Combining AI and Edge computing
- for industrial maintenance

DiSTENCE
DISTRIBUTED INTELLIGENCE

Contents

- <u>Distence in brief</u>
- Market & technology
- Applications of edge computing today
- Combining AI and the Edge computing
- Q&A

Distence – Distributed intelligence

- Extending the life and improving the performance of industrial machines

- Cloud + Hardware solution for health management

- Advantages of local solution with cloud scalability for rotating machines

- Service automation -From manual inspections to streamlined and digital lifecycles
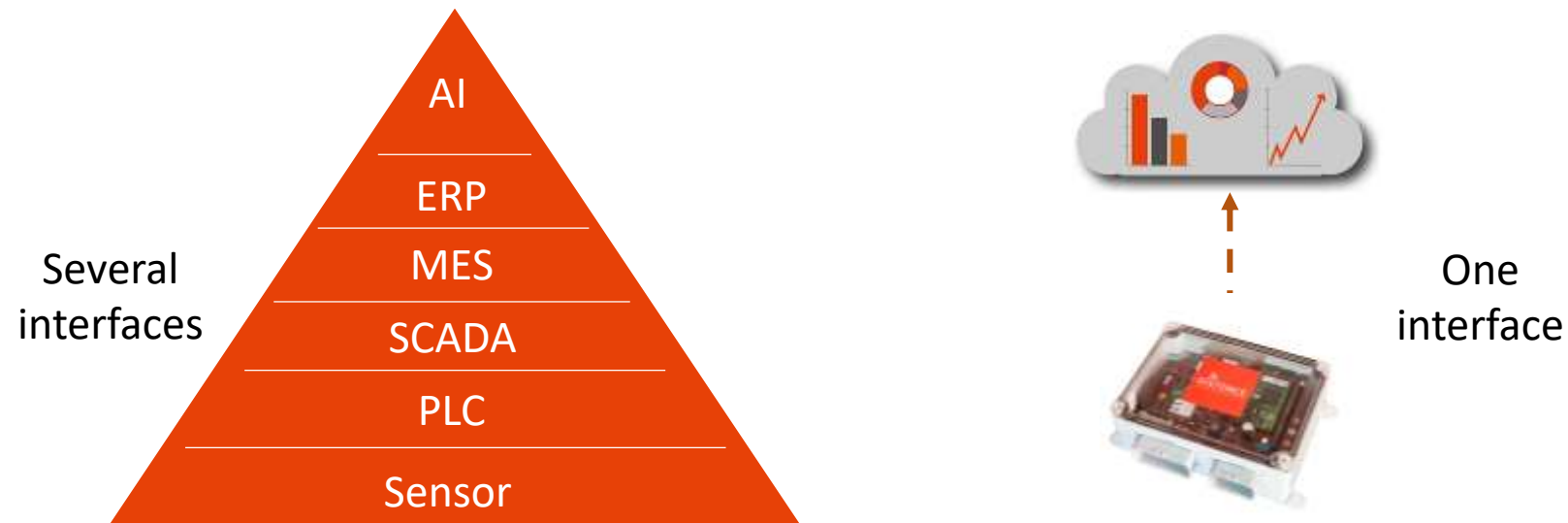
Several interfaces

AI

ERP

MES

SCADA

PLC

Sensor

One interface

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Evolution of condition monitoring

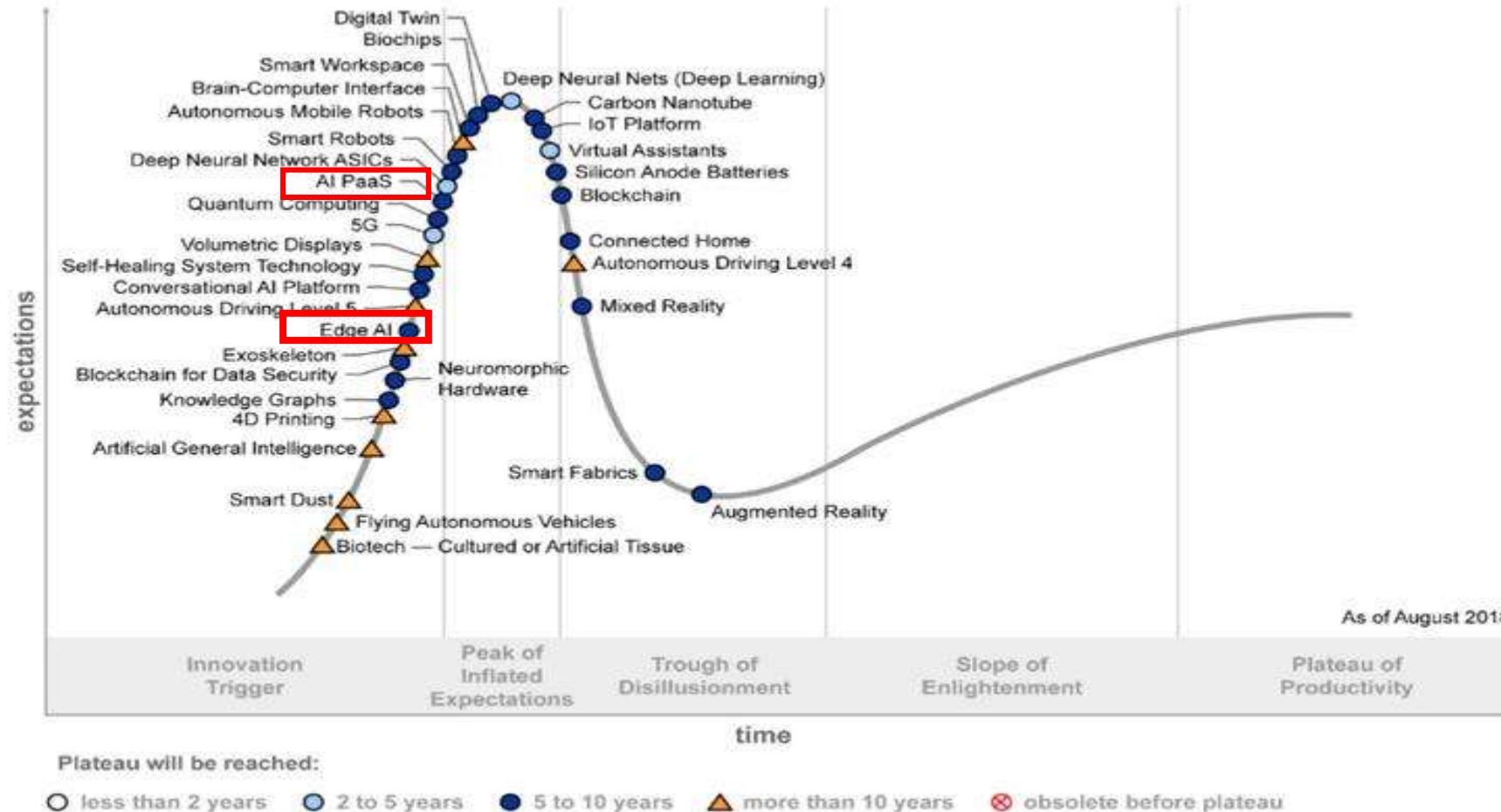1970   2000   2010   2020

Issues of existing Data

"However, a big challenge in the industrial analytics world is that most machine learning and **AI techniques are data-driven**. While the industrial world has a lot of data, the **type of data needed for** analysis from a reliability and **maintenance perspective is hard to access** because these **systems were not designed for this type of analysis.**"

-David Bell is senior product manager for APM at GE Digital, Plant engineering report 11/2019

"One big hurdle is that the data needs to be collected and stored in a way that allows AI to be applied."
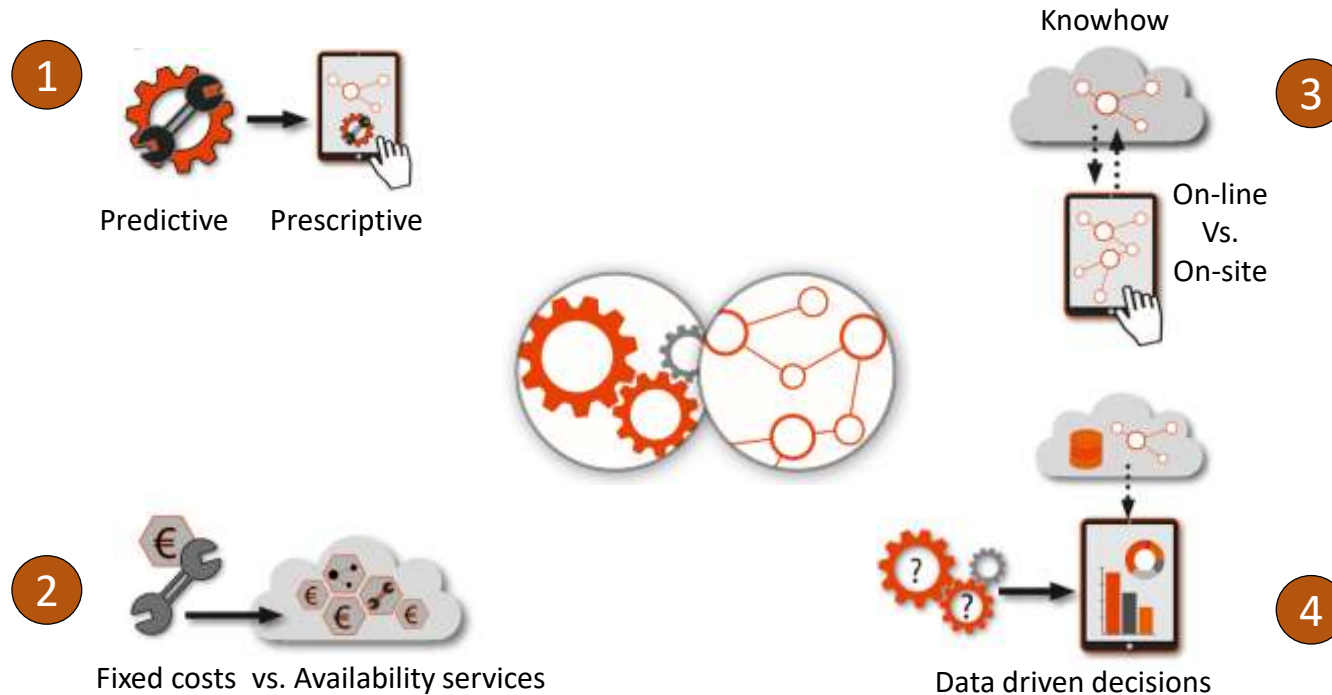
-Tomohiko Sakao, Lingköping university, Underhåll.se

Development of maintenance

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1. Predictive → Prescriptive

2. Fixed costs vs. Availability services

3. Knowhow
    On-line Vs. On-site

4. Data driven decisions

Digitalization impact on
1. Operational models
2. Business models
3. Distribution of know how
4. Decision making

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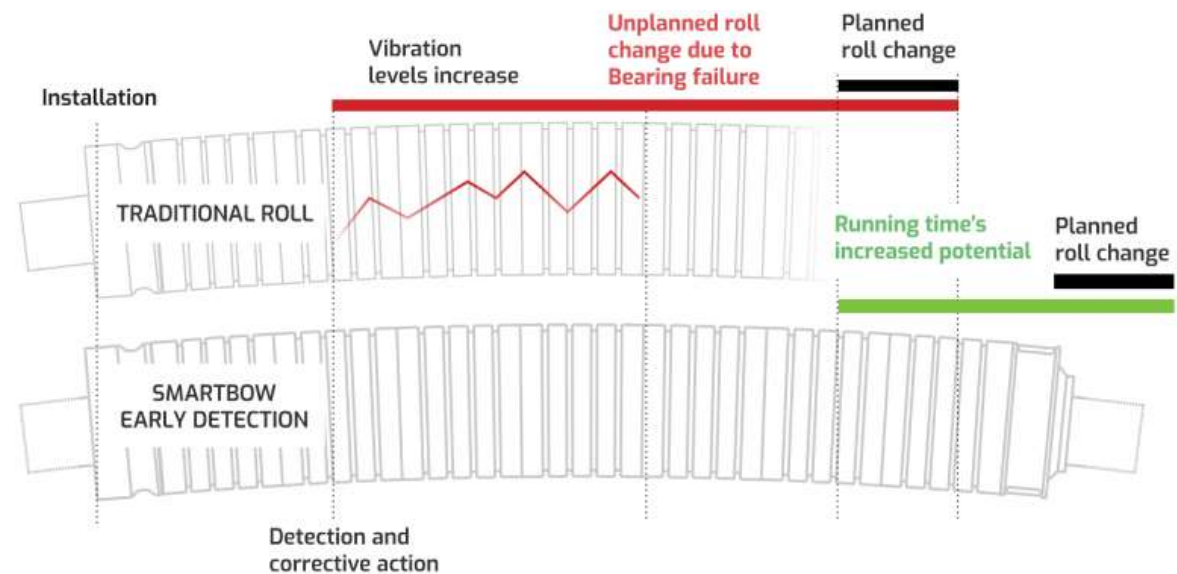- Q&A

Edge computing today

Relevant datasets

Edge analytics with physics and conversion to "smart data"
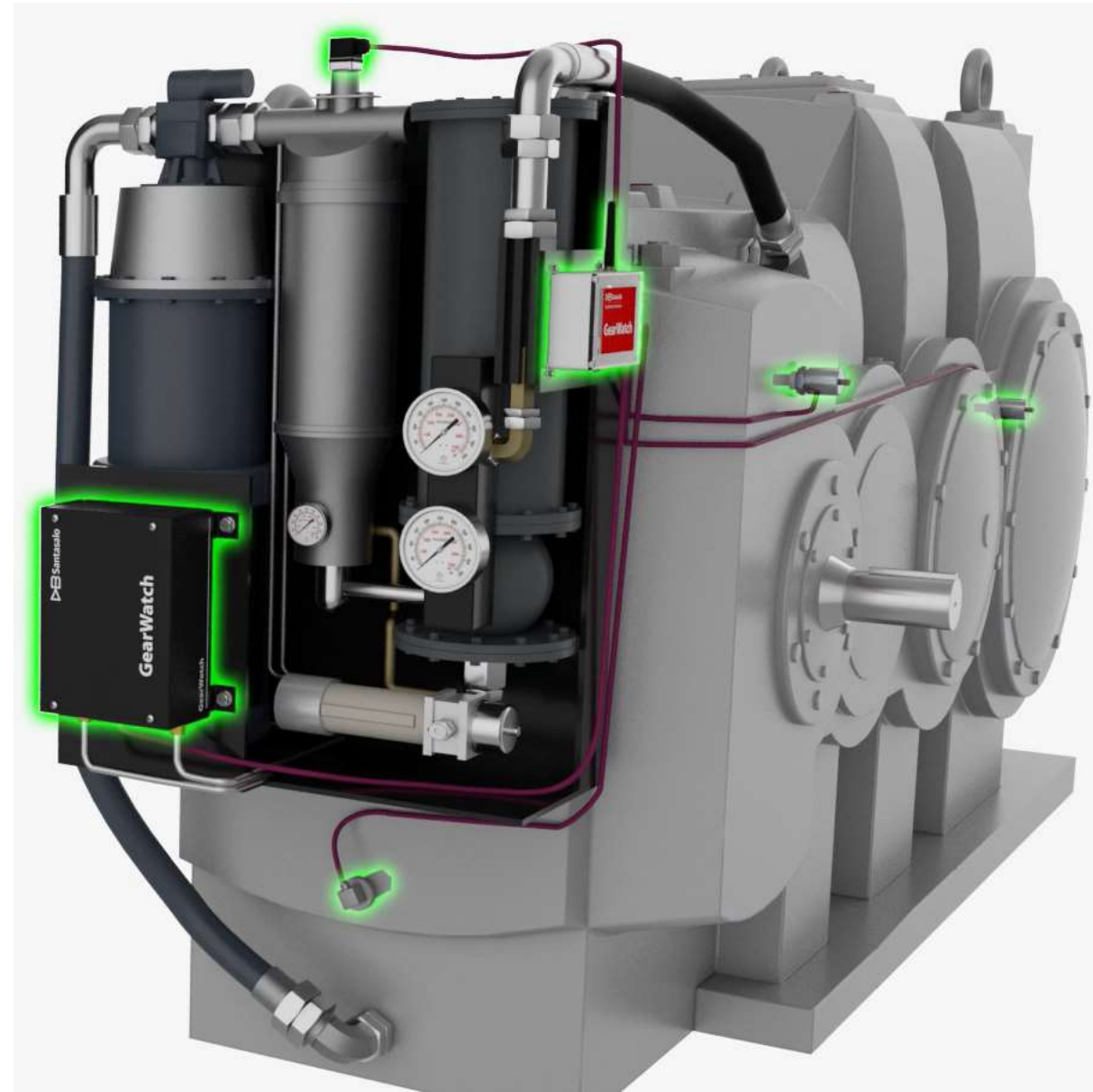
Actionable data "call for action"

Avoiding the root cause of failure
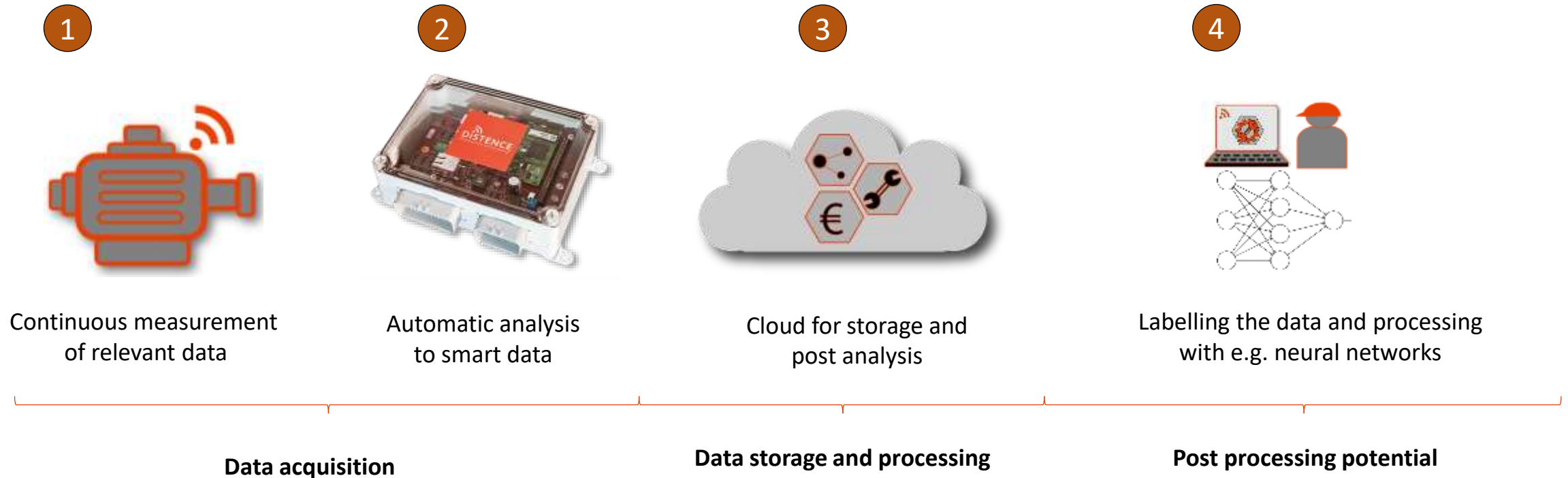
Global on-line
lifecycle service

Data collection & analysis for piston pumps in water treatment

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Studies on combining AI & Edge

1 Continuous measurement of relevant data

2 Automatic analysis to smart data

3 Cloud for storage and post analysis

4 Labelling the data and processing with e.g. neural networks

Data acquisition

Data storage and processing

Post processing potential

Pro gradu
Ojala, Mikko-Ilari
2013.

Testing, commissioning and additional development of neural network application for condition monitoring of wind turbine drive train

Step 1 – digital fingerprints

Continuous measurement of relevant data

Automatic analysis to smart data

Cloud for storage and post analysis

Labelling the data and processing with e.g. neural networks

1 Normal

2 Deviation

Increased values

3

Inlet pressure
2 minutes ago
● 2.54873 bar

Outlet pressure
2 minutes ago
● 55.48732 bar
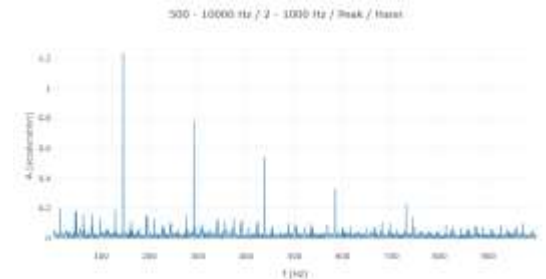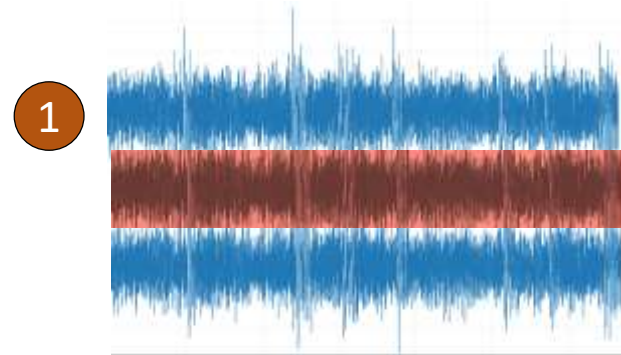
Vibration Radial RMS
2 minutes ago
● 0.35706 mm/s

4
Action: Start to follow
Reason: Bearing failure
Status: Minor, 6-12 months to failure

Step 2 – Supervised learning

Continuous measurement of relevant data

Automatic analysis to smart data

Cloud for storage and post analysis

Labelling the data and processing with e.g. neural networks

1 Raw datasets

2 Detection of problem

3 Trained engineers repoting to the system
-label datasets

-action taken

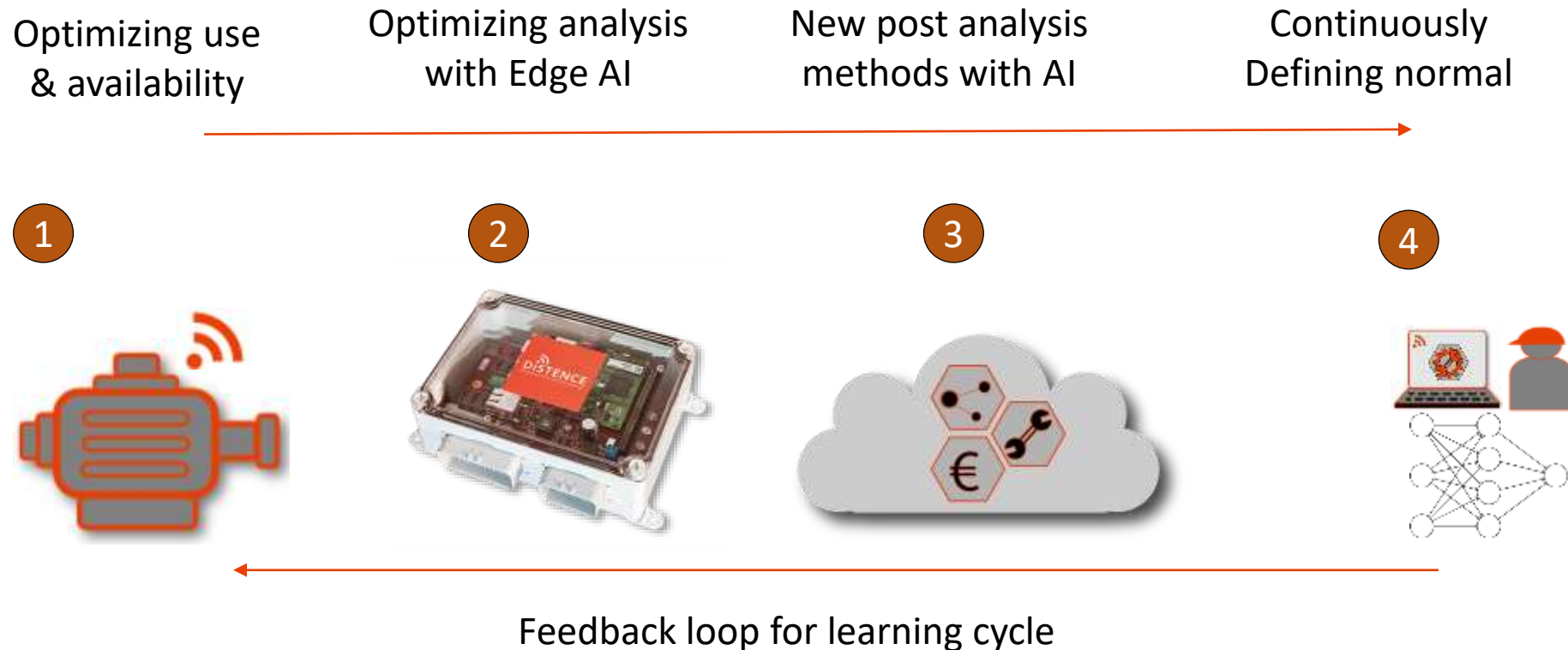Result: Sets of data "what to do, when, and why"

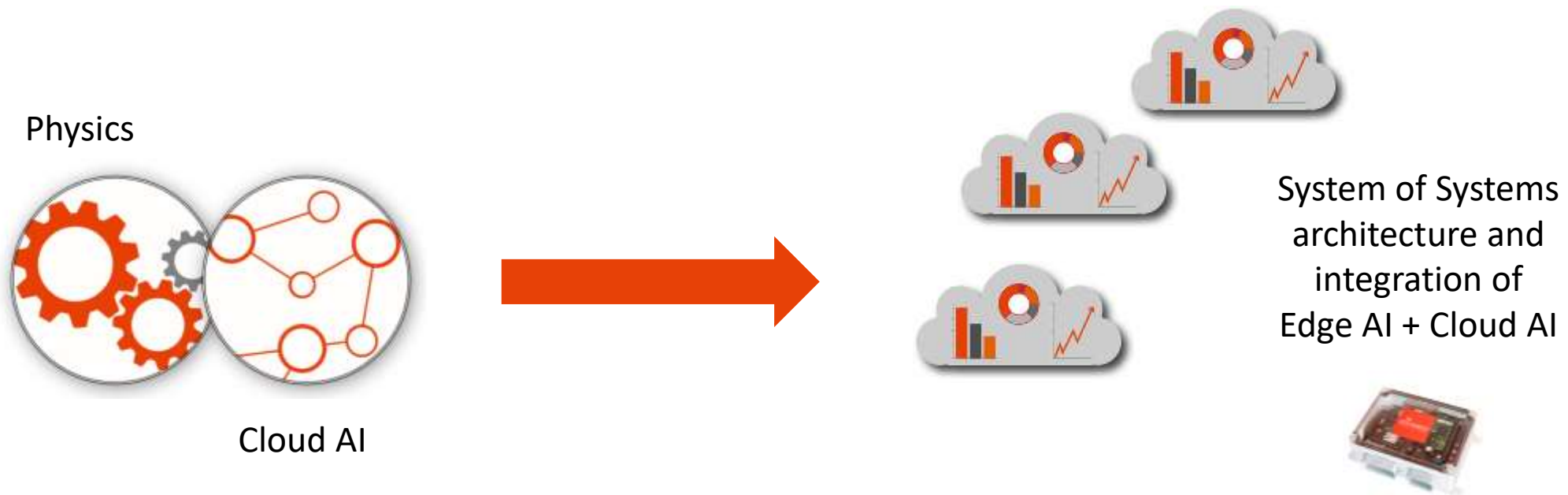**4** Automation of analysis & retrospect analysis
Results e.g.
Development of Deterministic decision & prescriptions
New correlations to fault analysis & root cause

Summary – AI and Edge concept

Physics

Cloud AI

System of Systems architecture and integration of Edge AI + Cloud AI

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Maximizing Machine Health

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Q & A