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Future-Focused Automation for the Digital Enterprise

John DeTellem | October 24th 2019

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What comes to mind with the following…

Industry 4.0

Digitalization

Internet of things, IIoT

Digital Transformation in Manufacturing

Smart Manufacturing

“when everything around us changes”

Data and Information sharing, amongst “components”

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Industry 4.0 is a name given to the current trend of automation and ***data exchange*** in manufacturing technologies. It ***includes*** cyber-physical systems, the Internet of things, cloud computing and cognitive computing.

Industry 4.0 is commonly referred to as the fourth industrial revolution. Wikipedia

Data evolving into Information, simply shared between components, (hardware / software)

The Future of Automation Concepts will be a key enabler for the vision of future factories

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Digital transformation has focus on…

- more flexibility
- shorter time-to-market
- increased quality and efficiency
- new business models

Now and in the future new technologies will further enhance the Digital Enterprise and enable smart factories

To handle increased complexity in a smart factory we must realize the best of both:
automation and digitalization

Envisioning the future of factories must first begin with a vision for the future of automation, an approach that has been relatively less explored in the industry today

Future of Automation trend technologies that can strongly influence automation

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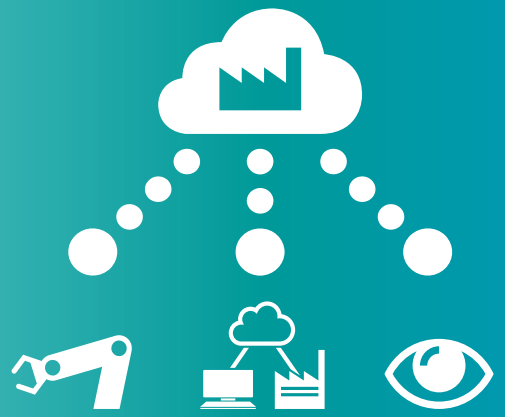
In particular, the 3 trends
of artificial intelligence,
edge computing,
and augmented reality
have been identified as factors that can strongly influence automation



1 **Artificial intelligence** has the potential to transform human-centered engineering models into automated systems, facilitating continuous operational learning and resulting in productivity gains that can exceed existing human-led approaches

2 **Industrial Edge** or computing at the edge can help expand PLC functionalities with additional computing power and personalized operational needs without sweeping changes to production architecture

3 **Augmented reality** will be the HMI of the future, enabling operators with high transparency and superior insights into controllers, machines, and production processes

New technologies will further enhance the Digital Enterprise and enable autonomous cyber-physical systems

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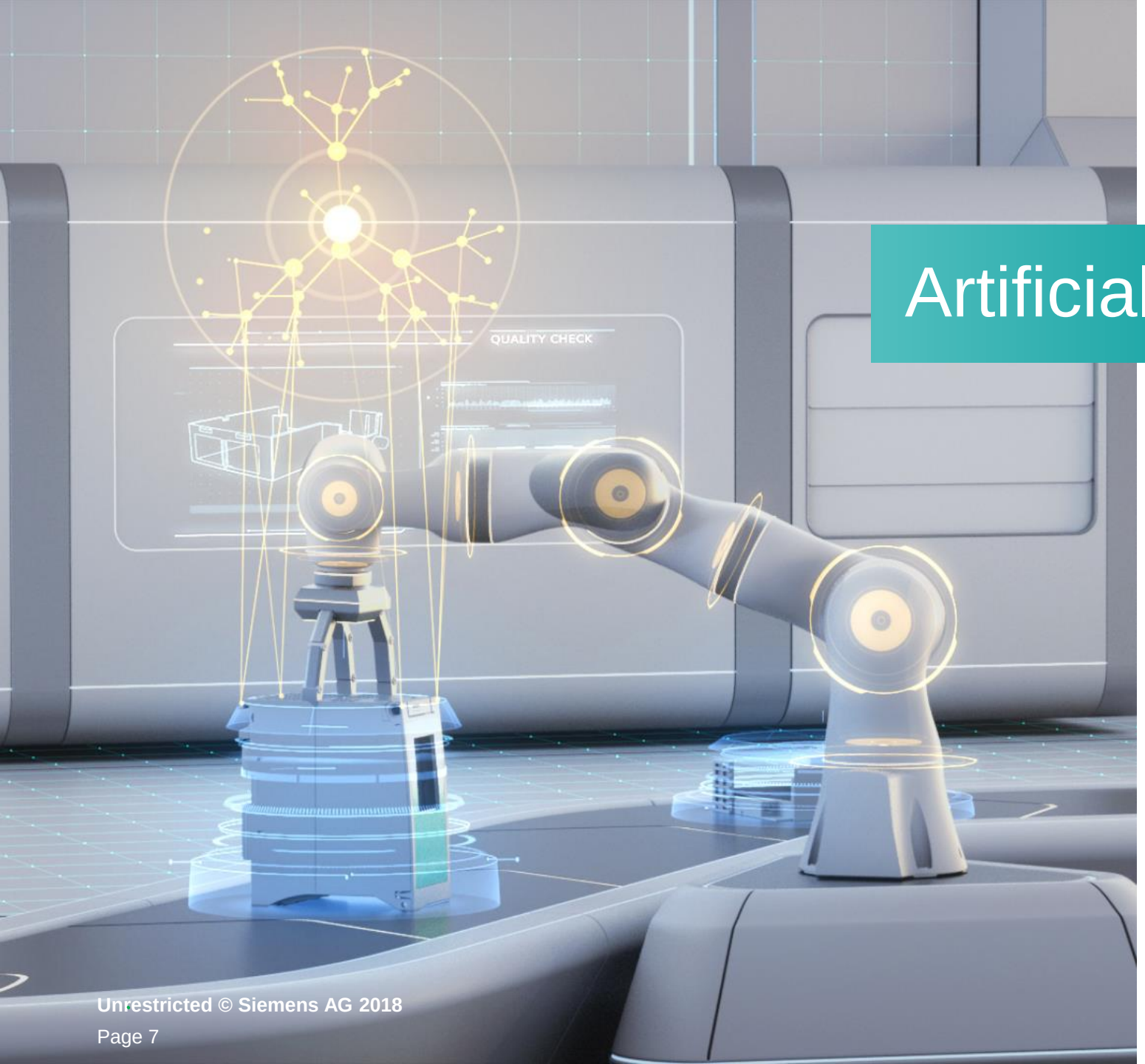
Existing	Current Innovations	Upcoming Innovations	Big Picture
Automation as the gateway to the Digital Enterprise	First portfolio elements	Automation of Engineering **Industrial Artificial Intelligence** **Industrial Edge** **Industrial Augmented Reality**	Automation of Automation • Edge meets AI • Autonomous Machines • Cognitive Engineering • Modularization
 • Digitalization • With TIA Portal and Options	 • Controller with a AI Interface  • Edge Box & Apps	Step by step new IT technologies will be utilized for industrial automation and will materialize in the form of further innovative products, applications and software.	• A digital holistically integrated value chain, leveraging AI will enable autonomous systems and model-based engineering. This is the major lever towards zero engineering. • Joint innovations based on cutting-edge IT technology will further increase productivity

Reduce Engineering Effort



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Artificial Intelligence

Artificial Intelligence (AI) can use new data to **learn continuously**.

This vision that is driving us is that of an autonomation which is capable **optimizing itself** and even **automating itself**

Why AI?

Artificial Intelligence with all its different facets will reduce programming and engineering efforts, make control logic more agile and flexible towards changes in the environment and production processes more flexible and precise.

John DeTellem / TIA Portal

Collaborative robots working with Artificial Intelligence

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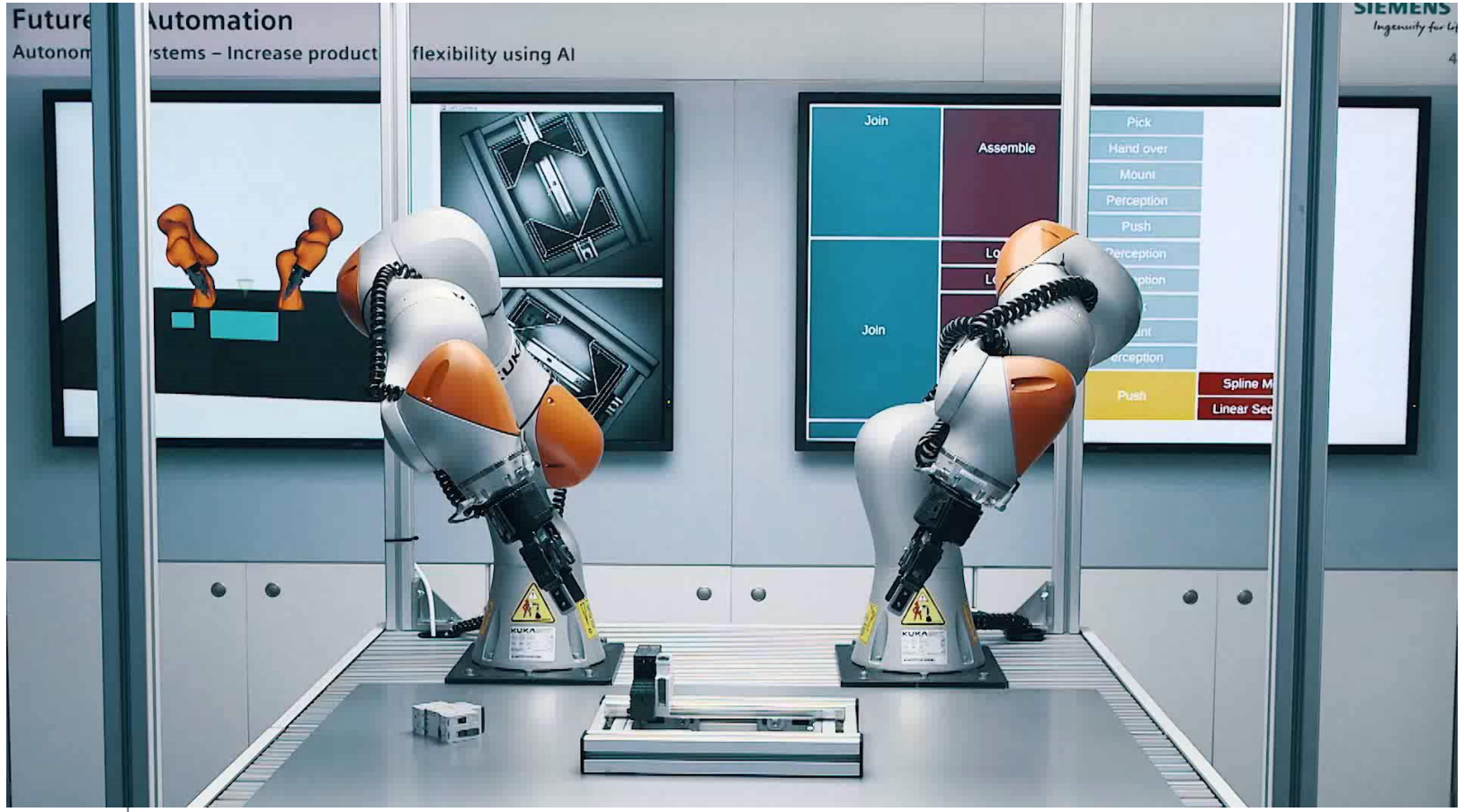
These robots independently perform part of the control panel assembly



The interesting thing is that the robots only get the instruction about **what is to be manufactured** and **no longer how** it is to be manufactured. This means robots **no longer need to be programmed in detail**. Moreover, the robots' wrists are equipped with cameras to locate the parts around them and monitor their surroundings.

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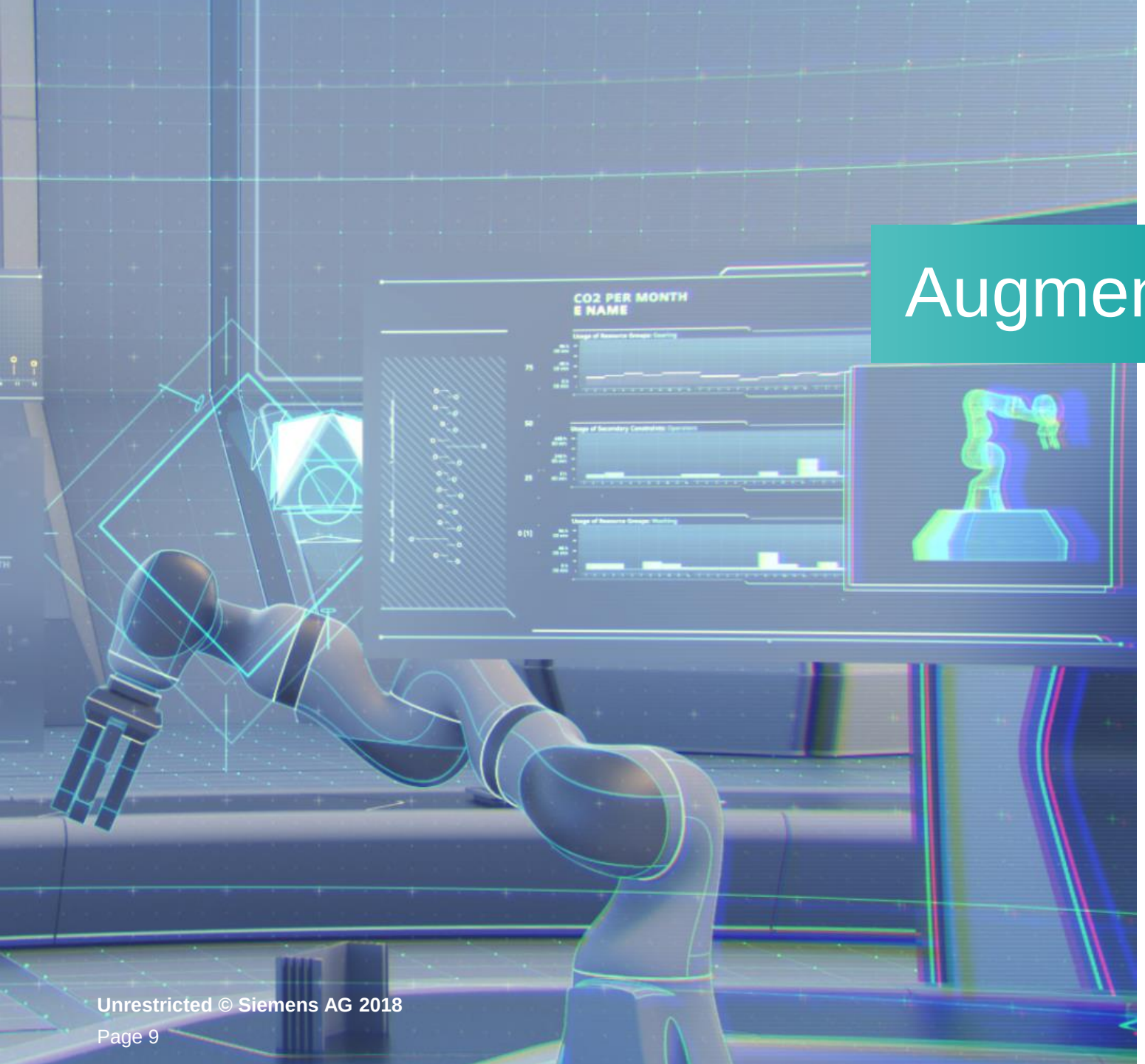
Augmented Reality



Using new visualization methods to maintain control over **increasingly complex production methods**.
Augmented reality (AR) **extends the view** of the real production, plant and machines with virtual components

Why AR?

From the planning stage of new machines or plants right up to the operation of complete plants, AR enables an high degree of planning security, extended transparency on machine KPI and analysis possibility for production optimization.

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Augmented Reality enables a view of the most important machines KPIs exactly at the place where they are created

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Presentation of virtual HMI panels & KPIs

Information is shown dependent on the viewing angle and the role of the user – **need for action is detected faster**, support provided where required
Dashboards are used to **automatically provide a quick overview of the current situation** and are adapted to the role of the user

With Augmented Reality we combine the digital twin with the production data in real time for full digital transparency

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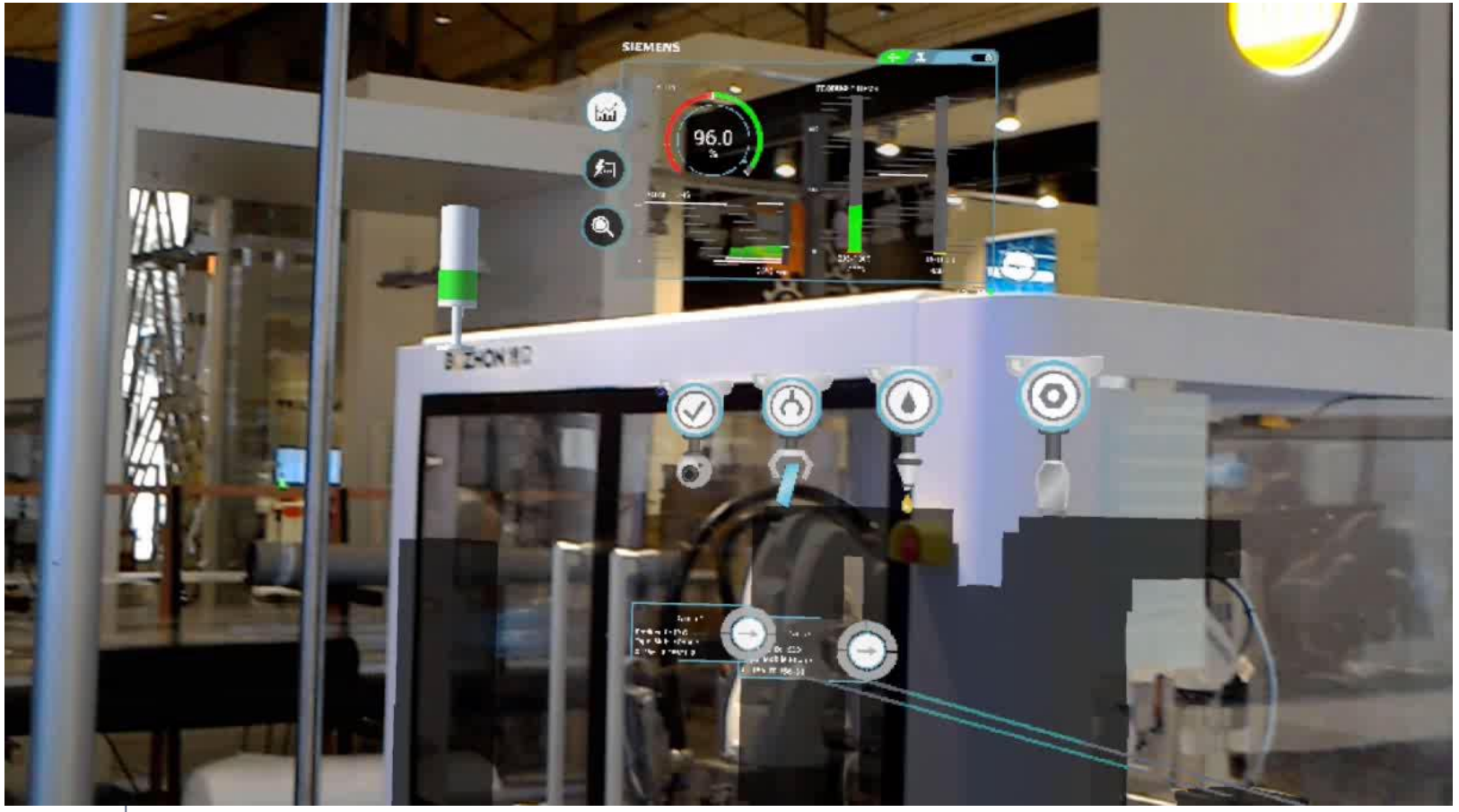
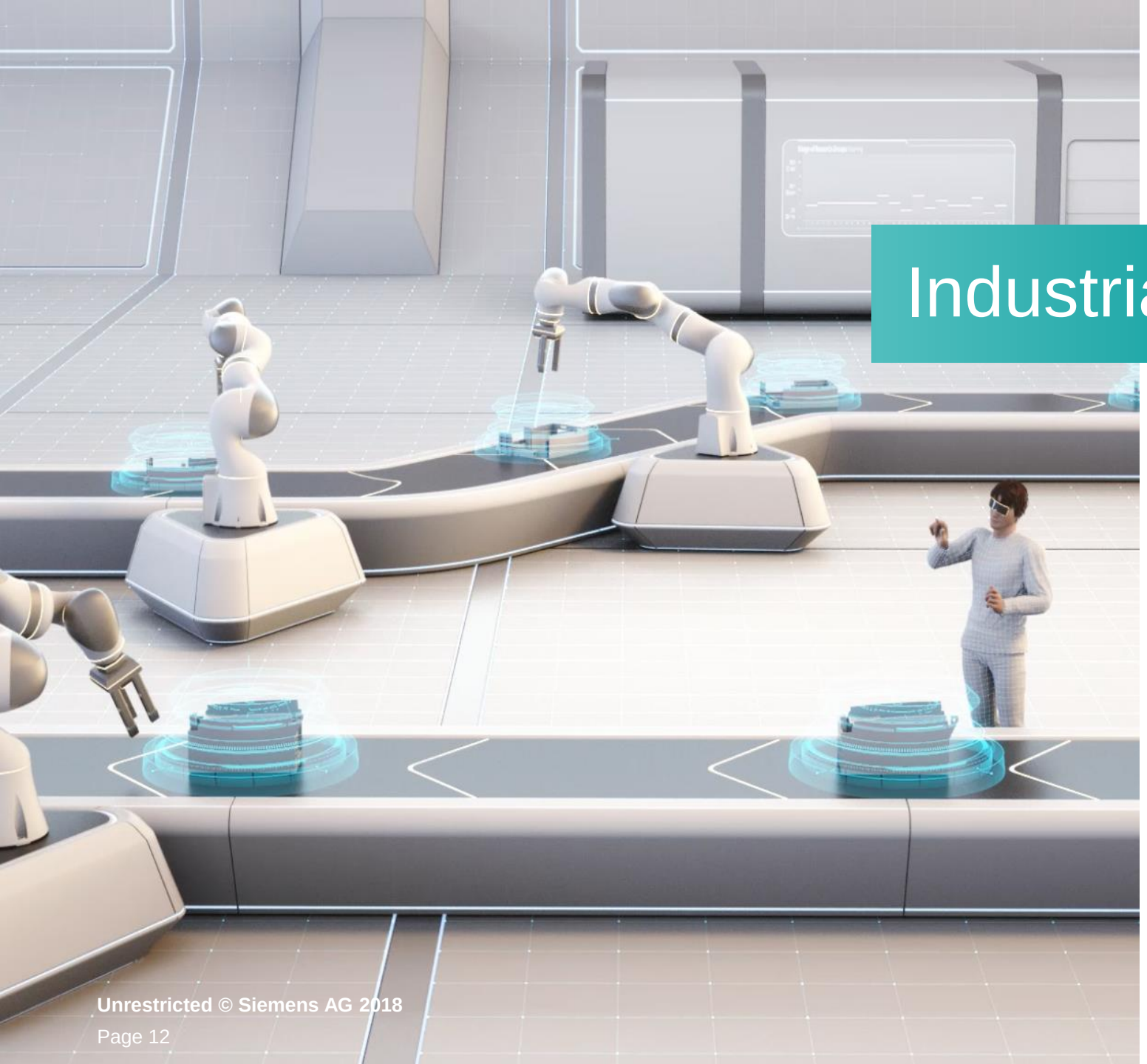
Virtual view of concealed production information



Maintenance personnel are **guided exactly to the location** of fault, see all the relevant information about the fault displayed, and can possibly **use the digital twin for additional virtual views of the plant**
Experts situated anywhere in the world can communicate with the engineers on site, share their view of the real plant and work jointly on solving problems



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Industrial Edge

Industrial Edge is the next generation of digital automation. Use the **intelligence an performance of the cloud directly in your production** with industrial edge

Why Industrial Edge?

Edge computing brings cloud technology into the field level. It allows functional upgrades of the field level from a central backend, preprocessing of data and thus a more efficient way of smart data usage.

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What is Edge Computing?

Edge Computing combines both local and cloud computing

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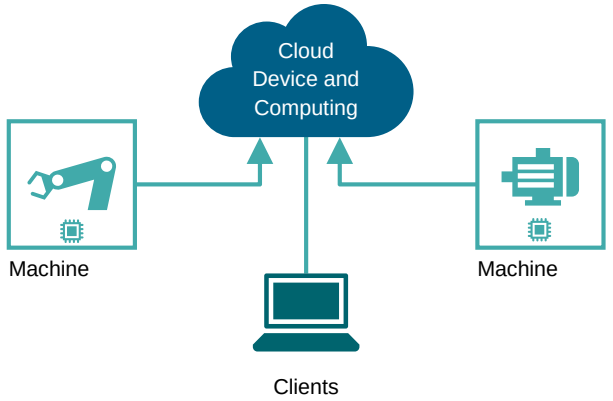
Local computing

Device Installed once –
never or seldom updated

- Data transferred per USB stick or local network

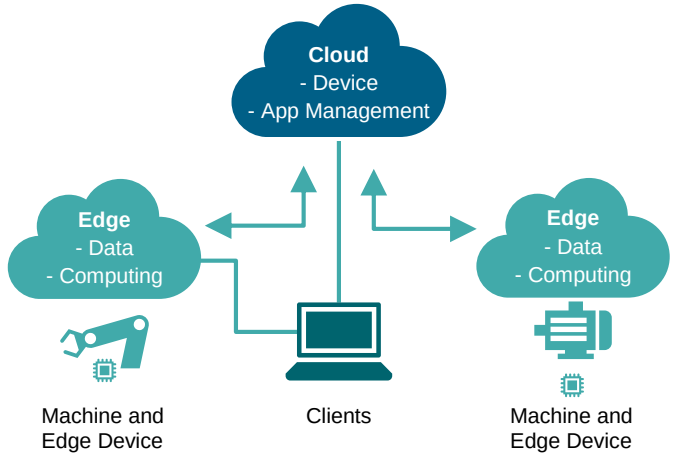
Cloud computing



App installation & deployment on-demand

- Central data and global intelligence
- Quick updates in the cloud
- Low frequency data/high latency of decisions
- Cloud dependency

Edge computing



App installation & deployment on-demand

- Local data and global data (if wanted)
- Shift from global to local intelligence
- Quick software update cycles for edge devices
- High volume data and low latency decisions

Siemens Industrial Edge

Enhanced shop floor functionality with full data control

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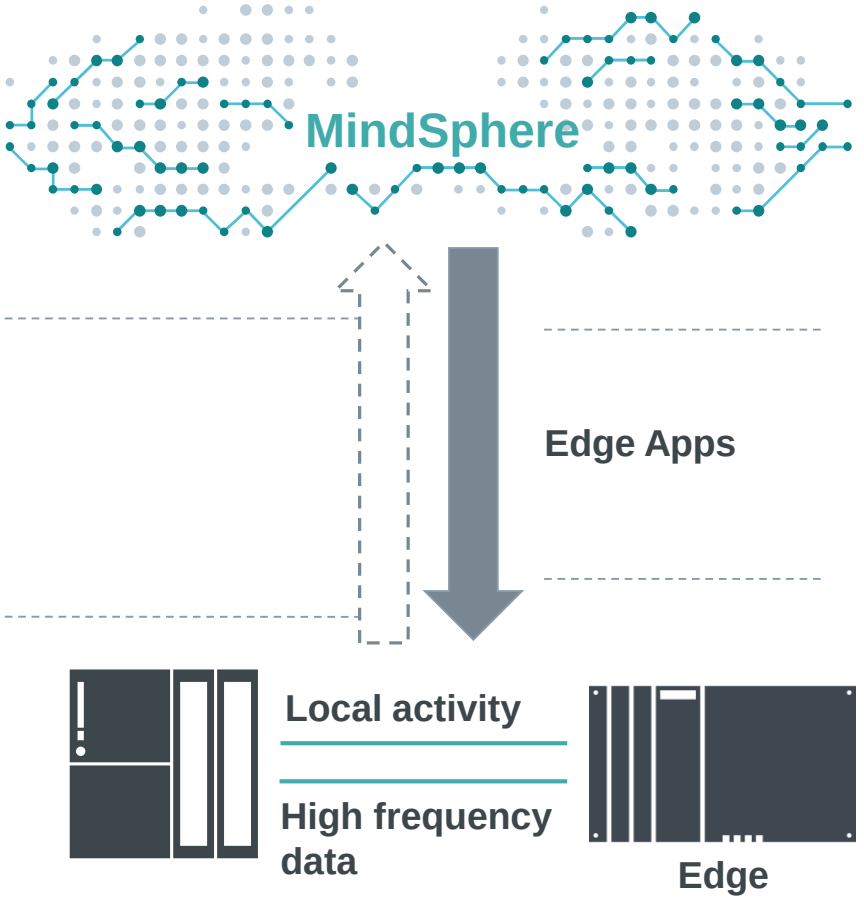
Edge Management
- Device Management
- Edge-App-Management
- Edge-App-Store

Edge Apps
Siemens-, Partner (OEM)-, 3rd-party- and own developed Edge-Apps

Edge-Devices
Secure and decoupled edge runtime infrastructure for edge apps



Application Examples:

Workpiece Analytics App for machine tool system
Intelligent workpiece analysis based on its digital twin

Inventory App
Inventory listing of connected automation components

Benefits
- Converting big data to smart data
- Enhanced data analysis in the shopfloor
- Full data control

OPC UA
Integrated security mechanisms

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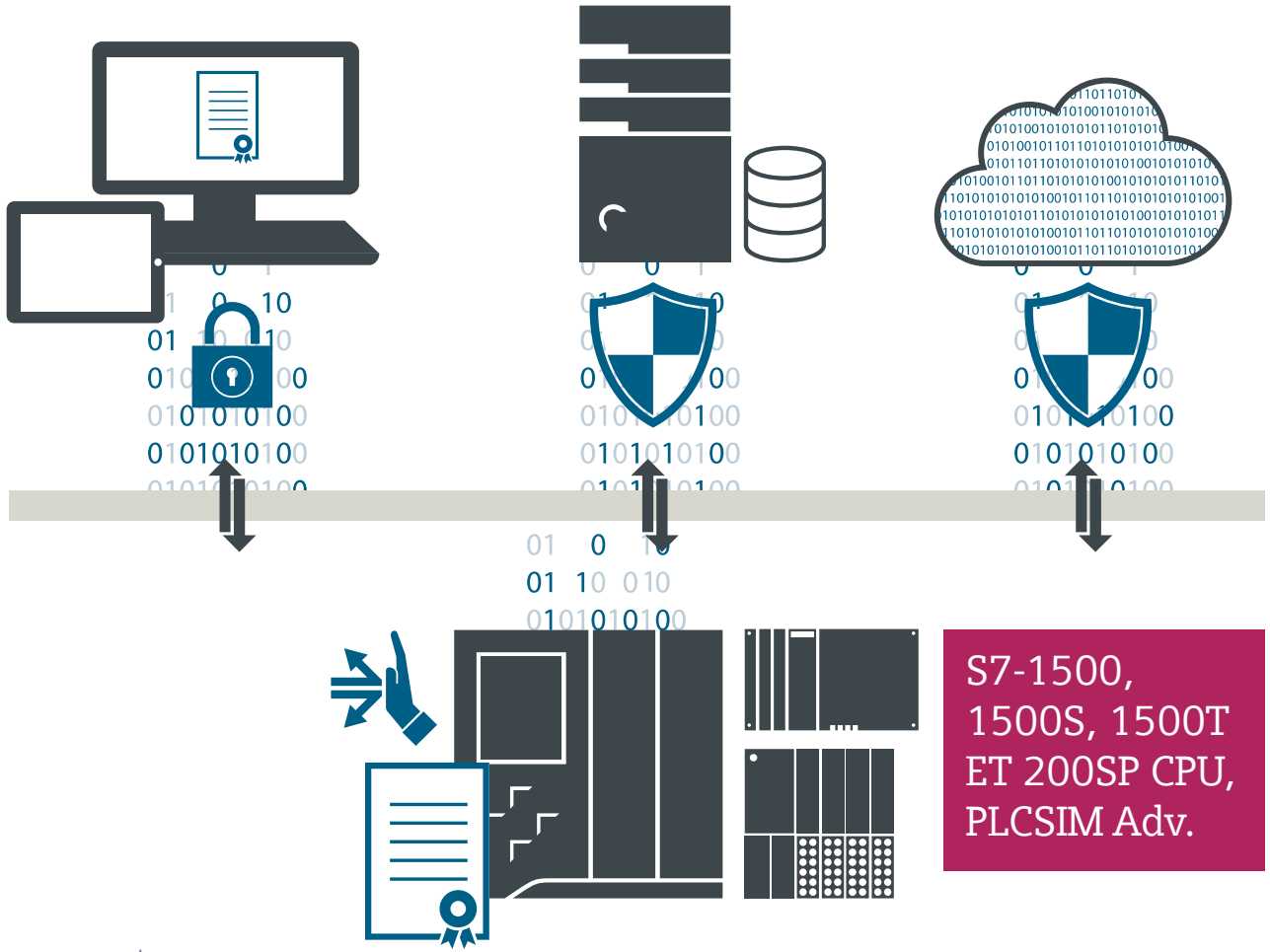

S7-1500,
1500S, 1500T
ET 200SP CPU,
PLCSIM Adv.

OPC UA Security

- Selectable security policies in Controller and Clients
- Device/application authentication based on certificates
- Integrity protection and encrypted communication
- User authentication and restricted access to PLC tags

Open Line Integration
OPC UA Server / Client in the S7-1500

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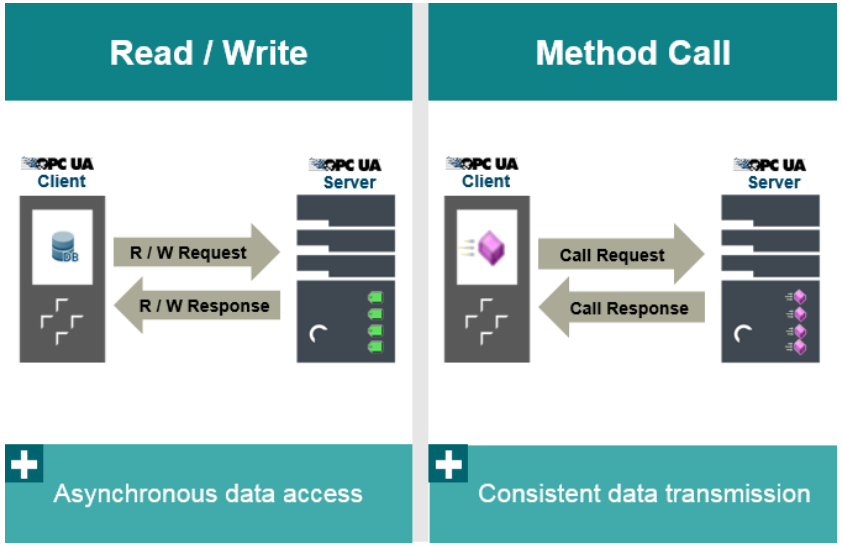


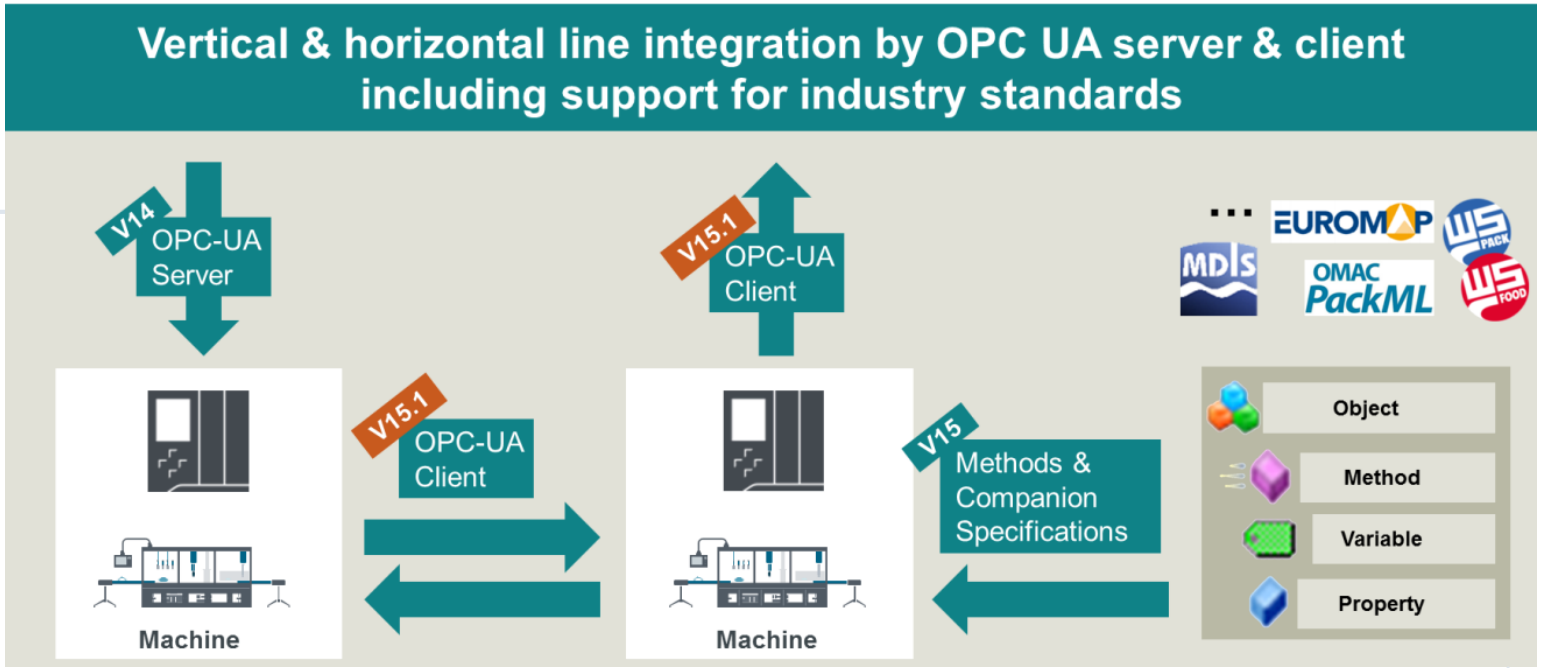
OPC UA server and OPC UA client

Ease of implementation, Secure Open Communications

- Method calls
- Reading and writing data

Benefits

- Vertical communication to HMI,
- MES systems or cloud services
- Controller-controller communication



Integrated engineering reduces the time from the first idea to the machine realization

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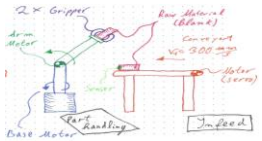
Today

Planning

Requirements

Concept Design

Mechanical concept



Detailled Engineering

Mechanical design

Electrical / Fluid

Software

Commissioning

Real Machine

Real commissioning

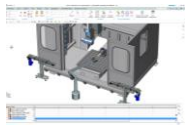
Future

Systems Engineering

Requirements

Concept Design

Mechanical concept



Interdisciplinary Engineering

Mechanical design

Electrical / Fluid

Software

Commissioning

Digital Twin

Virtual commissioning

Real Machine

Real commissioning

Operation

Time saved

Digital Twin - Performance

From Mechanics to Electrics to Automation

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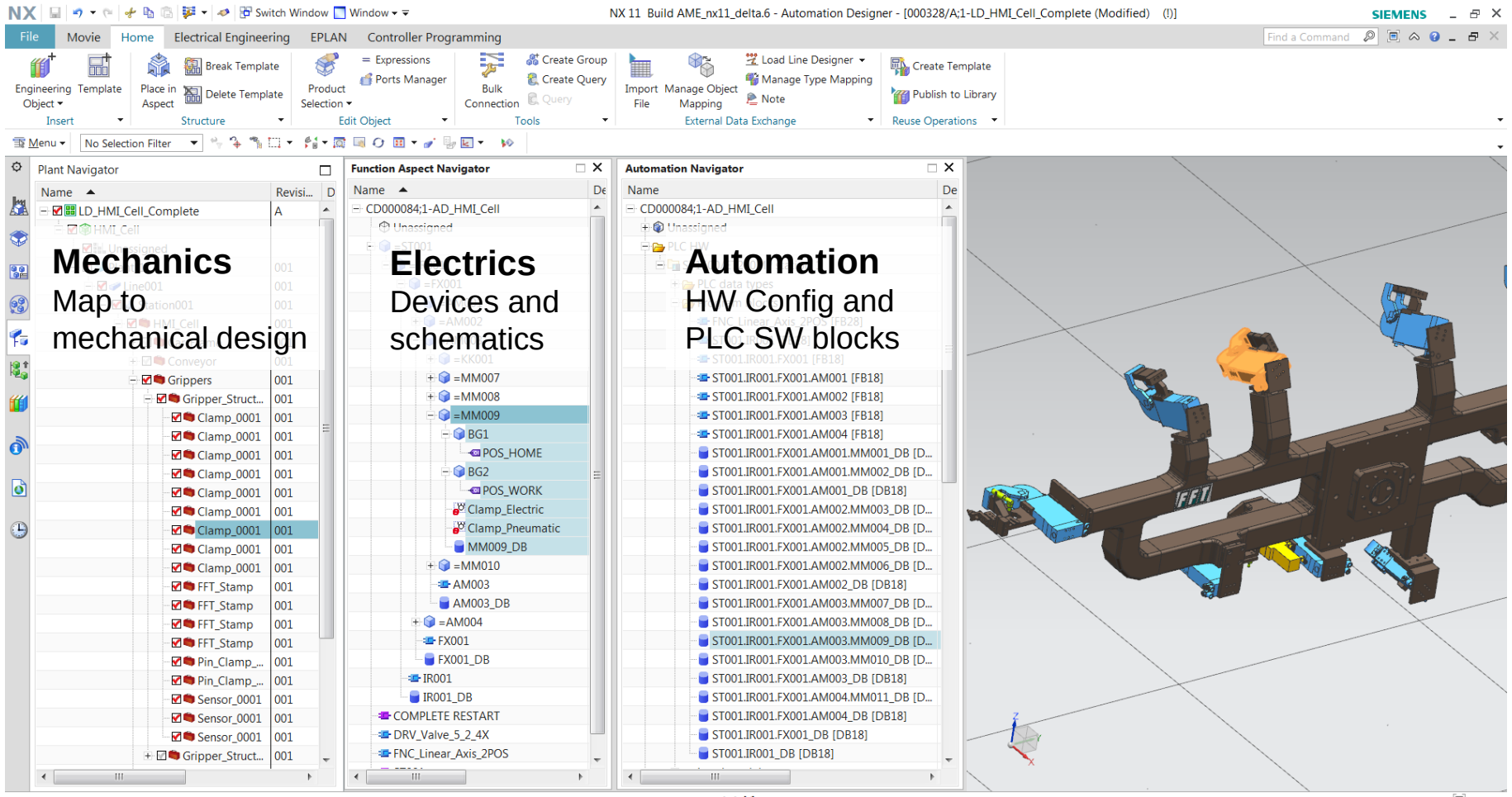
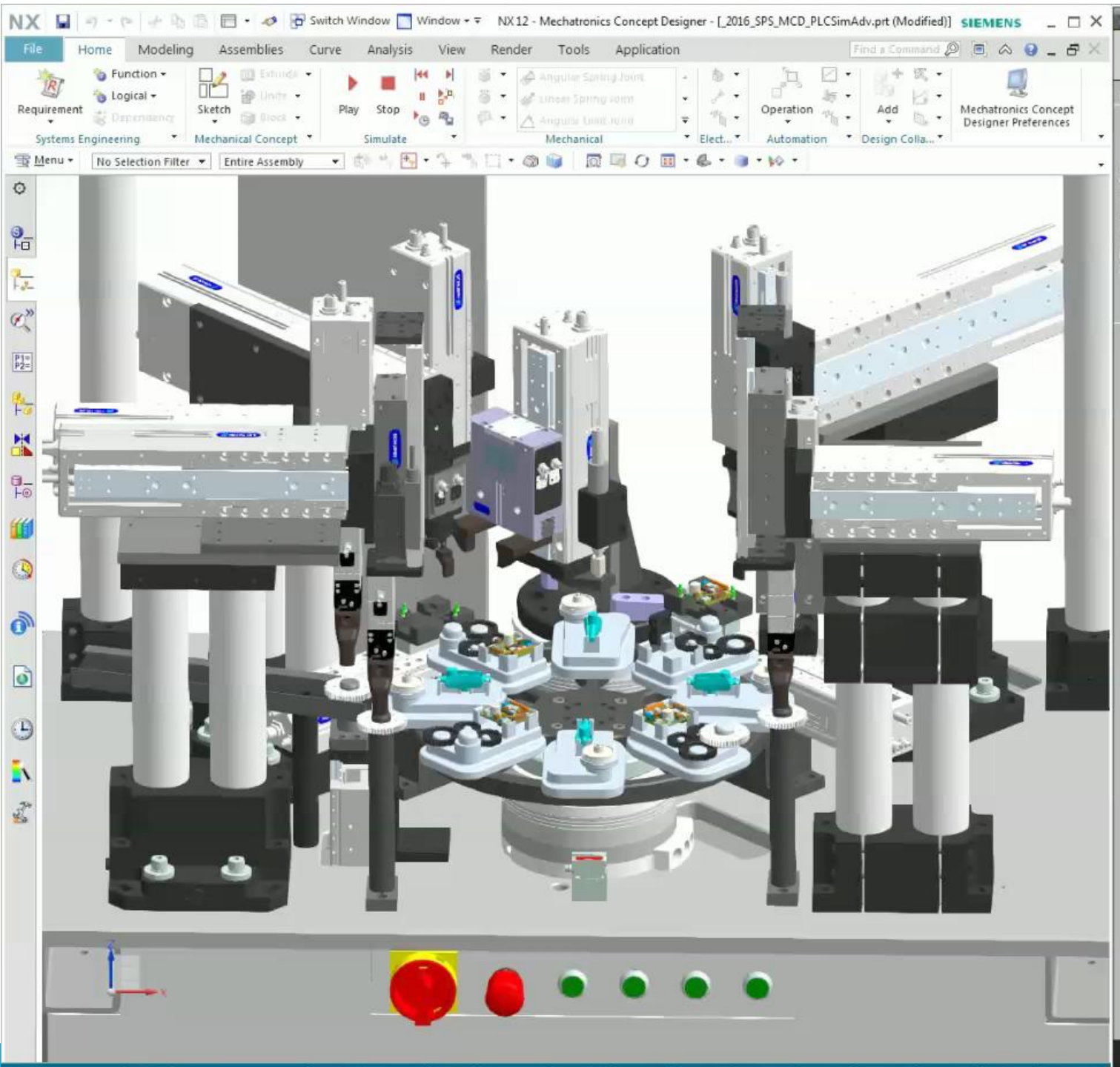
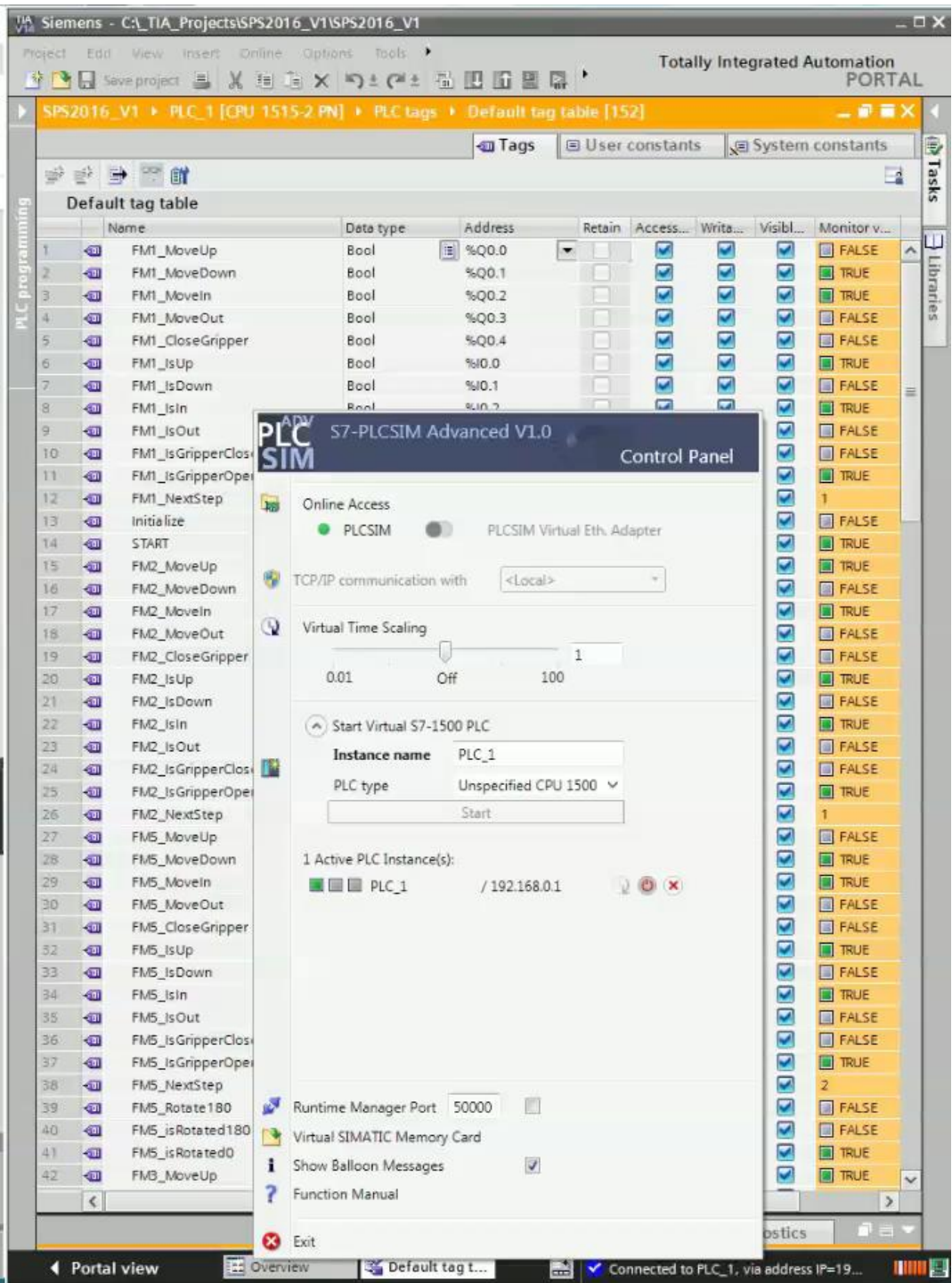


Teamcenter backbone


NX
Switch Window
Window
NX 12 - Mechatronics Concept Designer - [_2016_SPS_MCD_PLCSimAdv.prt (Modified)]
SIEMENS
File
Home
Modeling
Assemblies
Curve
Analysis
View
Render
Tools
Application
Requirement
Function
Logical
Sketch
Play
Stop
Operation
Add
Mechatronics Concept Designer Preferences
Systems Engineering
Mechanical Concept
Simulate
Mechanical
Automation
Menu
No Selection Filter
Entire Assembly


Siemens - C:_TIA_Projects\SPS2016_V1\SPS2016_V1
Totally Integrated Automation
PORTAL
SPS2016_V1 ▸ PLC_1 [CPU 1515-2 PN] ▸ PLC tags ▸ Default tag table [152]
Tags
User constants
System constants
Default tag table
PLC programming
Tasks
Libraries
Name
Data type
Address
Retain
Access...
Writa...
Visibl...
Monitor v...
FM1_MoveUp Bool %Q0.0 FALSE
FM1_MoveDown Bool %Q0.1 TRUE
FM1_MoveIn Bool %Q0.2 TRUE
FM1_MoveOut Bool %Q0.3 FALSE
FM1_CloseGripper Bool %Q0.4 FALSE
FM1_IsUp Bool %I0.0 TRUE
FM1_IsDown Bool %I0.1 FALSE
FM1_IsIn TRUE
FM1_IsOut FALSE
FM1_NextStep 1
Initialize FALSE
START TRUE
FM2_MoveUp TRUE
FM2_MoveDown FALSE
FM2_MoveIn TRUE
FM2_MoveOut FALSE
FM2_CloseGripper FALSE
FM2_IsUp TRUE
FM2_IsDown FALSE
FM2_IsIn TRUE
FM2_IsOut FALSE
FM2_NextStep 1
FM5_MoveUp FALSE
FM5_MoveDown TRUE
FM5_MoveIn TRUE
FM5_MoveOut FALSE
FM5_CloseGripper FALSE
FM5_IsUp TRUE
FM5_IsDown FALSE
FM5_IsIn TRUE
FM5_IsOut FALSE
FM5_NextStep 2
FM5_Rotate180 FALSE
FM5_isRotated180 FALSE
FM5_isRotated0 TRUE
FM3_MoveUp TRUE
PLC SIM ADV
S7-PLCSIM Advanced V1.0
Control Panel
Online Access
PLCSIM
PLCSIM Virtual Eth. Adapter
TCP/IP communication with
<Local>
Virtual Time Scaling
1
0.01
Off
100
Start Virtual S7-1500 PLC
Instance name
PLC_1
PLC type
Unspecified CPU 1500
Start
1 Active PLC Instance(s):
PLC_1
/ 192.168.0.1
Runtime Manager Port
50000
Virtual SIMATIC Memory Card
Show Balloon Messages
Function Manual
Exit
Portal view
Overview
Default tag t...
Connected to PLC_1, via address IP=19...

Integration of PLM and TIA: *Digital Workflow*
Merging mechanical and automation engineering

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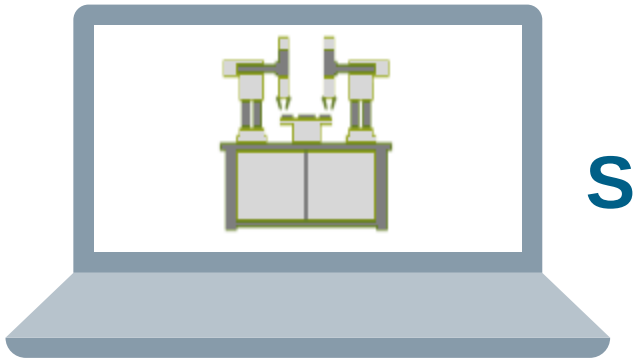
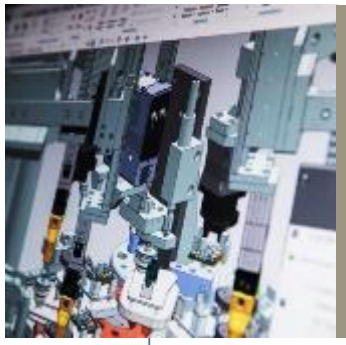


Mechanical model

Software in-the-loop

Automation



3D Model
(e.g. from SolidWorks, AutoCAD, CATIA, NX, etc.)

Digital Twin Controller

PLCSIMAdvanced

Automation Engineering Framework

TIA Portal

This Megatrend Digitalization: INDUSTRY 4.0

…What does this mean to us as we evolve our manufacturing?

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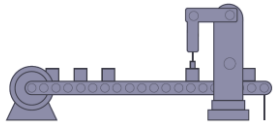
- **Software for seamless engineering solutions (Integrated Engineering)**
  - Integrated for *information sharing* in real time
  - Simulation and *virtual commissioning* (Digital twin)
  - *Automatic generation* of automation solutions
  - Virtual reality / Artificial Intelligence
- **Intelligent, Secure, Networked production systems (Integrated Production)**
  - Industrial Internet of things (IIoT)
  - Cyber physical systems (CPS)
  - Cloud and Edge computing
  - Augmented Reality
  - *Consistent Reliable Diagnostics …*

1st Industrial Revolution 1784



1870

1969

today

Mechanization **Electrification** **Automation** **Digitalization**

Overview of topics

…Automation positions the digital transformation for manufacturing

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- Hardware & field devices
  innovative, open, connected, simple maintainability, diagnostics
- Engineering software
  integrated, all in one, scalable, open, connected, efficient, ease of use
- Application development
  reduced engineering tasks, auto-generated solutions - eliminate errors
- Commissioning
  Optimized in the virtual world, simulation and virtual commissioning
- Transparent Operations
  Consistent reliable diagnostics, open, connected, - for our data analytics…

What key devices traditionally make up automation ?

…Basics of an automation solution

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Automation Devices…

Controllers, IO, Remote IO, Networks, Drives, HMIs, Switches, Power Supplies, …

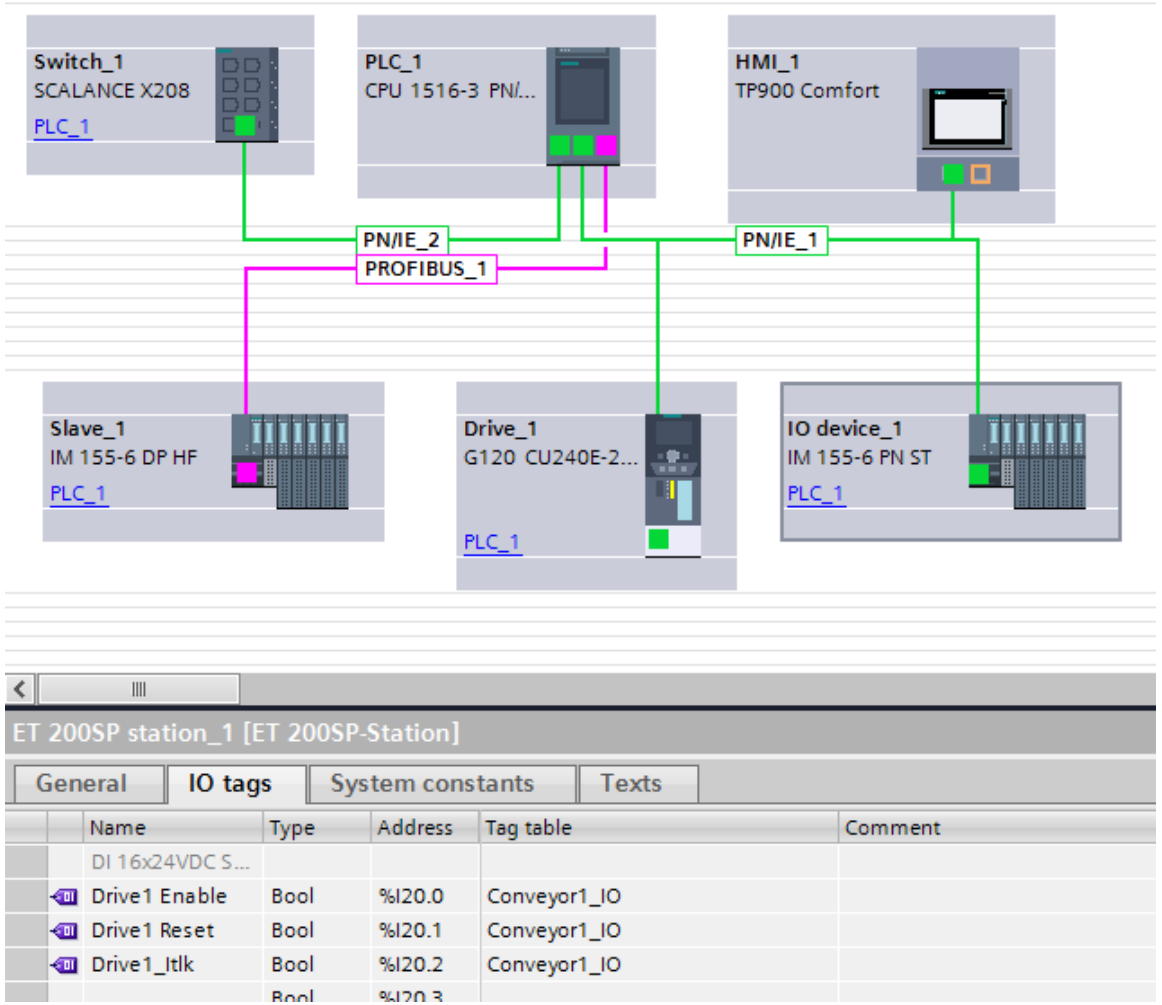
Additional functional…

Safety, Security, Communications, PID, Motion, Diagnostics…

Configuration / Software Tools

Selection Tools, Online Access & Debug, Programming and configuration…

traditionally device specific?



Requirements of the “controller” in the digital enterprise

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Overview of key requirements

- Network ports **built in** for IO Networking
- Memory Card **backup** for device replacement
  - *no programming device required in field*
  - *with **compatibility** support for newer versions*
- LED **diagnostics** plus integrated display
- Accessible “out of the box” with **no setup** required

- **Scalable** for diverse applications
- Supports **Integrated Safety & Motion**
- Can be realized within **PC based** applications
- System **diagnostics built in** + Alarm Server functionality
- Project is **uploadable** with complete tag database
- Configurable / Programming **in RUN**
- **Web Server** capabilities for diagnostics and maintenance

Controllers, now with advanced functionalities…

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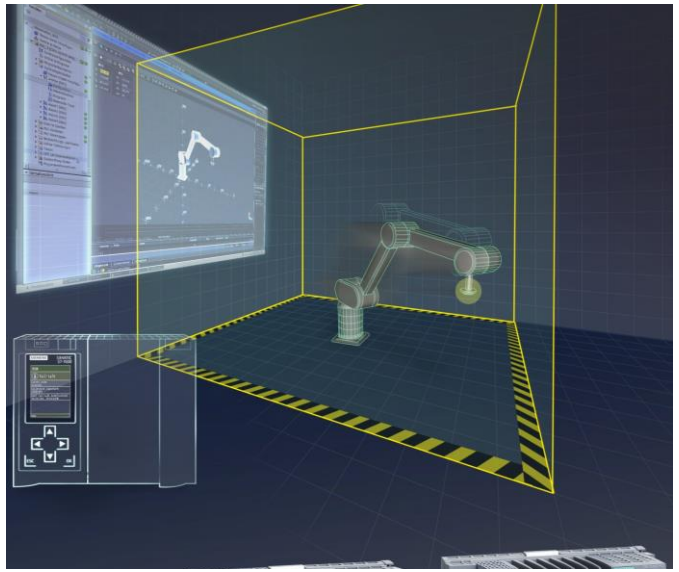
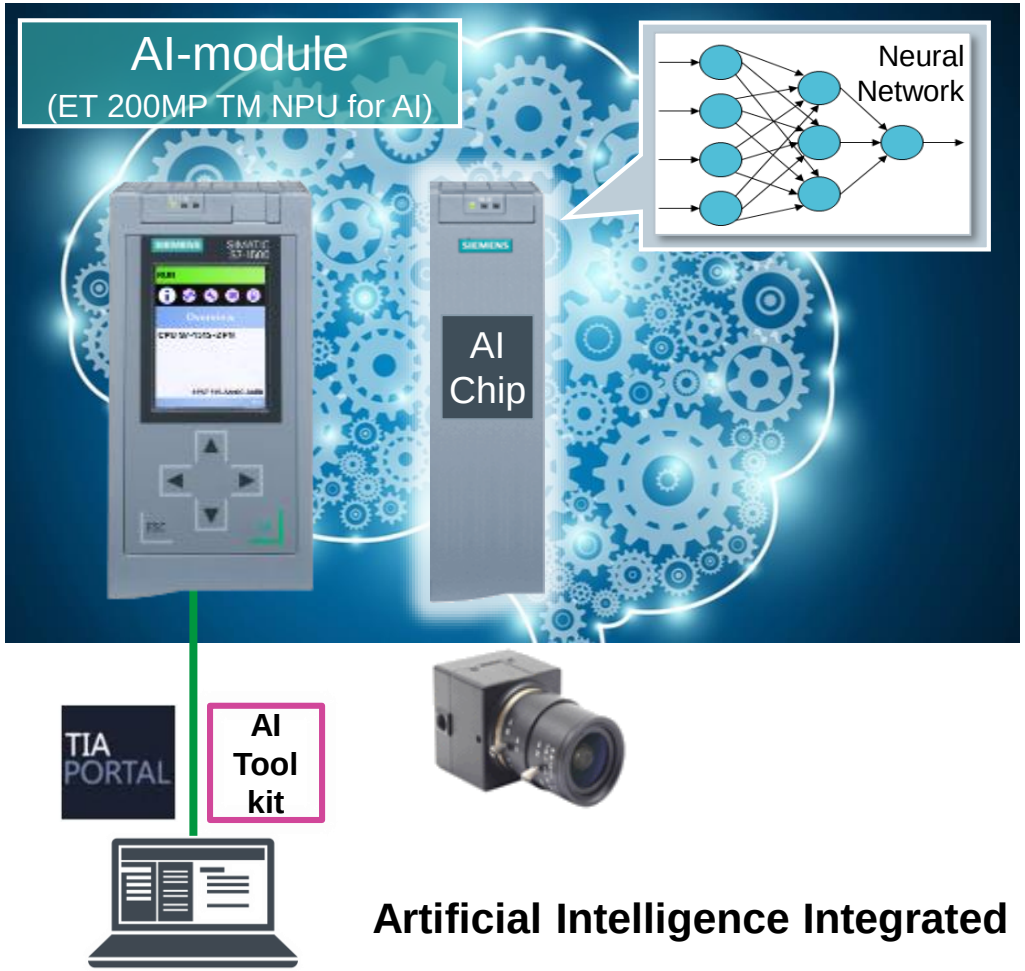


- Integration of **Kinematics** motion control applications

- Simple, easy to configure, with **traceable diagnosis** of coordinated axis and motion behavior with 3D-Viewer

Multifunctional Platform PLC
Integration of C/C++ Runtime
with high performance running on dedicated hardware-based PLC



Artificial Intelligence Integrated

Requirements of the HMI in the digital enterprise

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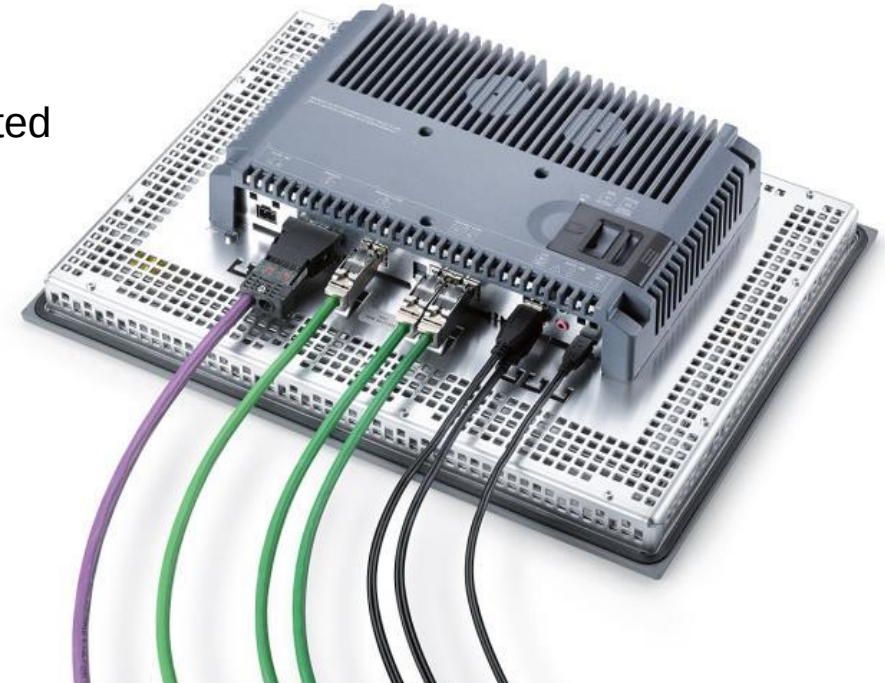
Overview of key requirements

- Communication ports **built in** for Networking
- Memory Card **backup** for device replacement
  - *No programming device required in field*
  - *with **compatibility** support for new version*
- Communications drivers **for 3rd party** PLCs
- Screen in Screen - Remote **client access** supported
- **Web Browser** to support access direct to devices
- **Scalable** 4 in to 22in, Touch plus Keypad
- Plus Mobile & Fully Enclosed / INOX
- Can be realized within I**PC based** applications



Requirements for a drive in the digital enterprise

…can you see some consistency across devices

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Overview of key requirements

- Communication ports **built in** for Networking
- Memory Card **backup** for device replacement
  - *No programming device required in field*
  - *with **compatibility** support for new version*
- Communications drivers **for 3rd party** PLCs

- **Scalable** for diverse applications

- Wi-Fi Smart Access for commissioning

Wi-Fi Smart Access module

And even the power supplies are positioned for digital enterprise

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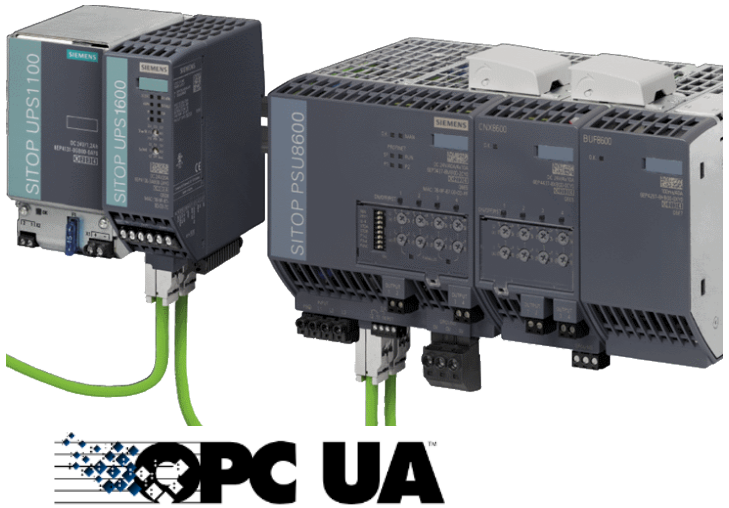
MindSphere

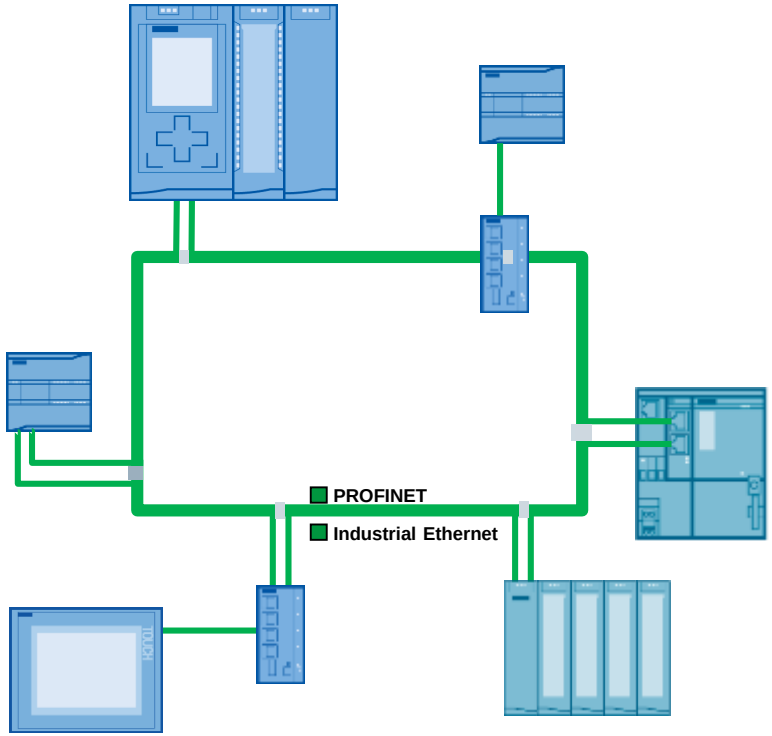


UPS Devices
Power Supplies…

Benefits of robust networking devices

- Remote diagnostics and monitoring
- Ease of Integration, no hardwired inputs
- Data Connectivity, transparency
  - OPC UA
  - and MindSphere

  independent of the automation solution
- Web Server capabilities for configuration and maintenance
- Networking capabilities including Media Redundancy



Gain “Transparent Operation” with intelligent field devices

From the Field to the Digital Enterprise

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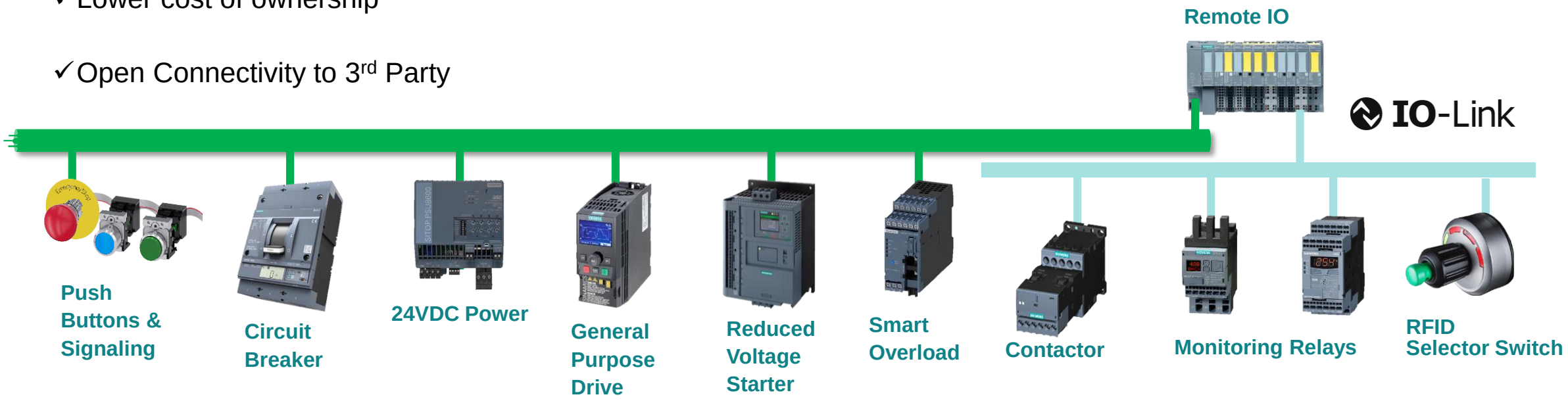
Why are field devices networked?

- ✓Foundation for Digitalization
- ✓Enhanced data and diagnostics
- ✓Reduced wiring & panel space
- ✓Reduced engineering time
- ✓Lower cost of ownership

- ✓Open Connectivity to 3rd Party



Totally Integrated Automation is a key technical component…

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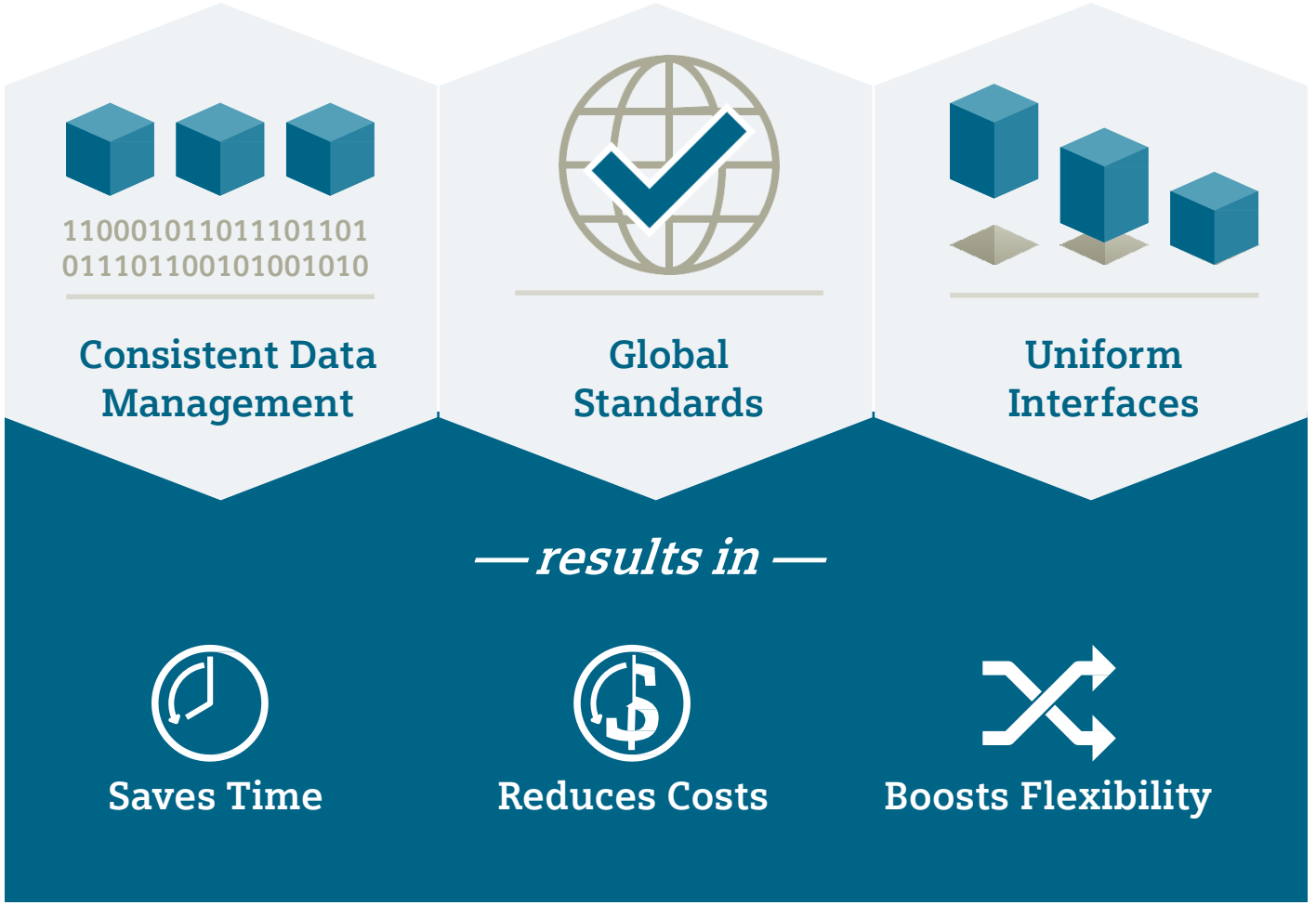
Interoperability of all Automation Components

The **TIA open system architecture** spans the entire life cycle process and offers maximum interoperability across all automation components.

The concepts applied are designed to **minimize engineering time.**



“All in one” framework - Integrated Engineering

… a automation solution engineering within one environment

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All devices in single framework

… **System Centric** with consistent and unified usability concept for all devices and engineering tasks

Integrated simulation, for commissioning

… Validate logic with HMI and motion, or test HMI changes directly before loading device

Centralized project management

… system diagnostics, network management, safety, security, motion… All in One

Intuitive, Efficient, based on concepts that have been successful in previous generation products

One Engineering Framework

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Configuration & Engineering for all Automation Components

The TIA Portal Engineering Framework spans the entire life cycle process and offers maximum interoperability across all automation components.

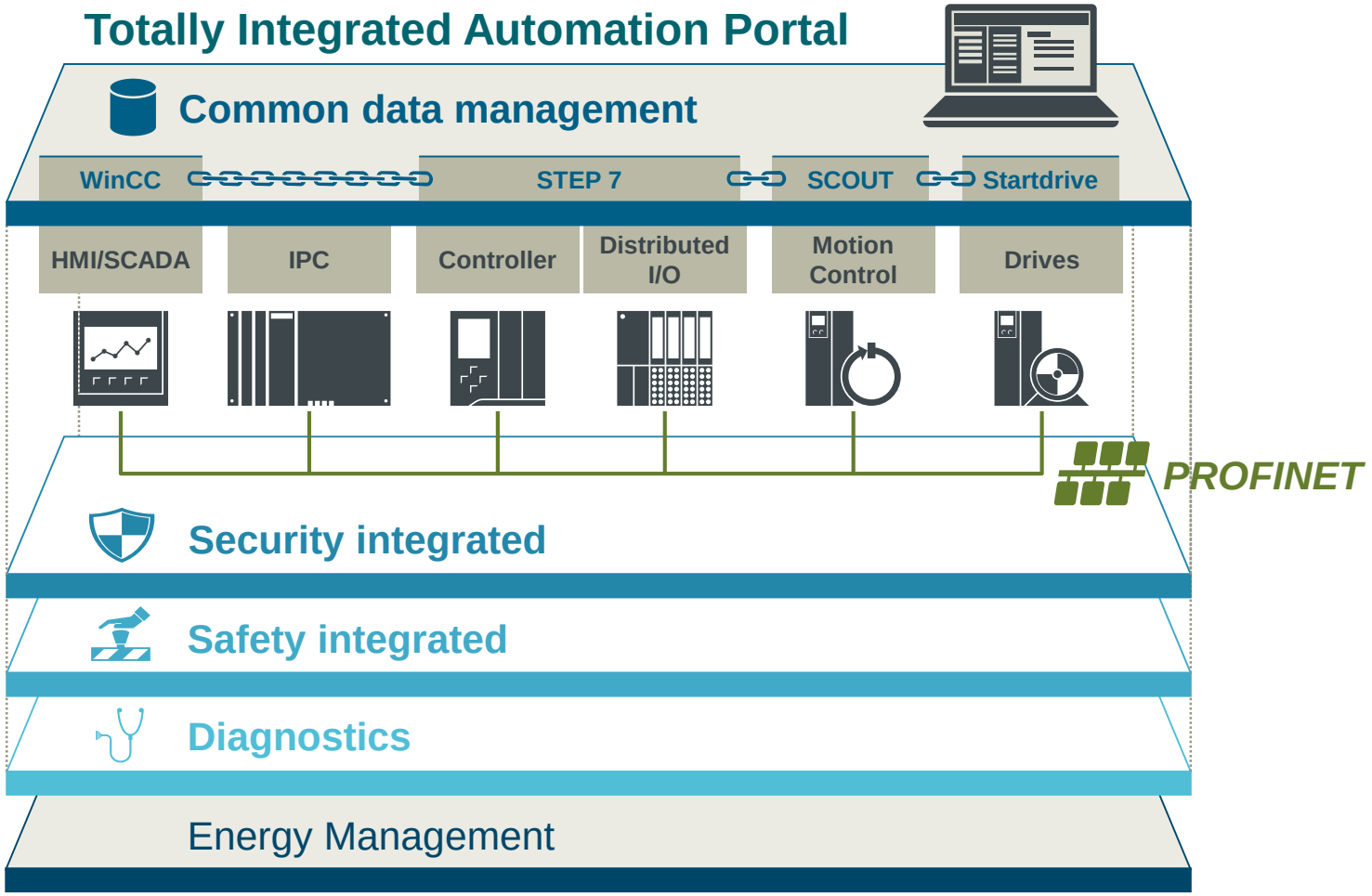
The concepts applied are designed to **minimize engineering time.**

Totally Integrated Automation Portal (TIA Portal)

… the gateway to automation solutions within the Digital Enterprise

SIEMENS
Ingenuity for life

- **One common database Integrated Engineering**
- **Consistent and unified usability concept for all devices and engineering**
- **Libraries, Diagnostics, Scalability, Flexibility**



www.usa.siemens.com\tia-portal

*…overview of the **base software** components*

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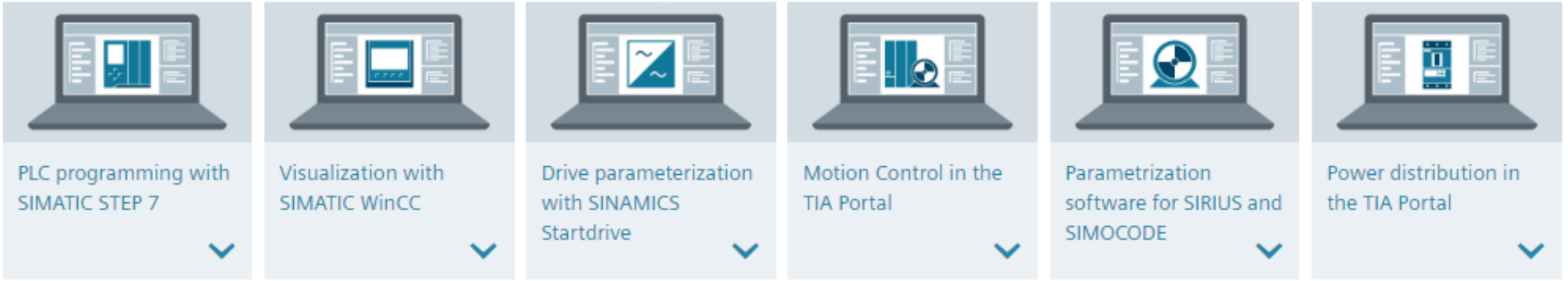
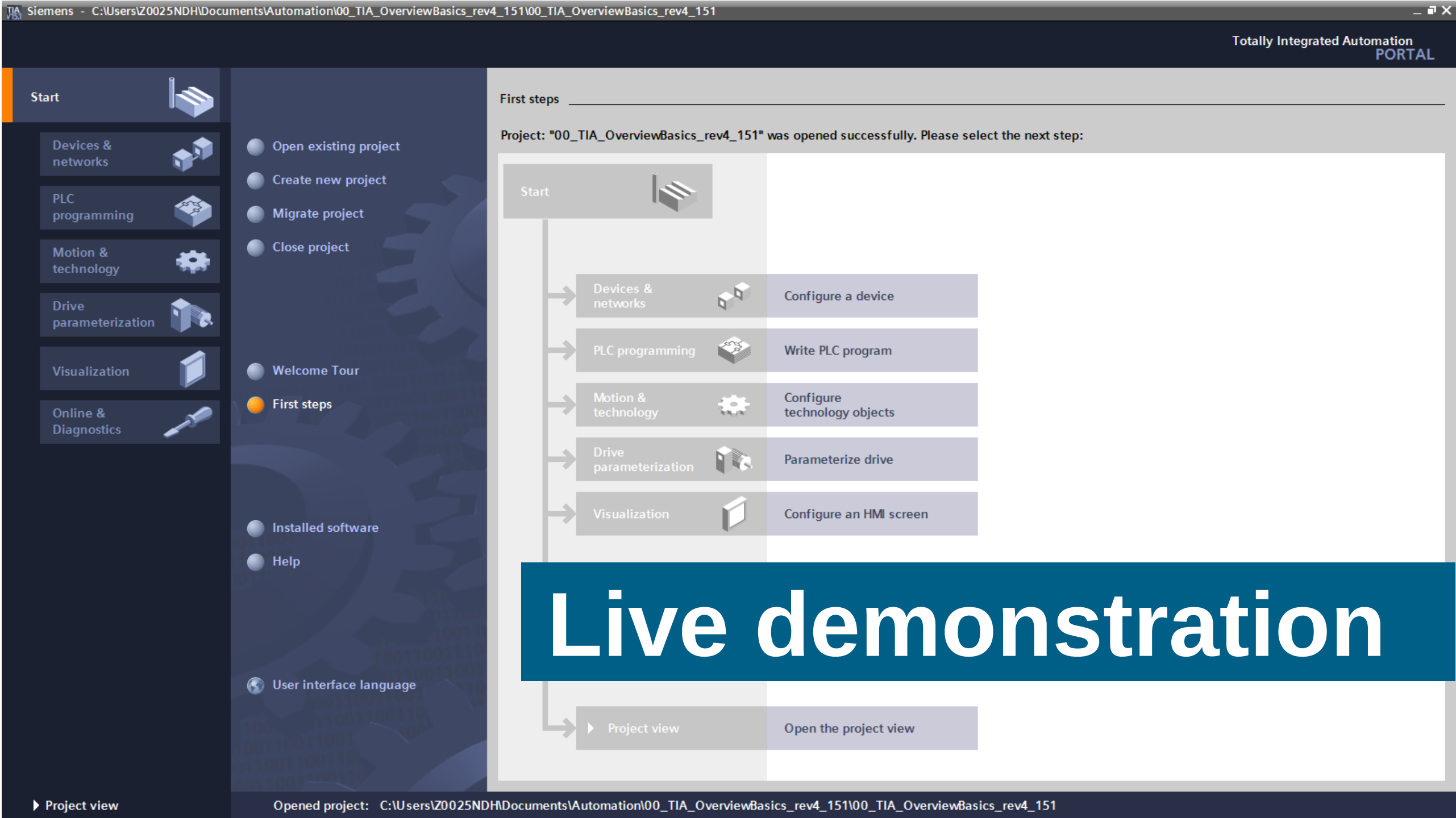
Ingenuity for life

Build into one framework



PLCS, IO, Networks | **HMI, IPCs, SCADA** | **Drives, Motion** | **Advanced Motion** | **Control Components** | **Circuit Breakers ++**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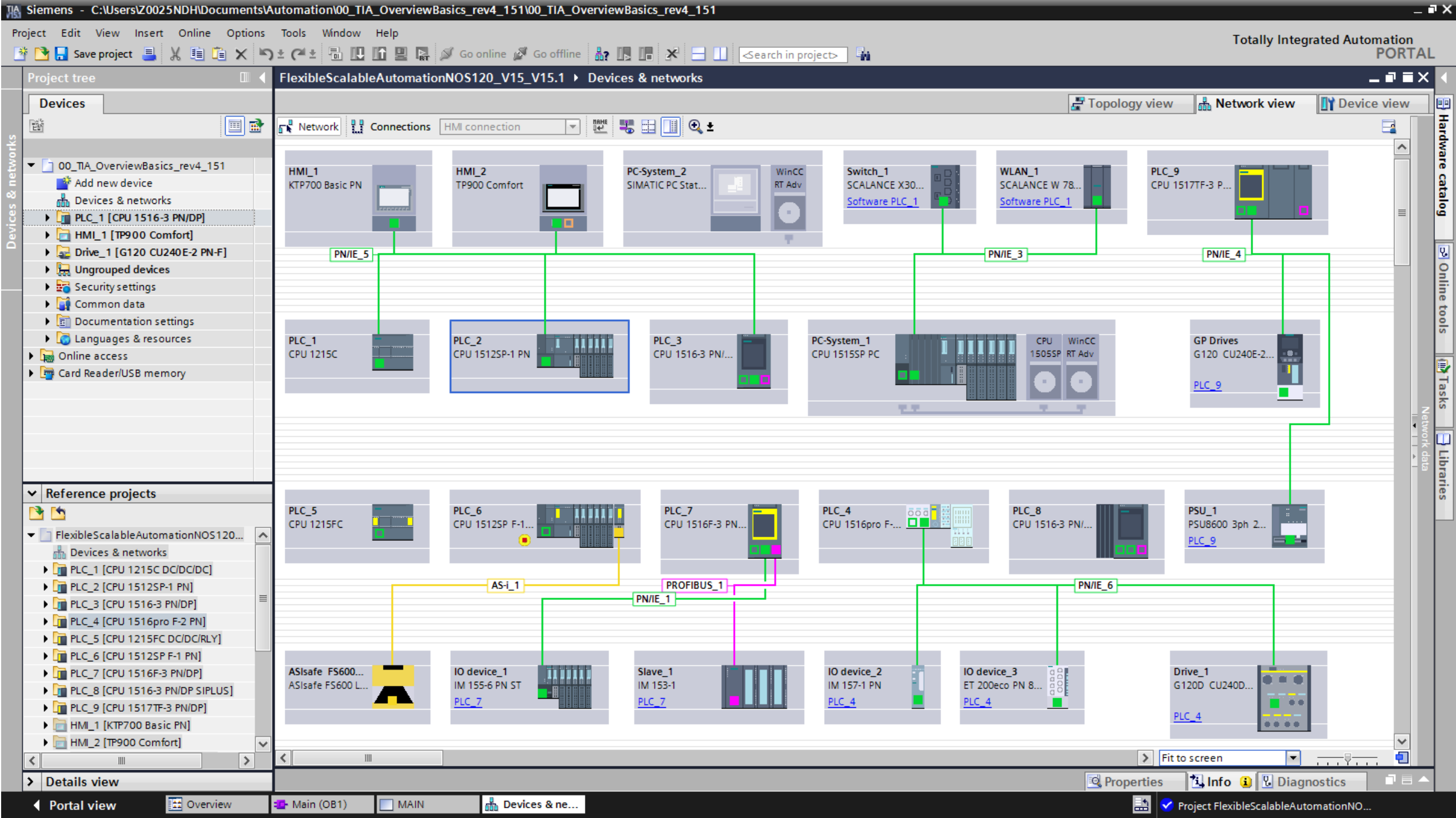
Totally Integrated Automation
PORTAL
Start
Devices & networks
PLC programming
Motion & technology
Drive parameterization
Visualization
Online & Diagnostics
Open existing project
Create new project
Migrate project
Close project
Welcome Tour
First steps
Installed software
Help
User interface language
First steps
Project: "00_TIA_OverviewBasics_rev4_151" was opened successfully. Please select the next step:
Start
Devices & networks
Configure a device
PLC programming
Write PLC program
Motion & technology
Configure technology objects
Drive parameterization
Parameterize drive
Visualization
Configure an HMI screen
Live demonstration
Project view
Open the project view
Project view
Opened project: C:\Users\Z0025NDH\Documents\Automation\00_TIA_OverviewBasics_rev4_151\00_TIA_OverviewBasics_rev4_151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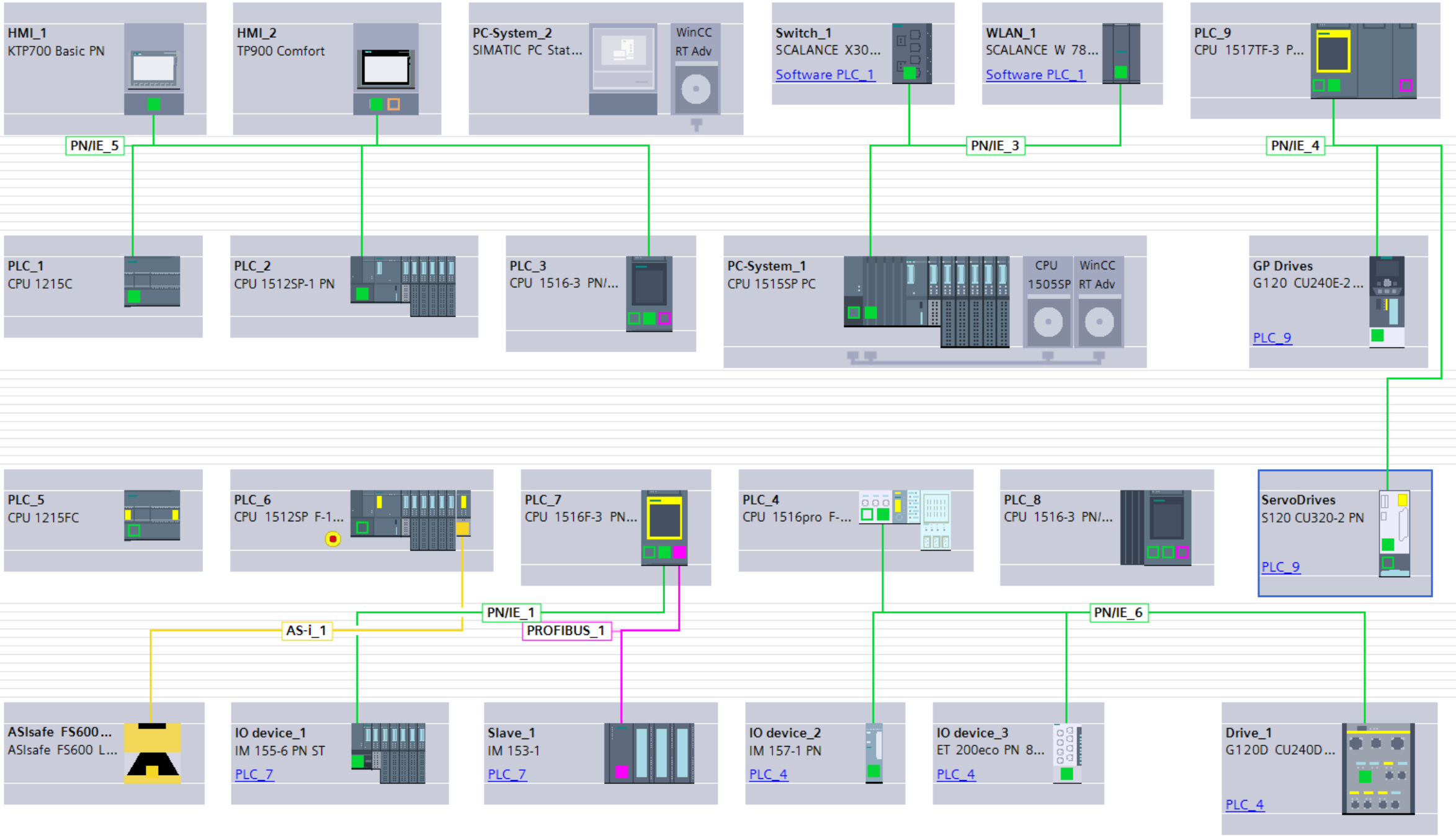
Project Edit View Insert Online Options Tools Window Help
Save project
Go online
Go offline
<Search in project>
Totally Integrated Automation
PORTAL
Project tree
Devices
00_TIA_OverviewBasics_rev4_151
Add new device
Devices & networks
PLC_1 [CPU 1516-3 PN/DP]
HMI_1 [TP900 Comfort]
Drive_1 [G120 CU240E-2 PN-F]
Ungrouped devices
Security settings
Common data
Documentation settings
Languages & resources
Online access
Card Reader/USB memory
Reference projects
FlexibleScalableAutomationNOS120...
Devices & networks
PLC_1 [CPU 1215C DC/DC/DC]
PLC_2 [CPU 1512SP-1 PN]
PLC_3 [CPU 1516-3 PN/DP]
PLC_4 [CPU 1516pro F-2 PN]
PLC_5 [CPU 1215FC DC/DC/RLY]
PLC_6 [CPU 1512SP F-1 PN]
PLC_7 [CPU 1516F-3 PN/DP]
PLC_8 [CPU 1516-3 PN/DP SIPLUS]
PLC_9 [CPU 1517TF-3 PN/DP]
HMI_1 [KTP700 Basic PN]
HMI_2 [TP900 Comfort]
Details view
FlexibleScalableAutomationNOS120_V15_V15.1 ▸ Devices & networks
Topology view
Network view
Device view
Network
Connections
HMI connection
HMI_1
KTP700 Basic PN
HMI_2
TP900 Comfort
PC-System_2
SIMATIC PC Stat...
WinCC RT Adv
Switch_1
SCALANCE X30...
Software PLC_1
WLAN_1
SCALANCE W 78...
Software PLC_1
PLC_9
CPU 1517TF-3 P...
PN/IE_5
PN/IE_3
PN/IE_4
PLC_1
CPU 1215C
PLC_2
CPU 1512SP-1 PN
PLC_3
CPU 1516-3 PN/...
PC-System_1
CPU 1515SP PC
CPU 1505SP
WinCC RT Adv
GP Drives
G120 CU240E-2...
PLC_9
PLC_5
CPU 1215FC
PLC_6
CPU 1512SP F-1...
PLC_7
CPU 1516F-3 PN...
PLC_4
CPU 1516pro F-...
PLC_8
CPU 1516-3 PN/...
PSU_1
PSU8600 3ph 2...
PLC_9
AS-i_1
PROFIBUS_1
PN/IE_1
PN/IE_6
ASIsafe FS600...
ASIsafe FS600 L...
IO device_1
IM 155-6 PN ST
PLC_7
Slave_1
IM 153-1
PLC_7
IO device_2
IM 157-1 PN
PLC_4
IO device_3
ET 200eco PN 8...
PLC_4
Drive_1
G120D CU240D...
PLC_4
Fit to screen
Properties
Info
Diagnostics
Portal view
Overview
Main (OB1)
MAIN
Devices & ne...
Project FlexibleScalableAutomationNO...
Hardware catalog
Online tools
Tasks
Libraries
Network data
Devices & networks


HMI_1
KTP700 Basic PN
HMI_2
TP900 Comfort
PC-System_2
SIMATIC PC Stat...
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CPU
1505SP
WinCC
RT Adv
GP Drives
G120 CU240E-2...
PLC_9
PLC_5
CPU 1215FC
PLC_6
CPU 1512SP F-1...
PLC_7
CPU 1516F-3 PN...
PLC_4
CPU 1516pro F-...
PLC_8
CPU 1516-3 PN/...
ServoDrives
S120 CU320-2 PN
PLC_9
PN/IE_1
PROFIBUS_1
AS-i_1
PN/IE_6
ASIsafe FS600...
ASIsafe FS600 L...
IO device_1
IM 155-6 PN ST
PLC_7
Slave_1
IM 153-1
PLC_7
IO device_2
IM 157-1 PN
PLC_4
IO device_3
ET 200eco PN 8...
PLC_4
Drive_1
G120D CU240D...
PLC_4

Our diverse applications require flexibility & scalability

… from small machine builder to the large enterprise

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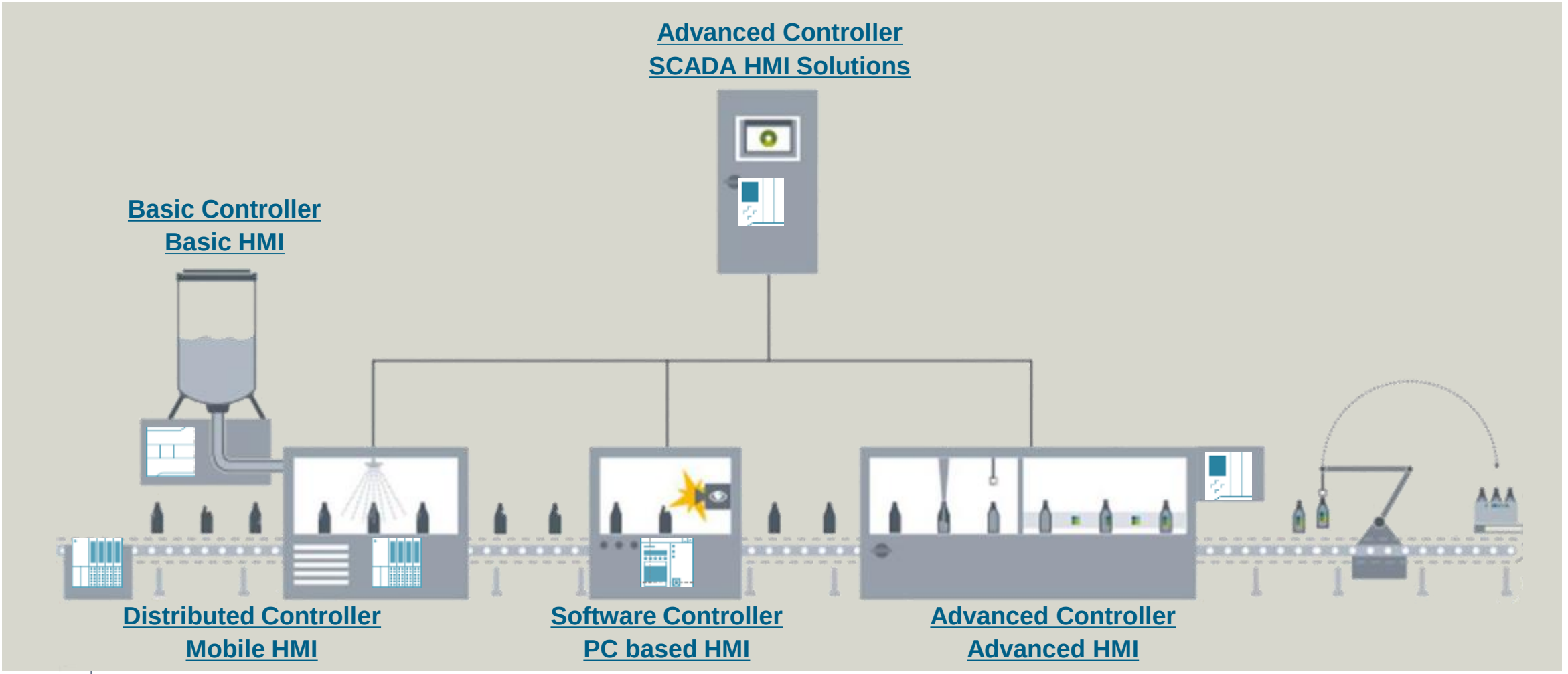

All in one - Engineering Framework

…. reducing the learning curve

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Easy to learn
… via intuitive interfaces and Wizards to guide complex tasks

Simple usability
… via intuitive operation with intelligent Drag & Drop

Efficient operations
… consistent look and feel for all TIA components and library concepts for standardizations

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How can we leverage digital concept for development?

Reduce engineering time, cost, time to market

Eliminate manual programming, and errors that affect productivity

Make use of data or information within other toolsets

Auto-generation of solutions… diagnostics, tags

application development

The traditional manual process for application configuration

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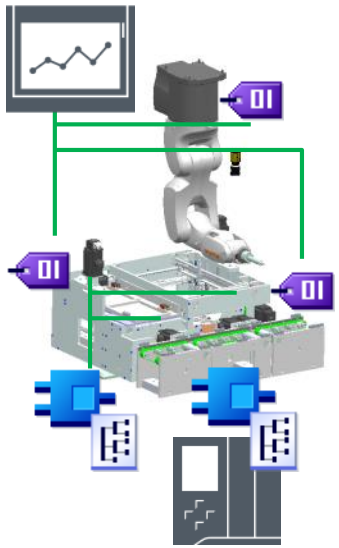

Electrical Engineering Network Configuration

1. Define the devices
2. Network the devices
3. Name inputs/outputs

PLC programming

1. Define the devices
2. Network the devices
3. Name inputs/outputs
4. Create logic blocks
5. Program process blocks

HMI configuration

1. Create the screens
2. Create the tags
3. Interconnect the tags
4. Interface to the PLC
5. Create scripts

...

Apply Standardization

What we do ..

- Redundant work in due to lack of information exchange between toolsets
- Many manual steps, resulting in errors

Objectives… What we should strive for

- Avoid redundant, manual work
- Use automatic processes and thus reduce errors – *“bridge the data information”* …

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Engineering workflow in the digital enterprise

… reduce engineering, minimize errors, short time to market

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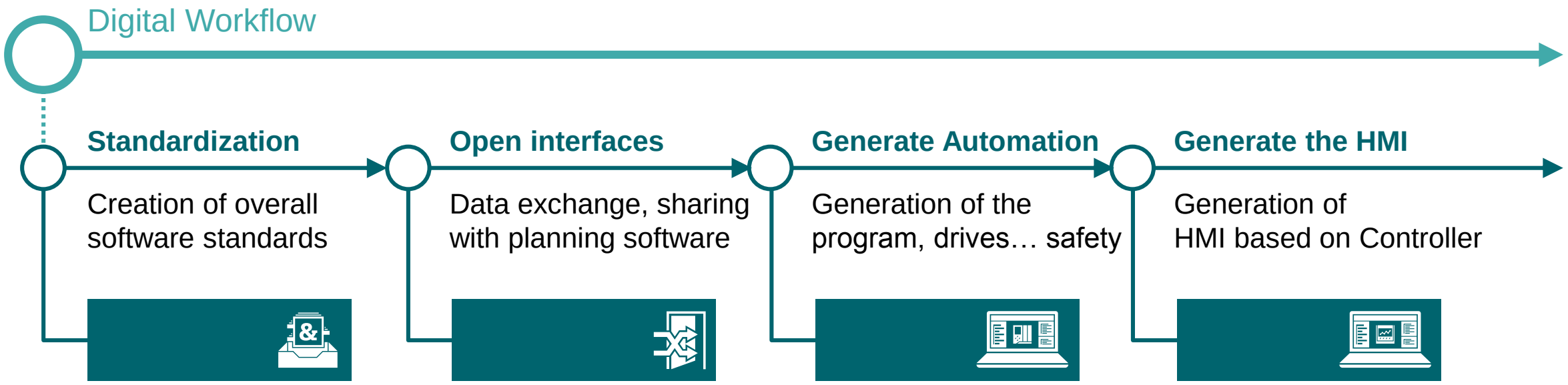

Standardize Reduce **Increased process quality**
Improve costs Simplified collaboration
quality **Reduced lead times**

Standardization begins with a Comprehensive Library

… share automation component company-wide

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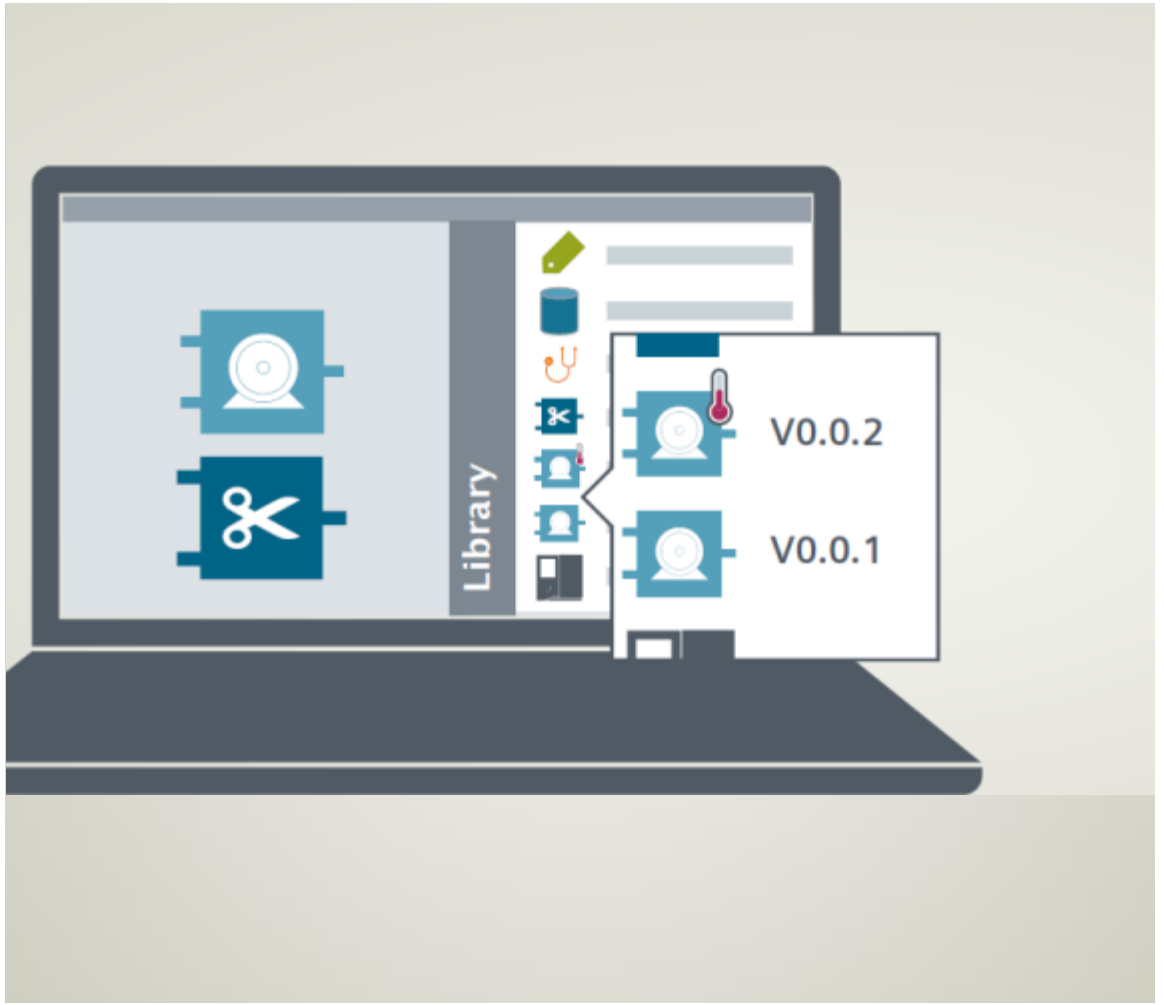
Modularize and reuse components
… reduce engineering time applying reusable automation components

Support of company standards
… manage automation components centrally and share company-wide

Version control and management
… track changes easily and update from a central location



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Project Edit View Insert Online Options Tools Window Help

Save project | Go online | Go offline | <Search in project>

Totally Integrated Automation PORTAL

Project tree

Devices

- Program blocks
  - Add new block
  - Main [OB1]
  - SetupSystem [FC1]
  - ConveyorLogicBlock [FB7]
  - Conveyor_1 [DB1]
  - Conveyor_45 [DB6]
- Motion Control System
- Positioning Control
- SupervisionDiag Control
- System blocks
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Traces
- OPC UA communication
- Device proxy data
- Program info
- PLC supervisions & alarms
- PLC alarm text lists
- Local modules
- Distributed I/O
- HMI_1 [TP900 Comfort]
  - Device configuration
  - Online & diagnostics
  - Runtime settings
  - Screens
    - Add new screen
    - ConveyorControl
    - MAIN
    - PLCCodeView

Reference projects

Details view

00_TIA_OverviewBasics_rev4_151 ▸ Devices & networks

Topology view | Network view | Device view

Network | Connections | HMI connection

PLC_1
CPU 1516-3 PN/...

IO device_1
IM 155-6 PN ST
PLC_1

Drive_1
G120 CU240E-2...
PLC_1

PN/IE_1

HMI_1
TP900 Comfort

HMI_2

100%

Properties | Info | Diagnostics

Libraries

Options

Library view

Project library

All

- Project library
  - Types
    - Add new type
    - AxisInterfaceUDT
    - DriveFaceplate
      - V 0.0.20
  - Master copies

Global libraries

All

- Buttons-and-Switches
- Drive_Lib_S7_1200_1500
- Drive_Lib_S7_300_400
- Long Functions
- Monitoring-and-control-objects
- Documentation templates
- Modernization101Project_ver4
  - Types
  - Master copies
    - ControllerTags
    - ConveyorLogicBlock
    - ConveyorControl
    - HMI_2
    - DebugHMIFaceplate TRACE
    - 01 SimulationSeries
    - 02 Diagnostics
  - Common data
  - Languages & resources

Info (Global libraries)

Hardware catalog | Online tools | Tasks | Libraries

Portal view | Overview | Main (OB1) | MAIN | Devices & ne... | Devices & ne... | Library Modernization101Project_ver4 ...

Version control with logic, data types, and screens

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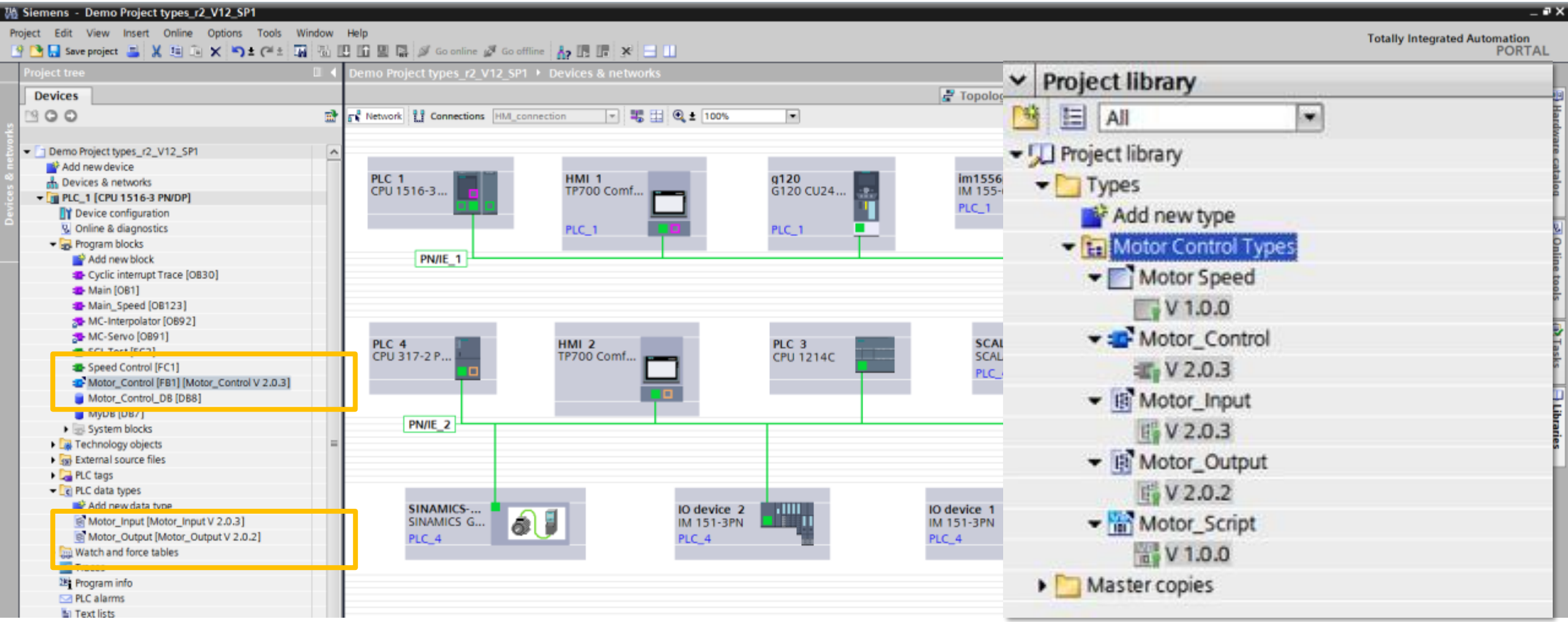

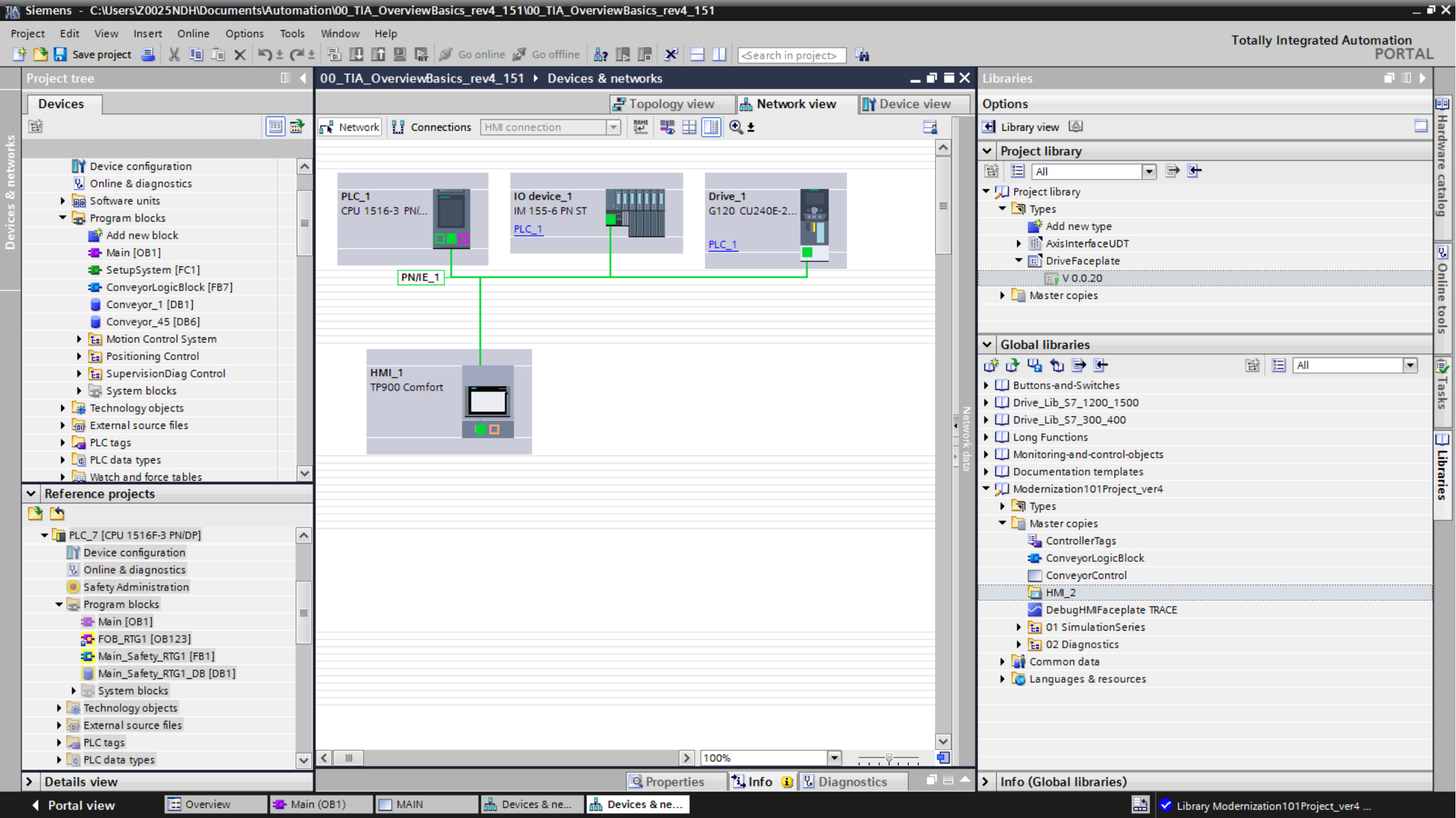
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Device configuration
Online & diagnostics
Software units
Program blocks
Add new block
Main [OB1]
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ConveyorLogicBlock [FB7]
Conveyor_1 [DB1]
Conveyor_45 [DB6]
Motion Control System
Positioning Control
SupervisionDiag Control
System blocks
Technology objects
External source files
PLC tags
PLC data types
Watch and force tables
Reference projects
PLC_7 [CPU 1516F-3 PN/DP]
Device configuration
Online & diagnostics
Safety Administration
Program blocks
Main [OB1]
FOB_RTG1 [OB123]
Main_Safety_RTG1 [FB1]
Main_Safety_RTG1_DB [DB1]
System blocks
Technology objects
External source files
PLC tags
PLC data types
Details view
00_TIA_OverviewBasics_rev4_151 ▸ Devices & networks
Topology view
Network view
Device view
Network
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HMI connection
PLC_1
CPU 1516-3 PN/...
IO device_1
IM 155-6 PN ST
PLC_1
Drive_1
G120 CU240E-2...
PLC_1
PN/IE_1
HMI_1
TP900 Comfort
100%
Network data
Properties
Info
Diagnostics
Libraries
Options
Library view
Project library
All
Project library
Types
Add new type
AxisInterfaceUDT
DriveFaceplate
V 0.0.20
Master copies
Global libraries
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Drive_Lib_S7_1200_1500
Drive_Lib_S7_300_400
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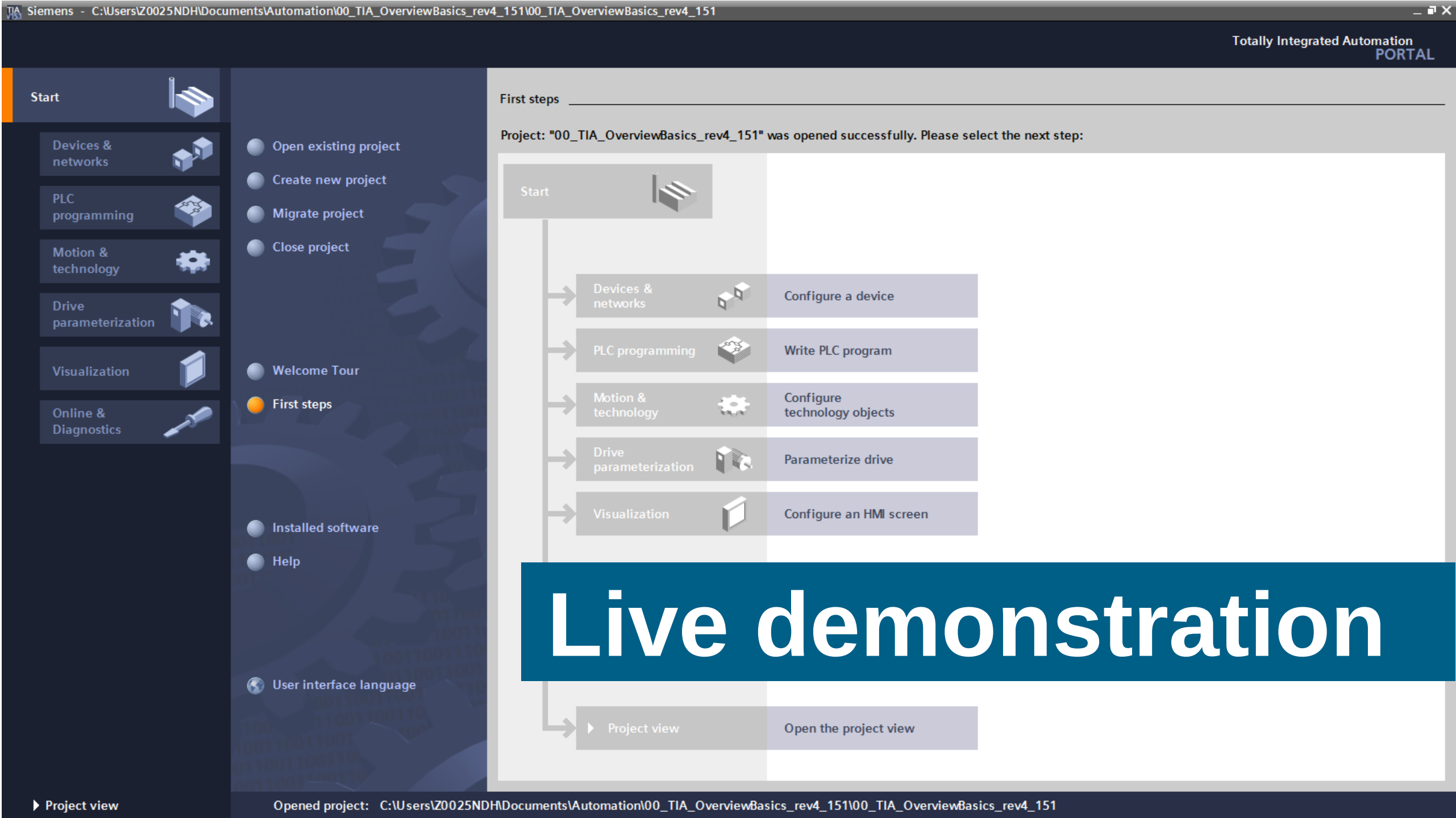
Languages & resources
Info (Global libraries)
Hardware catalog
Online tools
Tasks
Libraries
Devices & networks
Portal view
Overview
Main (OB1)
MAIN
Devices & ne...
Devices & ne...
Library Modernization101Project_ver4 ...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First steps
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User interface language
First steps
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PLC programming
Write PLC program
Motion & technology
Configure technology objects
Drive parameterization
Parameterize drive
Visualization
Configure an HMI screen
Live demonstration
Project view
Open the project view
Project view
Opened project: C:\Users\Z0025NDH\Documents\Automation\00_TIA_OverviewBasics_rev4_151\00_TIA_OverviewBasics_rev4_151

Engineering workflow in the digital enterprise

… reduce engineering, minimize errors, short time to market

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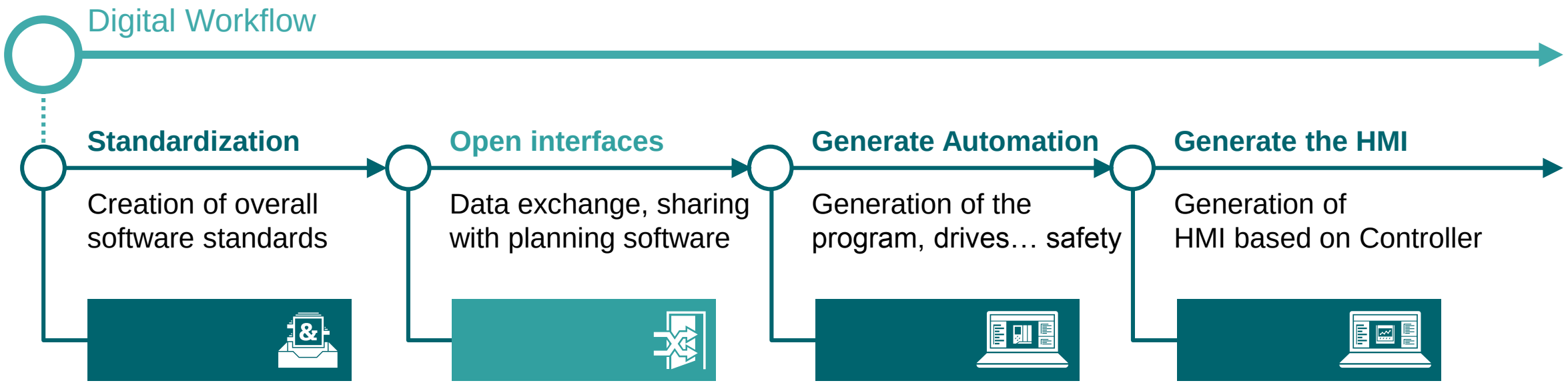

Standardize Reduce **Increased process quality**
Improve costs Simplified collaboration
quality **Reduced lead times**

Automatically generate TIA Portal Network Configuration
Pre-existing information from electrical engineering tools

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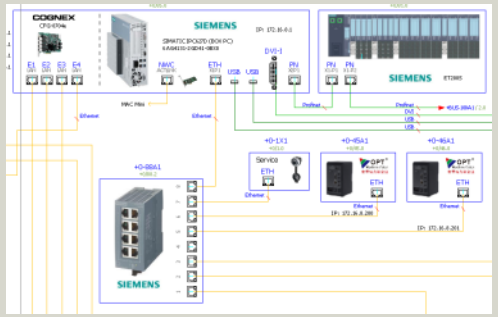
Transfer data from the Electrical Engineering tool to the TIA Portal

Electrical Engineering tools

- Hardware engineering
- Network engineering
- Process signals



Reduce engineering time,
eliminate errors,
Shorter time to market

Automatic Generation

Data exchange using international standard

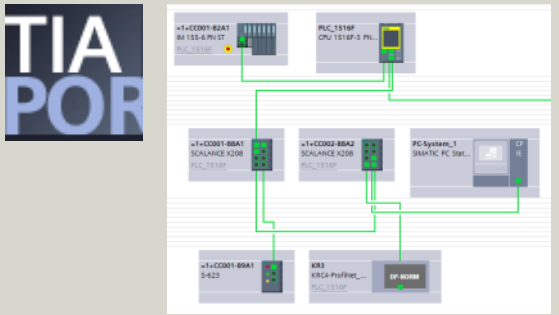
NEW

<AutomationML/>

Automation Markup Language

TIA Portal

- Hardware
- Network
- Tags



All inclusive no charge “Library Functionality”
Reusable code at accessible for all aspects of the automation

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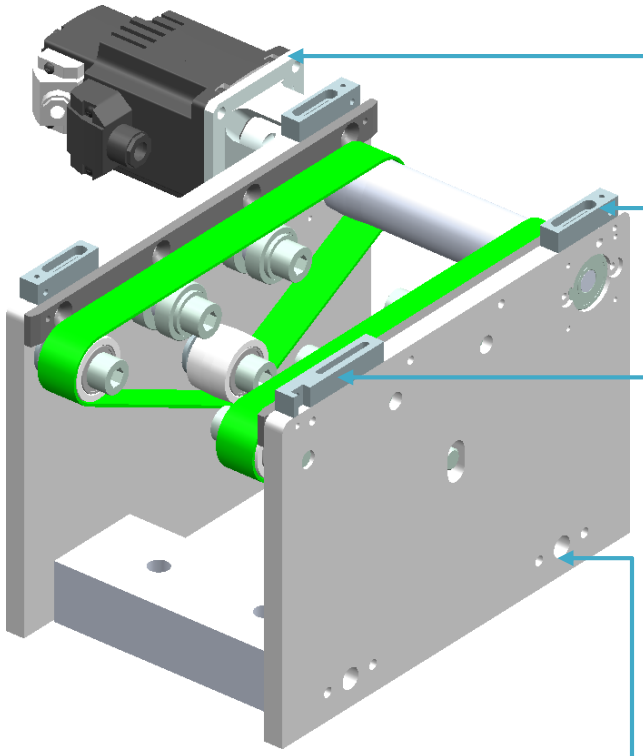
G120

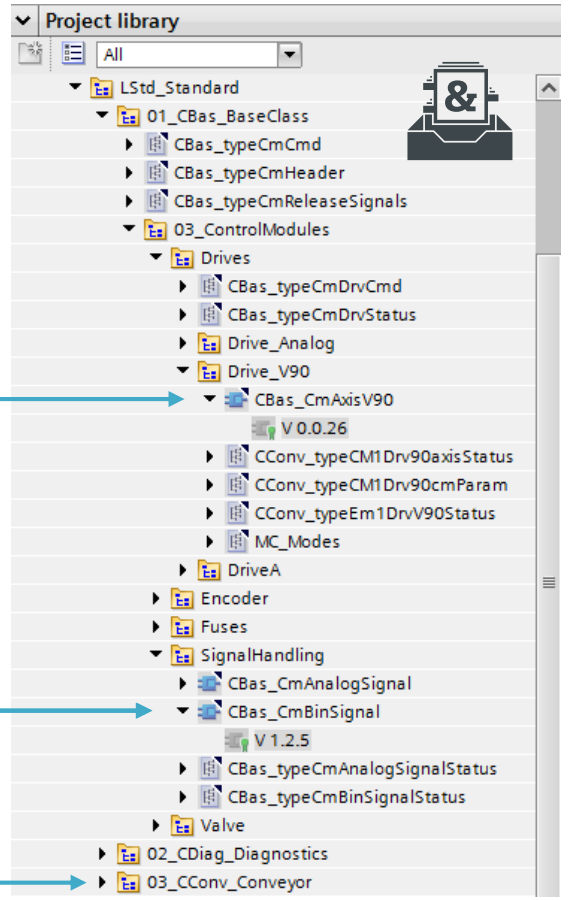
S120



Motor

Sensor

Conveyor belt



Potential to support automatic code generation of blocks

From Mechanics to Electrics to Automation

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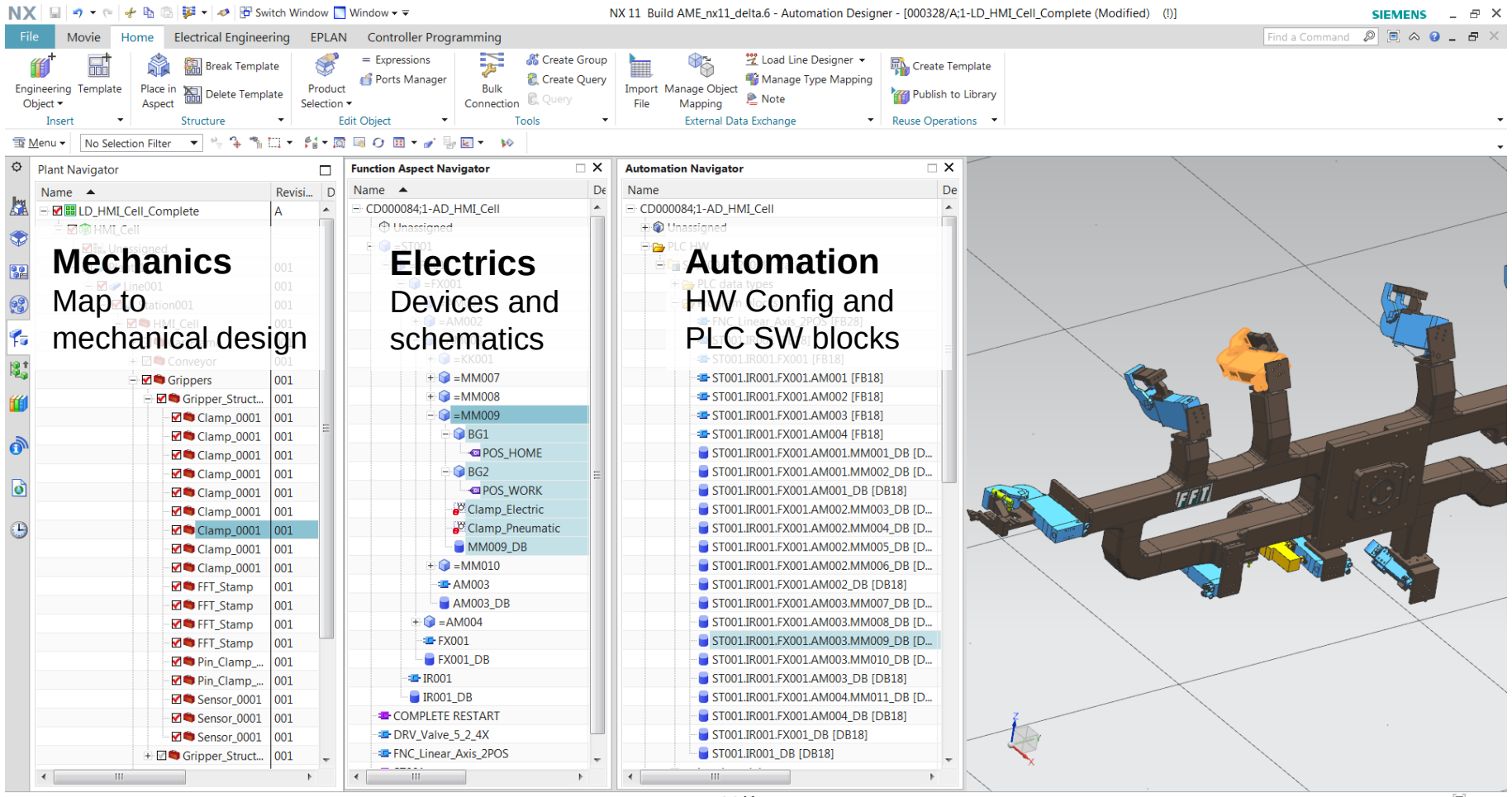

Teamcenter backbone

Engineering Software – with open interfaces

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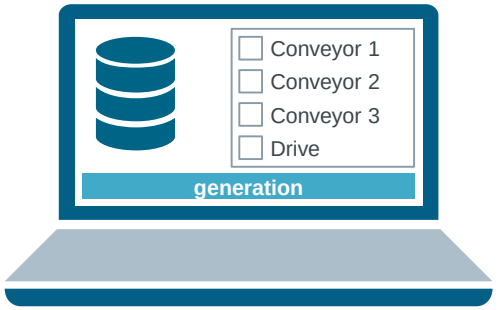
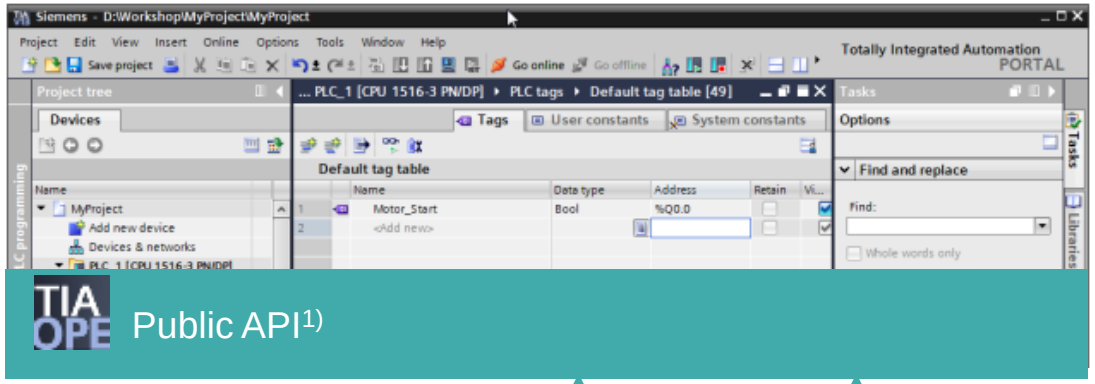
Openness functions, that allow program-controlled

- automated access to program data, libraries
- projects or project data can be generated,
  - modified and tested
- remote control of automation engineering functions

Export/import functionality for

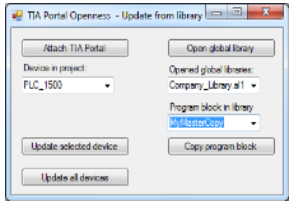
swapping out, modifying and swapping in of project data

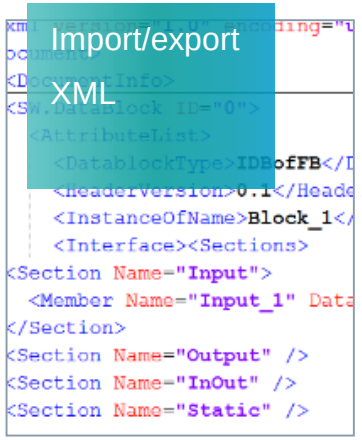




Fully automatic execution of actions

Simplified operator control with own user interface





Openness Scripter – Automating the tasks in TIA Portal projects without programming expertise

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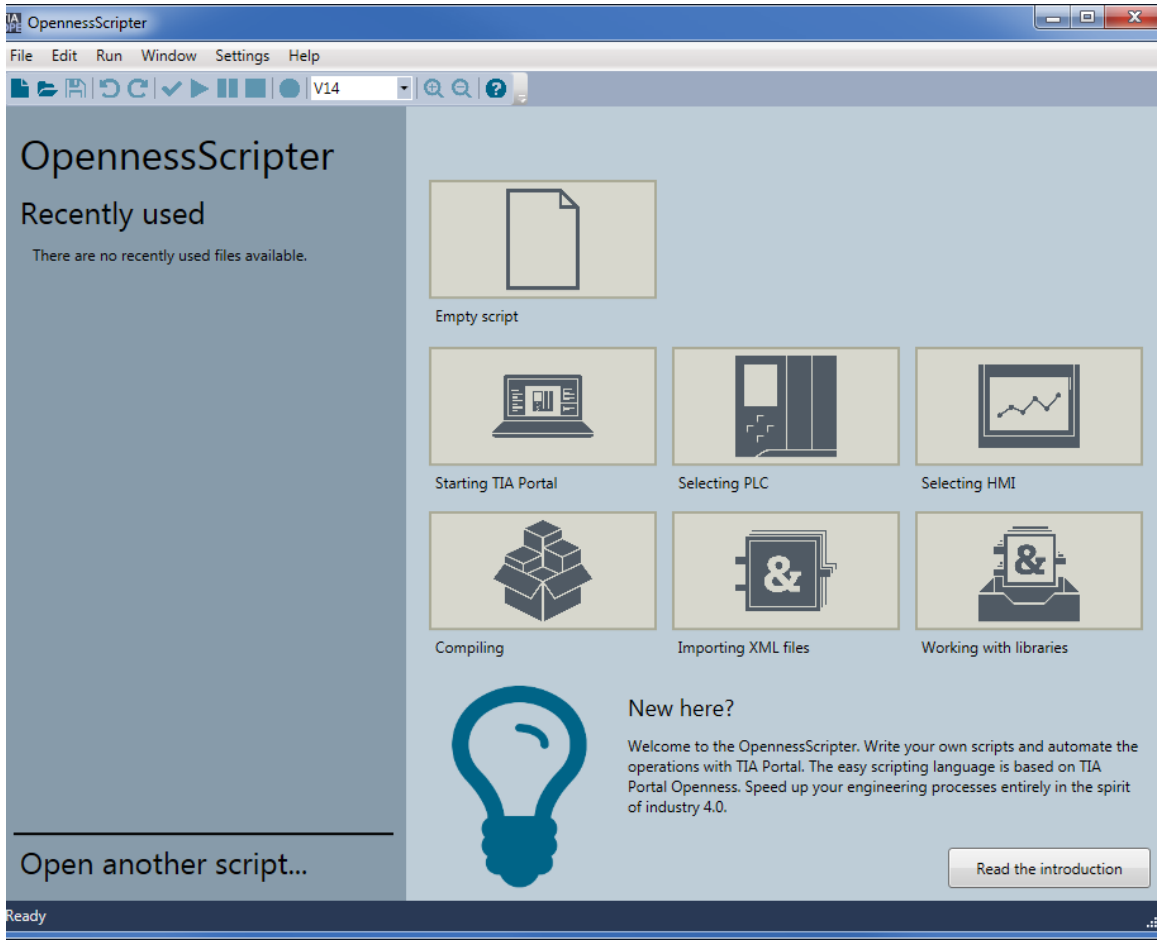
Required know-how for Openness Scripter

- User knowledge at a beginners' level
- No programming skills
- Simple script commands make complex programming unnecessary

Get started with simple toolsets



SIMATIC Visualization Architect
…automatic generation of HMI Objects and Screens

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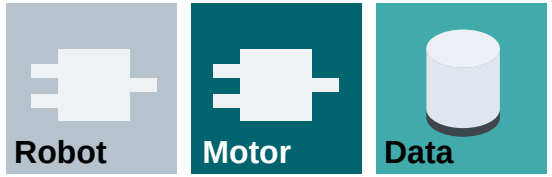
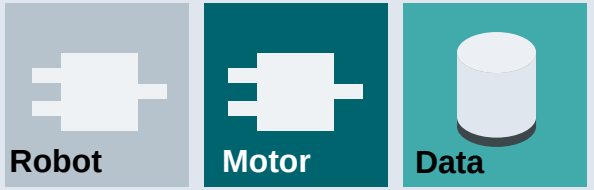
Control program



HMI library

SiVArc



Rules for generating

- Screens and screen objects
- Tags and tag tables
- Text lists

Automatic generation

Visualization

SiVArc - Example

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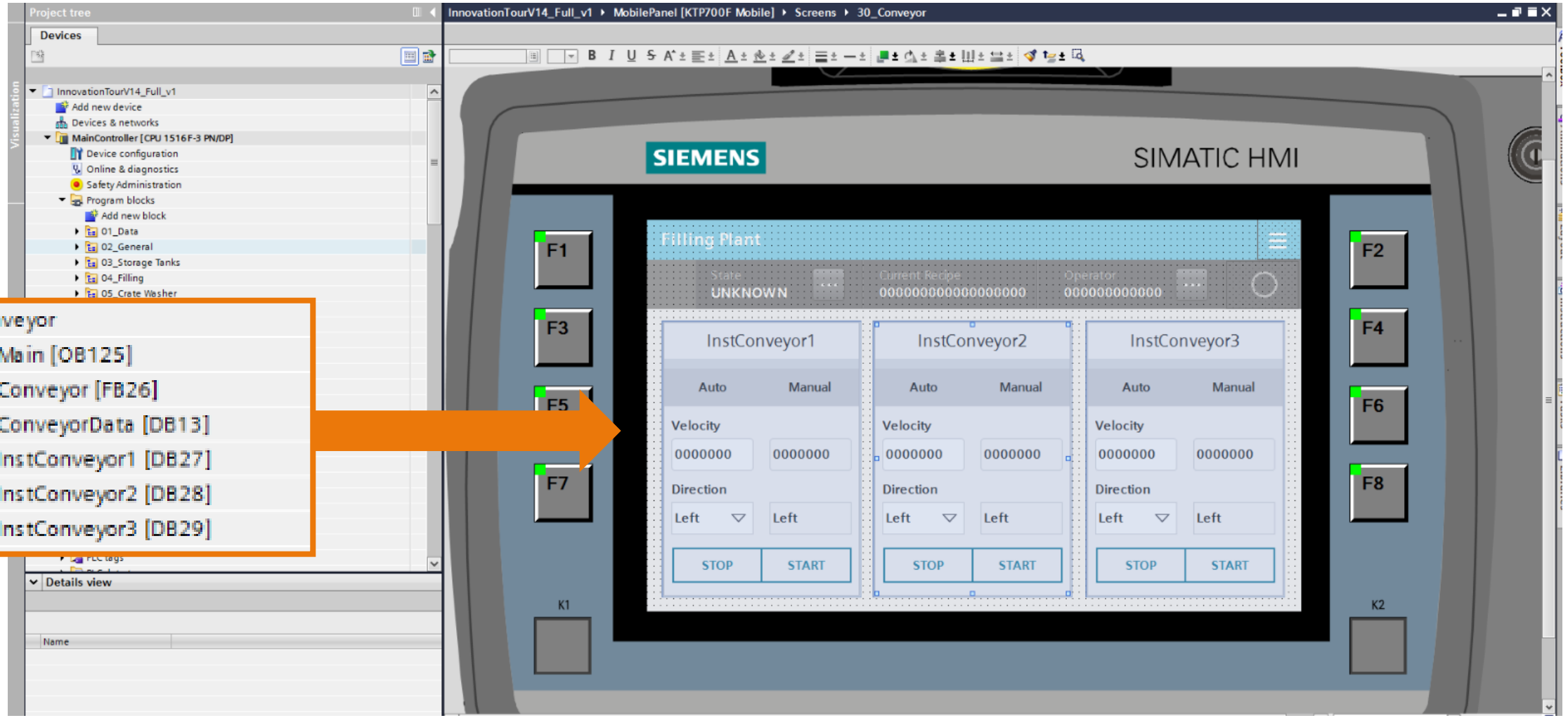

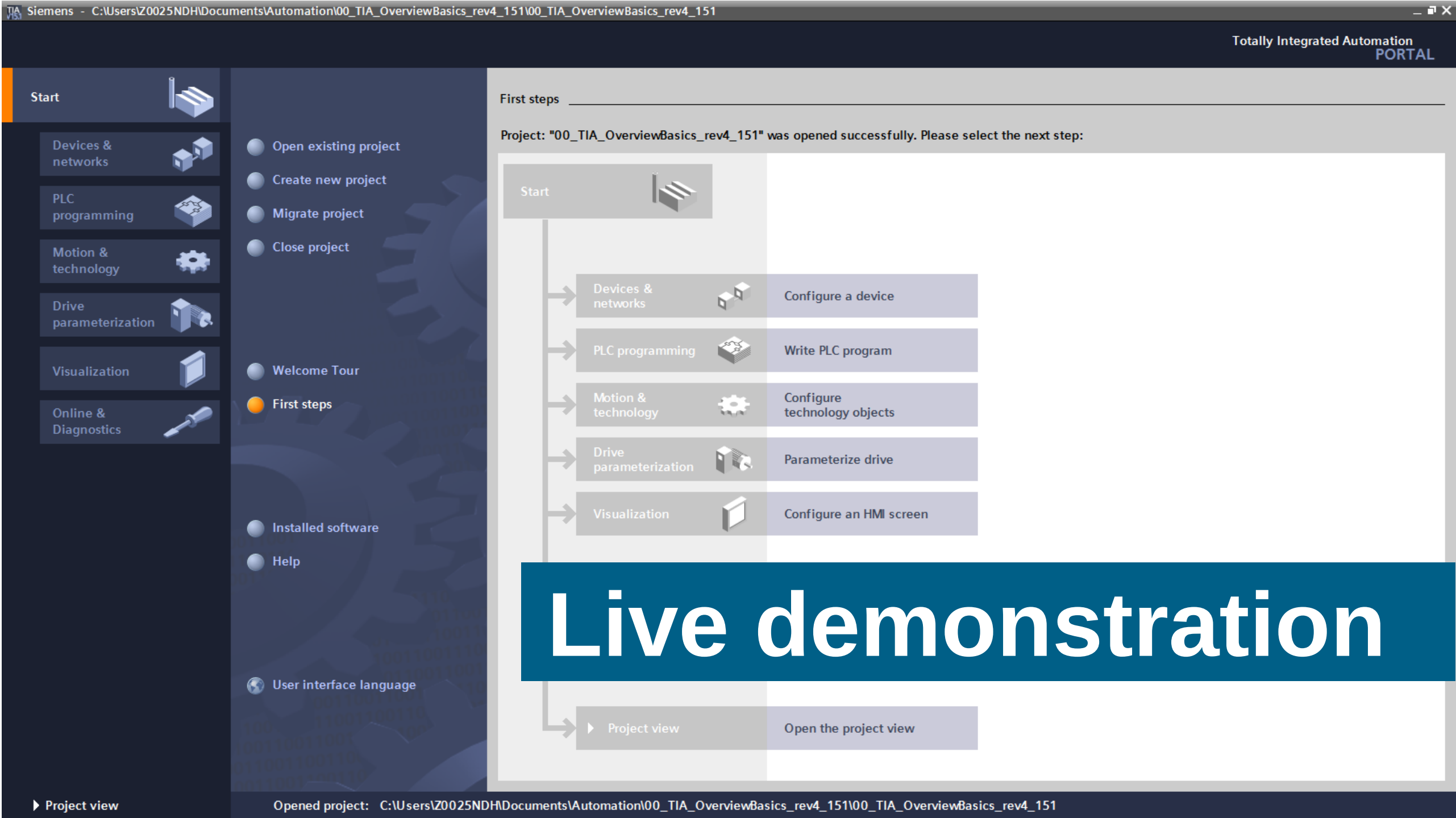
Siemens - C:\Users\Z0025NDH\Documents\Automation\00_TIA_OverviewBasics_rev4_151\00_TIA_OverviewBasics_rev4_151
Totally Integrated Automation
PORTAL
Start
Devices & networks
PLC programming
Motion & technology
Drive parameterization
Visualization
Online & Diagnostics
Open existing project
Create new project
Migrate project
Close project
Welcome Tour
First steps
Installed software
Help
User interface language
First steps
Project: "00_TIA_OverviewBasics_rev4_151" was opened successfully. Please select the next step:
Start
Devices & networks
Configure a device
PLC programming
Write PLC program
Motion & technology
Configure technology objects
Drive parameterization
Parameterize drive
Visualization
Configure an HMI screen
Live demonstration
Project view
Open the project view
Project view
Opened project: C:\Users\Z0025NDH\Documents\Automation\00_TIA_OverviewBasics_rev4_151\00_TIA_OverviewBasics_rev4_151

Runtime reconfiguration for automation systems

…configuration control in project – Option Handling

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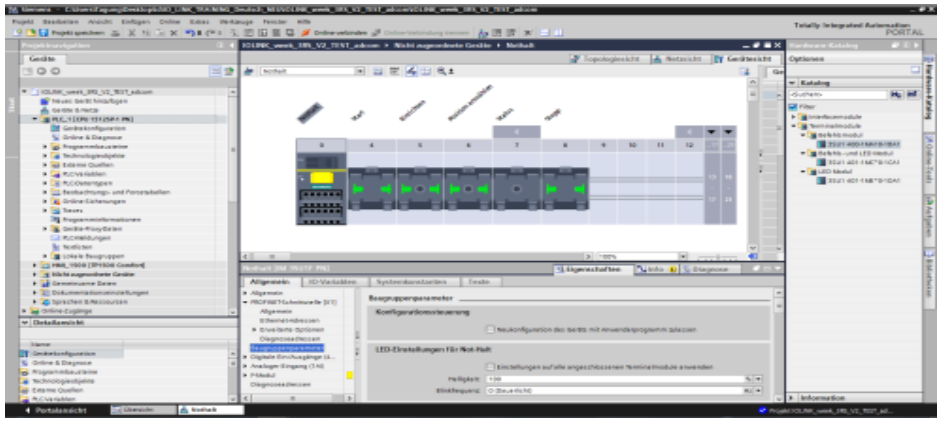
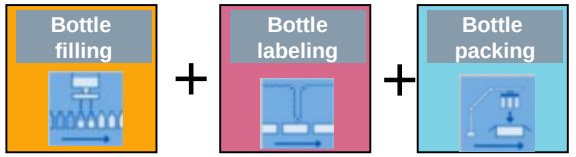
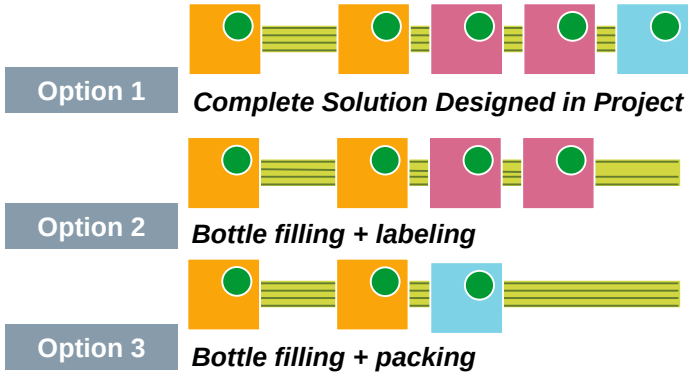
Maximum configuration:
Options:
A, B, C, D

Configuration upon delivery:
Options:
A, D

Machine update:
Options:
A, D, C







Reduce the engineering costs and time to market

… ensure error-free solutions for reducing downtime

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1 | Reduction of errors and continuous optimization

… through standardization and versioning
using intelligent tools and libraries

2 | Maximum efficiency in planning

… by transferring planning data
to / from various tools via a standardized interfaces

3 | Shorter time to market

… due to fast and error-free automatic
generation of program code & visualization solutions

4 | Increased competitiveness

… through optimized use of resources

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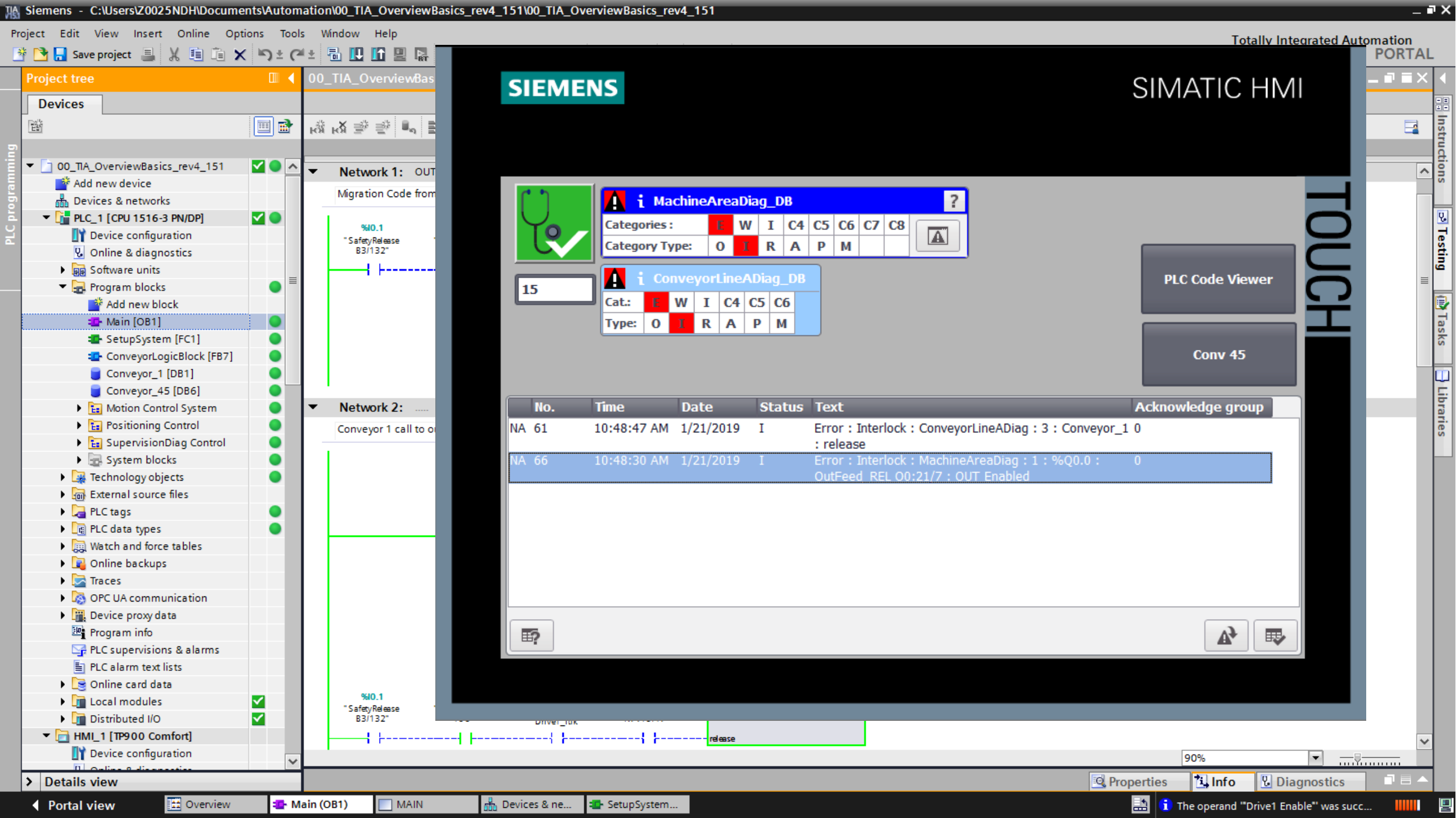
How can validate the mechanical, electrical, and automation

Reduce the risks, time, and costs resolving the process at the machine

Determine feasibility of retrofits and changes before engaging in

Ensure that “delivered solution” meets the expectations required

Simulation & Virtual Commissioning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Project Edit View Insert Online Options Tools Window Help
Save project
Totally Integrated Automation
PORTAL
Project tree
Devices
00_TIA_OverviewBasics_rev4_151
Add new device
Devices & networks
PLC_1 [CPU 1516-3 PN/DP]
Device configuration
Online & diagnostics
Software units
Program blocks
Add new block
Main [OB1]
SetupSystem [FC1]
ConveyorLogicBlock [FB7]
Conveyor_1 [DB1]
Conveyor_45 [DB6]
Motion Control System
Positioning Control
SupervisionDiag Control
System blocks
Technology objects
External source files
PLC tags
PLC data types
Watch and force tables
Online backups
Traces
OPC UA communication
Device proxy data
Program info
PLC supervisions & alarms
PLC alarm text lists
Online card data
Local modules
Distributed I/O
HMI_1 [TP900 Comfort]
Device configuration
Details view
Network 1:
Migration Code from
%I0.1
"SafetyRelease
B3/132"
Network 2:
Conveyor 1 call to o
%I0.1
"SafetyRelease
B3/132"
release
SIEMENS
SIMATIC HMI
TOUCH
MachineAreaDiag_DB
Categories : E W I C4 C5 C6 C7 C8
Category Type: O I R A P M
ConveyorLineADiag_DB
Cat.: E W I C4 C5 C6
Type: O I R A P M
15
PLC Code Viewer
Conv 45
No. Time Date Status Text Acknowledge group
NA 61 10:48:47 AM 1/21/2019 I Error : Interlock : ConveyorLineADiag : 3 : Conveyor_1 : release 0
NA 66 10:48:30 AM 1/21/2019 I Error : Interlock : MachineAreaDiag : 1 : %Q0.0 : OutFeed_REL O0:21/7 : OUT Enabled 0
90%
Properties
Info
Diagnostics
Portal view
Overview
Main (OB1)
MAIN
Devices & ne...
SetupSystem...
The operand "Drive1 Enable" was succ...
Instructions
Testing
Tasks
Libraries
PLC programming

How can we ensure the quickest response to downtown
… consistent reliable diagnostics at all systems

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The “Automation System” diagnostics – derived directly from hardware configuration

Application or “Process diagnostics” – derived directly from a control variable in logic

How can we ensure diagnostics are completed?

How can we ensure consistency across the plant?

Automatic generated system diagnostics

… integrated no code required, based on the hardware definition

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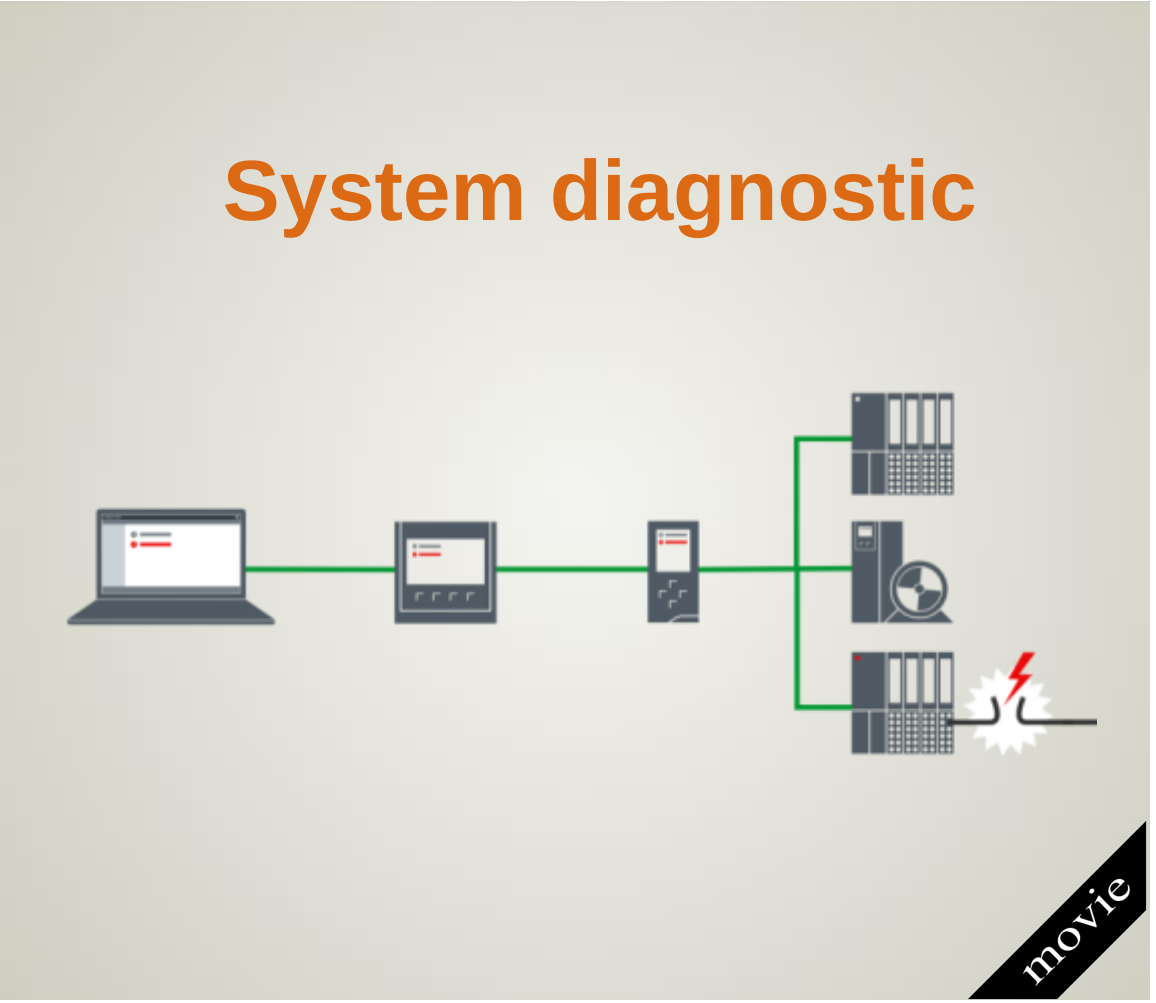
No programming necessary
… automatically generated, *leverage the imported CAx data from electrical planning tools*

Consistent view of alarms
… on the PLC display, TIA Portal, HMI, Webserver, Cloud and Edge

Easy and fast identification of errors
… clearly displayed error messages of fault location and cause



Automation “System Diagnostics” via the controller as the basis

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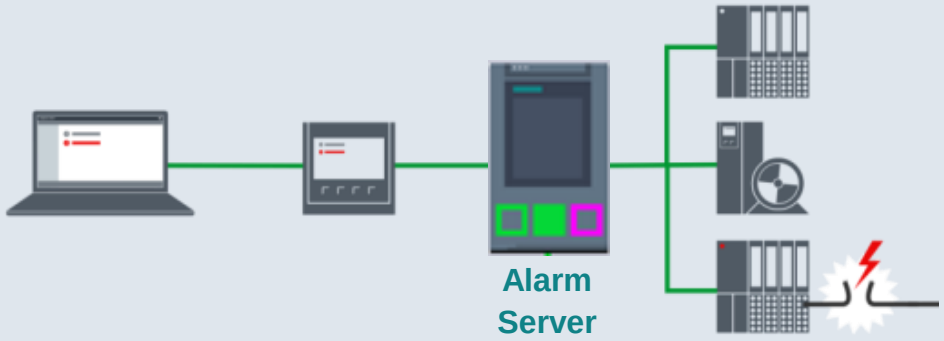

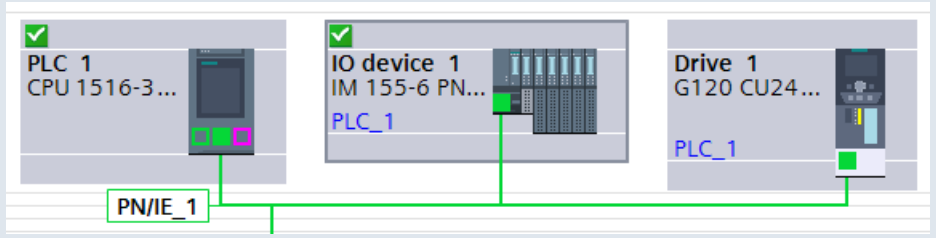

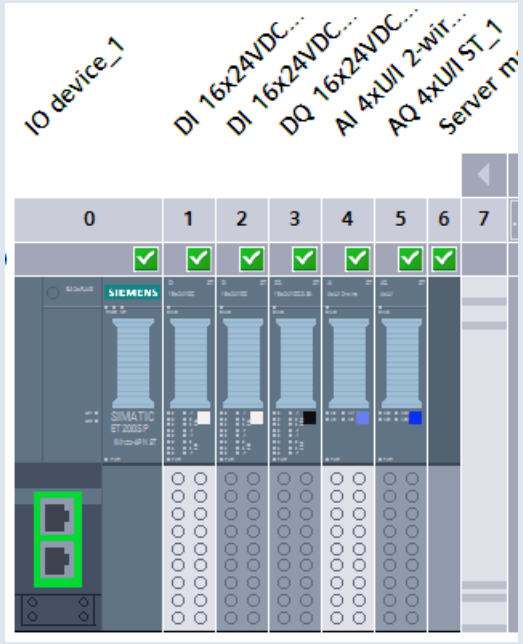

The Automation System Diagnostics are based on the actual configuration

The device labels & text translates automatically to alarms and diagnostic views for HMI

HMI provides the visualization of controller diagnostics

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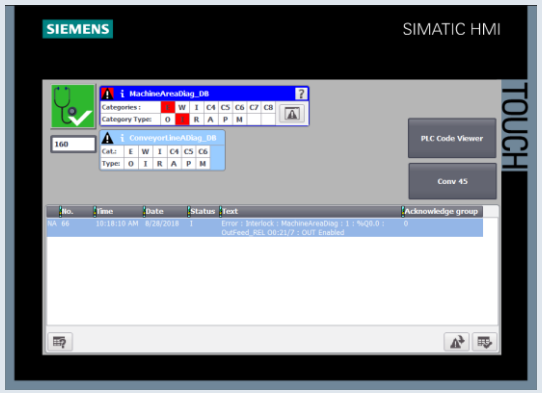

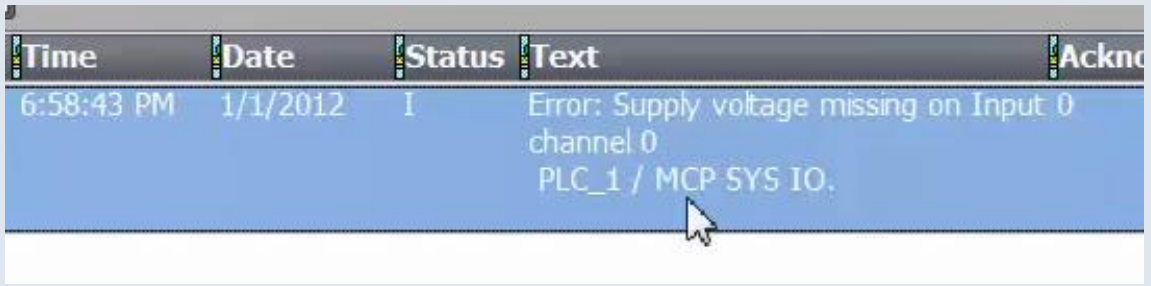

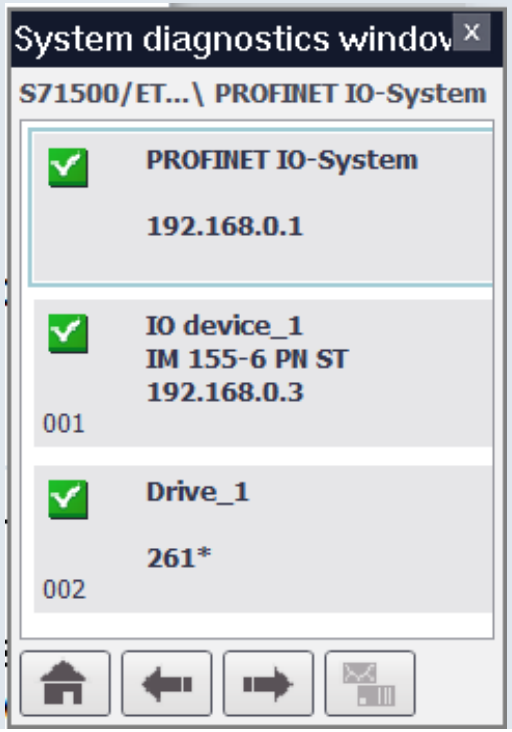

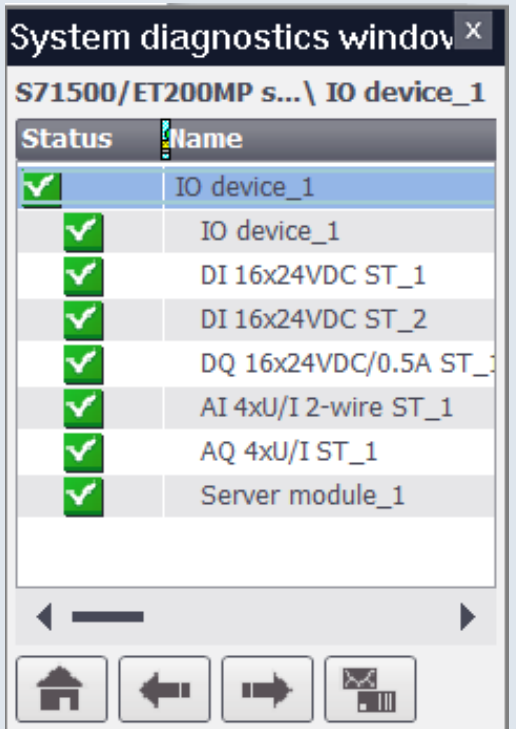

Totally Integrated Automation with System Diagnostics..

The hardware configuration described with your text translates directly to alarms and diagnostic views for HMI

And the process alarms are easy to configure within the PLC

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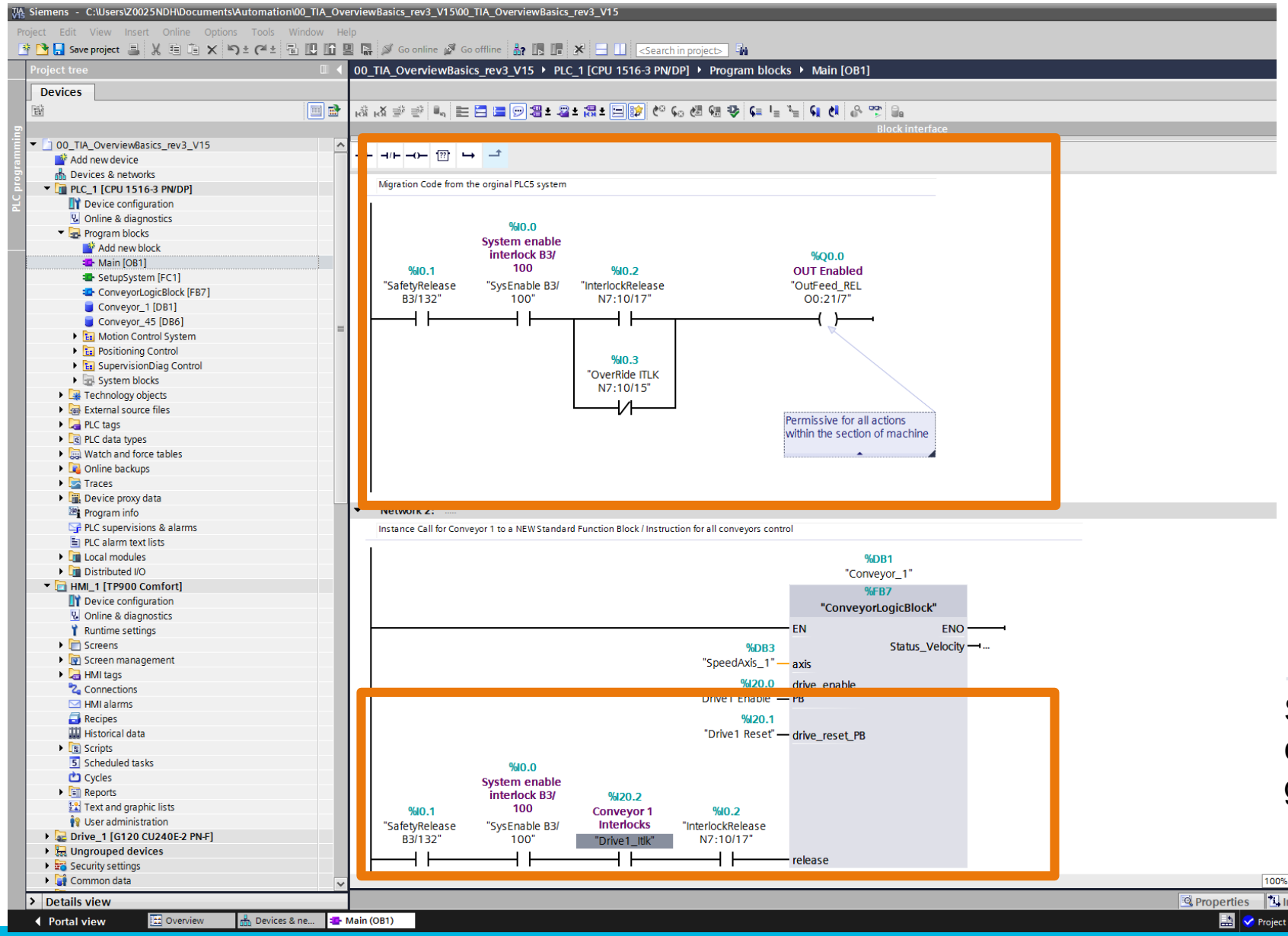
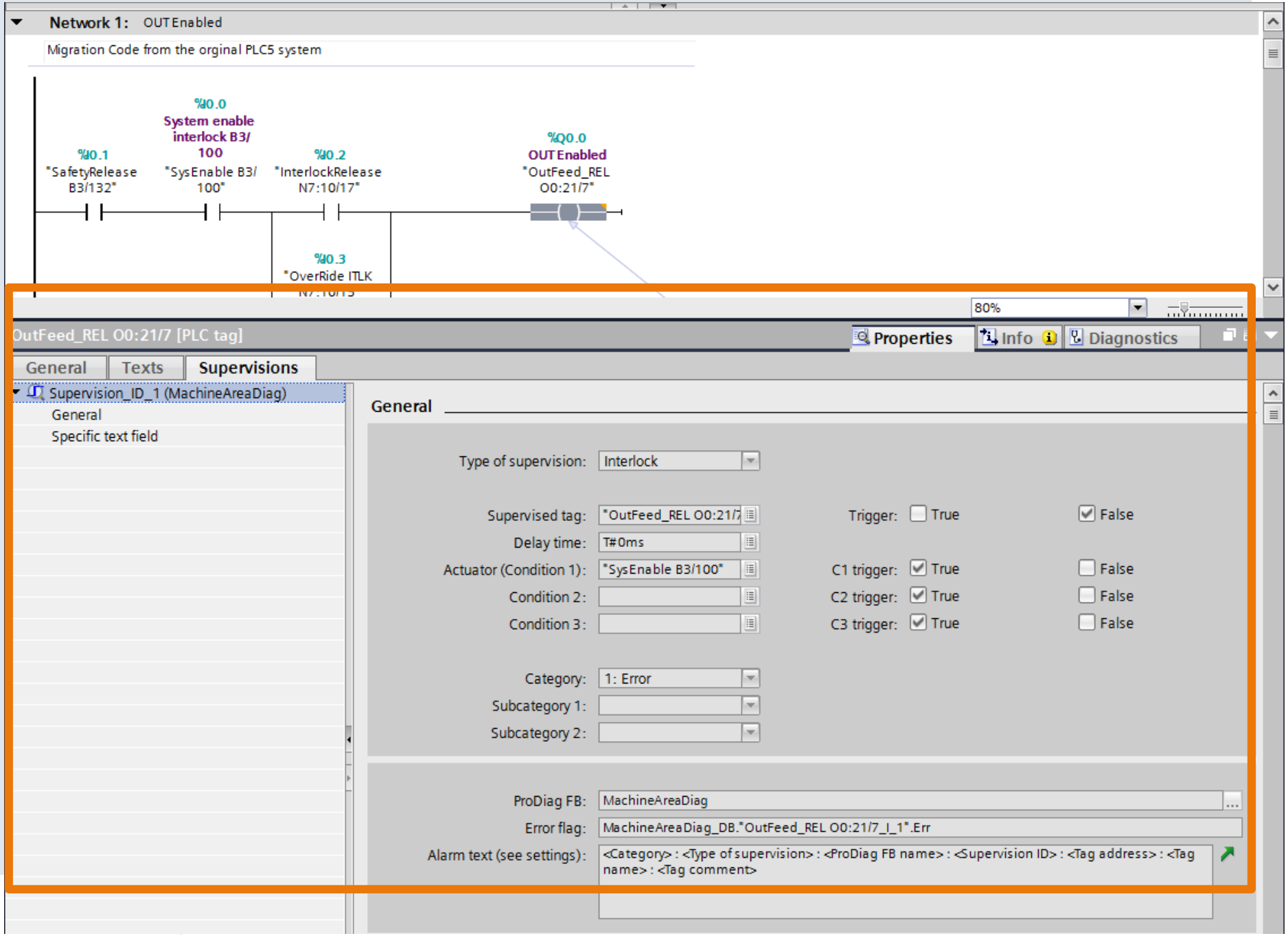


An output variable, as the global enable within the process

A series of conditions provide the release for a drive enable

Simple configuration of the monitoring conditions within the PLC, and generate out to operator interfaces….



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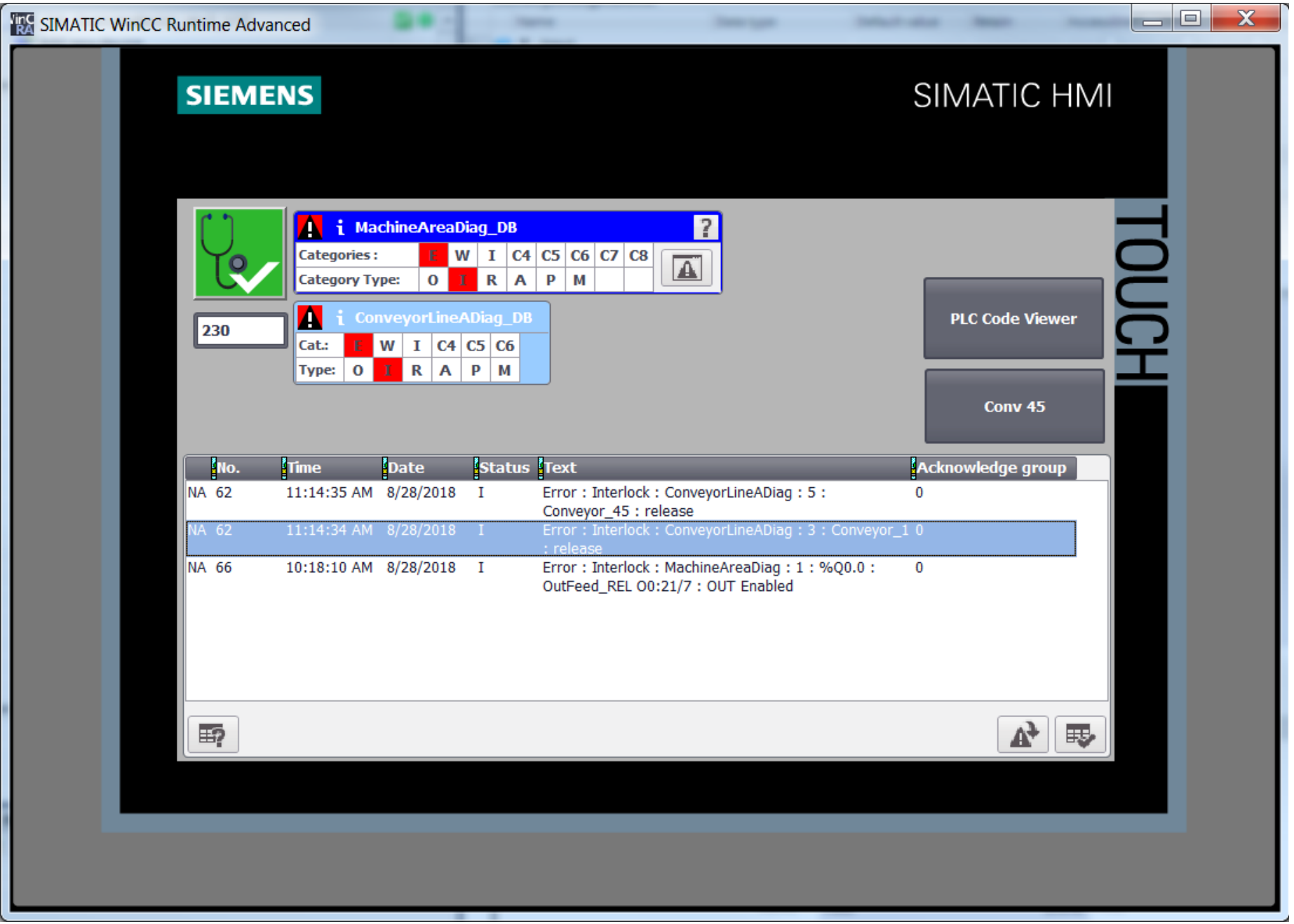
Configuration conditions

Efficient & Intuitive, applies text fields from objects already configured within control code



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Consistent messages fed to the alarm viewers

Simple easy classifications within the PLC table editors

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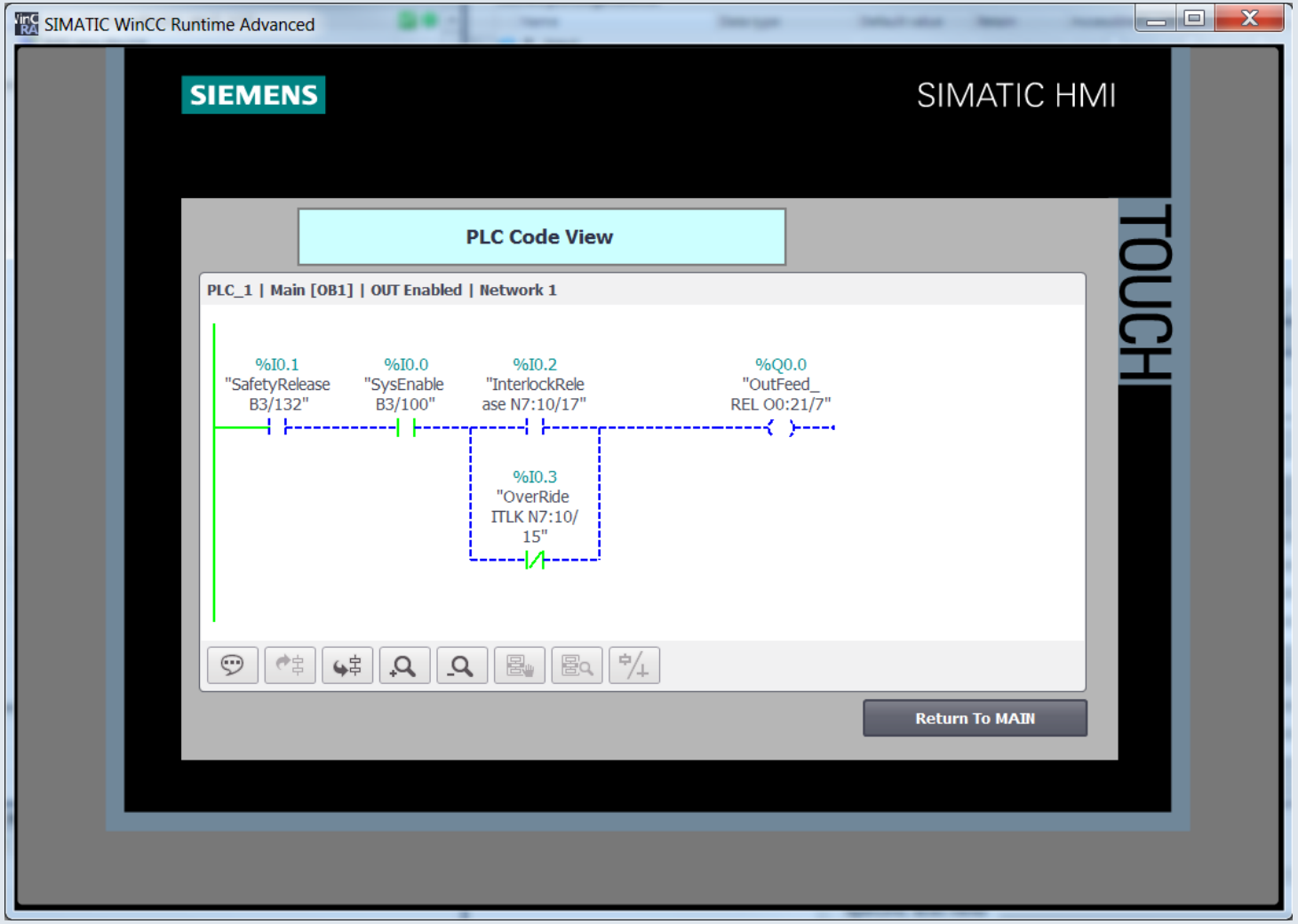
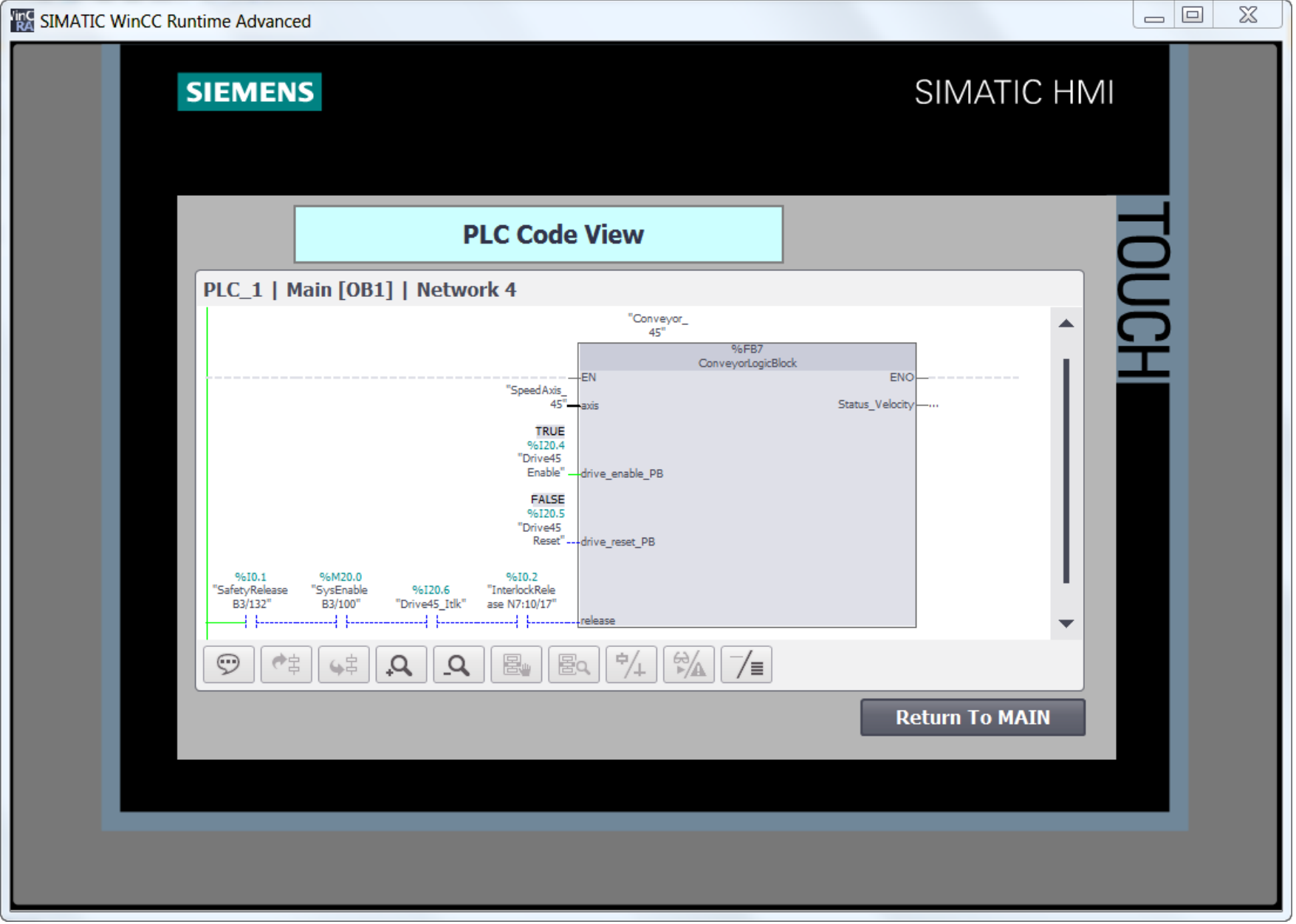


Visualize and debug, troubleshoot the entire “block call” of the instance selected

Reliable diagnostics on the HMI, without the need of a computer or engineering software online with the PLC



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Ingenuity for life

Visualize and debug, troubleshoot the entire “block call” of the instance selected

Reliable diagnostics on the HMI, without the need of a computer or engineering software online with the PLC

Runtime System Diagnostics are automatically generated
Reduce Engineering, Eliminate Errors, Increase Productivity

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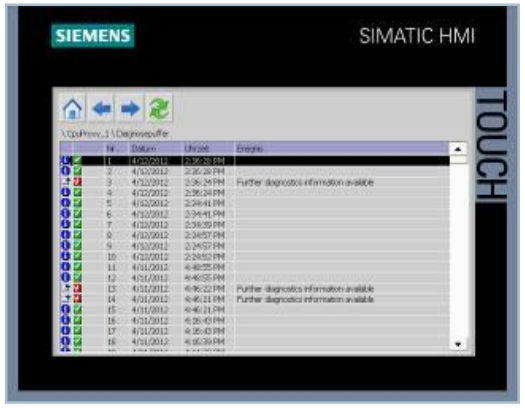
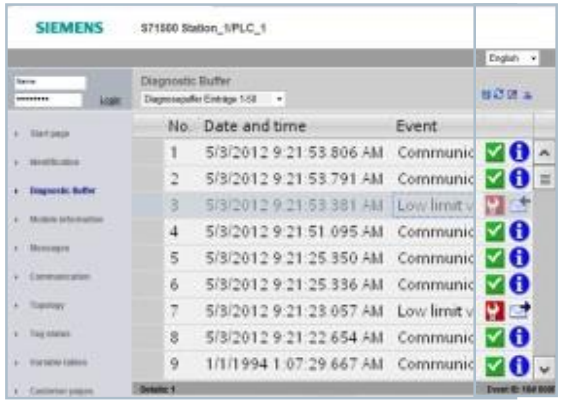


Display of the Controller

Web Server



Simatic Notifer App

Data Transparency Overview – “MindSphere”

Device level to Cloud to the palm of your hand via an App.

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MindApps

- Use **apps from Siemens, partners or develop own** apps
- Gain **asset transparency** & **analytical insights**

MindSphere

- Open interface for development of **customer specific apps**
- **Various cloud infrastructures:** SAP, AtoS, Amazon Web Services, Microsoft Azure offered as public or private (planned)

MindConnect

- **Open standards** for connectivity, e.g., OPC UA
- **Plug and play connection** of Siemens and 3rd party products
- **Secure** and **encrypted** data communication

SIMATIC Edge Technology
Enabling digitalization within automation

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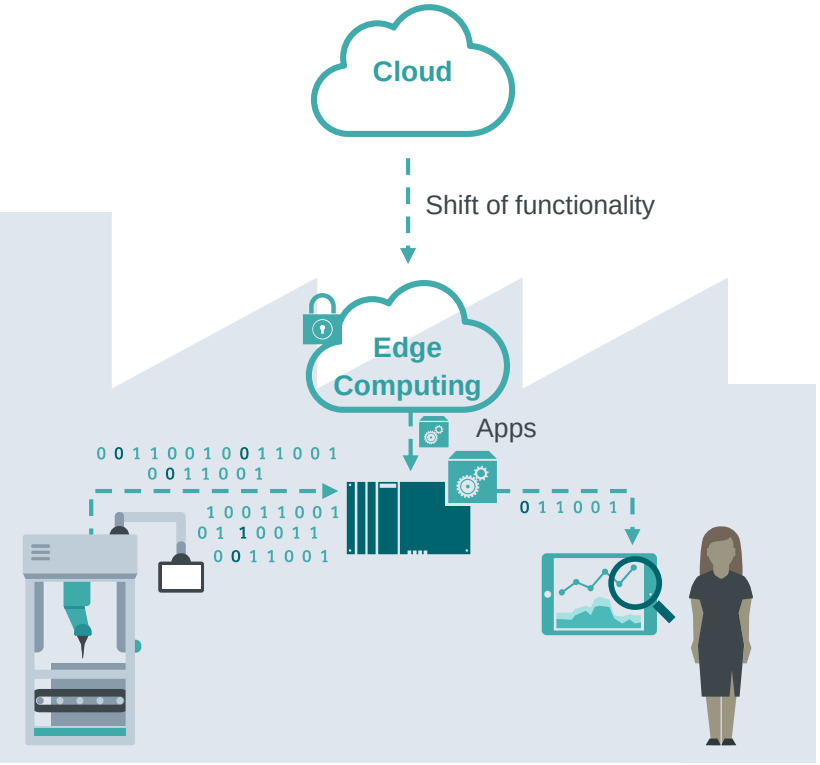
Ingenuity for life



Feature / Function	Benefit
Edge system consisting out of • Edge Management, • Edge Apps • Edge Devices	• Future proof platform to implement digitalization in automation today & tomorrow
• Cloud based backend to manage Edge devices and deploy Apps worldwide	• Efficient status and health monitoring of edge devices • Easy App deployment to distributed devices enabling new Use Cases
• Possibility to develop own Apps based on edge platform as well as integrating Siemens Apps	Enabling various automation tasks on app basis e.g. • Real time data analytics • Data processing • Data visualization
• Edge HW based on SIMATIC Nanobox PC	• Powerful platform to handle analytical- as well as communication tasks

Portfolio overview of SIMATIC MindApps

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	MindApp	Added value
	Performance Optimizer	Improved availability / productivity of manufacturing facilities through more transparency
	Notifier	Notification and location-independent access to alarm data
	Machine Insight	Pioneer for new OEM business models, e.g. maintenance agreements, extension of warranty for machinery, downtime insurance
	Energy Manager	Energy transparency in accordance with ISO 50001 and quick energy analysis

SIMATIC Performance Optimizer

Overview & Benefits

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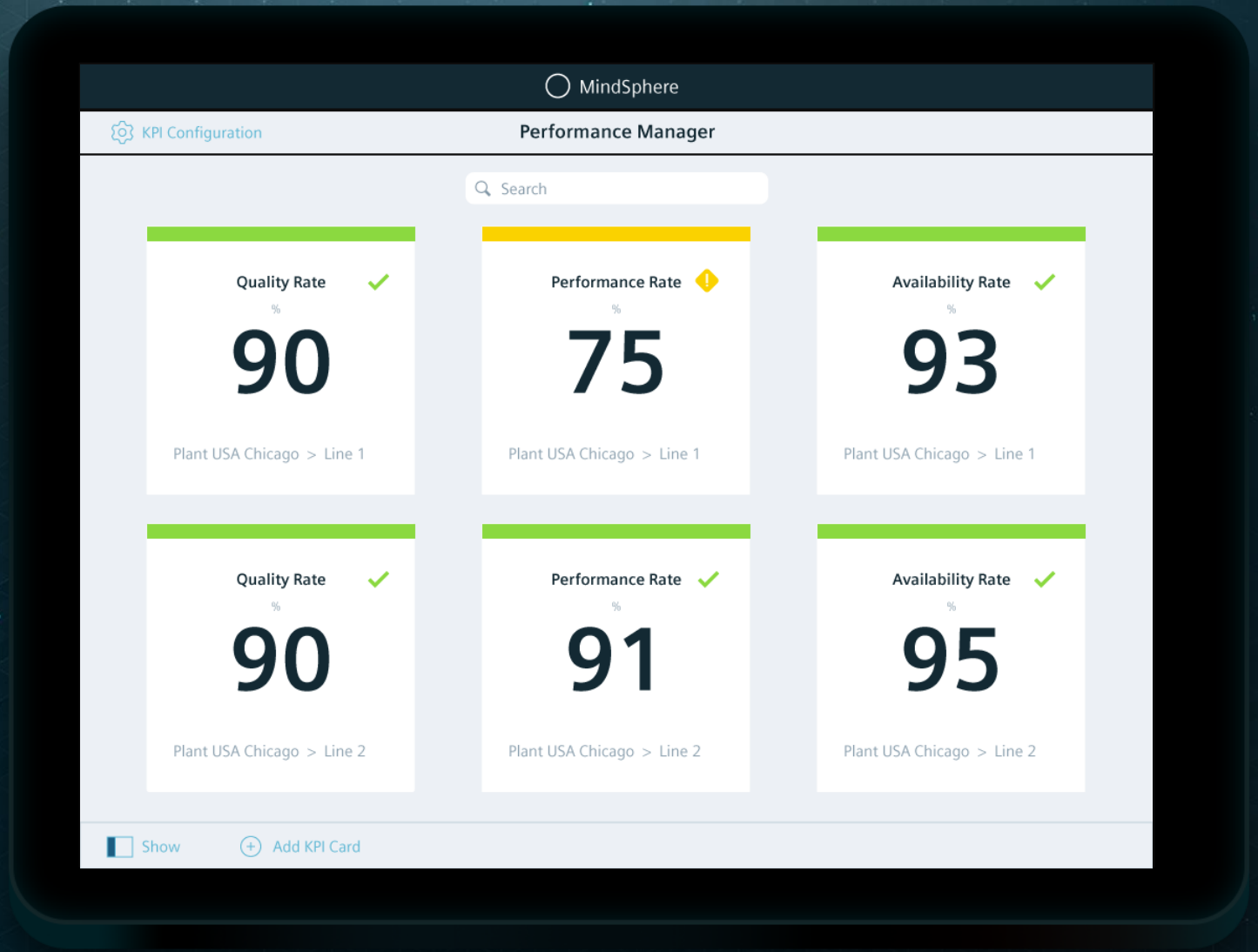
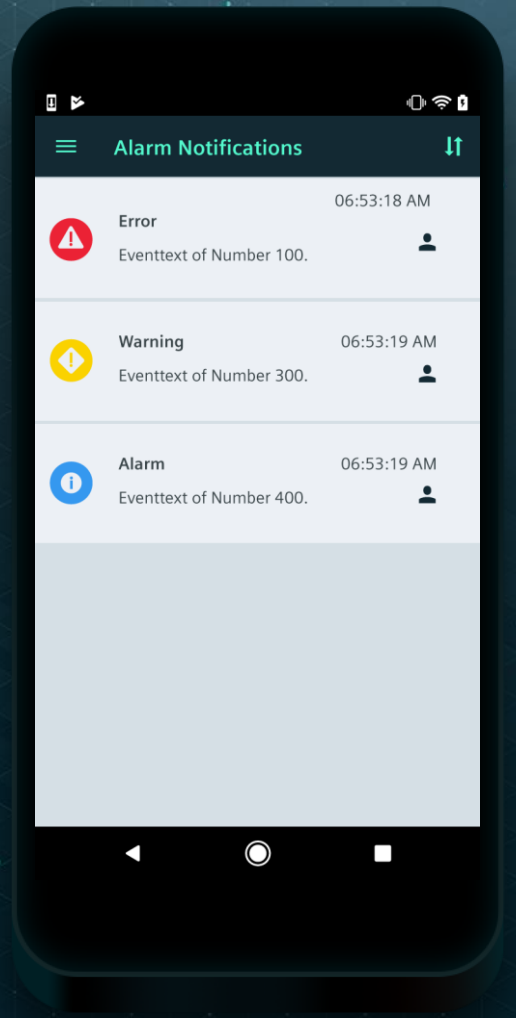


- Increased machinery and plant transparency
- Calculation and visualization of KPIs worldwide
- Decision-making aid on optimization of machinery and plants

SIMATIC Notifier

Overview & Benefits

SIEMENS
Ingenuity for life

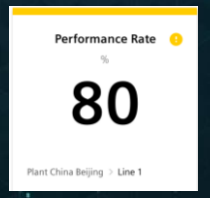


- Alert from SCADA systems, MindSphere data points and SIMATIC MindApps (for example if values fall below KPIs)
- Filtering of alarms
- Definitions of users with different views
- Active notification to mobile terminals (App)

Push alarms from...

PLC data points
Threshold

SCADA Alarms

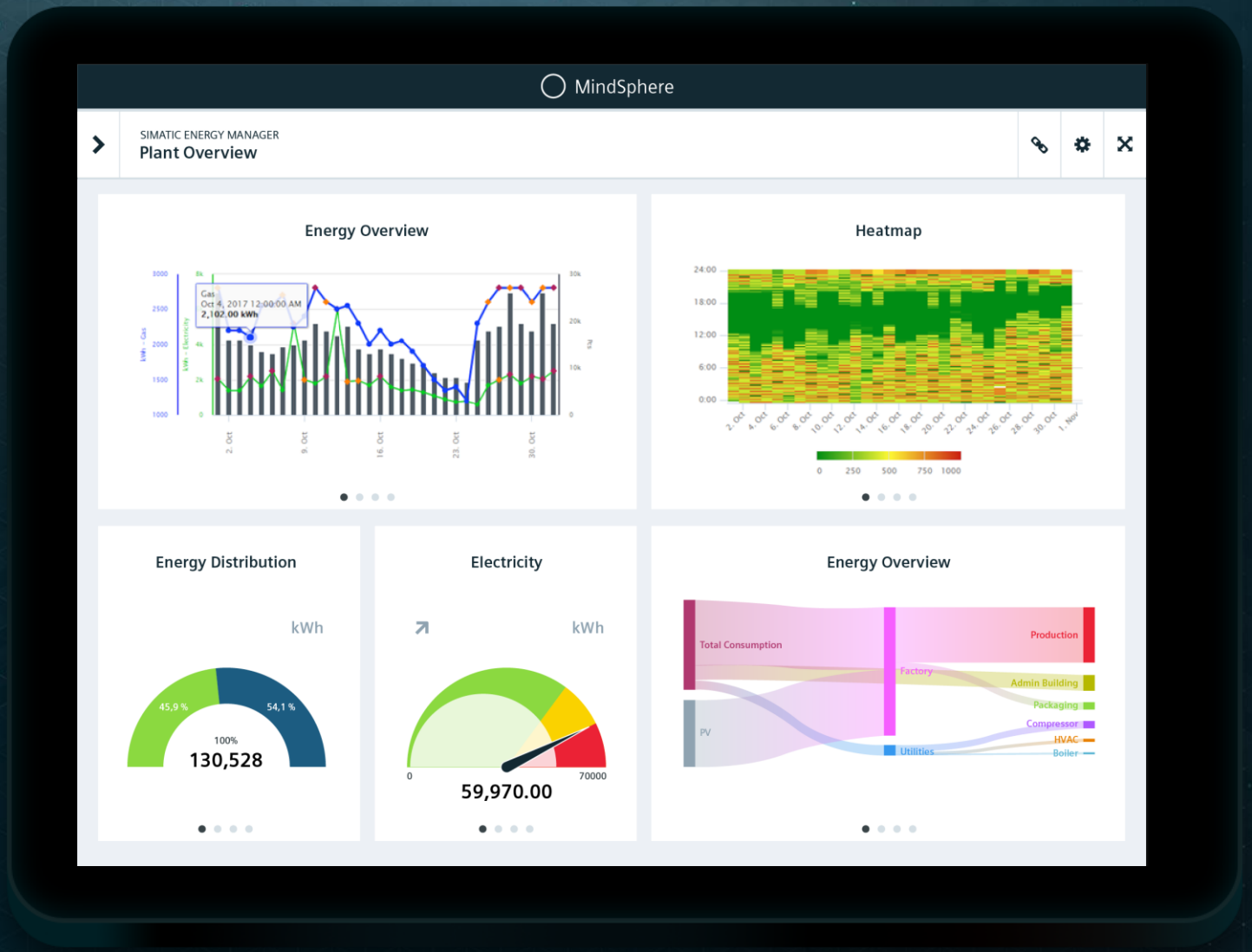


SIMATIC MindApps
Threshold

SIMATIC Energy Manager

Overview & Benefits

SIEMENS
Ingenuity for life



- Easy to use Widget based Dashboard with integrated basic analytic
- Simple KPI definition
- Bringing energy data in relation to further context like production, weather,..

SIMATIC Machine Insight

Overview & Benefits

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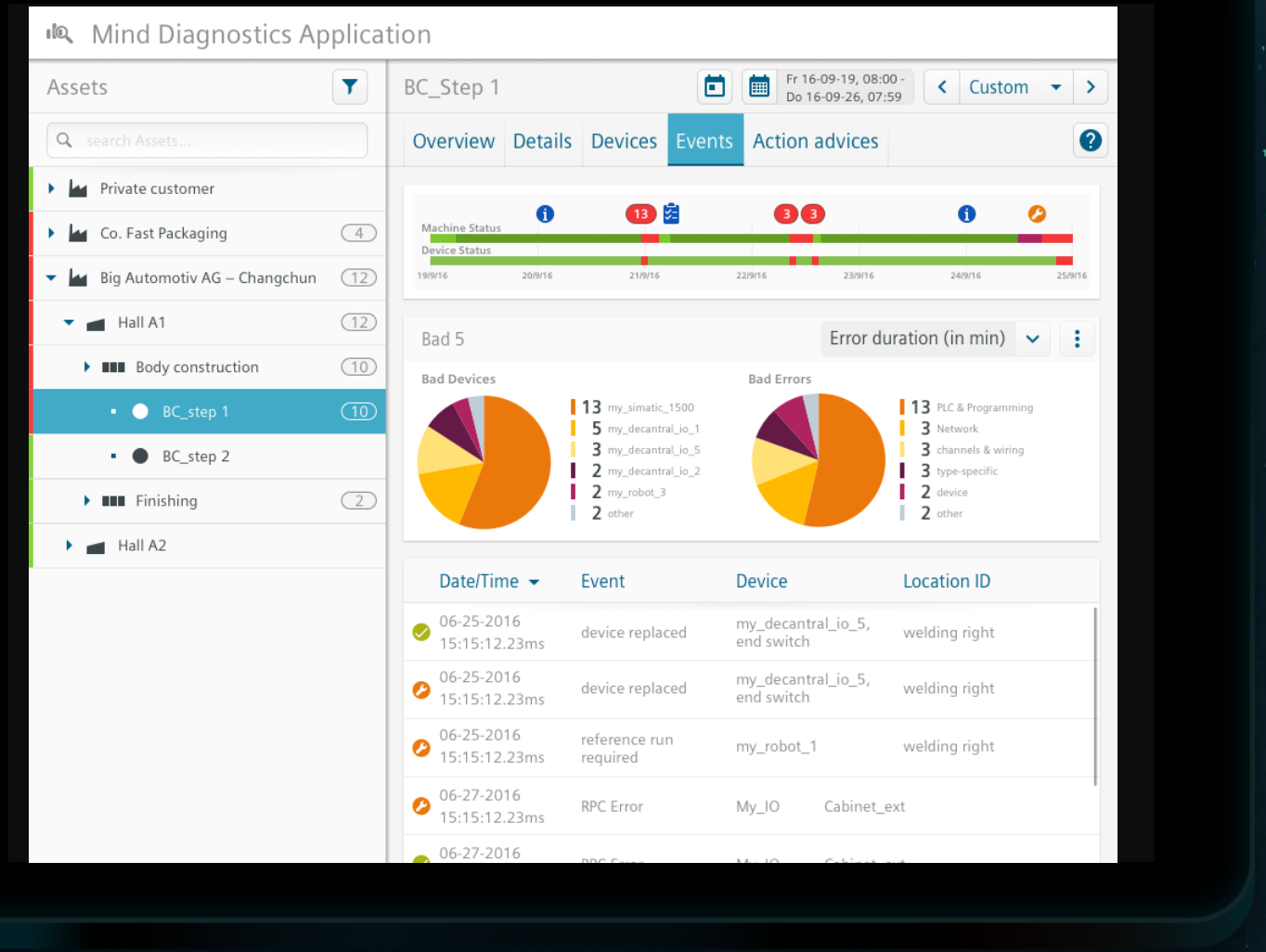

- Displaying of relevant machine performance indicators
- Device and machine traceability
- Display of most frequent diagnostics for serviceability
- Tracking of machine and device states
- Easy and fast connectivity (Plug & Play)

Combining the best out of both worlds!

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SCADA

SCADA (Supervisory Control and Data Acquisition)

Local / central ("on premise")

- Chronological acquisition
- Data aggregation guaranteed ("real-time") availability
- High Volume of process data
- Reliable connectivity to the process
- Analysis (e.g.: calculation of KPIs)
- Control functionality

Additional optimization potential as a result of cloud-based analysis

Cloud

Infrastructure platform

Global

- Decoupling of production and analytical processes
- Very huge variety of data from PLC / SCADA system plus external data (weather, statistics)
- Include domain knowledge
- Analytical apps & services (need to be created / bought)

Added value through combination of SCADA & external (domain) knowledge

More than just the sum of its parts: The individual components of the complete software package are closely linked. As a result, the TIA Portal offers a variety of functions that link automation and digitalization in a way that is both efficient and, most importantly, manageable.

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TIA Portal Cloud connector

Increase flexibility in your everyday work with engineering in the private cloud and direct access of the system controller from your private cloud

Learn more

TIA Portal Openness

Efficient generation of program code using code generators connected via the TIA Portal Open[illegible]interface

Learn mo[illegible]

Inclusive

PLCSIM Advanced

Holistic simulation of PLC functionality including e.g. communication and webserver as well as interaction with virtual machine and plant models by using PLCSIM Advanced

Learn more

Connectivity to MindSphere

Analyses and services with consistent quality worldwide with the MindSphere - the cloud-based, open IoT operating system from Siemens

Learn more

TIA Portal Teamcenter Gateway

Backup of projects plant-wide with the storage of TIA Portal projects in Teamcenter

Learn more

TIA Portal Multiuser Engineering

Work on the same project in a team and flexibly manage it on a server with Multiuser Engineering

Learn more

SIMATIC Visualization Architect (SiVArc)

Automatic generation of HMI visualizations with SIMATIC Visualization Architect (SiVArc)

Learn more

SIMATIC ODK 1500S

SIMATIC ODK 1500S supports development of Windows and realtime functions and enables integration of high-level languages

Learn more

SIMATIC Target 1500S™ for Simulink®

The SIMATIC Target 1500S enables model-based design with Simulink® and SIMATIC by automatically generating executable code from Simulink models.

Learn more

Machine and plant diagnostic (SIMATIC ProDiag)

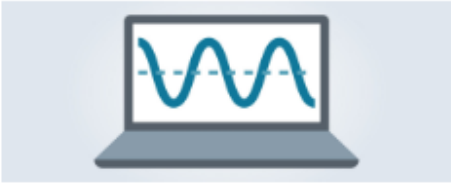
Efficient and integrated diagnosis of process errors reduces production downtimes and increases the availability of your machines and plants

Learn more

SIMATIC WinCC/WebUX

Operating and monitoring - any time, any place - efficient, mobile, and secure - on different devices

Learn more



SIMATIC Energy Suite

Maximum energy transparency in production with minimum expenditure, thanks to the automatic generation and intuitive configuration of measuring components

Learn more

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SIMATIC OPC UA

Open communication standard for I4.0 communication concepts, supporting standardized connections regardless of the platform

Learn more

TIA Portal User Management Component (UMC)

Global user administration minimizes maintenance effort and increases transparency as well as plant security.

Learn more

Energy Efficiency Monitor

Evaluation and optimization of energy efficiency of machines over the entire lifecycle.

Learn more

PLM integration with automation engineering

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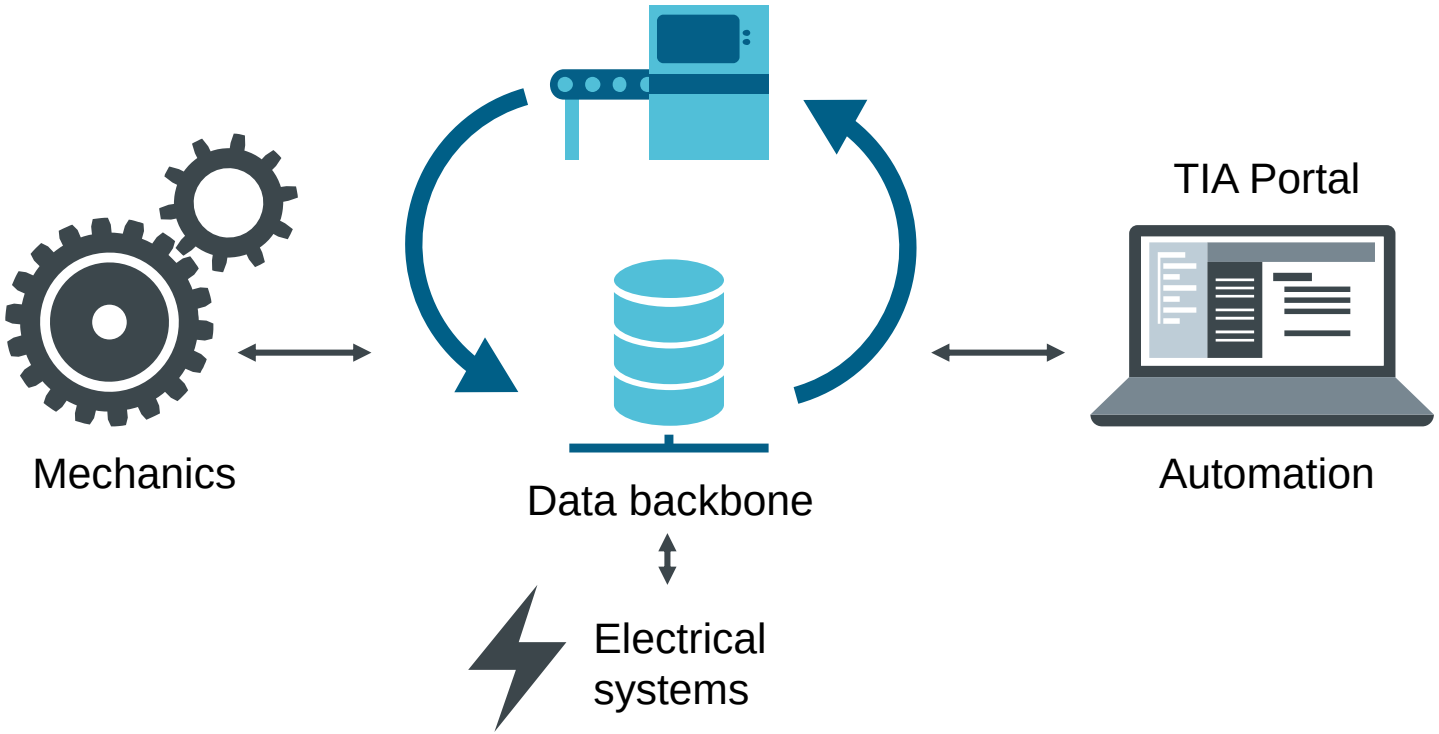
Ingenuity for life

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**

Efficient cloud based engineering

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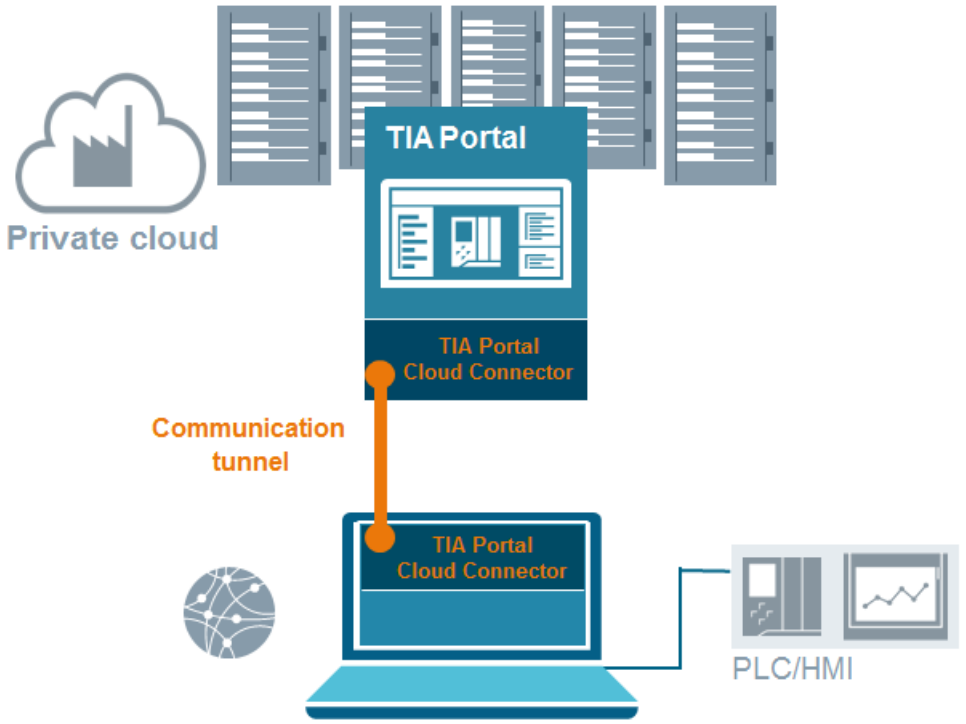
With **Cloud Connector**

- 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 the Engineering Software in a private cloud**

Integrated energy management

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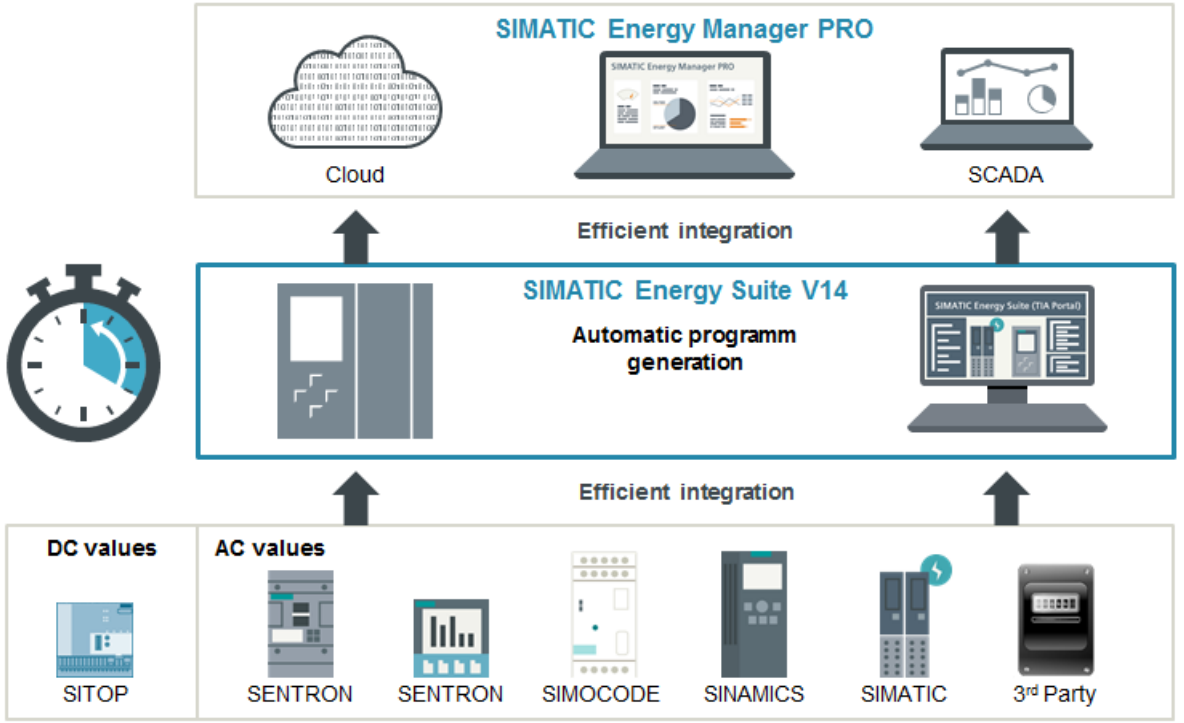
With **Energy Suite**

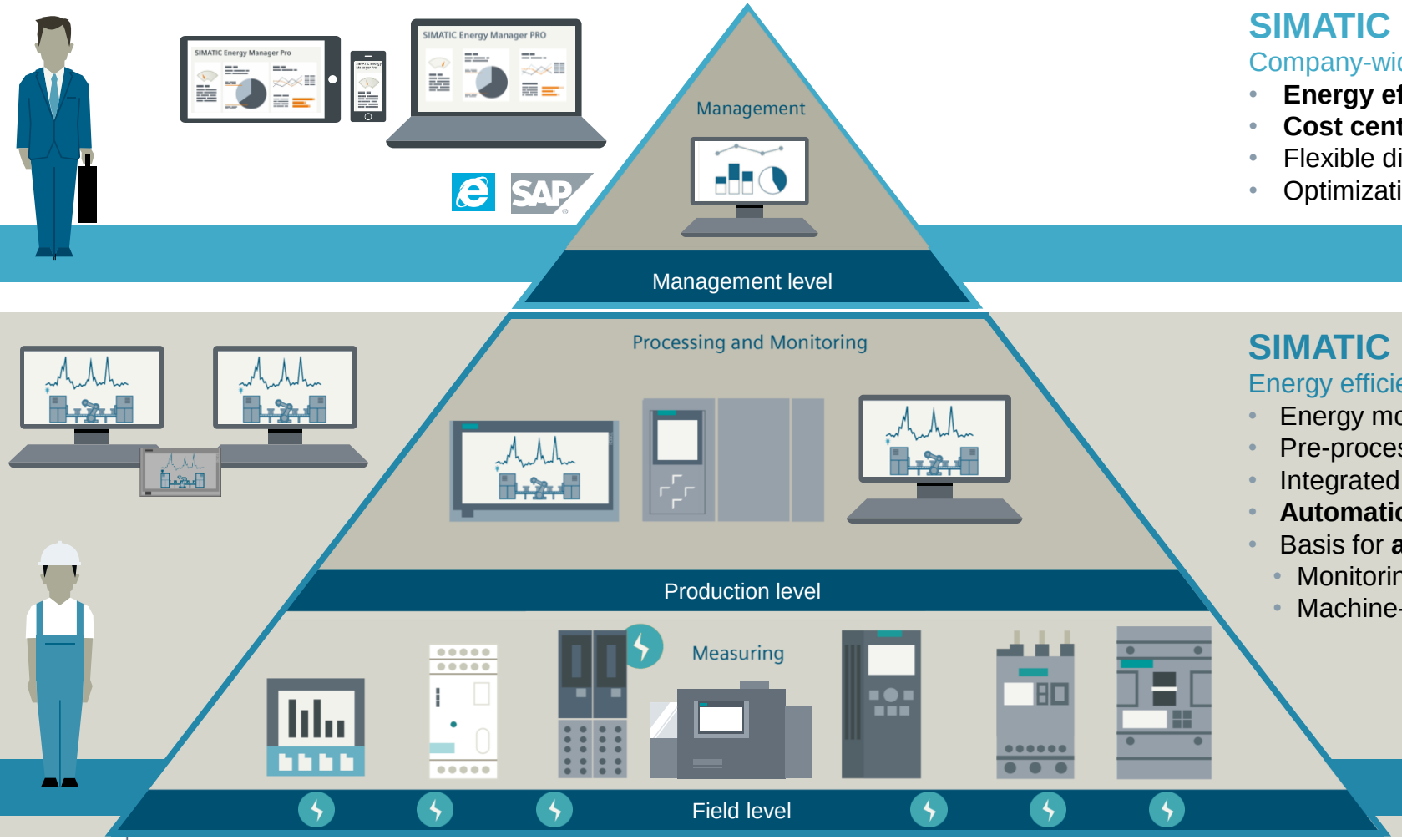
- Intelligent connection of energy and production data via devices
- Automatic generation of energy management program with controller
- Seamless integration to energy management system



- **Holistic energy management system from engineering to operation**

Energy management with SIMATIC – scalable solution for energy transparency at all levels

SIEMENS
Ingenuity for life



SIMATIC Energy Manager

Company-wide energy analysis

- **Energy efficiency controlling**, measures management
- **Cost center accounting** with link to SAP
- Flexible display and **analysis options**
- Optimization of the **energy procurement, prognosis**

Economic and management level

SIMATIC Energy Suite

Energy efficiency in production

- Energy monitoring on **HMI and SCADA**
- Pre-processing and monitoring **on PLC**
- Integrated energy measurement **directly in the field**
- **Automatically generated** instead of programmed
- Basis for **application expansion**
  - Monitoring of limits and alarms
  - Machine-level KPIs (e.g. kWh/unit)

Production level

Team Engineering - MultiUser

SIEMENS
Ingenuity for life

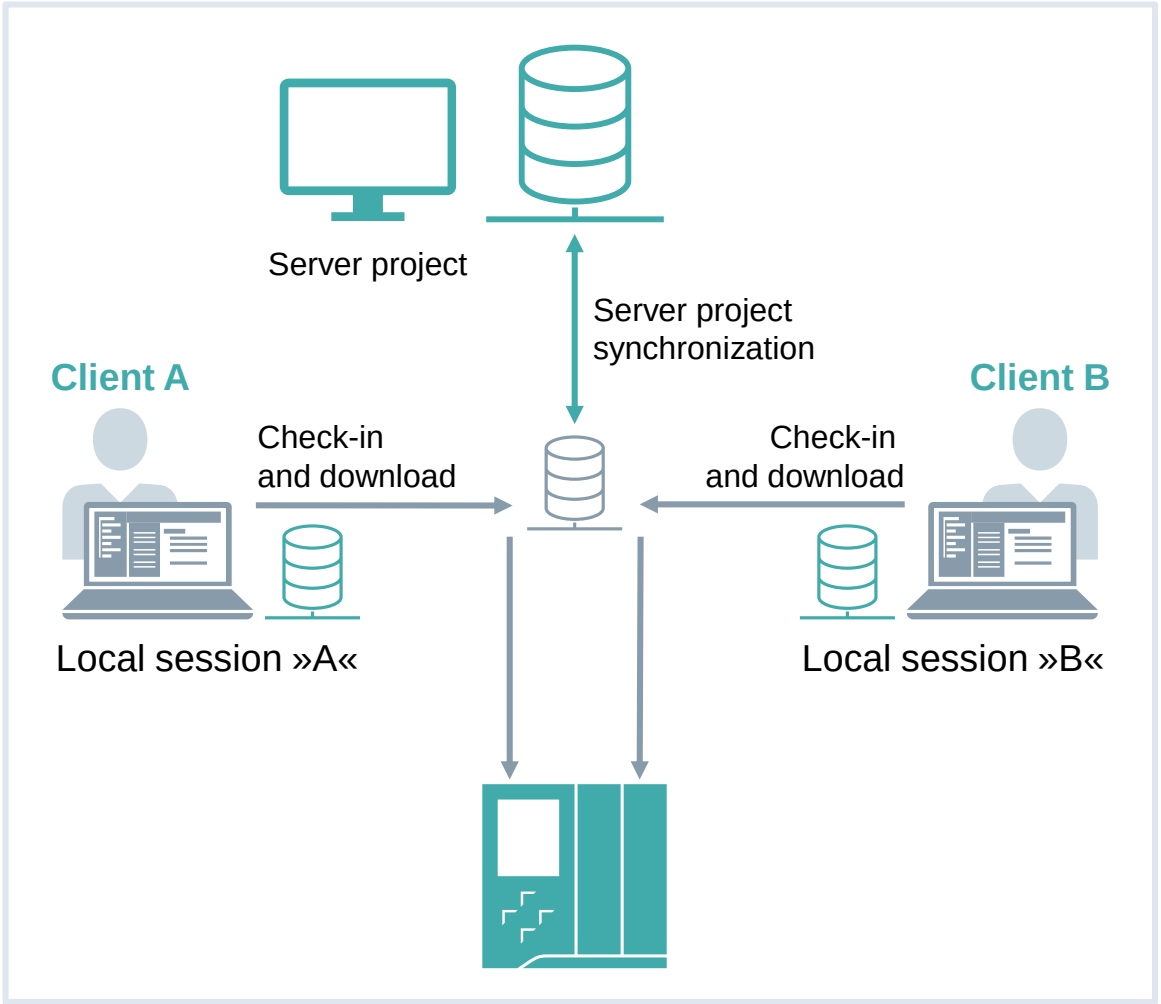
Shared commissioning in a team

Downloads are synchronized via the server project.
This enables a consistent status between device and server project.

Characteristics of the commissioning mode

In commissioning mode, the changes are automatically checked into the server project, compiled and loaded into the device when downloaded from the local session.

- Selectable project-granular via the multi-user administration tool
- A selected commissioning mode applies to all connected multiuser clients
- No change of the download workflow
- Local session, server project and the device having the same version after downloading



Implementation of multilayered Defense in Depth concept with TIA Portal and IEC 62443-4-1 certified products

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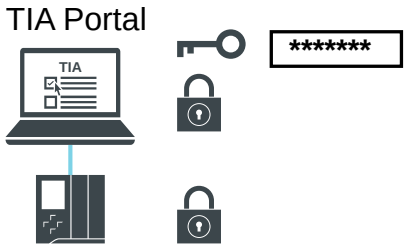
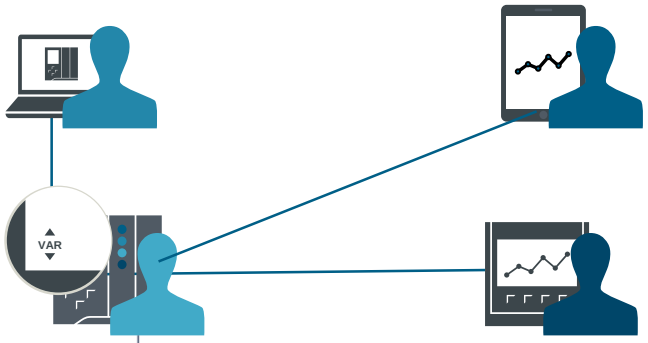
System Integrity

Know-how protection

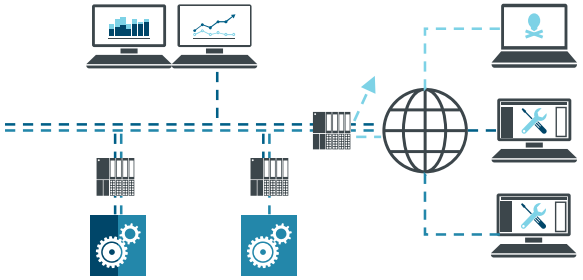


Access protection

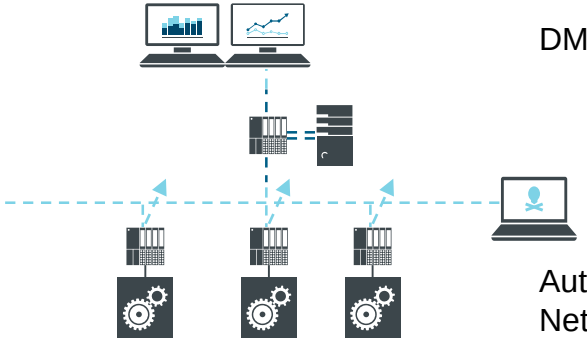


Network Security

Remote access



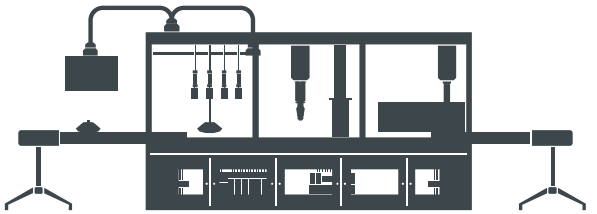
Cell protection + DMZ

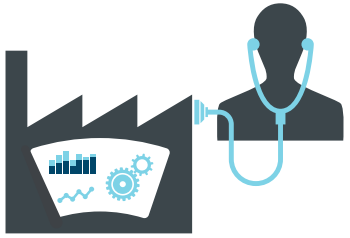


Plant Security

Security Monitoring

- Holistic monitoring of defined assets
- Root cause analysis of incidents





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Factory Automation

From hard-wired functions to an integrated engineering framework

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Software

Hardware

Wiring

PLC

TIA

SIMATIC MANAGER
Step 7 / WinCC +
SIMATIC WinCC flexible

TIA Portal Engineering
--Step 7 / PLCSIM
--WinCC
--Safety Integrated
--Start Drive

S7-1200

S7-1500

SIMATIC G | SIMATIC S3 | SIMATIC S5 | SIMATIC S7 and TIA | TIA Portal for Automation and Drives

1958 | 1973 | 1979 | 1995 | 1996 | 2002 | 2009 | 2010 | 2012 | 2020…

Safety Integrated

Integrated engineering

Close interaction between runtime (hardware) and engineering software tools needed.

*) Due to increasing and system crossing degree of automation.

The Totally Integrated Automation - Concept and Advantages

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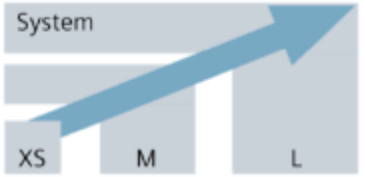
Easy engineering and integration

TIA Portal

One framework for the complete project

TIA Portfolio



Scalable and seamless TIA portfolio fits for each application

Production lifecycle

Connect old and new machines thanks to compatible components

Vertical integration

Uniform Ethernet communication from field to management level

High availability

TIA Portal

Increased availability by using one tool for controller, HMI, drives, etc.

System diagnosis

Uniform, integrated and self-explaining diagnosis for all devices

Device replacement

Device replacement in maintenance case without tools or engineering

Vertical integration

Direct connection to MES and cloud systems for improved data transparency

Summary…

…Automation positions the digital transformation for manufacturing

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- System & Process Diagnostics
  automatically generated by hardware designs, and control standards & libraries
- Automatic Generation of applications
  with use of consistent reliable openness tools, SiVArc,& Energy Suite
- Simulation and Virtual Commissioning
  Digital Twin – Automation / Mechanics / Performance
- Open, connected plant operations
  applying SCADA, EDGE, and CLOUD

SIEMENS
Ingenuity for life

Begin your digital transformation journey

Modernize, Retrofit, and apply a SIEMENS Automation Solution

Engage the automation solution to provide the gateway to digital enterprise concepts

modernization opportunities

Modernization – New or Retrofit existing equipment

Get started on familiar ground – "the application program"

SIEMENS
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Convert existing obsolete system into a Siemens Automation Solution geared the digital transformation

Expand your knowledge on the automation solution, on a familiar process or line.

Enhance the diagnostics and reduce downtime

… with **integrated system diagnostics** plus the configuration of key process variables to drive consistent reliable diagnostics as a new standard

Create standard libraries to reduce engineering

… evolve known / proven automation components into a global corporate library, embedded with diagnostics and available for auto-generation

Evolve your digital transformation … Analytics

… auto generate solution, apply virtual commissioning, and engage open secure communications for Edge, SCADA, and CLOUD

Embrace the automation solution geared for the future

And the Digital Transformation that fits your vision for the Future

Thank You!

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