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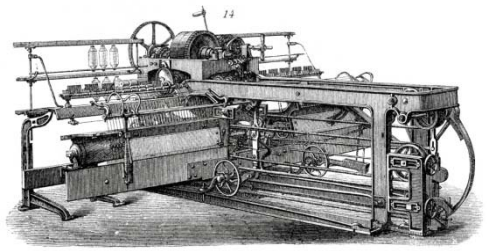
Dr. Wolfgang Heuring, Head of Research and Technology Center

Industrie 4.0 – The path from research to practice

Siemens is the driver of innovation in Automation for decades



Mechanical weaving loom

End of 18th century

1st Industrial Revolution

Siemens founded in 1847. Werner von Siemens inspired by innovations to discover the dynamo-electric principle in 1866.

End of 19th century

2nd Industrial Revolution

The world´s first reversible electric drive from Siemens at the Georgsmarien steelworks with 6,800 kW.

1970

3rd Industrial Revolution

SIMATIC and SINUMERIK boost industrial productivity

2020 - 2030

4th Industrial Revolution

Modular cyber-physical Systems

Path to Industry 4.0

The path to Industry 4.0: evolution – no revolution

Next step is the integration of product and production lifecycles

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Yesterday

Electronics for Automation

Today

Modular, IT-supported Automation

Tomorrow

Integration and optimization of the entire product and production lifecycles with innovative software

Future

Self-optimizing cyber-physical systems based on analysis of virtual models expressing options for action

Industrie 4.0

Research to realize the vision of Industrie 4.0 for leveraging customer benefits covers 3 levels: strategy, processes, system

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Level **strategy**

Horizontal integration across value networks

- New business models
- Eco-systems

Level **processes**

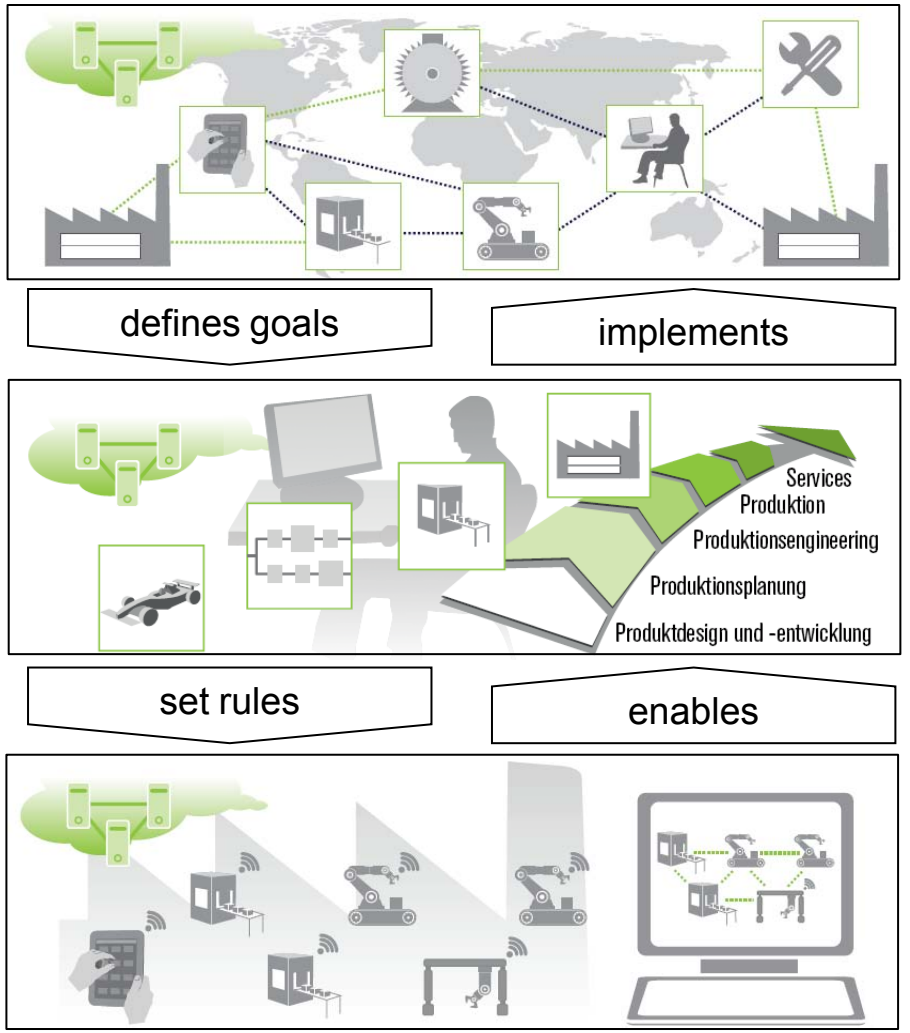
End-to-end engineering across entire value chain

- Integration of product and production lifecycle: From design to production to service and loop-back

Level **system**

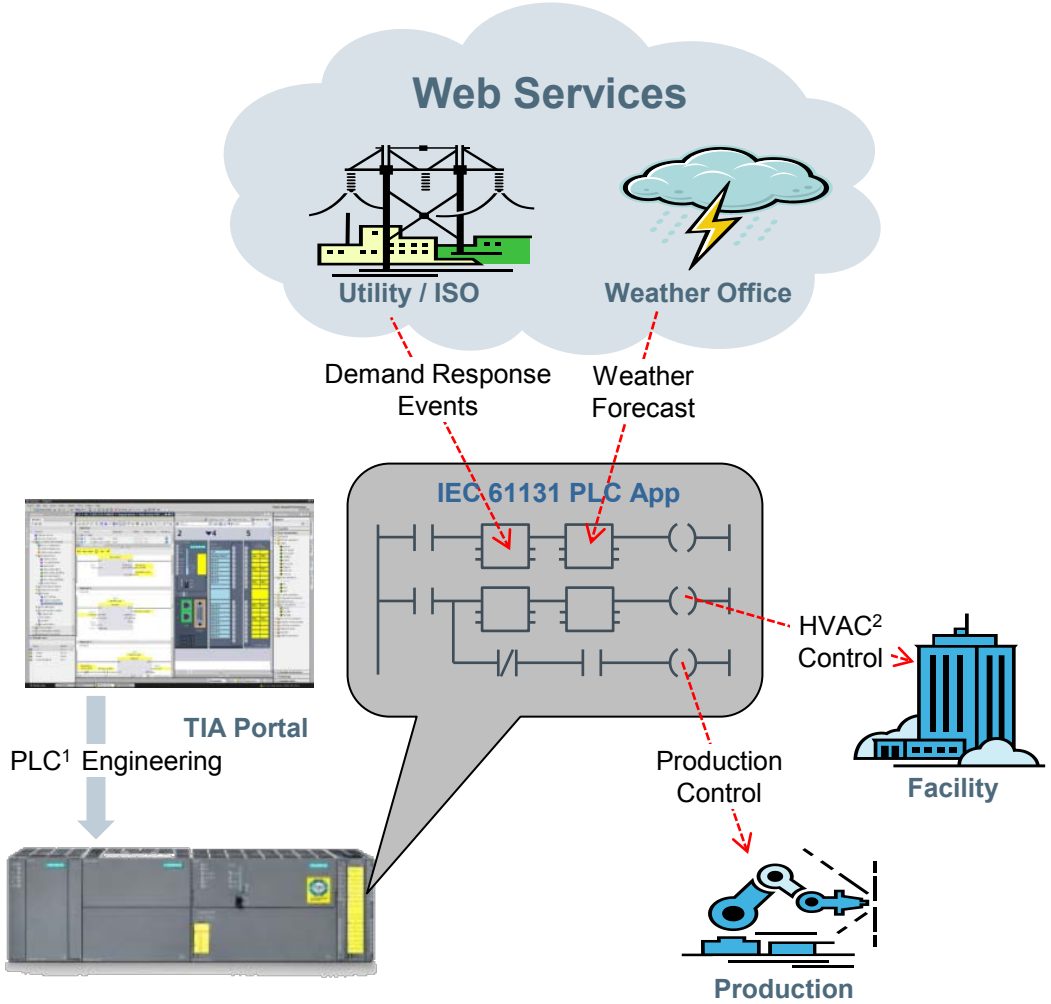
Vertical integration and networked production systems

- Flexible reconfigurable and adaptable production systems based on cyber-physical systems



Source: Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0

Standard PLC can be used as cyber-physical system (CPS) platform



Siemens research project:
Cyber-physical PLC

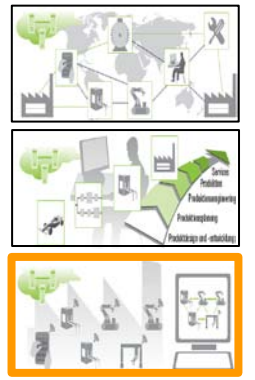
Results:

- Demonstrator for **integration of demand response in production and facility control**
- Realized as **CPS interacting with Web services**

Used platform: Standard PLC HW & SW

- Seamless integration of Web services with PLC apps in the IEC 61131 programming paradigm
- Application easy to implement

Level:



System

Timeframe:

Yester-day | **Today** | Tomor-row | Future

[1] Programmable Logic Controller
[2] Heating, Ventilation and Air Conditioning

Siemens is consortium leader for IoT@Work to develop self-organizing automation networks for modular cyber-physical production

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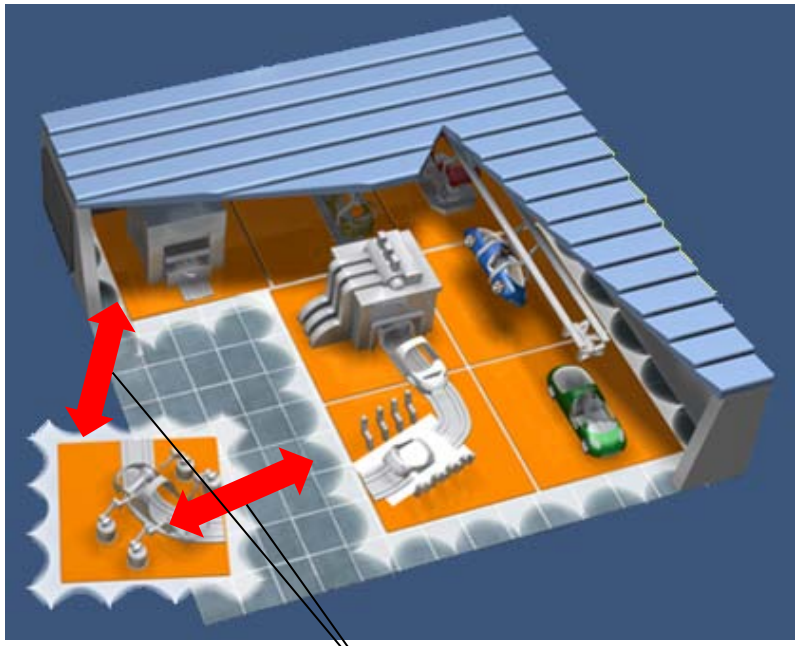
Cyber-physical systems
Self-organizing modular production



Self-organizing communication

EU FP 7 research project IoT@Work INTERNET OF THINGS AT WORK

Today: Pre-configured automation networks

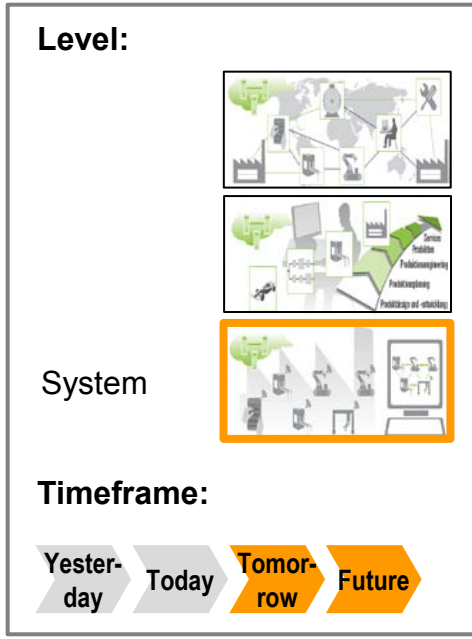
CPS: Demand for flexible communication services

Duration: 06 / 2010 – 5 / 2013

Partners, e.g.: SIEMENS, Microsoft Innovation Center Europe, TXT, FIAT GROUP, CITY UNIVERSITY LONDON

Expected results

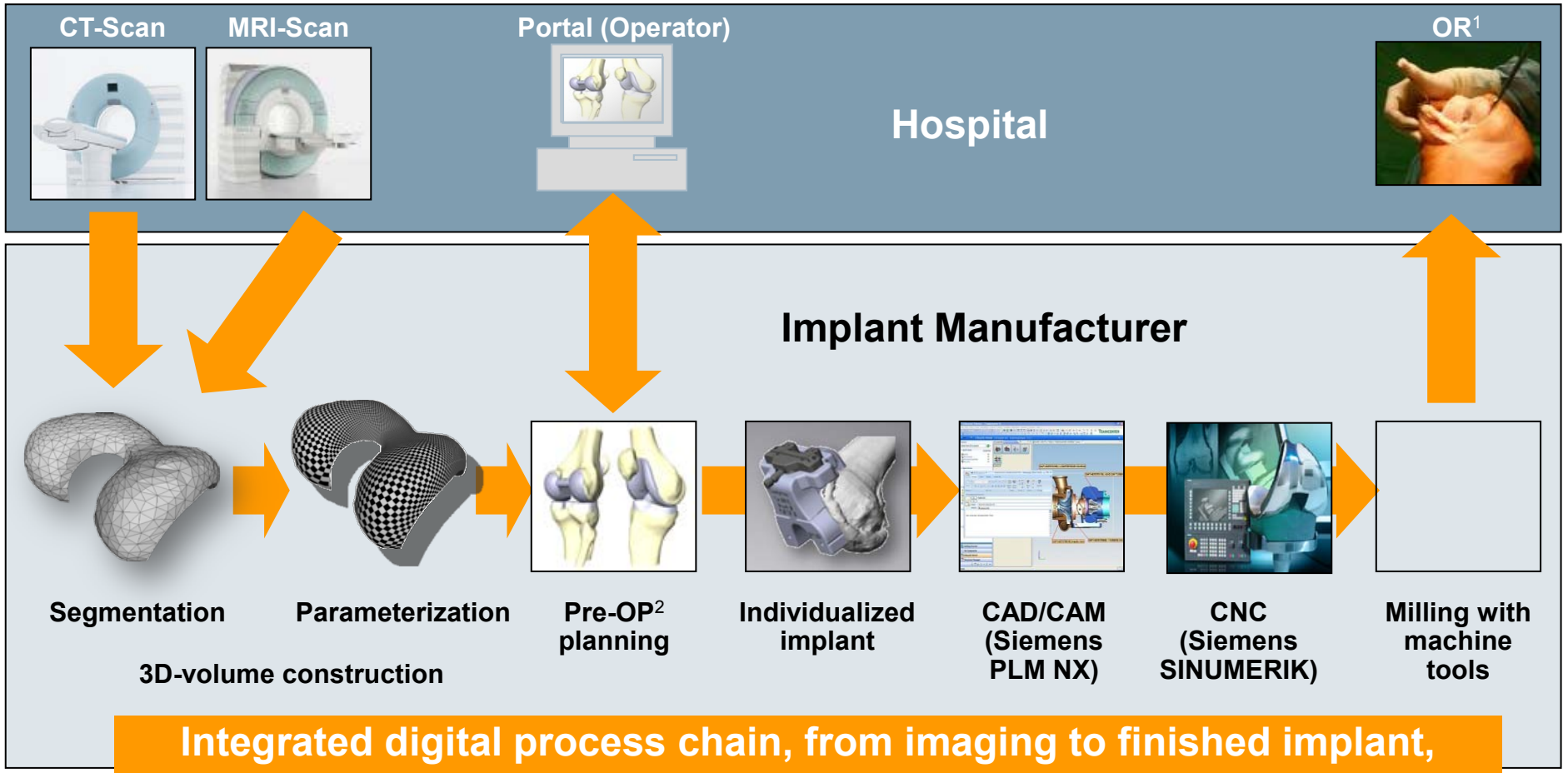
- **Self-organizing automation networks** combining network virtualization, resource mgt. and policy control
- **Communication services** can be **set-up** and modified **at run-time** w/o interruption of system operation
- **Pilot system** (automotive industry) available in Turin (FIAT)
- Input to **IEEE 802.1 standardization** delivered

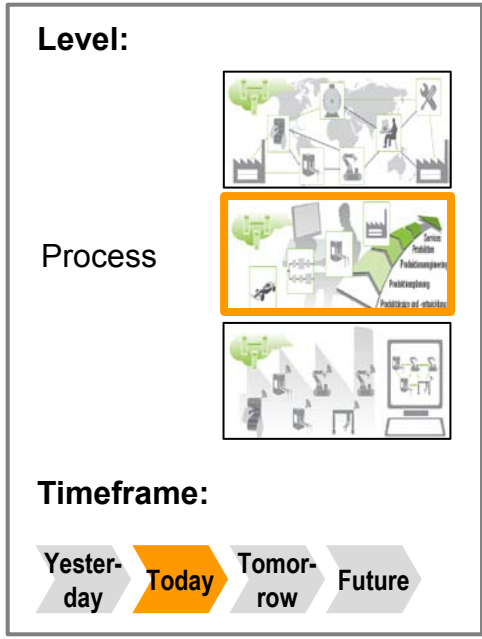


Source: www.iot-at-work.eu

For details visit the Forum "Industrial IT" at the Hannover Messe, 04/12/2013

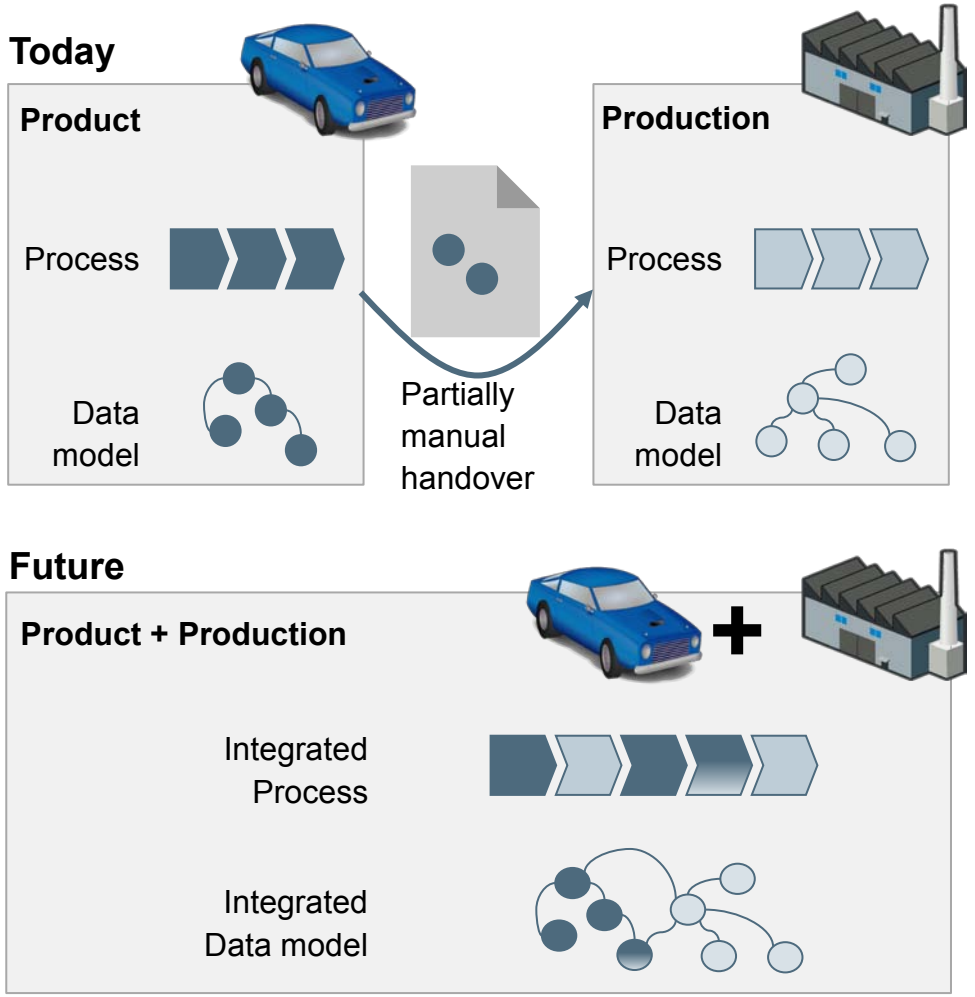
End-to-end solutions are already available
Example: Personalized Healthcare Manufacturing (shown at HMI 2012)





[1] OR = Operating room [2] OP = Surgical operation

The new BMBF project mecPro² addresses model based engineering of product and production system



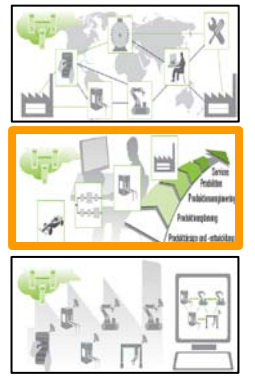
New BMBF research project: mecPro²

Duration: 9 / 2013 – 9 / 2016

Partners, e.g.: Technische Universität Kaiserslautern, Siemens, Continental, Schaeffler, LuK, INA, FAG

Level:

Process



Timeframe:

Yester-day | Today | Tomor-row | Future

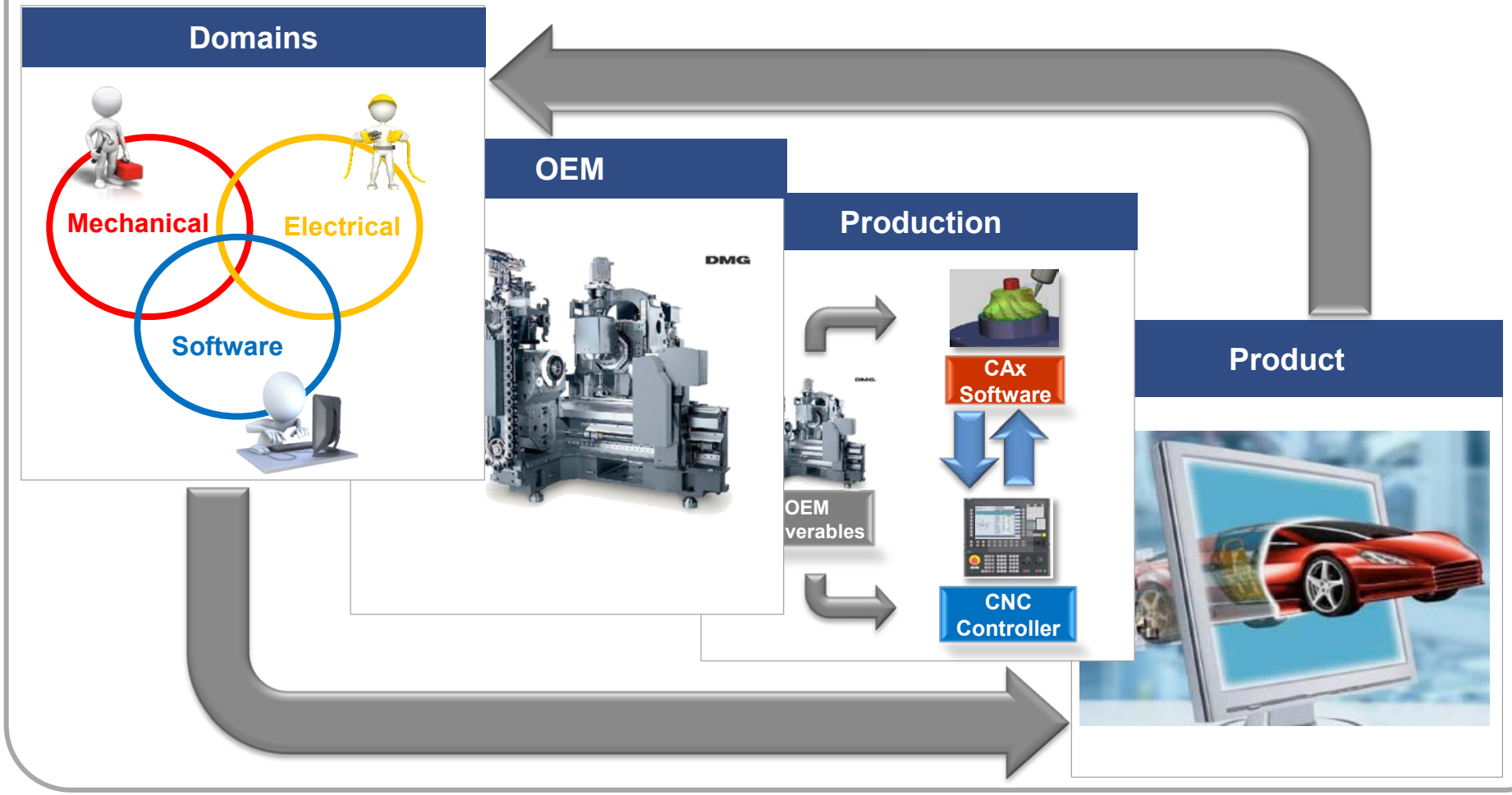
Expected results:

- **Integrated engineering process and data models** for product and production systems based on existing description languages
- **Simulation on system level** for verification of concepts in early stages of the engineering process (frontloading)

mecPro = Modellbasierter Entwicklungsprozess cybertronischer Produkte (CTP) und Produktionssysteme (CTPS)

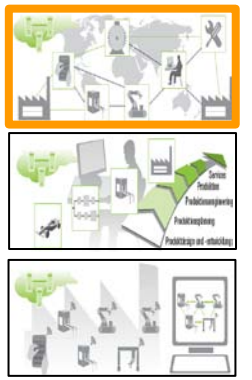
Integration needed across different domains (mechanics, electrics, software) and along complete value chain (suppliers, partners, customers)

Siemens´ holistic view into OEMs´ and End Customers´ PLM Processes



Level:

Strategy



Timeframe:

Yester-day | Today | Tomor-row | Future

Future research needed on Eco-Systems, joint approach with suppliers, partners and customers

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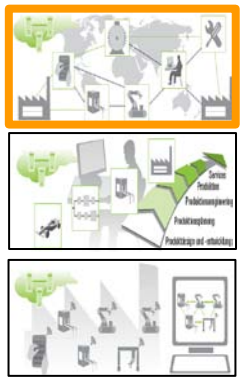
Eco-System

A network of market participants whose know-how, IP, products or services a company (OEM) relies on for it's product innovation.

Level:

Strategy



Timeframe:

Yester-day | Today | Tomor-row | Future

Focus of research to create Eco-Systems jointly with suppliers, partners and customers:

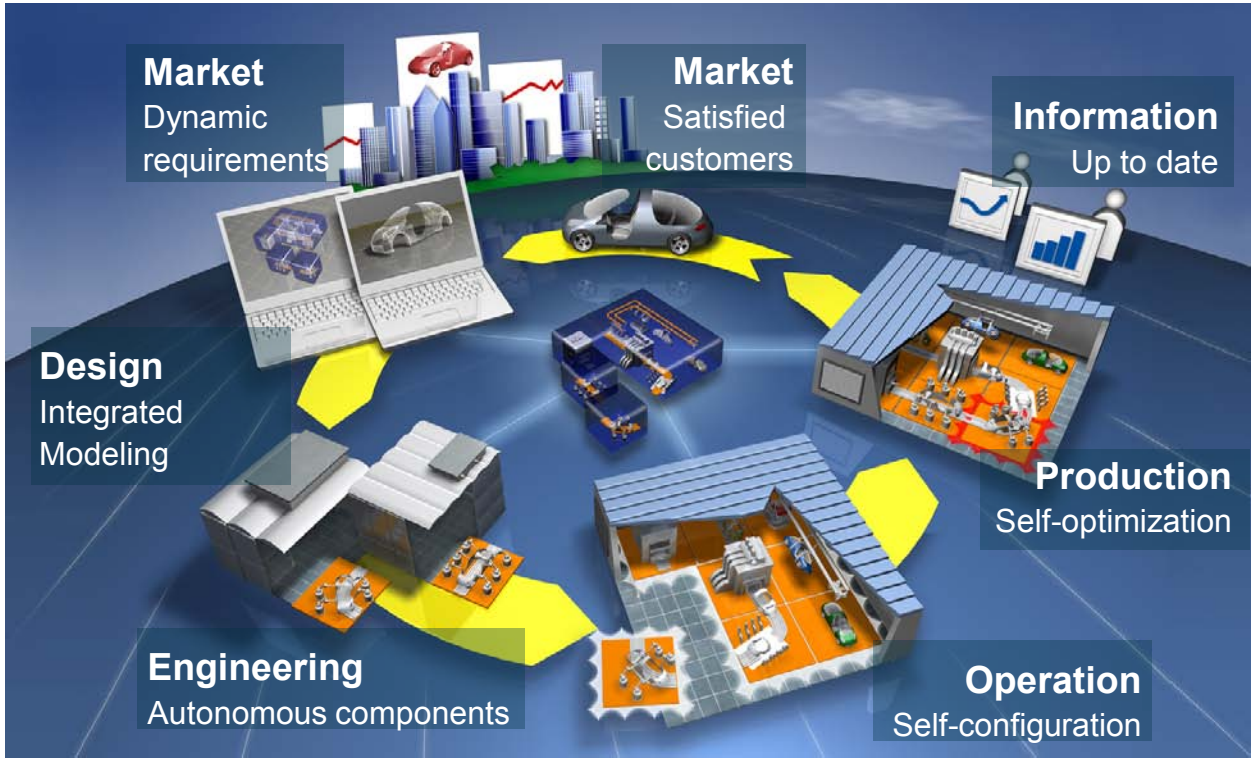
- Designing business models and value-networks
- Strategy for standardization
- Creation and protection of own knowledge
- Sustainability, e.g. resource efficiency
- Skills and people development across organizational borders
- Optimal bundling of goods with services across organizational borders

It`s a long way to Industrie 4.0 …
… we continue to proceed hand in hand with our customers and partners

- The path to Industrie 4.0:
  it‘s an evolution - no revolution

- Important milestones on the path to Industrie 4.0 have already been reached by Siemens **– certain aspects of the vision are already reality**

- Siemens has **initiated research activities** together with partners **to drive towards Industrie 4.0 and to deliver further proof points**



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