



Ing. Antonio Gordillo / Infraestructura y Sistemas de Automatización / 7 SEP 2021

# Welcome

## Inteligencia Artificial

### Producto AXC F XT ML 1000





**Be part of our smart future**  
**PHOENIX CONTACT**



PLCnext Technology Ecosystem

## PLCnext Technology

Much more  
than just a great vision –  
enhanced automation today!



PLCnext Technology<sup>®</sup>  
Designed by PHOENIX CONTACT



PLCnext Technology Ecosystem

## Motivation

All Electric Society

INDUSTRIAL  
INTERNET  
OF THINGS

Our solution for a rapidly changing world

PLCnext Technology<sup>TM</sup>  
Designed by PHOENIX CONTACT

The open ecosystem for  
limitless automation

# PLCnext Technology<sup>®</sup>

Designed by PHOENIX CONTACT



PLCnext Control

## Open Control Platform

Devices in various performance classes including PLCnext Runtime System and accessories



PLCnext Engineer

## Engineering Software

Engineering tool for commissioning, configuring and programming PLCnext Control



PLCnext Store

## Software Store

Apps for functional extension of PLCnext Control and PLCnext Engineer



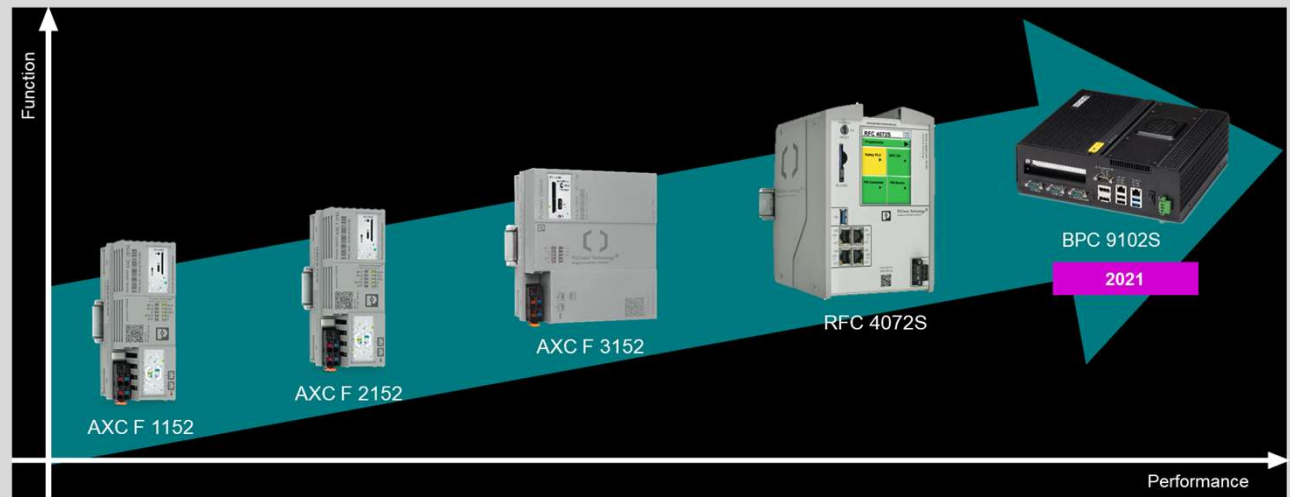
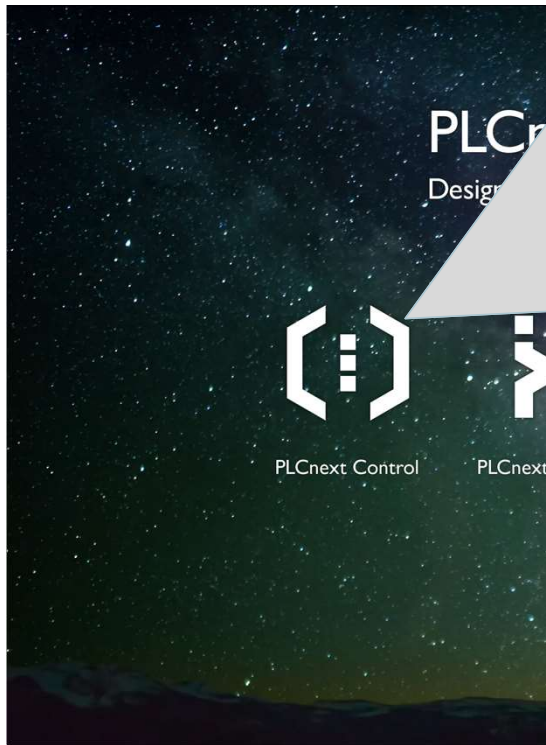
PLCnext Community

## Collaboration & Resources

We offer our community Information, support and helpful resources, including FAQs, forums, tutorials, and a GitHub presence

PLCnext Ecosystem

# PLCnext Technology



## Open Control Platform

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

PLCnext Ecosystem

# PLCnext Technology

PLCnext Technology   
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 PLCnext Control     PLCnext Engineer     PLCnext Store     PLCnext Commissioning

PHOENIX CONTACT PLCnext Store

Install unexpected possibilities

Filter: Rating, Price, Type

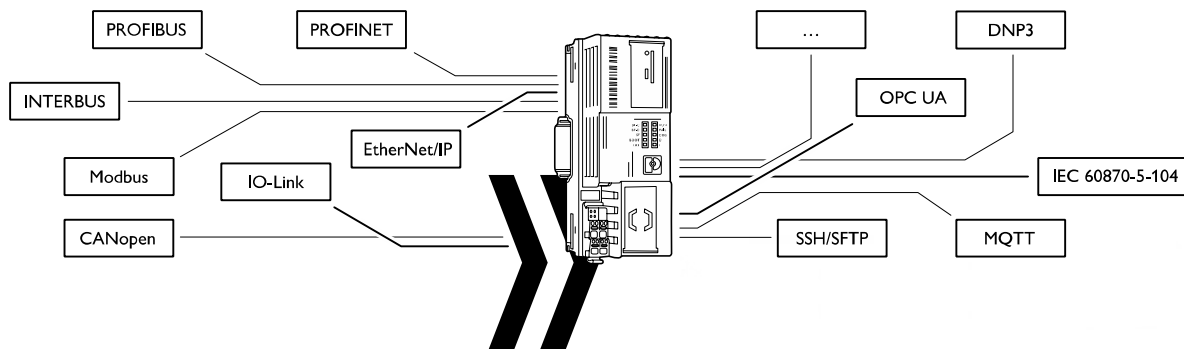
- AnalogTechnology** (Free)  
The AnalogTechnology library offers function blocks for acquisition and evaluation of analog signals.
- Basic Light Control** (Free)  
Optimize your energy consumption and reduce costs by adapting your lighting to the ambient conditions. The set our quick and easy automation of your lighting without any engineering or programming effort.
- Modbus RTU** (Free)  
Modbus is a communication protocol used for serial communication. It is a master/slave protocol. Only one master is connected to the bus at a time. In addition, one or more slaves (RTU) hardware are...
- Preload Writer** (Free)  
Easily automate and optimize your processes by analyzing your operational data out of the cloud. Start to log your data in the Preload and make it accessible no matter where you are. PHOENIX CONTACT.
- Pump Station Control** (Free)  
Save time and money by continuous monitoring and controlling of your pumping stations. Guide transform your concepts into a pumping station without any engineering or programming effort! Pump Station.

## Software Store for Automation

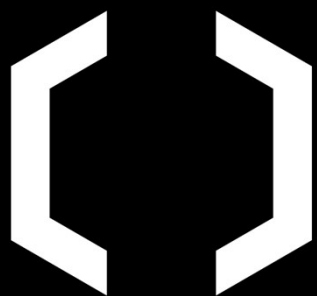
Apps for functional extension of PLCnext Control and PLCnext Engineer

enhanced connectivity – Intelligent Networking

## Future-proof Connectivity



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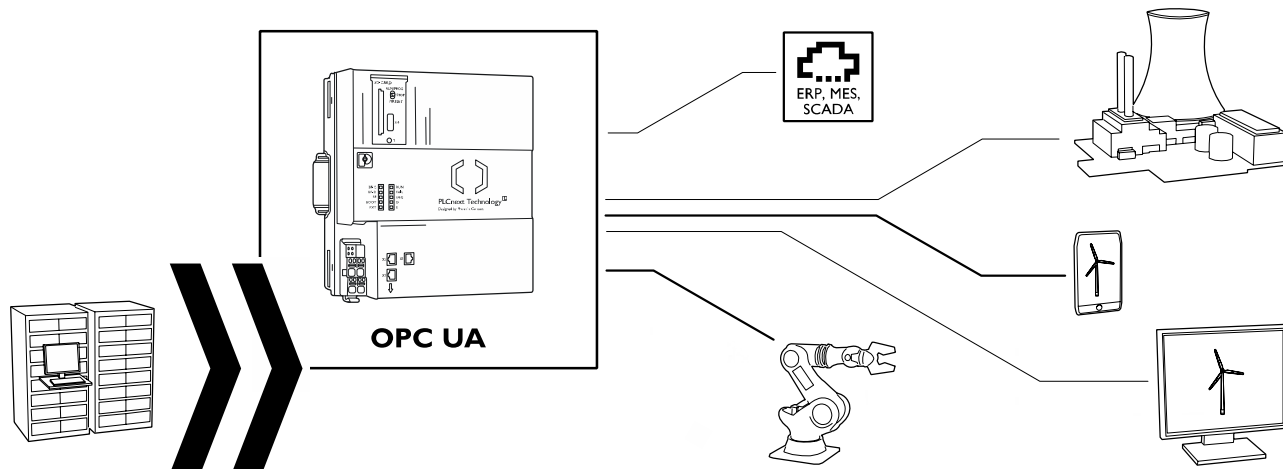


PLCnext Technology enables the integration of current and future interfaces and protocols for open communication in highly networked automation systems.

enhanced connectivity – Intelligent Networking

## Integrated OPC UA Server

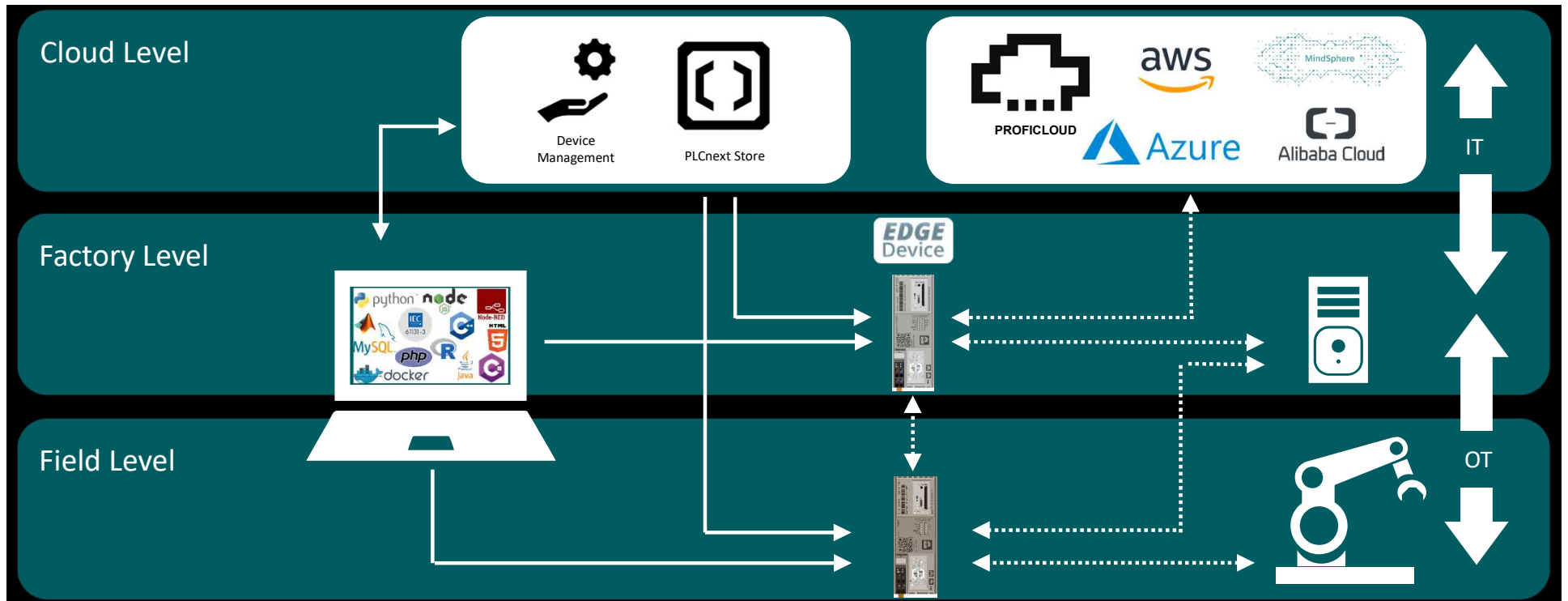
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Designed by PHOENIX CONTACT



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

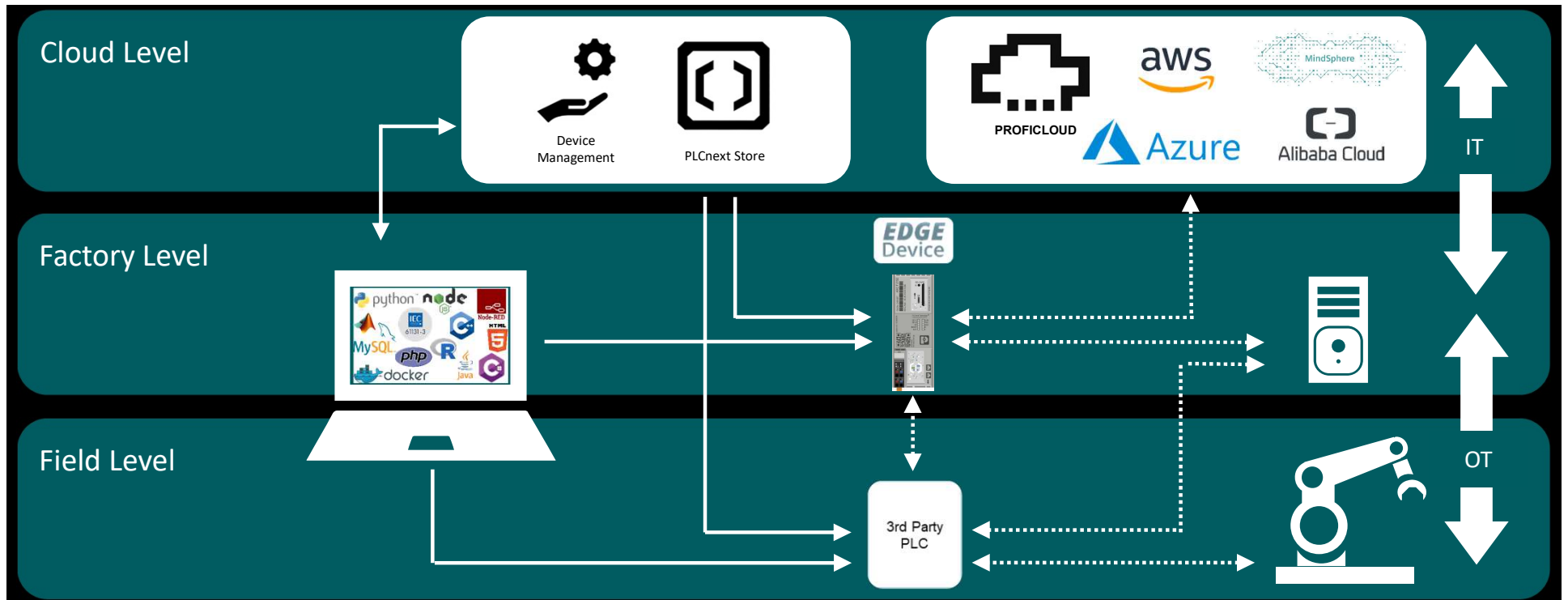
enhanced connectivity – Edge Device or PLC connecting all Levels

## PLCnext Control as PLC and Edge Device



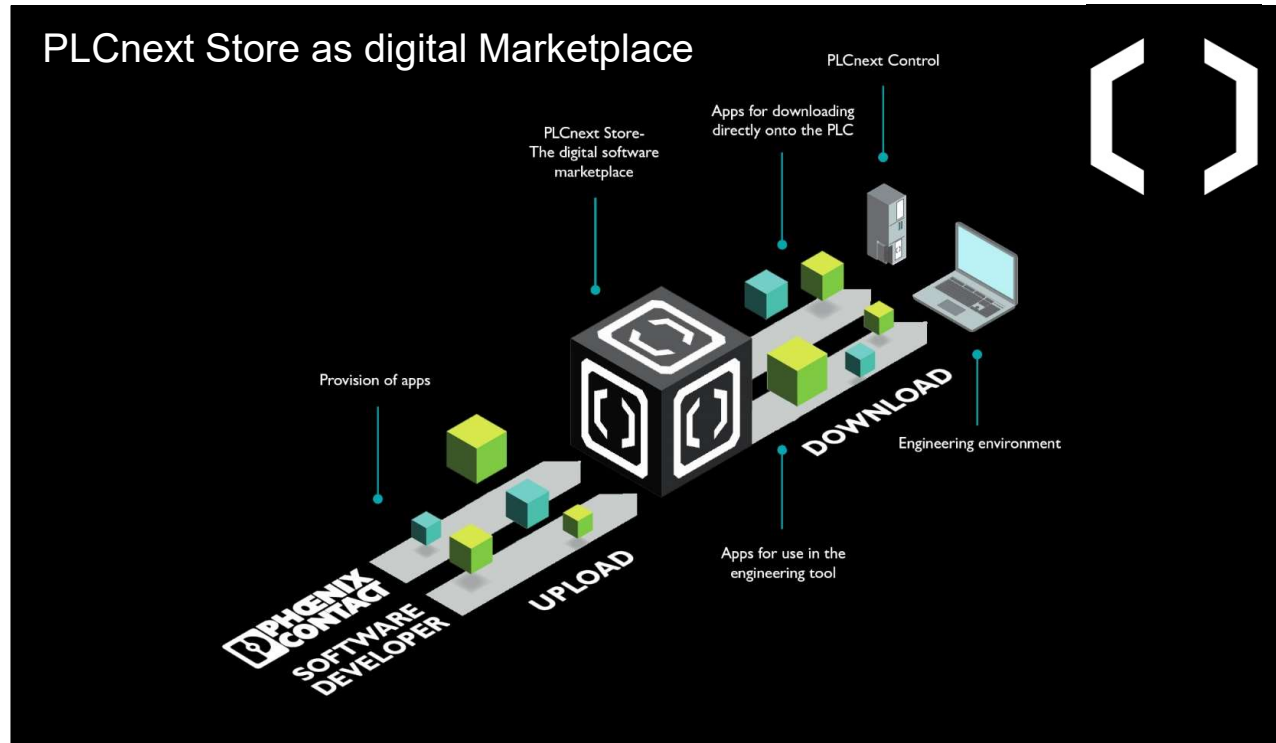
enhanced connectivity – Edge Device or PLC connecting all Levels

## PLCnext Control as Edge Device



enhanced freedom

# Limitless Adaption Capability



### Open-Source Software



php

C#

node.js

Java

C++

JS

Node-RED

HTML5

docker

MySQL

R

python



PLCnext Technology 

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The openness of PLCnext Technology makes it possible to use your favorite programming language, be it IEC 61131 or high-level language. Develop your individual solution comfortably in a familiar development environment, such as PLCnext Engineer, Matlab Simulink, Eclipse, or Visual Studio.

enhanced  
convenience

using your favorite  
programming tool

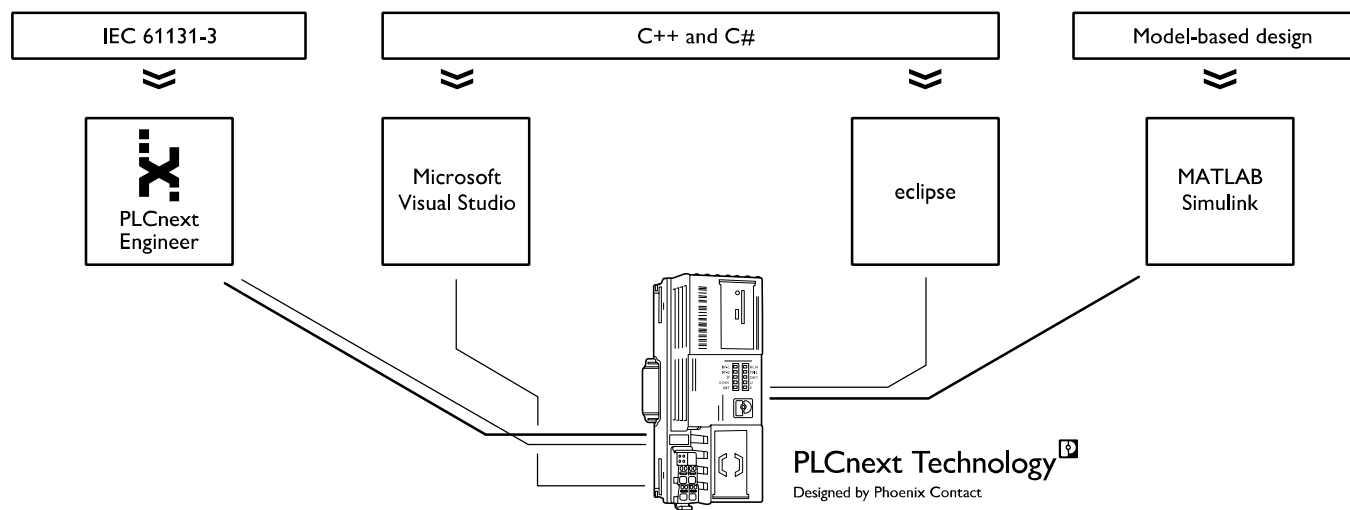


Artificial Intelligence In 10 Minutes | What Is Artificial Intelligence? | AI Explained | Simplilearn

enhanced convenience

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# Engineering and Application Development

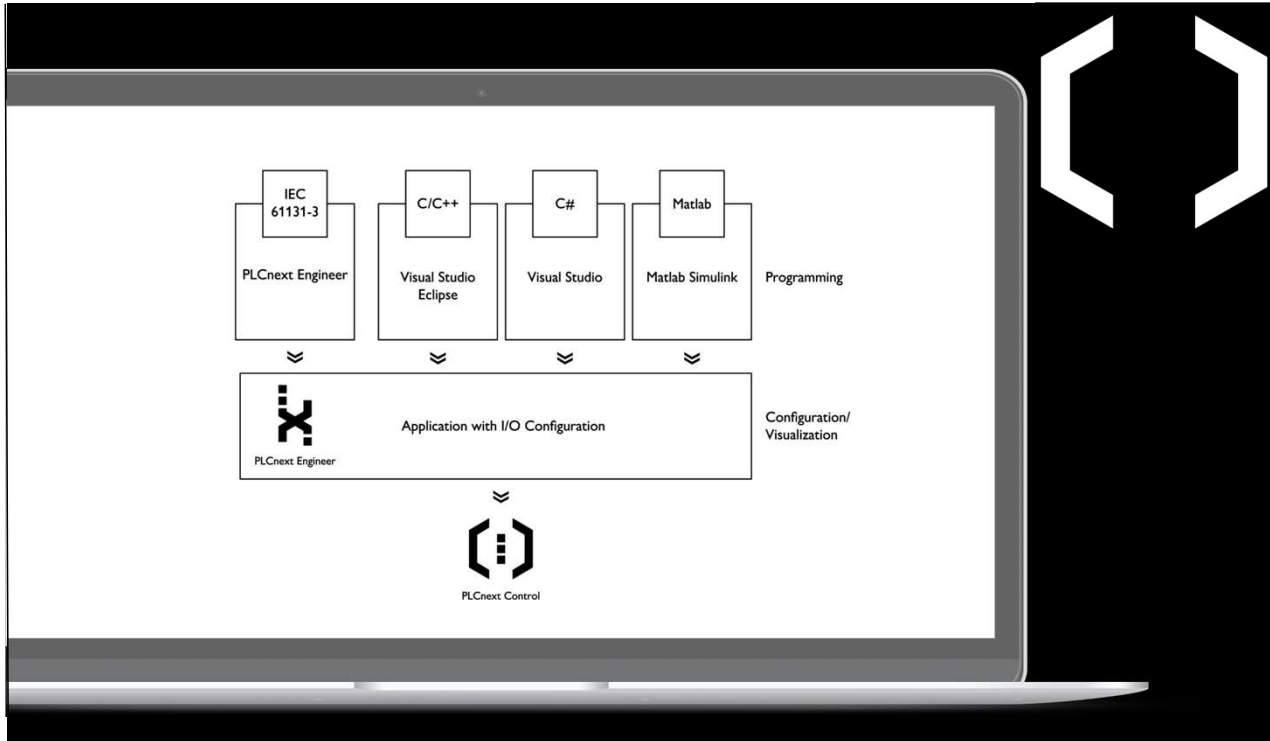


With PLCnext Technology, several developers from different generations, with different skill sets and expertise can work on one controller program, in parallel and yet independently, using different programming languages.

PLCnext Technology – Limitless engineering options

# PLCnext Engineer

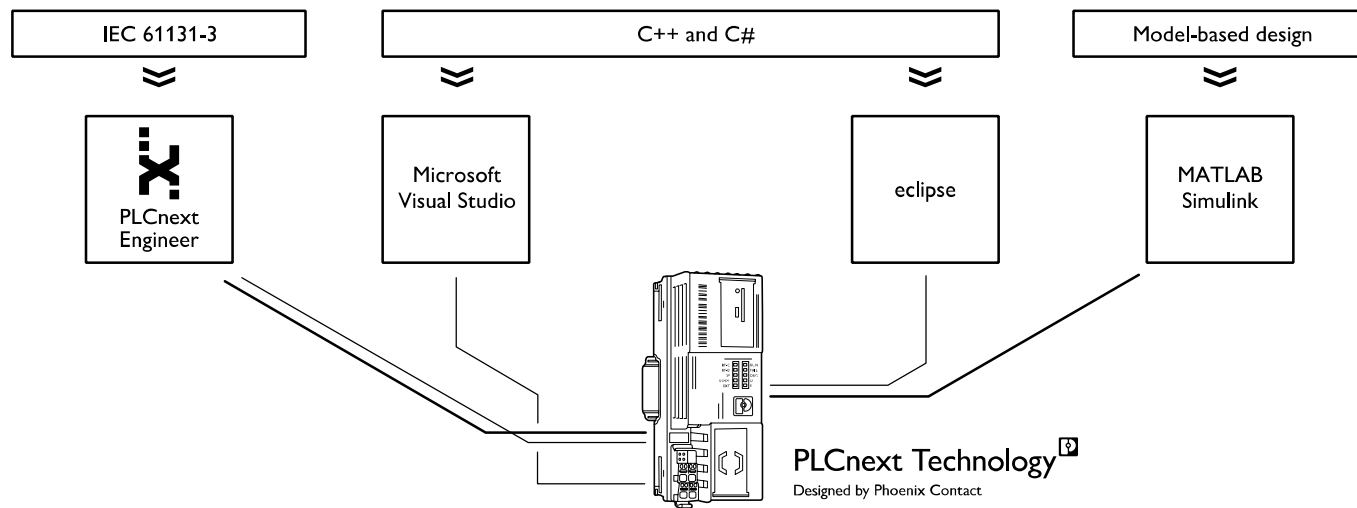
PLCnext Technology   
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enhanced development

# Engineering and Application Development

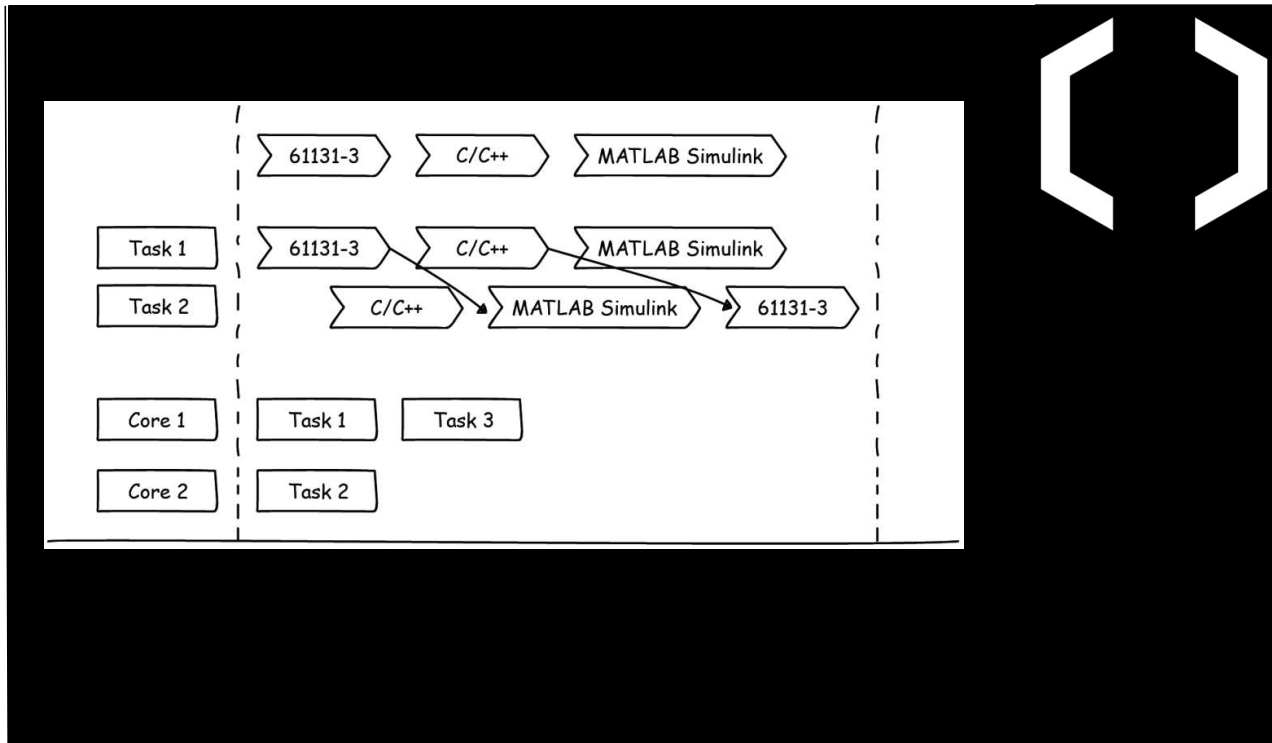
PLCnext Technology   
Designed by Phoenix Contact



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.

enhanced performance – PLC-typical Real-time Performance

## Execution & Synchronization Manager

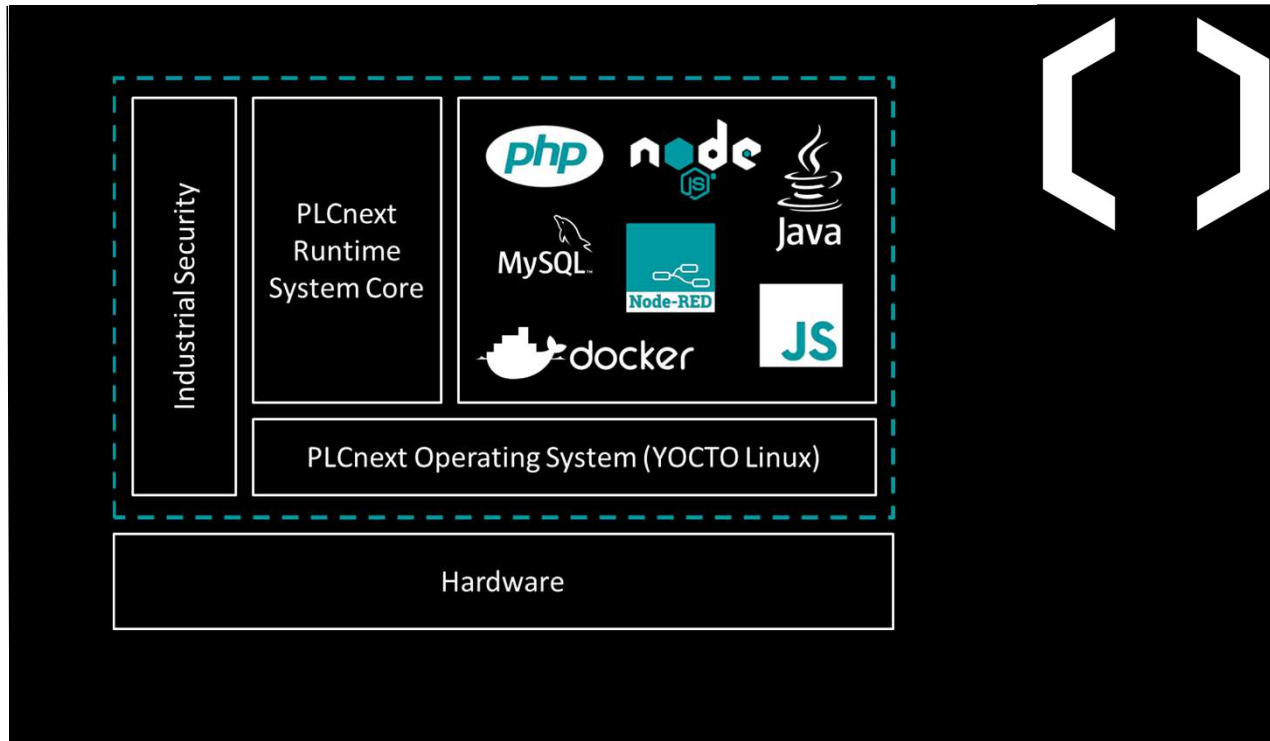


The patent-applied-for task handling of PLCnext Technology lets program routines of different origin run like classical IEC 61131 PLC code. Your high-level language programs become automatically deterministic.

PLCnext Technology – Limitless engineering options

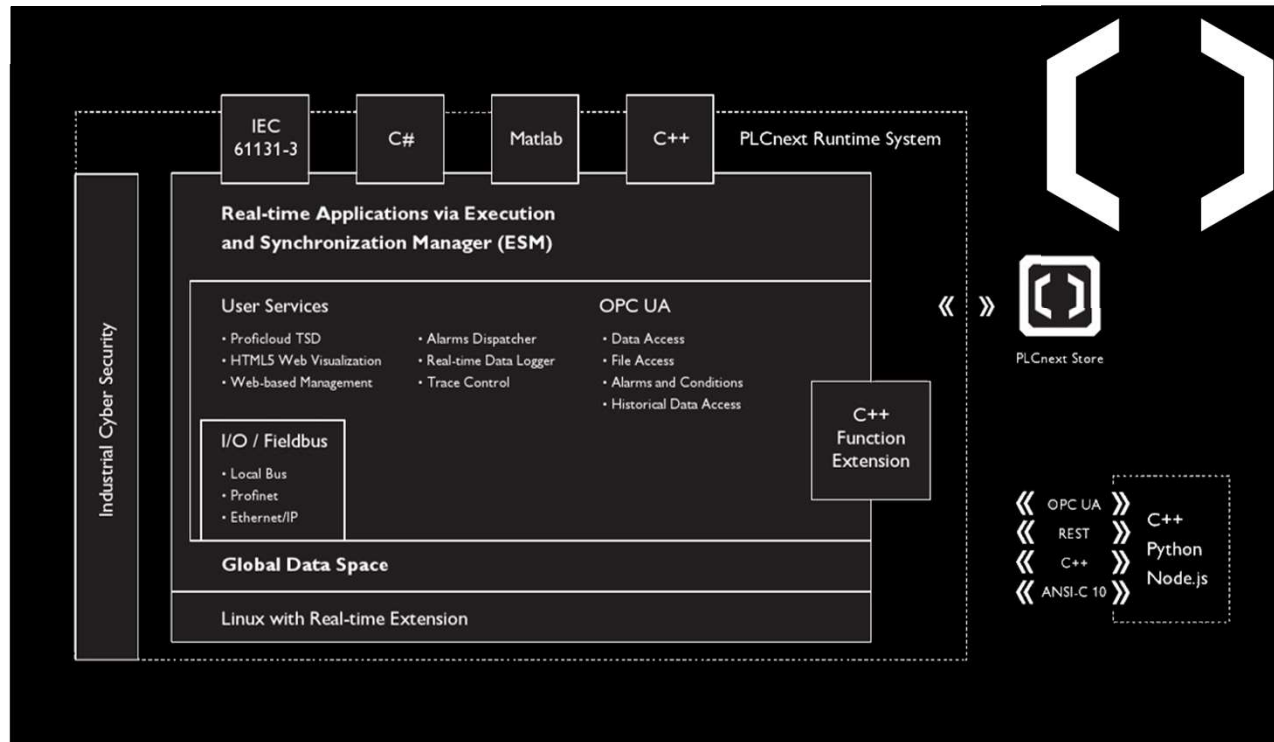
## PLCnext Runtime System

PLCnext Technology   
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- Reduced deployment time through the integration of source software
- Connectivity, security & real-time capability are already implemented
- Future-proof, flexible and secure thanks to continuous updates
- Integration of IEC61131-3, high-level languages and open source software possible
- Apps from PLCnext Store easy to implement

# PLCnext Runtime System Architecture

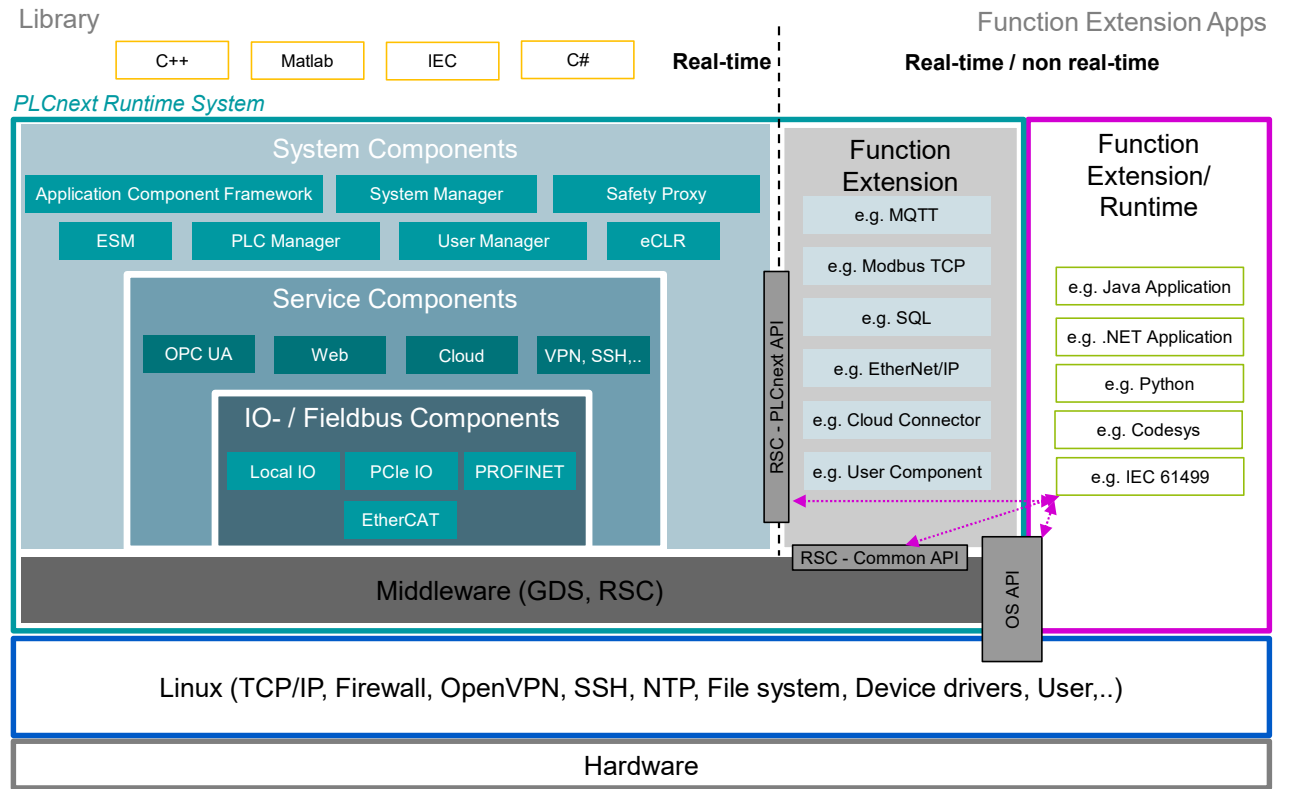


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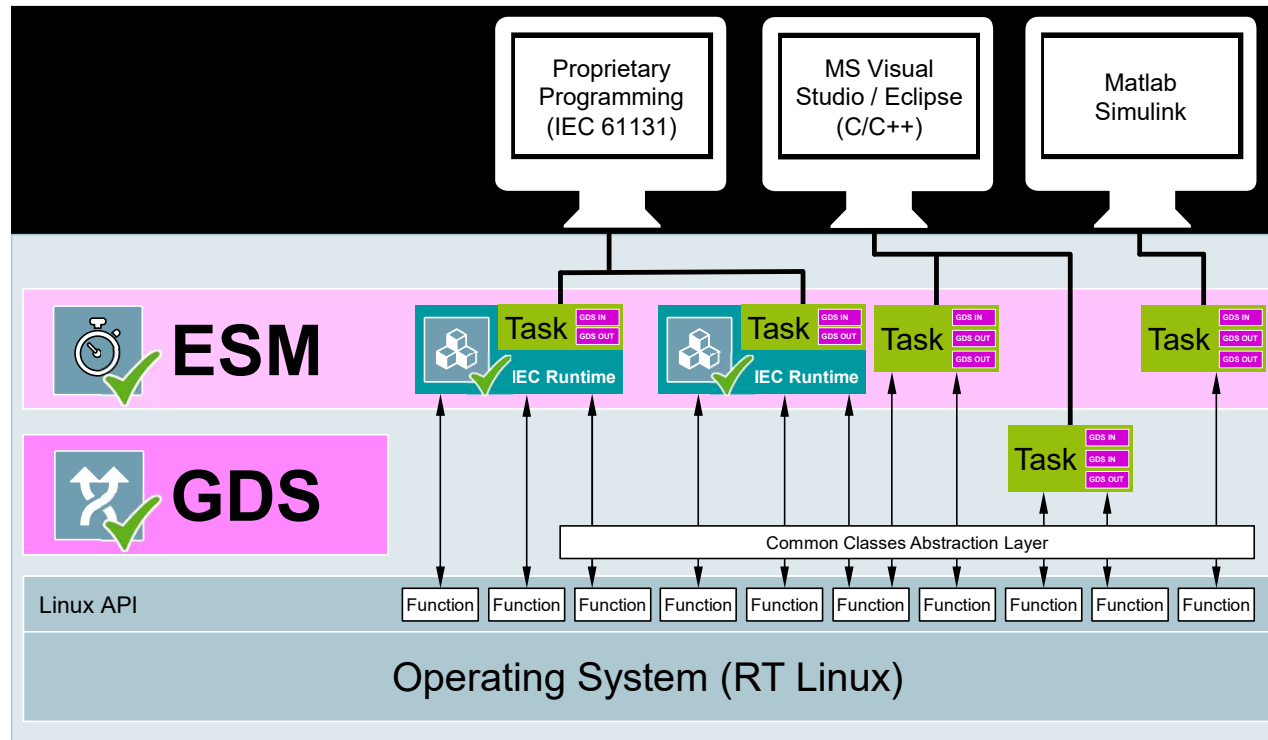
# PLCnext Runtime System Architecture

## PLCnext Runtime System Core Components

System Components	Service Components
<ul style="list-style-type: none"> <li>• Execution and Synchronization Manager (ESM)</li> <li>• System Manager</li> <li>• PLC Manager</li> <li>• Device Interface</li> <li>• User Manager</li> <li>• Diagnostic Logger</li> <li>• eCLR</li> <li>• Application Component Framework</li> <li>• Safety Proxy</li> <li>• Event Manager</li> <li>• ...</li> </ul>	<ul style="list-style-type: none"> <li>• OPC UA Server</li> <li>• PROFICLOUD Gateway</li> <li>• Web-based Management</li> <li>• PLCnext Engineer HMI</li> <li>• Data logger</li> <li>• Device HMI</li> <li>• Accessible via OS                             <ul style="list-style-type: none"> <li>• DHCP, DCP</li> <li>• SFTP, VPN</li> <li>• SSH, NTP</li> <li>• Trace Controller</li> </ul> </li> </ul>
IO Components	Middleware
<ul style="list-style-type: none"> <li>• Fieldbus Manager                             <ul style="list-style-type: none"> <li>• PROFINET Controller</li> <li>• PROFINET Device</li> <li>• Axioline</li> <li>• ...</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Global Data Space (GDS)</li> <li>• Remote Service Calls (RSC)</li> <li>• Commons Layer (Common Classes)</li> </ul>



## D: PLCnext Technology Architecture Advantages – Summary



- No vendor dependency
- Combined use of IEC 61131, HLL, and model-based programs
- Built-in real-time and data consistency for IEC 61131, HLL, and Matlab
- Unlimited OS API access

### EVALUATION

- ✓ Open programming tools
- ✓ Open application & network interfaces
- ✓ Open source & apps integration
- ✓ Real-time HLL programs can use OS API
- ✓ Future-proof through modular extensibility
- ✓ Integrated real-time capability
- ✓ Cloud connectivity integrated
- ✓ Security integrated

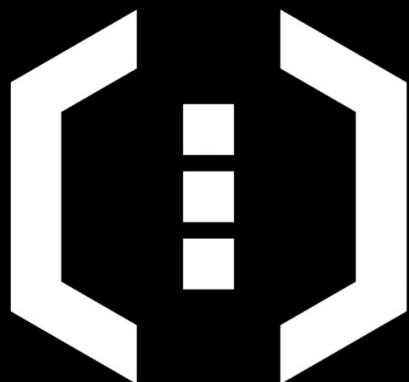


Confidential

# PLCnext Technology<sup>®</sup>

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Open control platform for flexible automation



PLCnext Control

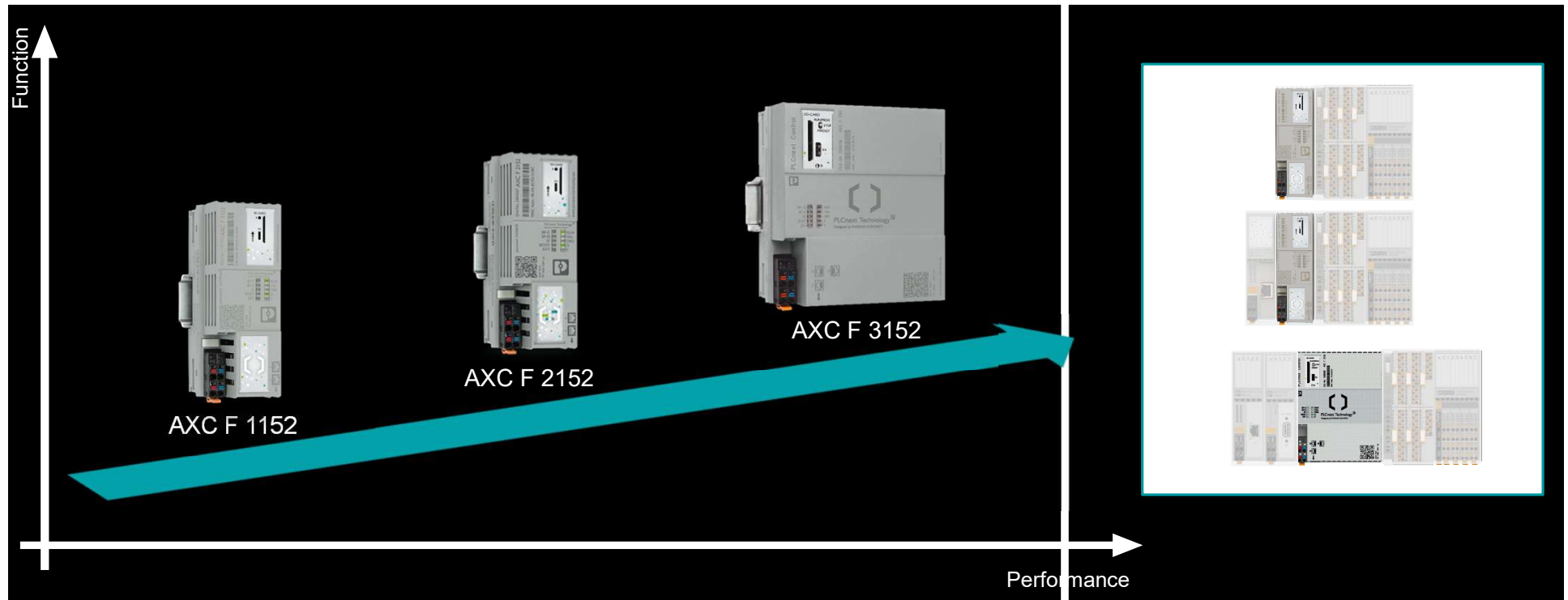
Discover flexible  
automation



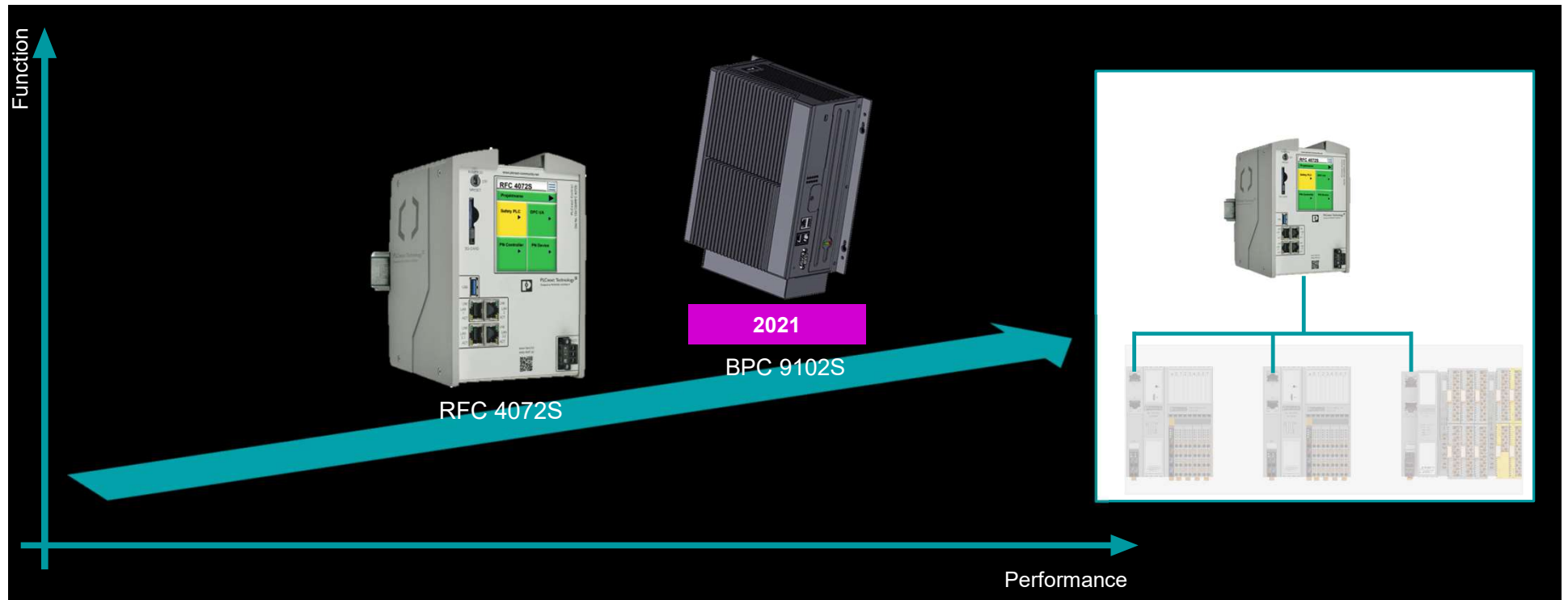
PLCnext Control

PLCnext Technology   
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## PLCnext Control for flexible automation with modular hardware platform



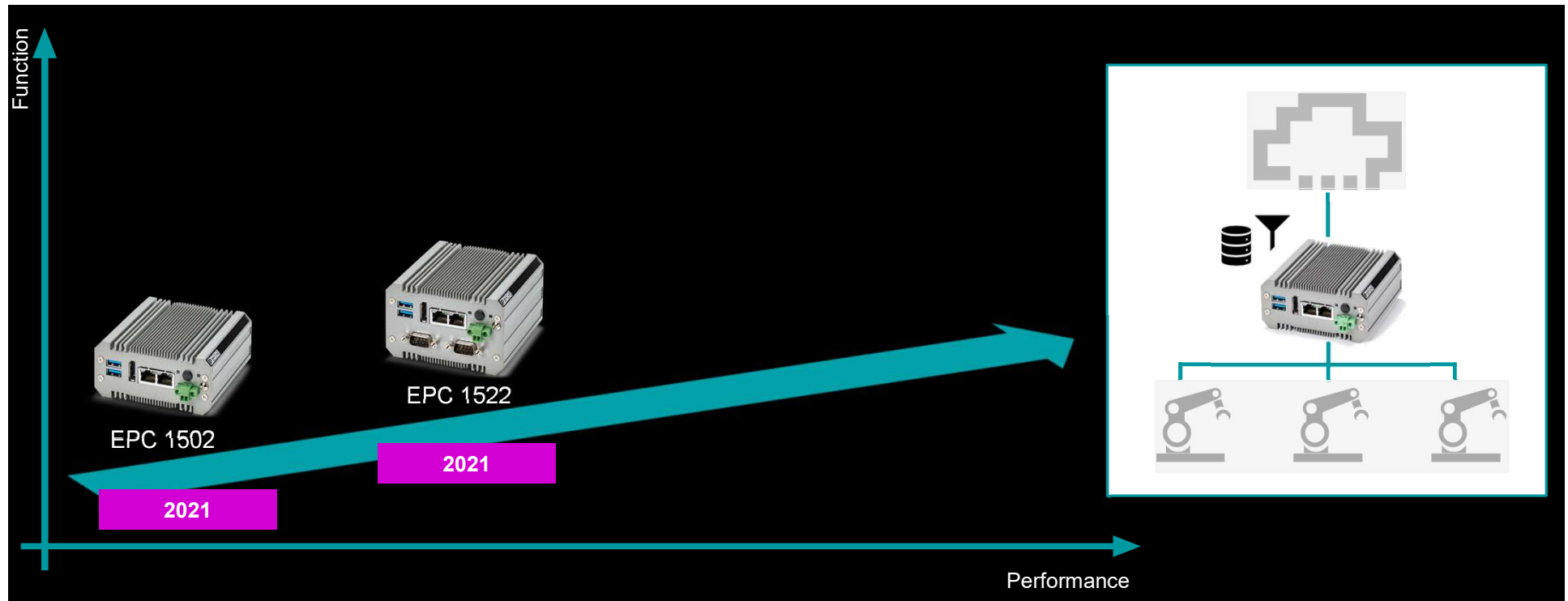
# PLCnext Control for centralized applications with decentralized IOs



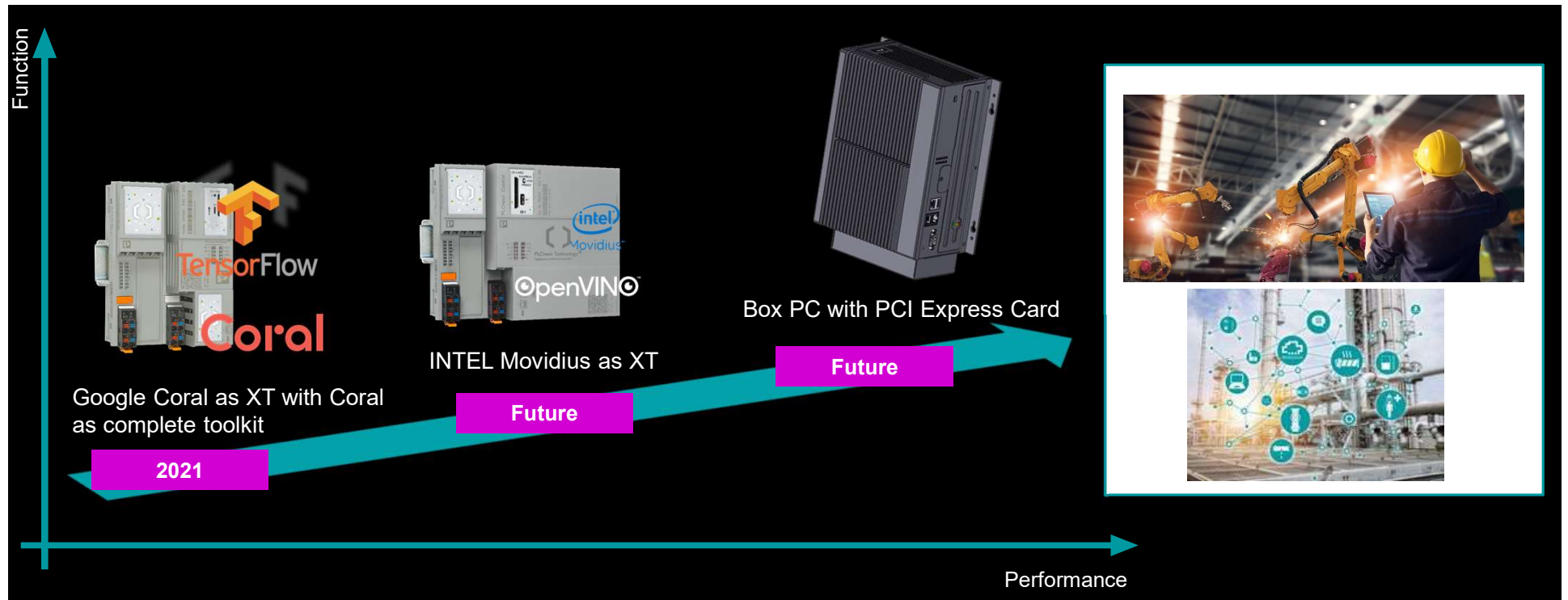
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# PLCnext Control for Edge Computing



# PLCnext Control for intelligent applications with Artificial Intelligence





Coral: Expanding the edge AI landscape | Session


# PLCnext Controls Performance Benchmark









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PLCnext Control

# PLCnext Control AXC F 2152




The image shows the PLCnext Control AXC F 2152 device, a compact industrial PLC. It features a grey metal casing with a front panel containing a status display with LEDs for RUN, FAIL, DBG, D, and E. The top panel has an SD-CARD slot and a barcode. The bottom panel has a terminal block for connections. The device is shown against a dark background.







Core	Working memory	Temperature
 <b>ARM Cortex-A9 (2x 800 MHz)</b>	 <b>512 Mbytes RAM</b>	 <b>-25°C-60°C</b>
 <b># control tasks (IEC 61131)</b> <b>32</b>	 <b>Min. cycle time (IEC 61131)</b> <b>1 ms</b>	 <b>Security</b> <b>TPM integrated</b>

PLCnext Control

# PLCnext Control AXC F 3152



The image shows a grey PLCnext Control AXC F 3152 unit. It features a control panel with buttons for RUN/PROG, STOP, and MR/RESET, along with an SD-CARD slot. The unit is labeled with 'PLCnext Control', 'AXC F 3152', and 'Designed by PHOENIX CONTACT'. It has various ports and connectors on the front and bottom.

Core	Working memory	Temperature
 <b>Intel ATOM x5-E3930 dual-core</b>	 <b>2 GB DDR4 dual-channel RAM</b>	 <b>-25°C-60°C</b>
 <b># control tasks (IEC 61131)</b> <b>32</b>	 <b>Min. cycle time (IEC 61131)</b> <b>500 µs</b>	 <b>Security</b> <b>TPM integrated</b>

## 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




## 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, IEC Ex, ATEX
  - DNV/GL, LR, BV, ABS, ...



PLCnext Control

# PLCnext Control RFC 4072S



Core	Working memory	Temperature
 <b>Intel i5 6300U 2 x 2,4 GHz processor</b> # control tasks (IEC 61131)  <b>32</b>	 <b>4 GB DDR 4 dual channel RAM</b> Min. cycle time (IEC 61131)  <b>500 µs</b>	 <b>0°C up to 55°C with fan</b> Security  <b>TPM integrated</b>

PLCnext Control

## 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






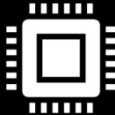
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PLCnext Control

# PLCnext Control BPC 9102S



<p>Core</p>  <p><b>Intel i7 CPU 8 cores</b></p>	<p>Random access memory</p>  <p><b>2GB RAM (min), int. UPS</b></p>	<p>Temperature</p>  <p><b>-20°C-60°C</b></p>
<p>Storage</p>  <p><b>Removable mass storage</b></p>	<p>Connections</p>  <p><b>2x RJ45, 1x TSN, 1x USB</b></p>	<p>PCIe</p>  <p><b>Safety board, AI acceleration</b></p>

PLCnext Control

## PLCnext Control BPC 9102S

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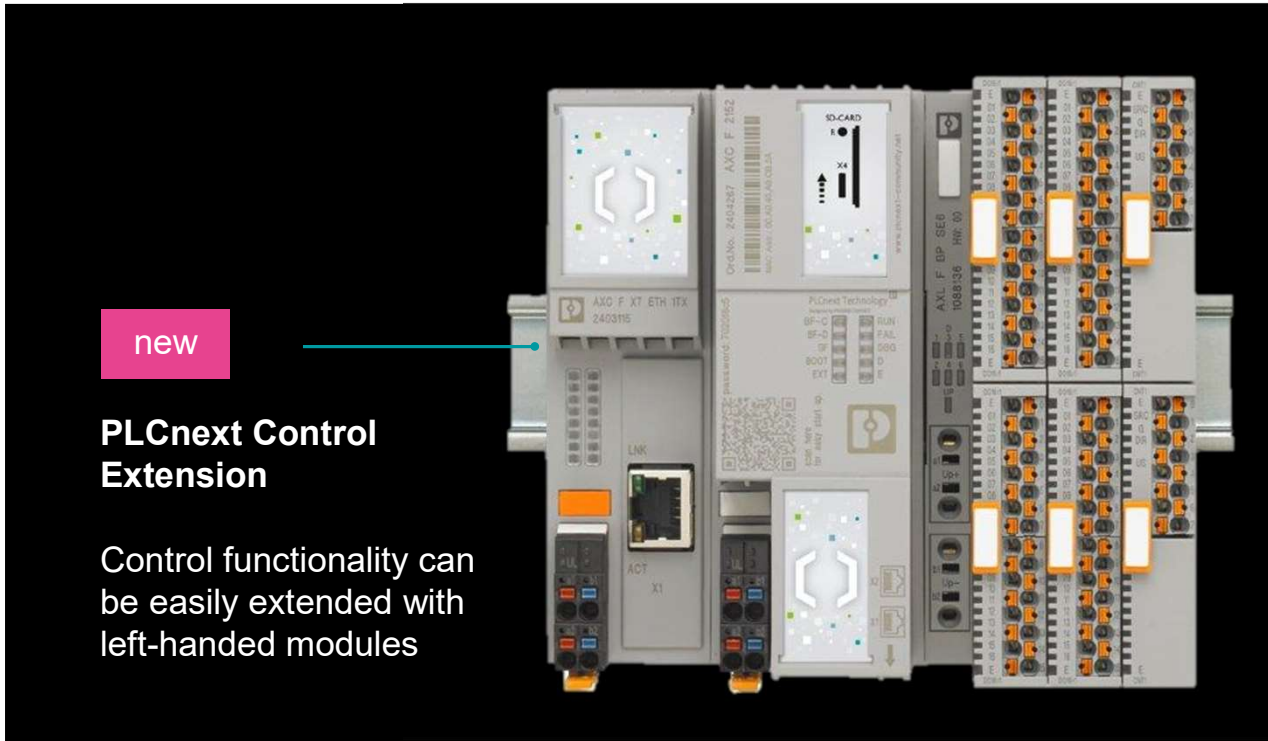
- CPU: i7-10700TE (10th Gen 8-Core)
- RAM: 16GB
- Interfaces:
- 3 separate and independent Ethernet interfaces with 1 RJ45 port each
  - LAN1: PN Controller (I225), 1GBit
  - LAN2: PN Device (I225), 1GBit
  - LAN3: RAW user ethernet communication (I225), 1GBit
- 1 Serial Interface RS232
- 1 USB for FW/SW Update
- Reset button and power switch
- SD Card
- Internal Super-cap UPS module
- Fan (only on between 50-60°C) to expand MTBF



Countless possibilities in hardware variance

# PLCnext Control

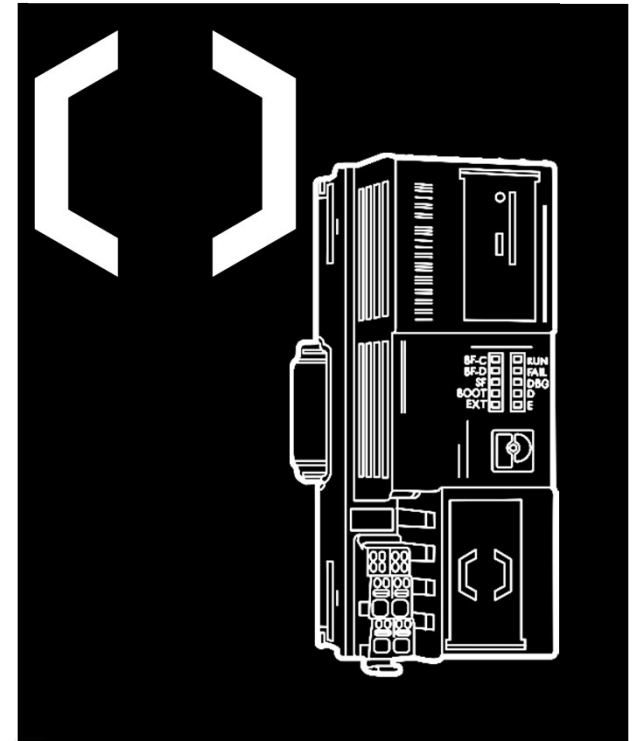
PLCnext Technology <sup>12</sup>  
Designed by PHOENIX CONTACT



new

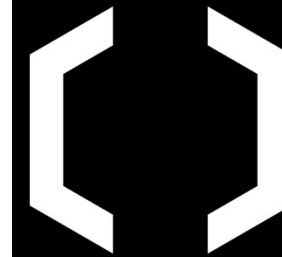
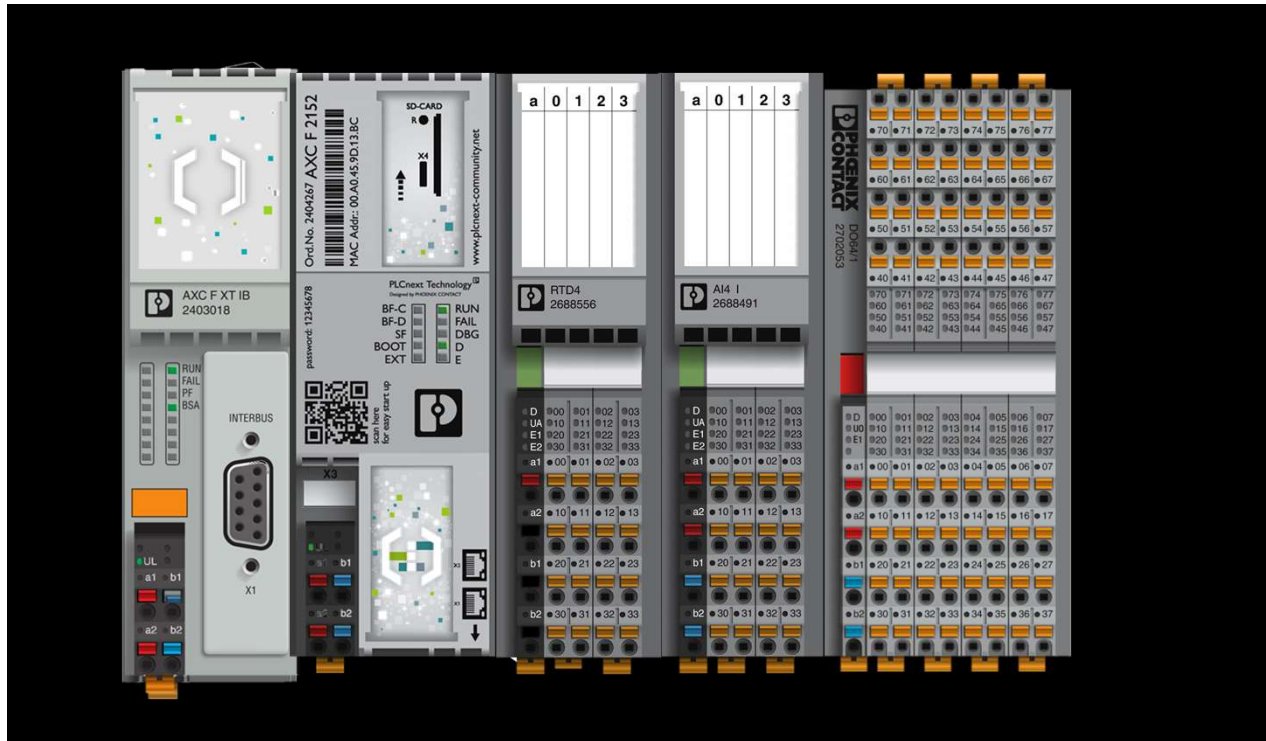
## PLCnext Control Extension

Control functionality can be easily extended with left-handed modules



## PLCnext Ecosystem – PLCnext Control

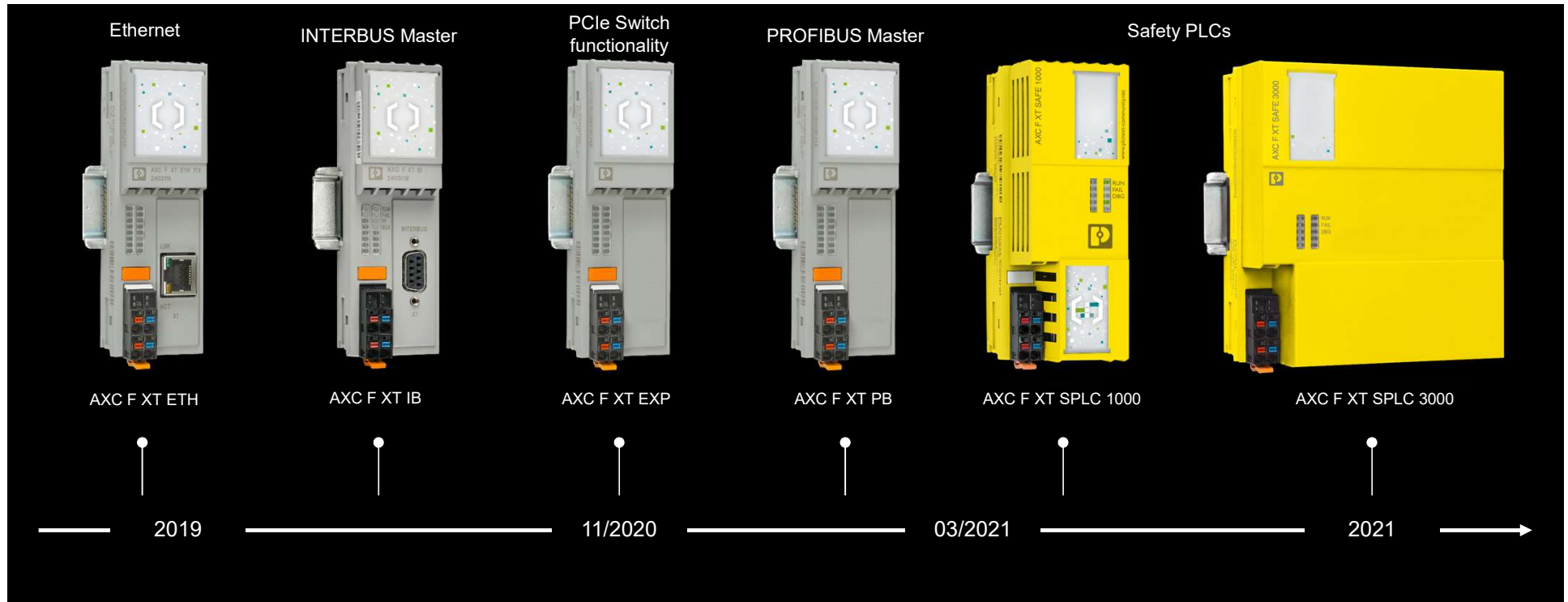
# Left-hand side extension possibilities



- Modular expandability of the controller through left-sided expansion modules on the PCI express interface via a corresponding bus socket
- Unlimited expansion possibilities

PLCnext Ecosystem – PLCnext Control

# Portfolio PLCnext Control Extensions



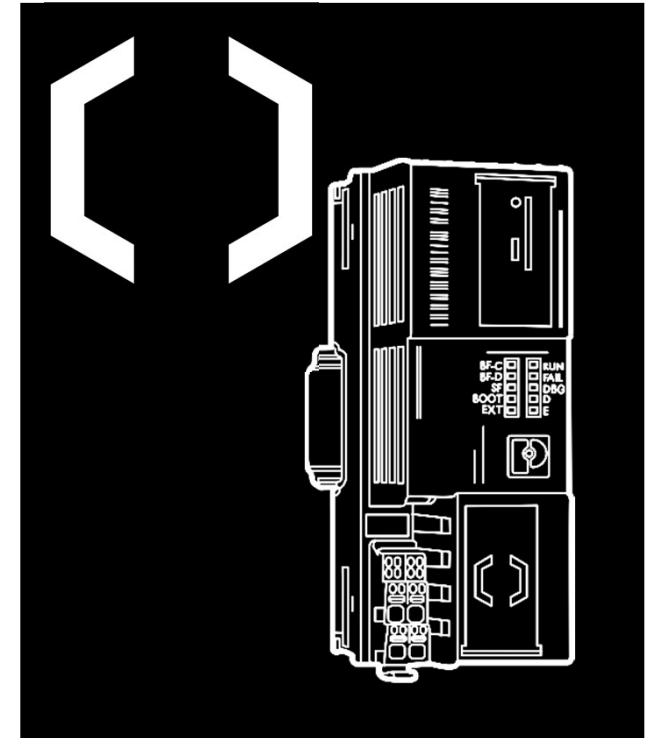
PLCnext Control

## PLCnext Extension AXC F XT IB

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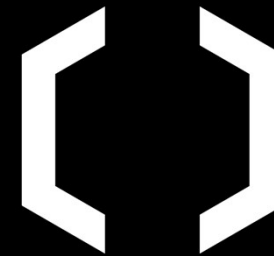
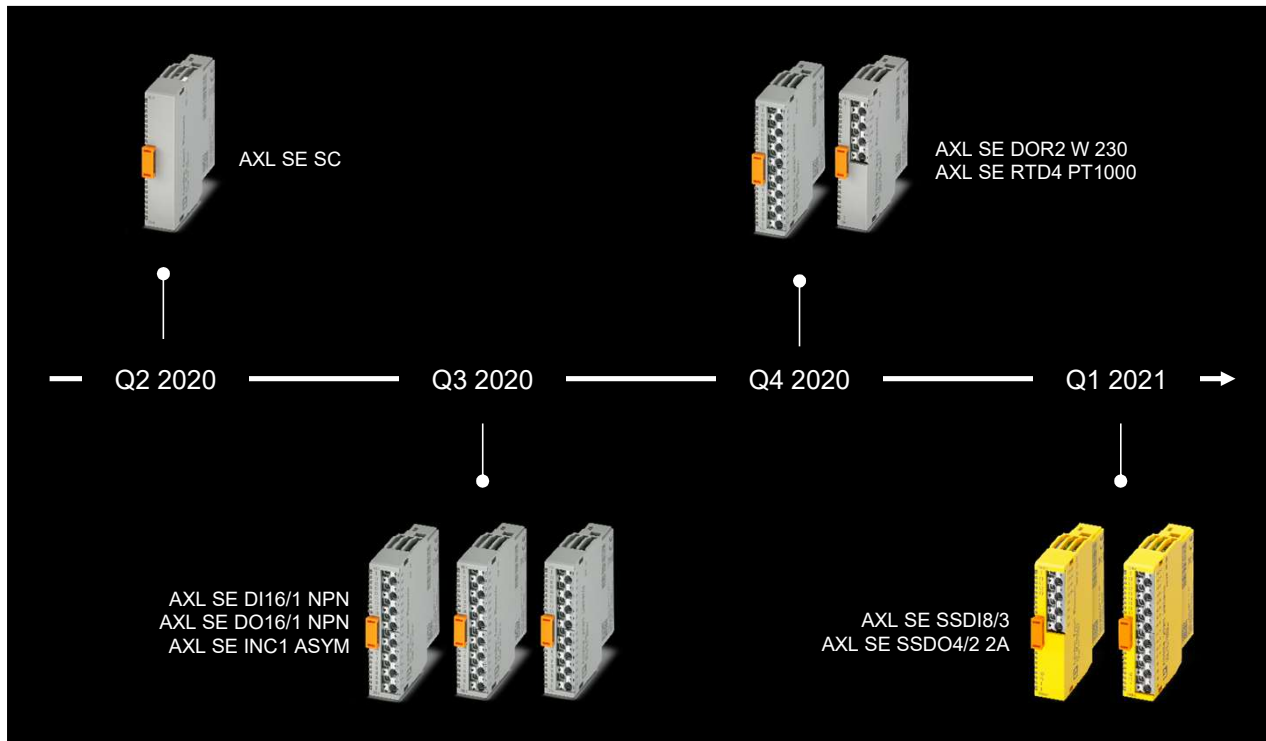


- Additional INTERBUS Master
- Up to 512 Devices, up to 255 Remote Devices
- Up to 126 PCP Devices
- Up to 16 Remote Bus Level
- 4096 Bit Process data
- 500kBit und 2 Mbit
- Ideal for Retrofit applications
- Approvals
  - UL (Hazloc), CUL, IEC Ex, ATEX
  - DNV/GL, LR, BV, ABS, ...
- Temperature range: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



Axioline Smart Elements

## More to come

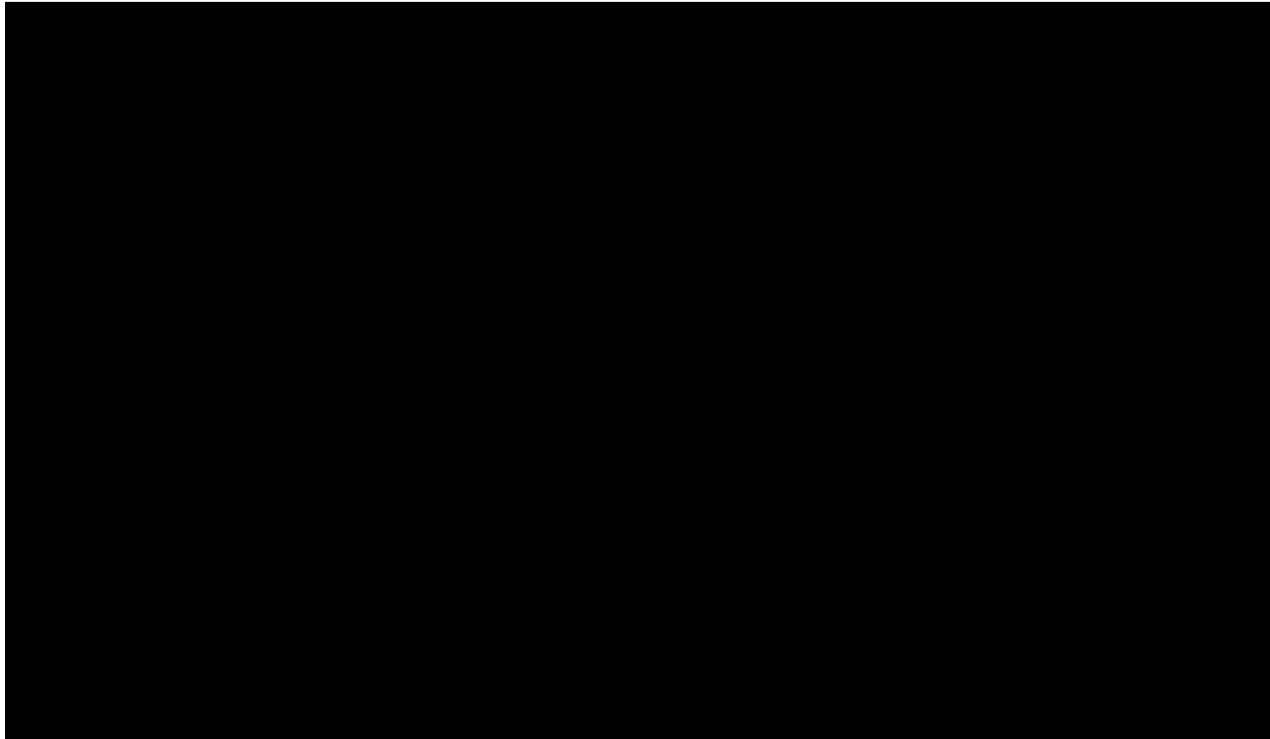


Be always up to date with the [I/O systems & light community](#) at the PC World.

Check regularly for latest information on new products, marketing tools and management updates.

PLCnext & Axioline Smart Elements

## Modular automation system

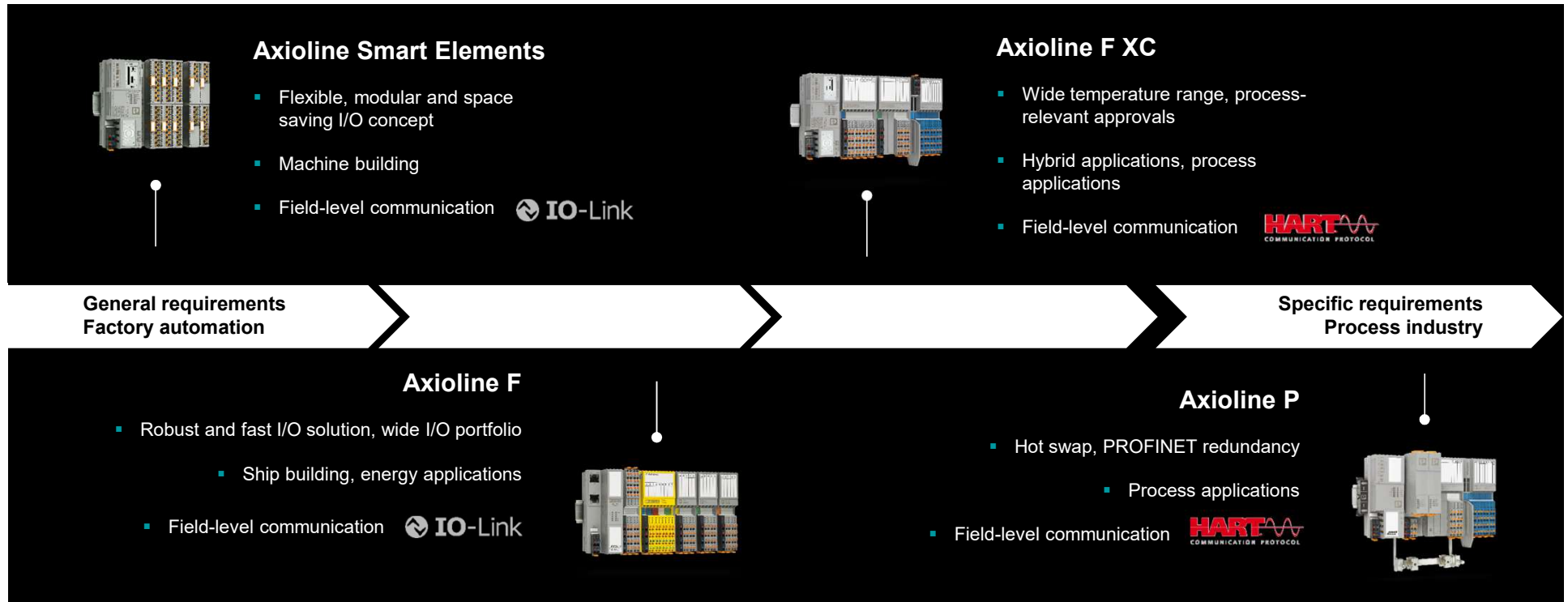


- Scalable automation system for simple to complex assignments
- Large selection of modules according to the modular system principle
- Optimal complement to PLCnext Control
- All components are part of the COMPLETE line system

PLCnext Technology <sup>®</sup>  
Designed by PHOENIX CONTACT

COMPLETE line

# Overview – Axioline IP20 I/O systems



# PLCnext Technology<sup>®</sup>

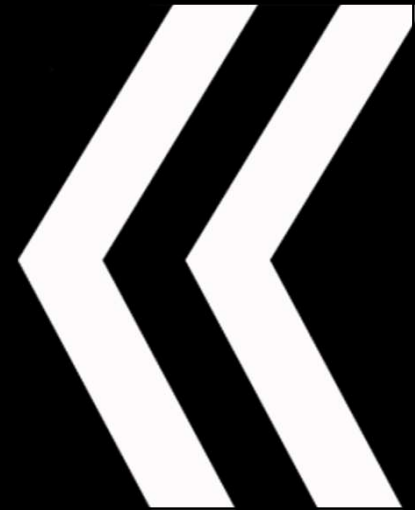
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PLCnext Engineer modular software platform



PLCnext Engineer

Speed up your  
application development



PLCnext Technology<sup>®</sup>

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Install limitless possibilities



PLCnext Store

Install limitless possibilities



PLCnext Ecosystem – PLCnext Store

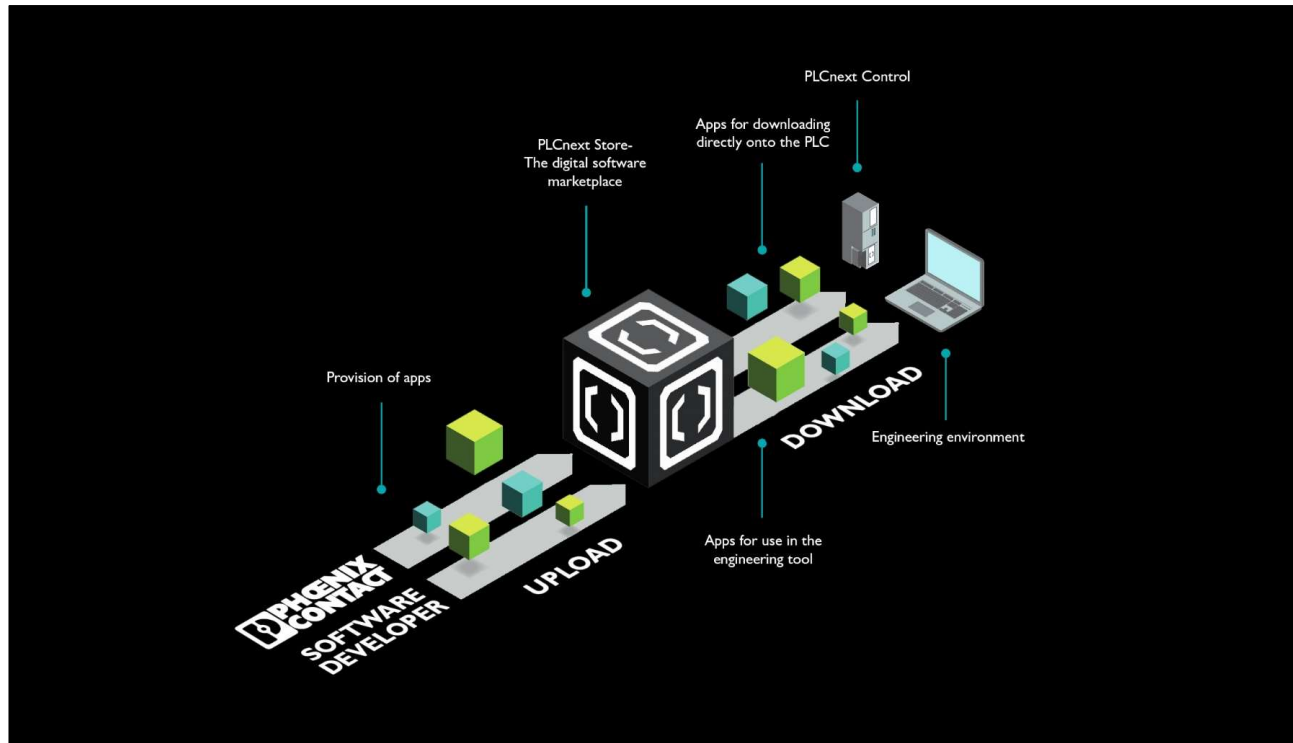
## PLCnext Store



PLCnext Ecosystem – PLCnext Store

# PLCnext Store

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## Benefits & Added Values



### Automation ecosystem

- Open ecosystem for the distribution of Apps for PLCnext Controls
- Flexible integration of Open Source software and Apps

### World of Applications

- Extends the PLC with the openness and flexibility of smart devices
- App variety from different vendors
- Apps suitable for your needs

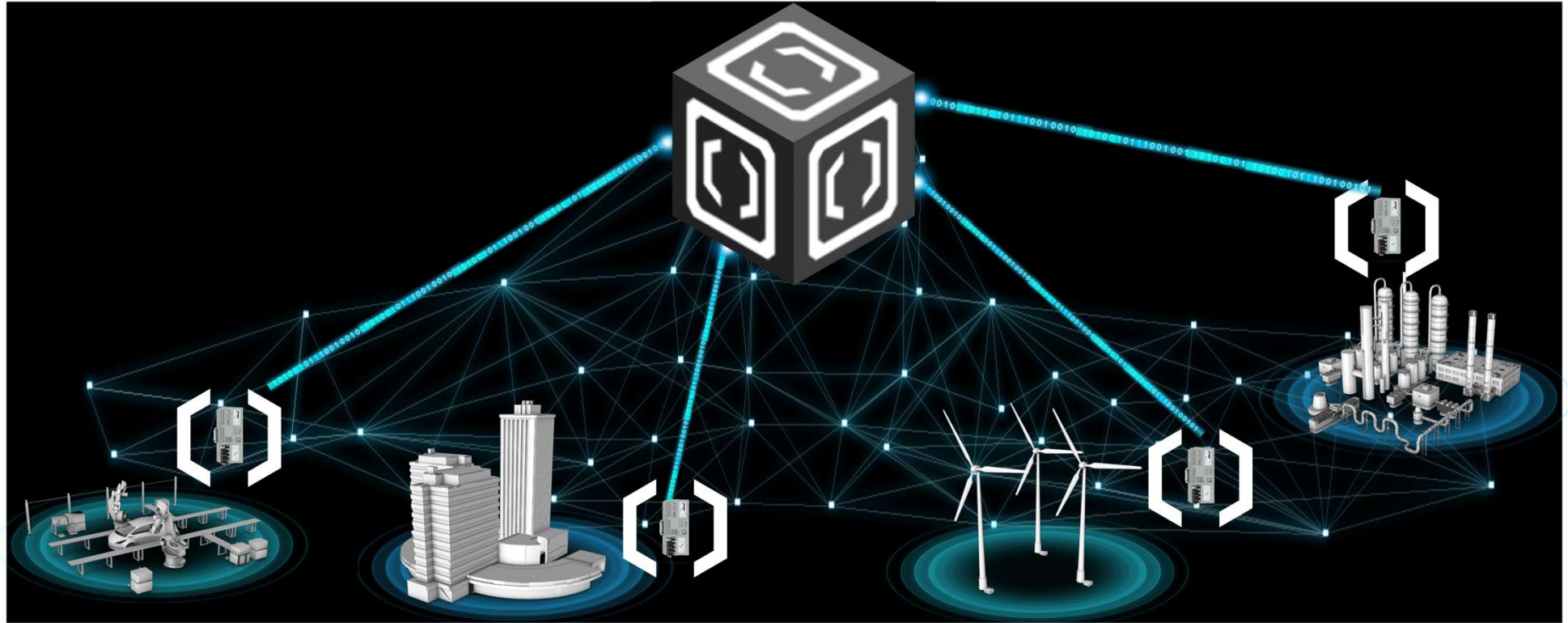
### Faster solution building

- Apps as ready to use solutions
- No programming, only parameterizing
- Plug & Work: customize your PLCnext Controller in minutes

PLCnext Store – Digital Marketplace for Limitless Automation

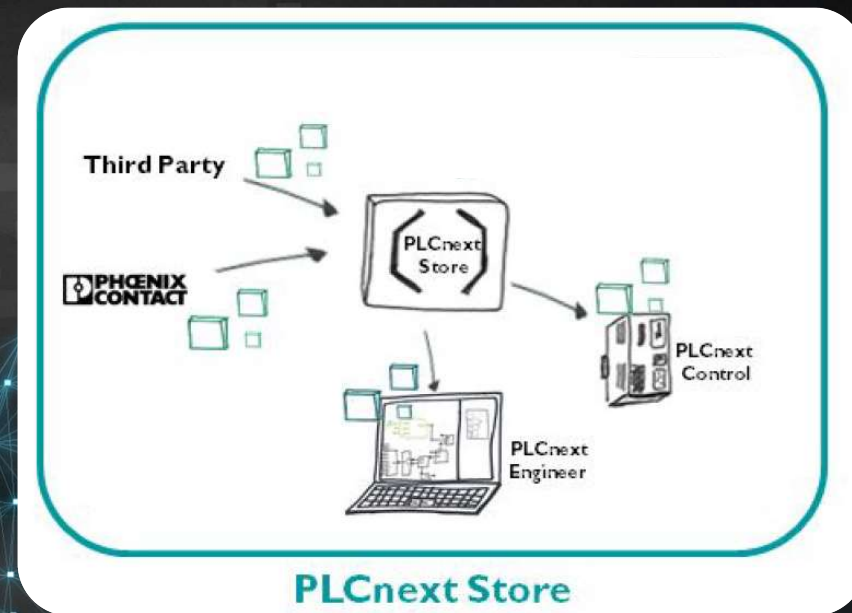
PLCnext Technology   
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## Ready-made Solutions



## What is an App?

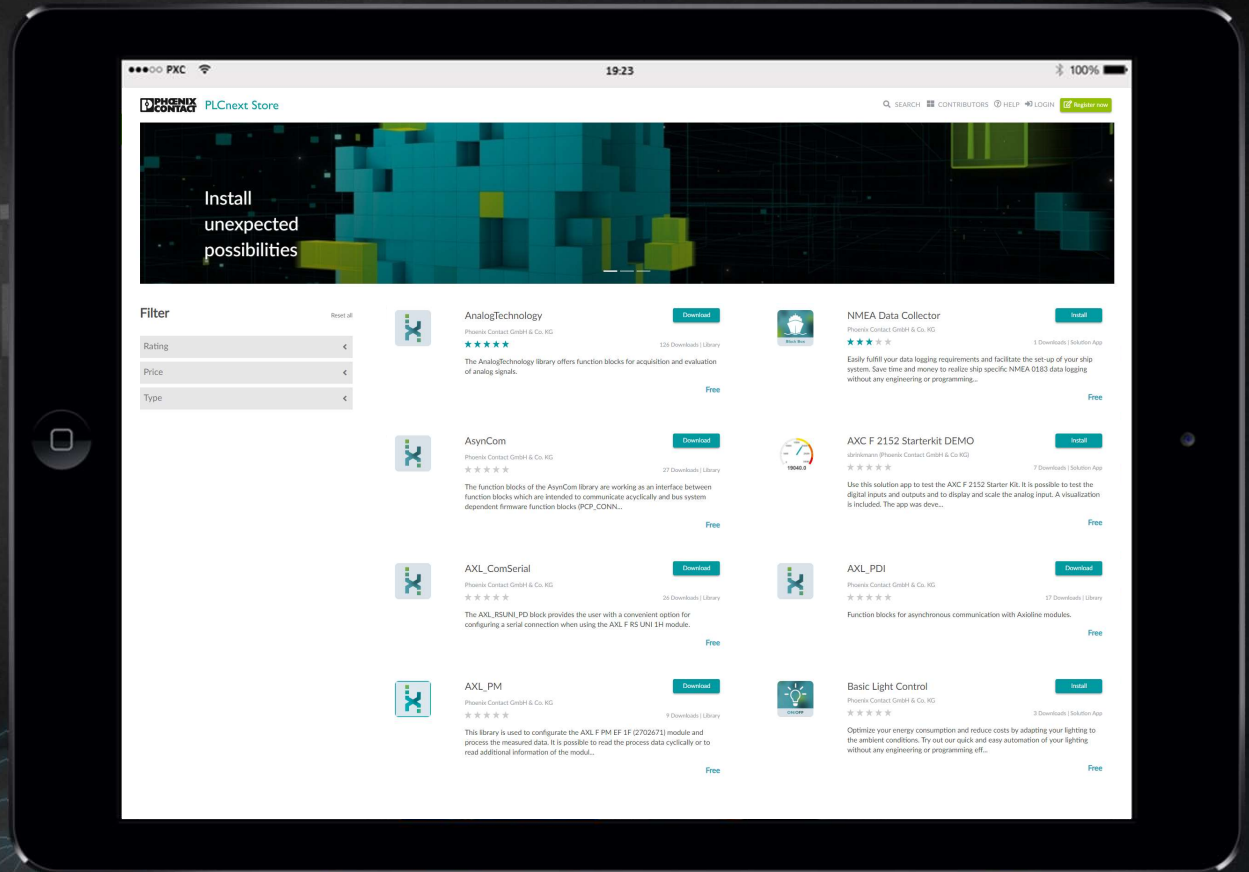
Application packages for industrial automation solutions



## Pump Station Example: Water Supply Well and high-level Tank

- **Pump station App for Wastewater**
- Complete solution app incl. visualization
- Turns the PLCnext Device into a ready-to-use pump station
- **App for water supply well and high-level tank**
- This App is used with a high-level tanks or wells
- Both are communicating with each other
- 2 PLCnext Controls

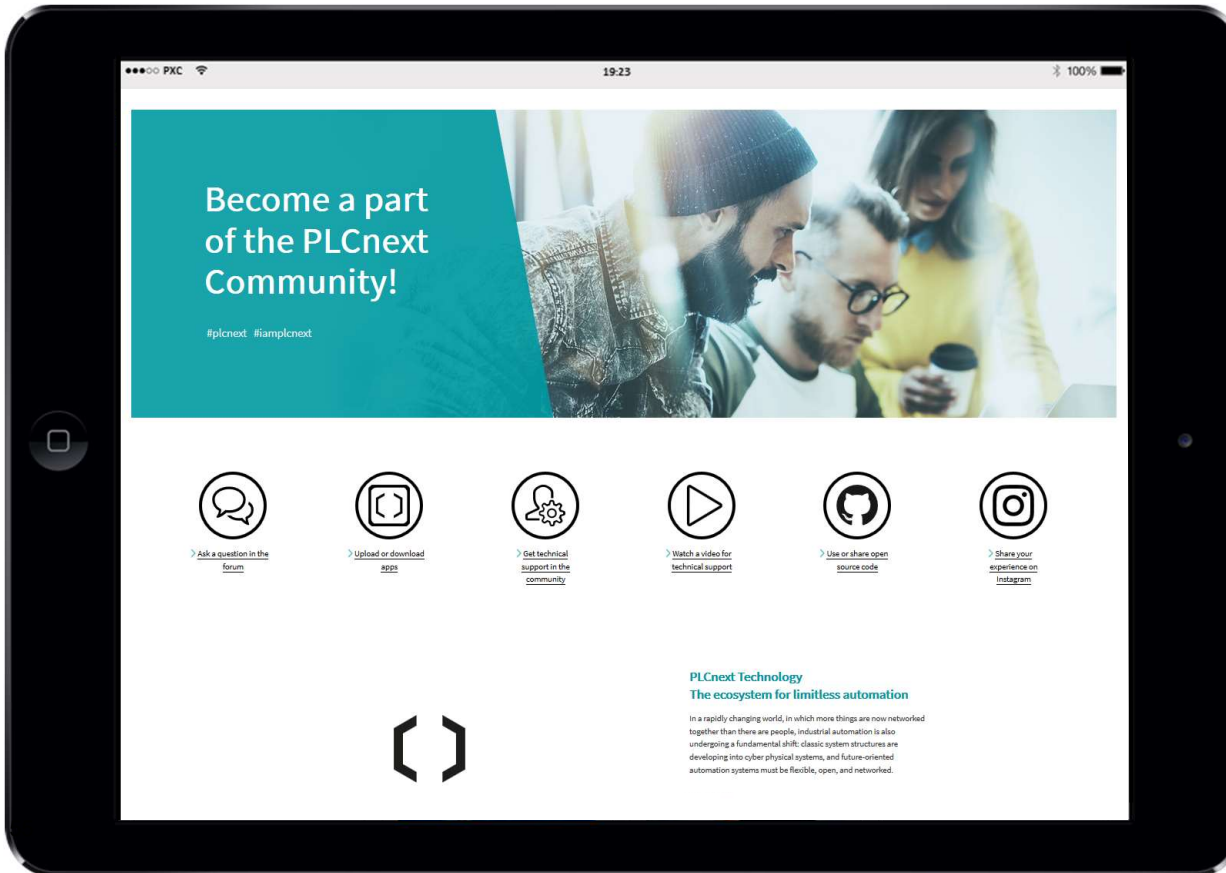




PLCnext Store – Digital Marketplace for Limitless Automation

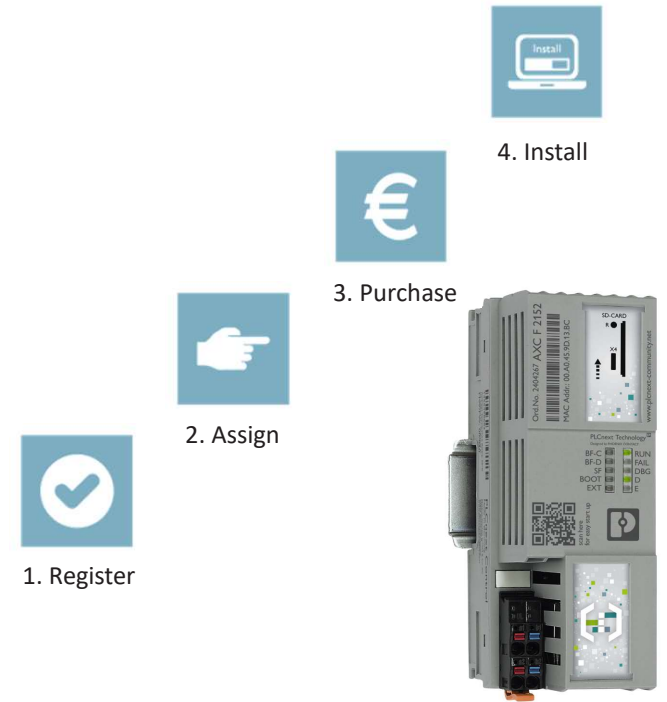
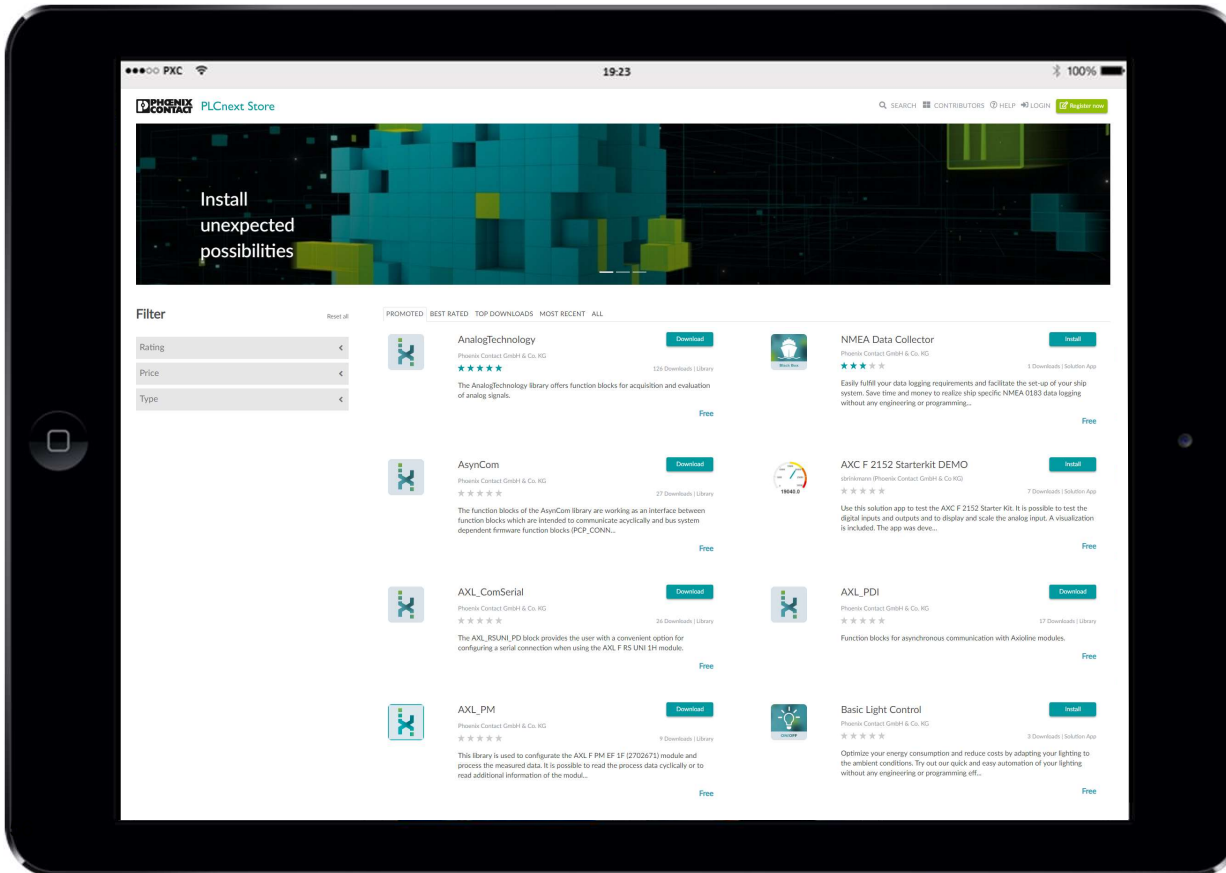
PLCnext Technology   
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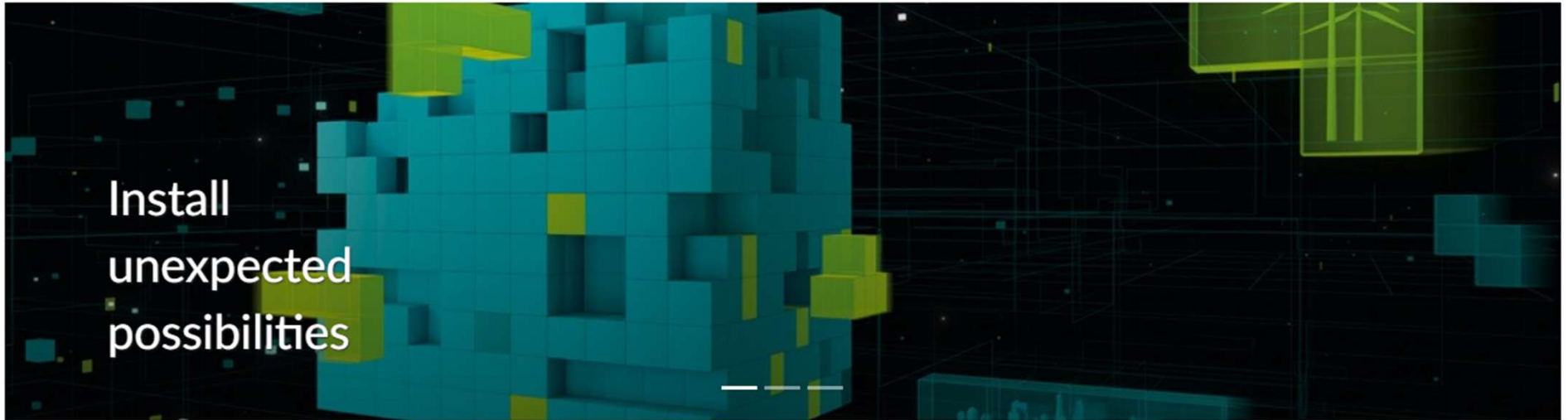
# Pump Station Example: Navigate to the PLCnext Store



PLCnext Store – Digital Marketplace for Limitless Automation

# Pump Station Example: Register and browse PLCnext Store





Install  
unexpected  
possibilities



### MLnext Framework

Get it

Phoenix Contact GmbH & Co. KG

NEW | Library

The MLnext Framework is an open-source framework for hardware independent execution of machine learning using Python and Docker. It also provides machine learning utilities for TensorFlow and Keras. T...

Free



# MLnext Framework

## by Phoenix Contact GmbH & Co. KG

Library | Version: 0.1.1

Price per License  
**Free - 0.00€**  
 Download this PLCnext Engineer library and import it to use in as many projects as you like. No license required.

**Install**  
no license required

**Download**  
import in PLCnext Engineer

**Contact**  
the app developer

### Description

The MLnext Framework is an open-source framework for hardware independent execution of machine learning using Python and Docker. It also provides machine learning utilities for TensorFlow and Keras. The corresponding Python package is called mlnext.

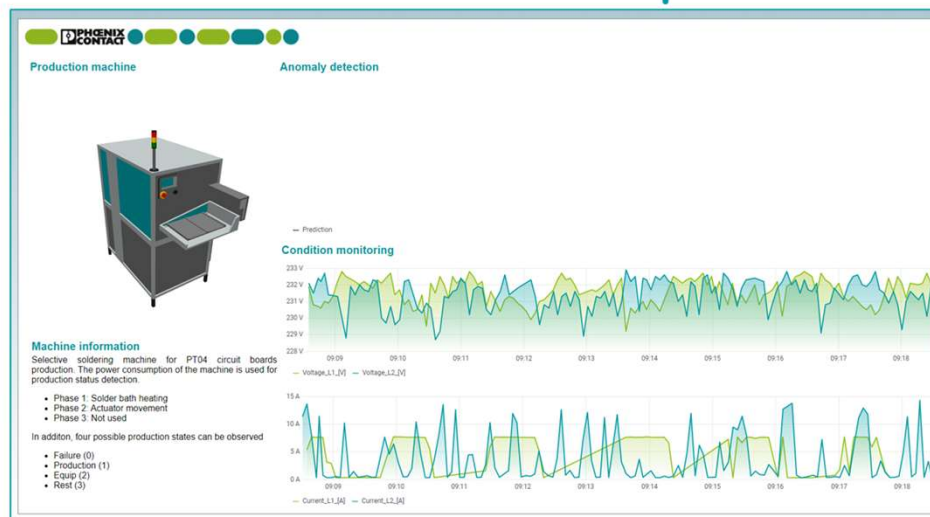
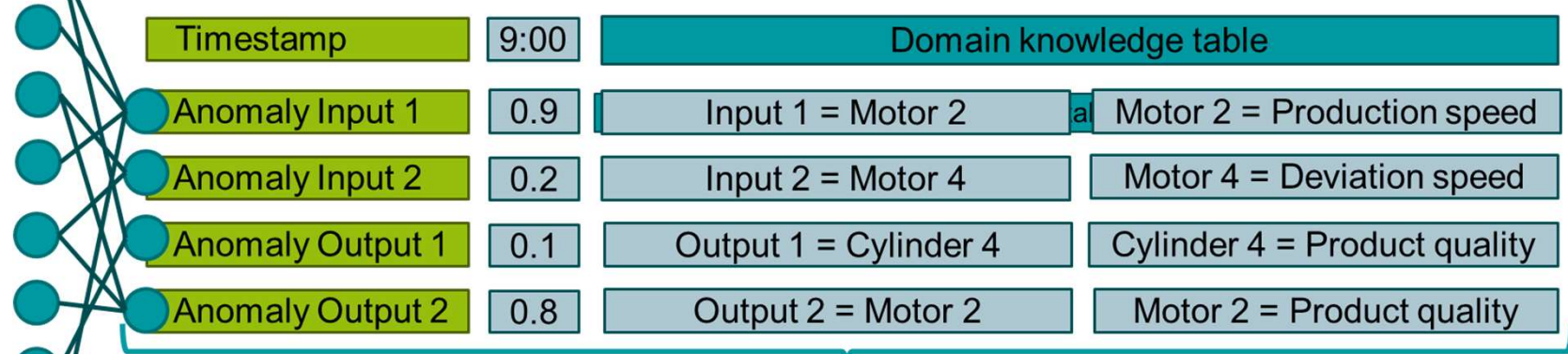
- The MLnext Framework consists out of 5 modules:
- For data loading and manipulation: import mlnext.data
  - For loading and saving files: import mlnext.io
  - For data preprocessing: mlnext.pipeline
  - For data visualization: mlnext.plot
  - For model evaluation: mlnext.score

It is part of the "Digital Factory now" campaign by Phoenix Contact Electronics to support the solution portfolio "Anomaly Detection".

**Support**

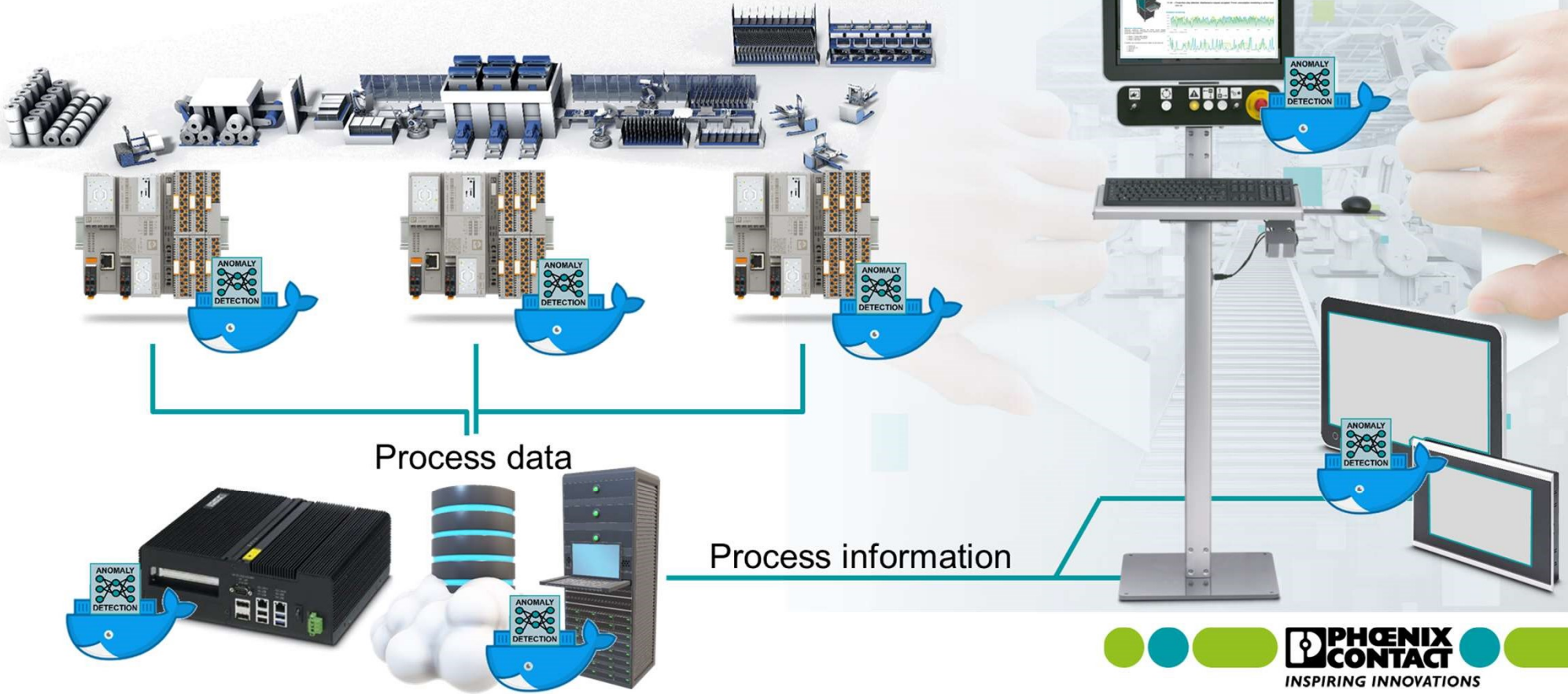
# Anomaly Detection

## Digital Factory now



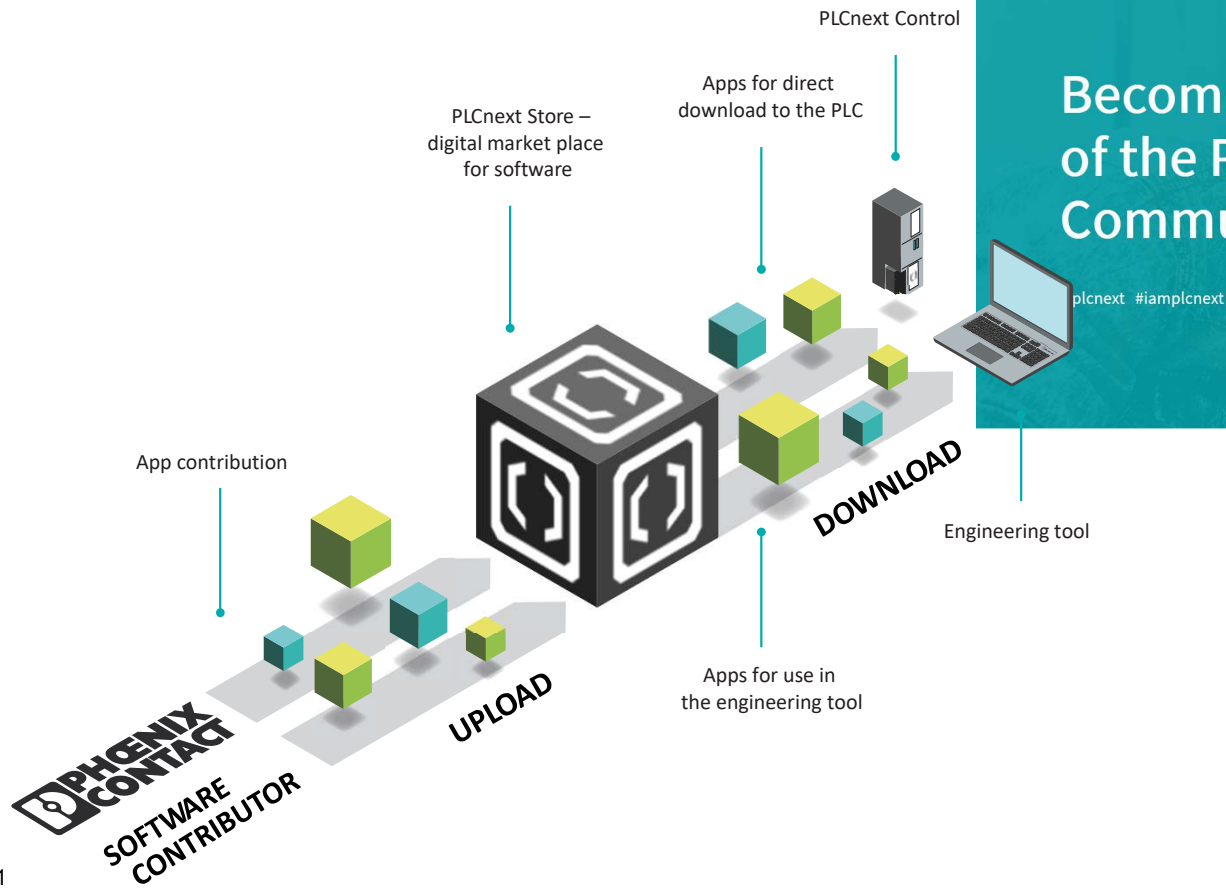
Data collection, storage and evaluation | Basic training

# Scalable topology



PLCnext Store – Digital Marketplace for Limitless Automation

# PLCnext Community



## Customer Journey for chargeable Apps

- The PLCnext Store provides various direct payment methods



- Customer journey for chargeable apps

1

Click

Buy



2

Choose payment method



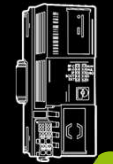
3

Check license pool



4

Activate license on PLCnext Control



Purchase option for chargeable Phoenix Contact App licenses via SAP under preparation (scheduled for Q4 2020)

PLCnext Ecosystem – PLCnext Store








# PLCnext Store


PLCnext Technology   
Designed by PHOENIX CONTACT



Ecosystem & PLCnext Store

# PLCnext Community – Global Exchange & Collaboration

<p>More about PLCnext Technology</p>  <p><a href="http://plcnextcommunity.com">plcnextcommunity.com</a></p>	<p>Upload or download apps</p>  <p><a href="http://plcnextstore.com">plcnextstore.com</a></p>	<p>Ask a question in the forum</p>  <p><a href="http://phoe.co/PLCnextForum">phoe.co/PLCnextForum</a></p>	<p>Watch and learn with tutorials</p>  <p><a href="http://phoe.co/PLCnextTutorials">phoe.co/PLCnextTutorials</a></p>
<p>Use or share open source code</p>  <p><a href="http://github.com/plcnext">github.com/plcnext</a></p>	<p>Share your experiences on Instagram</p>  <p><a href="https://www.instagram.com/plcnext">@plcnext</a></p>	<p>Get in touch on LinkedIn</p>  <p><a href="http://phoe.co/PLCnextLinkedIn">phoe.co/PLCnextLinkedIn</a></p>	<p>#PLCnext #IamPLCnext</p>



PLCnext Community

Join and get involved  
#IamPLCnext

Join and get involved

# PLCnext Community

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More about PLCnext Technology



[plcnextcommunity.com](https://plcnextcommunity.com)

Upload or download apps



[plcnextstore.com](https://plcnextstore.com)

Ask a question in the forum



[phoe.co/PLCnextForum](https://phoe.co/PLCnextForum)

Use or share open source code



[github.com/plcnext](https://github.com/plcnext)

Get in touch on LinkedIn



[phoe.co/PLCnextLinkedIn](https://phoe.co/PLCnextLinkedIn)

**#PLCnext**  
**#IamPLCnext**



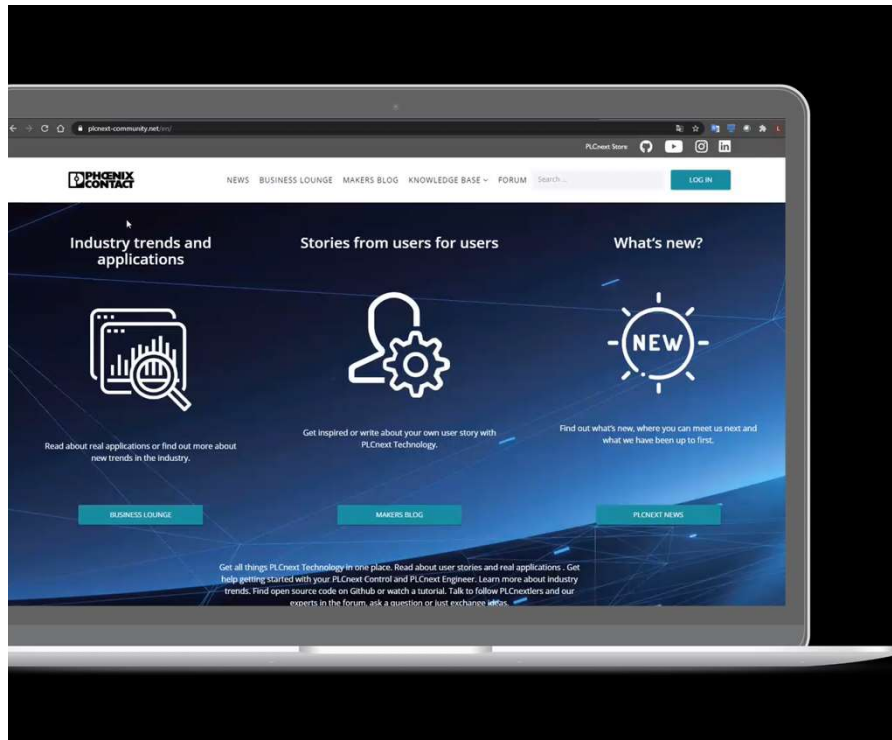
PLCnext Community

Join and get involved  
**#IamPLCnext**

PLCnext Technology

## PLCnext Community website

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The PLCnext Community website offers information, support and helpful resources:

- Forum
- FAQ
- Infocener
- MakersBlog
- Business Lounge

[plcnext-community.net](https://plcnext-community.net)

Join and get involved

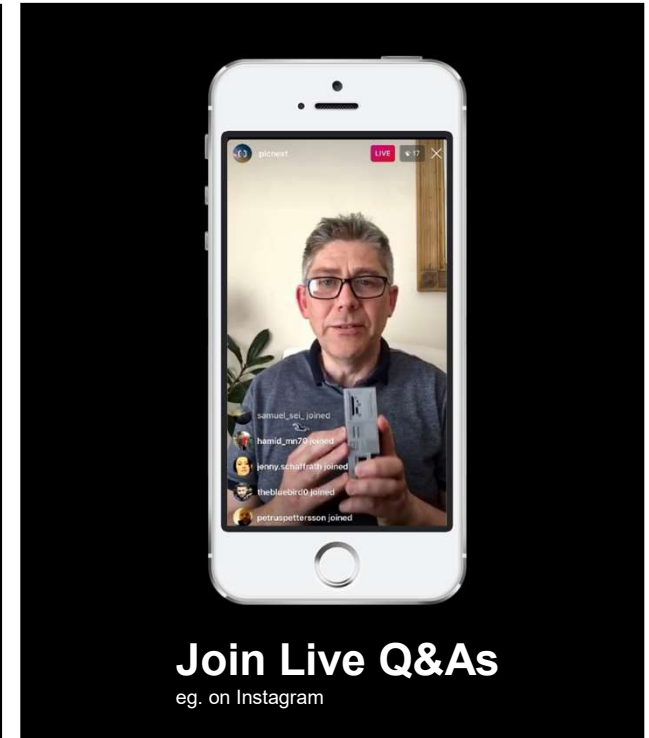
# PLCnext Community

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## Use GIPHY Brand Channel

Integration of PLCnext Technology branded Gifs and Stickers eg. On Instagram, Facebook, Snapchat, or Teams



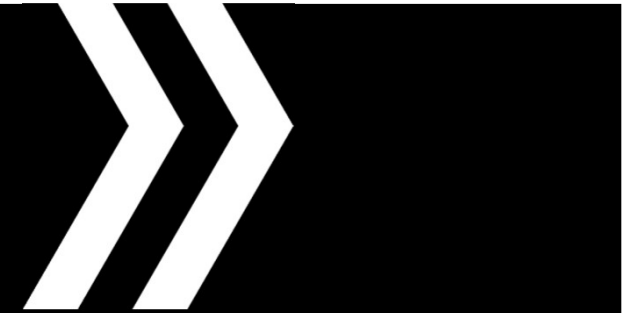
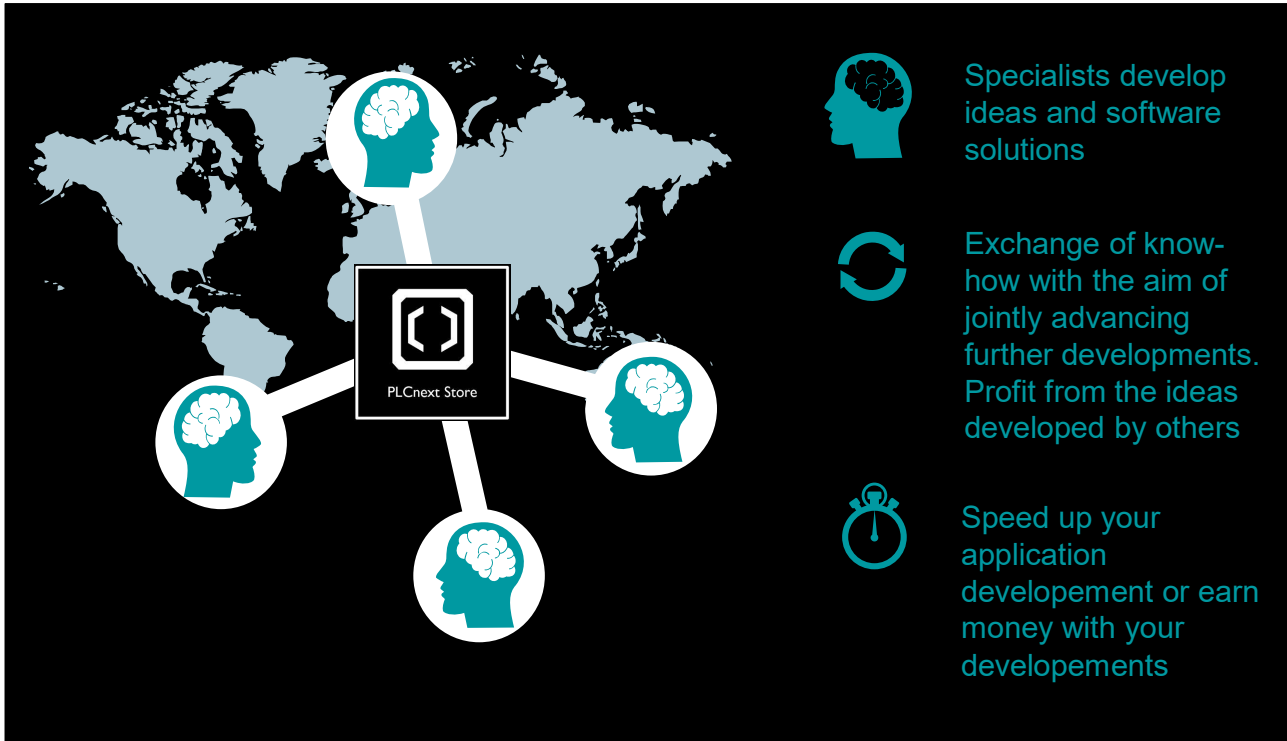
## Join Live Q&As

eg. on Instagram

PLCnext Ecosystem – PLCnext Community

## Benefit from Crowd Knowledge

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Market leadership requires speed

We need to make use of Crowd Knowledge



# Use AI in Manufacturing for Increased Productivity

Yuhang Guo

Senior Product Manager

Using AI in manufacturing for increased productivity by Google Cloud