CPSoS in Industrial Automation
Presentation at CPSoS Workshop Hannover Fair 2016-04-26
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

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

- The hype
- Mobility
- Big Data
- Internet of Things
- Cloud Computing
- Analytics
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 utilization / ROA
- More effective decisions

Internet of Things
Analytics
Cloud Computing
Mobility
Big Data

The hype
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

Spot Market Hourly Prices (1st week, December 2014)

Reduced pulp production
Running Tasks with iDSM

Shifting production to low cost times
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
PIMM
Pilot for Industrial Mobile Communication in Mining
With and without trim optimization

4 MW less propulsion power. Savings of $1 million per year.
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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