The Digital Enterprise Platform merges sophisticated PLM Software and powerful automation technologies, optimizing the entire value chain.
Organization

Digital Factory Division

<table>
<thead>
<tr>
<th>Factory Automation</th>
<th>Control Products</th>
<th>Product Lifecycle Management</th>
<th>Motion Control</th>
<th>eCar Powertrain Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Automation Products" /></td>
<td><img src="image2.png" alt="Control Products" /></td>
<td><img src="image3.png" alt="Product Lifecycle Management" /></td>
<td><img src="image4.png" alt="Motion Control" /></td>
<td><img src="image5.png" alt="eCar Powertrain Systems" /></td>
</tr>
</tbody>
</table>

Customer Services

Integrated product portfolio paves the way for the Digital Enterprise.
Digital “Factories of the Future”
Public/Private Partnerships

Realizing next-generation product/production processes
Roadmap towards Industrie 4.0:
Evolution, not Revolution

Introduction of electronics and IT to further automate production

Integration and optimization of the entire product development process

Industrie 4.0 – Self-optimization of cyber-physical systems (CPS)

On the way to Industrie 4.0

1960 2010 2030
Cyber-physical systems have all the information as a digital model.

Cyber-physical system (CPS)

- Physical production facility
- Digital model

Contains all the information on...

- Software / Informatics
- Mechanics
- Electrics, Electronics
- Automation, HMI
- Safety, security
- Maintenance
- Location, identity...
- Status
- SW version
- Interfaces
- ...

The digital model is always up-to-date and is extended over the entire lifecycle.

- Product design
- Production planning
- Production engineering
- Production execution
- Services
Digitalization is Transforming the Manufacturing Industry

**Smart Model**
The product model sets the objectives needed to produce itself

**Digital Twin**
Full digital product definition that simulates reality

**Optimized, Distributed Production**
Autonomous production with embedded intelligence.
Our Digitalization Portfolio
Siemens Integrated Product/Production
Digital Factory HW and SW Portfolio

Enterprise Level
ERP
PLM

Management Level
MES

Operator Level
SCADA

Control Level

Field Level

PLM
NX
Product Development
TEAMCENTER
Collaborative PDM
TECNOMATIX
Digital Manufacturing

SIMATIC
HMI
SIMATIC Controllers
SIMATIC IT Production Suite
SIMATIC IT Intelligence Suite
SIMATIC IT
Production Suite

SIMATIC WinCC
SCADA System
SIMATIC HMI
SIMATIC IT
Intelligence Suite
TIA PORTAL
Engineering Framework for Automation Tasks

SINUMERIK
CNC
SIMOTION
Motion Control

SIMATIC NET
Industrial Communication
SIRIUS
Industrial Controls
SIMATIC IDENT
Industrial Identification
SIMATIC Distributed I/O
SINAMICS
Drive Systems

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Siemens PLM Software Integrated Product/Production

Collaboration through a common platform

Design/Manufacturing Collaboration
Integrated Planning and Simulation
Process and Layout Collaboration
Ramp-up support
Plant planning and feedback

JT – 3D Collaboration on ISO Standard

Teamcenter – Integrated Product/Production Platform

Global Production and Supplier Collaboration
The Future of Manufacturing
1. Faster development of product design through PLM software

Virtual Development & Planning with PLM Software
Reduced development times
Product Design
- Product Planning -

Program Management

Product Data/Change Management

Requirements/System/Functional Definition

Global Collaboration

Product Design
Production planning
Production engineering
Production
Service
Product Design
- Product Development -

Concept Layout and Styling

Multi-discipline Design

Analysis and Simulation

Computer-aided Manufacturing

Product Design
Production planning
Production engineering
Production
Service
Product Development Demonstration
Requirements Driven Product Development

Requirement:
Open/ close time to meet market expectation
Criteria:
Overall cycle - 7.6 sec.
Retract target - 6.5 sec.
Tilt target - .9 sec.

Requirement:
During closure roof must reverse if obstructed
Criteria:
Maximum pressure on obstruction not to exceed 40N

Requirement:
Customer forum - Sun roof aperture needs to increase
Criteria:
Increase runner to maximum size meeting roof crush properties

Increase aperture opening requirement
Roof opening requirement
Roof opening obstruction requirement
Today’s Product Challenges are More Difficult Than Ever Before…

Landing on Mars is one of the hardest jobs on Earth.

On August 5, the Mars rover Curiosity landed successfully on the surface of Mars. There was only one chance to get it right. For this unprecedented challenge, NASA employed Siemens PLM software solutions. The development team at NASA’s Jet Propulsion Laboratory digitally designed, tested, assembled, and simulated the entire Mars rover before a single physical prototype was created.
Digital Model
Leverage Hybrid Machining for Replacement Parts

Additive Manufacturing Process: 273 min
Subtractive Process (Milling) : 155 min
Digital Model (https://www.youtube.com/watch?v=s9IdZ2pI5dA)
Leverage Hybrid Machining for Replacement Parts
The Future of Manufacturing
2. Simulation of production planning reduces time to market

Complete Simulation & Optimized Production
Up to 50% reduced time to market
Smart Models in Production Planning

Example: Energy Efficiency
Problem Statement

Not only the CO2 emission during use of a product is relevant but also the CO2 emission spent during manufacturing.

Therefore manufacturing companies are giving more and more attention to energy efficiency of their factories.

Besides using more smart and more energy efficient equipment, the manufacturing processes themselves can be optimized for energy efficiency as well.

Digital Models should help analyzing various energy saving scenarios without disrupting running production.
Sustainability
PROFIenergy Profile

Plant Simulation supports the creation of simulation models testing the effects of PROFIenergy related energy control strategies for manufacturing equipment.

The PROFIenergy Profile enables control devices (e.g. PLCs) to send commands to Energy Consuming Units (ECU), to signal pauses such as lunch breaks, holidays, random line stoppages or even peak load conditions. On receipt of the PROFIenergy commands, software ‘agents’ in the ECU firmware initiate pre-defined ‘sleep’ modes for the duration of the pause.
Case Study

Saving 1.66 Mio kWh per year through “start-stop” control strategy for machines

Measurement did match simulation prediction

Additional 1.4 Mio kWh saving through turning of high-pressure pumps for cooling lubricants in case of idling machines

Positive side-effect: noise reduction
Energy Simulation in Tecnomatix Process Simulate
Tecnomatix Process Simulate
Robot – Human Interaction
Digital Twin in Production Planning
Problem Statement

Most planning projects are dealing with “brown-field planning”

Can I use my current production line for a new or modified product?

Can I fit another piece of equipment into my current production line?

I would love to do this in a digital model without disturbing running production, but:
• Do I have a complete enough digital model?
• Can I be sure that my digital model matches reality?
Usage of Point Clouds in Digital Manufacturing

Planning in factory context*
- Integrate factory design with PLM
- Re-use of point cloud data with Bentley .POD format
- Change Management between process and layout engineering

Visualization of point cloud data and planning data
- Visualize the assembly process in the real plant context
- Adjust simulation layout according to “as built” plant

Simulation and verification
- Verify plant installation 3D-CAD geometry and point cloud
- Plant items designed in CAD will be verified against actual scans
Hannover fair Siemens booth
Laser scanning workflow

Survey and Scan

Registration & Pre-processing

Reference scan in Process Planning model

Simulation and Validation
Hannover fair 2014 – Laser scanning of Siemens Future Forum
Laser Scanning process and pre-processing
Hannover fair 2014 – Laser scanning of Siemens both Tecnomatix Process Simulate - Reference scan in Process Planning model
Digital Twin
Dynamic Human Motion – Record and Analyze
The Future of Manufacturing
3. Cost savings through highest efficiency in production engineering

Smooth Communication of all components
Integration of all Automation Functions
Typical Engineering and Commissioning

- Mechanical Engineering
- Automation Engineering
- Physical Commissioning
- Test and Debug
- Operation

Job 1
New Engineering and Commissioning

- Mechanical Engineering
- Automation Engineering
- Virtual Comm.
- Physical Comm.
- Test and Debug
- Operation

Job 1
From Planning to Virtual Commissioning On All Levels

Planning, Validation, Commissioning
The Future of Manufacturing
4. Efficient Production based on one high performance network technology

Fully integrated Product & System Portfolio

Data integration from shop-floor to top-floor
Production
Digital Twin – Plant Behavior

Customer Value:
- Analyze impact and demand for manufacturing changes
- Determine production system parameters based on actual order look-ahead

Our approach:
- Maintain a precise behavior model of your factory
- Leverage data from MES and Order systems to feed the model
- Allow for on-demand simulations, where the model represents the current real production to the best possible level

Concept – Automatic build-up of simulation models

Benefits:
- Easy and direct access to actual production data (for integration new product variants or reuse)
- Import of actual cycle time and availability (OEE data)
Quality Solutions
Integrating Design, Manufacturing and Production

Continuous improvement through a PLM Platform
Overlaying Production Measurement with Virtual Planning
Big Data for DPV in Production
Parsing 1.6 million data files a month

Data Load Verification and Transformation:
Automatically extract translate & load plant floor measurement data to Teamcenter:
• Real time data flow from 360+ data drops around the world.
• ~.8 GB of measurement database inserts a day.

Advanced Analysis:
SSAS Cube – multidimensional statistical aggregations:
• Automating multiple complex quality metric calculations for monthly, weekly and daily basis.
• ~.6 GB of stored statistical calculations a day
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Thank You

Visit us online today and get in on the conversation:

**Tecnomatix Manufacturing Discussion Forum**

www.siemens.com/plm/community/tecnomatix

**World Wide Web**

www.siemens.com/tecnomatix

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