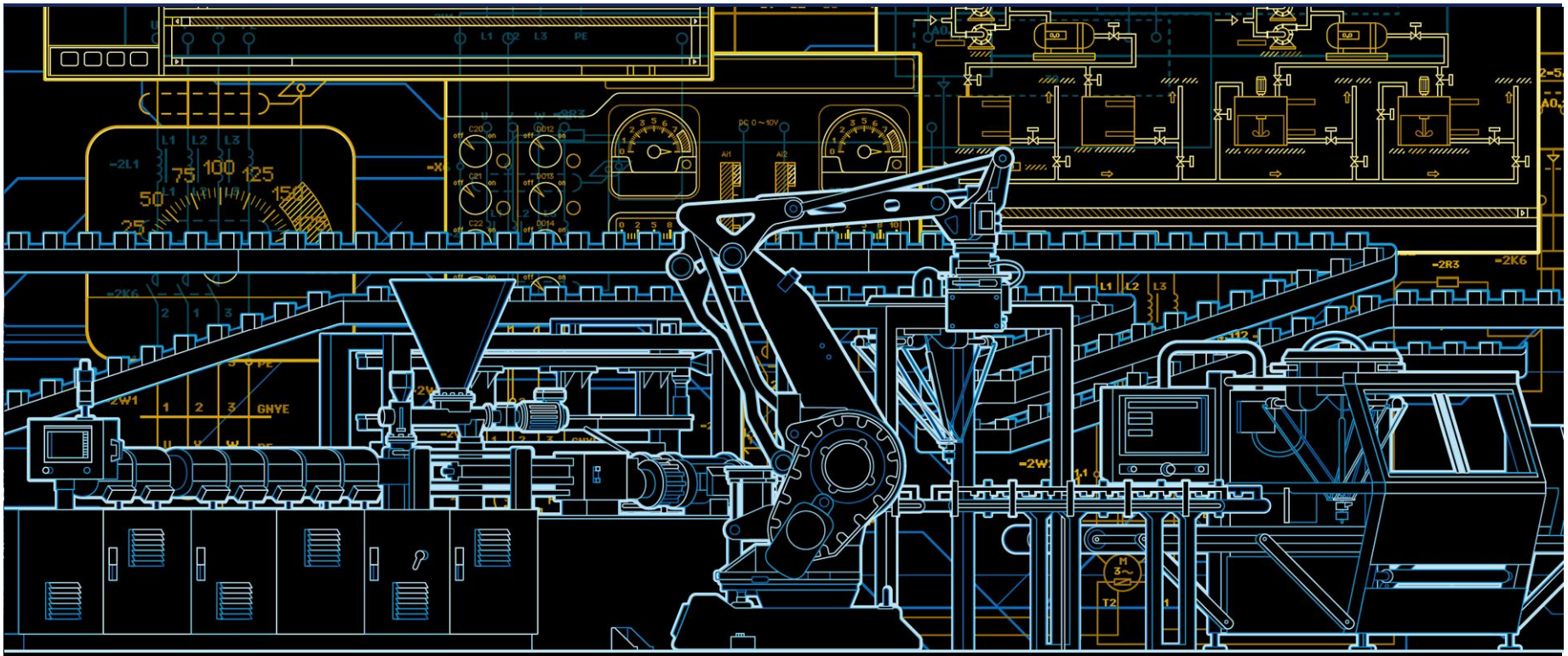


Alf Isaksson, ABB Corporate Research, 2016-04-26

CPSoS in Industrial Automation

Presentation at CPSoS Workshop Hannover Fair 2016-04-26

Power and productivity
for a better world™

Outline

- ABB & ABB Corporate Research
- Future of automation?
  - Internet of things, services and people
- Examples
  - Sustainability & Optimization
- Summary & Conclusions

A global leader in power and automation technologies
Leading market positions in main businesses

~140,000 employees

$40 billion
In revenue (2014)

Present in ~100 countries

Formed in 1988
merger of Swiss (BBC, 1891) and Swedish (ASEA, 1883) engineering companies

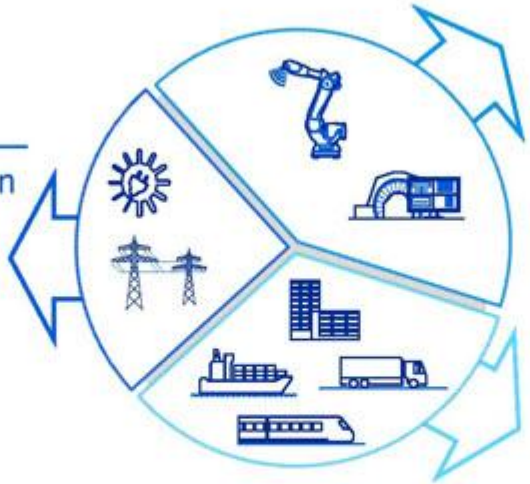
Well positioned in attractive markets

Power & automation demand drivers in three customer segments

Utilities

~$200 bn

- Renewables
- Grid automation
- Smart upgrades
- Emerging markets
- New consumption points



Industry

~$250 bn

- Productivity
- Energy efficiency
- Automation penetration
- Power quality and reliability
- Emerging markets
- US re-industrialization

Transport & Infrastructure

~$150 bn

- Urbanization
- Energy efficiency
- Electric transport
- Power quality and reliability

Significant market opportunities – today: ~ $600 bn, 2020: ~ $750 bn

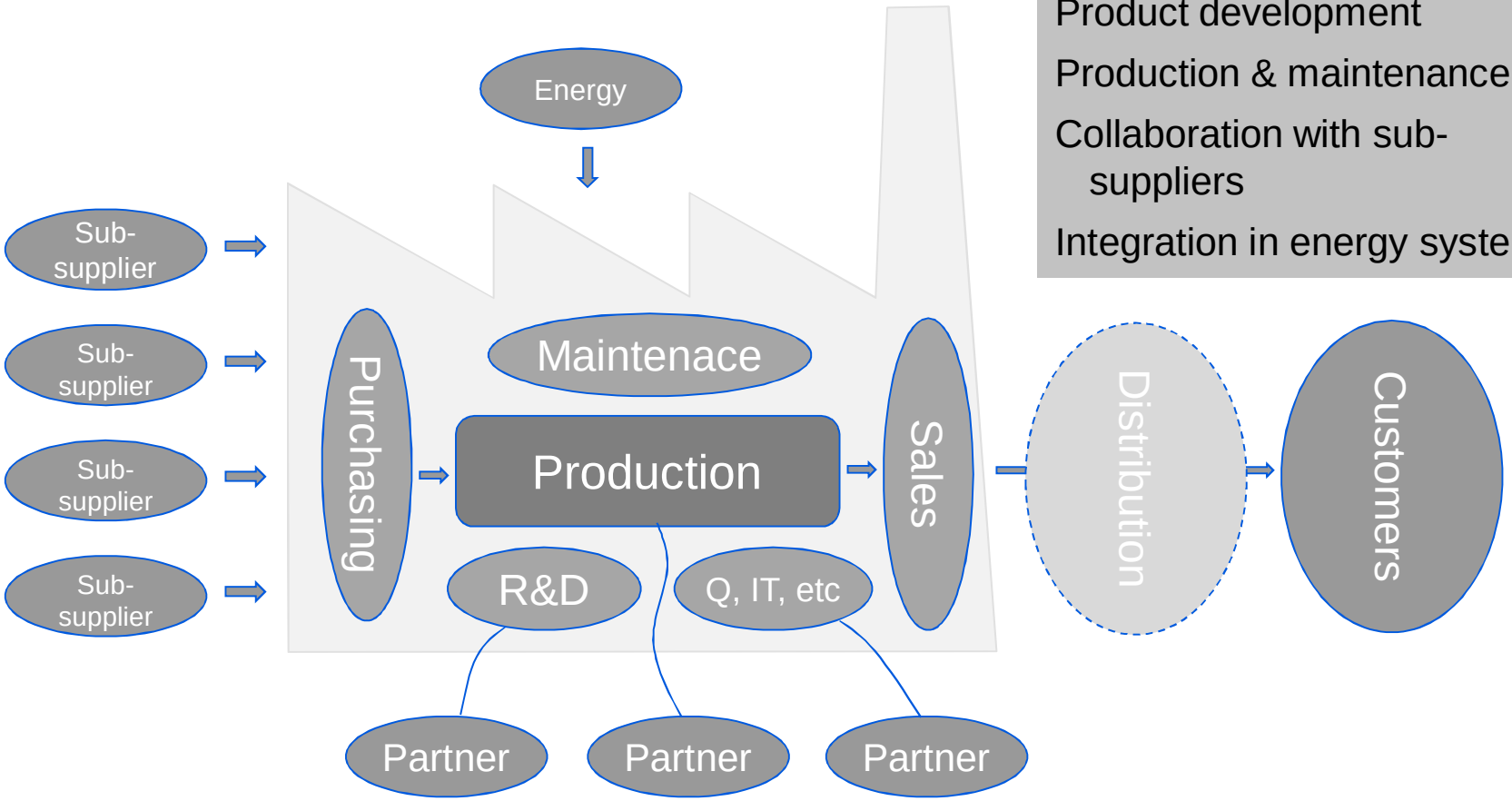
Corporate Research Centers

Close to major customers, universities and ABB's business responsible units

Future of Automation

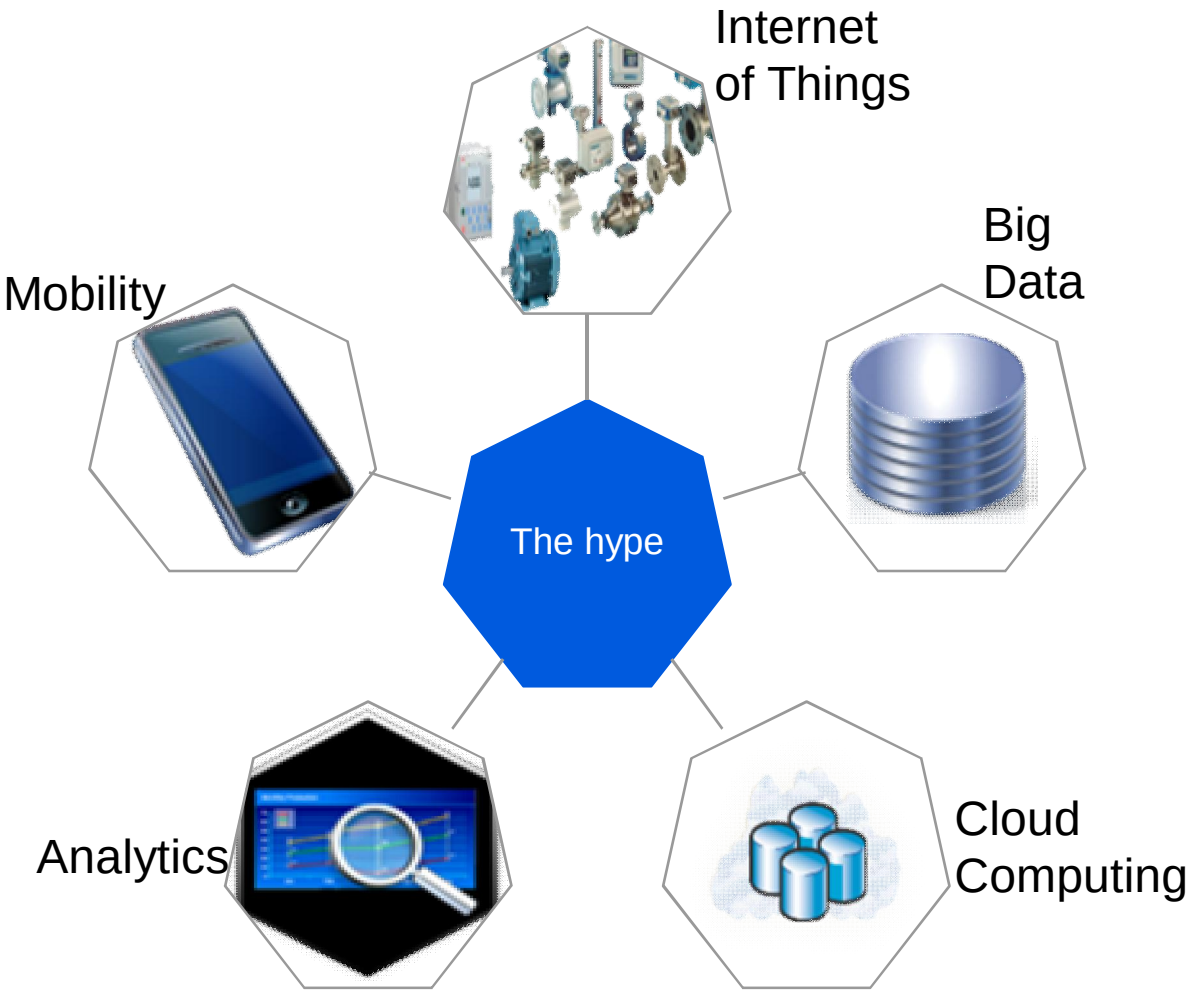
Industrial Digitalization
What does that mean?

- Product offering & business models
- Distributionen
- Market channels
- Customer contacts
- Product development
- Production & maintenance
- Collaboration with sub-suppliers
- Integration in energy system



Market Trends

The Five Major Trends that Manufacturers Must Follow



Market Trends

The Five Major Trends that Manufacturers Must Follow

What the customer really needs

- Safety
- Lower cost and simplified operations
- Production efficiency
- Better asset utilitization / ROA
- More effective decisions

Internet of Things

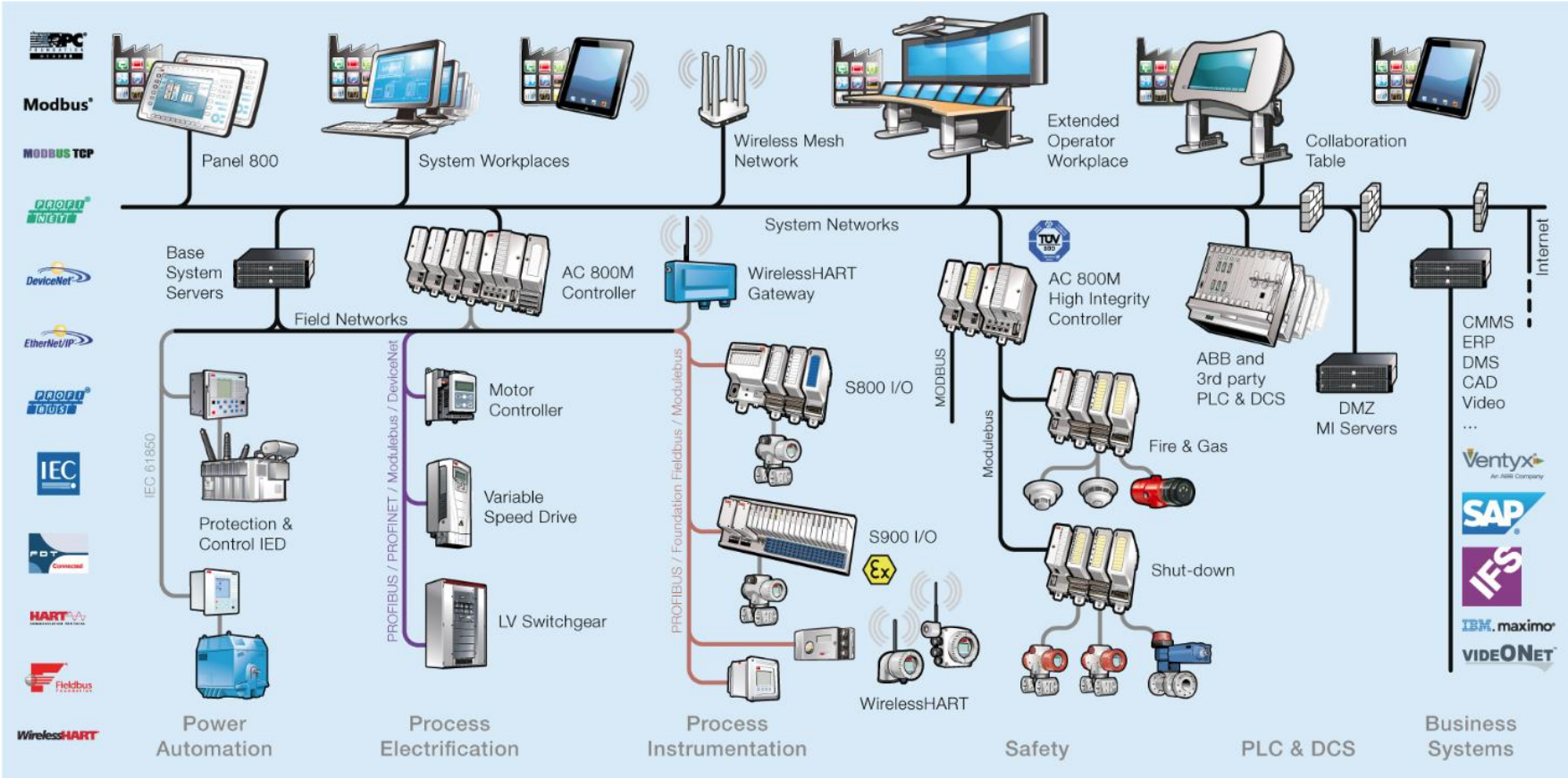
Mobility

Analytics

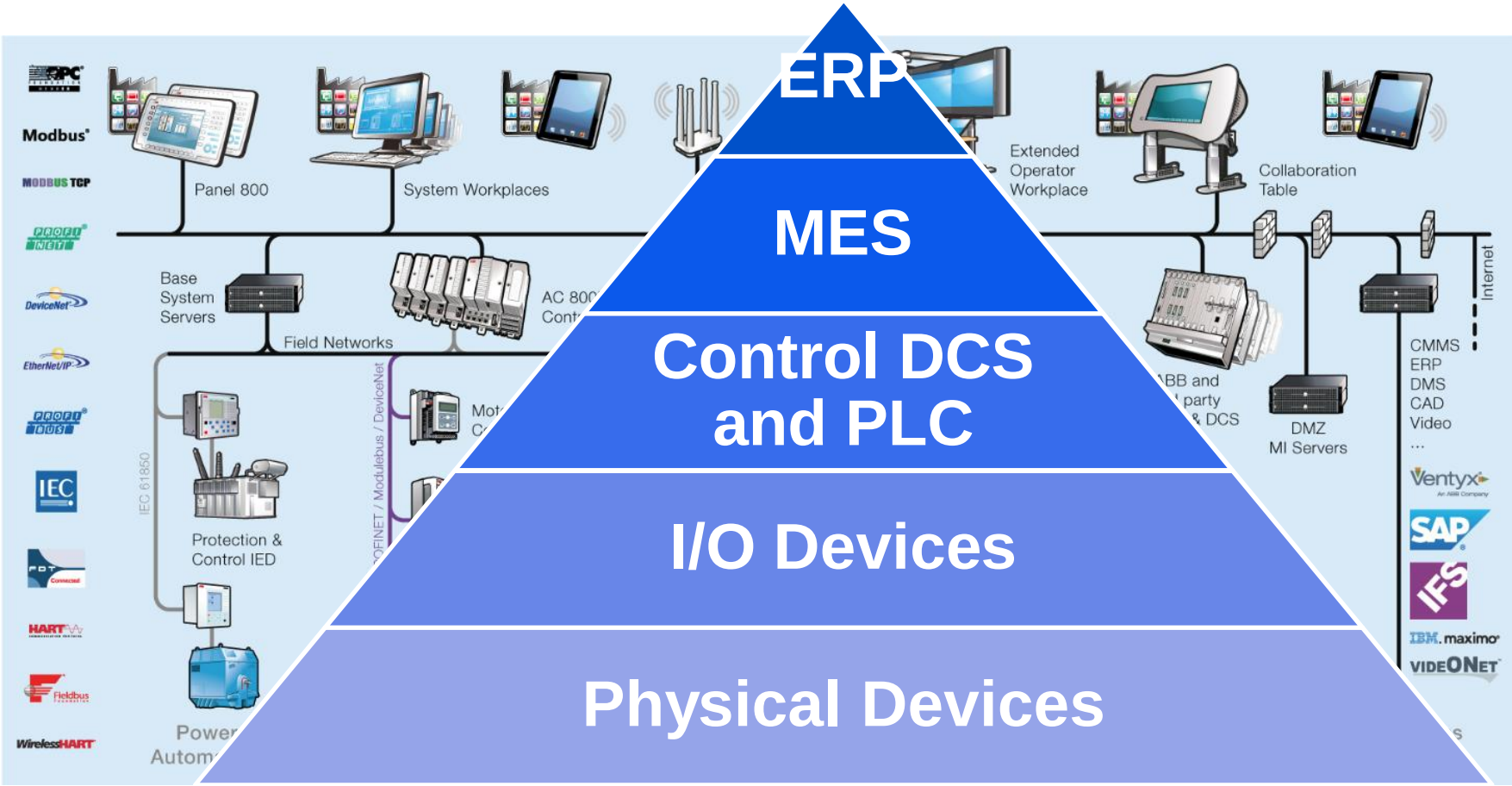
Big Data

Cloud Computing

Today’s automation systems
Automation Network and Hierarchy

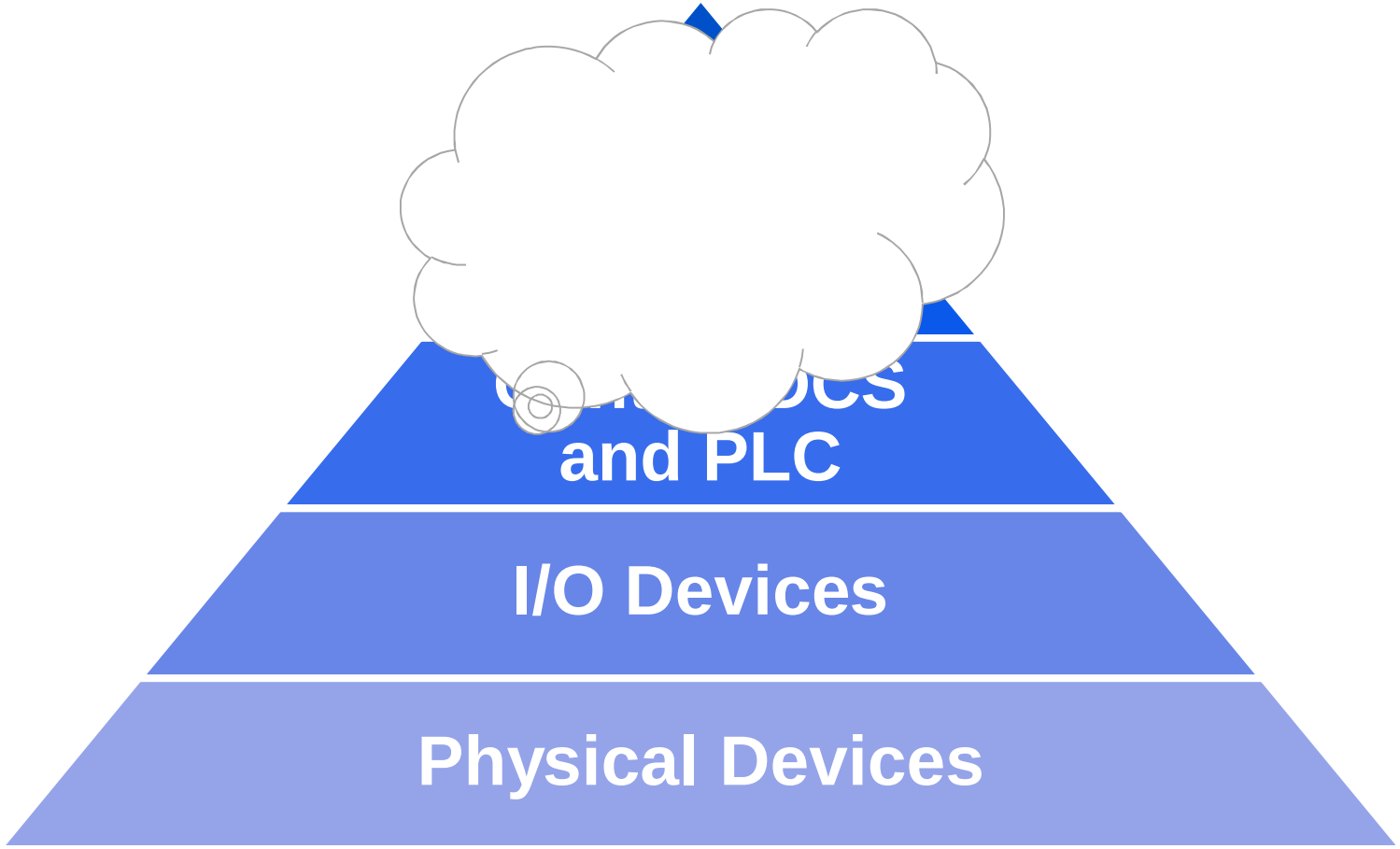


Today's automation systems
Automation Network and Hierarchy



What is happening next?

Upper levels moving to the cloud



End of Isolated Solutions
Balancing Between Control Systems

Energy availability and pricing (smart grids)

Grid control

Industrial demand-side management

Production Management (P&S, APC, Analytics, …)

Integration of scheduling and control

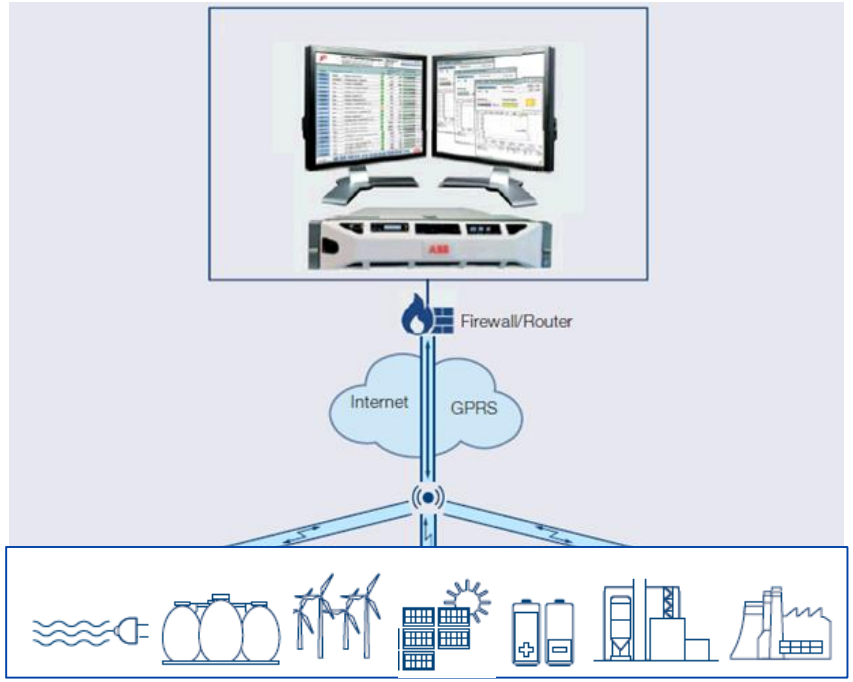
Process variations, e.g. quality, yield, disturbances (DCS)

Process control

Examples
Sustainability & Optimization

OPTIMAX® PowerFit

Optimizing control of Virtual Power Pools



Task

- Aggregate many small production units and treat them like one big power plant
- Exploit multiple forms of energy (e.g. el and heat) and storages

Solution

- Build overall plant model (exploiting Modelica multi-physics)
- Formulate optimizing control task as mathematical program
- Online optimization of set points and plant schedules

Digitalization is crucial for the interconnection of power generation, consumption, storage and production

Industrial demand side management in pulp & paper

Coordination of production planning and energy management

Mechanical pulp production

- Thermo-mechanical pulp (TMP) production is highly integrated with other parts of paper plant
- Most energy consuming production steps are moved **to low cost times**
- Paper output of plant is **not reduced**

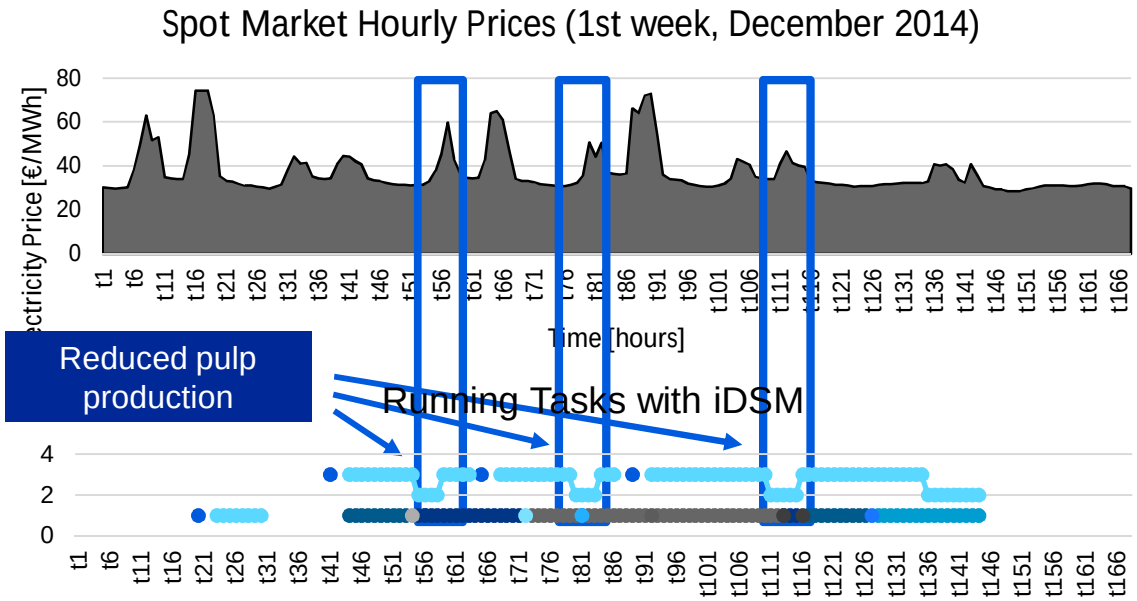
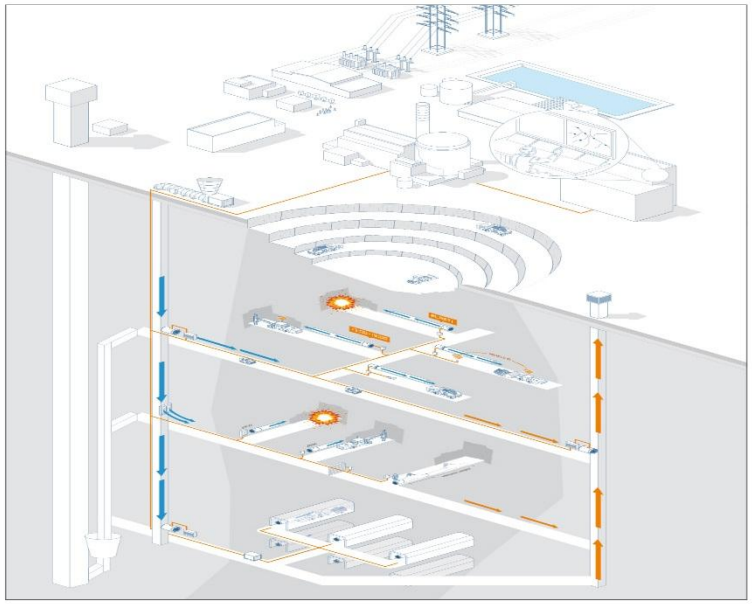


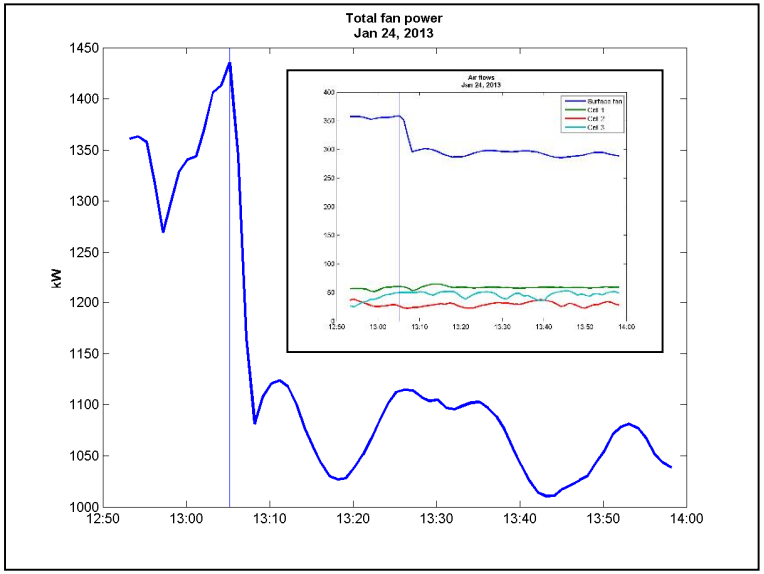
ABB Smart mine ventilation

Healthy working environment and Energy efficiency

Ventilation where needed



Real-time feedback control



Extended lifetime of existing infrastructure
Energy consumption reduction of 30-50% validated on site

In cooperation with Boliden

PIMM

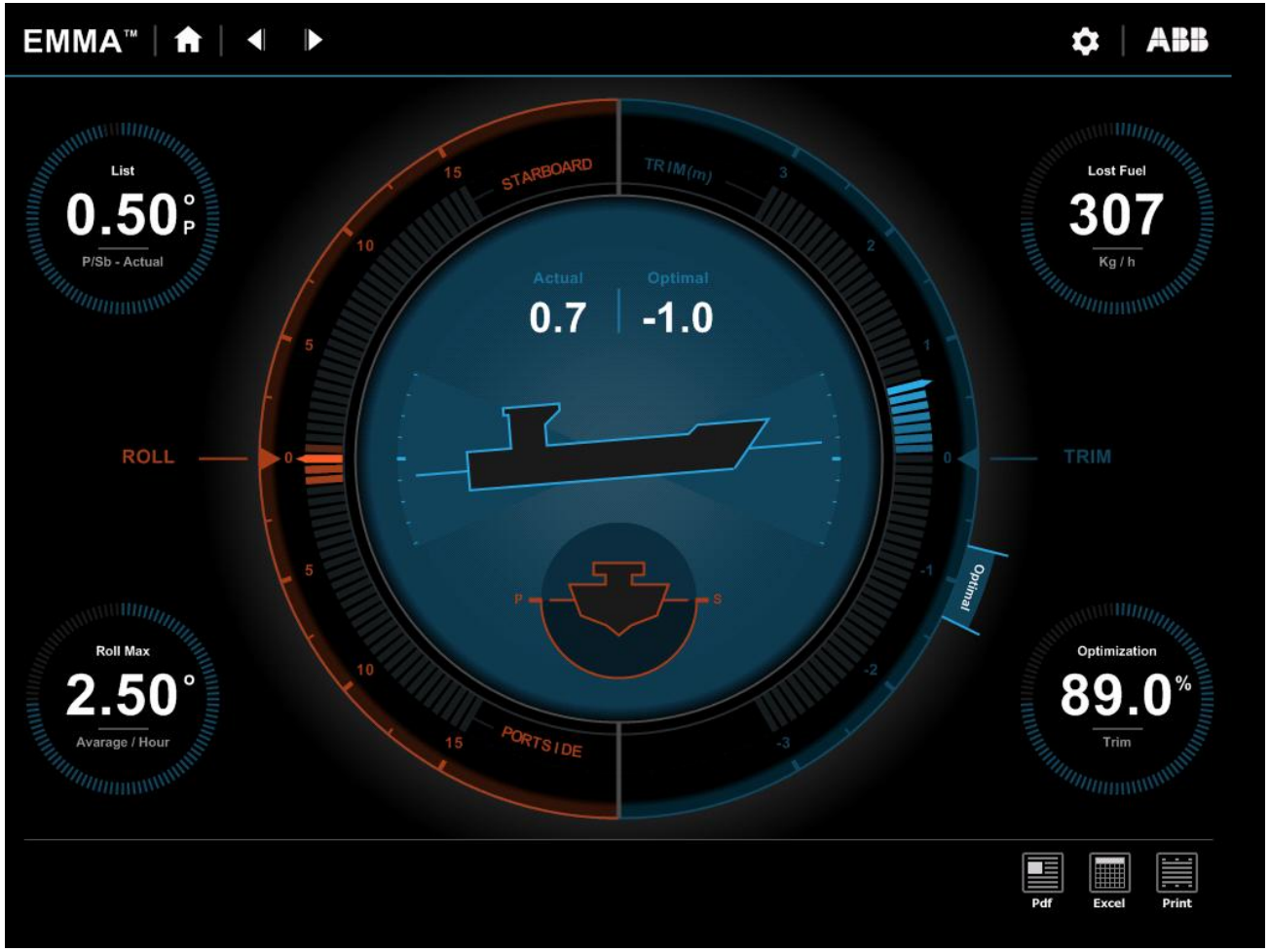
Pilot for Industrial Mobile Communication in Mining

ABB BOLIDEN ERICSSON LULEÅ TEKNISKA UNIVERSITET PiiA SWEDISH ICT SICS Telia VINNOVA VOLVO WOLFIT

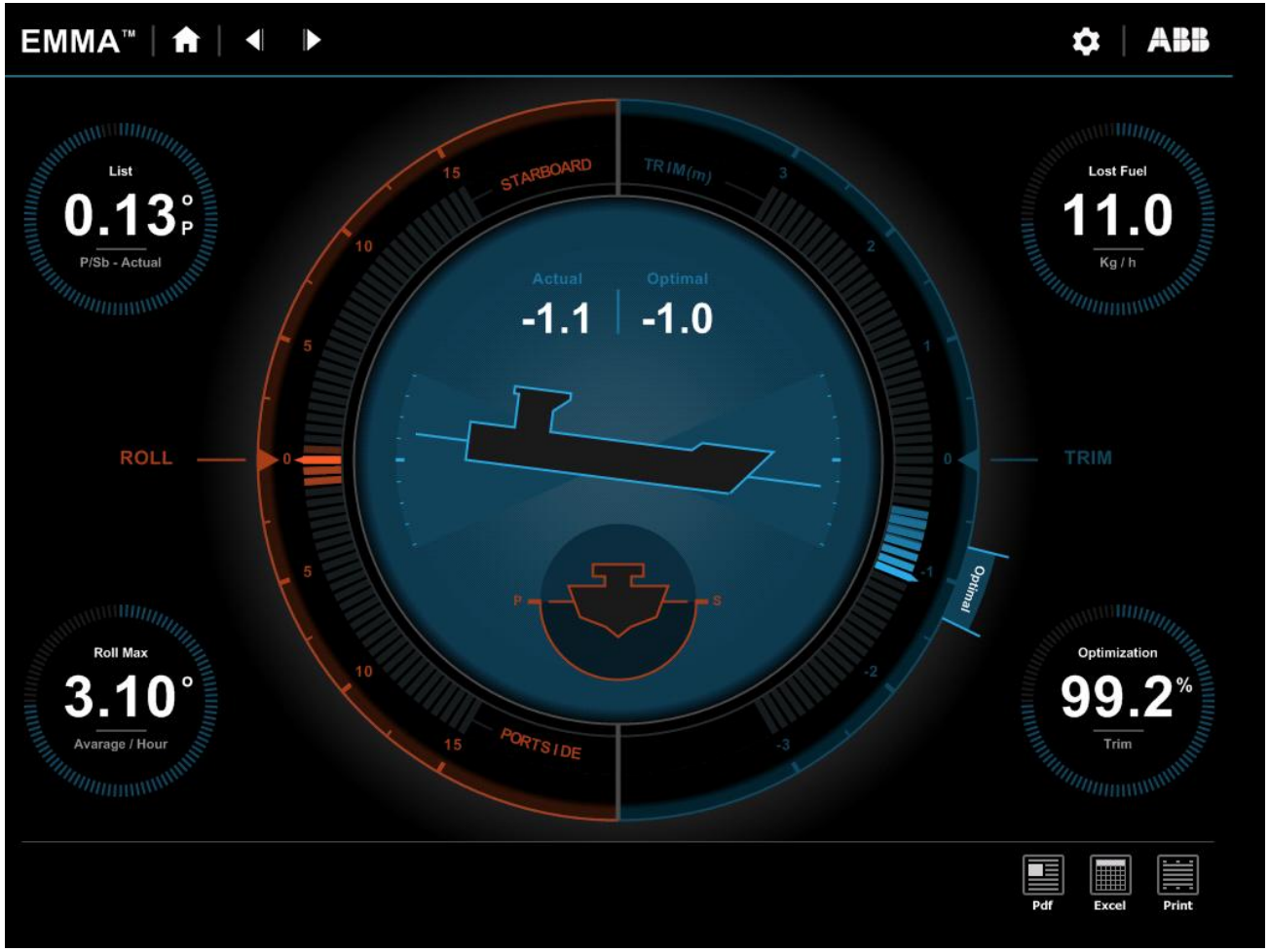
ABB

With and without trim optimization

Advisory
Trim – not in an optimal state



Advisory
Trim – close to perfect



Summary and discussion

Summary & Conclusions
Interesting Journey ahead for Academia & Industry

- Intranet of Things – Internet of Things
  - Intelligent devices equipped with sensors are providing large amounts of data that is today used in the automation system
  - Today's essential requirements remain valid (safety, reliability), cyber security and data privacy become even more important
- Internet of people
  - People will not be obsolete. They are still the decision makers.
- Internet of Services
  - Business model is key. Monitoring and analytics natural first step, but operations will follow.
- More complex systems need to become simpler to manage
  - Smartphone a good example of this…
- Revolution or Evolution?
  - The answer lies still in the future… depends on you!

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