext Control AXC F 3152

- Intel ATOM x5-E3930 dual-core CPU (2 x 1,3 GHz)
- 2 GB DDR4 dual-channel RAM
- 3 independent ETH-MAC interfaces (3 x 1 Gbit)
- Supports 2 PLCnext Control extensions (internal PCIe bridge)
- Supports INLINE and AXIOLINE I/O modules
- Integrated uninterruptible power supply (UPS) for targeted application shutdown
- SD card slot
- Diagnostic LEDs
- Real-time clock
- Temperature range: -25°C up to 60°C
  - Optional fan to increase service life



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# More Performance – PLCnext Control AXC F 3152

- Based on PLCnext Technology
  - Linux operating system
  - Supports high-level programming languages
  - PROFICLOUD Connection
- PROFINET Controller (up to 128 devices) + Device
- OPC UA
  - Easy integration of other fieldbus protocols (Linux OS)
- Prepared for TSN
- Trusted platform module (TPM) for security
- Approvals
  - UL (Hazloc), CUL
  - DNV/GL, LR, BV, ABS, …
  - IEC Ex, ATEX



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# PLCnext Control RFC 4072S

- Intel i5 6300U 2 x 2,4 GHz processor
- 4 GB DDR 4 dual channel RAM
- Profisafe integrated (up to 300 F-Devices)
- Operation Mode Switch
- Touch display
- SD Flash card slot
- 3 ETH-MAC interfaces
  (2 x 1 Gbit, 1 x 100 Mbit switched)
- Real-time clock
- Trusted platform module (TPM) for security
- Temperature range: 0°C up to 55°C with fan



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# PLCnext Controls Performance Benchmark

**RFC 4072S**

4362

Intel i5 – 6300U dual core

**AXC F 3152**

811 Intel E3930 1,3GHz dual core

**~ 2.7 times faster than AXC F 2152**

**AXC F 2152**

300 Cyclone 5 Cortex-A9 800 MHz dual core (Comparable with AXC 3050)

**AXC F 1152**

150 Cyclone 5 Cortex-A9 800 MHz single core (Comparable with ILC 390)



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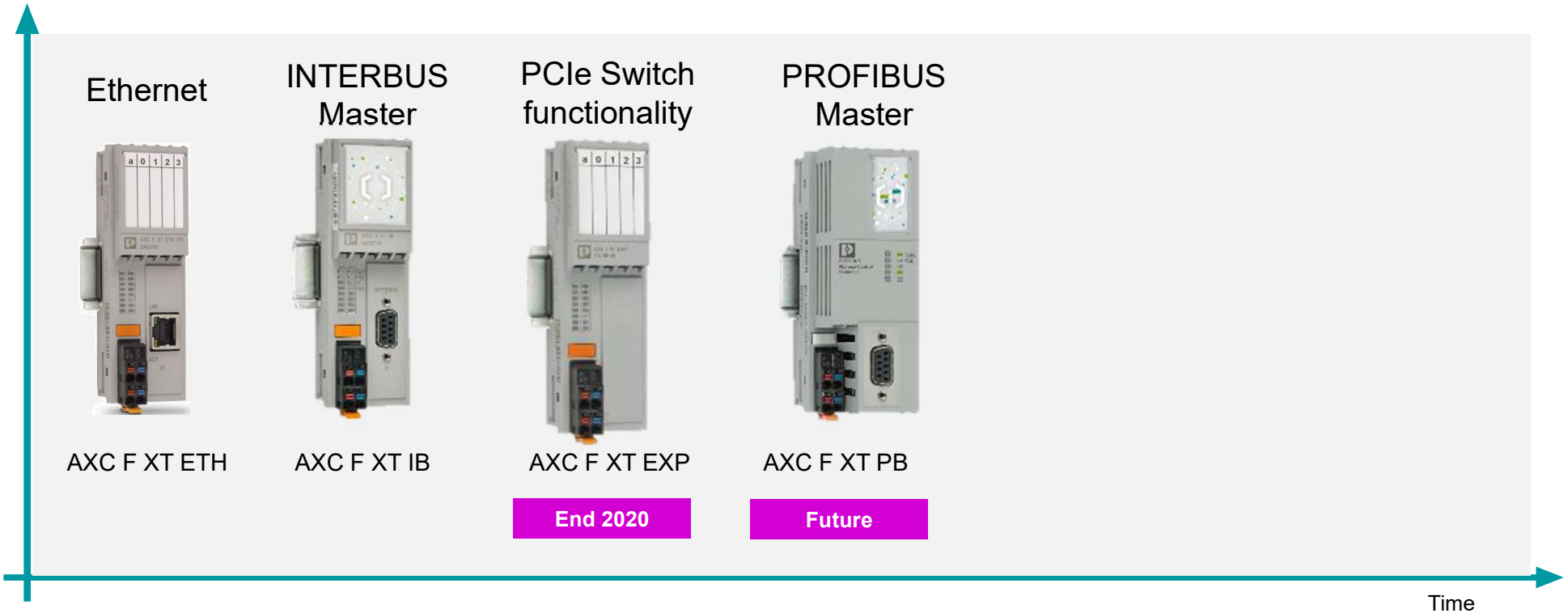
# PLCnext Control Left-hand Side Extensions Portfolio



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# PLCnext Extension AXC F XT ETH

- Additional 1Gbit MAC interface
- Temperature range: -25°C up to 60°C
- Profinet Control capability
- Security due to separated interfaces
- Modularity and Flexibility
- Approvals
  - UL (Hazloc), CUL
  - DNV/GL, LR, BV, ABS, …
  - IEC Ex, ATEX
- Temperature range: -25°C up to 60°C



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# PLCnext Extension AXC F XT IB

- Additional INTERBUS Master
  - Up to 512 Devices, up to 255 Remote Devices
  - Up to 126 PCP Devices
  - Up to 16 Remote Bus Level
  - 4096 Bit Processdata
  - 500kBit und 2 Mbit
- Ideal for Retrofit applications
- Approvals
  - UL (Hazloc), CUL
  - DNV/GL, LR, BV, ABS, …
  - IEC Ex, ATEX
- Temperature range: -25°C up to 60°C



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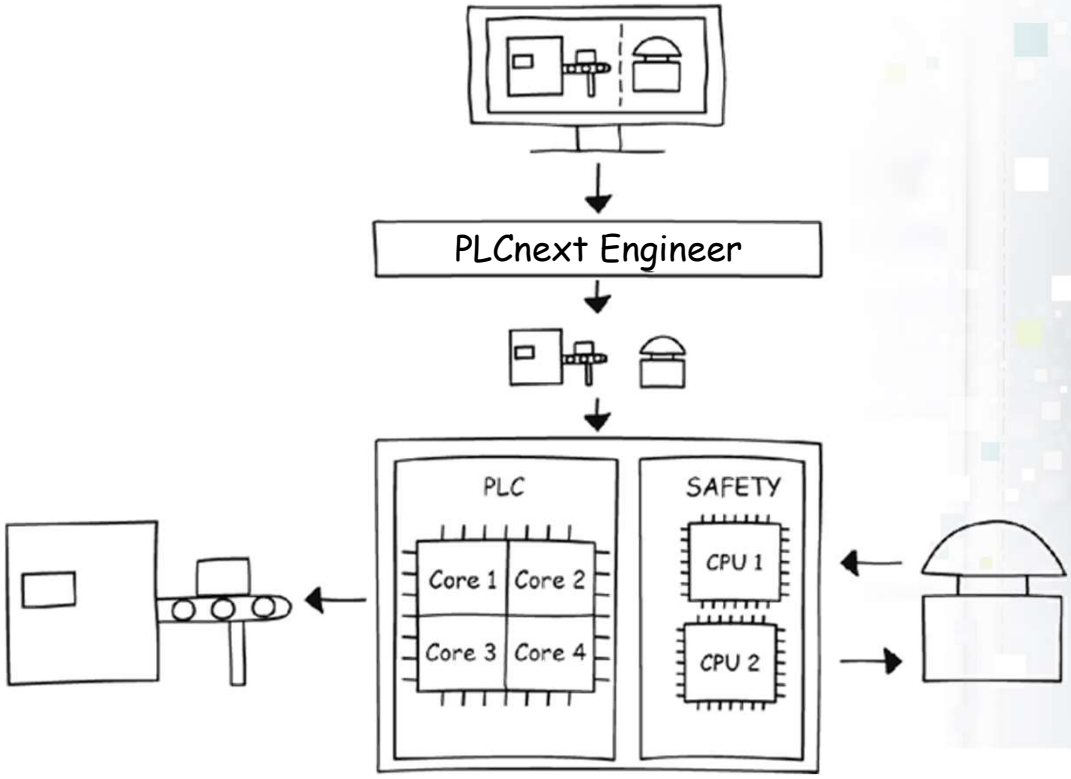
Functional Safety Integration

# Functional Safety Integration



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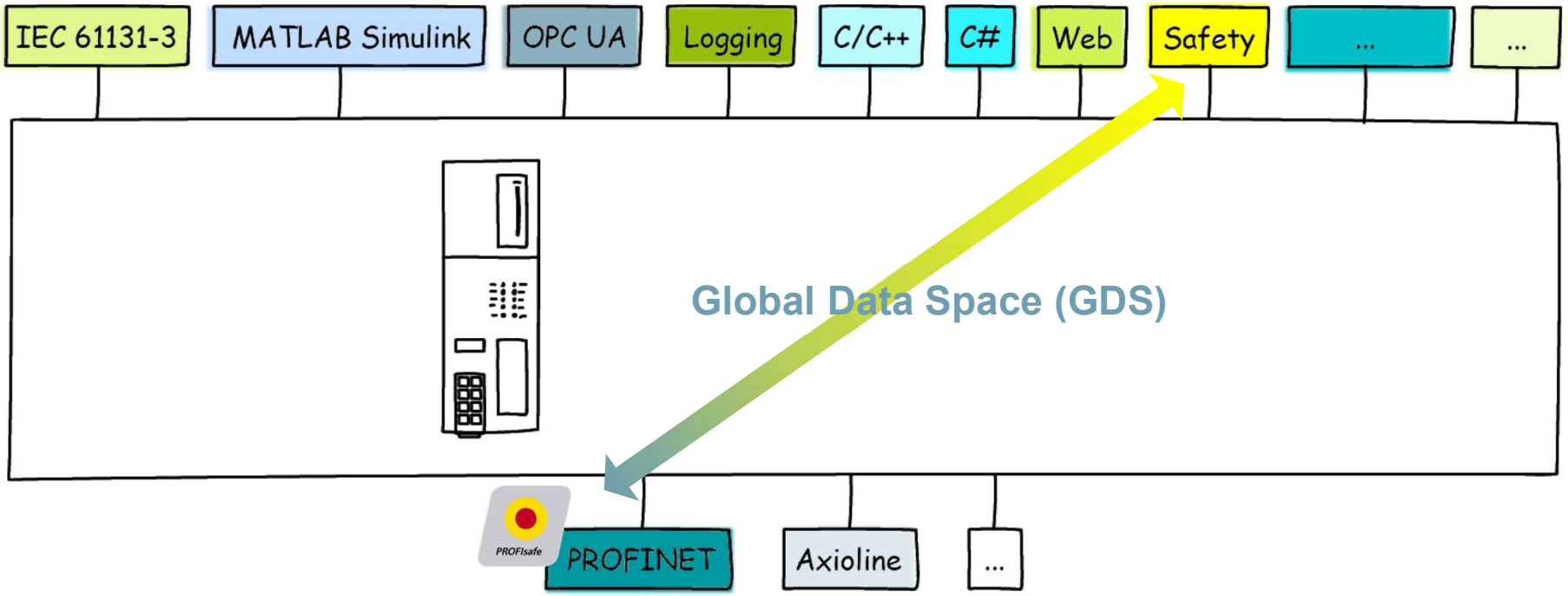
# Safety integrated



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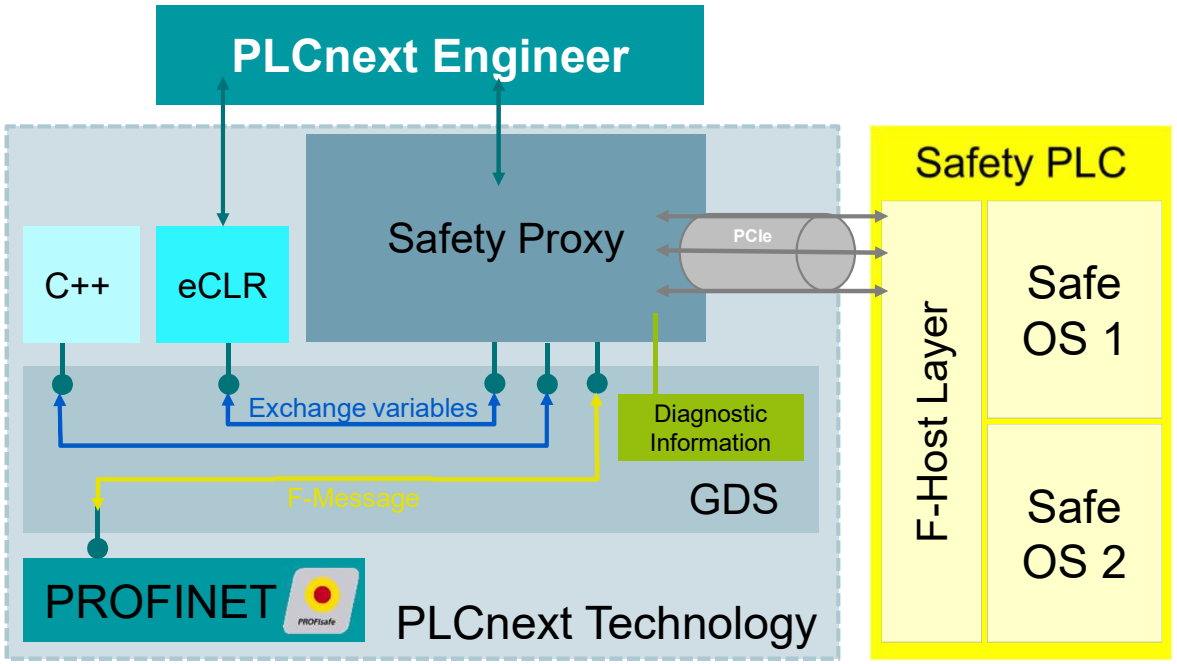
# Safety integrated




- Safety integrated (programming, hardware configuration)
- Consistent usability
- SIL 3
- Separate Safety PLC
  - 2 different cores



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# PLCnext Control RFC 4072S

**RFC 4072S: Integrated Safety PLC**

- Intel i5 6300U 2 x 2,4 GHz processor
- 4 GB DDR 4 dual channel RAM
- Profisafe integrated (up to 300 F-Devices)
- Operation Mode Switch
- Touch display
- SD Flash card slot
- 3 ETH-MAC interfaces
  (2 x 1 Gbit, 1 x 100 Mbit switched)
- Real-time clock
- Trusted platform module (TPM) for security
- Temperature range: 0°C up to 55°C with fan



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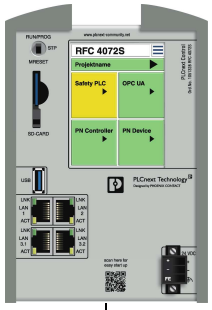
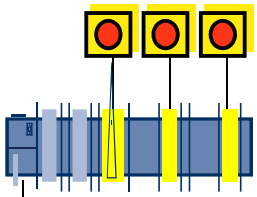
RFC 4072S
(F-Host)




Emergency Stop

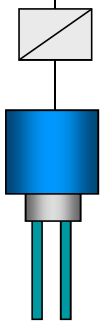


Safety I/Os

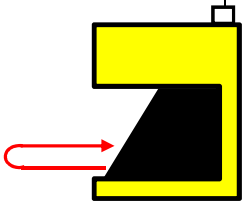
Standard I/Os

**Standard and safety devices in common ethernet network**

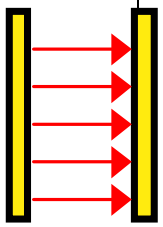
DP/PA



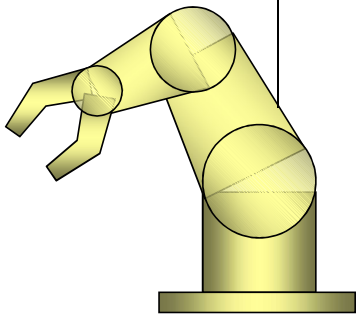
Limit switch



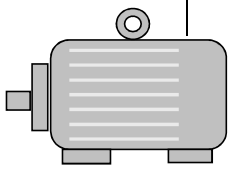
Sick
Safety
Scanner



Light curtain



Kuka Robot



E Motors

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# Functional Safety Programming

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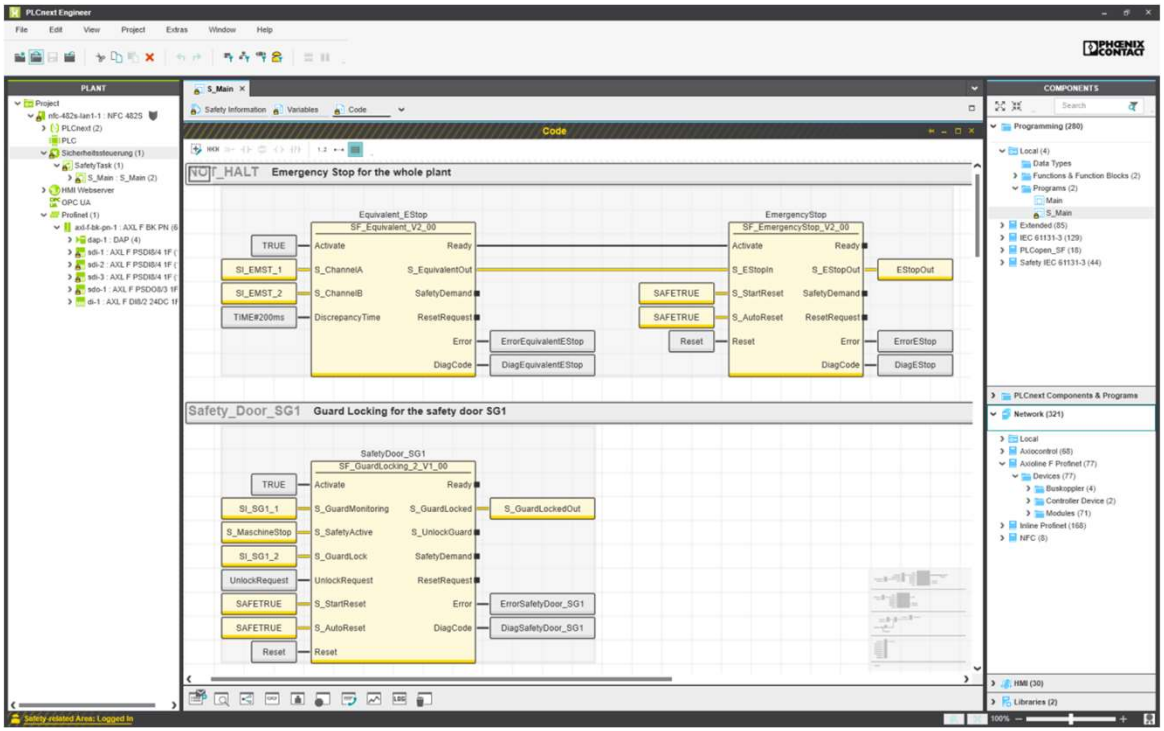
## Fully integrated Safety Programming

- TÜV Rheinland certified according to IEC 61508
- Editor with common behavior as known from standard FBD or LD editors
- Low Variability Language support
- Network granular CRC checksums
- PROFIsafe Support



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PLCnext Engineer

# Functional Safety Programming

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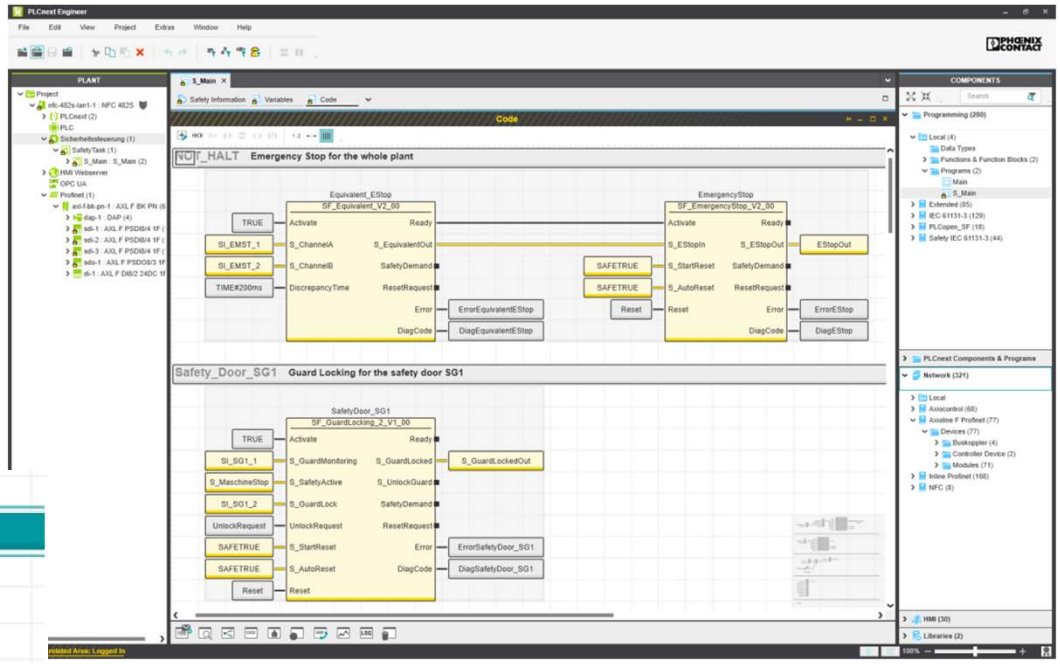
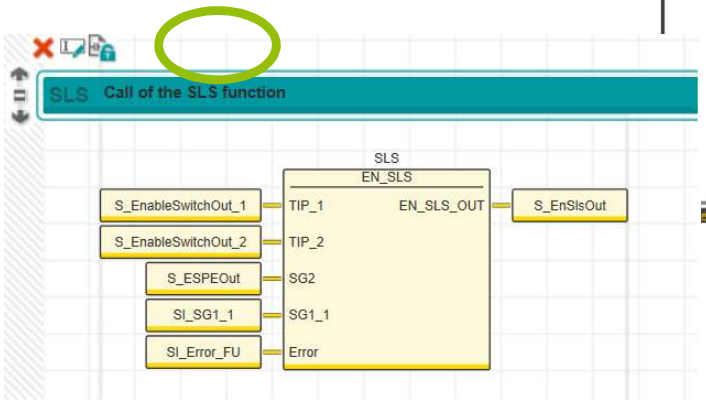
## Fully integrated Safety Programming

- Individual safety functions can be protected by a verification function
- Background signal path analysis
- Background safe semantic analysis
- Diversely-redundant code generator



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PLCnext Safety / SafetyBridge Categorization

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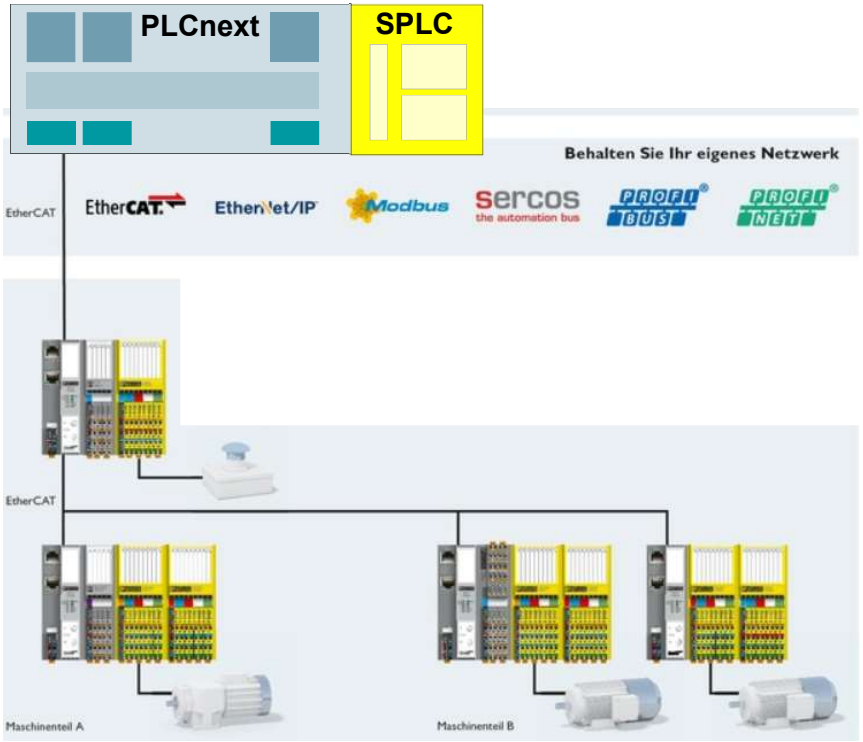
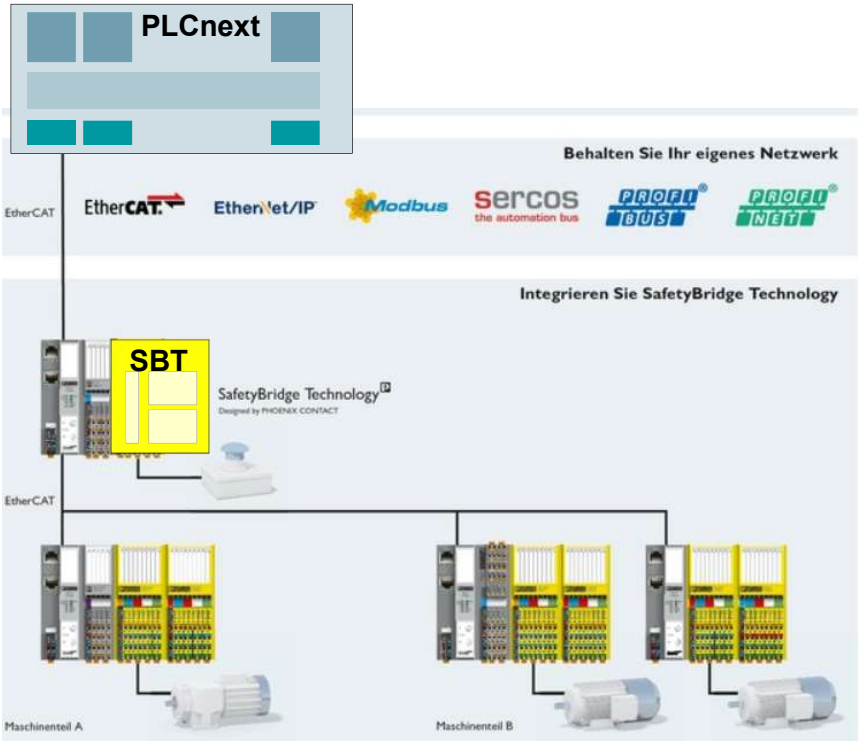
# PLCnext Safety




# SafetyBridge Technology

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enhance your automation thinking
Security by design
acc. to IEC 62443

# Effects of Security Incidents on Production Facilities

**Plant downtime**
Due to security problems, production has to be stopped for hours or days. What are the costs of such a production downtime?

**Loss of know-how**
A competitor can access your sensitive data (design, engineering,...). Can you quantify the damage economically?

**Standing**
What happens if your reputation for the reliability and security of your company's data is compromised by your partners?

**Data loss**
Suddenly all data is lost. What would be the cost of reconstructing this data?

# Agenda

**Applicable Security Laws and Standards**

Terminology, Roles, and Tasks in Security Processes

Secure Product Development

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Applicable Security Laws and Standards

# Brief Overview of the Most Important Laws & Standards

## **Security Laws** (What must be done?)

Bundesministerium des Innern

### IT Security Act (2015)

Asset owner of critical infrastructures must establish and certificate an **ISMS** (**I**nformation **S**ecurity **M**anagement **S**ystem) as well as fulfill a set of minimum technical requirements

Version 2.0 in preparation

### EU Cybersecurity Act (3/2019)

A comprehensive set of regulations, technical requirements, standards and procedures for certification or conformity assessment of products

## **Recommendations** (What should be done?)

Bundesamt für Sicherheit in der Informationstechnik

### BSI IT Basic Protection Catalogs

(asset owner / device manufacturer)

## **Basic Security Standards** (How to implement?)

### IEC 62443 Security for industrial automation

(asset owner / device manufacturer)

### ISO/IEC 2700X Information Technology

(asset owner)

Applicable Security Laws and Standards

# Sector-specific Security Standards

| Standard | Target Group | Main Purpose | Geographical / Industry Focus | Certification possible? |
|---|---|---|---|---|
| **BDEW** | Device manufacturers / system integrators | Security requirements for suppliers | D, A, CH Energy & water sectors | No |
| **WIB** | Device manufacturers / system integrators | Device manufacturer certification | Oil & Gas sector | Yes |
| **ISO/IEC 27019** | Asset owners / plant operators | IT security for control systems | Energy sector | Yes |
| **NIST 800-82** | Asset owners / plant operators | Technical security recommendations | USA | No |
| **NERC CIP** | Asset owners / plant operators | Increasing reliability of energy supply infrastructure | USA, Canada | Yes |
| **IEC 62443** | Device manufacturers / system integrators / plant operators | Requirements for secure products, secure solutions, and secure operation | General industry sector | Yes |

Applicable Security Laws and Standards

# State of the Art Security Standard for Industrial Automation

## IEC 62443

***Industrial Automation***
***Basis Standard***

# Agenda

Applicable Security Laws and Standards

**Terminology, Roles, and Tasks in Security Processes**

Secure Product Development

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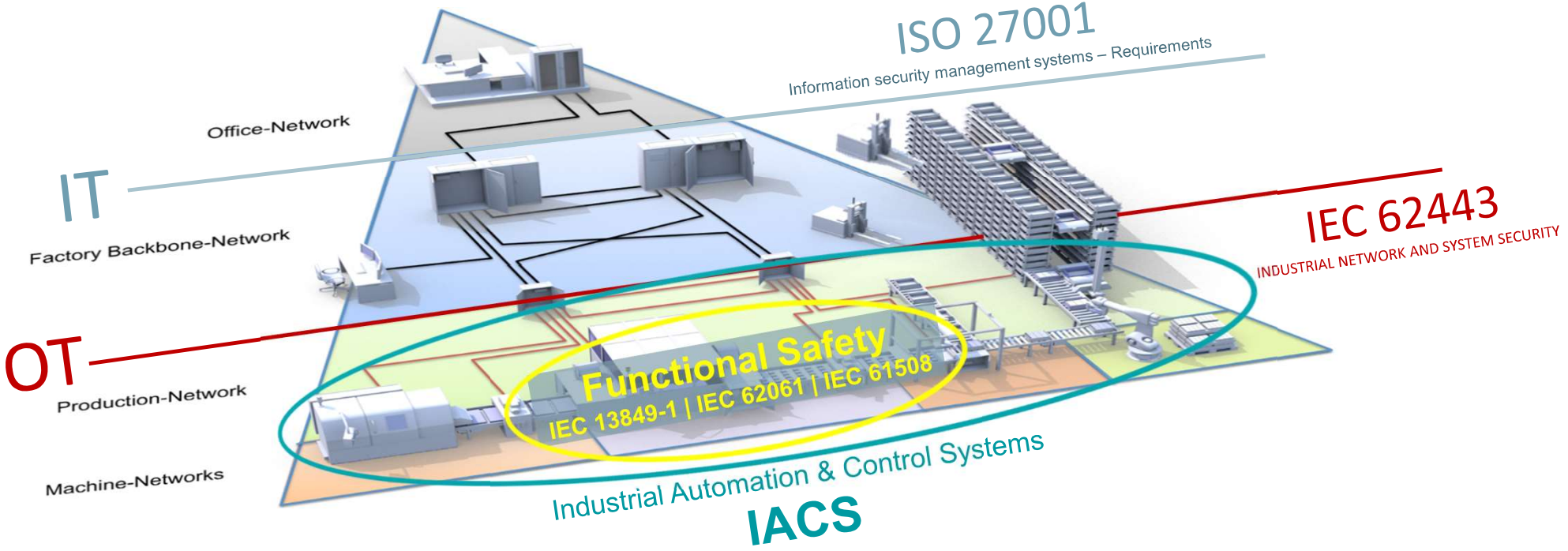
# The “Automation Pyramid”



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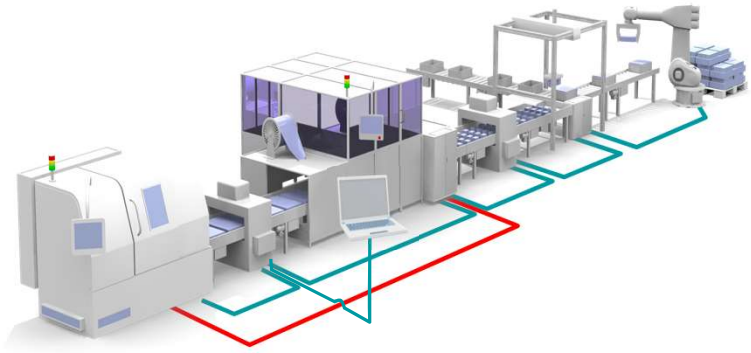
Terminology, Roles, and Tasks in Security Processes

# Basic Roles & Purposes of the IEC 62443 Standard

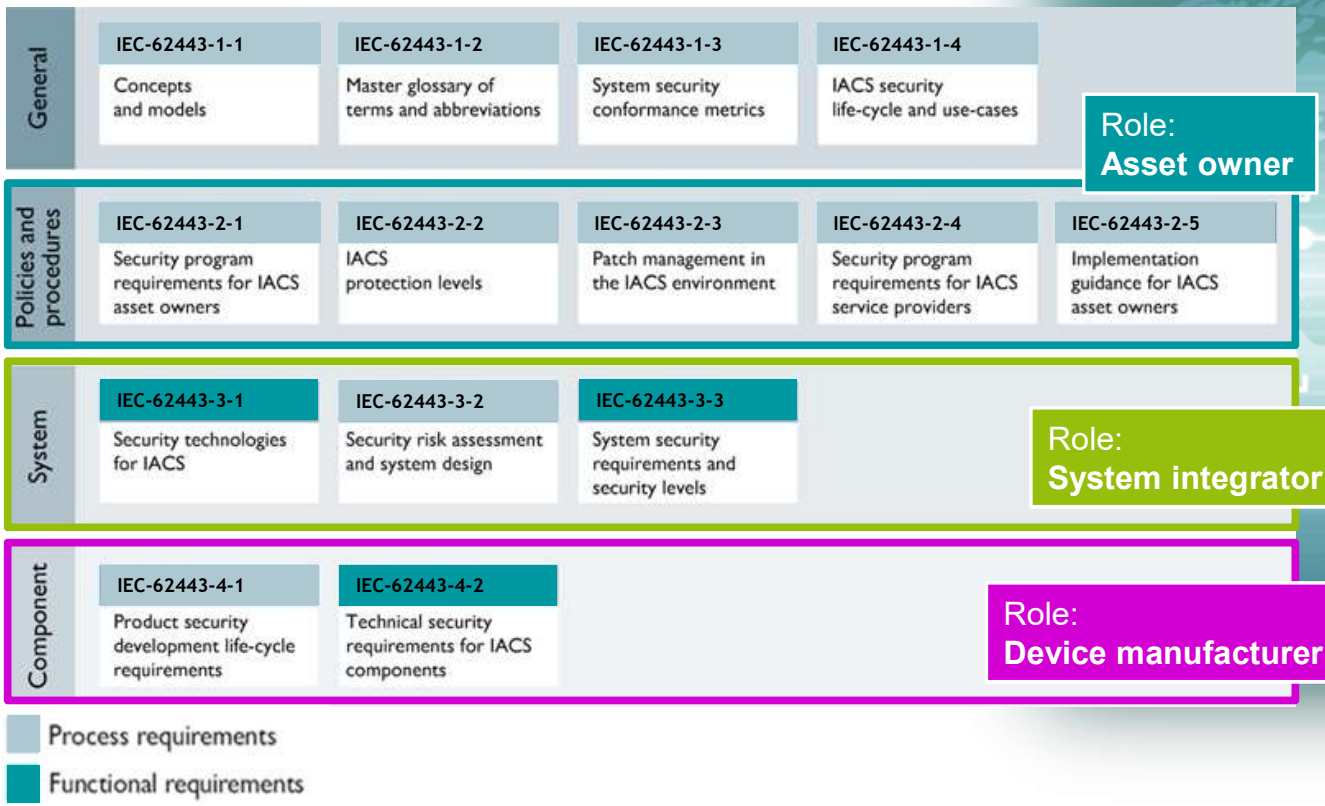
| Role | Focus | Interest |
|---|---|---|
| **Asset owner / plant operator** | **Operation & maintenance** of automation solutions | Secure operation |
| **System integrator / Machine builder** | **Design & commissioning** of automation solutions | Secure solution |
| **Device manufacturer** | **Design & management of components** for automation solutions | Secure devices |

**Companies can check their automation technology for potential weaknesses and develop protective measures**



Terminology, Roles, and Tasks in Security Processes

# IEC 62443 Structure and Systematics




Role:
**Asset owner**

Role:
**System integrator**

Role:
**Device manufacturer**



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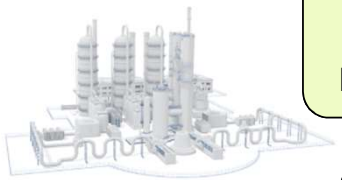
# Role Distribution in d Chain according to IEC 62443

Security program requirements for IACS service providers

## Asset Owner



IEC 2700x ISMS

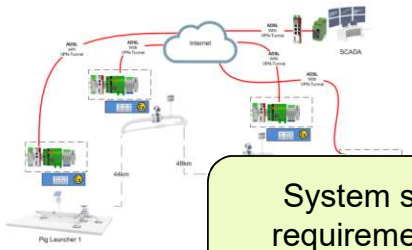
IEC 62443-2-1

Security program requirements for IACS asset owners

Security Level

IEC 62443-2-4

## System Integrator



System security requirements and system security levels

IEC 62443-3-3

Security Level

Security Level

IEC 62443-4-2

nal
ments

Technical security requirements for IACS components

## urer

Product security development life-cycle requirements

IEC 62443-4-1

**Example: Planning & implementation of a new production plant**



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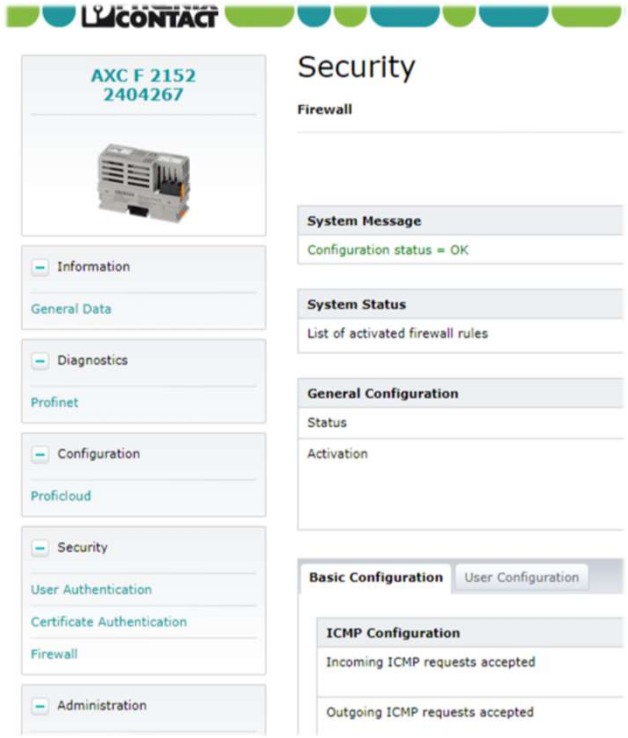
# Supported Security Features (Status as of 2019.0)




- Security Architecture: Configurable Linux using Yocto build system
- OS components:
  Bootloader, Syslog-ng, SSH, Open SSL, Firewall nf-tables, …..
- Hardware design with TPM to store manufacturers roots of trust
- Secure Communication: SFTP, VPN, NTP, HTTPS, …..
- Role based User Management via WBM
- Firewall configuration via WBM
- Certificate handling; Crypto store via WBM
- Firmware Update via WBM
- VPN via Linux configuration files (more info => PLCnext Community)
- OPC UA with security support



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Secure Product Development

# Product Security Incident Response Team

PSIRT – Public Website

Security Certifications

# Certifications according to IEC 62443

| | | | | |
|---|---|---|---|---|
| General | IEC-62443-1-1<br>Concepts and models | IEC-62443-1-2<br>Master glossary of terms and abbreviations | IEC-62443-1-3<br>System security conformance metrics | IEC-62443-1-4<br>IACS security life-cycle and use-cases |
| Policies and procedures | IEC-62443-2-1<br>Security program requirements for IACS asset owners | IEC-62443-2-2<br>IACS protection levels | IEC-62443-2-3<br>Patch management in the IACS environment | IEC-62443-2-4<br>Security program requirements for IACS service providers |
| System | IEC-62443-3-1<br>Security technologies for IACS | IEC-62443-3-2<br>Security risk assessment and system design | IEC-62443-3-3<br>System security requirements and security levels | |
| Component | IEC-62443-4-1<br>Product security development life-cycle requirements | IEC-62443-4-2<br>Technical security requirements for IACS components | | |

**Phoenix Contact is one of the first companies in Germany to have been certified by TÜV SÜD in accordance with the IEC 62443-4-1 and 2-4 series of standards for IT security.**

This confirms that the company develops secure by design products in compliance with the IEC 62443-4-1 process and that it designs secure automation solutions in compliance with the IEC 62443-2-4 process.

Standard IEC 62443 comprises a series of documents handling the IT security of industrial automation and control systems (IACS). The term IACS represents all elements, such as systems, components and processes, which are required for the secure operation of an automated production system. By specifically focusing on industrial applications, IEC 62443 also sets itself apart from ISO 27001, which deals instead with traditional IT systems. For operators of critical infrastructure, ICE 62443 covers all the requirements for secure solution design, start-up, operation, and maintenance. IEC 62443 has become the "in-house standard" in the process industry.

The central elements of part 4-1 and 2-4 of the IT security standard are, on the one hand, a threat and risk analysis based on the application scenario. ie; application examples and the required hardening measures are defined for devices and systems. For automation solutions, a security concept is devised with the required precautionary measures. On the other hand, a product or solution development process is established which ensures that all identified security requirements are implemented, verified and documented with traceability.

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# IEC 62443-4-1 – Secure Product Development Lifecycle Certificate

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.: 18CR01S007

Valid until: 2021-07-29

Date, 2018-08-01 (Andreas Barwald)

Page 1 of 1
TÜV SÜD Product Service GmbH • Certification Body • Ridlerstraße 65 • 80339 Munich • Germany

Industrial IT Security
TÜV SÜD
Secure Product Development Lifecycle

Secure Product Development Lifecycle assessed & monitored according to IEC 62443-4-1

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# IEC 62443-2-4 – ICS-Security Service Provider Certificate

CERTIFICATE
No. Q4B 029429 0008 Rev. 00

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

Certification Mark:

Scope of Certificate: ICS Security Service Provider

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.: 19CR11S007

Valid until: 2022-03-17

Date, 2019-03-18

**As an ICS service provider we are offering**

- Security services
- Design and commissioning of an automation system for acceptance as system integrator

CERTIFICATE
No. Q4B 029429

Factory(ies): PHOENIX CONTACT Electronics GmbH
Vertical Market Management
Dringenauer Str. 30, 31812 Bad Pyrmont, GERMANY

PHOENIX CONTACT Deutschland GmbH
Vertical Market Management
Flachsmarktstrasse 8, 32825 Blomberg, GERMANY

Applied Standard(s): IEC 62443-2-4:2015
IEC 62443-2-4:2015/AMD1:2017
PPP 15010A:2018 (IEC 62443-2-4: Profile for a Generic Integration Service Provider)

ICS = Industrial Control System

IEC 62443

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# Videos para iniciar con  PLCnext Control

[Link PLCnext Technology Basic]

[Overview to the Web-based Management on PLCnext Control]



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# Videos para iniciar con  PLCnext Control

[PLCnext Lesson 1  Unboxing PLCnext]

[Author: rajvirsingh.43]

[PLCnext Lesson 2 PLC to PC Communication]



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PLCnext Control

# STARTERKIT

- AXC F 2152 STARTERKIT

- Kit de inicio AXC F 2152 incluido PLCnext Control AXC F 2152, interruptor de tensión, módulo de entrada y salida digital, módulo de entrada y salida analógico, potenciómetro, módulo de interruptores, licencia PROFICLOUD y fuente de alimentación, patch cable, conectores para países y documentación.

1046568 AXC F 2152 STARTERKIT



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PLCnext Control

# STARTERKIT

- PLCNEXT TECHNOLOGY STARTERKIT

- Kit de inicio PLCnext Technology que incluye PLCnext Control AXC F 2152, módulo de E/S AXL Smart Elements DI16/DO16/AI4, potenciómetro deslizante, pulsadores, adaptador de red, licencia de Proficloud y patch cable.

1188165 PLCNEXT TECHNOLOGY STARTERKIT



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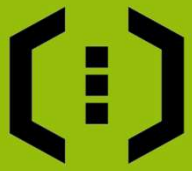
Ecosystem & PLCnext Store

# The Open Ecosystem for Limitless Automation

PLCnext Technology
enhance your automation thinking

| PLCnext Control | PLCnext Engineer | PLCnext Store | PLCnext Community |
|---|---|---|---|
|  | | | |
| **Open Control Platform**<br>PLCs in various performance classes including PLCnext Runtime System and accessories for PLCnext Technology | **Engineering Software**<br>Engineering tool for commissioning, configuring, and programming PLCnext Controls | **Software Store for Automation**<br>Apps for functional extension of PLCnext Control and PLCnext Engineer | **User Collaboration & Resources**<br>Information, support, and helpful resources about PLCnext Technology including FAQs, forums, tutorials and a GitHub presence |



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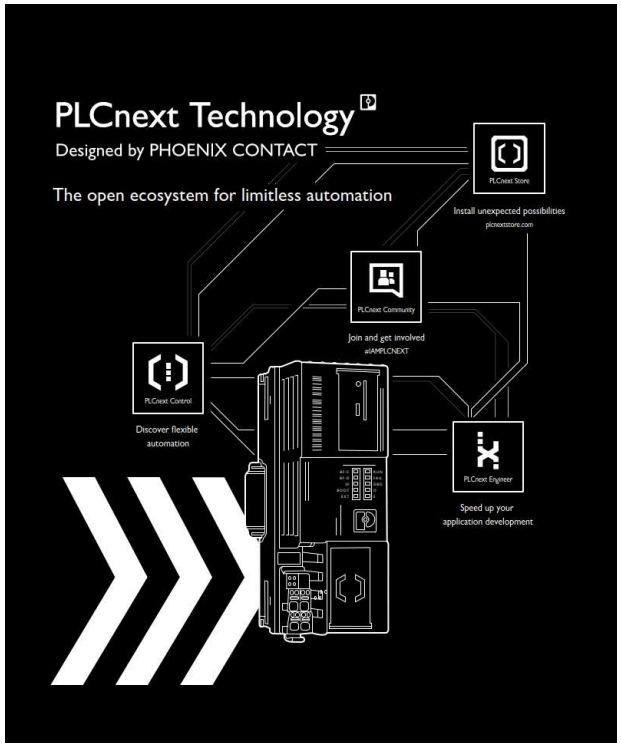
Ecosystem & PLCnext Store

# PLCnext Technology Ecosystem

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Ecosystem & PLCnext Store

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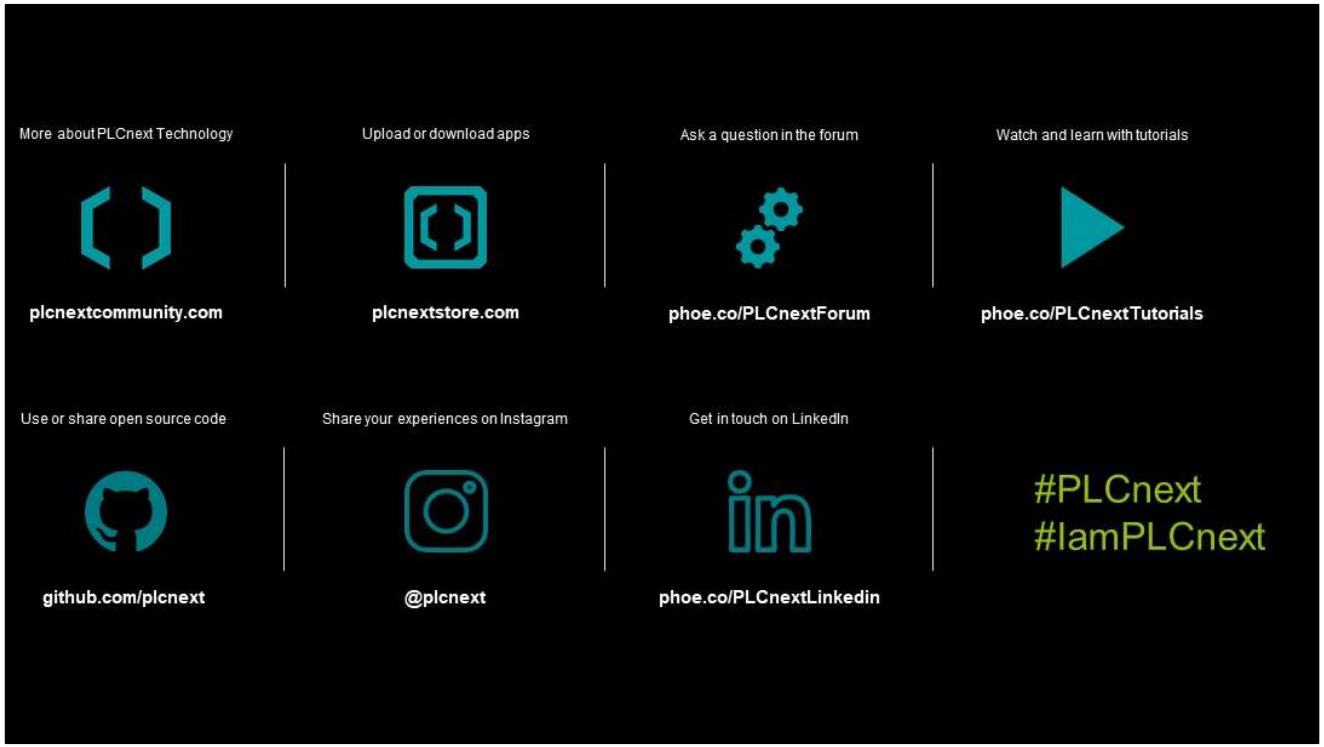
# PLCnext Community – Global Exchange & Collaboration



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