



ISA Delhi Section

Setting the Standard for Automation™

Enhanced Connectivity

ISA-D: "Fertiliser , Food and Pharma Symposium-2019"

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ENHANCED CONNECTIVITY

NAMUR

User Association of Automation Technology in Process Industries

NAMUR is an international user association of automation technology in process industries. They have been representing the interests of their members for more than 65 years.

NOA – NAMUR Open Architecture

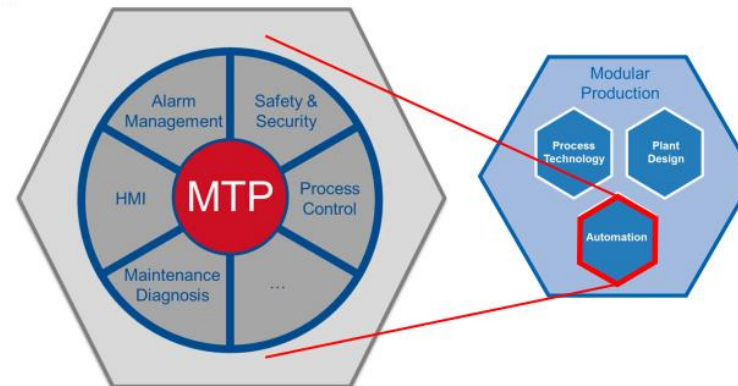


Enhancement of existing approaches as a baseline for the efficient and flexible utilization of Industrie 4.0 with the process industry

Modular Automation with MTP



Modular Automation with Module Type Package (MTP), a standardized non-proprietary description of modules for the Process Automation



5G in process industry

Access Conditions

The 5th generation of mobile radio will change wireless communications in the industry and is an enabler and accelerator of digital transformation. For the first time, mobile radio will be able to fully meet industry requirements.

NAMUR is currently in intensive communication with associations, industry users, politics and the Federal Network Agency, thereby ensuring that the requirements of the process industry are included in the development and implementation of 5G. NAMUR thus supports the future adequate and economic use of 5G technology in the industrial environment and actively shapes the path of digitization of the process industry.

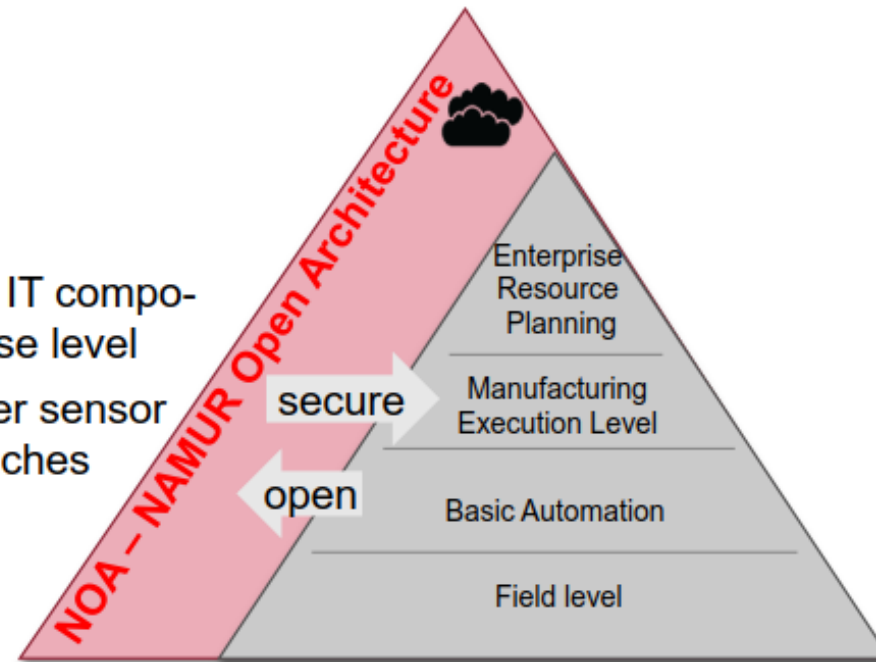


NOA – NAMUR Open Architecture



Enhancement of existing approaches as a baseline for the efficient and flexible utilization of Industrie 4.0 with the process industry

- Additive to existing structures
- Open for new approaches within Industrie 4.0
- Based on existing standards
- Simple integration of fast changing IT components from field level up to enterprise level
- Significant improvements of cost per sensor due to open and integrative approaches
- No risk of availability and safety of installed base



NOA – Namur Open Architecture

- The [NAMUR](#) Pyramid automation structure is generally accepted and supports long term reliability of operation. But these systems lack openness; new technologies are implemented with delays, and the costs are high. In view of the rapid developments in the Internet of Things, Industrie 4.0, mobile devices and big data, this obstructs innovations.
- The [NAMUR](#) Open Architecture ([NOA](#)) concept offers possibilities to enable innovative solutions for new and existing plants. The process control core remains largely unaffected. The basic idea is an open interface, e.g. OPC UA, between the existing core process control domain and the monitoring and optimization domain. Alternatively, a second communication channel can directly access information from existing field devices.

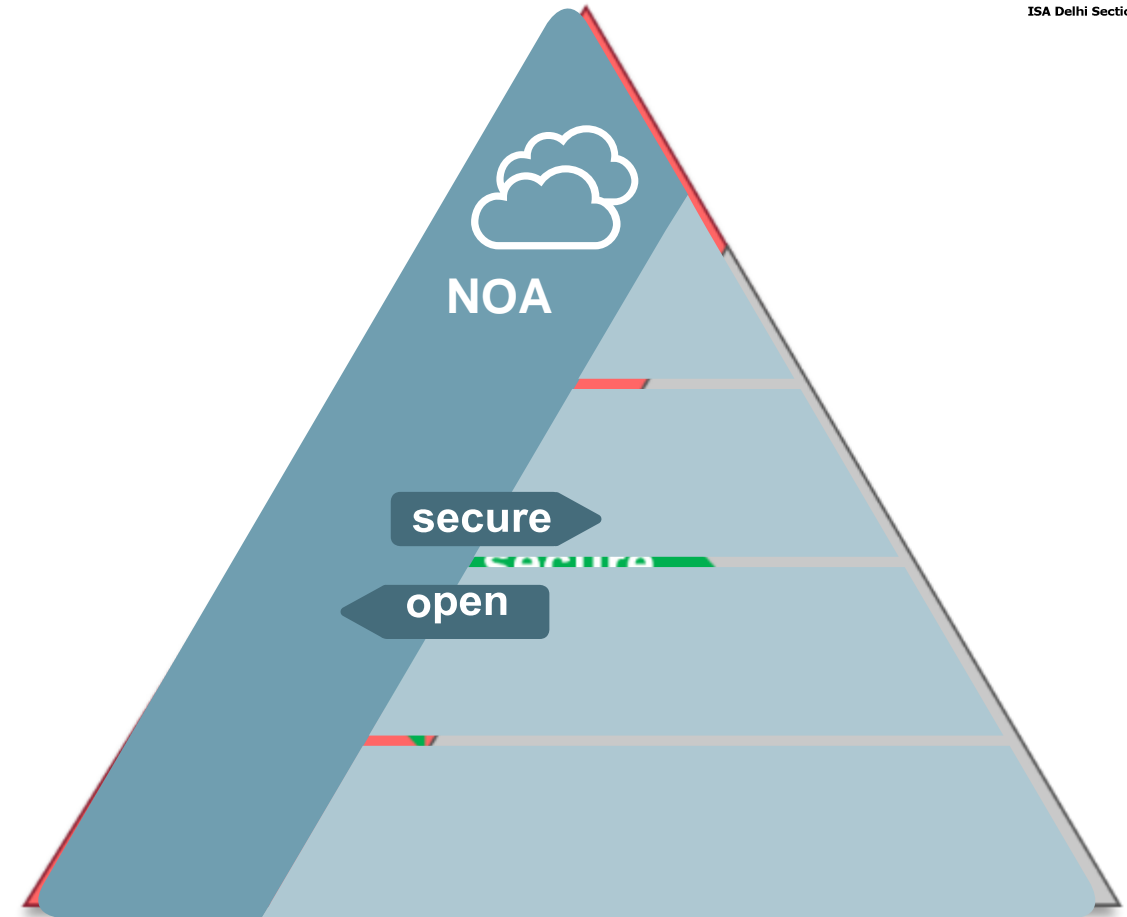
Dr. Jan De Caigny
BASF SE



NAMUR

OPEN

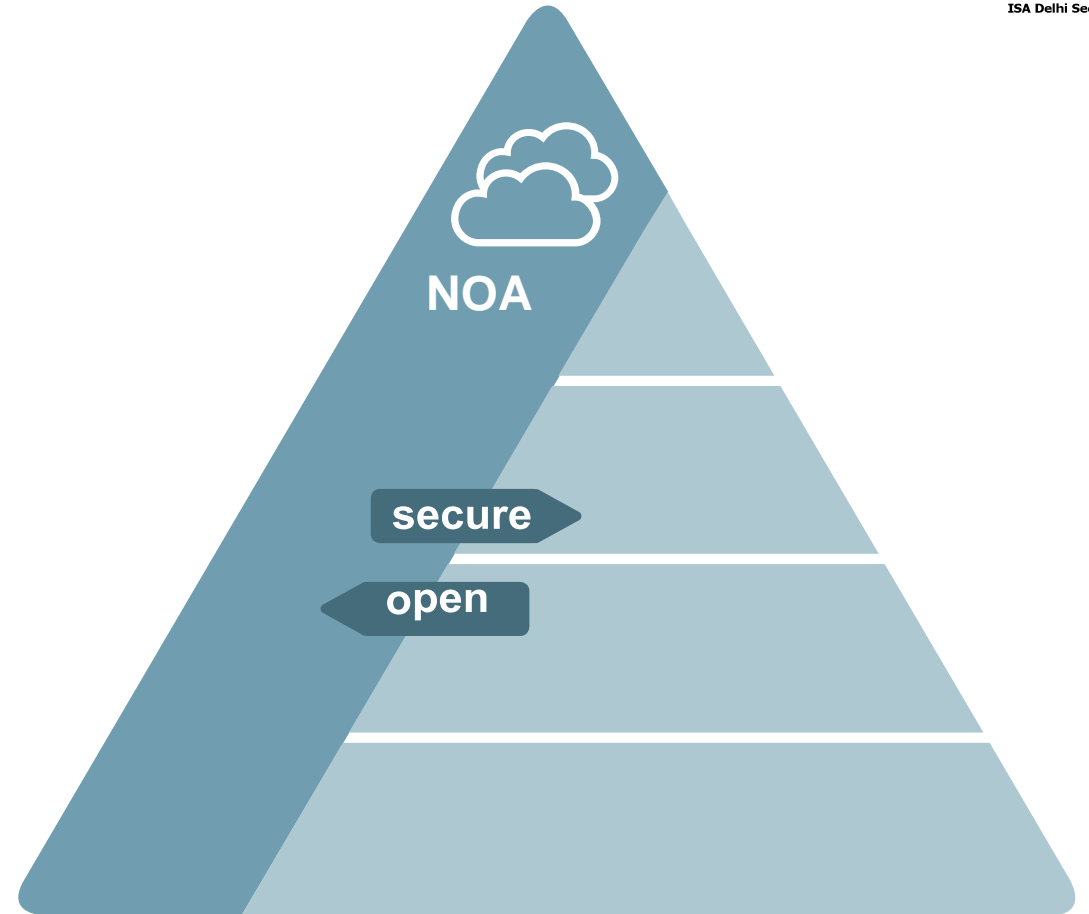
ARGUMENT
RATIONALE
CONTEXT
HISTORY
EVIDENCE
ASSUMPTIONS
RISKS
EFFECTS
TRENDS
ACTIONS
RESPONSIBILITIES
EVALUATION
CONCLUSIONS



NOA SOLUTION APPROACH



An open standard
Protocol-independent
Impact-free access

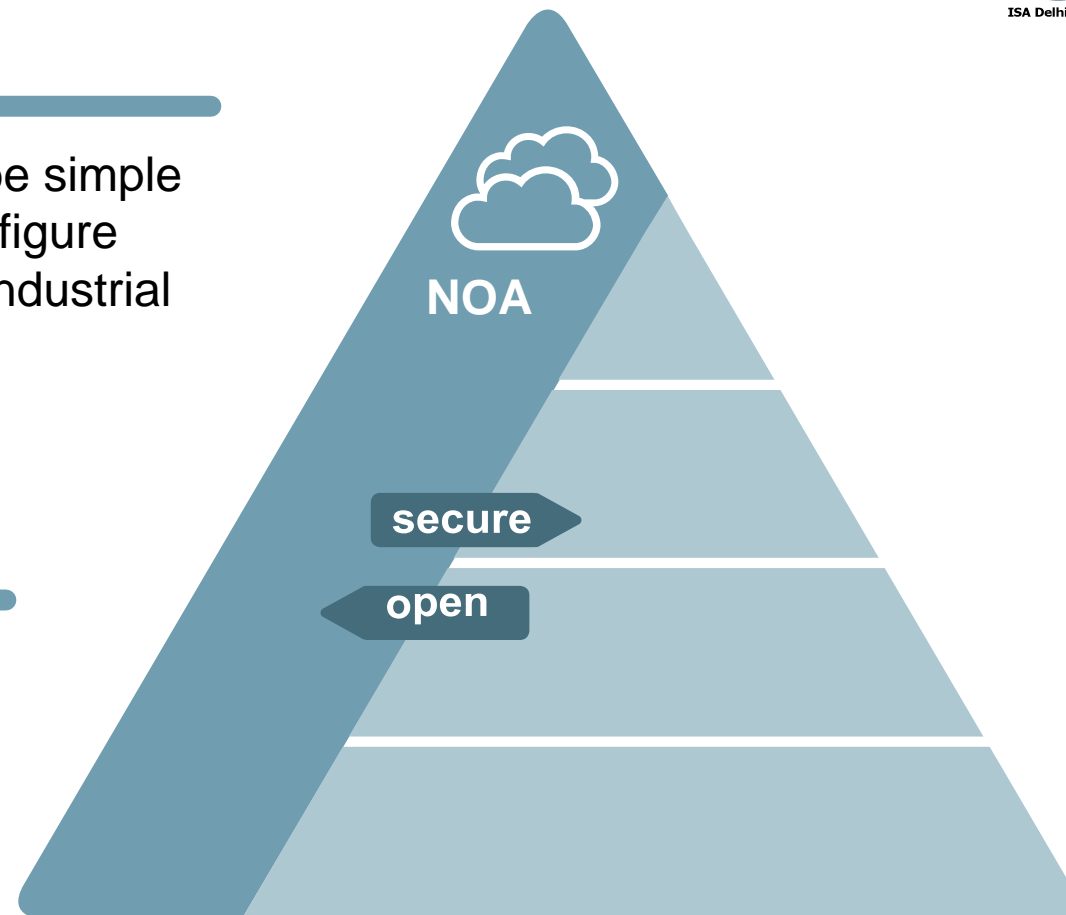


Putting NOA applications into practice

Hardware must be simple to install and configure and suitable for industrial applications

We need to create an impetus for innovation (new business model)

Encapsulating complexity (simple use of apps)



OPEN ARCHITECTURE ENHANCED CONNECTIVITY ECOSYSTEM



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Information processing

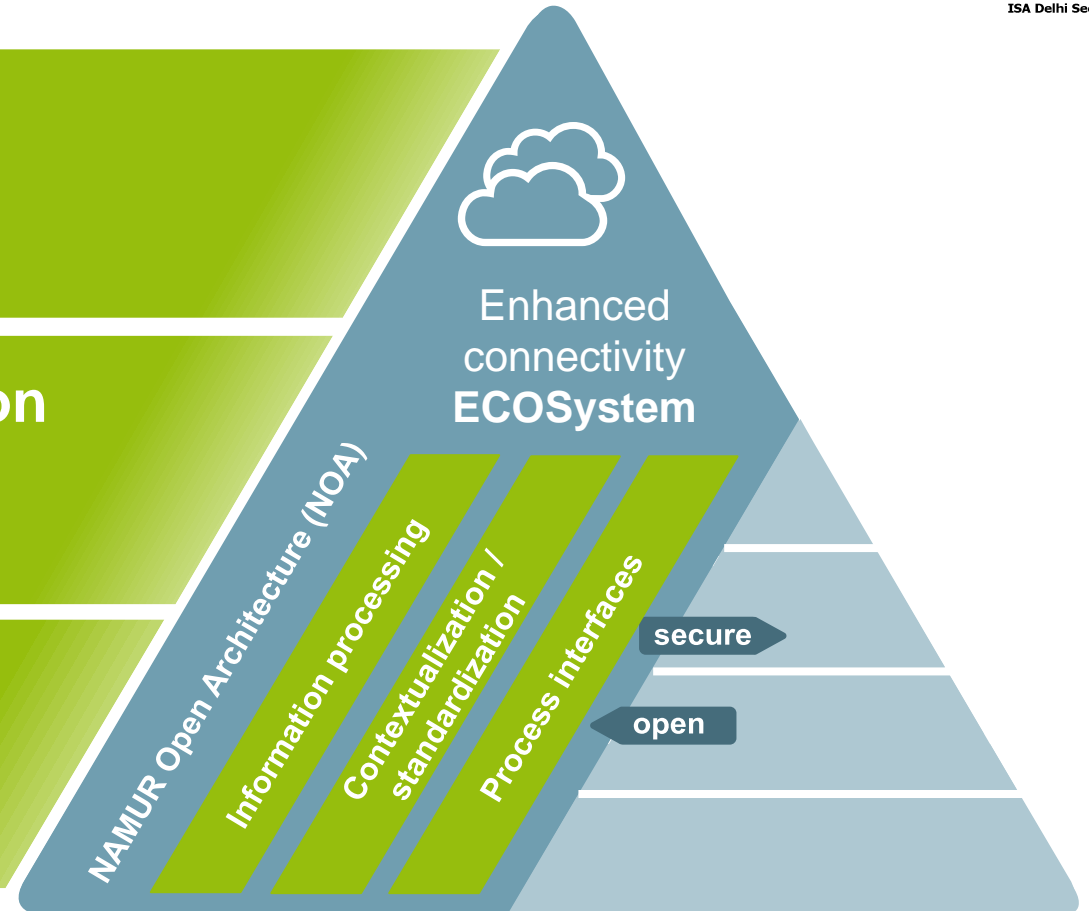
- Cloud connectors
- Apps / SaaS

Standardization & contextualization

- Standardize data formats
- Make reference / edge computing

Process interfaces

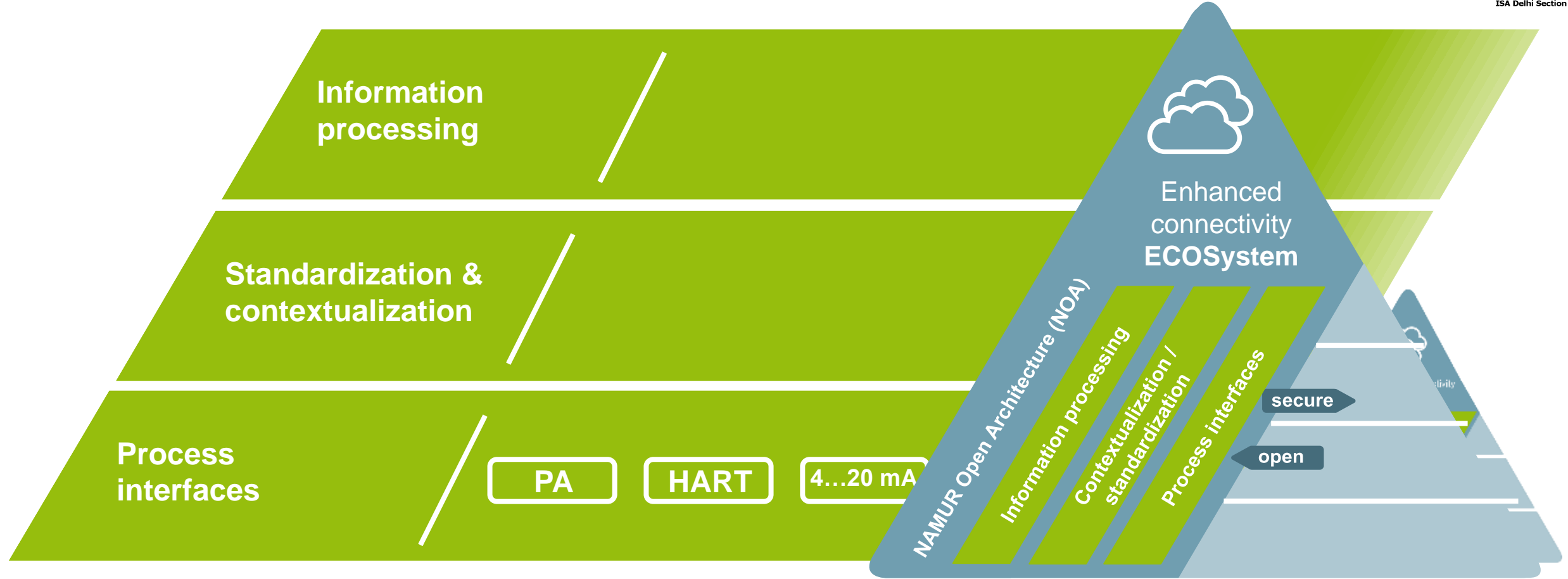
- Connection to field signals
- Impact-free / safety / security



OPEN ARCHITECTURE ENHANCED CONNECTIVITY ECOSYSTEM



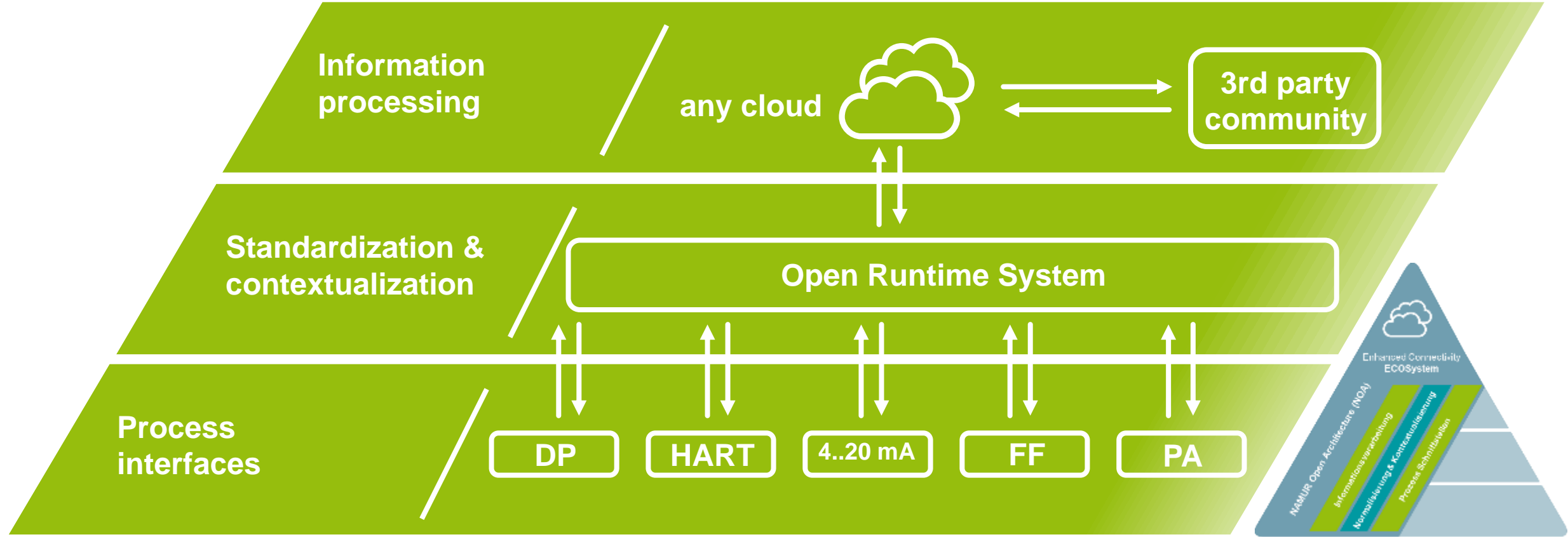
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OPEN ARCHITECTURE ENHANCED CONNECTIVITY ECOSYSTEM



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REAL

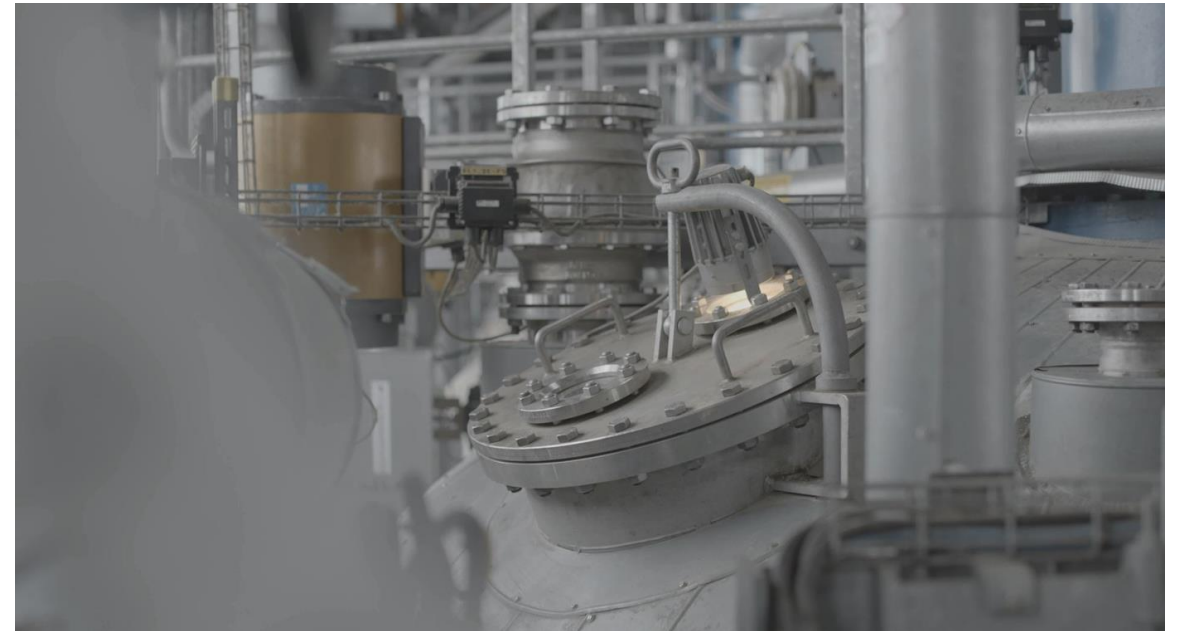
APPLICATIONS

Use Case



Task

- Early detection of a defect on the mixer
 - Pilot project: BASF
- Object: Mixer integrated in a reactor, incl. two downstream mixers in processing tanks.
 - Basic chemical for foamed material production
 - Reactor: height: approx. 12 m, diameter: 4 m
 - Motor for mixer drive: 1 x 250 kW, 2 x 90 kW



#EnhancedConnectivity – Monitoring of Rotating Equipment

Task

- Identified weak points of the mixer:
 - Motor
 - Gearbox
 - Upper shaft sealing
 - Footstep bearing



#EnhancedConnectivity – Monitoring of Rotating Equipment

Task

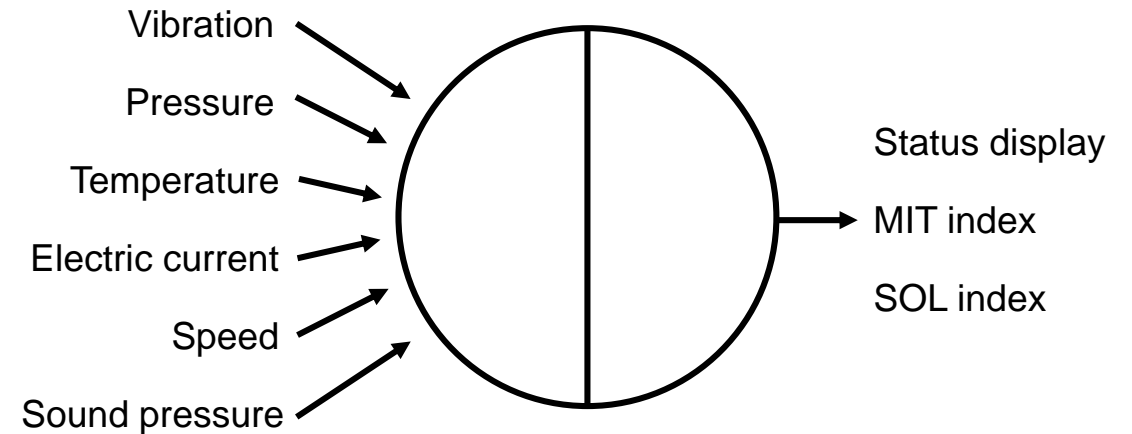
- Impacts of a defective footstep bearing:
 - Long downtimes
 - Long procurement times
 - High effort
 - Subsequent systems also stand still



#EnhancedConnectivity – Monitoring of Rotating Equipment

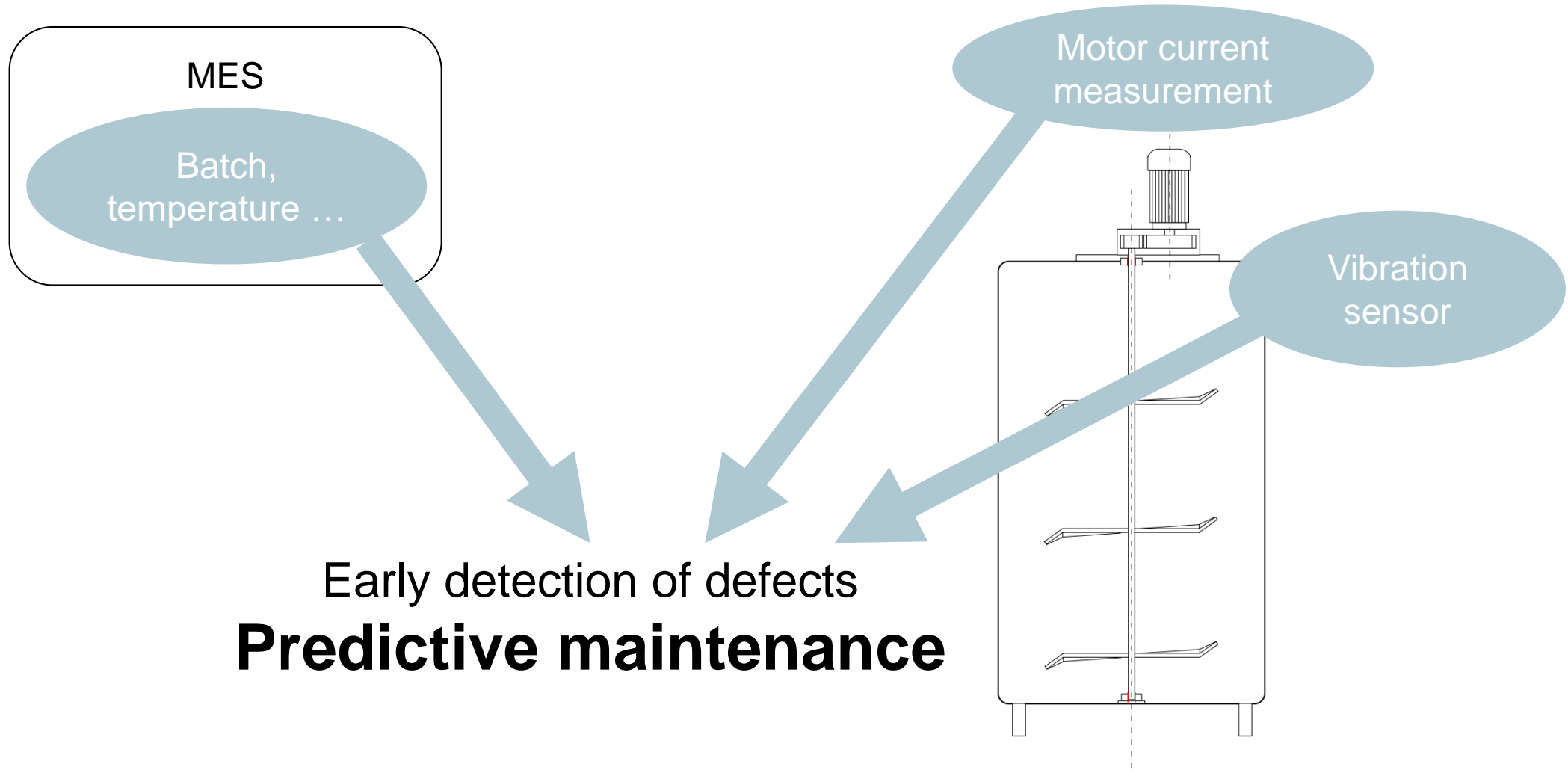
Analysis: Monitoring, but how?

- We need data!
 - Motor?
 - Bearing?
 - Context information?
- Prediction model / Algorithm
- Non/Minimally invasive architecture
- Ex area



#EnhancedConnectivity – Monitoring of Rotating Equipment

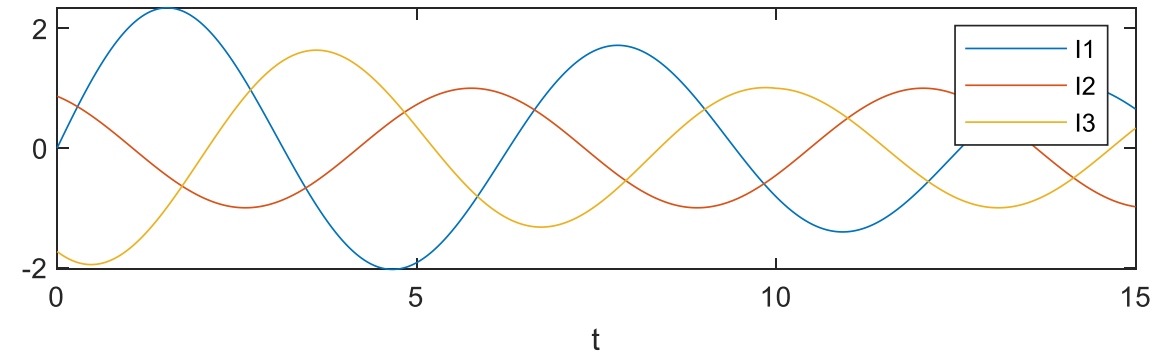
Analysis: Monitoring, but how?



#EnhancedConnectivity – Monitoring of Rotating Equipment

Modeling level 1

- Without context information
- Maximum value monitoring
- Phase balance



Williamson & Smith 1982, Thomson & Fenger 2001, Kliman & Stein 2007

Modeling level 2



- With context information

- Monitoring model (complex)

- Combination of generalized moments + frequency approach (according to Lahdelma & Juuso, 2011)
 - Function still to be created
 - Derivations allow for conclusions

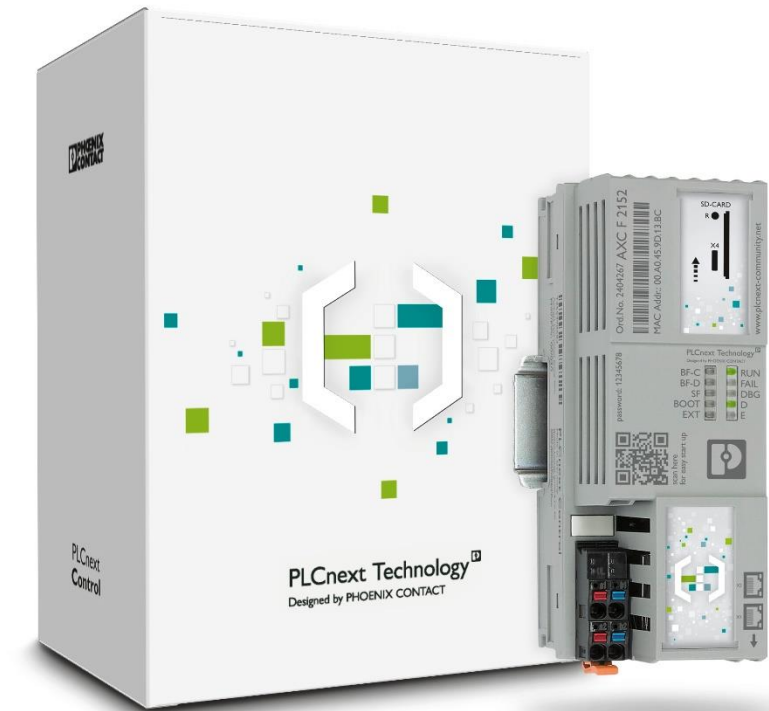
$$\| \tau M_{\alpha}^{\rho} \|_{\rho} = \left(\tau M_{\alpha}^{\rho} \right)^{1/\rho} = \left(\frac{1}{N} \sum_{i=1}^N |x_i^{(\alpha)}|^{\rho} \right)^{1/\rho}$$

(Lahdelma & Juuso, 2011)

#EnhancedConnectivity – Monitoring of Rotating Equipment

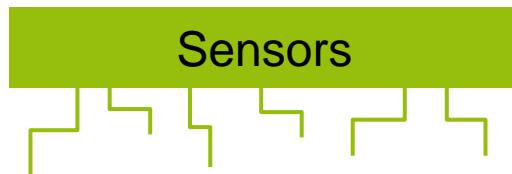
Developing a solution strategy

- ✓ Flexible engineering platform
- ✓ Connection to the simulation
- ✓ Evaluation of sensors
- ✓ Possibility to make data available



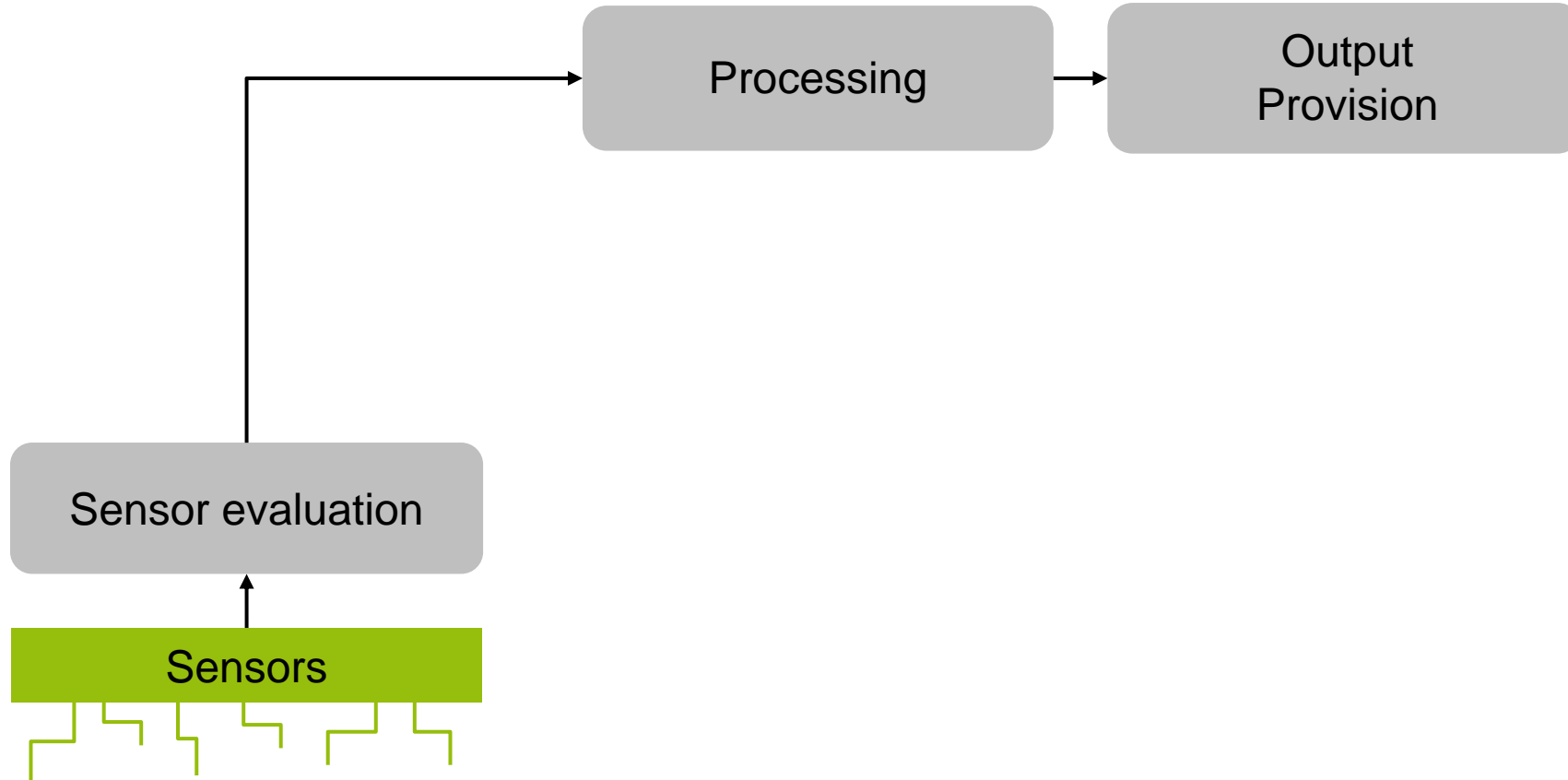
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy



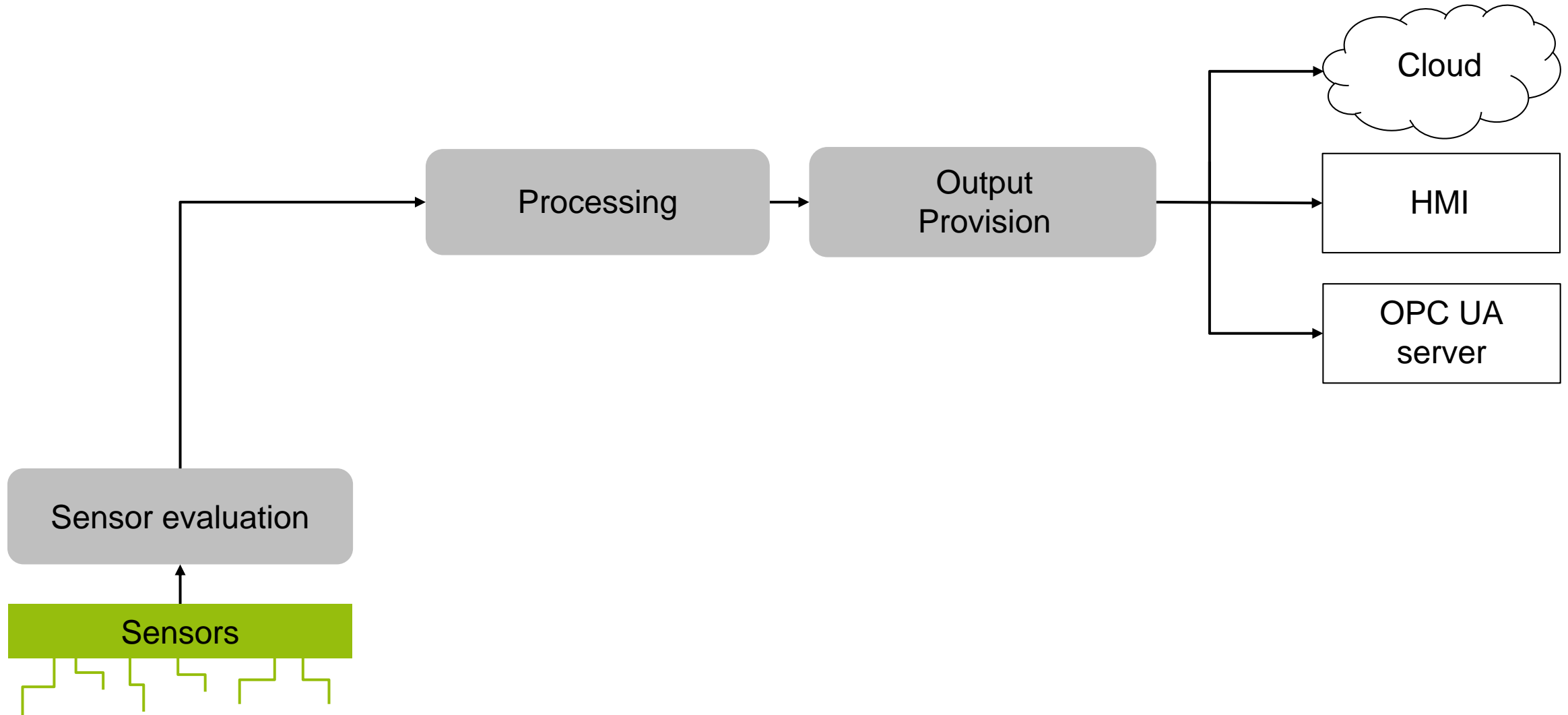
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy



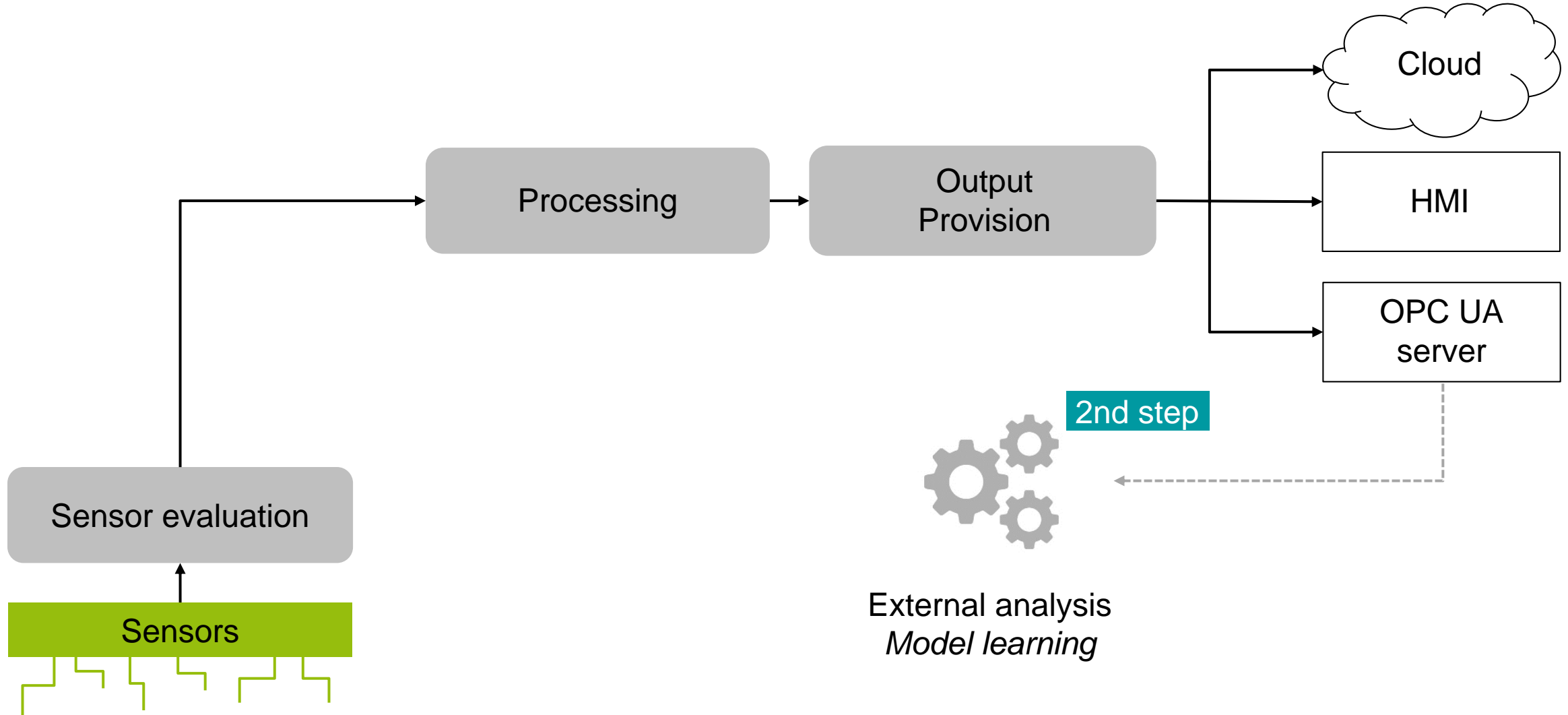
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy

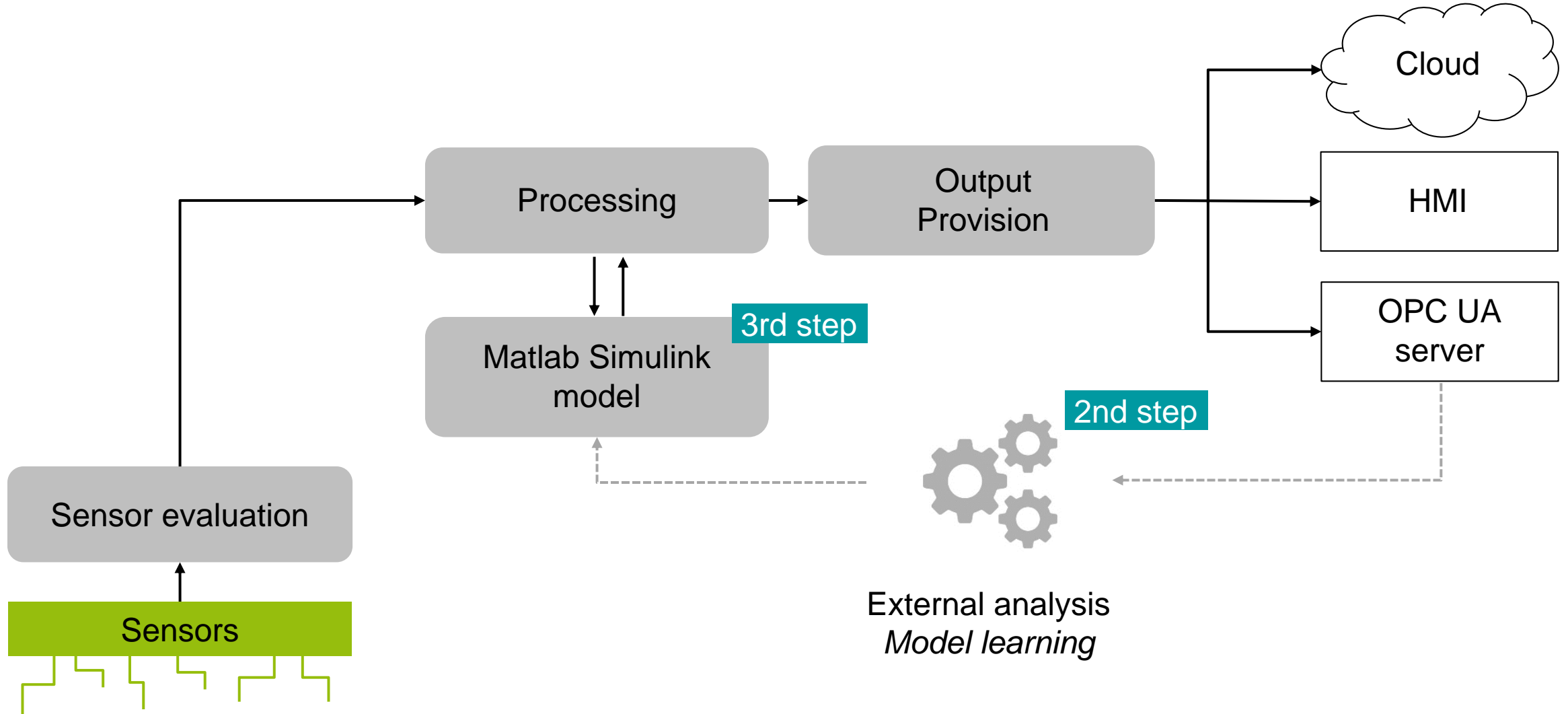


#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy

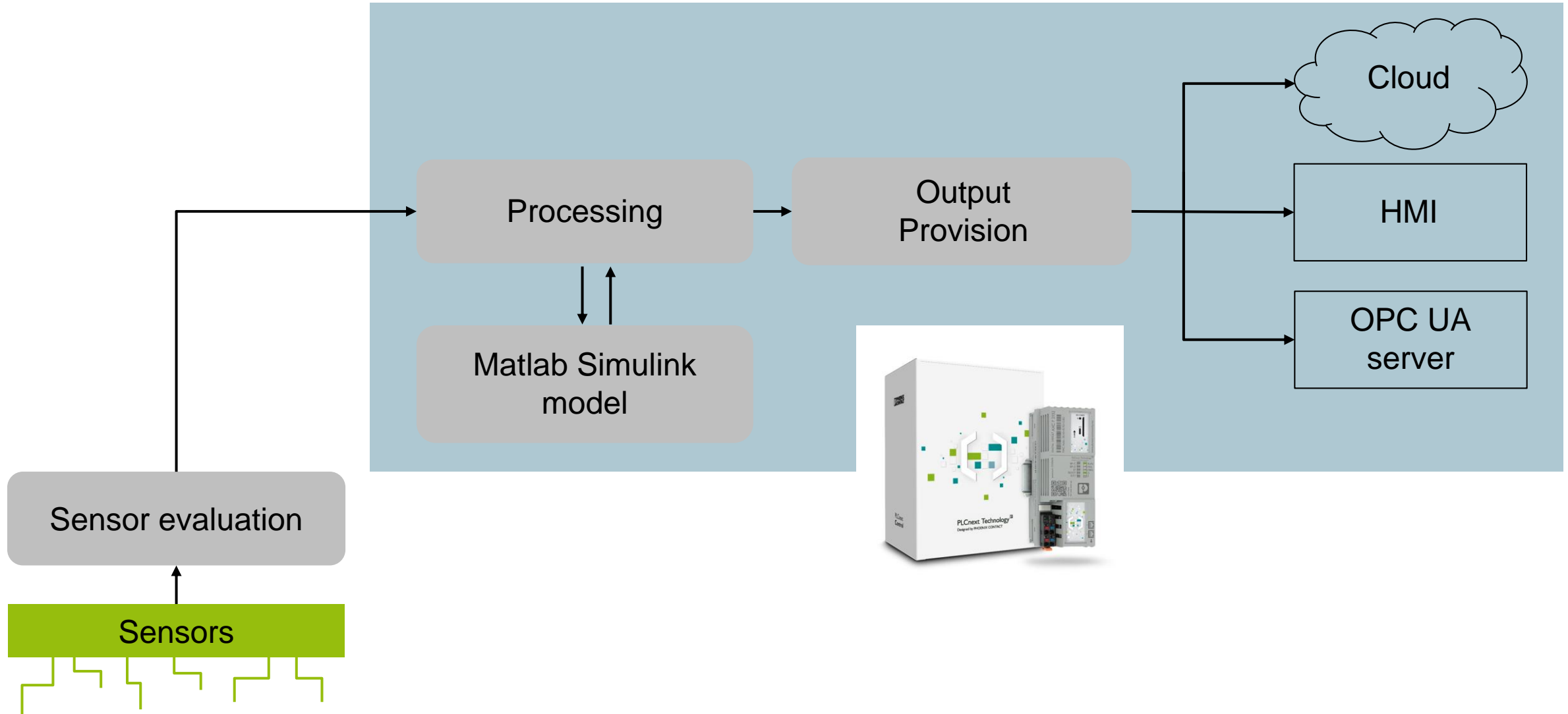


Developing a solution strategy



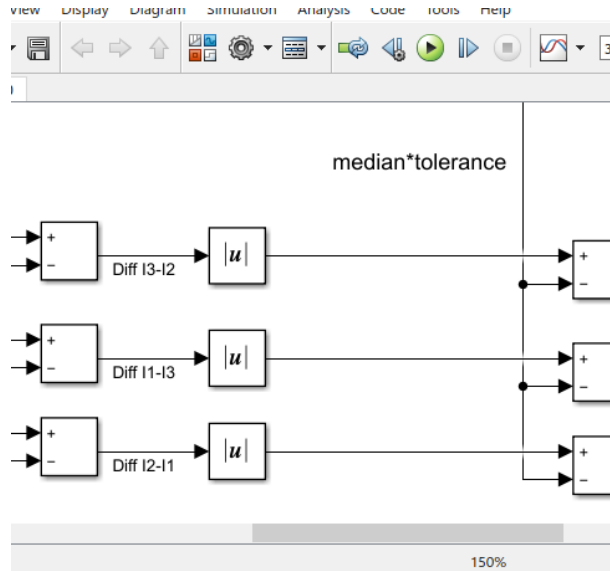
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy



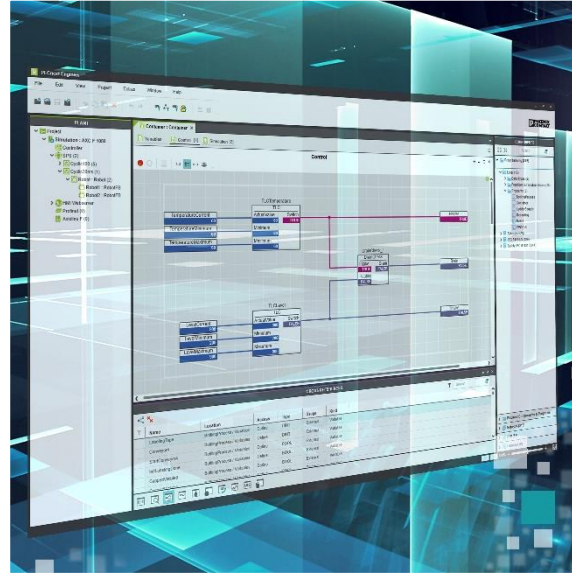
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy



Implementation

Model development
in Matlab Simulink



Build

Target for PLCnext



Integration

Integration into
the control project

Developing a solution strategy

Motor-Overview 11.10.2019 9:38:09

M001	M002	M003
Status: Off	Status: Running	Status: Running
Behavior: normal	Behavior: unnormal	Behavior: unnormal
Show Details	Show Details	Show Details

Profinet-Status
 Valid Data
 Profinet Status

M001
M002
M003
9:37:46

Name:

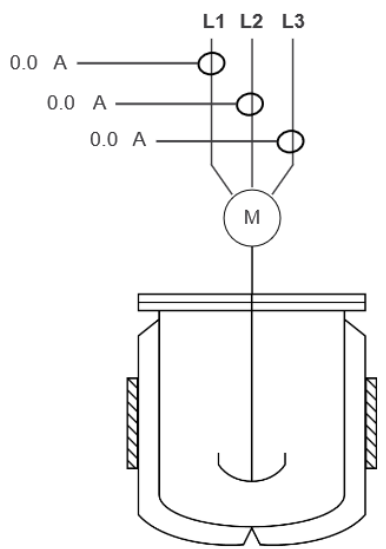
Status: Off

Behavior: normal

conversion factor:

 primary side
 secondary side

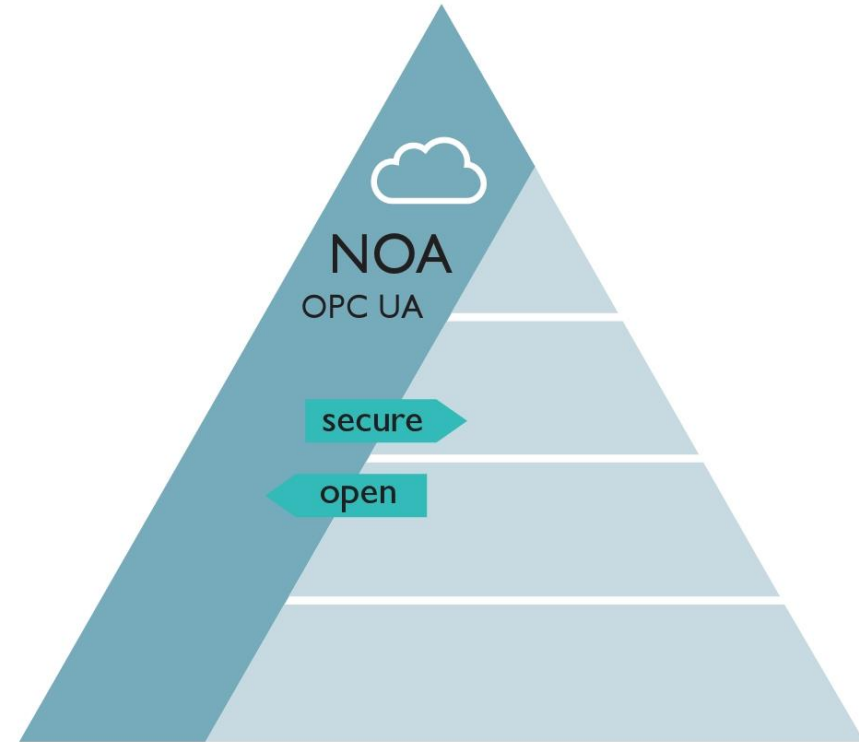
Errors:



#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: Practical implementation

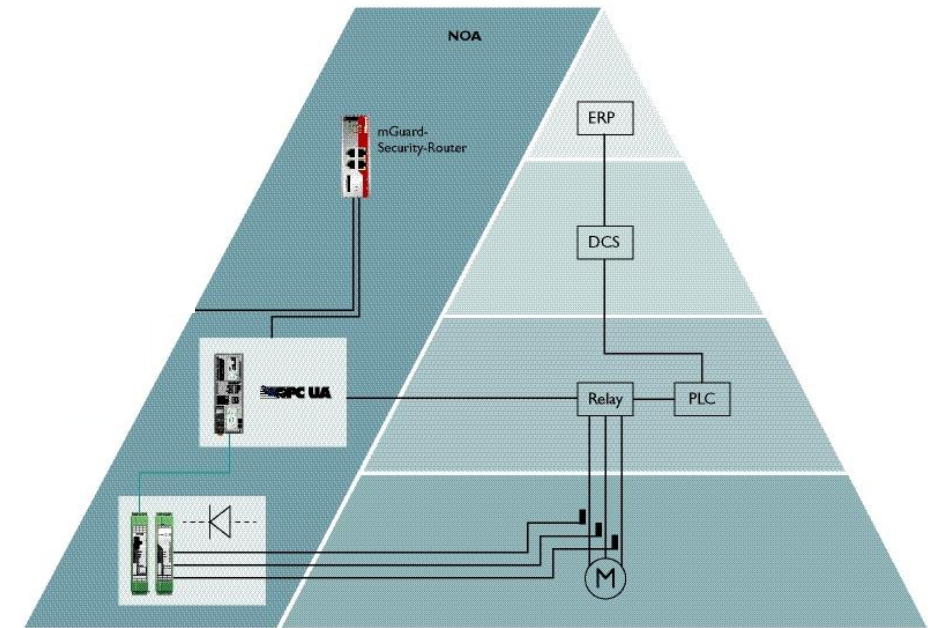
- Implementation as regards control technology:
 - NOA



#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: Practical implementation

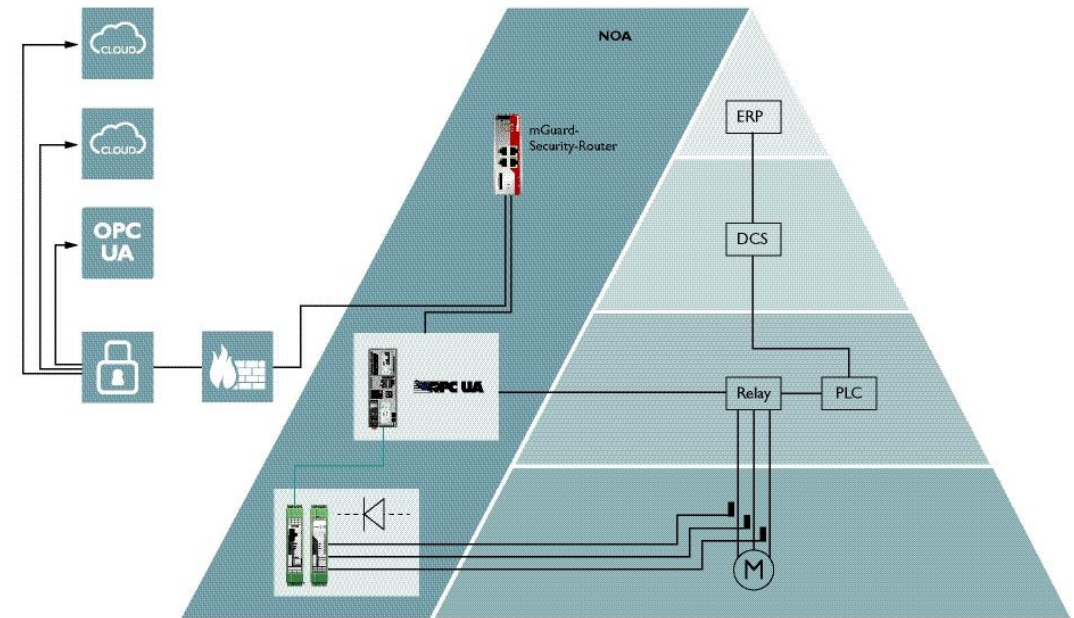
- Implementation as regards control technology:
 - NOA
 - Subsequent installation with as little interference with the existing systems as possible



#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: Practical implementation

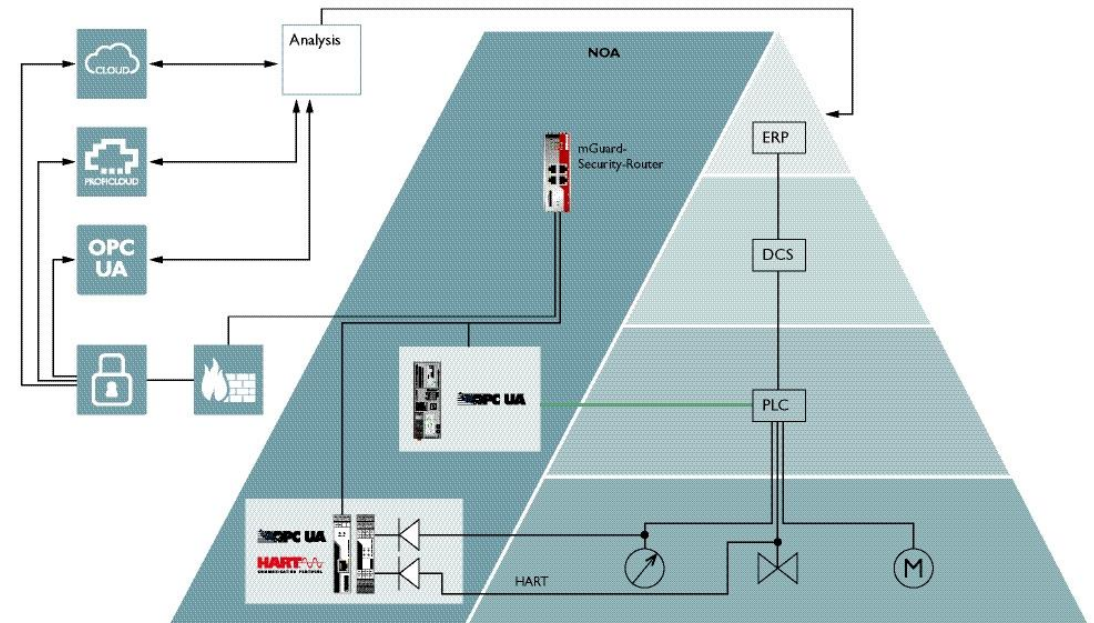
- Implementation as regards control technology:
 - NOA
 - Subsequent installation with as little interference with the existing systems as possible
 - Secure
 - OPC UA
 - Cloud on premise --> Cloud
 - Cloud off premise



#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: Practical implementation

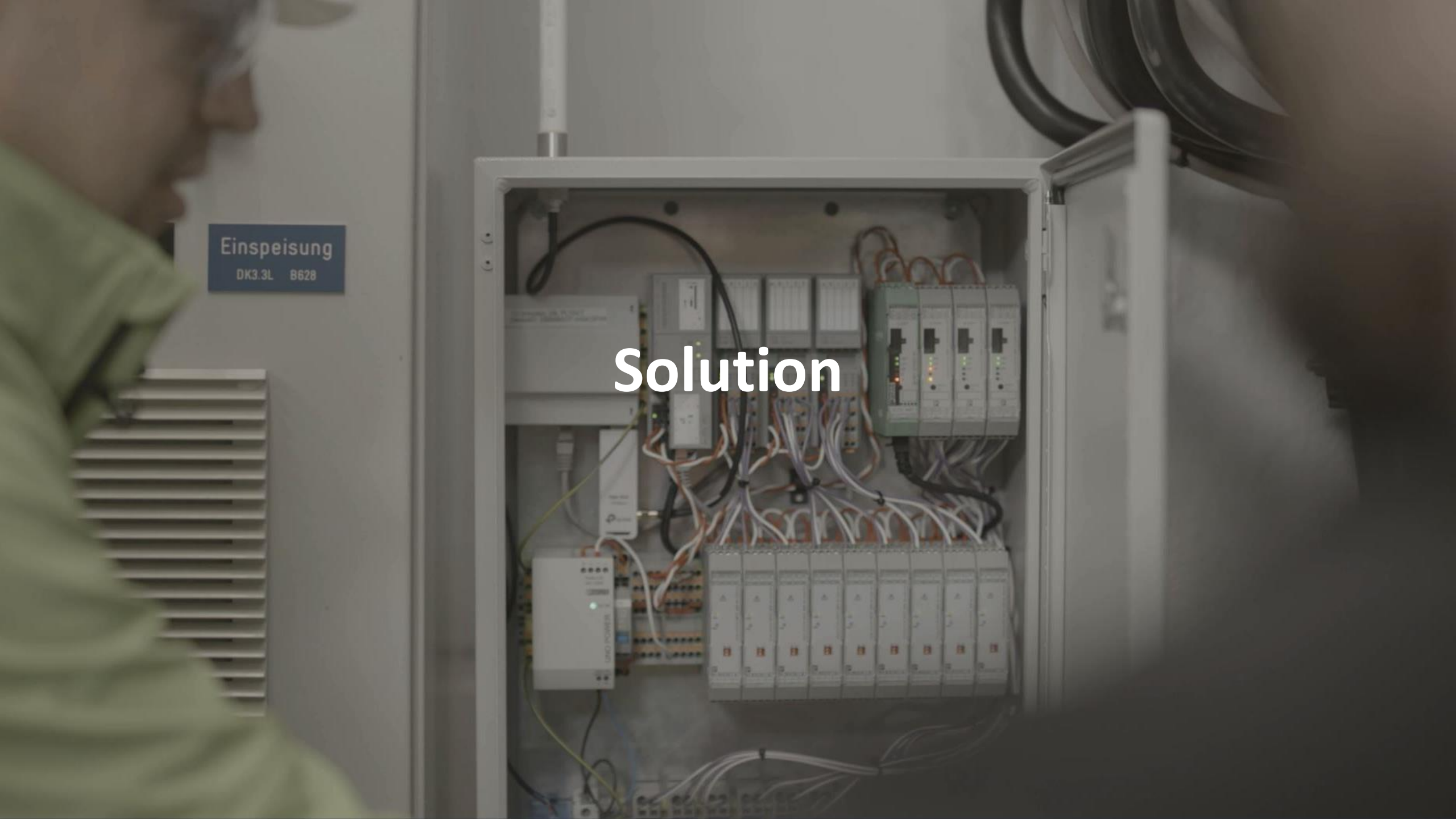
- Implementation as regards control technology:
 - NOA
 - Subsequent installation with as little interference with the existing systems as possible
 - Secure
 - OPC UA
 - Cloud on premise --> Cloud
 - Cloud off premise
 - Flexible, modular, and mobile use



Einspeisung

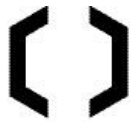
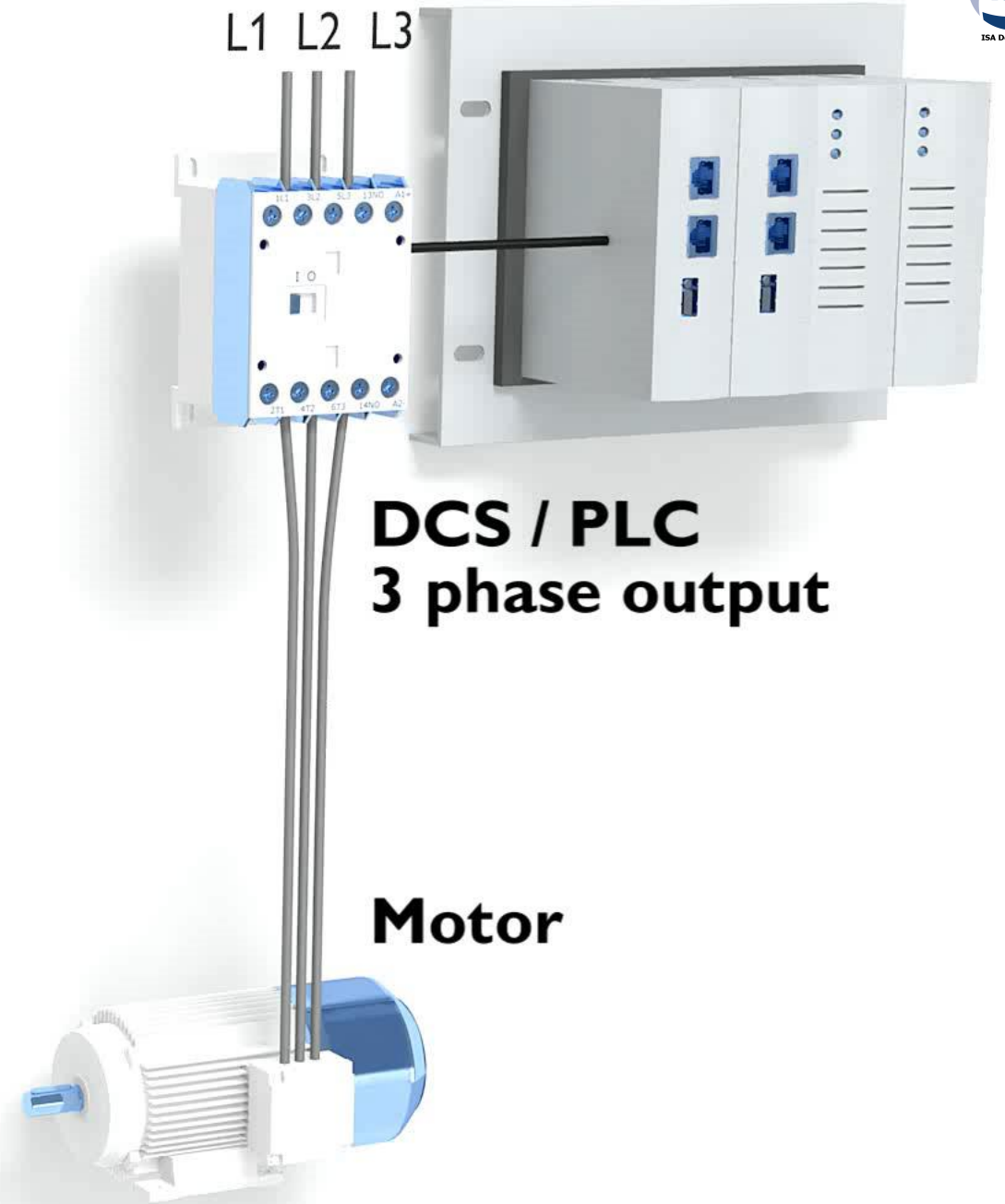
DK3.3L B628

Solution



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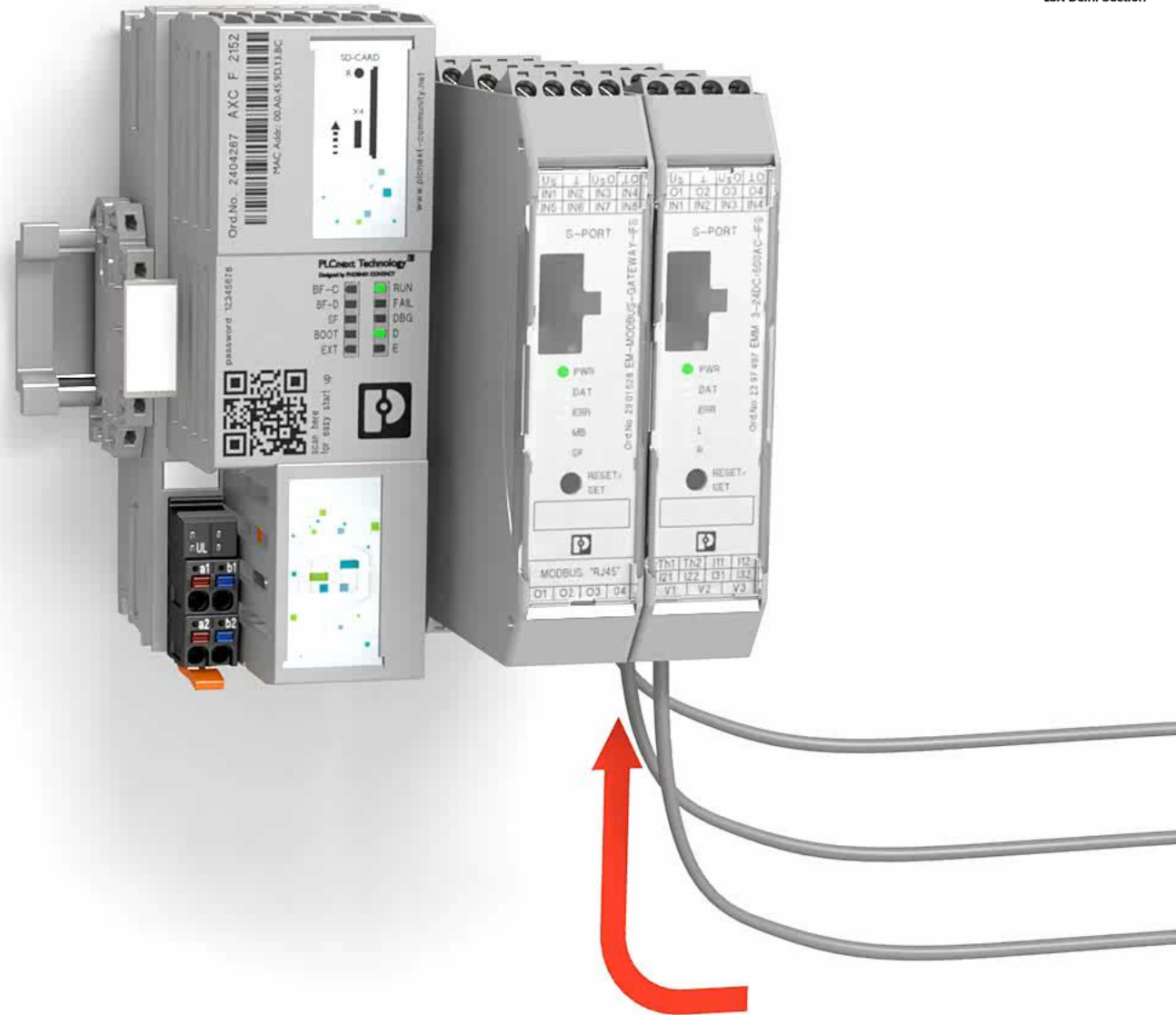
Solution: Motor manager



PLCnext TechnologyTM
Designed by HUBNER CONTACT

#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: PLCnext Controller



Electrical power



PLCnext TechnologyTM
Designed by HUBNER CONTACT

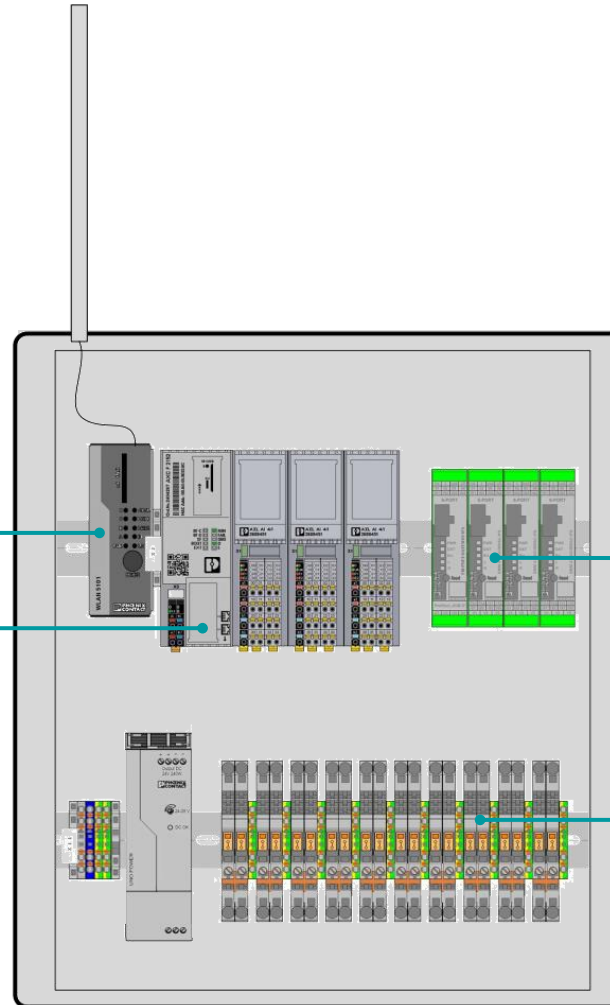
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Solution: Control cabinet



PLCnext controller with OPC UA server
(NOA ready, PA DIM compliant, secure)

Security router
(LAN/WLAN)

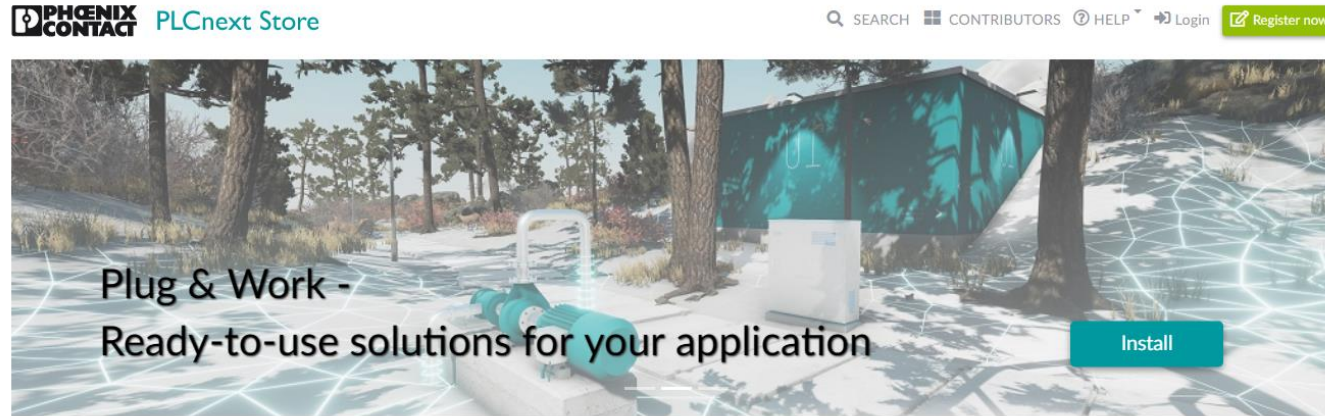


Motor manager for acquiring motor currents via split core current transformers

Test disconnect terminal blocks for split core current transformers

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Solution: PLCnext Store



PHOENIX CONTACT PLCnext Store

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Node.js v10.15.3 LTS

Phoenix Contact GmbH & Co. KG


★★★★★

71 Downloads | Runtime

Node.js runtime version 10.15.3 LTS for the controller AXC F 2152. This app installs the Node.js prebuilt package for armv7l. This includes npm version 6.4.1. Node.js is a trademark of Joyent, Inc. a...

Free

Install



MQTT Client

Phoenix Contact GmbH & Co. KG

★★★★★ 18 Downloads | Function Extension

Transfer data between Program Ports and remote MQTT brokers. Supported features: - MQTT versions 3.1 and 3.1.1 - SSL/TLS - Web Sockets
NOTE: Installing or uninstalling this Function

Buy



IXON Cloud Connector

IXON

★★★★★ 11 Downloads | Runtime

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Install



Thank you
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