Digital Enterprise – Thinking industry further!

Hannover Messe 2019 | April 1, 2019
Klaus Helmrich, Member of the Managing Board of Siemens AG and CEO of Digital Industries
Digital Industries will lead industry to the next level of digital transformation: Thinking industry further!

- Digital Industries will extend its Digital Enterprise portfolio with future technologies
  - At the Hannover Messe 2018, our message was “Digital Enterprise – Implement now!”
  - Now innovation leader Siemens is thinking further: to the next level of digital transformation
  - The deeper use of data pools and linking of hardware, software and Cloud platforms will create a new level of data consistency and knowledge acquisition from data – for more flexible and productive processes

- Numerous innovations will be presented for deeper and broader data usage and increased productivity.
  - Integrated future technologies in the Digital Enterprise portfolio create new potential for optimization: Edge computing, artificial intelligence, autonomous handling systems, Industrial 5G, Blockchain, Additive Manufacturing
  - New process control system Simatic PCS neo

- The carefully developed Digital Enterprise portfolio offers end-to-end solutions for the specific requirements of each sector in the manufacturing and process industries
  - This supports increased flexibility, productivity and new business models for companies of any sector or size, as can be seen in the concrete examples from our customers and our Siemens factories

- The implementation of this digital transformation requires a strategy – Digital Industries is the ideal partner
  - Siemens provides support for the evaluation, implementation, integration and continuation of Industrie 4.0 measures

- Paving the way for the future: convergence of Information Technology (IT) and Operational Technology (OT)
  - Technologies such as Edge computing bring mechanisms from the IT world to the level of OT.
  - In future, this will enable the integration of data across all levels: from the shop floor to IT systems such as Supply Chain Management, Enterprise Resource Planning, etc.
Making industrial processes more flexible – greater customization with increased demands on productivity

**Flexible production**
Customized products, variable batch sizes down to batch size 1

**Performance**
Plant availability, changeover times, maintenance, cyber security

**Lifecycle optimization**
Transparency over the entire lifecycle, productivity, time-to-market, asset and cost optimization

**Global collaboration**
Networked, secure operation, cooperation between many users in real time

**New business models**
Digital Enterprise at the Hannover Messe 2018
Implement now!

Digital Enterprise
Digital end-to-end solutions for discrete and process industries

Cloud
MindSphere

Automation and industrial software for process and discrete industries

Industrial communication
Industrial security
Industrial services
Hannover Messe 2018 – Implement now!

<table>
<thead>
<tr>
<th>Faster product development</th>
<th>Shorter commissioning: robots programmed offline</th>
<th>Greater customization</th>
<th>Higher availability up to</th>
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<tbody>
<tr>
<td>&gt;15%</td>
<td>&gt;98%</td>
<td>100l instead of &gt;5000l</td>
<td>10%</td>
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Study by VDMA industry association – proves increased productivity through digitalization

- Twice as many variants in 10 years with the same number of employees (Automated process chain)
- Shorter development cycles (Digital Enterprise platform for data and process management)
- >50% fewer engineering hours (NX environment)
- Up to 70% shorter commissioning phase (offline robot programming)

VDMA (2018) „Leitfaden Investitionsrechnung für Digitalisierungsprojekte und Industrie 4.0 Vorhaben“ 1) p.15, 2)p. 16, 3) p. 17, 4) p. 18
Accenture study: Digitalization requires expertise, collaboration and entrepreneurial decisions

Few successful pilot projects – Comprehensive digitalization strategy required

Many small individual programs – Introduce consistent, end-to-end solutions and new business models

Division of tasks is slowing digitalization – Strengthen interdisciplinary collaboration with partners

Digital expertise and courage are missing – Push ahead with training and continuing education and supplement it with external expertise

https://www.accenture.de/weckruf-zur-digitalisierung
Determining the digital readiness of companies – with Siemens and the Singapore Economic Development Board

Smart Industry Readiness Index from Singapore Economic Development Board, Siemens, SAP, McKinsey and TÜV Süd

Prioritization matrix for Industrie 4.0 measures

Launch in Hanover, April 1, 2019, with Dr. Koh Poh Koon, Senior Minister of State (Trade and Industry), Singapore
Digital Enterprise 2019

Thinking industry further!

Data usage | Platforms | Cutting-edge technologies
Digital Enterprise – Thinking industry further!
Data as the new resource for discrete and process industries

MindSphere

Design
- Product Requirements Data
- Product Design Data
- Product Simulation Data
- Product Features Data

Engineering
- Production Planning Data
- Automation Engineering Data
- Production Engineering Data
- ... 

Production
- Production Performance Data
- Operational Order/Job Data
- Production Track and Trace
- ... 

Performance
- Product Service Data
- Product Usage Data
- Product/Plant Maintenance Data
- Product/Plant Runtime Data

Teamcenter, Comos, PlantSight

Klaus Helmrich, Member of the Managing Board of Siemens AG
Growing volumes of data in the digital transformation are opening up new productivity potential and greater flexibility.

**Data volume** (in zettabytes\(^1\))

50

0

**Industrie 1.0**
Steam engine

**Industrie 2.0**
Conveyor belt

**Industrie 3.0**
Automation
Secure processes

**Industrie 4.0**
Digital Enterprise
End-to-end solutions

Greater data usage via algorithms on suitable hardware.

Data from design, engineering, production, performance.

Productivity/Flexibility

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1 \( \text{zettabyte} = 10^{21} \text{ bytes} \)

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Thinking industry further!

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<th>MindSphere</th>
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<td>Artificial intelligence</td>
<td>Blockchain</td>
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<td>Autonomous production systems</td>
<td>Additive manufacturing</td>
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<tr>
<td>Industrial 5G</td>
<td>New process control system</td>
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Digital Enterprise automation platforms

**SIMATIC**
Scalable industrial automation systems

**SINUMERIK**
Intelligent solutions for machine tools

**SIMATIC PCS 7**
Powerful, compact hardware for process industries

**SIMOTION**
High-end motion control system

**SINAMICS**
Frequency converter for every drive application

**SIMOTICS**
Highly efficient electric motors

**SIRIUS**
Modular industrial controls

**SCALANCE**
Reliable industrial communication
Digital Enterprise software platforms – comprehensive, constantly expanding software portfolio
MindSphere | World – currently about 90 member companies in Europe and Asia

Germany: 53 members, thereof 8 Belgian companies

Italy: 18 members

Korea: 5 members

Singapore: 15 members

1 In the process of foundation
Collaboration: Volkswagen also to cooperate with Siemens for Industrial Cloud

Siemens as integration partner ensures efficient networking of production systems, machinery and equipment at 122 Volkswagen plants.

Data transparency and analysis to lay foundations for further productivity improvements.

Volkswagen, Siemens and machinery and equipment suppliers develop new functions and applications together.
Digital Enterprise automation platforms – enhanced by Edge functionality
Renaissance on the shop floor –
a scalable concept up to the MindSphere Cloud system

- MindSphere apps
- NEW: Apps for Edge and Cloud
- Edge apps
- Industrial Edge
- Machine/controller
Data analysis platform brings benefits of the Cloud to the shop floor

- Analyze MyWorkpiece/Capture application: for optimized production process
- Realtime analysis of process data from machine control system
- Target/actual value comparison using digital twin product/digital twin performance
- Analyze MyMachine/Condition application: Periodic checking of machine properties
- High machine availability through improved diagnostics
Artificial Intelligence

NX software with AI: detection of the next processing step

First CAx software extended to include AI and machine learning

Functions provided dynamically depending on user behavior

Very high level of detail for digital twin

Up to 20% more efficient process sequences in construction
Autonomous handling systems

Artificial Intelligence module for Simatic S7-1500 – robots perform handling tasks independently

- Reliable detection and processing of unknown workpieces
- Easy learning process without time-consuming training
- Direct processing of data using neural networks
- Intelligence at field level
Autonomous manufacturing structures

Automated Guided Vehicle for more flexibility and scalability

- Transport of a battery pack for electric cars from manufacturing to assembly
- Flexibility in manufacturing for different vehicle and battery types – up to 30% shorter changeover times
- Fitted with Siemens technology (controller, HMI, drives, RFID, automation software, etc.)
Cloud-based engineering

TIA Portal in the Cloud – new concept of providing Software as a Service

- No installation effort
- Fast availability of new versions
- Use of various hardware (PC, tablet, etc.)
- Trial version from October 2019
Industrial 5G: reliable and high-performance communication for Industrie 4.0

Digital Connectivity for Industry

- **Platforms**: Data storage and compaction, virtual runtime environment, business process engines, hosting
- **Connectivity**: Gateways, switches, routers, access points, network services
- **Smart objects/“things”**: PLCs, field devices, sensors, motors, Edge devices, workpieces, tools, etc.

**NEW**

- Industrial 5G is a clear part of Siemens strategy
- Own research projects for Industrial 5G
- 5G Interoperability Test Center under real OT conditions
- Evaluation and testing of industry standards (TSN, OPC UA)
- In future at Digital Industries: Infrastructure for Industrial 5G (base stations and clients)
Blockchain

Traceability of products and data security

Secure gateway at every step of the supply chain, connected to IoT, PLC or MES as required

NEW

- Transparency of global supply chain through to end customer
- Data security through global secure gateways
- Product security and transparency along the entire value chain
Consistent portfolio for industrial Additive Manufacturing – example of frame concept for e-car batteries

1 Product design
- Design, validate and optimize parts

2 Production planning
- Prepare assembly space for scaled and optimized production

3 Production engineering
- Realize »Print First Time Right« principle through digital twins

4 Production
- Seamless production process along several steps with the digital twin and automaton

5 Services
- Ensure quality through data analysis during production

Data and process management

1 Projektpartner: EDAG, BLM Group, Concept Laser, Constellium, IAPT

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Faster with Edge and KI

Basis for automation and digitalization – cyber security

- Data analysis and anomaly detection
  Cyber security apps based on Edge device with AI support

- Security-relevant data from hardware to Edge device

- Edge apps

- Industrial Edge

- Machine/controller

- Up to 60% faster anomaly detection

- Detection of cyber attacks in real time

- Use of local data reduces risks

- Intelligent response to unexpected events through machine learning
PlantSight Cloud services

Secure, web-based access to all plant data

NEW

Cloud-based portal for digital twin of the plant

- Consolidation of all relevant 1D/2D/3D data
- Visualization of current plant data at any time
- Data consistency even on plant expansion
- All tasks visible thanks to intuitive web portal
New process control system – web-based

SIMATIC PCS 7 for …

- Comprehensive range of applications for all process industries
- Continuous processes as well as batch and regulated industries
- New and existing plants

Common hardware platform and application architecture for Simatic PCS 7 and new process control system

New process control system for

- Petrochemicals, water and plant infrastructure
- Continuous processes, from process modules to world-scale plants
- New plants
• Web-based **multi-user engineering**

• An **intuitive user interface** for every application

• **Object-oriented** data management

• Open and flexible architecture for **modular automation** and **maximum scalability**
SIMATIC

PCS neo
Higher productivity with greater customization and complexity

Example Siemens factories

Amberg factory and Karlsruhe factory

Annual productivity

2017 2018 2019 2020 2021

Thanks to cutting-edge technologies
- Flexible automation
- Digitalization
- IoT/artificial intelligence

Conventional productivity measures

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Concrete examples from Siemens factories

Automation and digitalization for greater flexibility and productivity

More flexible automation (Amberg)
**Lightweight robots** – more efficient handling

Artificial intelligence (Amberg)
**Quality control via algorithm** – higher output

Artificial intelligence (Karlsruhe)
**Intelligent planning** – asset optimization & greater delivery reliability

- 20% higher productivity
- 30% reduction in costly X-ray inspection for printed circuit boards
- >50% better demand forecasting
Data usage – Platforms – Cutting-edge technologies – Heller4Industry example

HELLEN

Automation

Sinumerik
Heller Maschinenbau
Control of machines

Sinumerik Edge
Heller4Performance
Optimization of machines
Heller4Operation – Integration in value chain

Productivity

Flexibility

Analyse MyMachine/
Analyse MyCondition
Heller4Services
Predictive maintenance

Business models

Heller4Use
Flexibility and transparency in machine use

MindSphere
Digital Enterprise tailored to specific industries – success factor: collaboration of OEM – user – Siemens

Process industries
- Chemicals
- Glass & Solar
- Marine
- F&B
- Electronics
- Aerospace
- Automotive
- Water & Wastewater
- Minerals
- Pharma
- Batteries
- Wind
- Machine building
- Intralogistics
- Oil & Gas
- Fiber
- Power & Utilities
- Tire
- Additive Manufacturing
- Cranes
- Robotics

Discrete industries

1 Will be addressed in cooperation with other OpCos/POC
Siemens supports digital transformation from concept development to implementation

Concept development, implementation and optimization

Determining readiness for digital transformation

Roadmap for Digital Enterprise
Thinking industry further!

Outlook: increasing convergence of IT and OT

Industrie 4.0

Working with data

Optimizing with data

Connecting with data from IT

Operational Technology (OT)

Information Technology (IT)

Closed Loop
Digital Enterprise – Thinking industry further!
An overview of our booth

Digital Enterprise Showcase
End-to-end solutions for specific industries
- Automotive, Additive Manufacturing and Battery
- Chemicals

Hall 6: Siemens Digital Enterprise Software
Hall 16: Industrial 5G