ISA Delhi Section

Setting the Standard for Automation™

Enhanced Connectivity

ISA-D: “Fertiliser , Food and Pharma Symposium-2019”

ISA Delhi Section

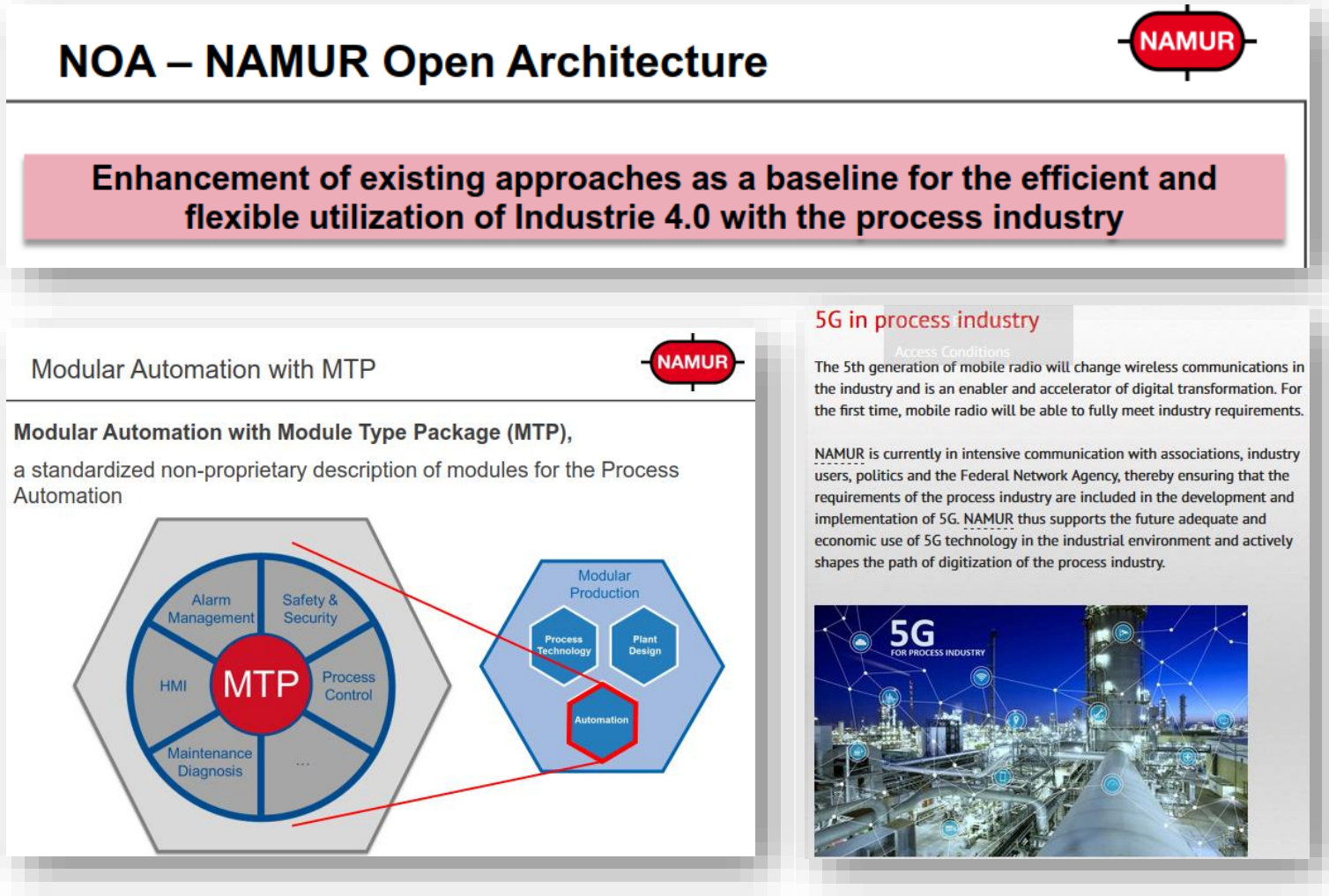
ENHANCED CONNECTIVITY

PHOENIX CONTACT
INSPIRING INNOVATIONS

NAMUR

User Association of Automation Technology in Process Industries

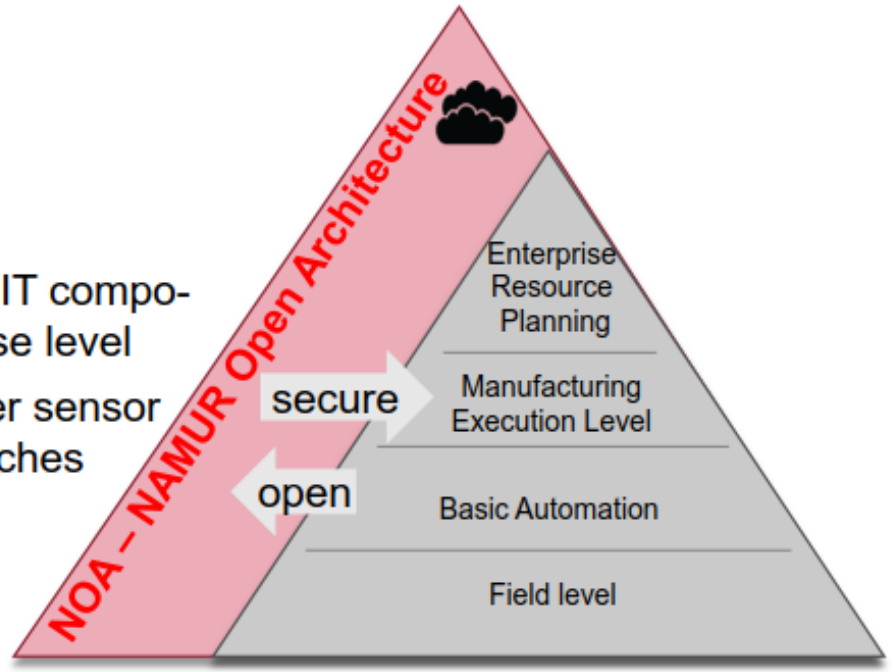
NAMUR is an international user association of automation technology in process industries. They have been representing the interests of their members for more than 65 years.



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

- Additive to existing structures
- Open for new approaches within Industrie 4.0
- Based on existing standards
- Simple integration of fast changing IT compo-nents 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



NAMUR - Interessengemeinschaft Automatisierungstechnik der Prozessindustrie e.V.
Sitz des Vereins: Leverkusen Eintragung: Amtsgericht Köln, VR 18371

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.

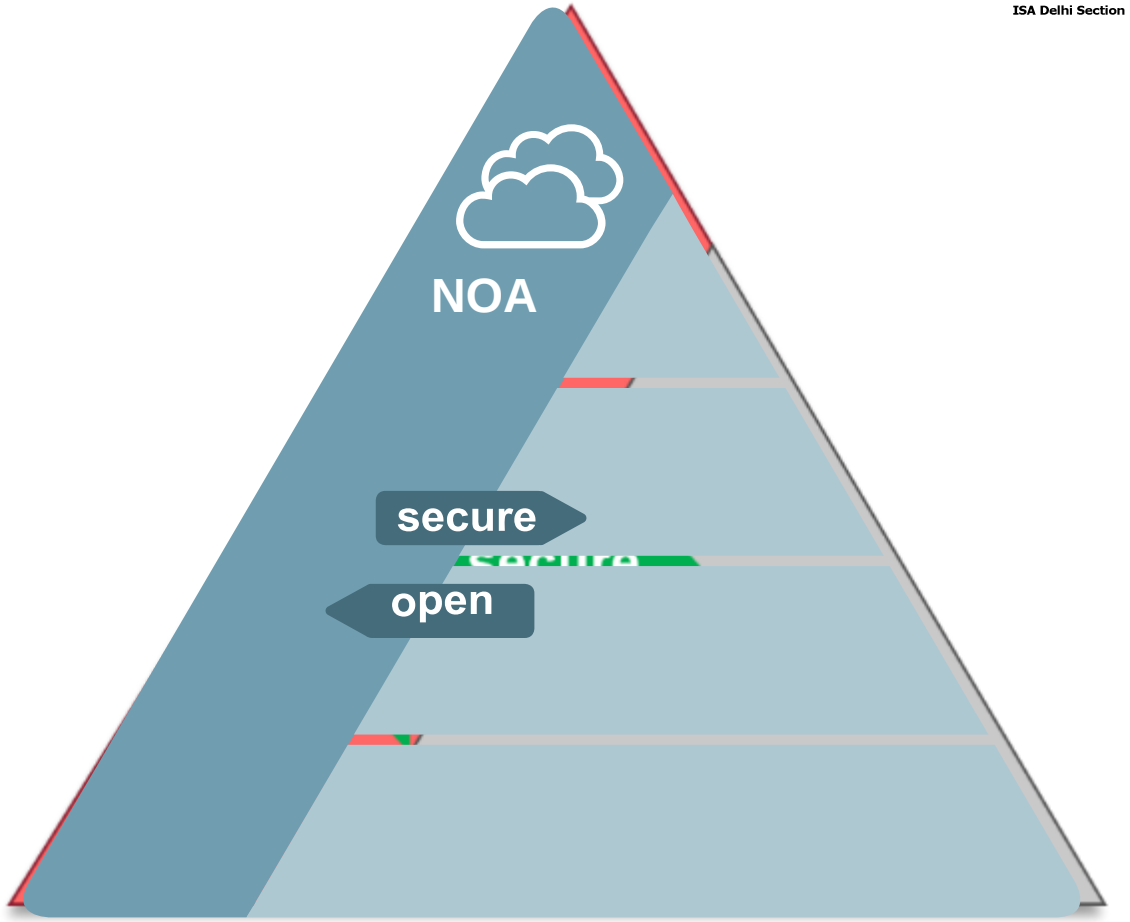
Dr. Jan De Caigny
BASF SE

NOA ARCHITECTURE

NAMUR

OPEN

ARCHITECTURE



NOA SOLUTION APPROACH

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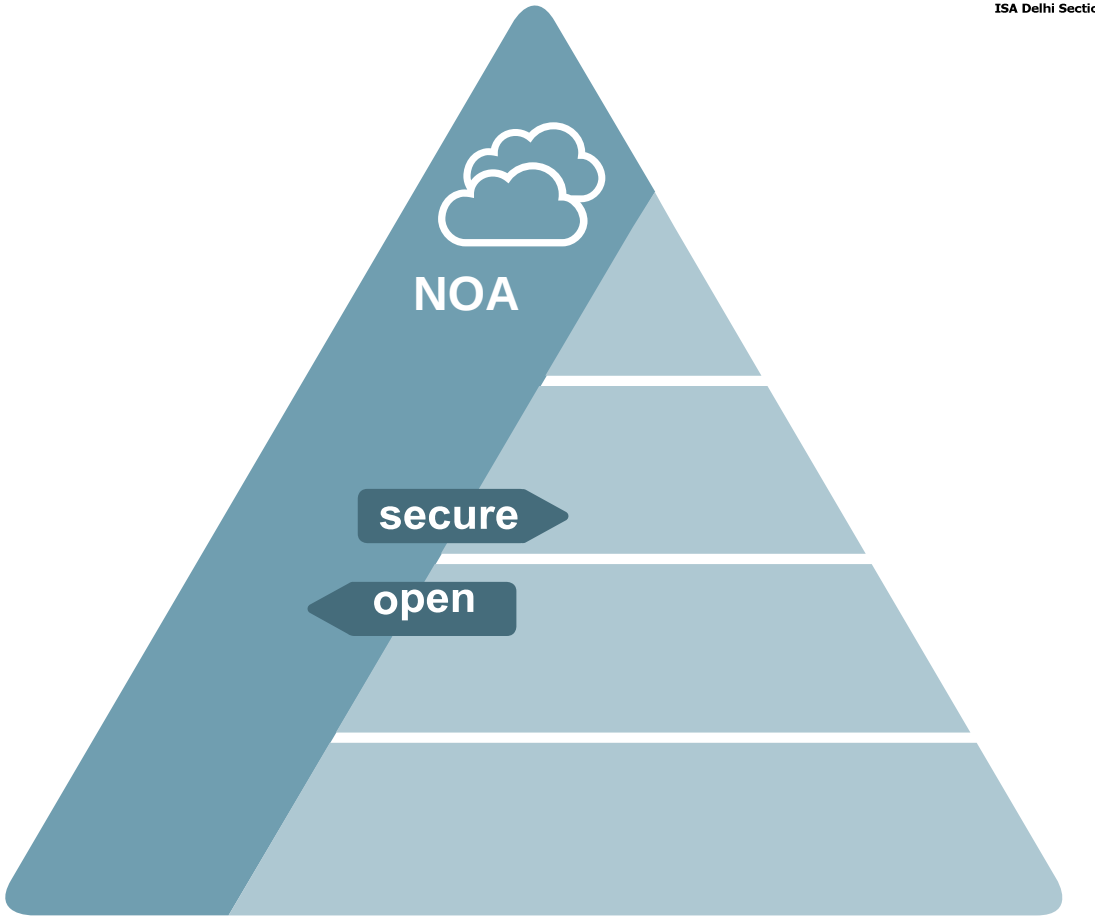
An open standard

Protocol-independent

Impact-free access



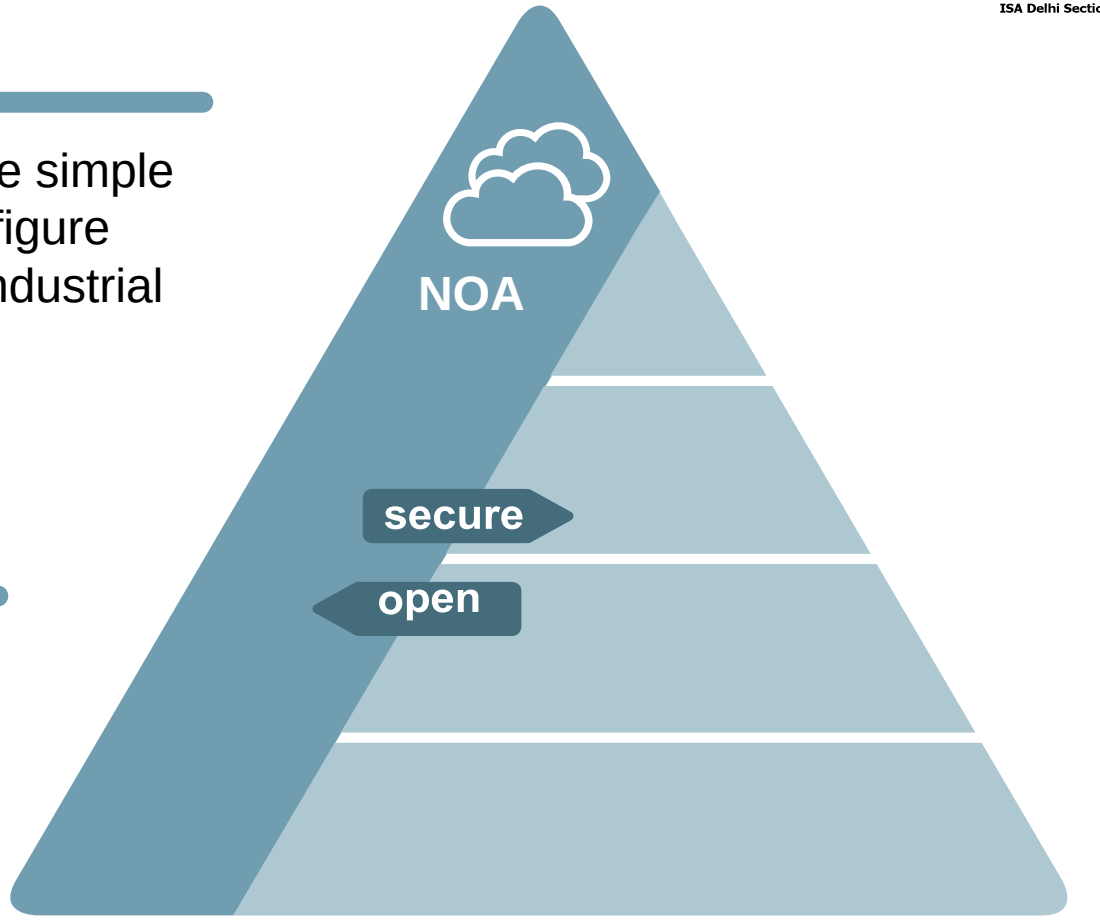
NOA NEXT

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)



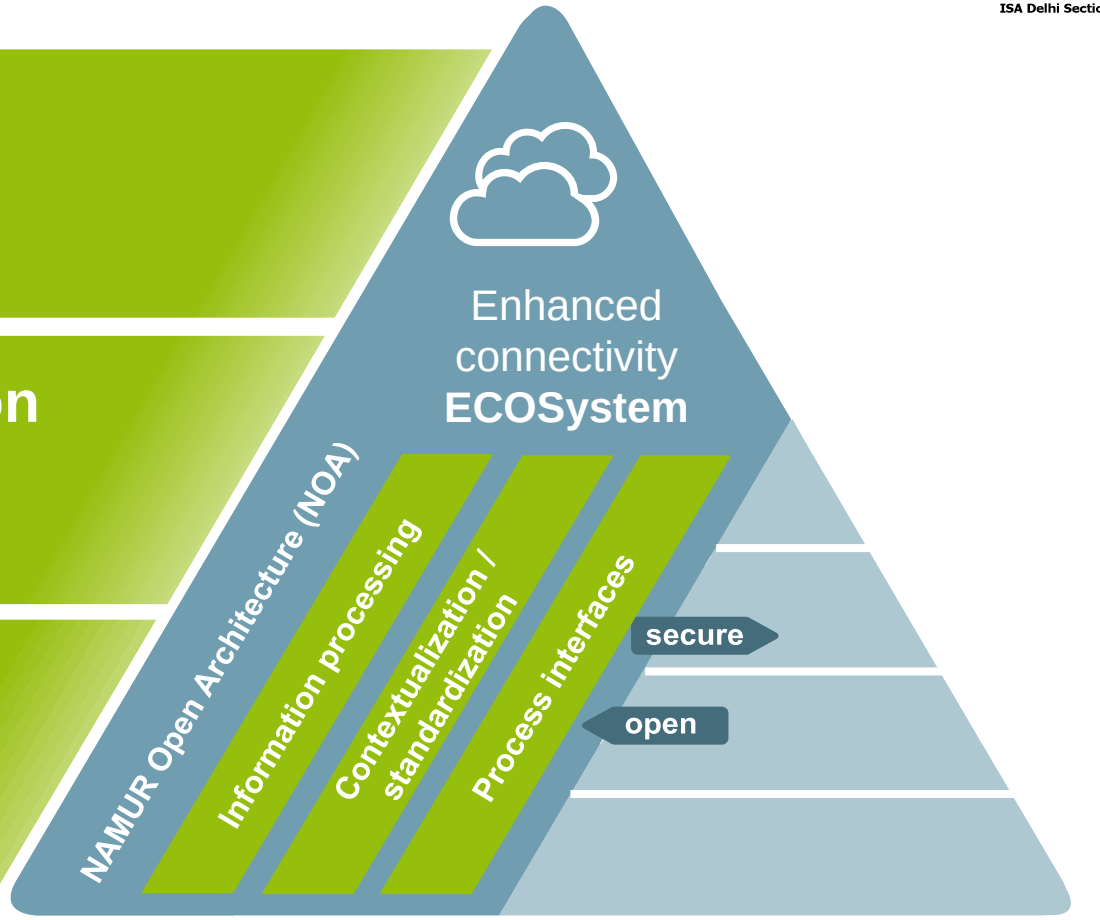
OPEN ARCHITECTURE
ENHANCED CONNECTIVITY ECOSYSTEM

ISA Delhi Section

Information processing
- Cloud connectors
- Apps / SaaS

Standardization & contextualization
- Standardize data formats
- Make reference / edge computing

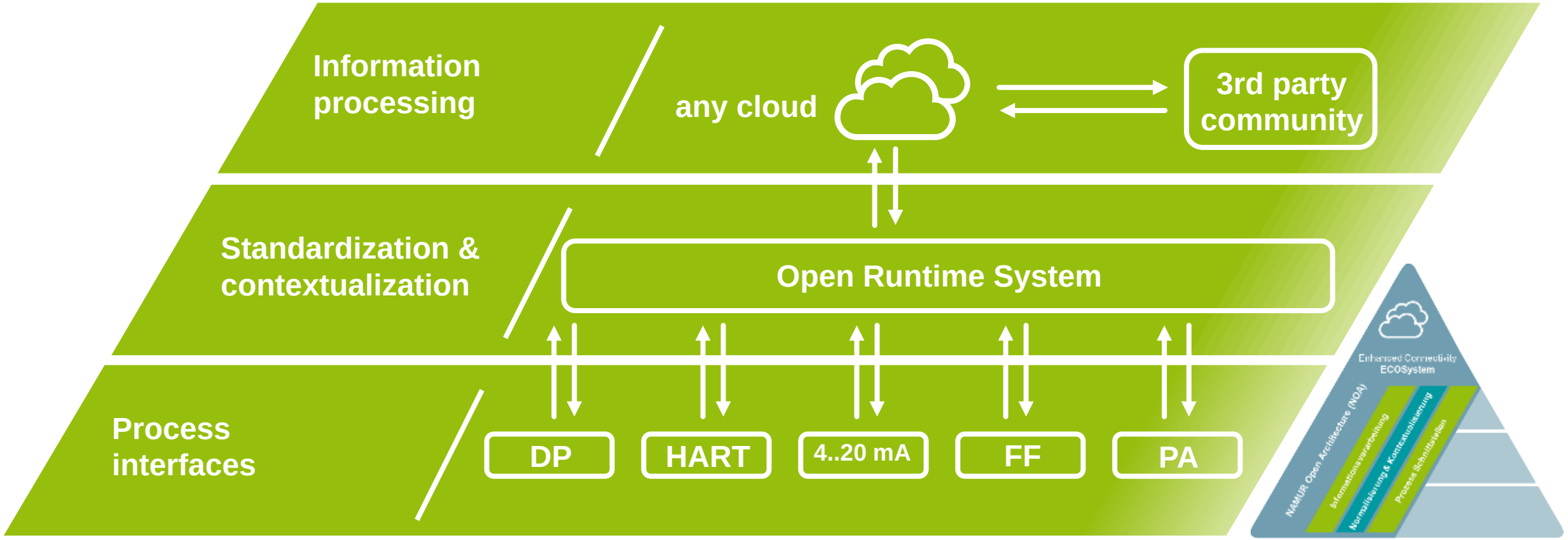
Process interfaces
- Connection to field signals
- Impact-free / safety / security



OPEN ARCHITECTURE
ENHANCED CONNECTIVITY ECOSYSTEM

OPEN ARCHITECTURE
ENHANCED CONNECTIVITY ECOSYSTEM

ISA Delhi Section



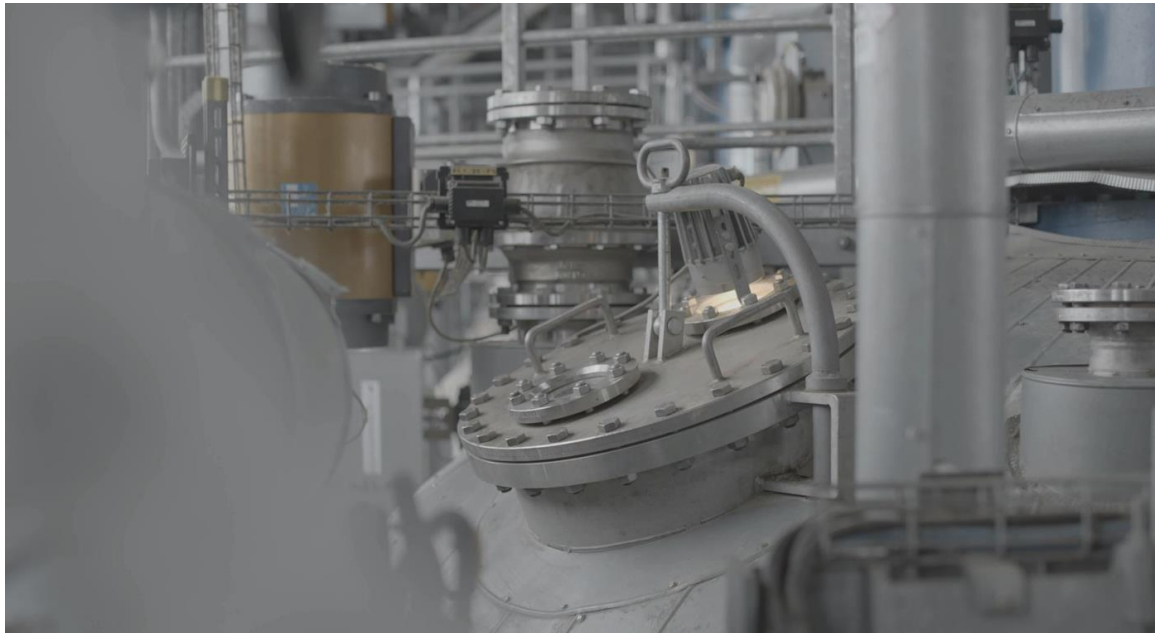
ISA Delhi Section

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

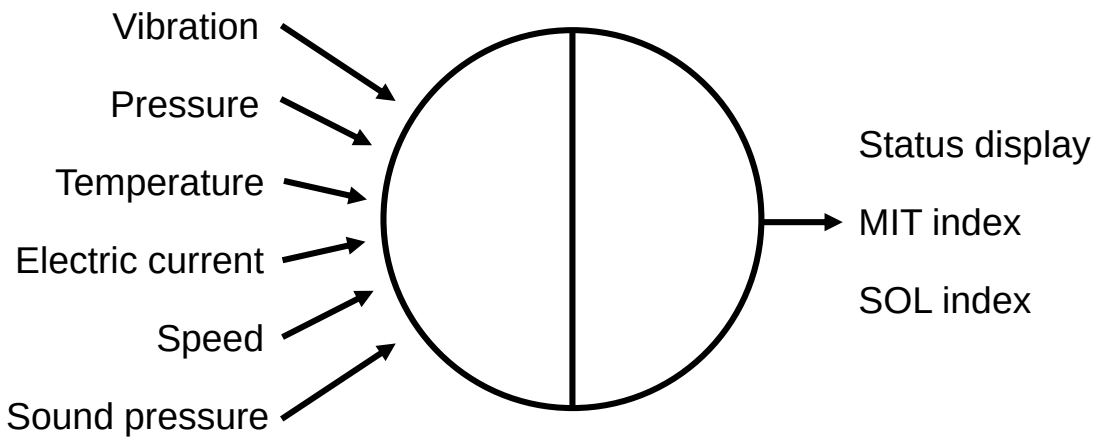
Task

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

Analysis: Monitoring, but how?

- We need data!
  - Motor?
  - Bearing?
  - Context information?
- Prediction model / Algorithm

- Non/Minimally invasive architecture
- Ex area



Combined indications according to Lahdelma & Juuso, 2011

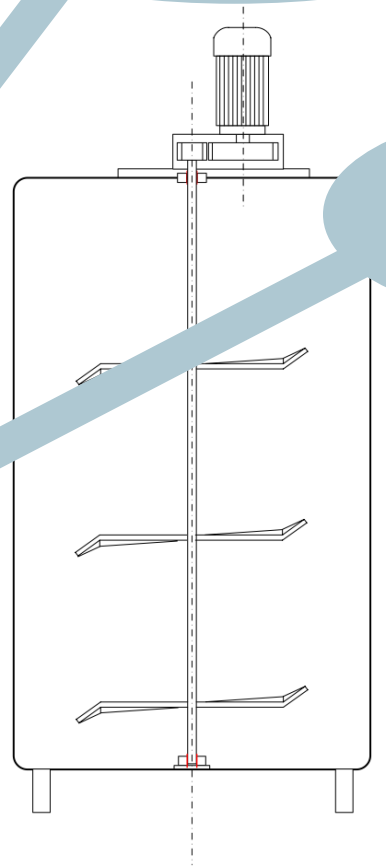
Analysis: Monitoring, but how?

MES

Batch,
temperature …

Motor current
measurement

Vibration
sensor



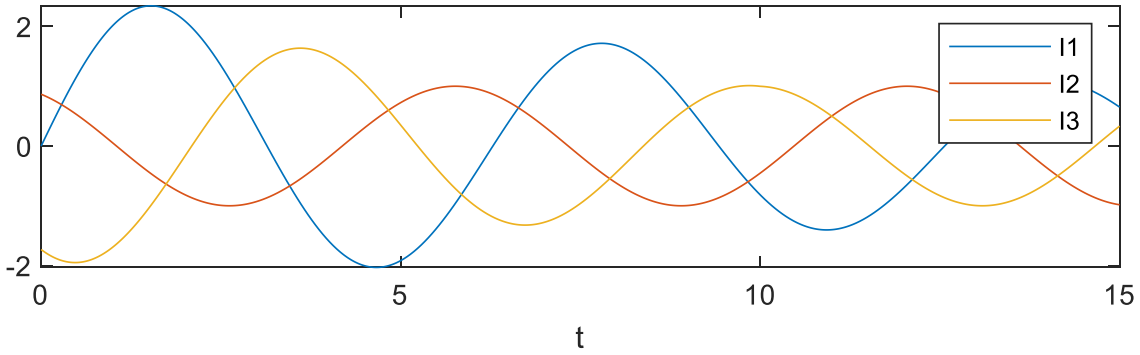
Early detection of defects

Predictive maintenance

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

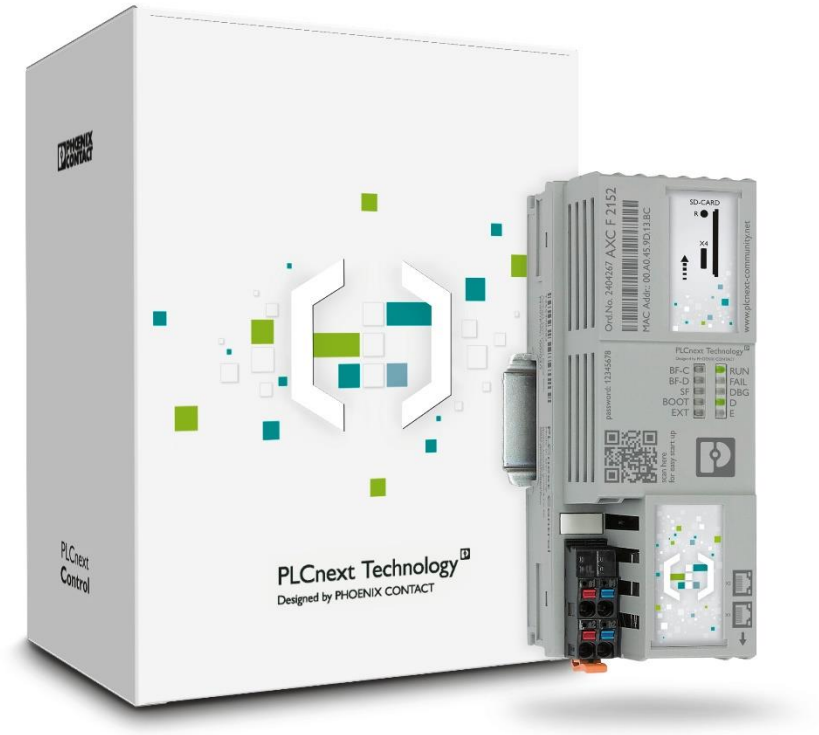
$$\left\| {}^{\tau}M_{\alpha}^{\rho} \right\|_{\rho} = \left({}^{\tau}M_{\alpha}^{\rho} \right)^{1/\rho} = \left(\frac{1}{N} \sum_{i=1}^{N} \left| x_i^{(\alpha)} \right|^{\rho} \right)^{1/\rho}$$

(Lahdelma & Juuso, 2011)

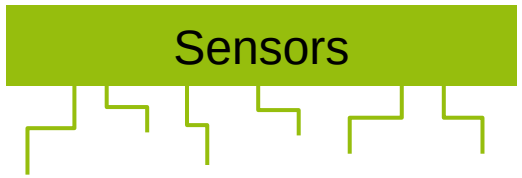
#EnhancedConnectivity – Monitoring of Rotating Equipment

Developing a solution strategy

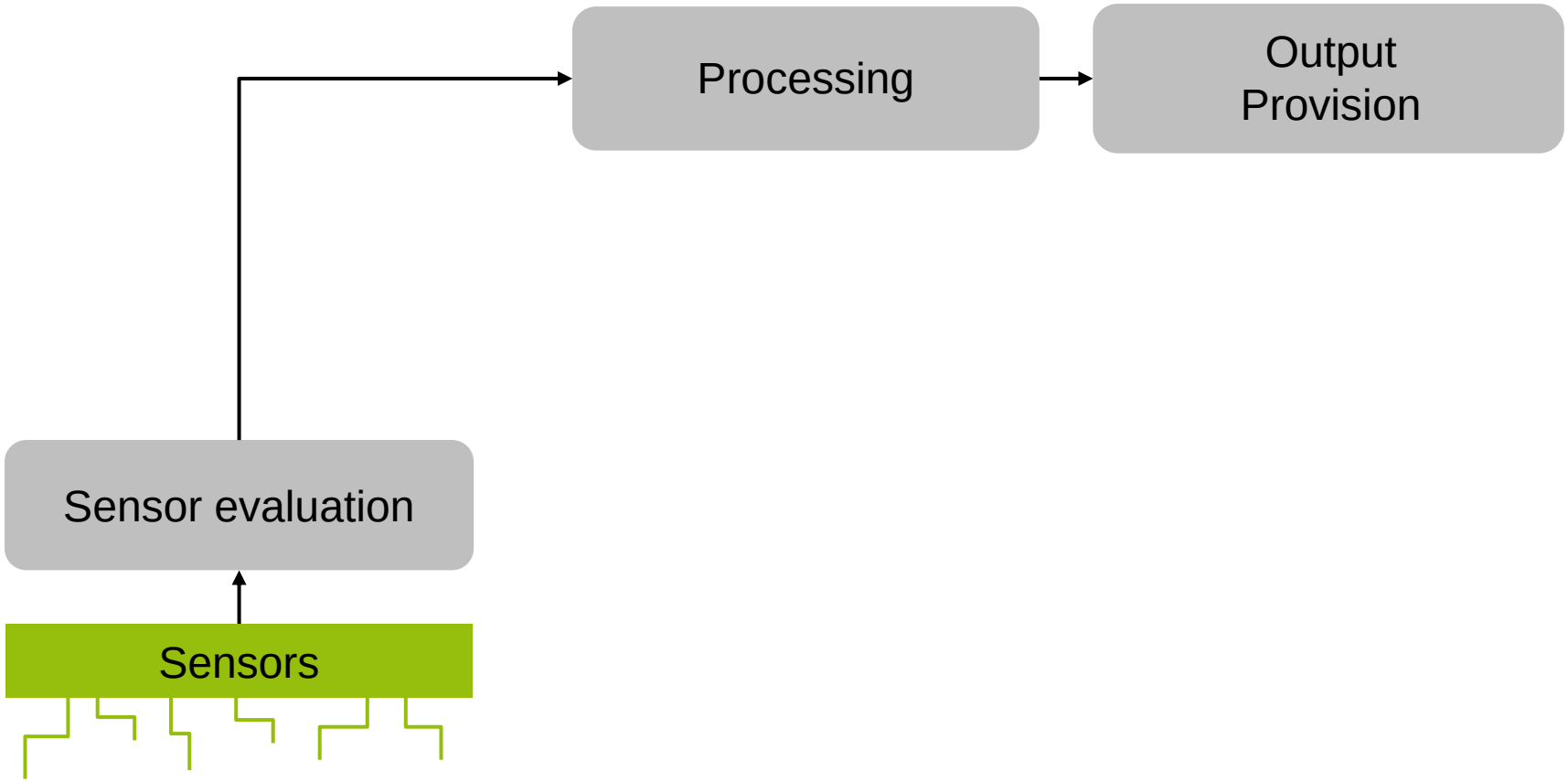
- ✓ Flexible engineering platform
- ✓ Connection to the simulation
- ✓ Evaluation of sensors
- ✓ Possibility to make data available



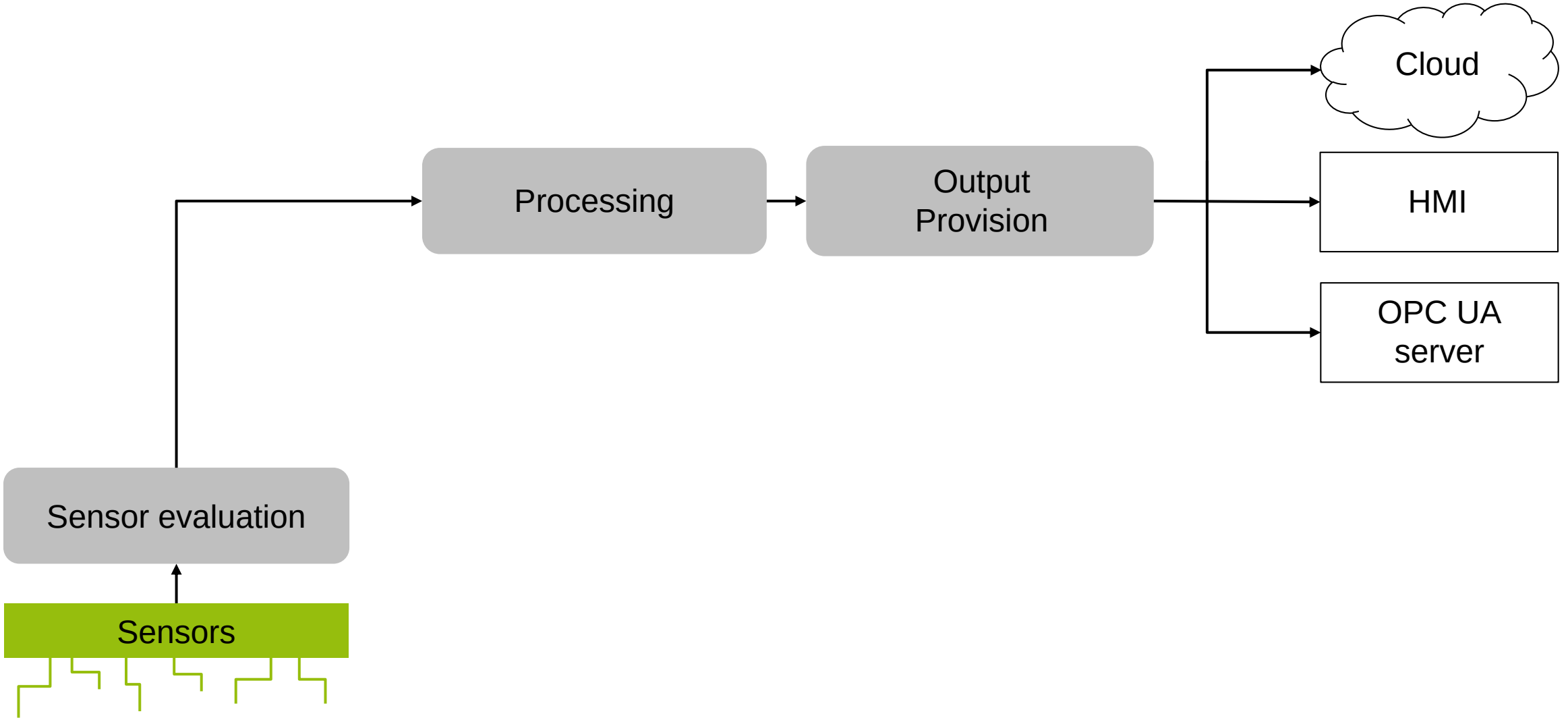
Developing a solution strategy



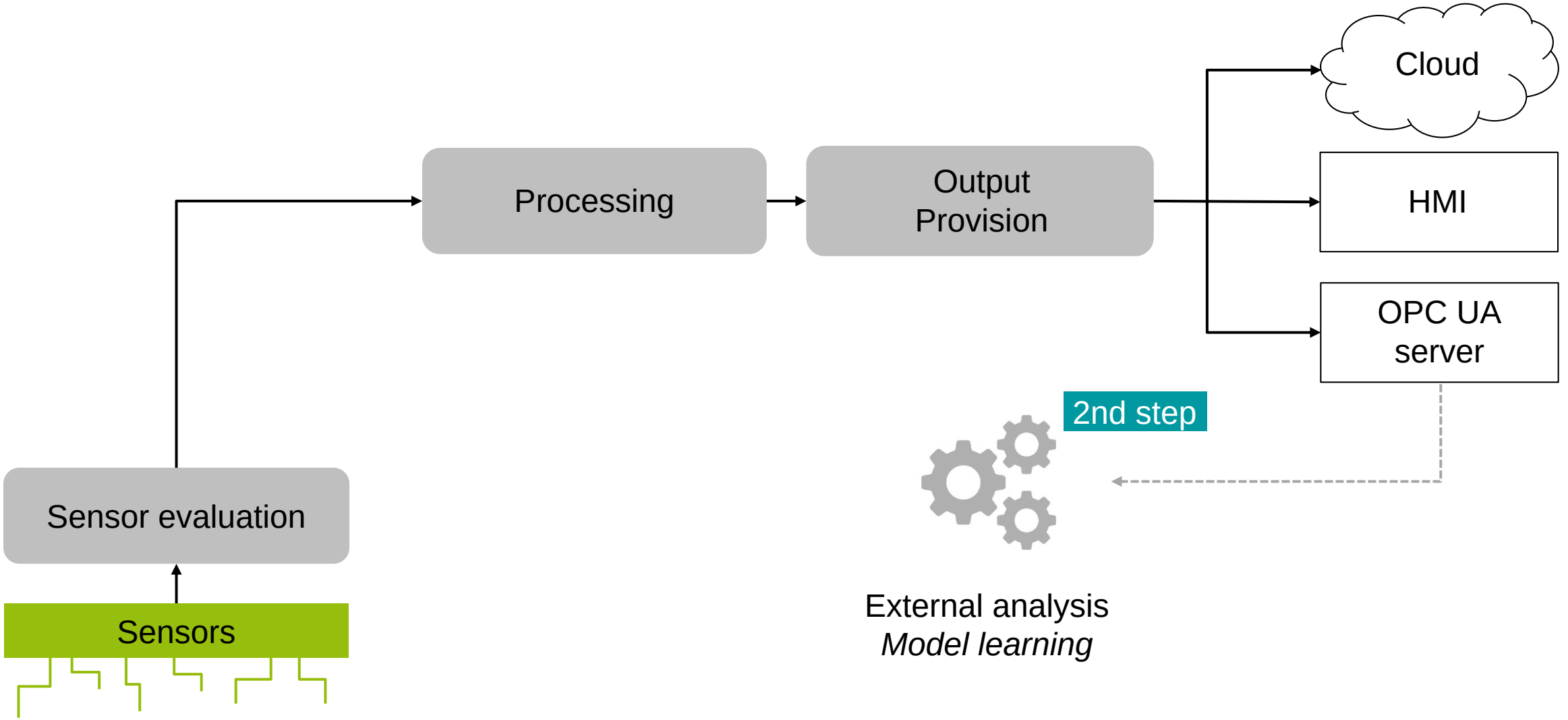
Developing a solution strategy



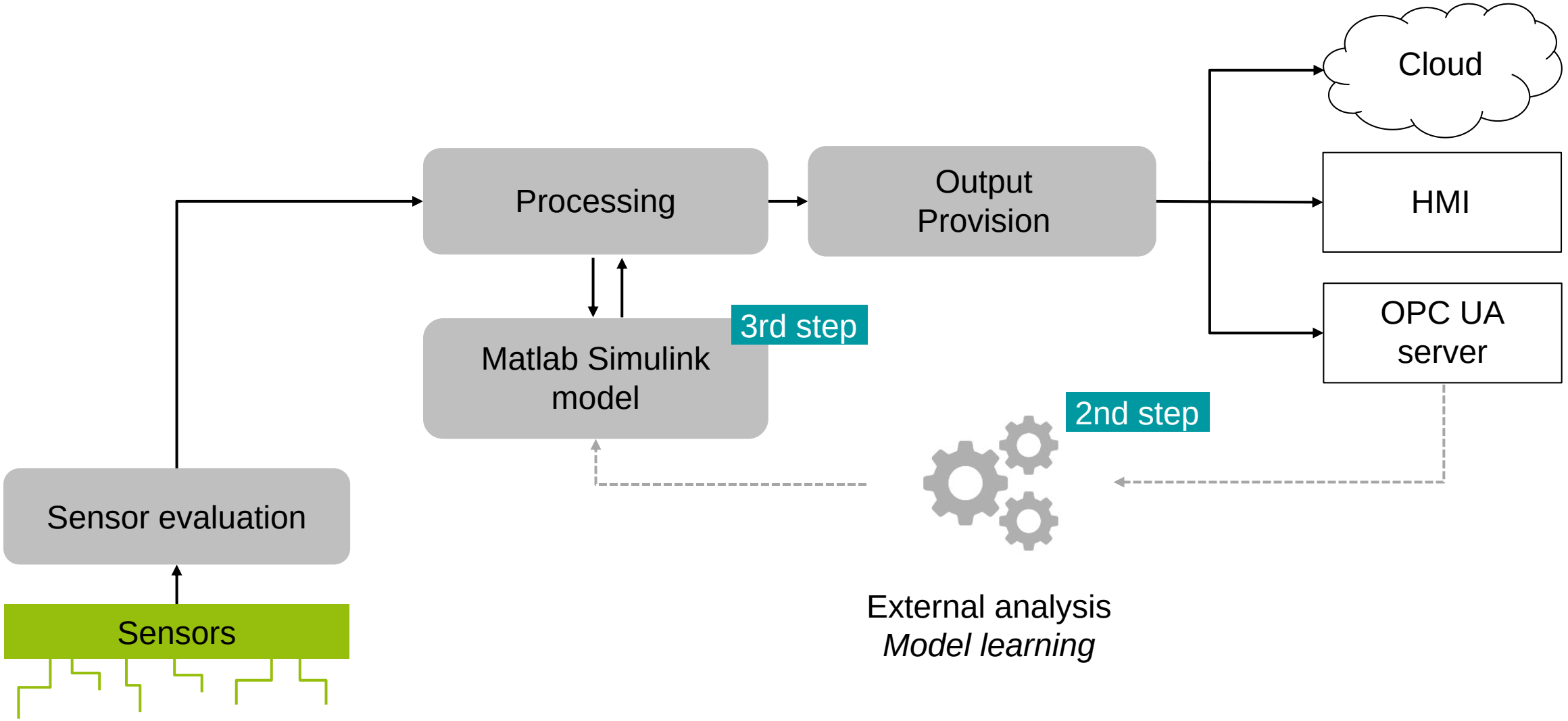
Developing a solution strategy



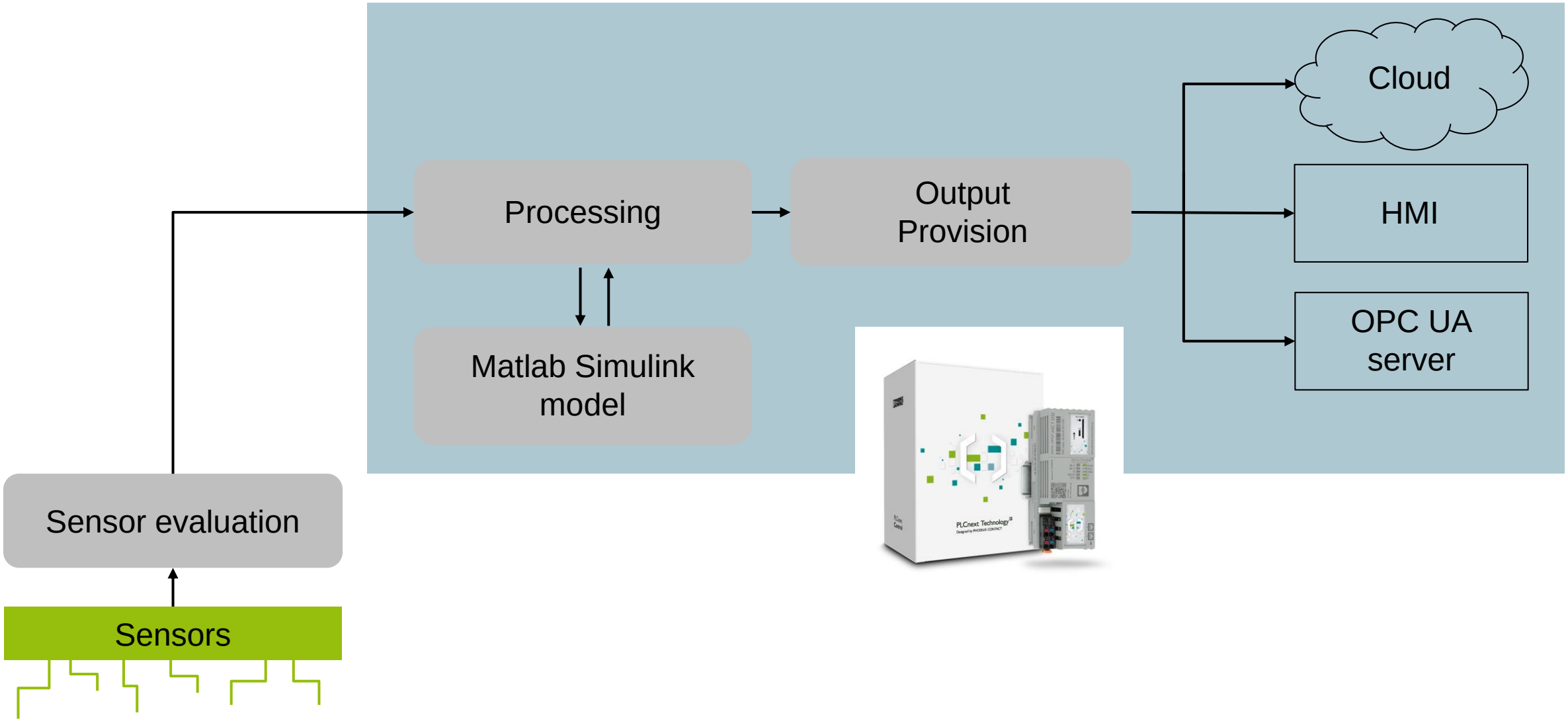
Developing a solution strategy



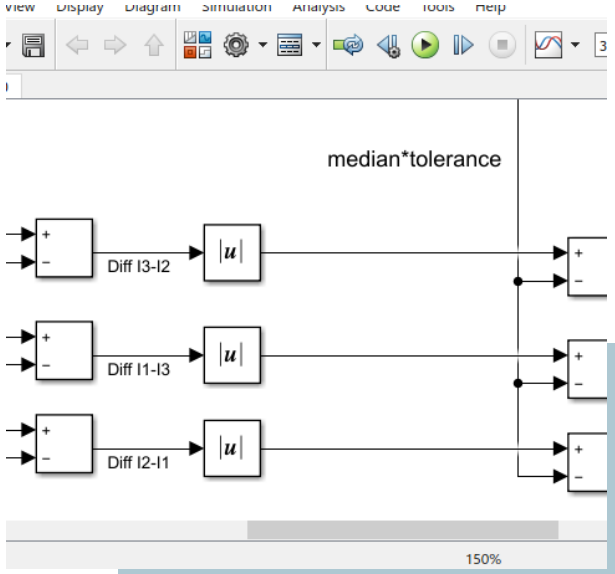
Developing a solution strategy



Developing a solution strategy



Developing a solution strategy

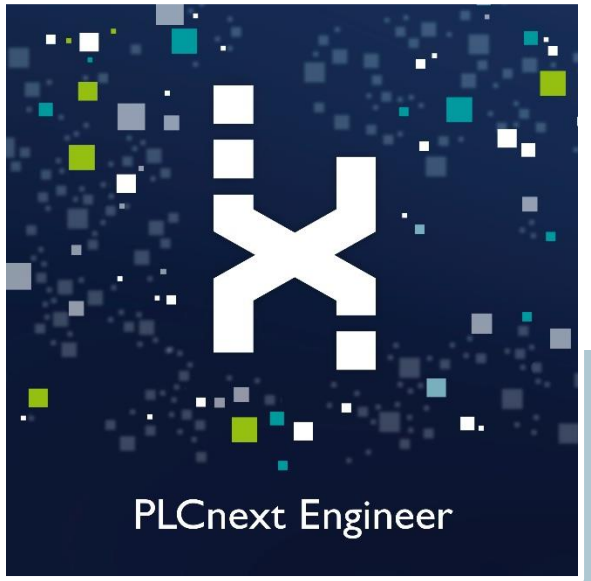


Implementation

Model development in Matlab Simulink

Build

Target for PLCnext

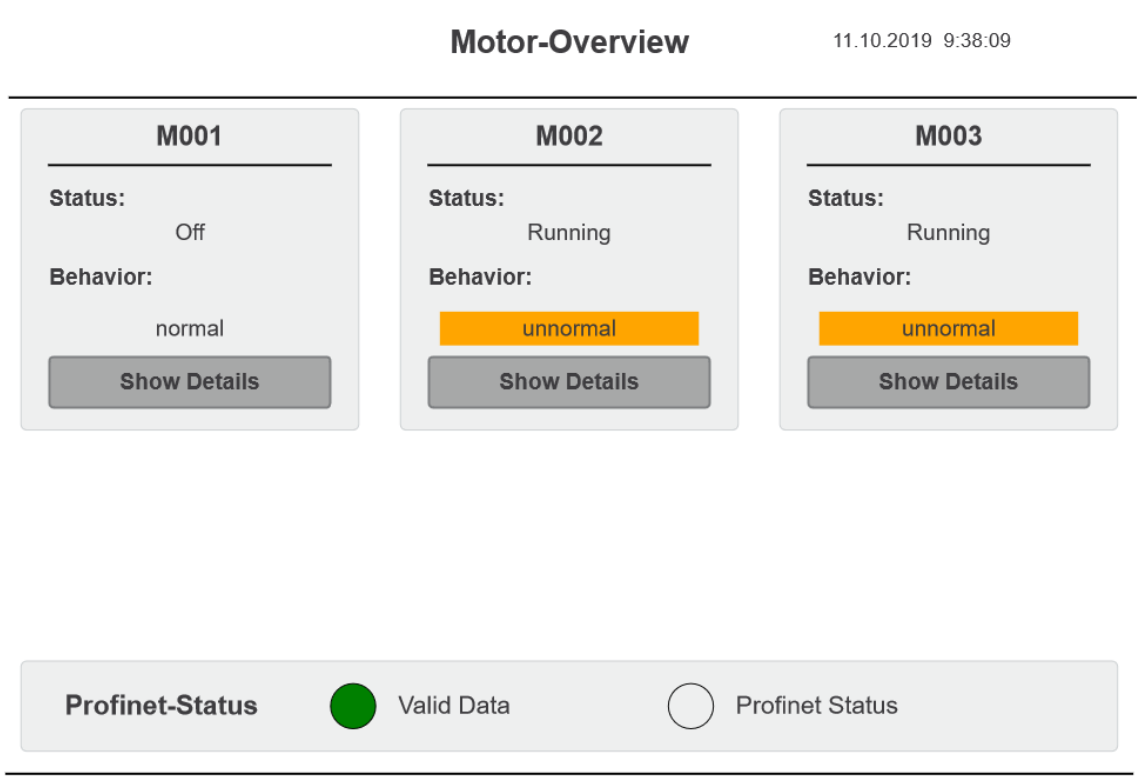


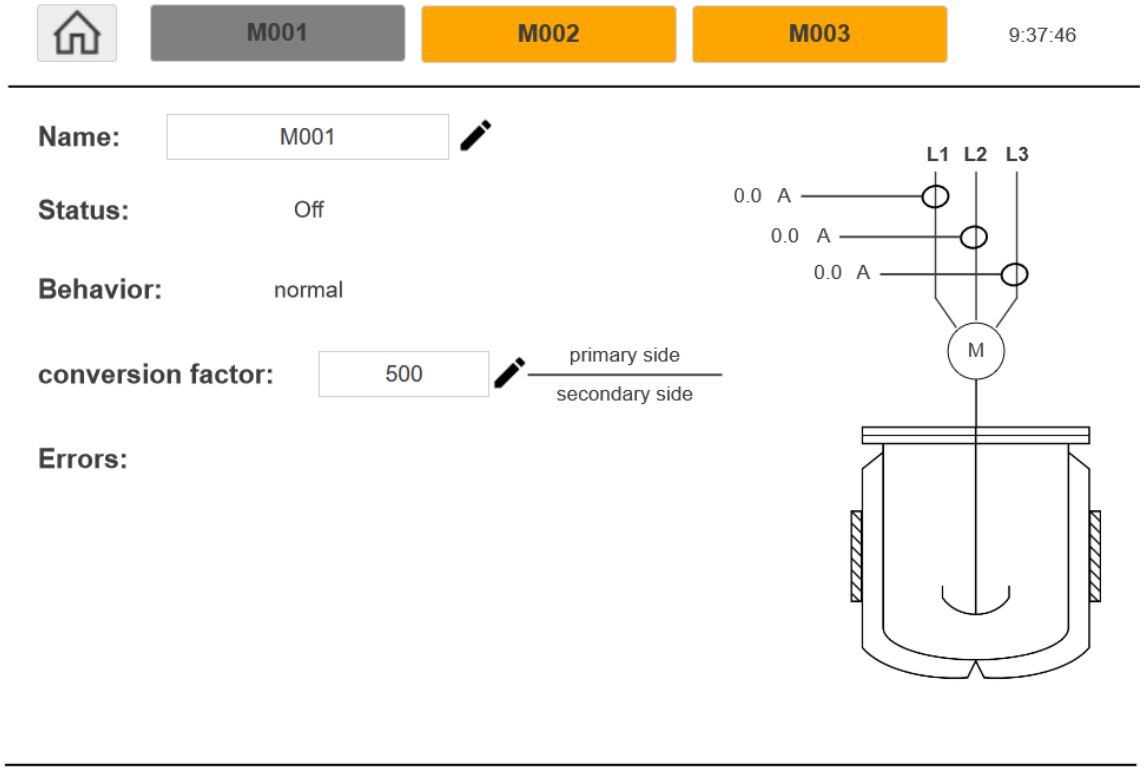
Integration

Integration into the control project

#EnhancedConnectivity – Monitoring of Rotating Equipment

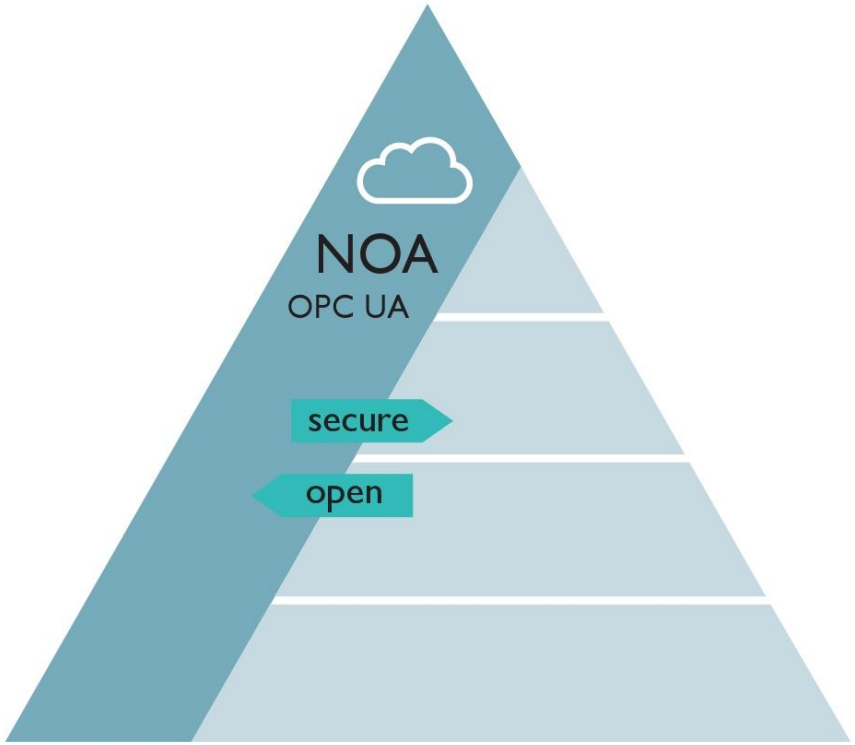
Developing a solution strategy





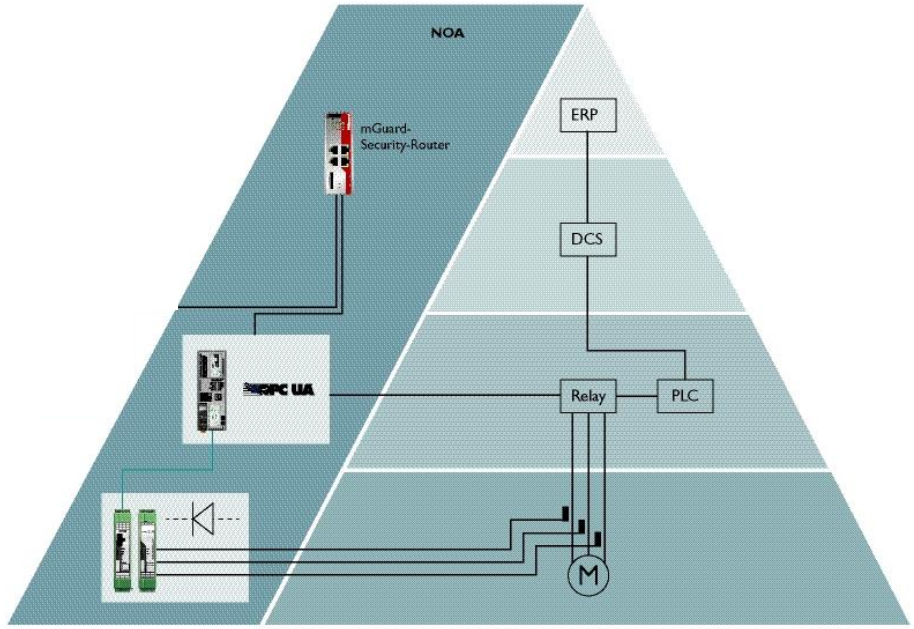
Solution: Practical implementation

- Implementation as regards control technology:
  - NOA



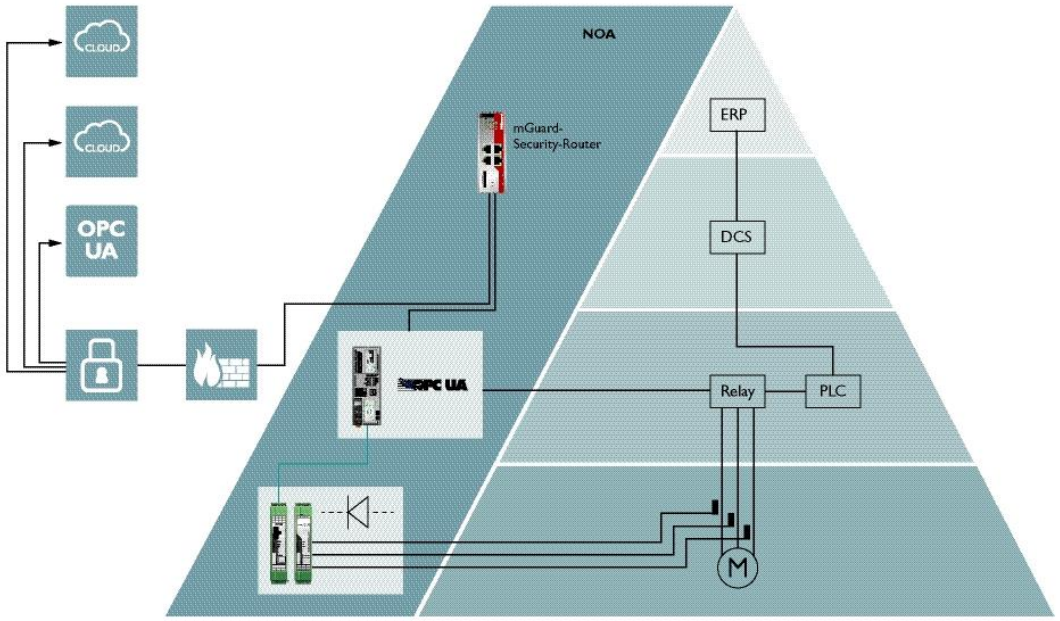
Solution: Practical implementation

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



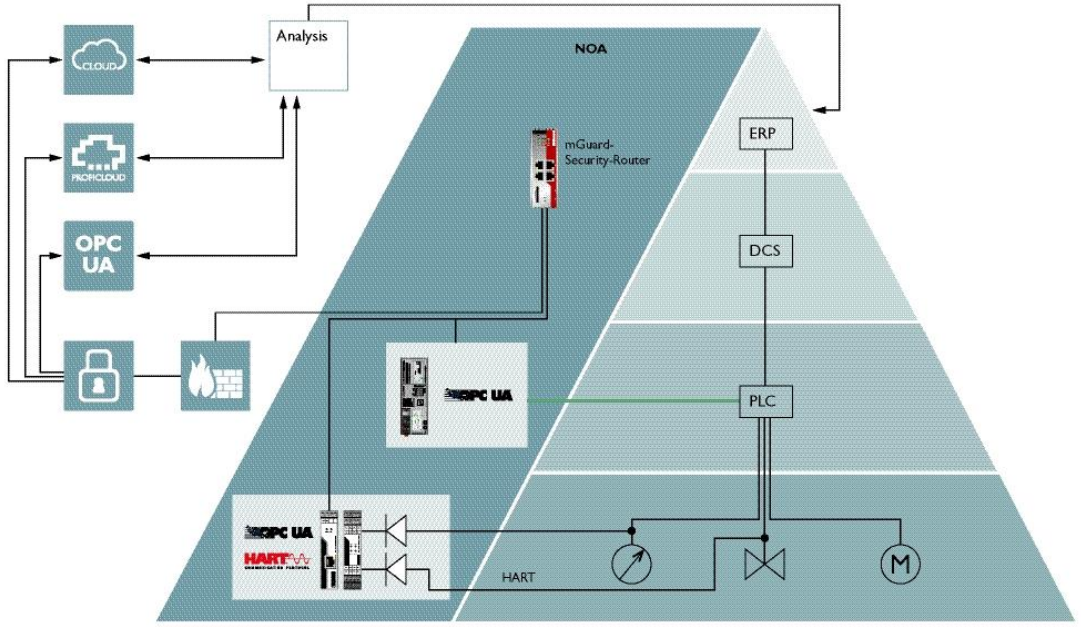
Solution: Practical implementation

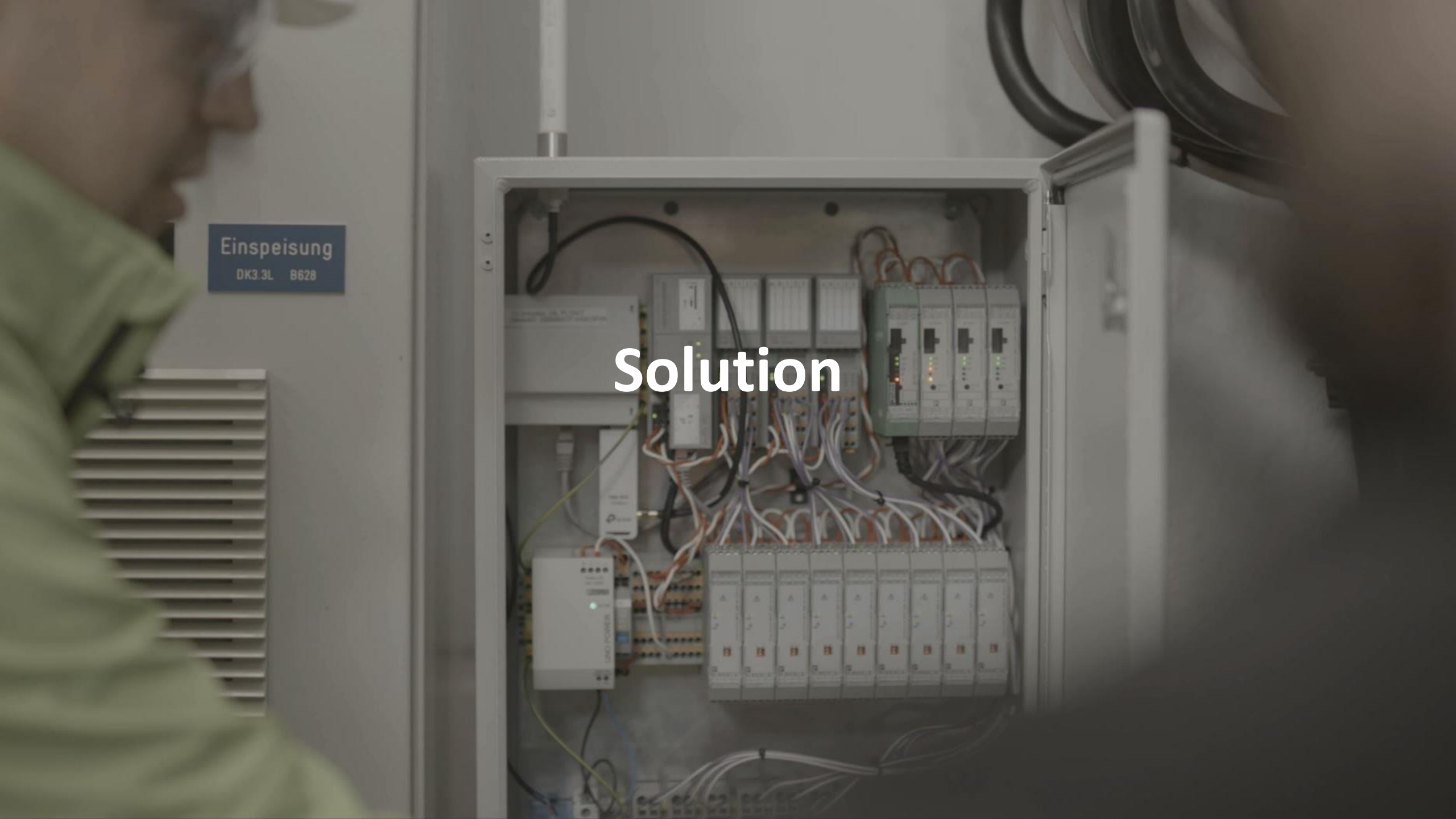
- Implementation as regards control technology:
  - NOA
  - Subsequent installation with as little interference with the existing systems as possible
  - Secure
  - OPC UA
  - Cloud on premise --> Cloud
  - Cloud off premise



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

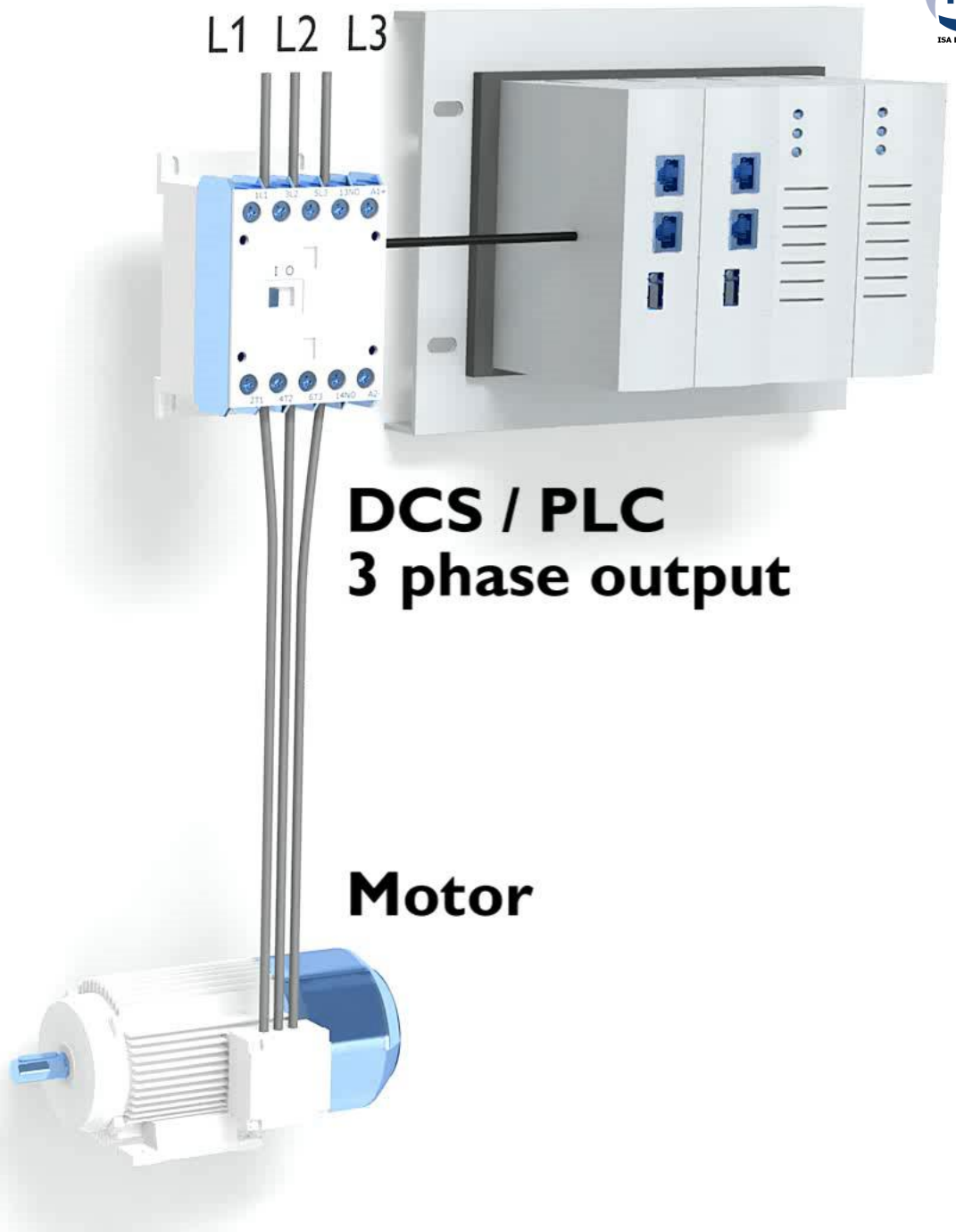




Solution

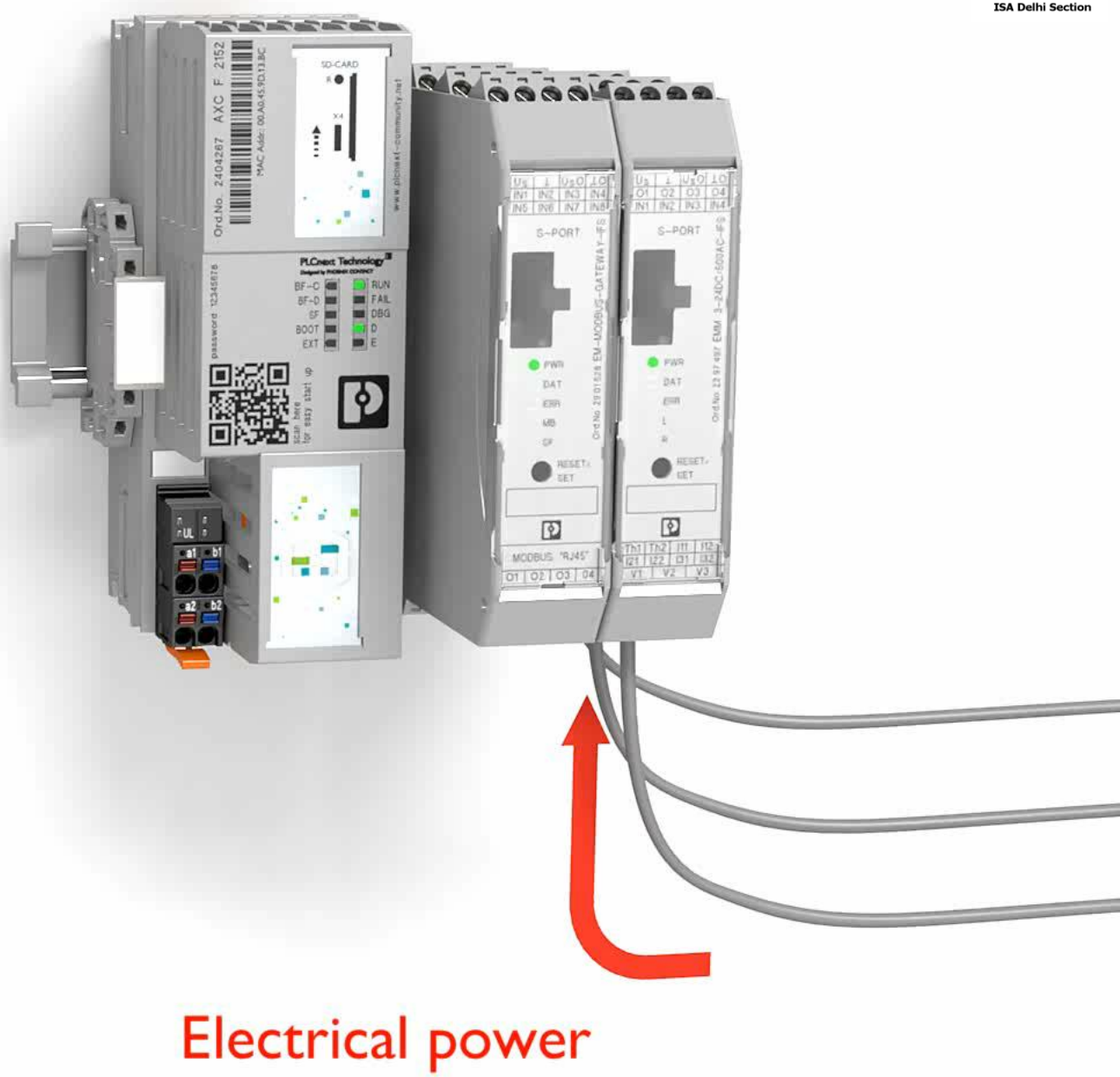
#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: Motor manager

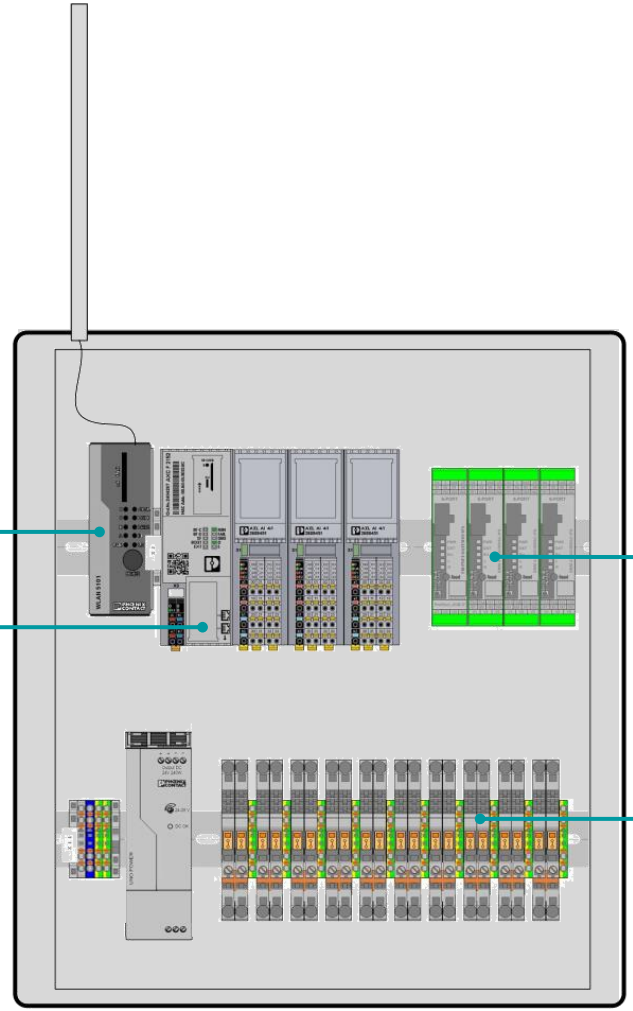


#EnhancedConnectivity – Monitoring of Rotating Equipment

Solution: PLCnext Controller



Solution: Control cabinet



Security router
(LAN/WLAN)

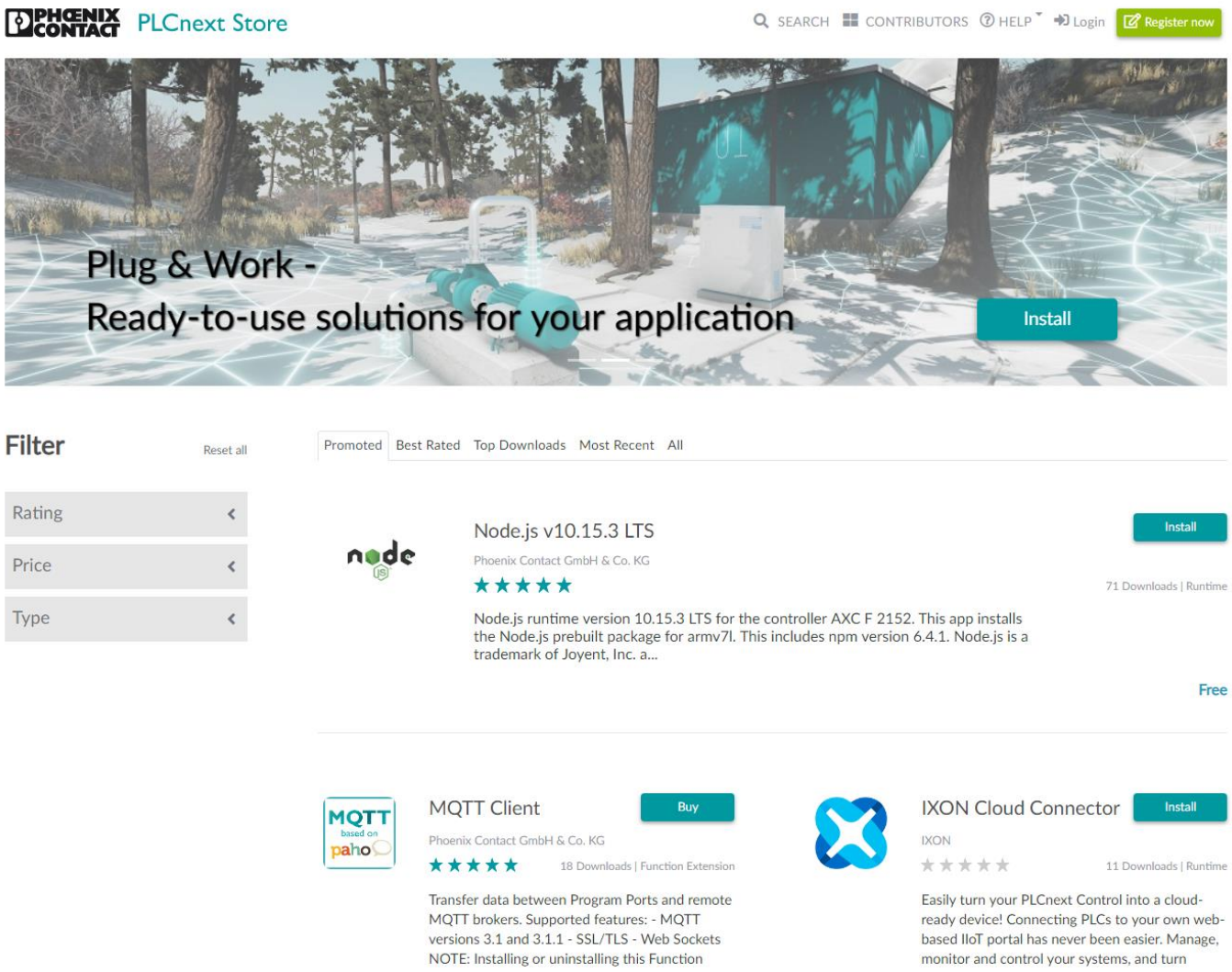
PLCnext controller with OPC UA server
(NOA ready, PA DIM compliant, secure)

Motor manager for acquiring motor currents via split core current transformers

Test disconnect terminal blocks for split core current transformers

PLCnext Technology
Designed by PHOENIX CONTACT

Solution: PLCnext Store



www.plcnextstore.com

Karsten Uhlendorff

Thank you

#EnhancedConnectivity