

EEIC – Eaton European Innovation Center



Eaton perspective of Industry 4.0

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Powering Business Worldwide

November 30, 2016

Content

- Introduction to Eaton Electrical sector
- Eaton platform for connected devices - Smartwire DT
- Architecture of future production systems
- From Smart Devices to CPS
- SWD – technology for intelligent components
- Pilot project - FoF: Flexible, Optimized and Traceable Production Systems

Machine builders

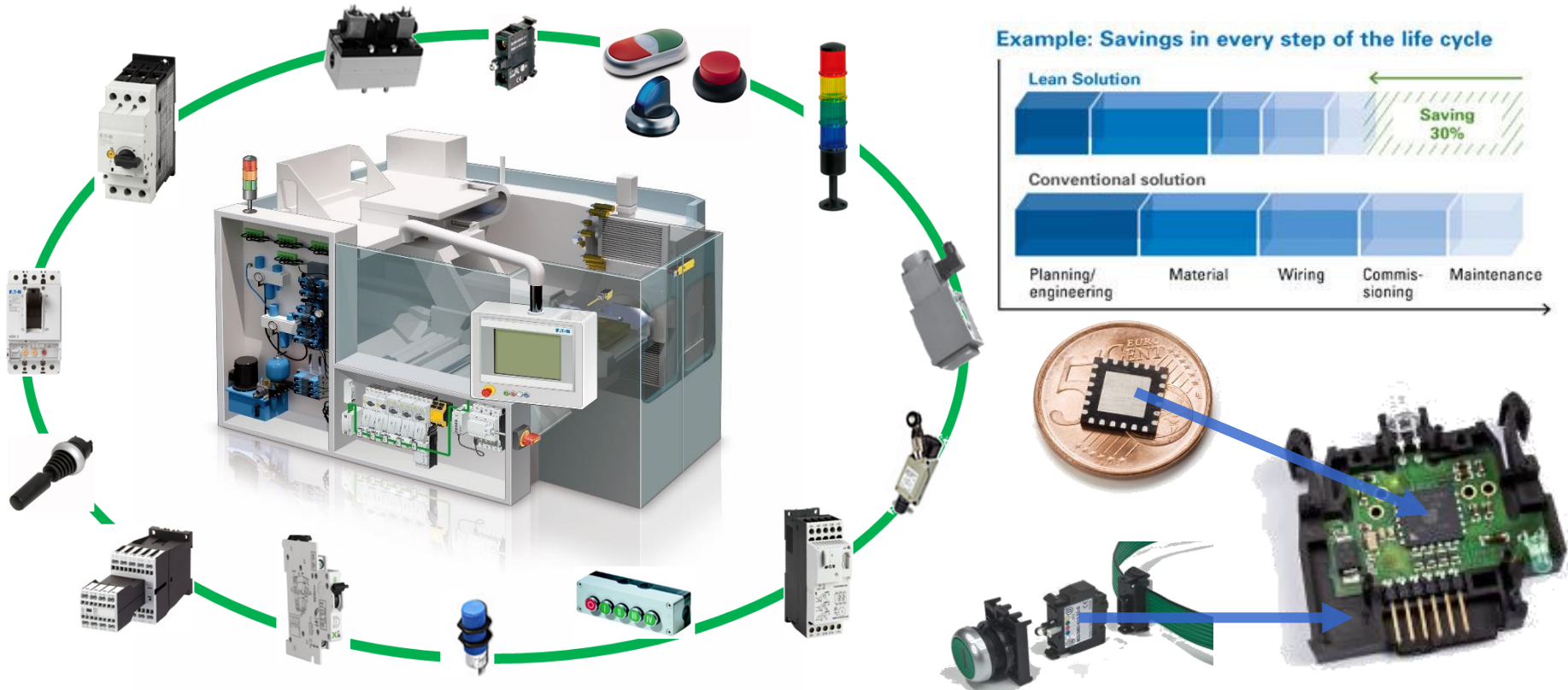
Supporting a wide range of design-for-purpose machines with industry leading solutions



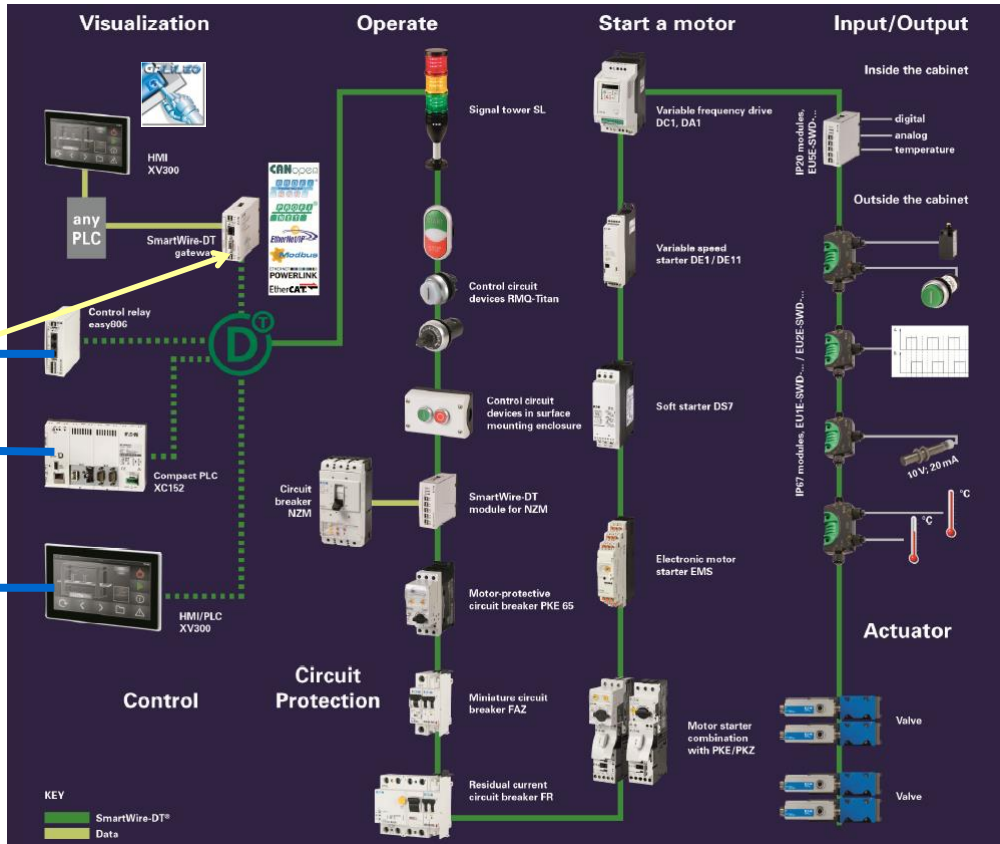
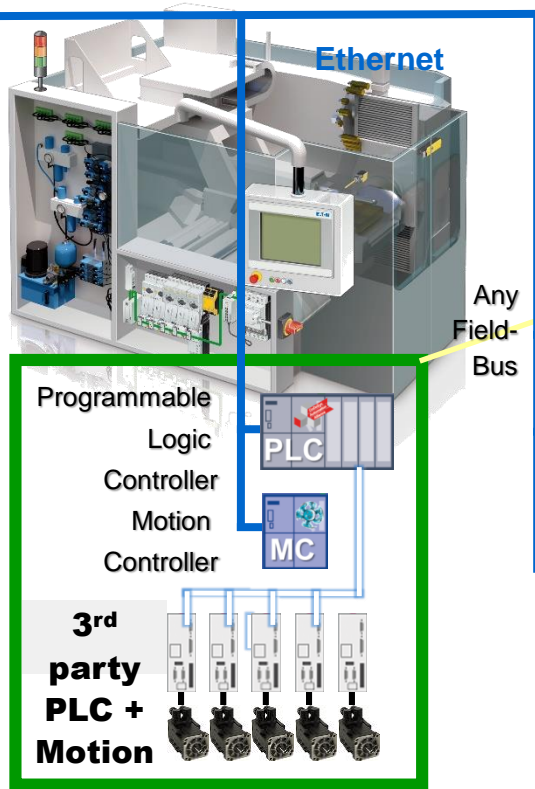
- Motor control
- Human machine interface and logic control
- Intelligent wiring solutions
- Sensors and limit switches
- Circuit and power protection
- Hydraulic pumps and valves
- Fluid conveyance and management
- Filtration solutions

SmartWire-DT Technology

A single communication system for all Switchgear Components



Eaton's SmartWire-DT Examples



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Innovation, Motor of the Economy from products to solutions & services

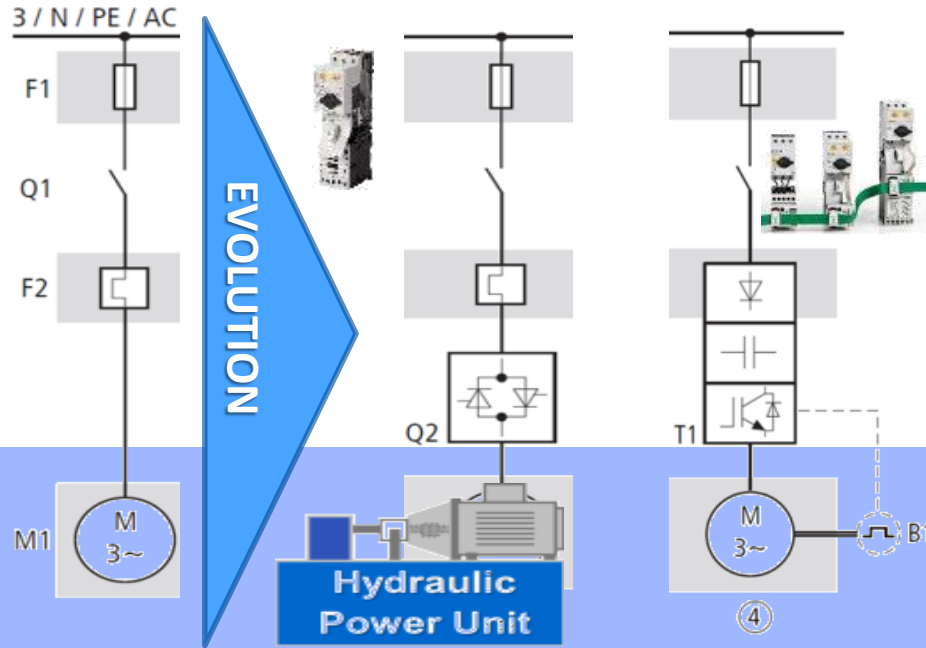


Mechanics

Mechatronics

Energy and Data Management

MACHINE ELECTRICAL CABINET



Scalable Functions

vs. Components

Protect

Switching

Control

open & closed loop

monitoring

of power / condition

Intelligence

Decentralized functionalities

Mechatronic

horizontal integration
(energy flow)

Access

vertical integration
Data-Availability
(data flow)



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Trends, Needs and Technology

Remote Service Solution

- Industrial Internet of Things
- M2M communication / Cloud service solutions
- Predictive Maintenance
- Process & Diagnostic data
- Subscription business model
- NFC, Bluetooth, LPWA Network



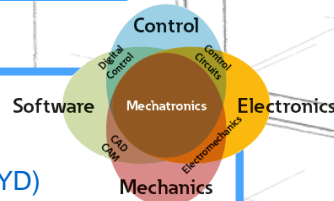
Outside the Electrical Cabinet

- IP67 Intelligent Devices
- Cyber-Physical-Systems
- Decentralized functionalities
- Scalable granularity
- Connectivity to standards plugs (e.g. M12)
- Connectivity to standard field buses (e.g. I/O link)
- Machine-to-Device solutions (e.g. RMQ-Compact)



Mechatronic Solutions

- Electro Mechanics -> Power Electronics
- Hybrid Electric and Fluid-Power Solutions (EL&HYD)
- Energy Efficiency
- Predictive Maintenance / Mechatronic-Wellness
- Smart-Motors / Smart-Valves / Intelligent Switching



Operator Interface Solutions

- iPad look and feel / new scalable designs
- Ergonomic Push Button Design
- Highly customized & small lot sizes
- Hygienic design / Flat Glass front
- Chemically resistant
- Haptic, Gesture, Cap Touch



Energy Management

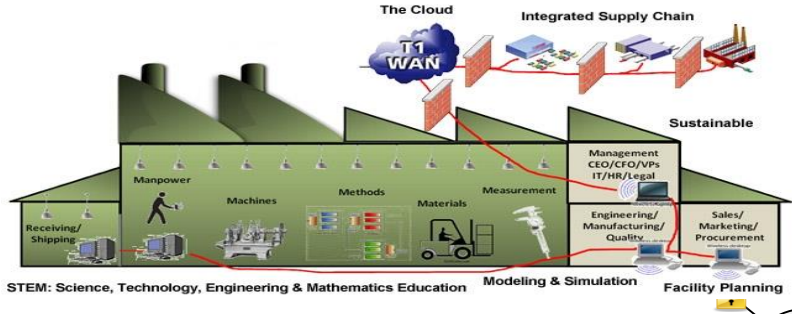
- Energy measurement & storage
- Power-on-Demand solutions
- Reduced Downtime



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Factory of the Future

Factory of the Future – Energy Management



STEM: Science, Technology, Engineering & Mathematics Education

Factory of the Future – MOEM - Decentralized Intelligence



Services

Energy Management

- Data Transparency – Cloud Solution
- Cloud Applications and Services
- Intelligent Devices – Distributed
- Cyber Physical System
- Cyber Security
- Industry 4.0, Internet-of-Things

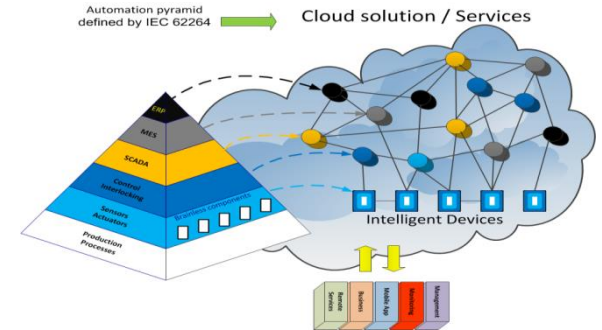
Cloud Server Solution



Client Web-Browser (HTML 5)

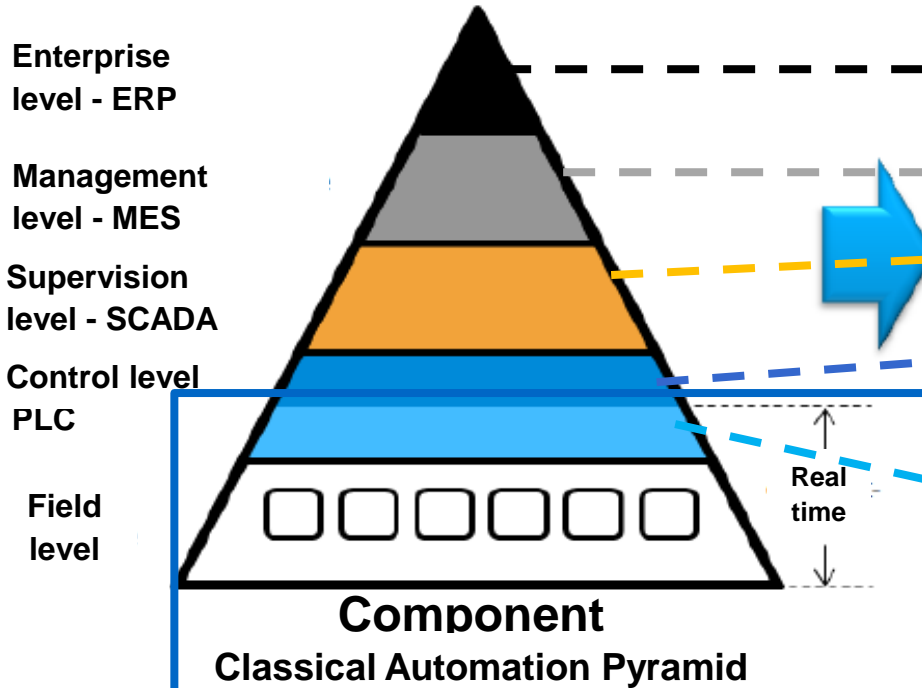
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M2M communication

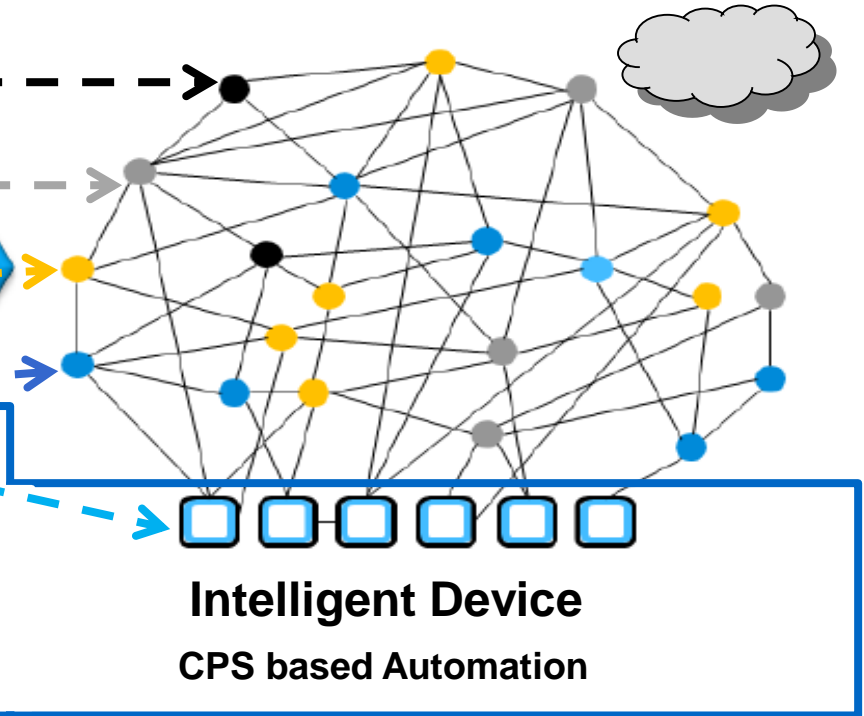


Eaton's future playground with Intelligent Devices

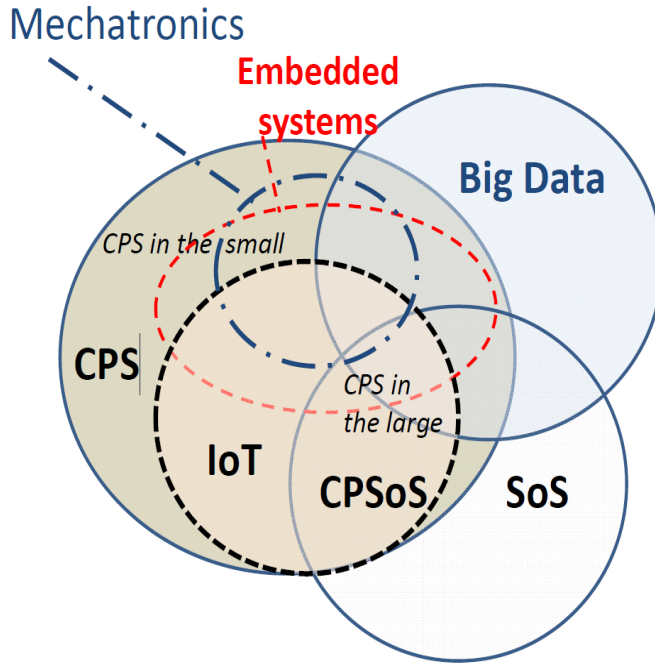
Today Solution



Cloud Solution / Services



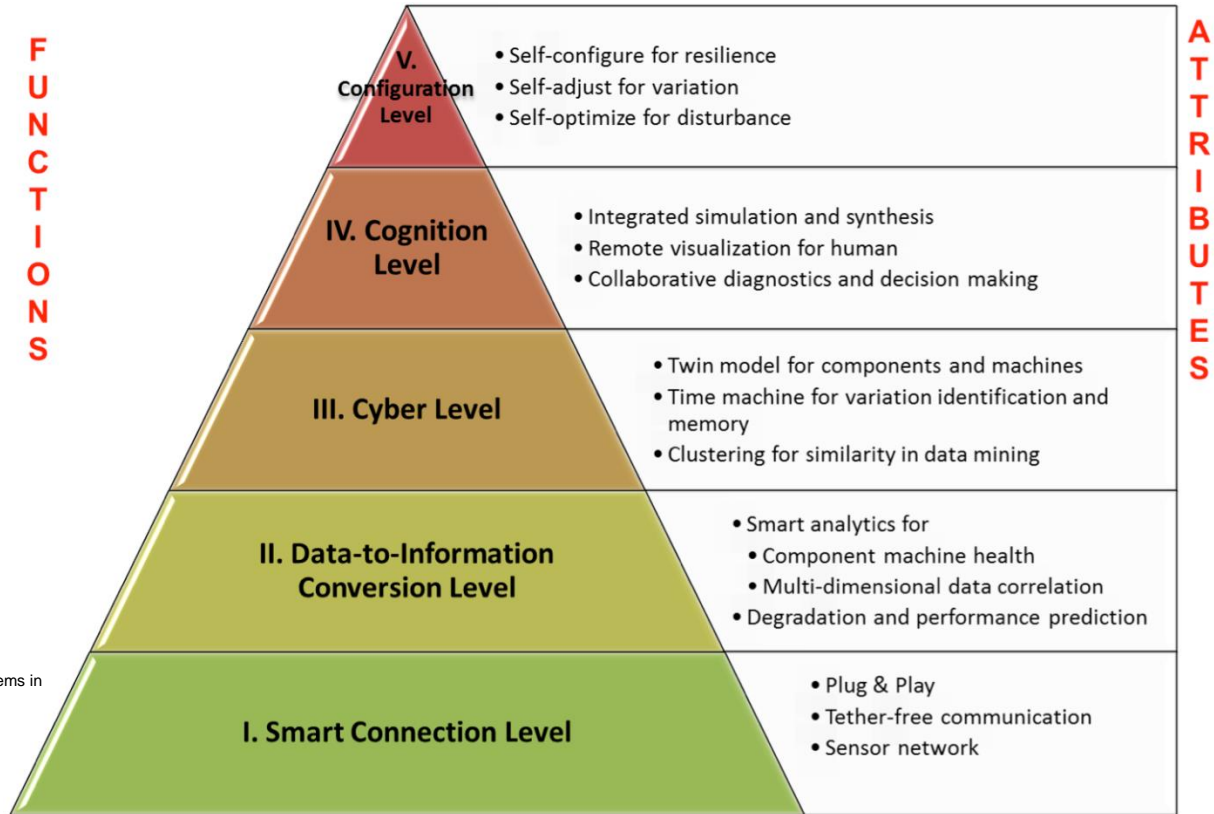
Relating CPS to IoT, Embedded systems, Big data and SoS



- CPS have complex, cross-technology nature
- CPS must draw on all results form these technology domains, but must specifically address the cross-domain/discipline-/technology aspects

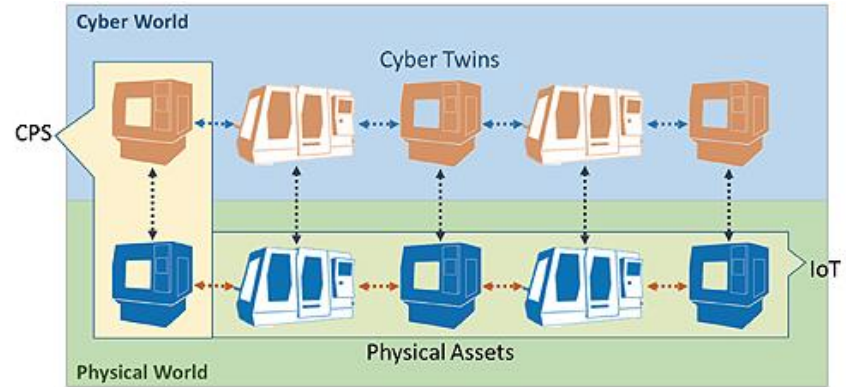
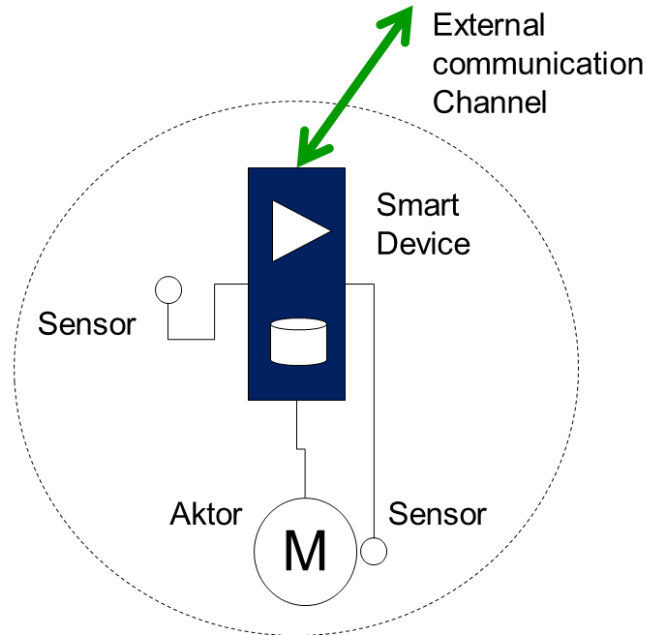
CyPhERS, Cyber-Physical European Roadmap & Strategy
<http://cyphers.eu/sites/default/files/D5.2.pdf>

5C Architecture for designing CPS



5C Architecture for Designing Cyber-Physical Systems in Manufacturing
Source: IMSCenter.net
Date: 2014/09
Author: Behrad3d, CC

CPS



Big future for cyber-physical manufacturing systems

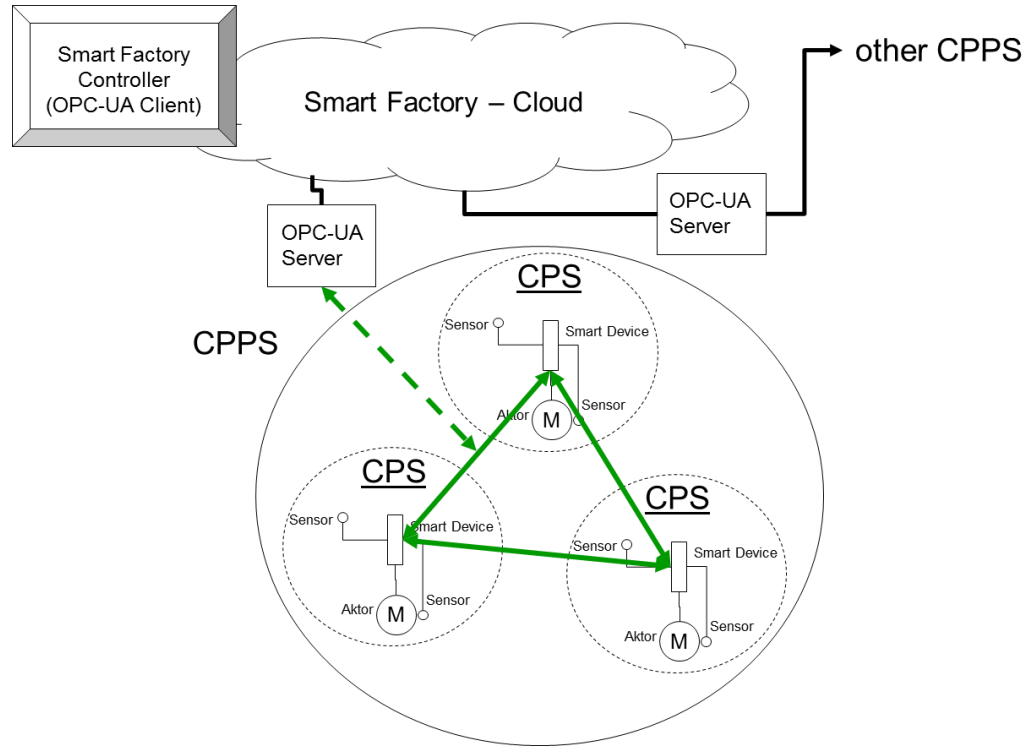
Source: <http://www.designworldonline.com/big-future-for-cyber-physical-manufacturing-systems/>

Date: September 23, 2015

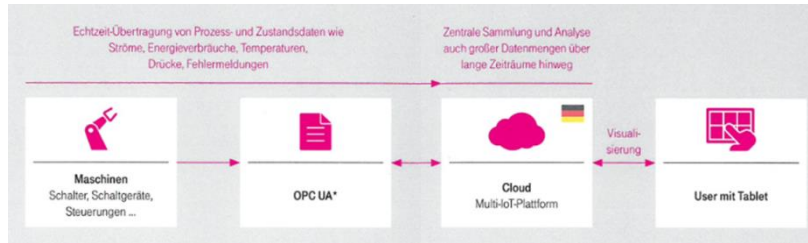
Author: BEHRAD BAGHERI, NSF I/UCRC for Intelligent Maintenance Systems (IMS) and JAY LEE, University of Cincinnati



Cyber Physical production systems (CPPS)



Highlight from Eaton booth at SPS IPC Drives 2016



FoF- Flexible, Optimized and Traceable Production Systems

Funding agency:

Program OP PIK APLIKACE
Ministry of Industry and Trade, Czech Republic

Duration:

36 months

Eaton Objectives:

- Development of new generation of the technology platform to come the way from Industry 3.0 to 4.0 by developing Intelligent Devices (GW, Operator interface, Energy management)
- Applying concepts to various manufacturing use cases via manufacturing line pilot at EEIC (with data from Chomutov and/or Suchdol).
→ learning and showcasing of FoF application (also for IoT)



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SWD Comms / ASIC 2
Intelligent Components
Integration w/ cloud services
Pilot demonstration



Multi-objective process
schedule & optimization,
Algorithms,
web-based services



Scheduling
ERP Integration

Deliverable (Government):

- Test report describing the performance of the pilot line including evaluation of I4.0 & IoT concepts, such as intelligent networked components and web based services for production optimization.

Targets Metrics:

- Production plan preparation time reduced from hours to minutes
- 10% faster machine set-up & changeover times

The Eaton logo is rendered in a bold, white, sans-serif font. The letters are thick and blocky. The letter 'O' is unique, featuring a solid white circle in its center. The logo is positioned in the upper middle of the frame against a dark blue background.

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