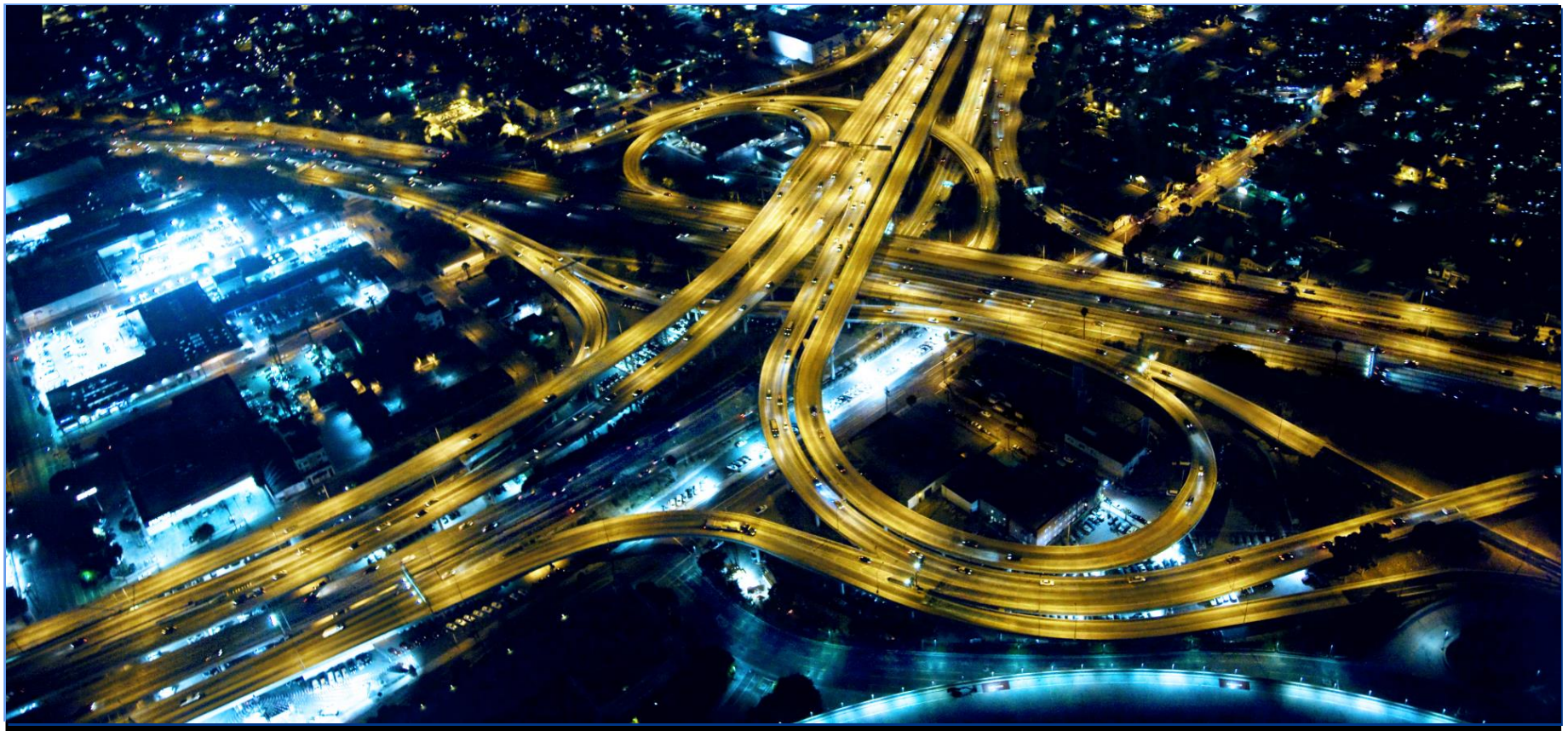


Trond Løkstad, 09.07.2014

ABB Corporate Research

IEEE IOLT: Reliability for Industrial Electronics

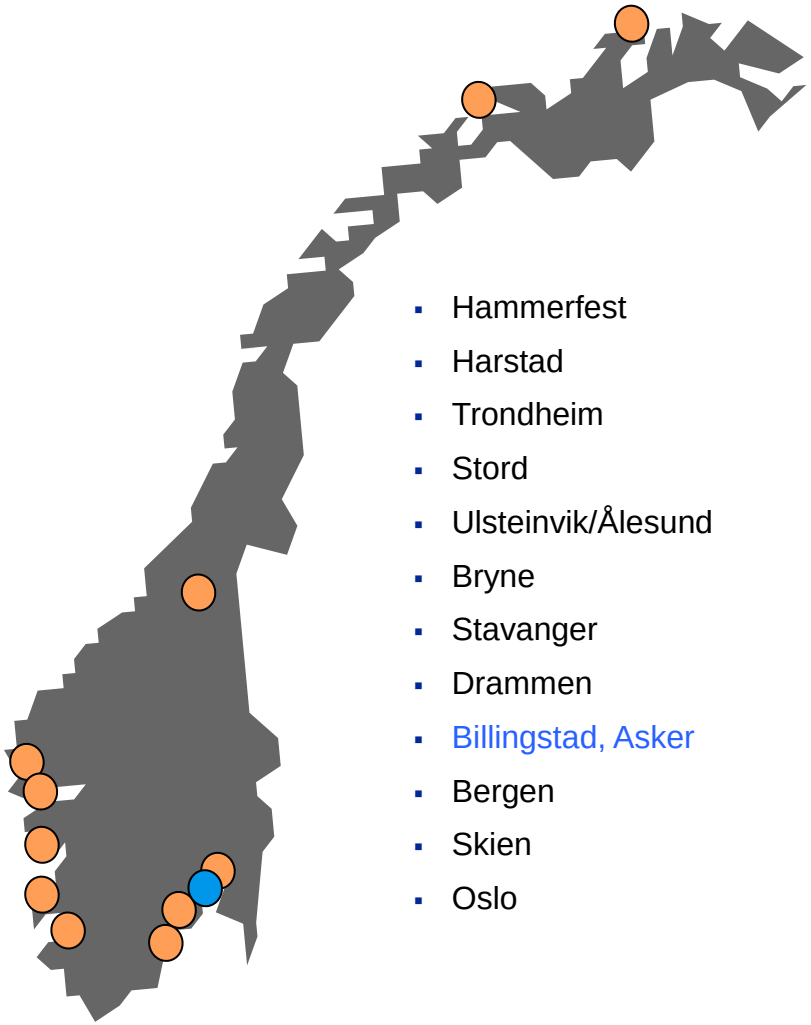
A Leading Player in Power and Automation Technologies

ABB Group in a nutshell

- Core business: Power and Automation technologies.
- Formed in 1988 as a merger of Swedish (ASEA) and the Swiss (BBC) engineering companies.
- Predecessors founded in 1883 and 1891, respectively.
- Publically owned company with head office in Switzerland.
- 145,000 employees in about 100 countries.
- 6000 scientists and developers world-wide.
- Research areas:
  - Communications
  - Electromagnetics
  - Mechanics
  - Sensors
  - Switching
  - Control
  - Materials
  - Power Electronics
  - Software
- Cooperation with national and foreign research centers and universities.

ABB in Norway – Substation, Oil and Gas

ABB AS, Norway

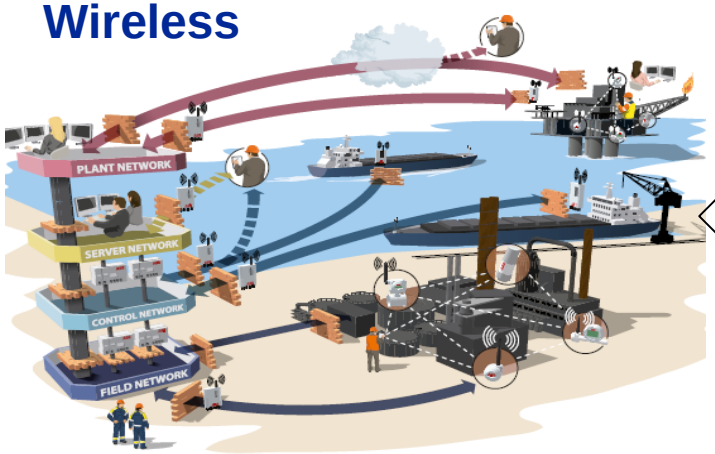


- Hammerfest
- Harstad
- Trondheim
- Stord
- Ulsteinvik/Ålesund
- Bryne
- Stavanger
- Drammen
- Billingstad, Asker
- Bergen
- Skien
- Oslo

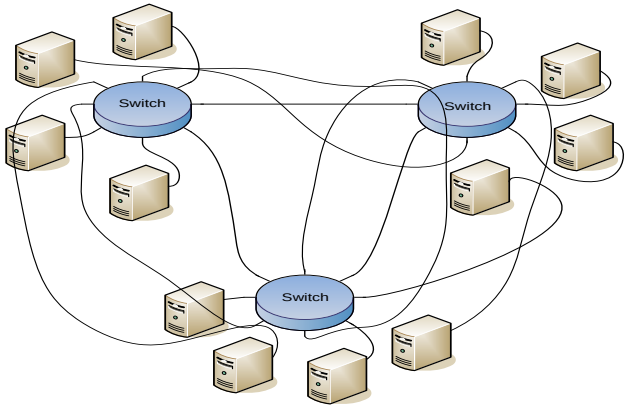
- Core business is organized into five divisions.
- In total 12 geographical locations, with research departments in Asker and Oslo.
- Number of employees ABB AS: 2,200.
- 24 scientists in Norwegian corporate research center (NOCRC), Billingstad.

Our Competence Areas

Wireless



Wired



Safety
Reliability
Security

Embedded design

- Radio Platforms
- Wireless Infrastructure
- Protocols & Standards
- Quality of Service
- Resource Management
- Application requirements

- Ethernet Switching & Routing
- Automation Protocols
- Real time communication
- Time synchronization
- Network Management
- Redundancy

Architecture
System design
Platform choice
Implementation

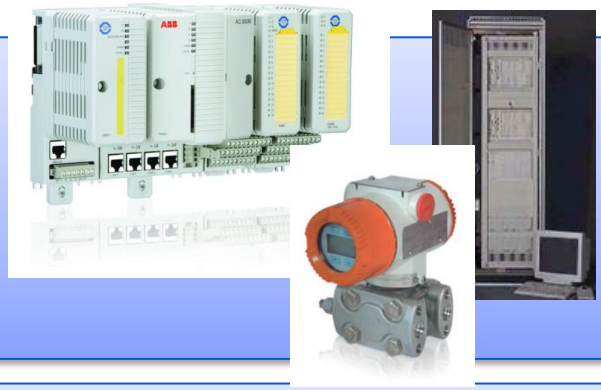
HW/SW design
Processors, CPUs, FPGA
Real time implementation
Model driven design
Multicore
SW tools & programming

Architecture
System design
Platform choice
Implementation

ABB's Safety Portfolio and Roadmap

Control Systems

- SafeGuard 700
- SafeGuard 9000
- SafeGuard 3000
- SafeGuard 400 Series
- Safety Instruments (Pressure, Temperature)
- AC 800M HI SIL 2 including Safe IO Modules
- AC 800M HI SIL 3



Low Voltage Products

- Advant Controller 31-S
- ArcGuard SIL 2
- Universal Motor Controller UMC 100 ATEX (SIL 1)
- Safety Option SIL 2
- SM560 AC500-S SIL 3 including Safe IO Modules
- Multicore Safety for PACT & Robotics

1979 '83 '93 '97 ……. 2004 2008 2010 2013 and beyond

Factory Automation (Jokab safety)

JOKAB SAFETY
A MEMBER OF THE ABB GROUP

- Adapter Units
- Fencing system
- E-stops
- Safety Relays
- Control devices
- Rails/bumpers/mats
- Light beams/light curtains/scanner
- Safety roller door
- Stopping time/machine diagnosis
- Sensors/switches

ABB Current Safety Product Characterization

- Long lifecycle (> 20 years)
- High uptime
- Slow response time (100 ms)
- Low performance – high cost pressure
- Low power – in many cases sleep and wake up
- Device fieldbus (proprietary)
- Ethernet in CS

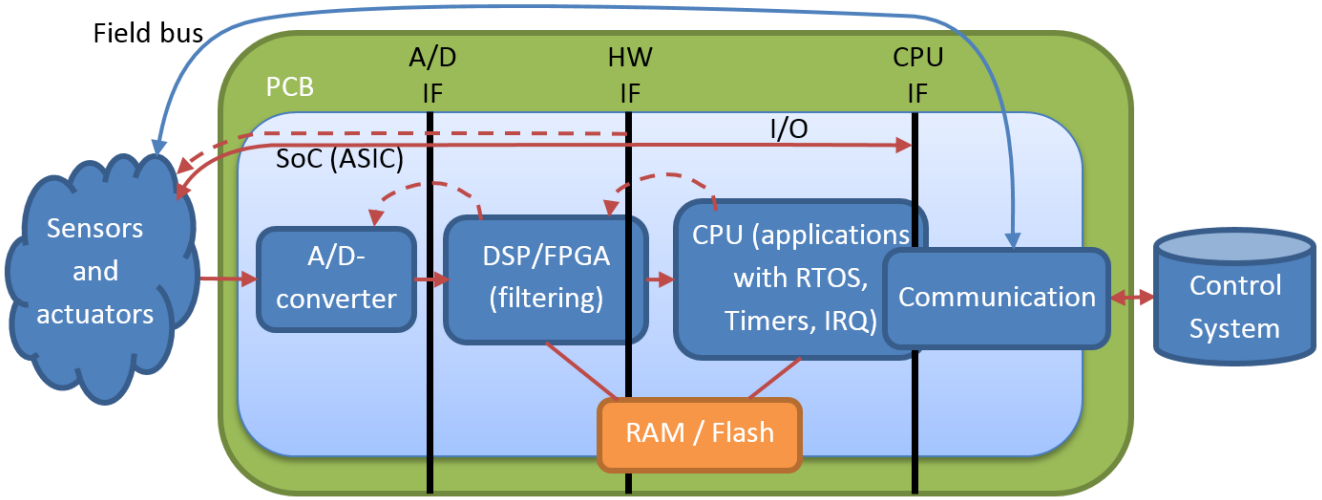
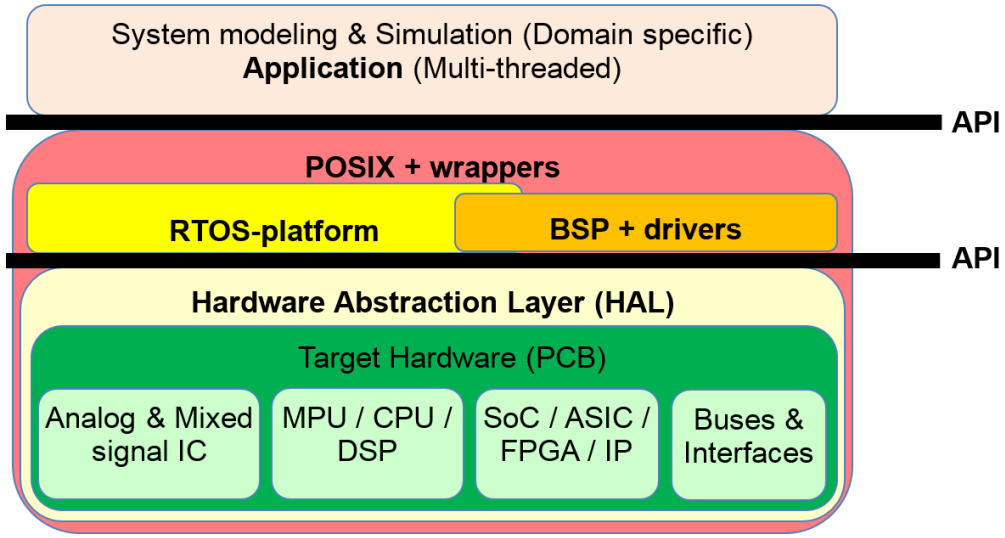


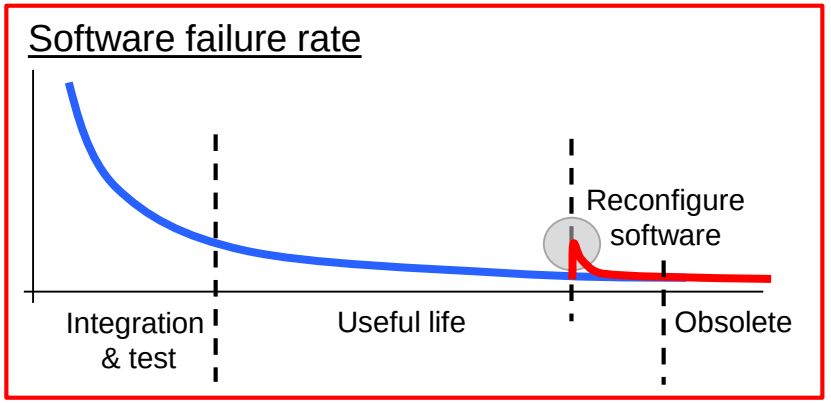
ABB Future Safety Trends

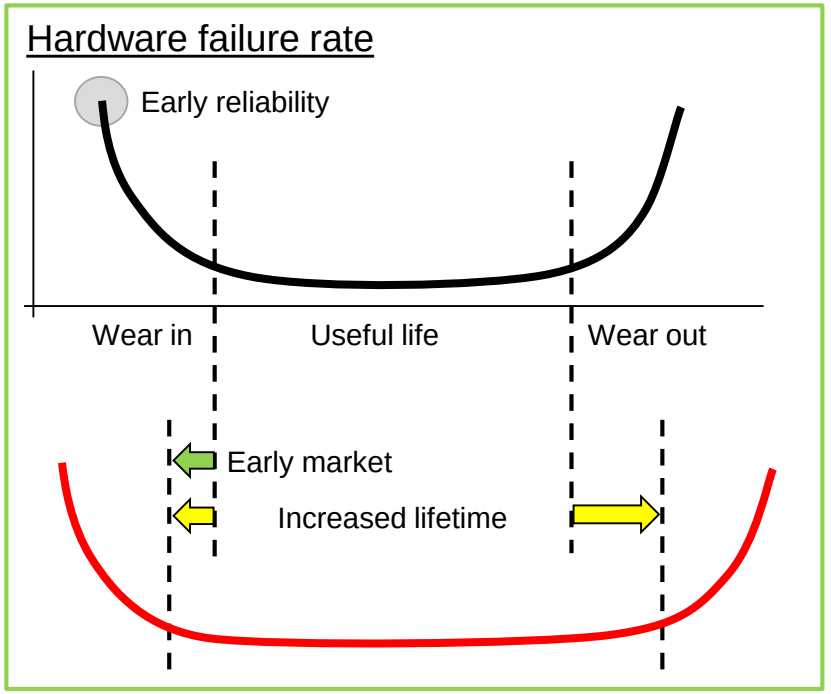
- High reliability and availability – SIL is a selling argument
- Higher abstraction level (MDD, simulation, code generation)
- Everything will be connected (IoT) – also layers
- Increased Customer focus – added services
- Increased use of Freeware – reduce cost pressure



How to meet future challenges?

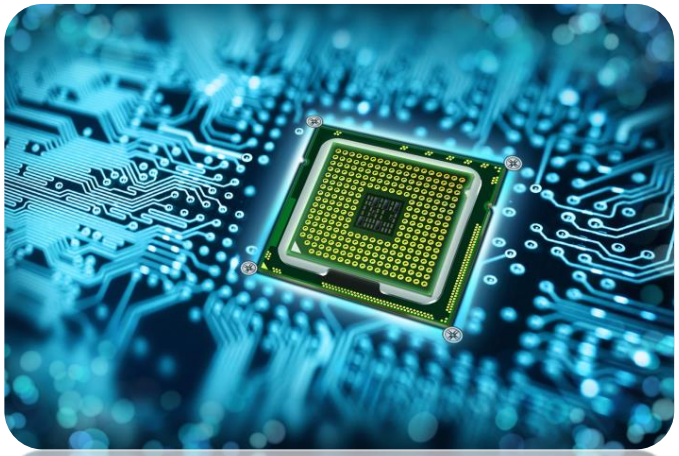
- Die sizes are shrinking
- Performance increasing
- “Useful Life” will be reduced
- How can we increase the lifetime?
- Extending “Wear out” by doing constant measurement with reconfigurable software (e.g. multicore)
- Reducing “Wear in” by using early/simulate hardware fault injection combined with self-correcting hardware (Early market)





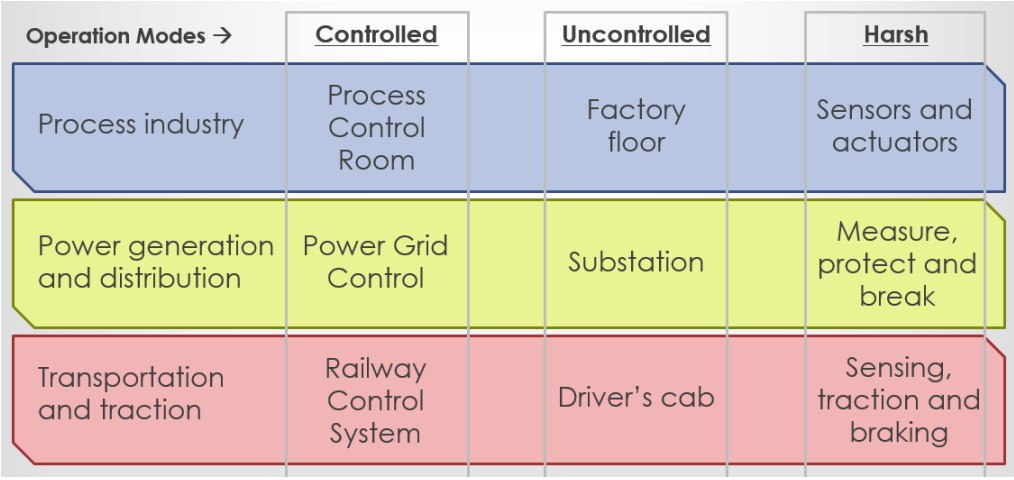
Involvement in Recent EU Projects

- CESAR (safety framework)
- VERDE (testing of embedded systems)
- iFest (tool adapters for efficient development)
- Currently: Segrid (security), EMC^2 (iFest2), CLERECO (early reliability estimation)



Expected Main Contribution in CLERECO

- Delivering domain requirements (e.g., operation modes)
- Analyzing the fault propagation through the software stack with an industrial application
- Reviewing the CLERECO reliability framework
- Developing a domain specific pilot application
- Help on disseminating the results



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for a better world™