Industry 4.0: OPC UA bridging IT and automation

Smart Machine Module

smart controller

smart controller

smart controller

WiFi

smart controller

smart controller

smart controller

smart controller

German Research Center for Artificial Intelligence | IFS Innovative Factory Systems

Forschungsunion

Wirtschaft und Wissenschaft
begleiten die Hightech-Strategie

acatech

DEUTSCHE AKADEMIE DER
TECHNIKWISSENSCHAFTEN
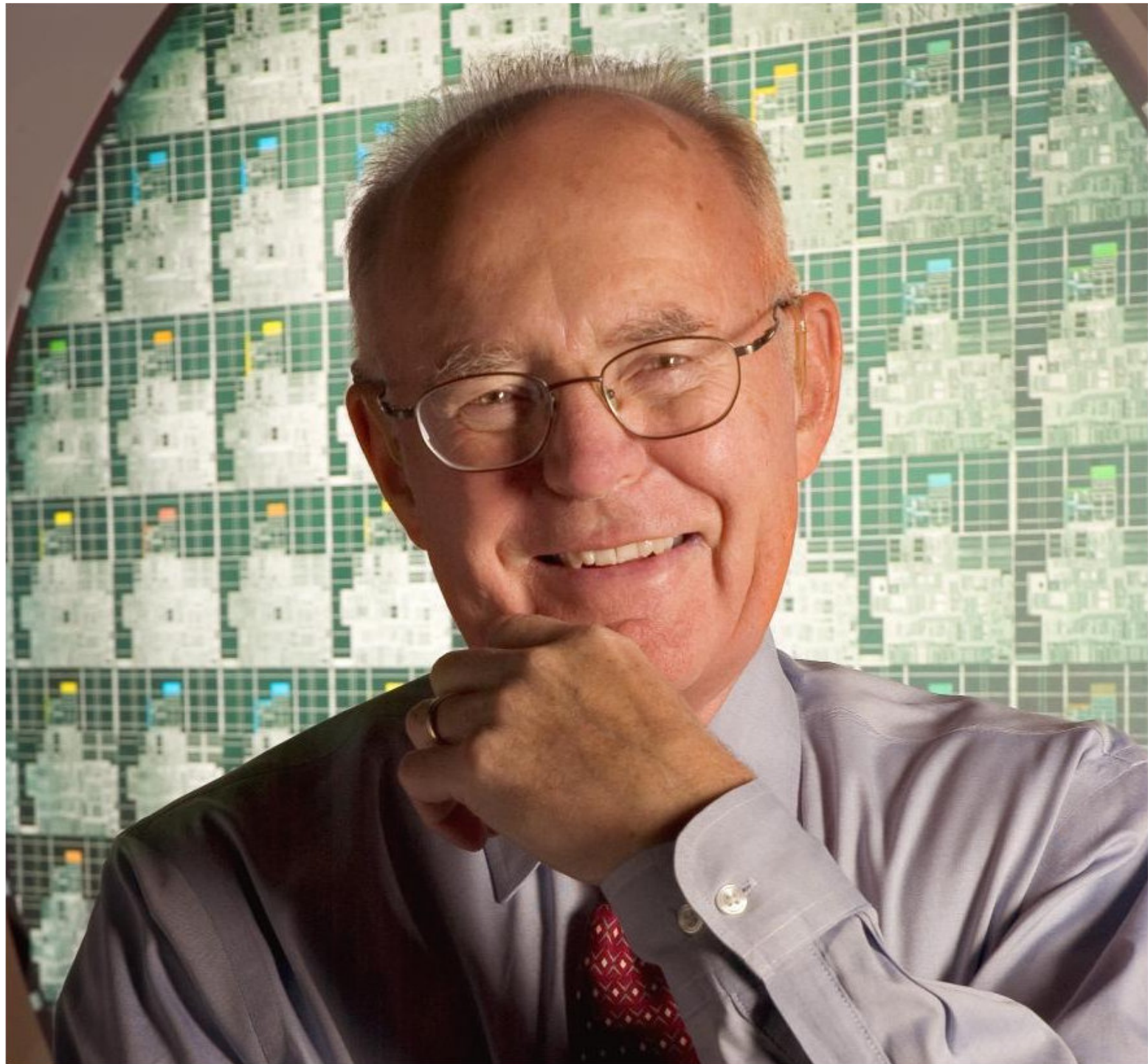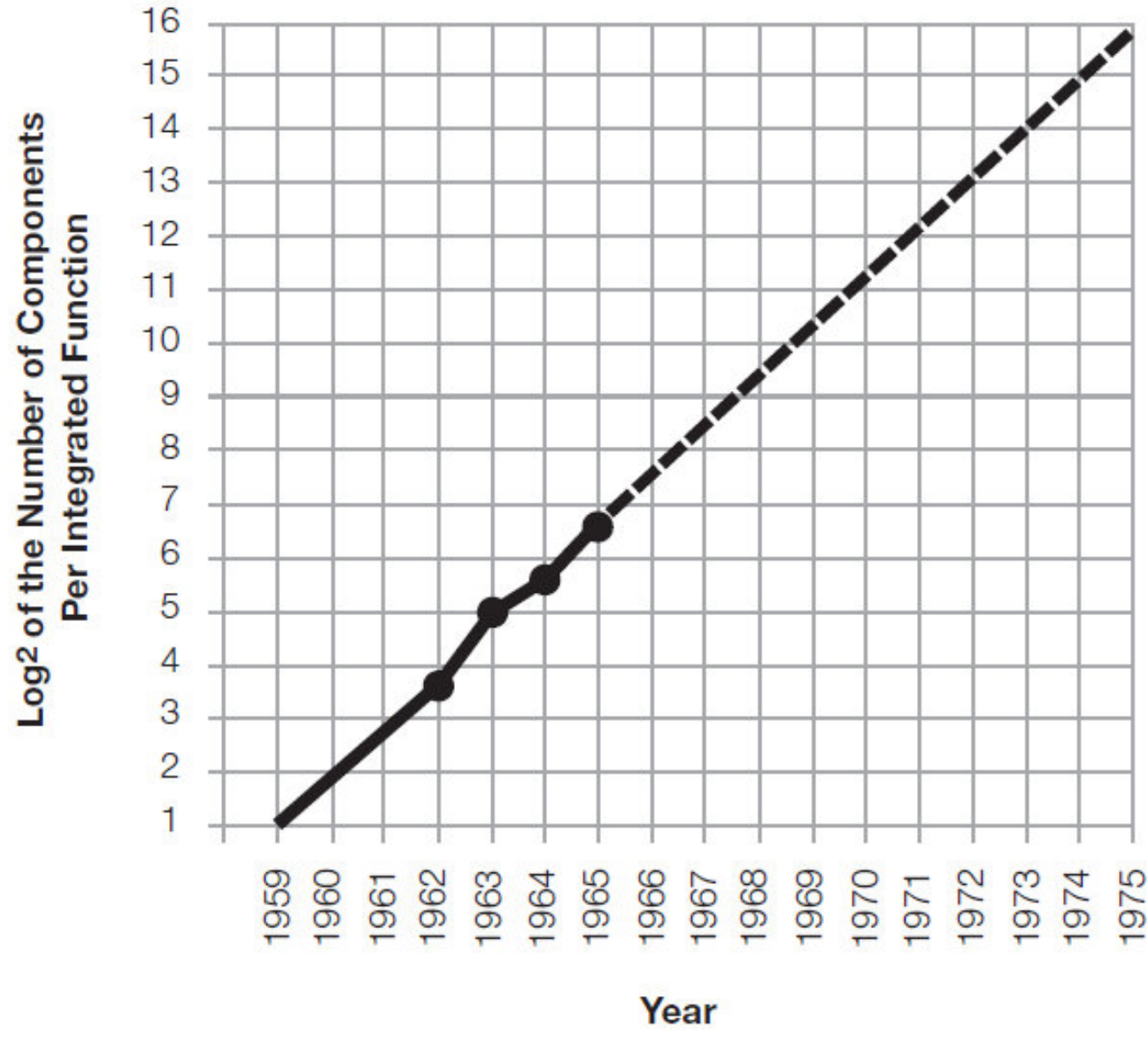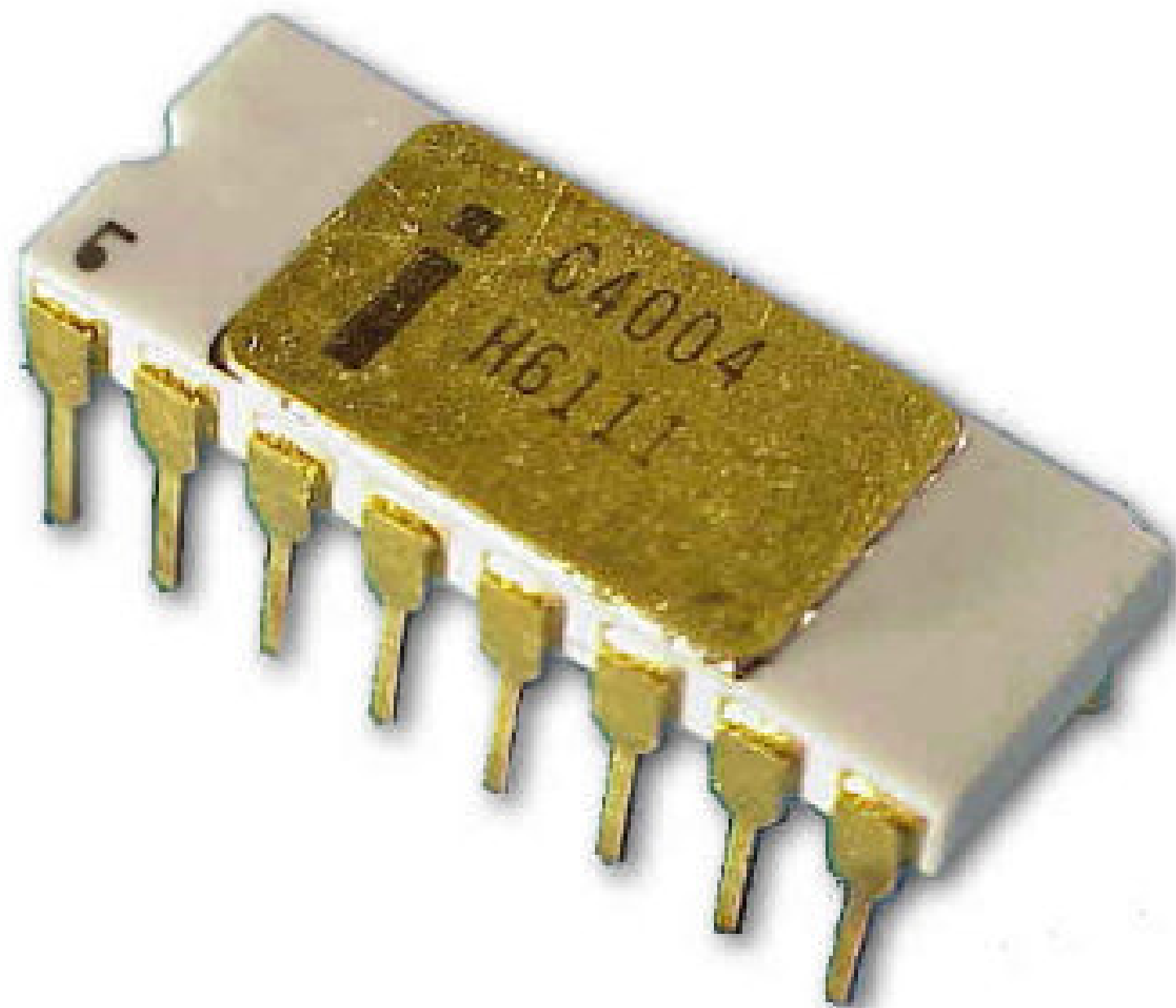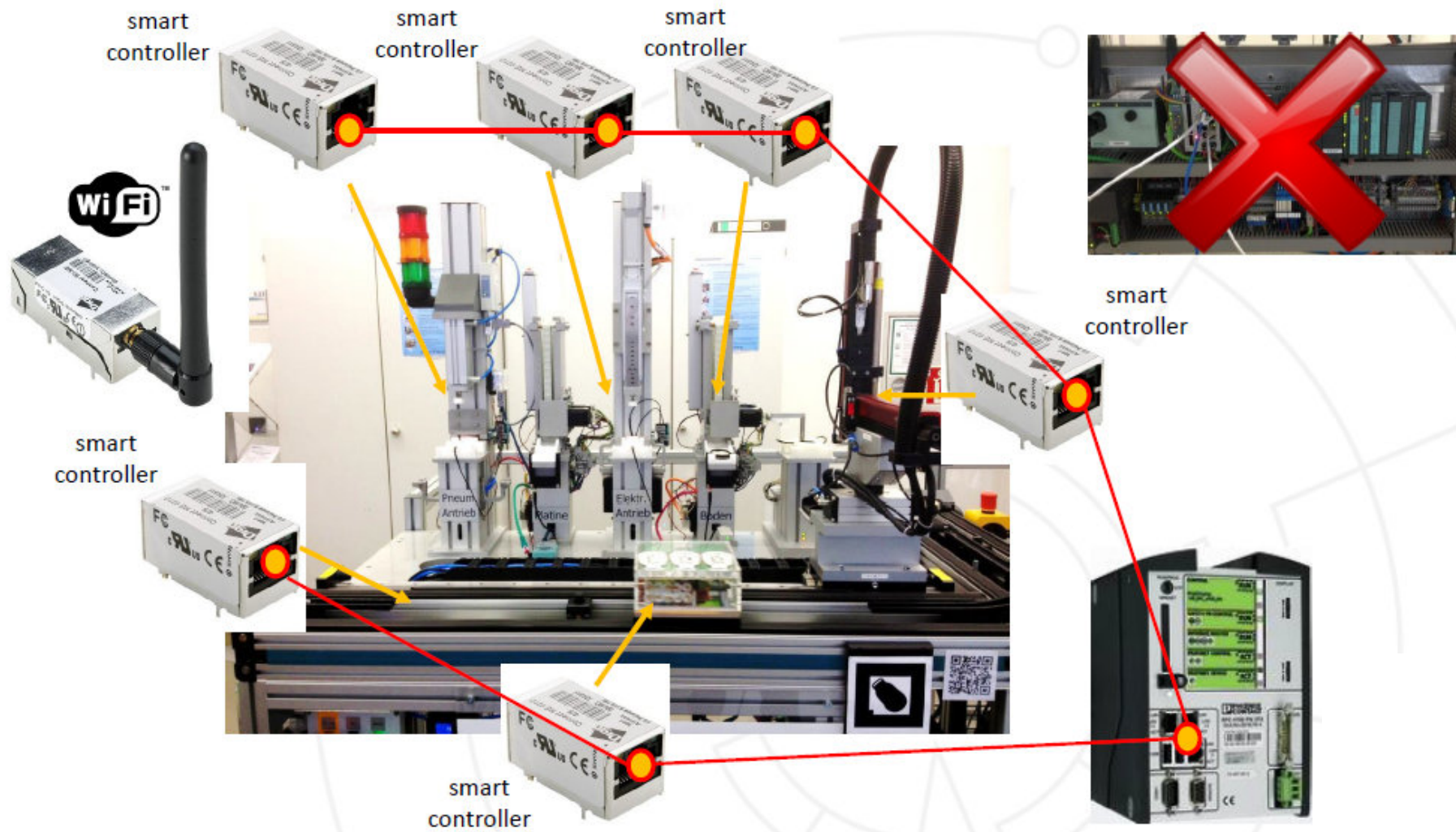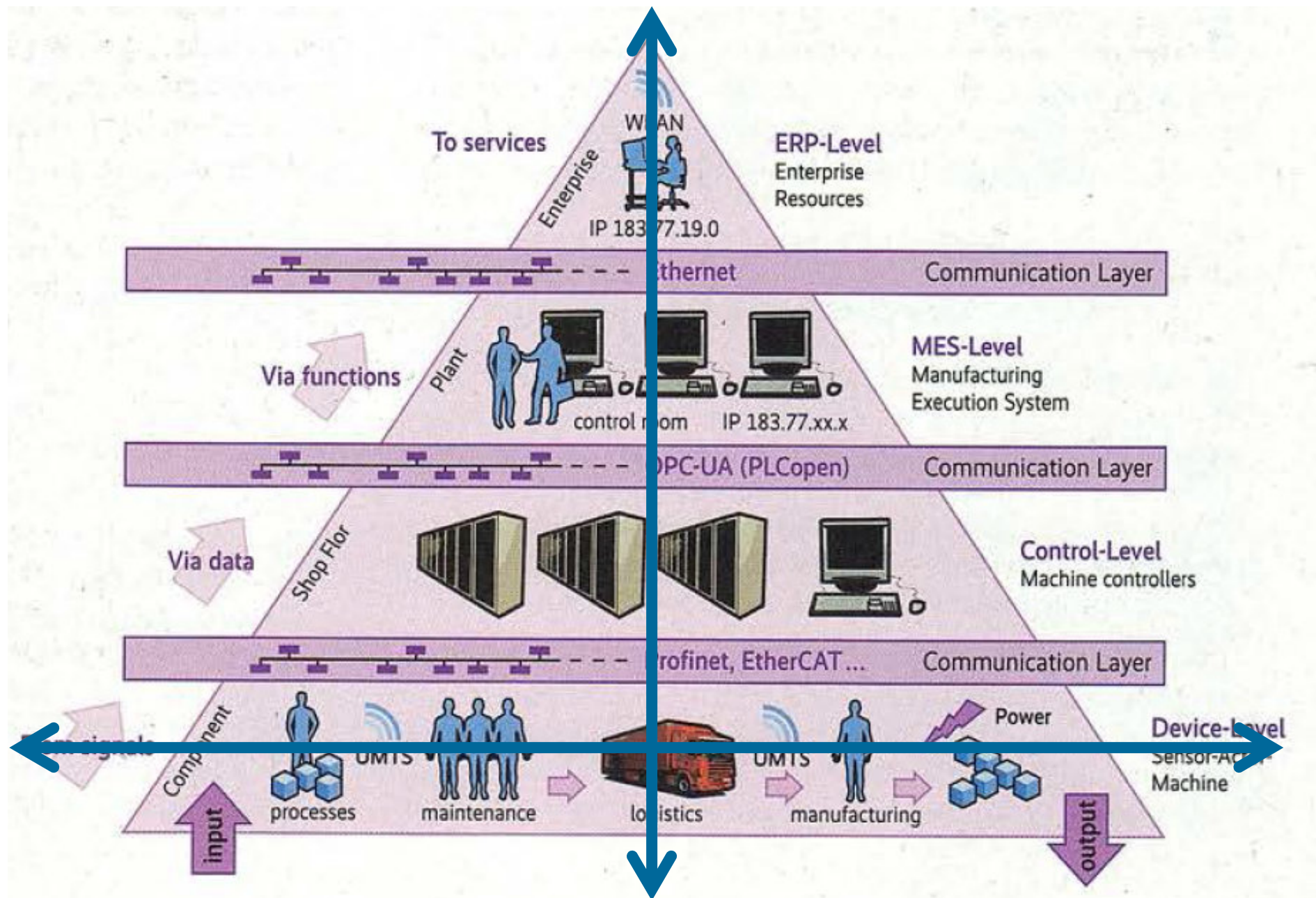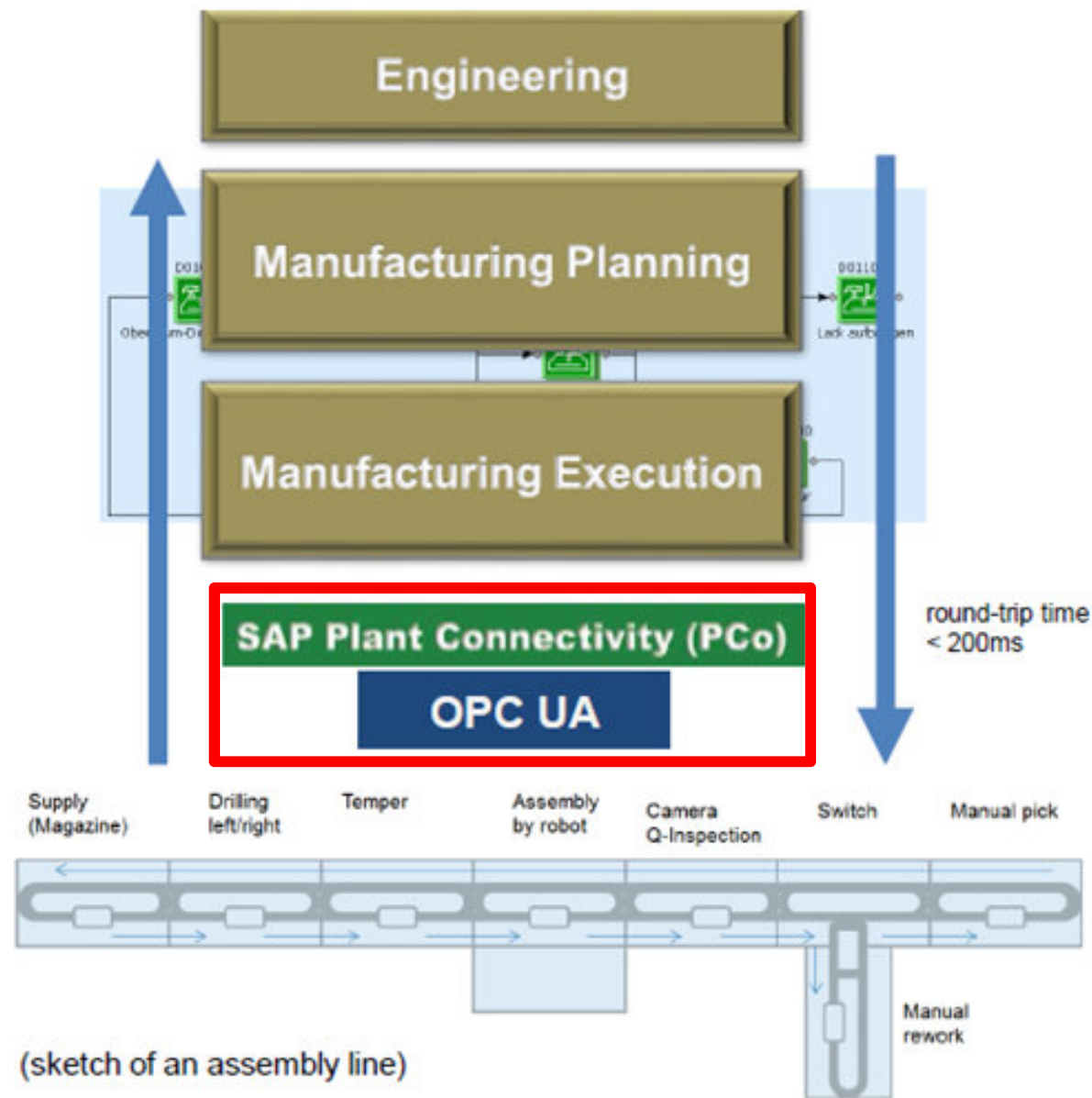
Recommendations for implementing the strategic initiative INDUSTRIE 4.0

Final report of the Industrie 4.0 Working Group

To services

WLAN

ERP-Level
Enterprise
Resources

Enterprise

IP 183.77.19.0

Ethernet — Communication Layer

Via functions

Plant

MES-Level
Manufacturing
Execution System

control room   IP 183.77.xx.x

OPC-UA (PLCopen) — Communication Layer

Via data

Shop Flor

Control-Level
Machine controllers

Profinet, EtherCAT... — Communication Layer

Component

Power

Device-Level
Sensor-Act-
Machine

processes   maintenance   logistics   manufacturing

UMTS   UMTS

input   output

Manufacturing Process Control

(sketch of an assembly line)

h

Abdampfl.z.Kondensator

Abdampfl.ins Freie

b

N

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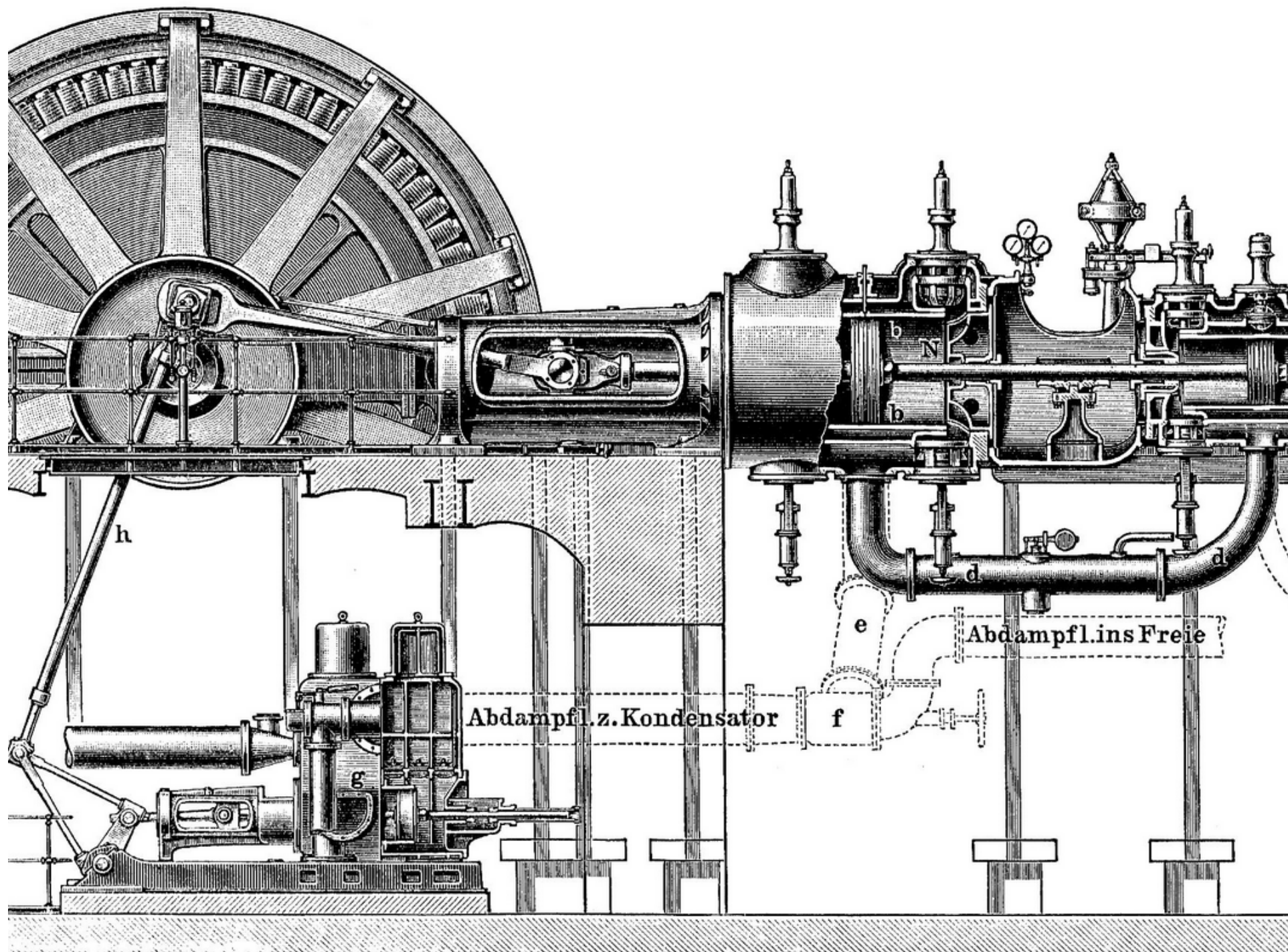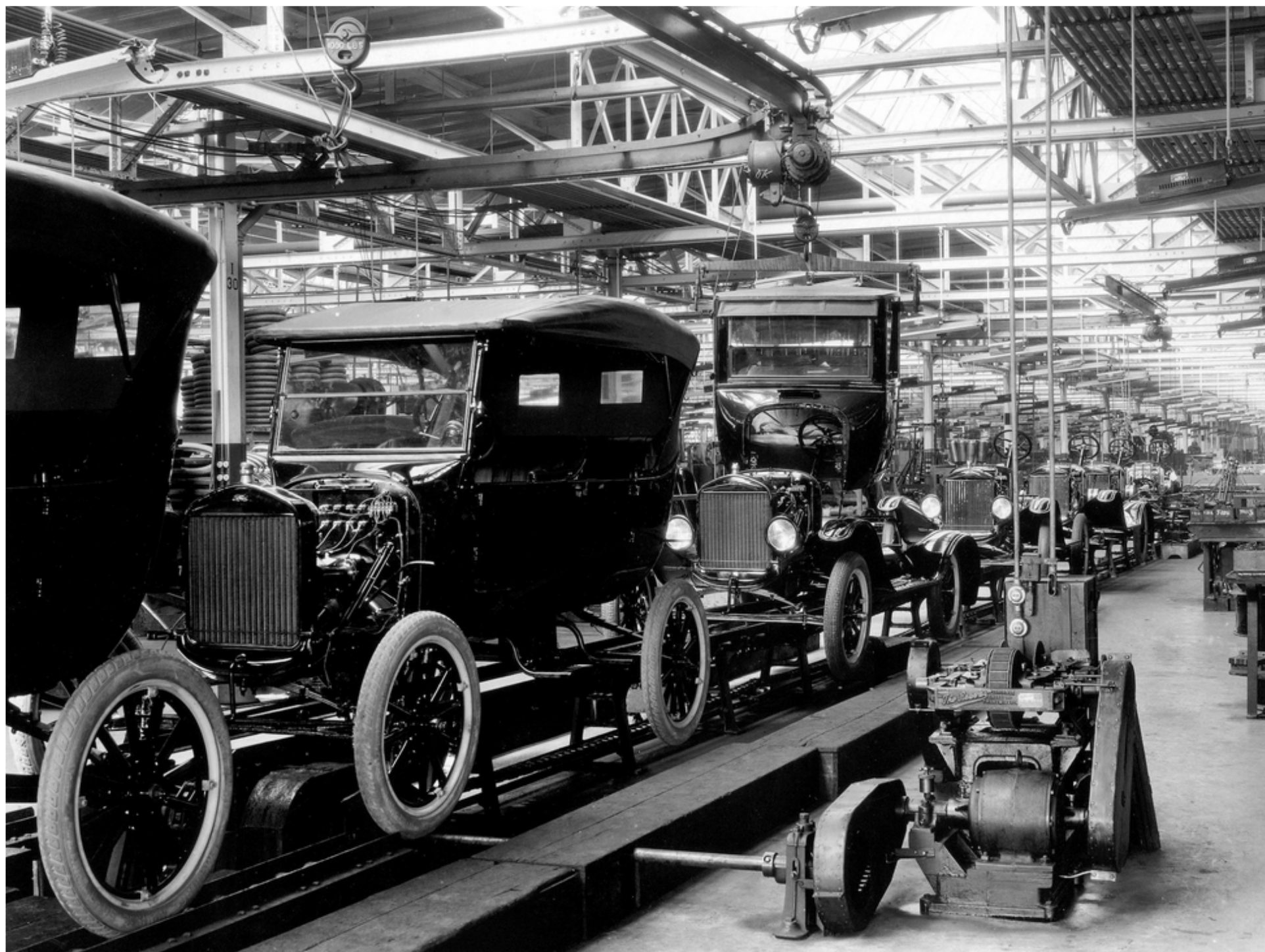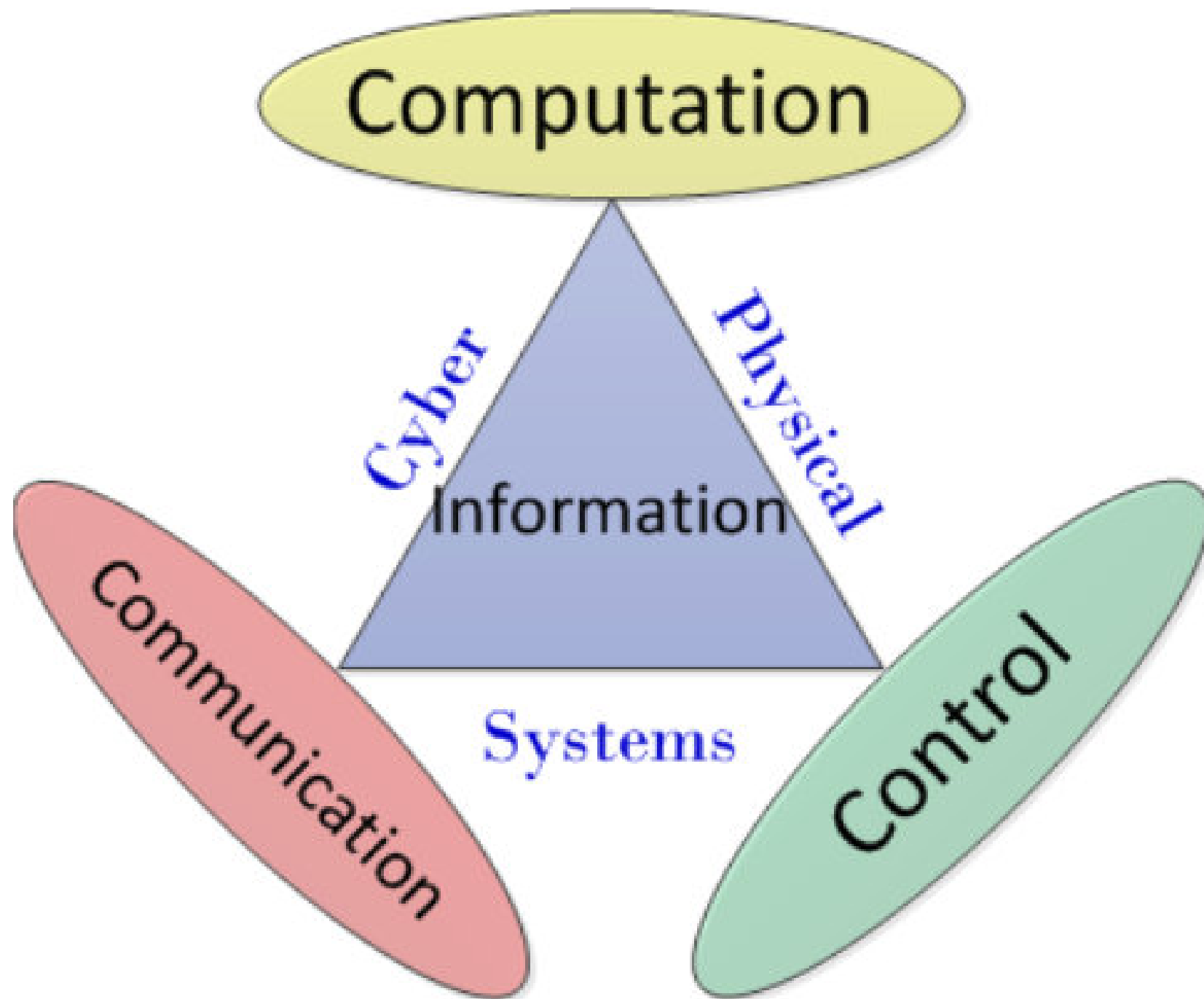
Changing control architecture

FB nach IEC 61499

???

Enterprise level

Control level

Field level

Profibus

Nachrichten

M R V M

HMI

service

service

Ethernet

CPS

service

service

service

ERP

M R V M

CNTR

Wi-Fi

Today

hierarchical automation pyramid

Tomorrow

smart CPS network

smartFactory KL
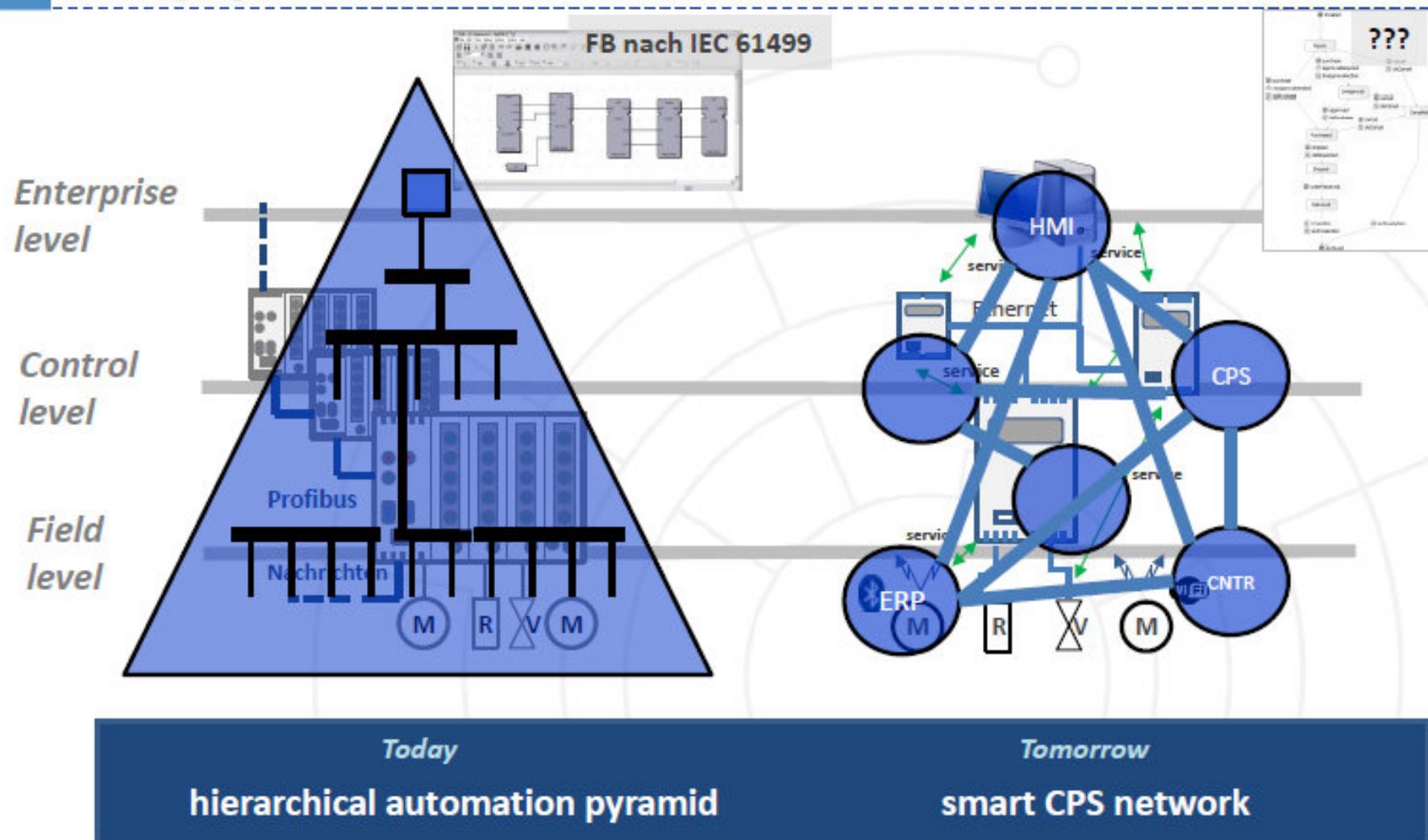
Before OPC
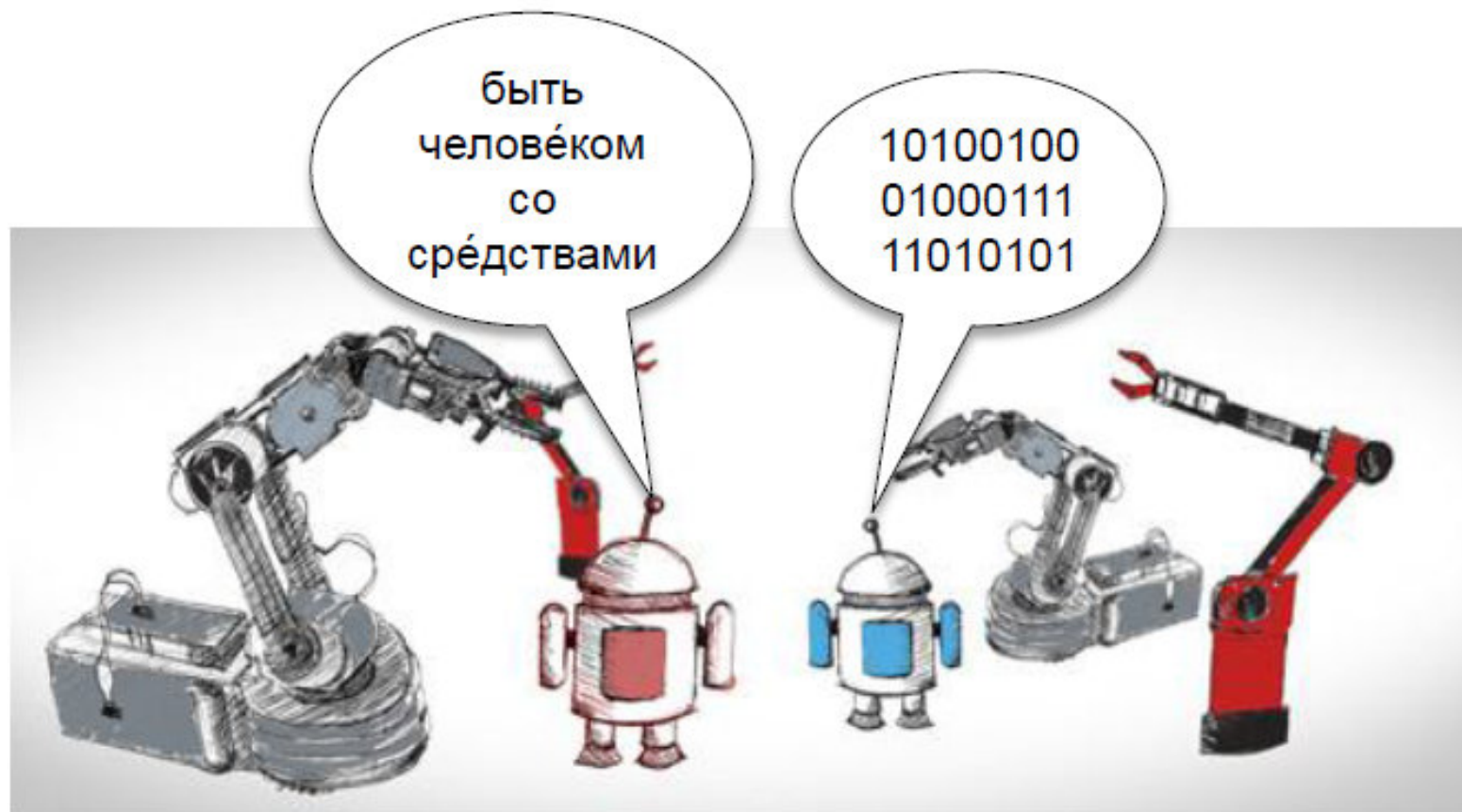
With Classic OPC
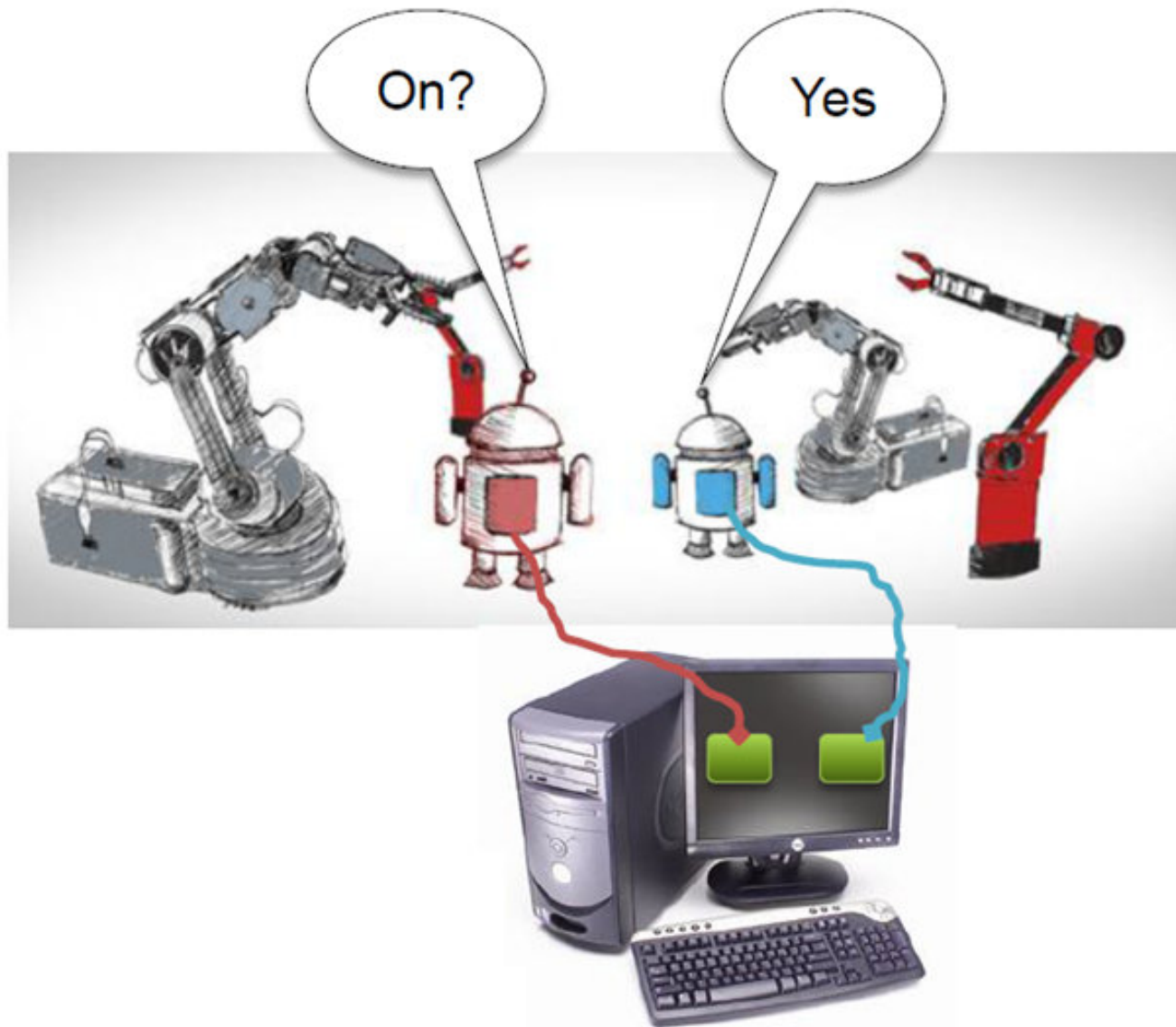
With OPC Unified Architecture

With OPC UA Information Models

IEC 62541

February 2010
Part 1 – Overview
Part 2 – Security Model

July 2012
Part 7 – Profiles
Part 9 – Alarms & Conditions
Part 10 – Programs

December 2014
Edition 2.0
Part 1 – 10
New – Edition 1.0
Part 11 – Historical Access
Part 13 – Aggregates

Edition 1.0/OPC UA 1.01

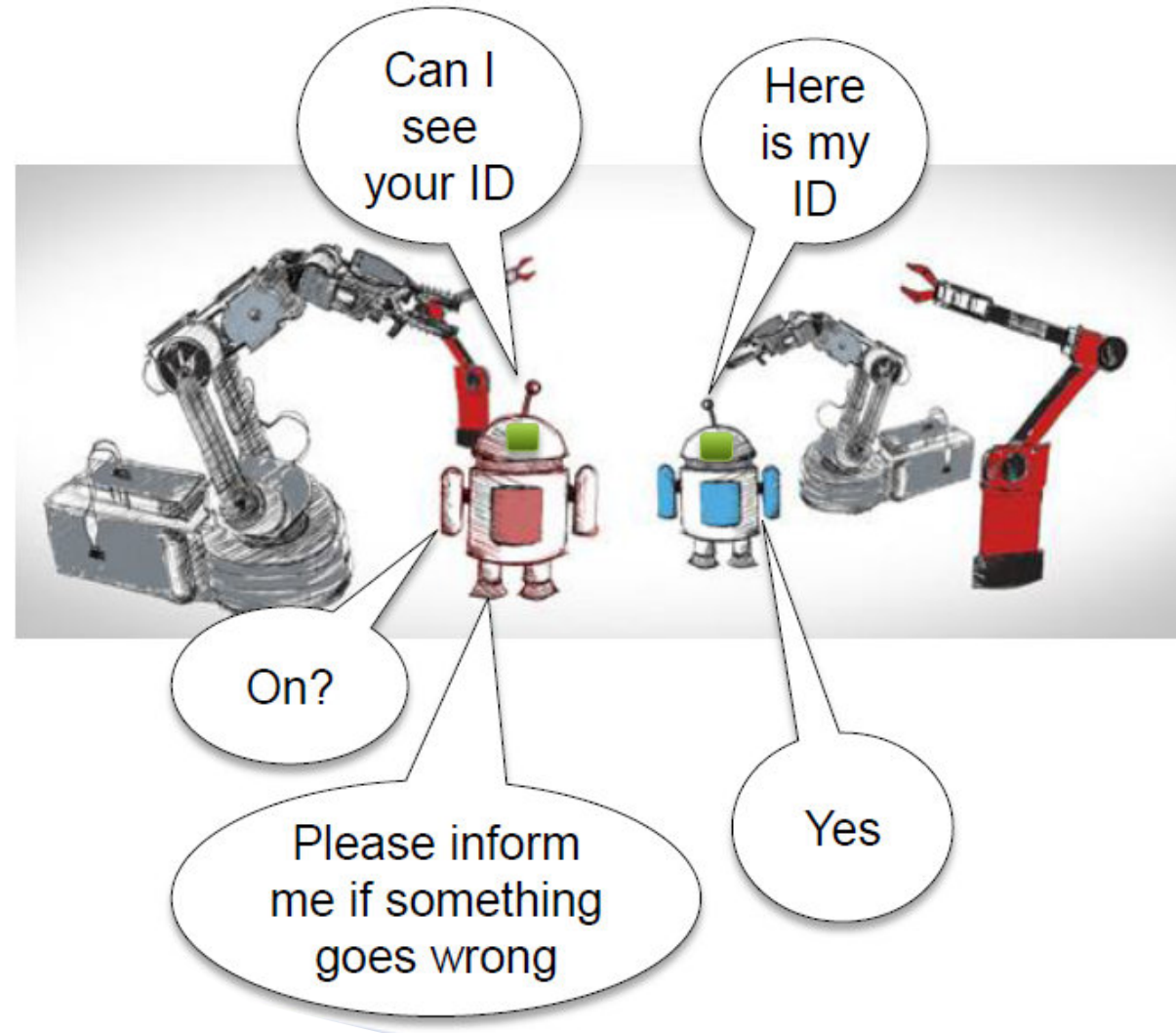| 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |

October 2011
Part 3 – Address Space Model
Part 4 – Services
Part 5 – Information Model
Part 6 – Mappings
Part 8 – Data Access

OPC UA 1.02

Companion
Part 100 – Devices

August 2015
Part 12 – Discovery

Implicitly Secure

Authentication of Clients and Servers

▶ Achieved by using X.509 certificates ("application instance certificates")

Authentication of users

▶ Achieved by using username/password, X.509 certificate, or WS-SecurityToken

Integrity of their communications

▶ Digital signatures based on X.509 certificates

Confidentiality of their communications

▶ Encryption based on symmetric cryptography, key negotiation includes authentication based on X.509
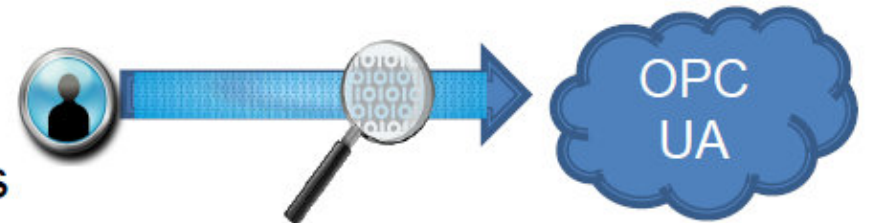
Platform Independence

Scalability

Cloud

Server
Cluster

Server

Desktop
PC

Portables

Controllers

Embedded
Systems
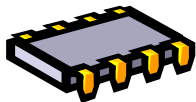
Mac	Java Client		Java Server	Linux
Windows 7	.NET Client		.NET Server	Windows XP Embedded
Linux	C\C++ Client		C\C++ Server	VxWorks
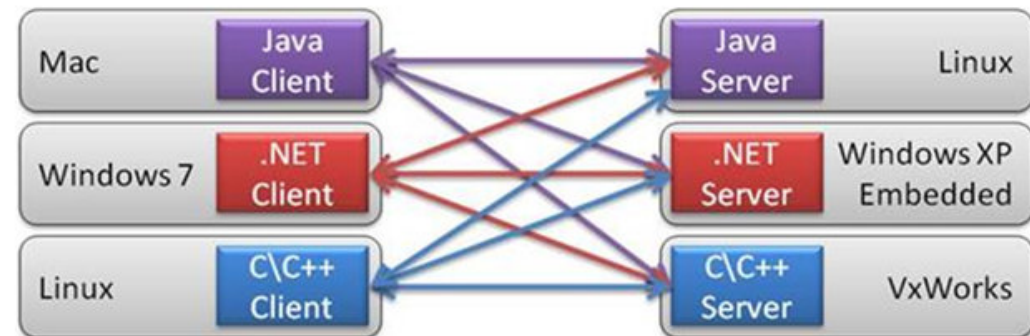
Communication Reliability

▸ OPC UA recovers from communication loss
▸ OPC UA ensures robust and reliable communication
  ◦ Keep-alive monitoring
  ◦ Buffering of data and acknowledgements
  ◦ Fast recovery in case of communication errors
  ◦ Redundancy concepts
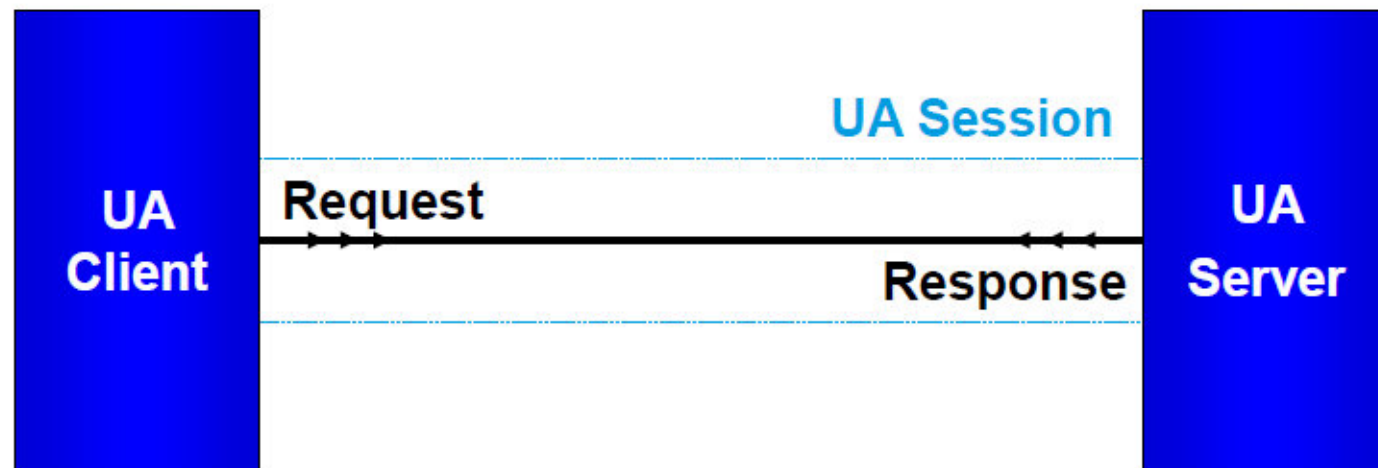
Information Modelling
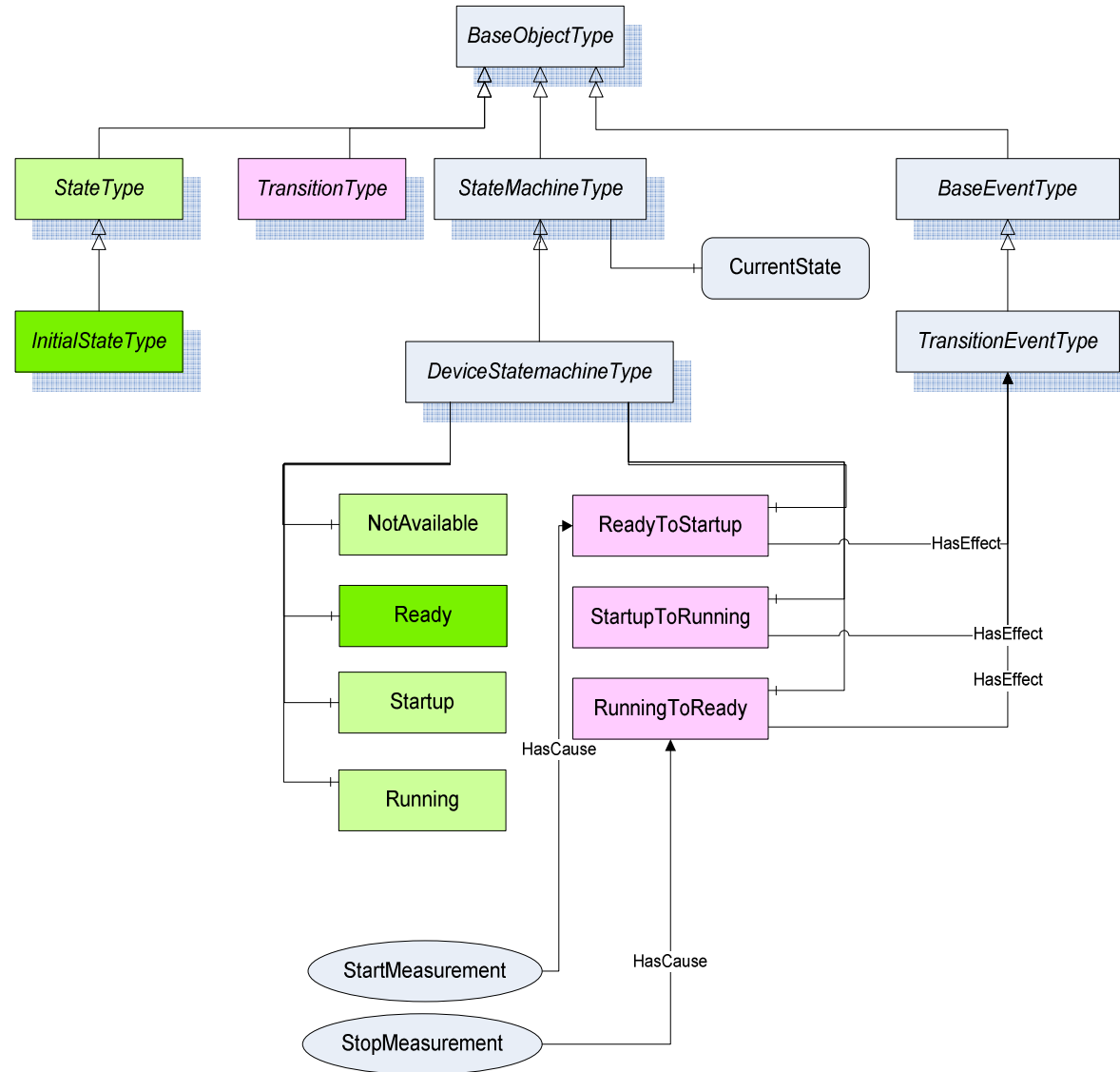
Compliance

OPC Interoperability Workshop, Asia

June 18 - 20, 2014, Tokyo, Japan

Test applications in a real-world environment with peers

Interops are *"extremely valuable"* in preparing products for release

Learn more ▶

Transport Protocol Bindings

▶ OPC UA has been architected for speed and network performance

XML Web Services	Optimized OPC UA Binary
UA XML	UA Binary
WS Secure Conversation	UA Secure Conversation
SOAP 1.2	UA TCP
HTTP	TCP/IP
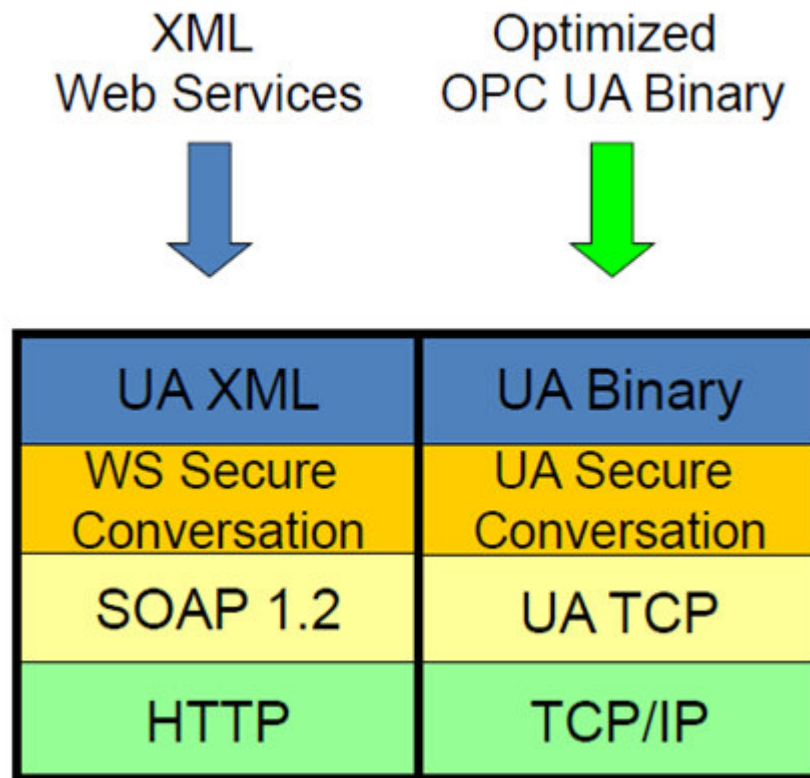
The new smartfactory demonstrator and its partners

OPC-UA

Worldwide first Industrie 4.0 demonstrator built by industry

smartFactory ^KL ®

expectations

- 3D Flat-Panel TVs and Displays
- 4G Standard
- Activity Streams
- Wireless Power
- Media Tablet
- Augmented Reality
- Cloud Computing
- Cloud/Web Platforms
- Private Cloud Computing
- Internet TV
- Speech-to-Speech Translation
- 3D Printing
- Gesture Recognition
- Social Analytics
- Mobile Robots
- Mesh Networks: Sensor
- Microblogging
- Pen-Centric Tablet PCs
- Video Search
- Autonomous Vehicles
- Electronic Paper
- Speech Recognition
- Extreme Transaction Processing
- E-Book Readers
- Video Telepresence
- Location-Aware Applications
- Tangible User Interfaces
- Predictive Analytics
- Interactive TV
- Internet Micropayment Systems
- Terahertz Waves
- Computer-Brain Interface
- Biometric Authentication Methods
- Context Delivery Architecture
- Broadband Over Power Lines
- Mobile Application Stores
- Human Augmentation
- Virtual Assistants
- Idea Management
- Consumer-Generated Media
- Public Virtual Worlds

As of August 2010

| Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Years to mainstream adoption:

○ less than 2 years ○ 2 to 5 years ● 5 to 10 years △ more than 10 years ⊗ obsolete before plateau

Peter Seeberg
Market Segment Manager,
Factory Automation

Softing Industrial Automation GmbH
http://industrial.softing.com