Digital Workflow
Virtual Commissioning

TIA Portal Innovation Tour

siemens.com/tia

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

Cloud-based, open IoT operating system: MindSphere
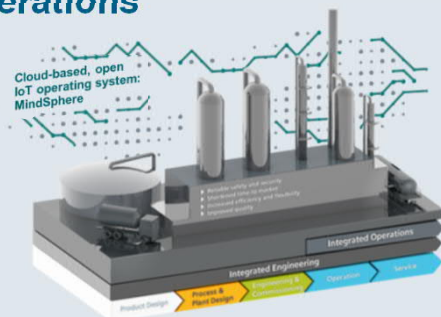
+ **Industrial Communication**

+ **Industrial Security**

+ **Industry Services**

Digital Enterprise Software Suite

Cloud-based, open IoT operating system: MindSphere

Digital Enterprise Suite

Collaboration platform: Teamcenter
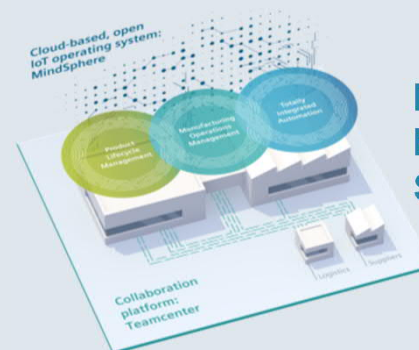
TIA in the Digital Enterprise

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Horizontal and vertical TIA value chain
Use cases to experience digitalization with TIA Portal

#	Use case	
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	

#	Use case	
9	Line integration	New
10	Integrated engineering of kinematics	New
11	Virtual training	New
12	Automation planning	New
13	Collaborative automation design	New
14	Edge computing	New
15	RFID-enabled supply chain management	New
16	Analysis of drive data	New

Third party applications

Cloud-based, open IoT operating system: MindSphere

1 Product design

2 Production planning

3 Production engineering

4 Production execution

5 Services

Collaboration platform: Teamcenter
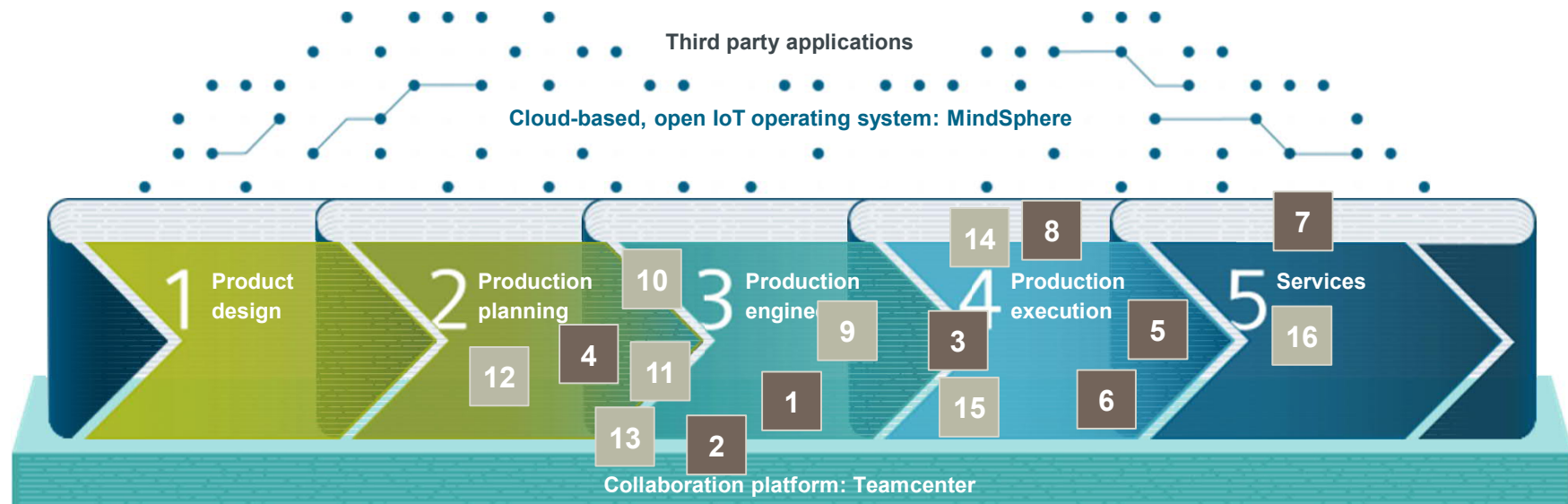
Reference Videos

Reference Video
https://www.youtube.com/watch?v=UhuJS6CAWhs
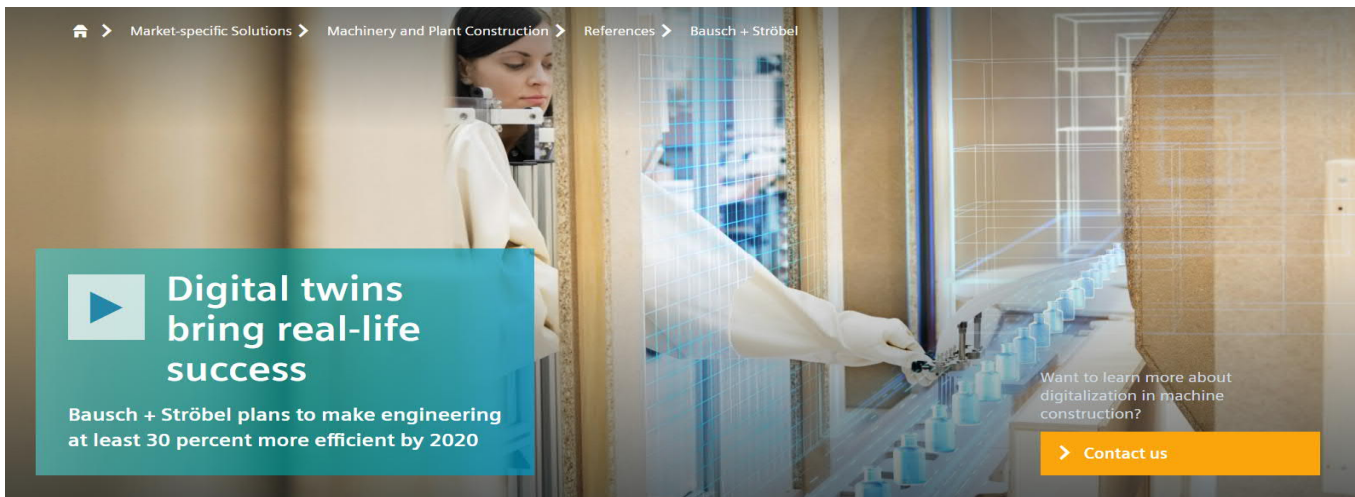
Reference Story

https://new.siemens.com/global/en/markets/machinebuilding/references/tronrud.html

Reference Video
https://www.youtube.com/watch?v=8Qo9CRp659k

Reference Story

https://new.siemens.com/global/en/markets/machinebuilding/references/bausch-stroebel.html

Virtual commissioning lowers the risks for real commissioning

Without virtual commissioning
Unexpected problems increase

Time requirements

Personnel requirements

Materials requirements

And this for international projects ...

= incalculable costs

With virtual commissioning
Problem scenarios are known

Best case: Cause of error already eliminated

Solution strategies already developed

Personnel are trained accordingly

Replacement material is at the ready
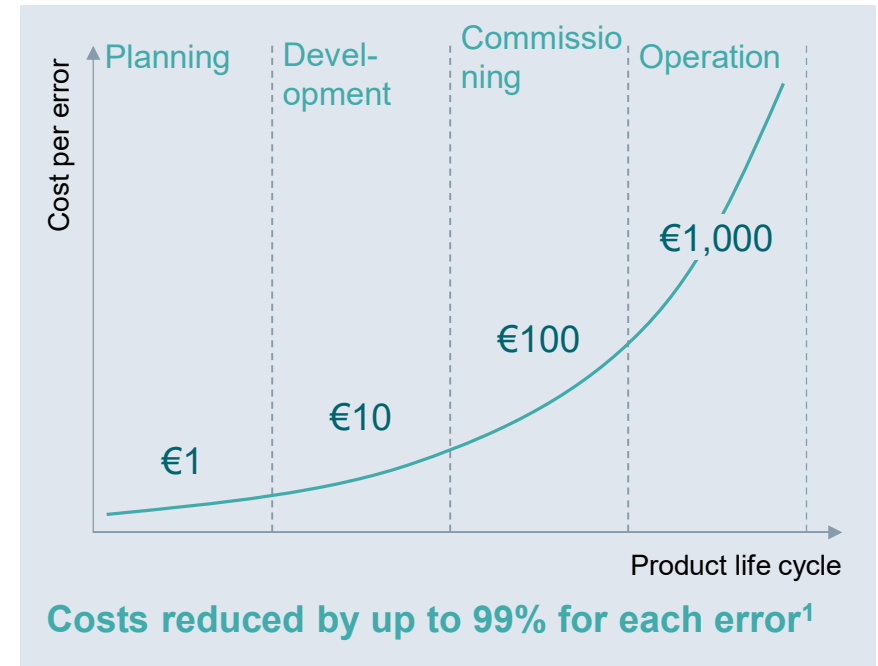
= calculable costs

Simulation allows errors to be identified early in the product life cycle

Six Sigma/ Quality rule Rule of ten

»The rule of ten states 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 more cost effective it is
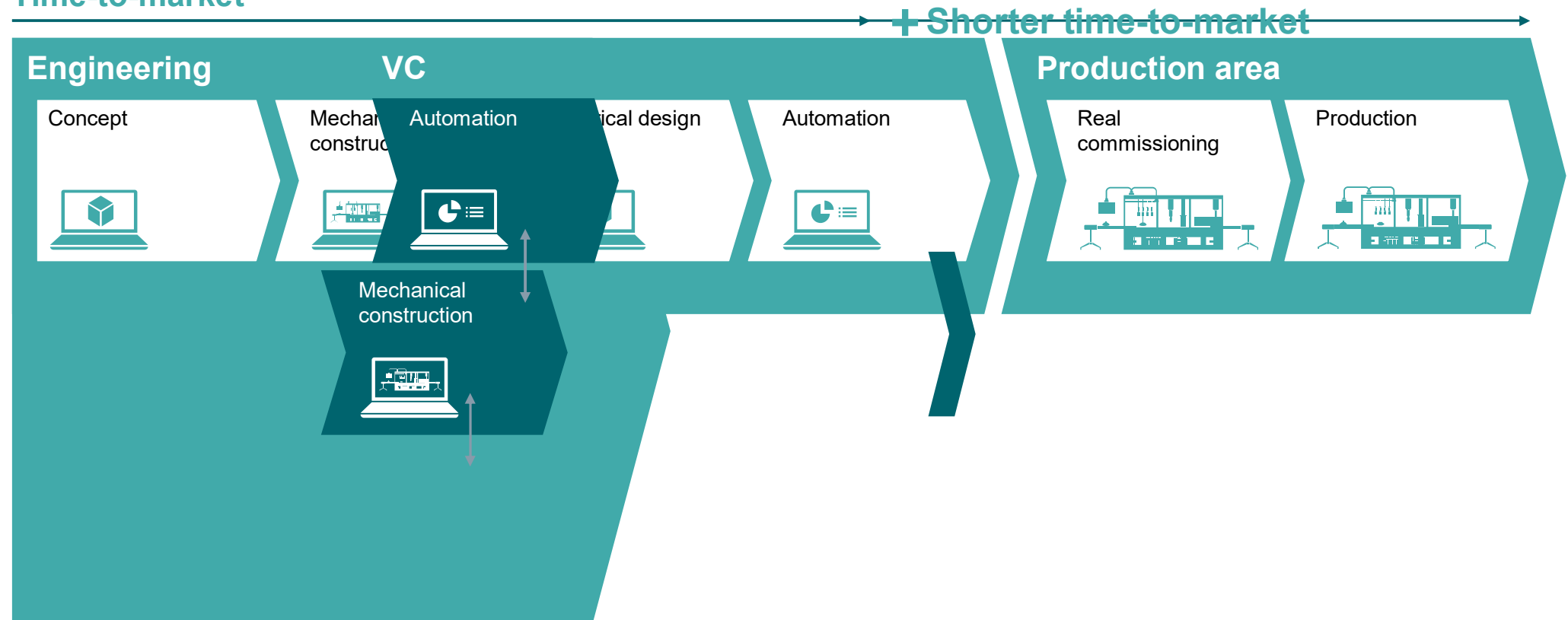for the organization. (…)«

Cost per error

Planning | Devel-opment | Commissio ning | Operation

€1,000

€100

€10

€1

Product life cycle

Costs reduced by up to 99% for each error[1]

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 permits working in parallel and thus a shorter time to market
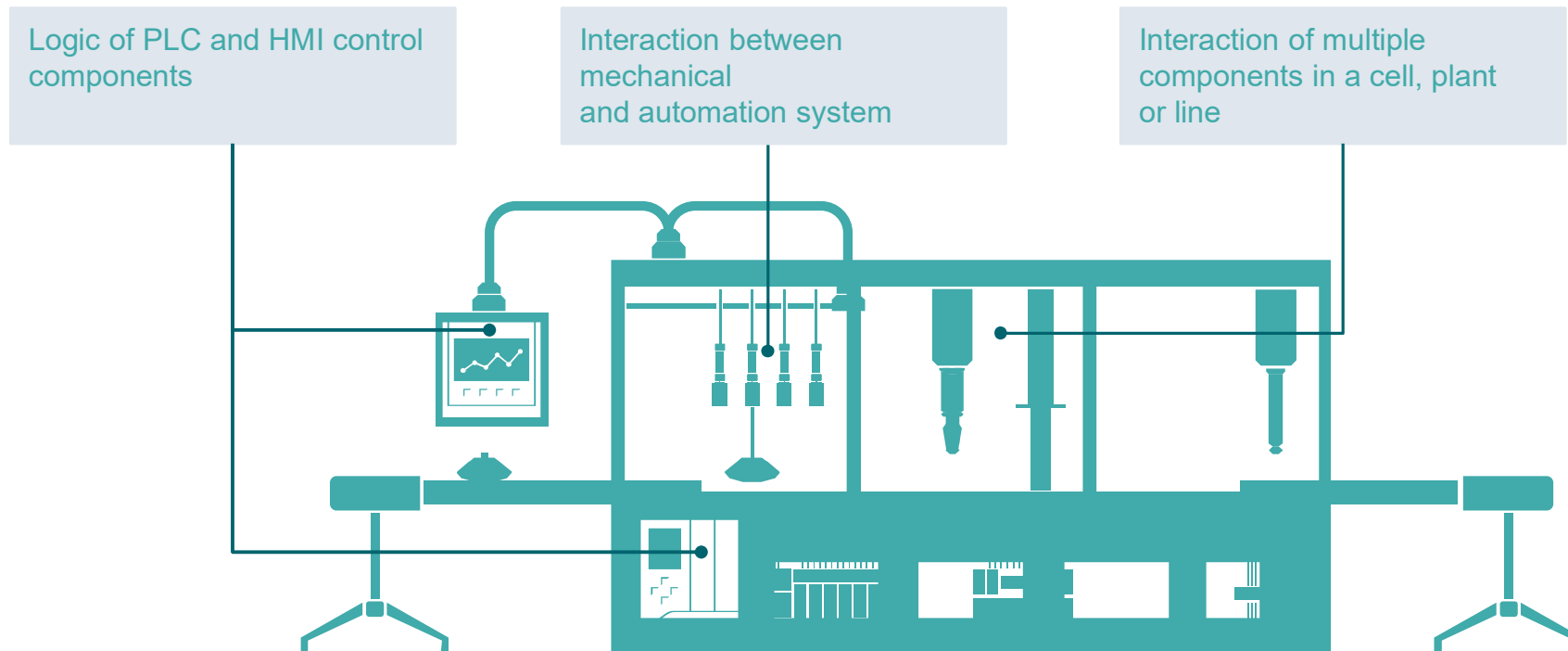
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Time-to-market

+ Shorter time-to-market

Engineering

VC

Production area

Concept

Mechanical construction

Automation

Mechanical design

Automation

Real commissioning

Production
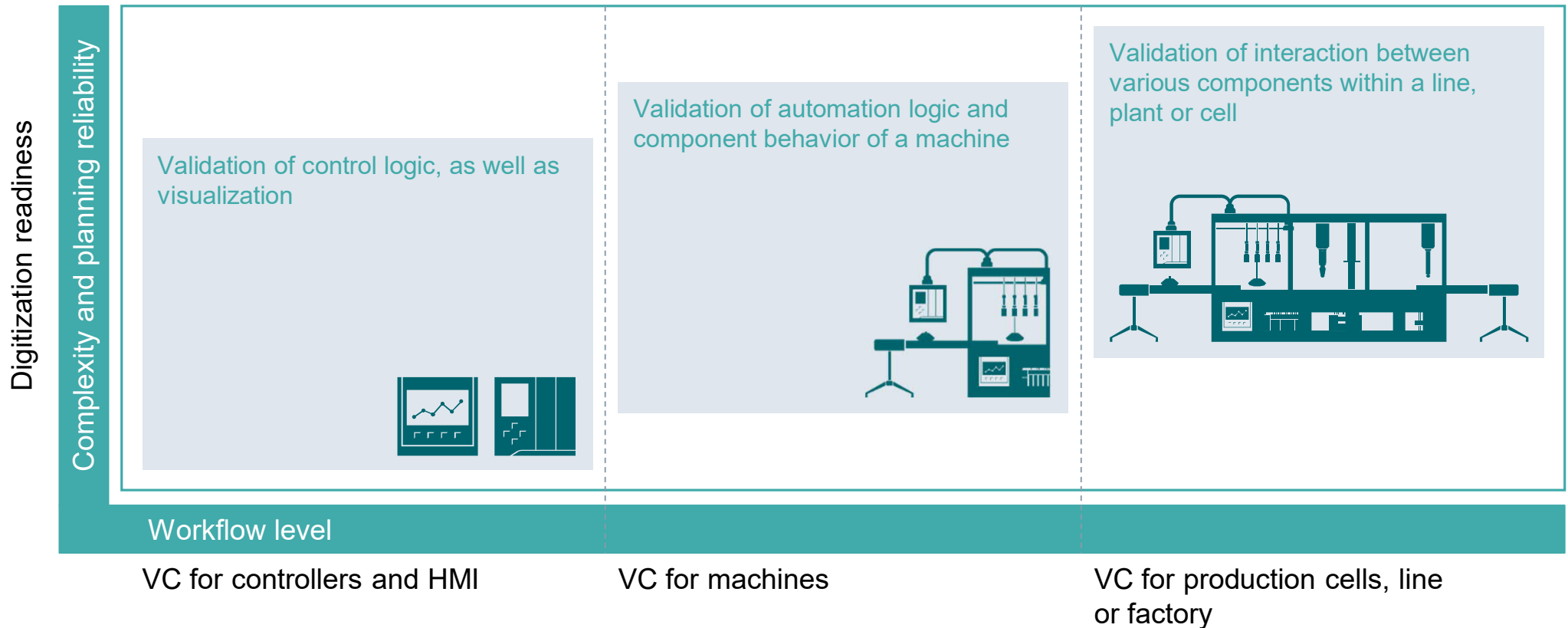
Mechanical construction

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»Virtual commissioning is beneficial for us as we are able to test the machine prior to actual commissioning!«

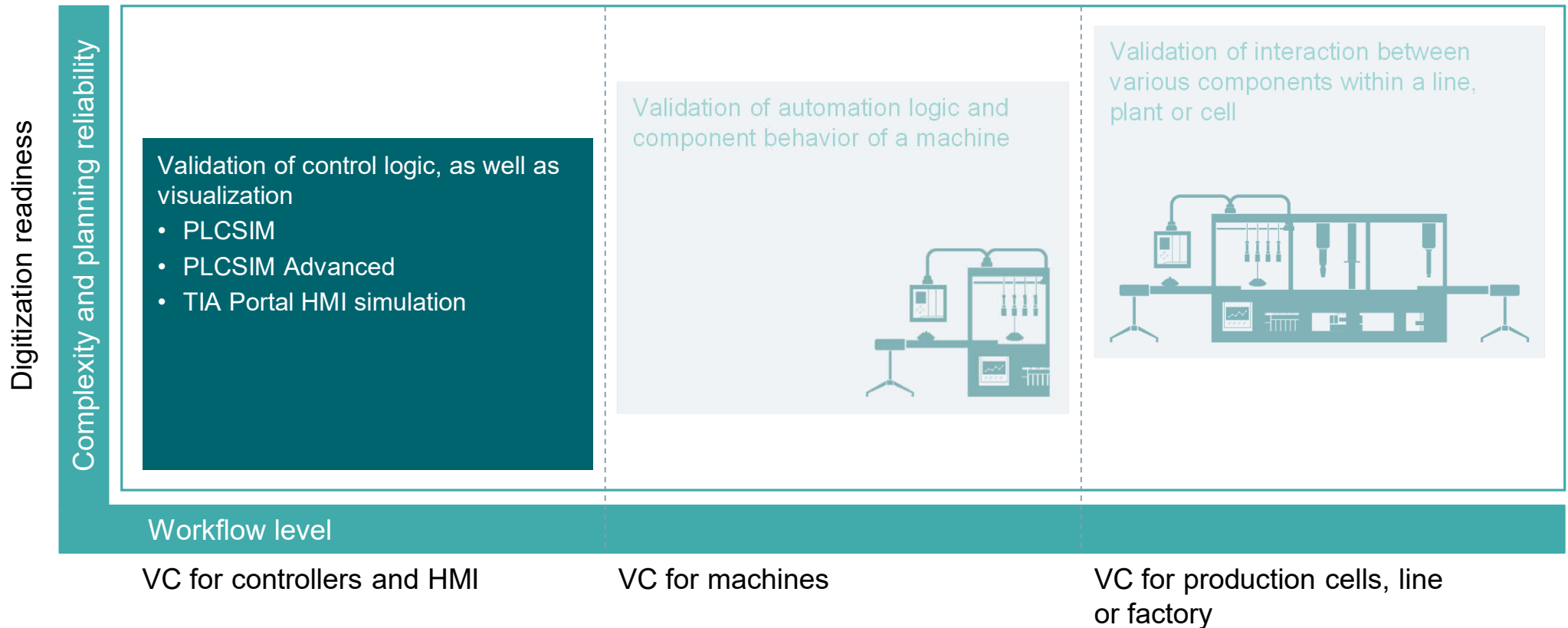# The virtual environment is dependent upon the respective issue under investigation

Logic of PLC and HMI control components

Interaction between mechanical and automation system

Interaction of multiple components in a cell, plant or line

The Siemens portfolio offers solution scenarios for virtual commissioning for all analysis stages

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Digitization readiness

Complexity and planning reliability

Validation of control logic, as well as visualization

Validation of automation logic and component behavior of a machine

Validation of interaction between various components within a line, plant or cell

Workflow level

VC for controllers and HMI

VC for machines

VC for production cells, line or factory

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Ingenuity for life

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Validation of control logic, as well as visualization
- PLCSIM
- PLCSIM Advanced
- TIA Portal HMI simulation

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SIMATIC PLCSIM Advanced is the virtual controller of SIMATIC S7-1500

SIEMENS
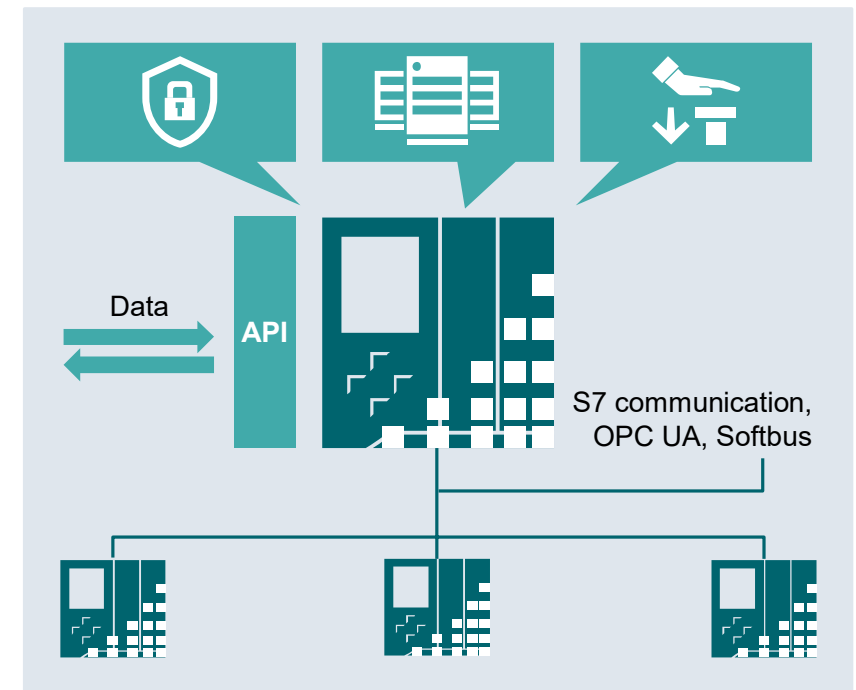*Ingenuity for life*

A virtual control system ...

… for comprehensive simulation of functions, 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 co-simulation or customer-specific test software in C/C++

Support of multiple and distributed instances …

… for simulation of multiple controllers on a PC/in the network

Data
API

S7 communication, OPC UA, Softbus

Benefit – Comprehensive simulation of control functionality

Unrestricted © Siemens AG 2020

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New features of the PLCSIM Advanced V2.0

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Testing of spontaneously occurring errors ...

… through the support of acyclic services and alarms, such as …

- Process interrupts (OB40)
- Status interrupt (OB55)
- Update interrupt (OB56)
- Manufacturer-specific interrupt (OB57)
- Diagnostic interrupts (OB82)
- Removing/inserting (OB83)
- Rack failure (OB86)

Simulation of motion control applications ...

… for verification of the user program, including access to a consistent map of current process signals when calling cyclic OBs …

… through support for synchronization of process image partitions

Reliable testing...

… with improved deterministic response and performance…

... by decoupling from Windows Task Manager

Efficient working...

… due to higher usability such as …

- Parallel installation of PLCSIM and PLCSIM Advanced
- Expansions in the GUI, including auto-completion and new buttons for changing the operating state and memory reset

Simulation of alarms via the API

Live demonstration

Testing and simulation of HMI projects
in conjunction with a SIMATIC controller and PLCSIM
https://support.industry.siemens.com/cs/de/en/view/109748099

PLCSIM Advanced
Co-simulation with API interface
https://support.industry.siemens.com/cs/de/en/view/109739660

S7UnitTest
Automated testing with SIMATIC S7-PLCSIM Advanced
https://support.industry.siemens.com/cs/de/en/view/109746405

Digitalization with TIA Portal
Virtual commissioning with SIMATIC and Simulink
https://support.industry.siemens.com/cs/de/en/view/109749187

TOTALLY INTEGRATED AUTOMATION
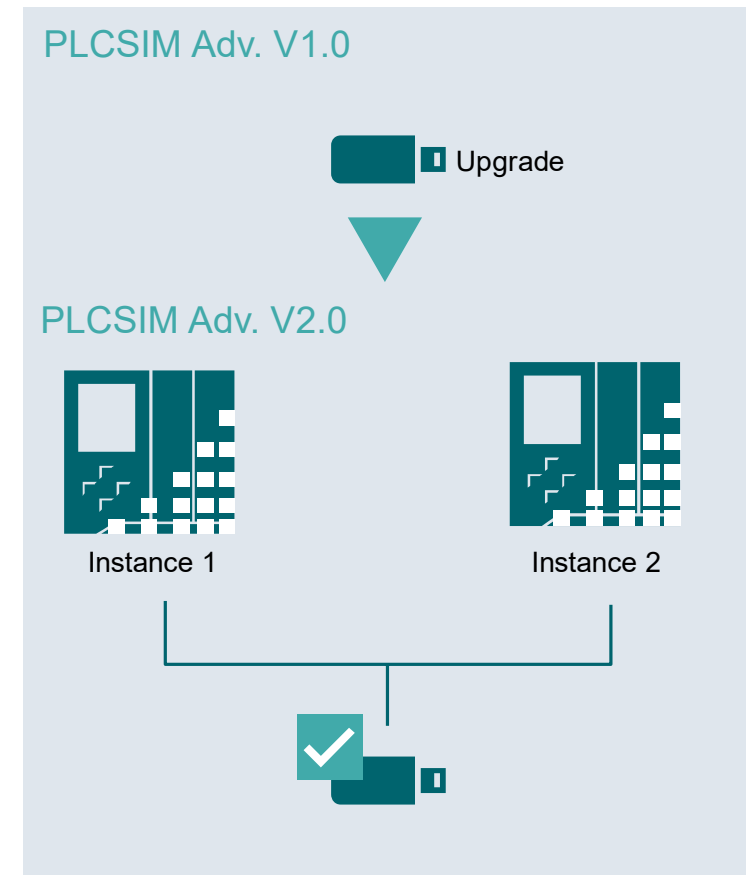SIEMENS
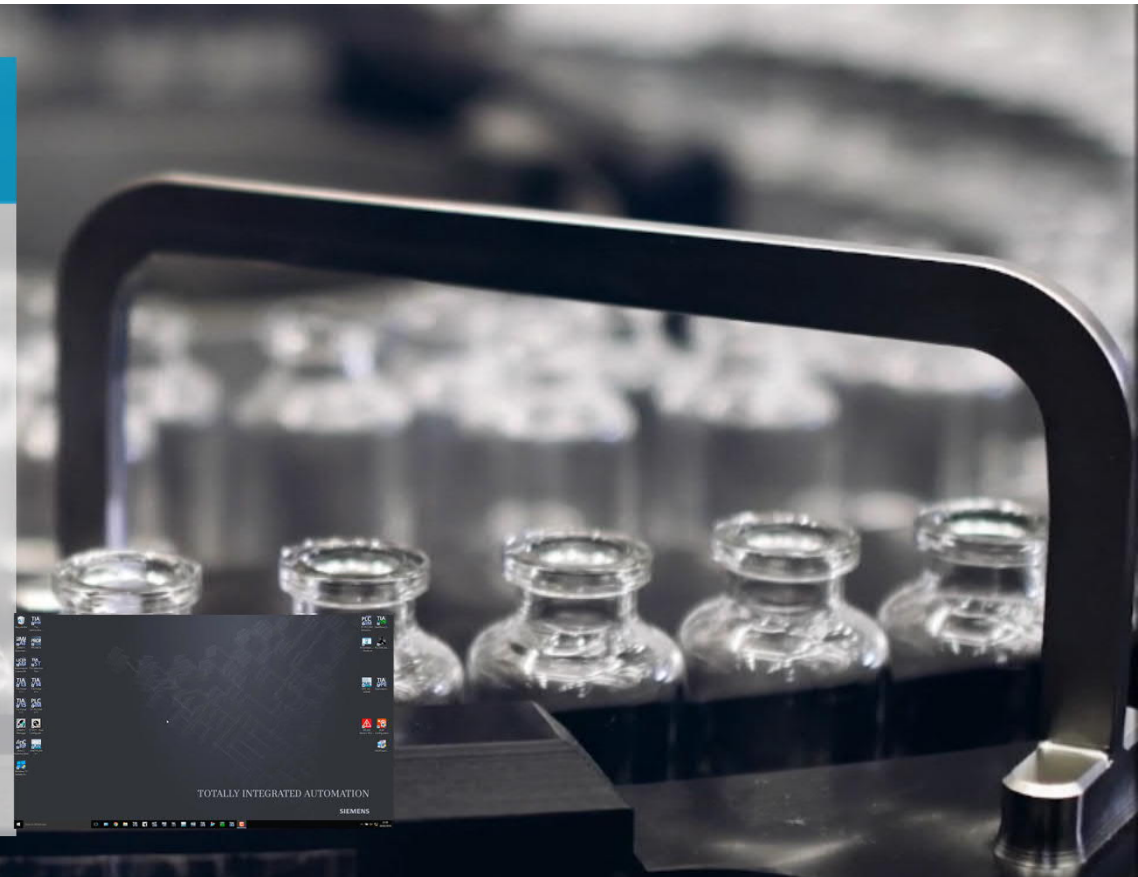
PLCSIM Advanced

Overview of licensing concept

- PLCSIM Advanced can be upgraded to the latest version
- One license activates PLCSIM Advanced instances on your PC
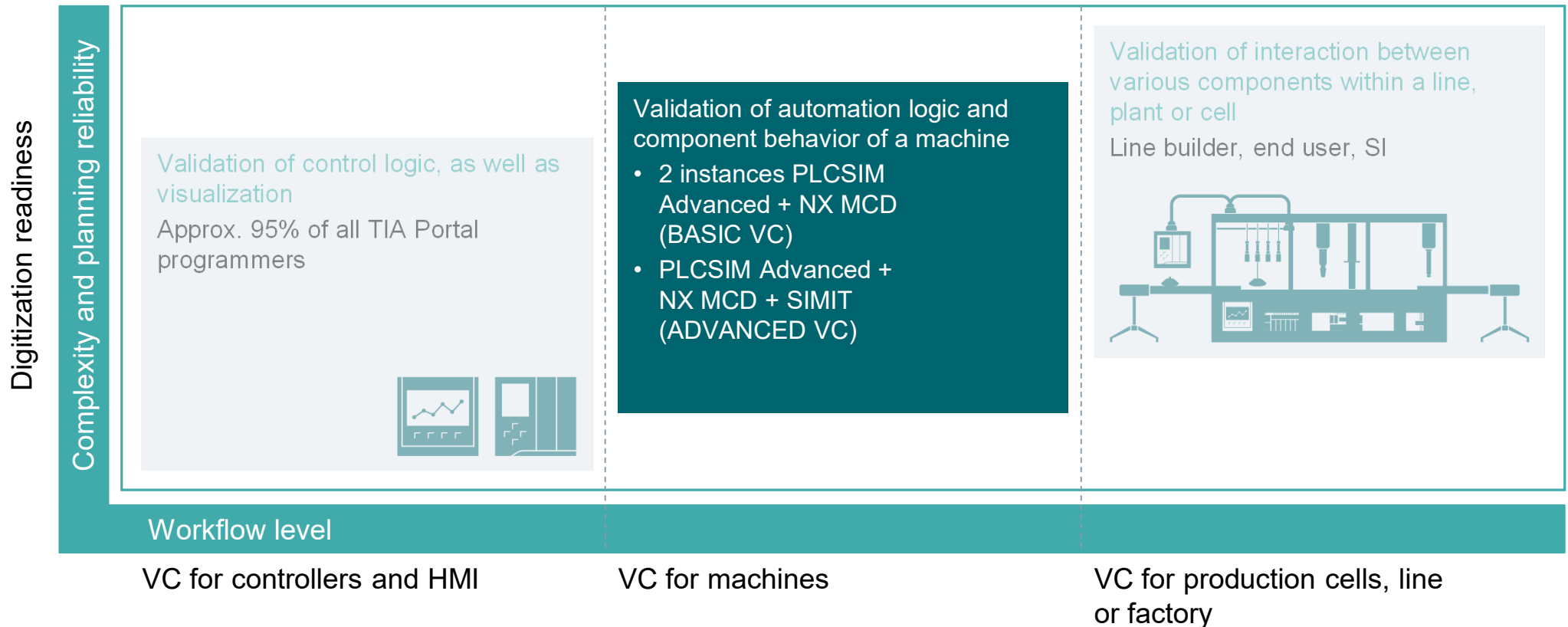
License options

- Floating License
- Trial – 21-day trial available for download
  https://support.industry.siemens.com/cs/
  de/de/view/109745647

PLCSIM Adv. V1.0

Upgrade
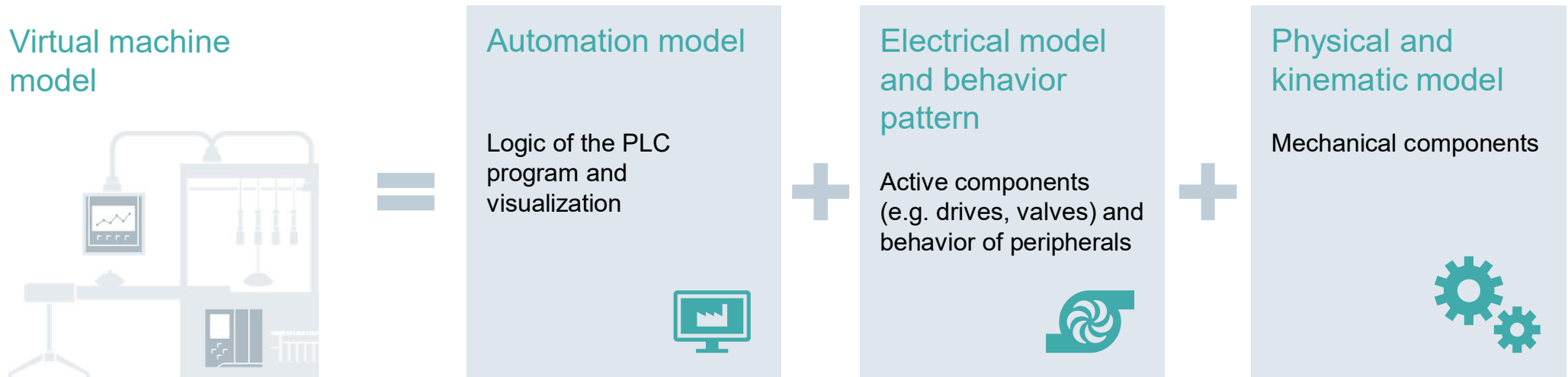
PLCSIM Adv. V2.0

Instance 1   Instance 2

»The customer receives all aspects of virtual commissioning from a single source – mechanical concept, automation, and even the physical behavior pattern.«

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The Siemens portfolio offers solution scenarios for virtual commissioning for all analysis stages

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Digitization readiness

Complexity and planning reliability

Validation of control logic, as well as visualization

Approx. 95% of all TIA Portal programmers

Validation of automation logic and component behavior of a machine
- 2 instances PLCSIM Advanced + NX MCD (BASIC VC)
- PLCSIM Advanced + NX MCD + SIMIT (ADVANCED VC)

Validation of interaction between various components within a line, plant or cell

Line builder, end user, SI

Workflow level

VC for controllers and HMI

VC for machines

VC for production cells, line or factory

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The virtual machine model is a combination of different simulation models

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Virtual machine model

=

Automation model

Logic of the PLC program and visualization

+

Electrical model and behavior pattern

Active components (e.g. drives, valves) and behavior of peripherals

+

Physical and kinematic model

Mechanical components

Siemens offers
- One integrated software landscape
- Implemented interfaces to PLCSIM Advanced
- Presales and consulting support

SIMATIC Machine Simulator in combination with NX MCD enables virtual commissioning for machines

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1 **Control emulation with PLCSIM Advanced**
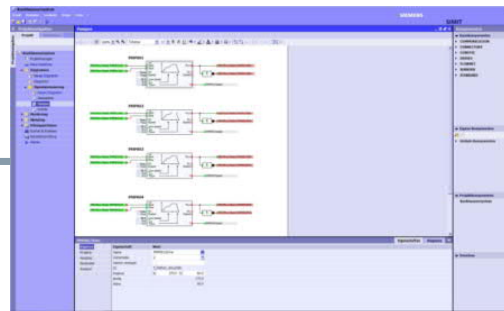- Interface of I/O scan to behavior model
- Output of motion position/speed
- Time management
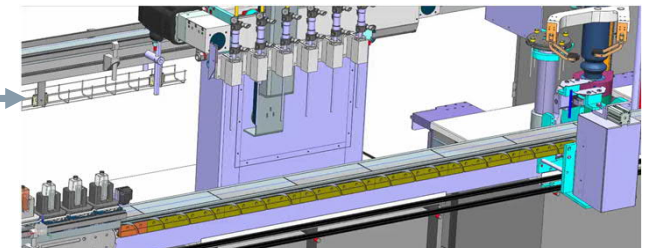- Common startup/shutdown/ failure handling

2 **Behavior model with SIMIT**
- Sensors
- Actuators
- Process features
- Temperature
- Pressure
- Hydraulics
- Pneumatic

3 **Kinematic model with NX MCD**
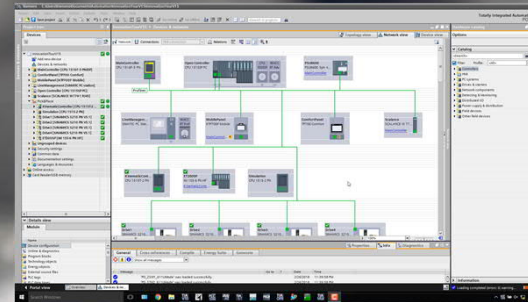- Motion
- Material flow
- Collision check

- Input/Output
- Axis position and speed

Position of axes

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Virtual commissioning with two PLCSIM Advanced instances and Crosslink

Live demonstration

Virtual Commissioning by basic behavior modeling with
SIMATIC S7-PLCSIM Advanced
https://support.industry.siemens.com/cs/ww/en/view/109754823

The Siemens portfolio offers solution scenarios for virtual commissioning for all analysis stages

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Complexity and planning reliability

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Approx. 95% of all TIA Portal programmers

Validation of automation logic and component behavior of a machine OEM

Validation of interaction between various components within a line, plant or cell

Combination of
- PLCSIM Advanced
- TECNOMATIX Process Simulate

Workflow level

VC for controllers and HMI

VC for machines

VC for production cells, line or factory

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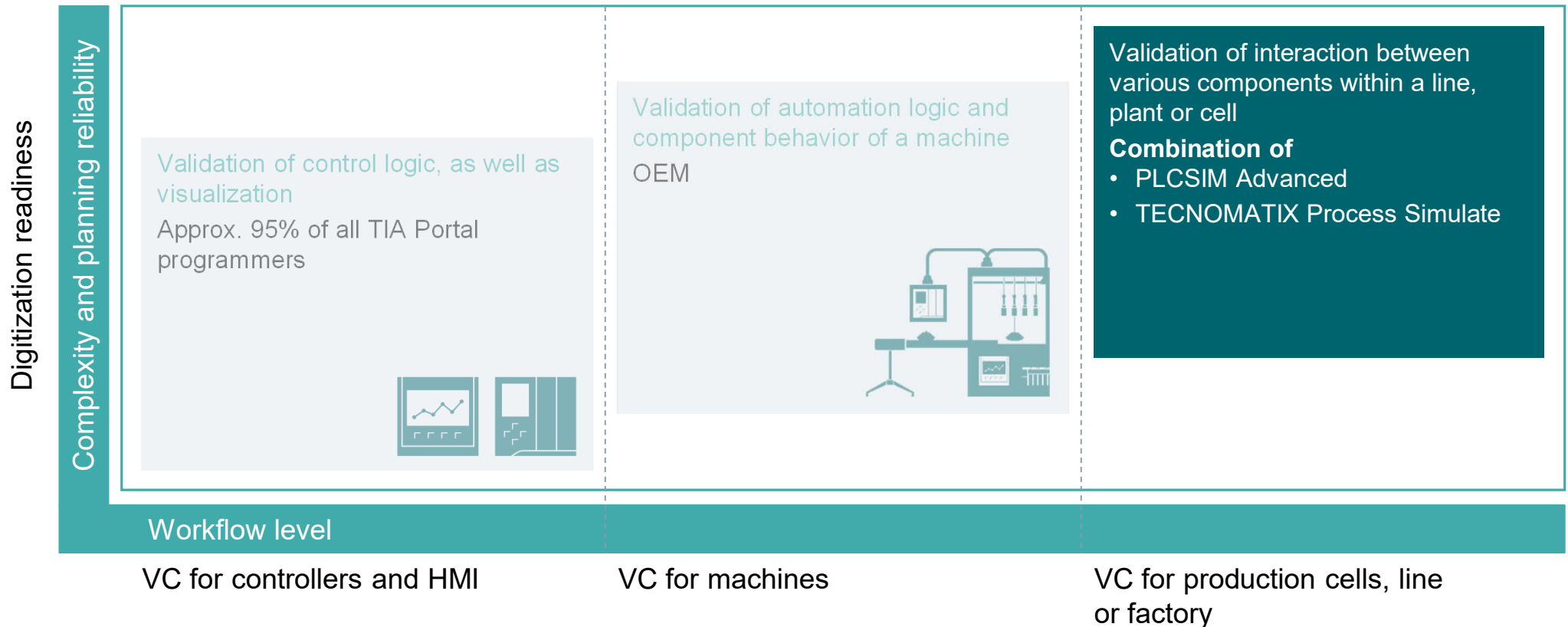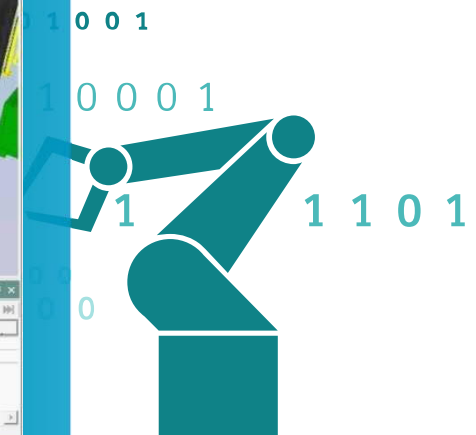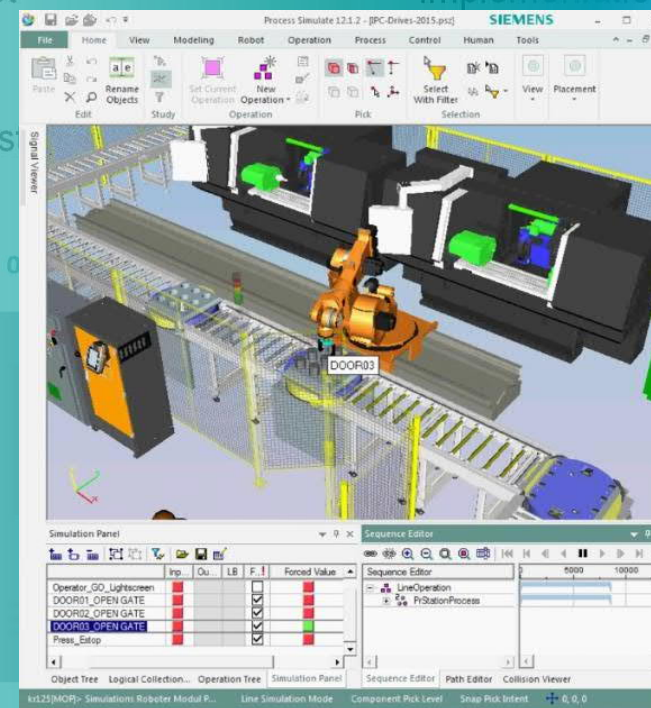
Cell validation –
Virtual commissioning with the assistance of »Process Simulate«

Capabilities

- Validation of mechanical processes
- Verification of the PLC code, robot program and HMIs
- Checking of safety interlock
- Implementation of system diagnostics

Key points

- Development of complete robot programs
- Implementation of »if-then« (potential errors)
- to cell construction

Example of "Process Simulate":

`1 0 1 0 1 0 1 1 1 0 1 0 0`
`1 0 1 0 1 0 1 1 1 0 1 0 0 1 1 0 1`
`1 0 1` `0` `0 1 0`
`0 0 1 0 0 1 0 1 0`
`1 1 0 0 1 0 1`
`0 1 0`
`0 1 0 1 0 1 1 1 0 1`

`1 0 0 1`
`1 0 0 0 1`
`1` `1 1 0 1`

Summary of digital workflow –
Virtual commissioning

1 | High quality

… by optimizing the control project and machine functionality in a virtual environment

2 | Speed

… due to shorter commissioning times in the plant and parallel implementation of mechanical and automation engineering

3 | Minimize costs and risks

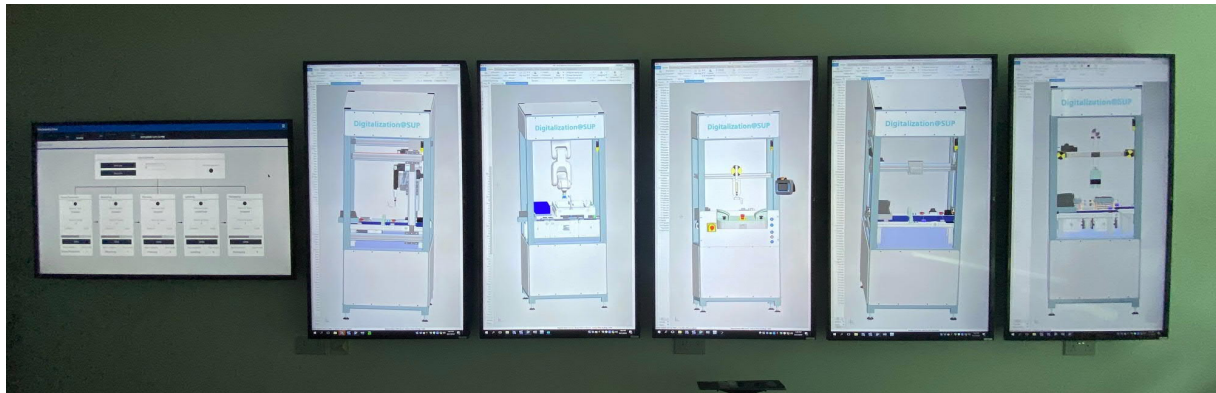… through lower commissioning costs and fewer fault conditions in the actual plant

4 | Utmost flexibility

… by way of a »laboratory« for the development of alternative control concepts and the evaluation of changes to the machine during ongoing operation
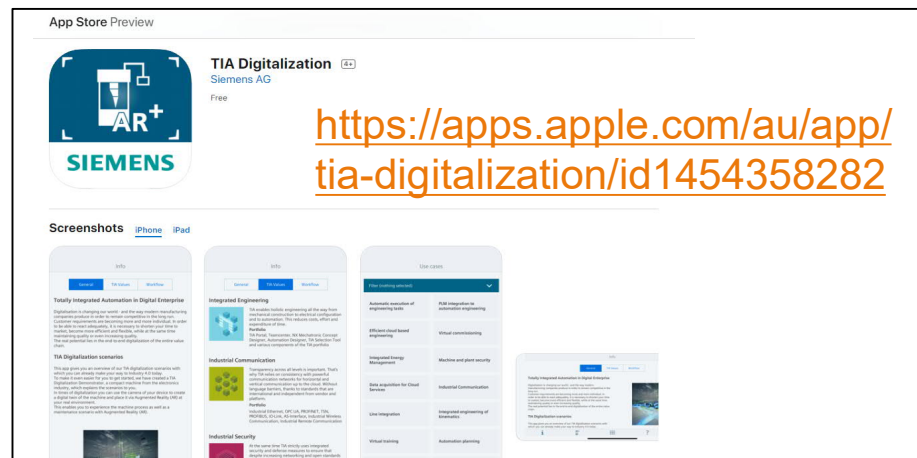
Singapore Digitalization Demo Room

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Looking for the value add and finding **#siemens** solutions in **#digitalization** around **#TIA** and **#simatic** where **#tiaportal** connects you to the **#future** of Automation

Today **MM Electrical Merchandising** was visiting us in our Singapore office. Together with **Bernd Lieberth** we could present f.e. the concept for a Digital Twin based on our demo-machine.

Thanks to **APS Industrial** and especially **Rupert Blatch** and **Kevin Toohey** from MM Electrical for beeing our guest, see you soon!

App Store Preview

TIA Digitalization
Siemens AG
Free

https://apps.apple.com/au/app/tia-digitalization/id1454358282

Screenshots   iPhone   iPad

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Thanks for listening

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