TIA in the Digital Enterprise
Digitalization Use Cases
Digital Enterprise - our portfolio of solutions for the digital transformation

Digital Enterprise

### Process Industries
- Product design
- Process and plant design
- Engineering
- Operation
- Services

### Discrete Industries
- Product design
- Production planning
- Production engineering
- Production execution
- Services

### Digital Enterprise for Process Industries – from Integrated Engineering to Integrated Operations

- Industrial Communication
- Industrial Security
- Industry Services

### TIA in the Digital Enterprise

Digital Enterprise Suite
Our holistic approach
Specific for product manufacturers and machine builders

Product manufacturer perspective

1. Product design
2. Production planning
3. Production engineering
4. Production execution
5. Services
   - Machine concept
   - Machine engineering
   - Machine commissioning
   - Machine operation
   - Machine services

Machine builder perspective
In order to remain competitive in the future, the value chain must be integrated and digitalized.
Continuous optimization with the Digital Twin

Digital Twin Product
- Virtual product
- Specification
- Verification

Digital Twin Production
- Virtual production
- Validation
- Commissioning

Digital Twin Performance
- Real production
- Real product
- Ideal delivery

Collaboration platform: Teamcenter

Insights from performance with MindSphere

Continuous improvement
Digital Enterprise Suite – Our unique portfolio for the digital transformation
Digital Enterprise Suite – comprising 5 core elements

- MindSphere
- Totally Integrated Automation
- Product Lifecycle Management
- Manufacturing Operations Management
- Teamcenter
Digital Enterprise Suite – Totally Integrated Automation

**Totally Integrated Automation**
Seamless integration of engineering tools and uniform data transparency for ensuring best possible efficiency and verified product quality at production sites.

**Portfolio highlights:**
- TIA Portal
- SIMATIC
- SINUMERIK
- SINAMICS
- SIRIUS
MindSphere - the cloud-based, open IoT operating system by Siemens forms the core of a strong ecosystem with capacity for data analysis and connectivity, tools for developers, users and services.

Digital Enterprise Suite - MindSphere
TIA – the foundation of automation for the digital enterprise

Totally Integrated Automation

»TIA in the Digital Enterprise«
TIA Digi Use Cases for the Digital Enterprise

1. Automatic execution of engineering tasks
2. PLM integration to automation engineering
3. Efficient cloud based engineering
4. Virtual commissioning
5. Integrated Energy Management
6. Machine and plant security
7. Data acquisition for Cloud Services
8. Industrial Communication
9. Line integration
10. Integrated engineering of kinematics
11. Virtual training
12. Automation planning
13. Collaborative automation design
14. Edge computing
15. RFID-enabled supply chain management
16. Analysis of drive data
PLM integration of automation engineering

With **TIA Portal Teamcenter Gateway**

- All machines engineering data consistently available at one central place
- Integration of automation engineering into versioning and release workflows
- Worldwide collaboration among distributed team members

- Common database for mechanical, electrical and automation engineering
The challenge – Administrating huge data flows from the engineering process

How to organize all this data?

MCAD

ECAD

TIA Portal
The status with no structured data management

Different data
- E.g. NX
- E.g. EPLAN/E3/…
- TIA Portal

Different files and versions
- MCAD data
- ECAD data
- TIA projects
- TIA Global libraries

Different locations
- E.g. on hard disk
- E.g. in cloud
- E.g. on network drive
The question – How to deal with this complexity?

Project lead engineering or maintenance

- Where is the engineering data of the machine?
- What’s the latest version of my TIA Portal project?
- What is the release status of the TIA Portal project?
- Which TIA global library has been used in a specific project?
The innovative solution – Intelligent data management with a consistent data basis

One data backbone – one location

- Managing of TIA Portal projects and libraries as a whole
- Consistent versions
- Consistent release workflow

All machine variants

- MCAD
- ECAD
- TIA project
- TIA global library
The innovative solution –
Intelligent data management with a consistent data basis

**MCAD**

**ECAD**

**TIA Portal**

**One data backbone – one location**

- Managing of TIA Portal projects and libraries as a whole
- Consistent versions
- Consistent release workflow

**All machine variants**

SIEMENS
Ingenuity for life.
Your benefit –
Current and consistent data throughout the engineering process

- **Central management** of TIA projects and global libraries
- GUI for Teamcenter access **integrated** in TIA Portal
- **Central engineering data storage** of all machines

No time-consuming searches

Fewer errors due to consistent engineering data

Facilitated service by up-to-date data throughout installed fleet
Efficient cloud based engineering

With **TIA Portal Cloud Connector**

- Reduced maintenance for software installations
- Changes performed directly on site on the machine, even without programming device
- Secure access to the machines automation components

- **Access to TIA Portal in a private cloud**
TIA Portal Cloud Connector – Flexible working within a network – any time and any place!

Requirements

- Central management of various TIA Portal versions
- Changes on the machine – without programming device
- Separation of IT and machine networks is ensured

Benefits of the solution

- Central management of the engineering software
- Uniform software
- Secure access across sub-networks
- Reduction of hardware requirements
TIA Portal Cloud Connector – The network bridge in the TIA Portal!

Virtualization is the basis!

Office (IT network)

Production system (Automation network)
Cloud-based engineering
Virtualization as the basis for a secure connection of 2 networks!

1. Activate the Cloud Connector at the Programming device/PC end
2. Establish connection with the virtual machine (RDP)
3. Activate the Cloud Connector at the TIA Portal end
Virtual commissioning

With **PLCSIM Advanced** as a virtual controller and simulation tools

- Simulation of single automation units with PLCSIM Advanced
- Simulation of machines with PLCSIM Advanced connected to NX MCD over SIMIT

- “Commissioning in the office” instead of at customer’s plant
- Safe and efficient testing of control concepts using the model
- Parallization of mechanical and automation engineering
- Optimization of automation project in virtual environment
Recommended plan of action “virtual commissioning”
Integration of PLM and TIA – interplay between machine building and automation engineering

Software in the loop

Mechanical model

NX
Mechatronics
Concept
Designer

PLCSIM
Advanced

Totally
Integrated
Automation
Portal

Siemens Digital Ecosystem Partner Conference 2018
Simulation allows errors to be identified early in the product life cycle

Six Sigma/Quality Rule
Rule of tens

"The rule of tens says that error-related costs for an unidentified error increase by a factor of 10 from one value-added level to the next. The earlier an error is identified and corrected, the cheaper this is for the organization. (...)"

Conclusion
The quality of the engineering project must be increased as early as possible in the product life cycle!

1) This assumes that the error would otherwise not be detected until operation
Virtual Commissioning enables parallel work and thus a shorter time to market.
Virtual Commissioning lowers the risks for real commissioning

**Without Virtual Commissioning**
Unexpected problems increase:

- Time requirements
- Personnel requirements
- Materials requirements

And when international projects are involved ...

= Incalculable costs

**With Virtual Commissioning**
Problem scenarios are known from Virtual Commissioning

- Best case: Cause of error eliminated
- Solution strategies are already developed
- Personnel are trained accordingly
- Replacement material is at the ready

Calculable costs =
With PLCSIM or PLCSIM Advanced, customers can check their control program in a virtual way.

Validation of control logic and visualization:
- PLCSIM
- PLCSIM Advanced
- HMI simulation

Validation of interaction between controller and mechatronics of a machine:
- PLCSIM Advanced
- NX MCD
- SIMIT

Validation of interaction of various components in a cell, line or plant:
- PLCSIM Advanced
- Simulation software, such as TECNOMATIX Process Simulate and TECNOMATIX Plant Simulation, Matlab Simulink, WinMOD

Digitalization Readiness
Complexity and Planning Security
Workflow Level

PLC/HMI simulation
Machine simulation
Cell/Line/Plant simulation
SIMATIC PLCSIM Advanced is the virtual controller of SIMATIC S7-1500

**Benefit:** Comprehensive simulation of controller functionality

**A virtual controller**
… for extensive function simulation including communication, know-how protected blocks, Safety and web server

**Includes a documented public interface**
… for exchange of data (I/Os, bit memory, DBs, timers) with customized co-simulation or test software

**Support of multiple and distributed instances**
… for simulation of multiple controllers on a PC/in the network
The right co-simulation is determined by the application

Siemens Portfolio

Universal
- PLCSIM Advanced

Machines
- NX Mechatronics Concept Designer

Robot cells (e.g. Automotive)
- TECNOMATIX Process Simulate

Material flow simulations
- TECNOMATIX Plant Simulation

Process simulation
- SIMIT

Siemens offers

- An integrated system landscape
- Ready-to-use interfaces to PLCSIM Advanced in work or planned
- Presales & consulting support
Data acquisition for cloud services

With Siemens cloud MindSphere
- Global access to assets
- Data analytics
- Ongoing supervision of the machine performance
- Specific planning of services
- New business models for machine builder

- Secure data connection between automation and MindSphere
- Easy configuring of connection
- Flexibility to realize best fit for connectivity concept
Technical expertise at individual production sites

MindSphere

SIEMENS
Ingenuity for life
Benchmarking between individual plants
The challenge –
Connecting your assets – Wherever they are

What do you need?

- Global access to assets
- Ongoing supervision of the machine performance
- Optimized planning of services
- New business models for machine business

How to get there

- Secure data acquisition for cloud services with MindSphere
The innovative solution: Flexible MindSphere connectivity concepts

1) Outlook

- SCADA Connectivity
- IPC/PC and Connectivity software

- Integrated Connectivity
  - e.g. MindConnect Function Blocks for S7-1500

- Gateway/Network Connectivity
  - MindConnect (Nano, IOT …)
  - IPC/IOT and Connectivity software
  - SCALANCE and Connectivity software

Company IT know-how and infrastructure
The innovative solution – Connecting securely automation to MindSphere

Connecting SIMATIC to MindSphere

1. Asset configuration and onboarding MindConnect
2. Connecting automation (e.g. PLC) and configuring data collection
3. Visualization and request configuration

1. TIA Portal
2. MindSphere Asset Configuration and Onboarding
3. MindSphere Visualization and Request Configuration

- PLC
- DB
- Function
Your benefit – Easy and flexible connectivity of your automation to MindSphere

Data collection and analysis in the cloud

- Secure data connection between automation and MindSphere
- Easy configuring of connection
- Flexibility to realize best fit for connectivity concept

Data-driven services, e.g. condition monitoring

MindConnect: SIMATIC S7-1500, SIMATIC IPC/IOT
DF FA Team
Tran Vinh Thanh
Truong Dinh Chau
SIMIT
Digitalization by Simulation
Challenge: Production Start is Scheduled - But there is Commissioning …

Simulation and Virtual Commissioning

Start thinking!!! This is definitely not the right way!

- Plant delays
- Process is not fully running
- Plant hardware is not complete
- Infrastructure is not complete
- Limited error analysis
- Requirements not complete/correct
- Testing is time consuming
- Operators needed
- Risk for damage and accidents
- Inconsistent data

Design | Engineering | FAT | Commissioning | Operation
Automation Architecture to Simulation Architecture →
The Digital Twin

**Real World**
- HMI: PCS 7 OS Server/WinCC
- Automation System (AS)
- Remote IO/devices
- Actuators/Sensors
- Plant/Machine

**Virtual World**
- HMI: PCS 7 OS Server/WinCC
- Software-in-the-loop Emulation of AS
- Simulation of Signals
- Simulation of Drives/Signals
- Simulation of technological behavior
- Hardware-in-the-loop PROFIBUS or PROFINET via SIMIT Unit
- SIMIT VC – Virtual Controller
- PLCSIM Adv.
- SIMIT-Connector to domain specific simulators

- High fidelity chemical process simulators
- 3D or discrete event driven simulators

**SIMATIC S7**
- Remote IO/devices
- Actuators/Sensors
- Plant/Machine
- Automation System (AS)

**SIMATIC S7**
- Remote IO/devices
- Actuators/Sensors
- Plant/Machine
- Automation System (AS)
Clever combination: Testing and training of automation projects with SIMIT

Your benefits with SIMIT

- Up to 80% time savings in commissioning
- Significantly reduced risk for errors and accidents
- Substantial cost savings
Train your operator

Even for the most complex plants

Virtual training environments of all sizes
Training even before plant is ready
No machinery, equipment, facility plant and hardware involvement
Thank you

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