



| Real Digital Twin

Vårens webinarier om simulering och virtuell driftsättning

Din digitala väg till snabbare, smidigare och mer kostnadseffektiv utveckling och tillverkning



Generell simulering

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Real Digital Twin

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Junior arbetskraft till senior –
på kortare och kortare tid

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Snabb driftsättning och ökad
produktionstakt genom
produktionssimulering

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Rundbordssamtal om simulation
och produktion

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| Real Digital Twin

Fredag 12 mars – 10:00-10:45

Hur tekniken som ligger bakom lösningarna ser ut och varför en digital tvilling kan skapa bättre produktionslösningar och öka produktiviteten.

I detta webinarium kommer Andreas Buhlin från AFRY att presentera deras koncept RDT, som bygger på Siemens simuleringsmjukvaror. Han kommer att berätta mer om tekniken som ligger bakom lösningarna, arbetsmetoderna de använder sig av, samt visa ett par praktiska exempel.



Andreas Buhlin
Head of development RDT/ RVC
Digitalization, Manager Advanced
Manufacturing at AFRY



Real Digital Twin Framework

10100
01011
11010



We make digitalization work

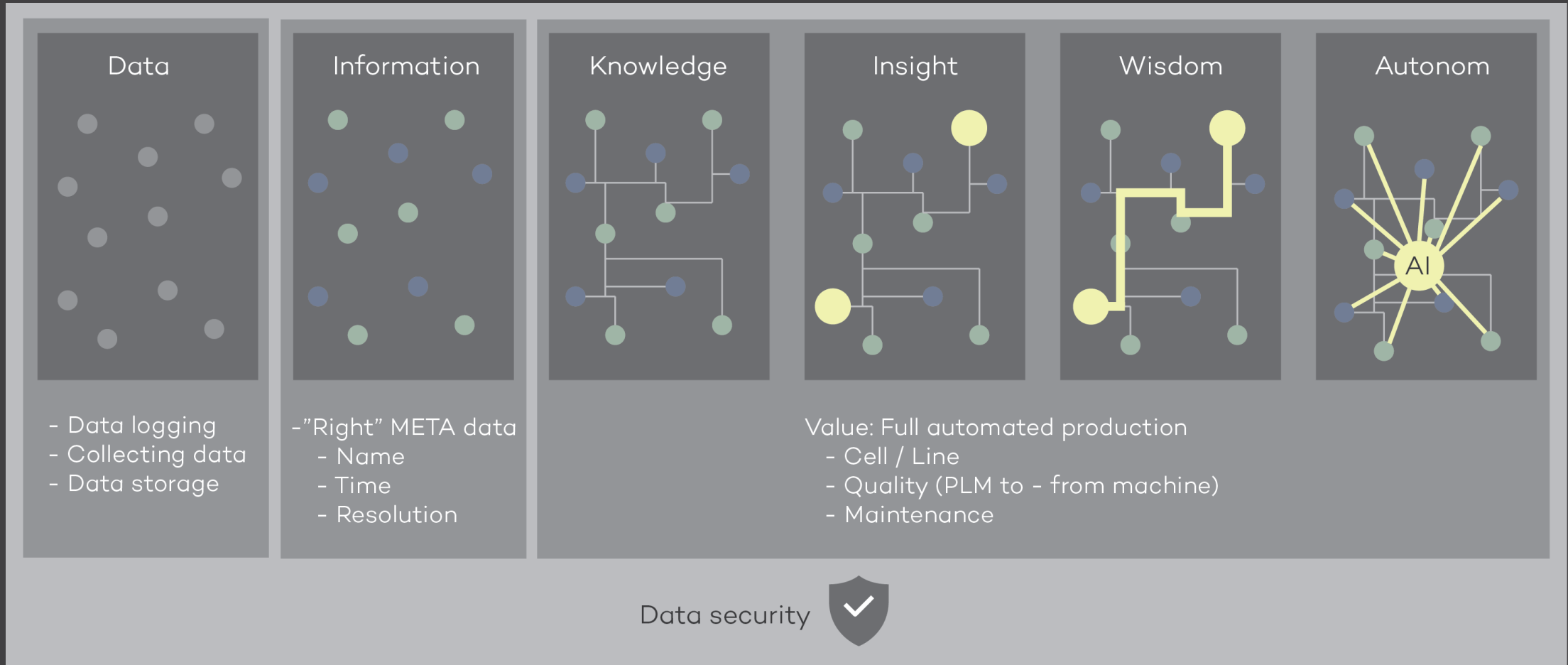


The demands / requirements for the modern industrial company

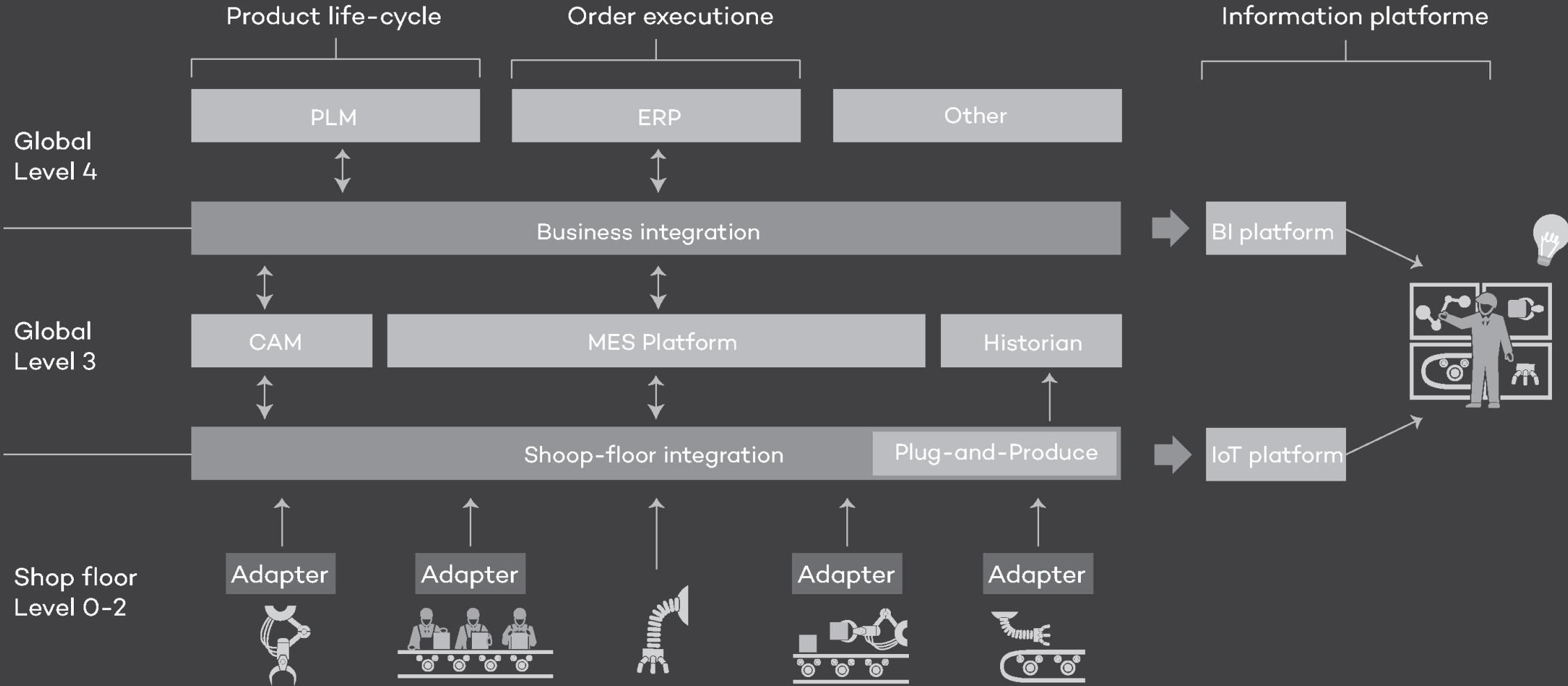
- The customer of the customer wants a unique product, fast
- Fast, flexible, scalable, safe
- Produce for order
- Global, multiple production units in different countries

FROM DATA TO WISDOM

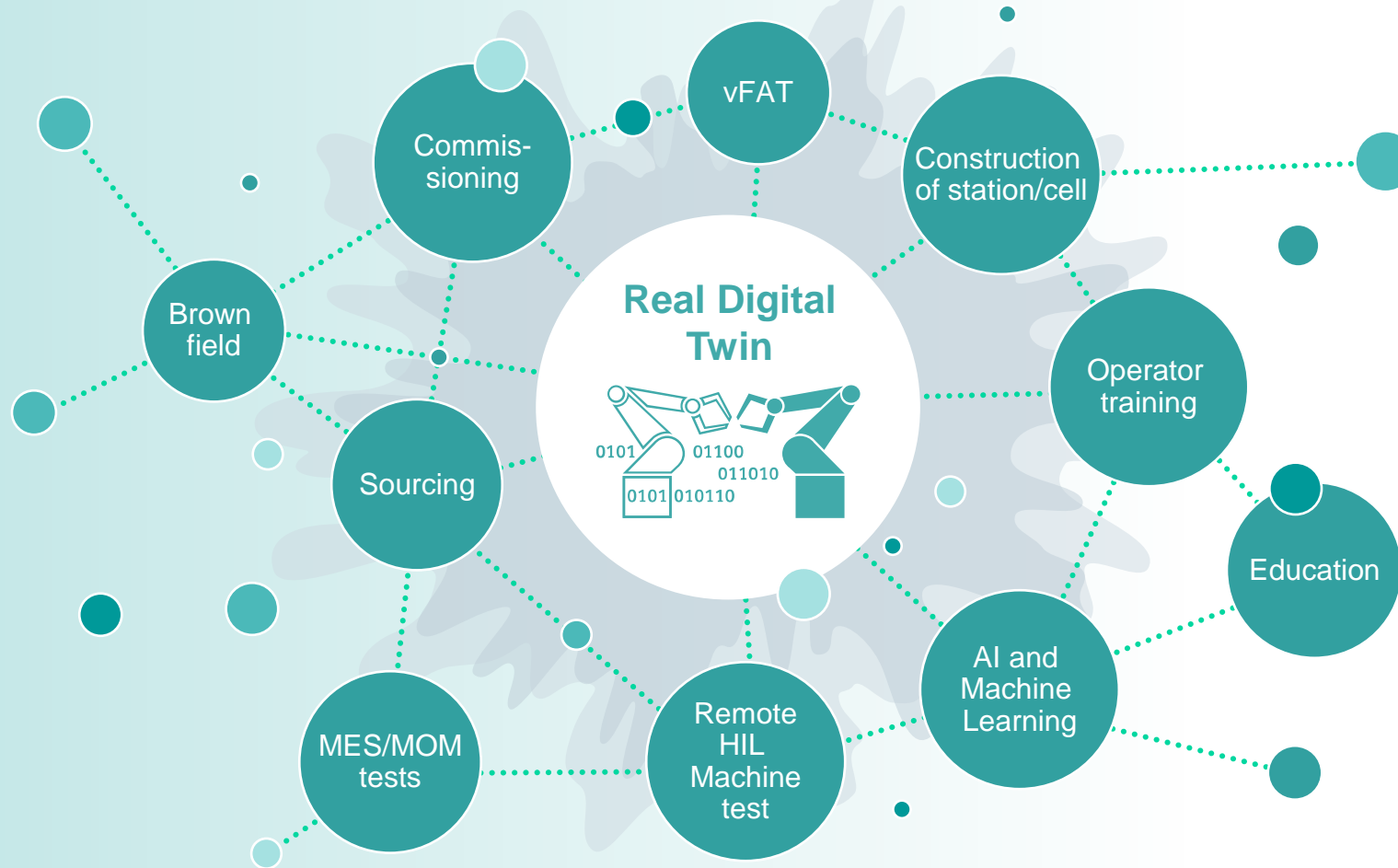
Create value based on data



Implementing the Digital Thread

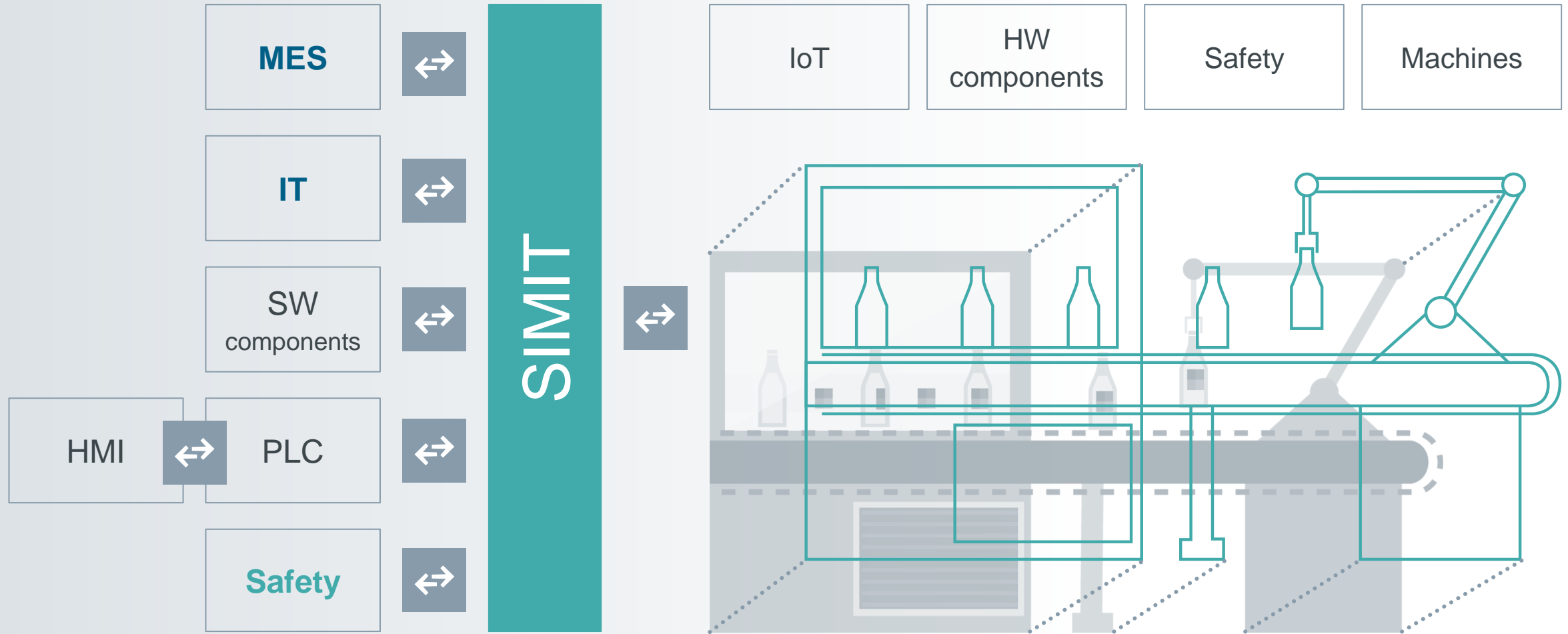


Real Digital Twin

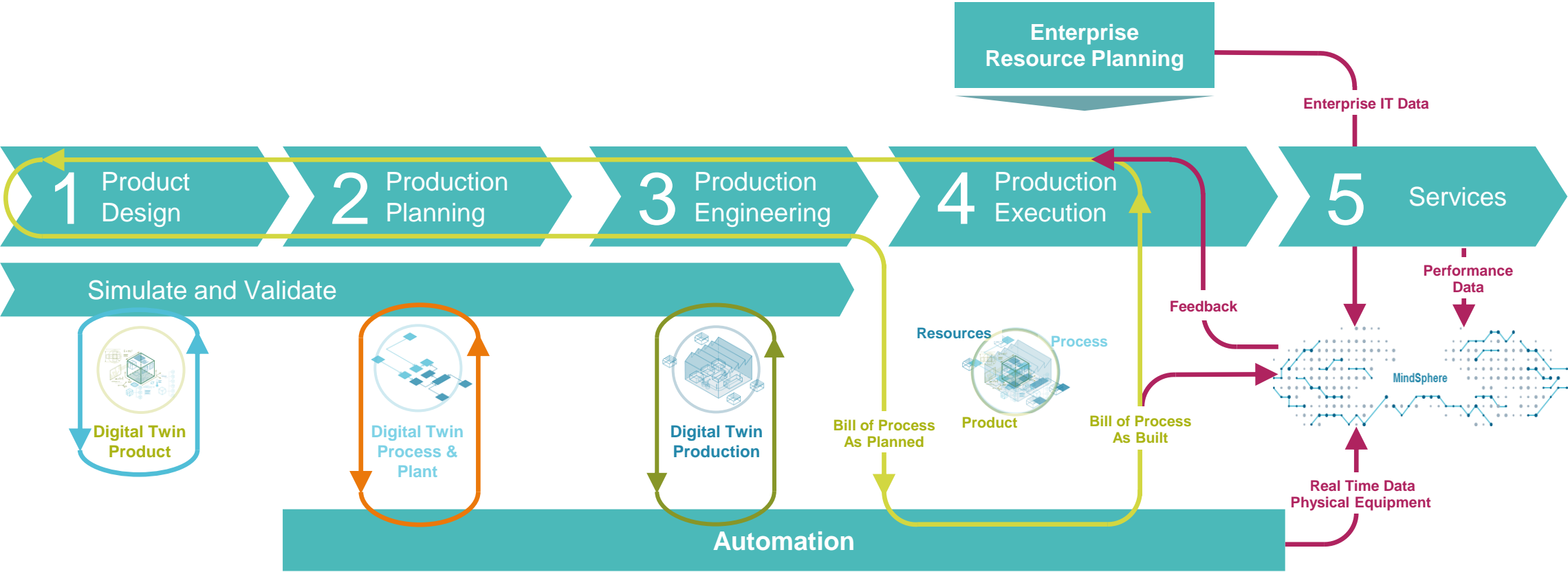


Real Digital Twin

- The architecture



One Digital Twin of Many

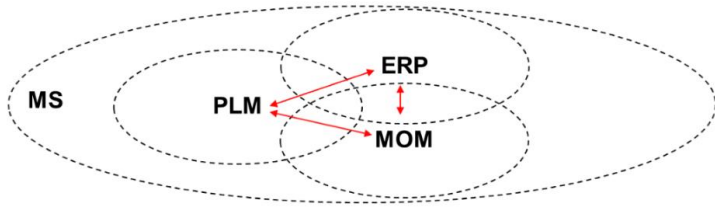


- Closed Loop Product Design
- Closed Loop Production Planning

→ Closed Loop Production

AFRY Real Digital Twin

- Closed Loop Manufacturing
- Closed Loop Analytics



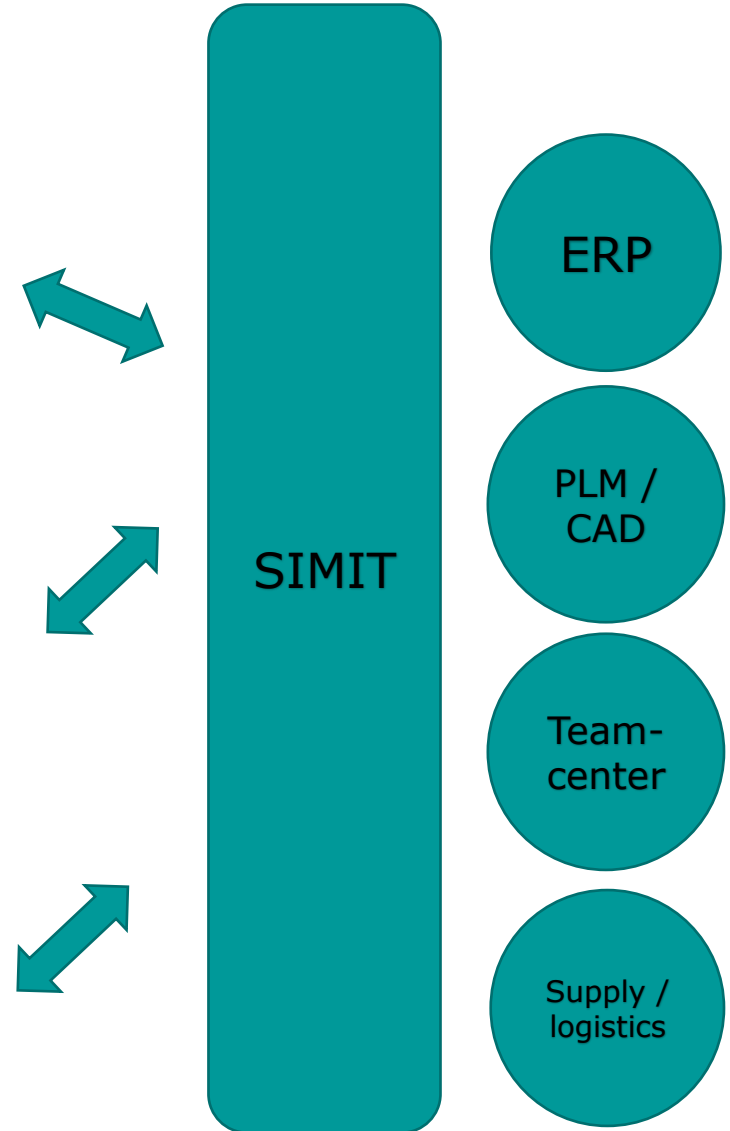
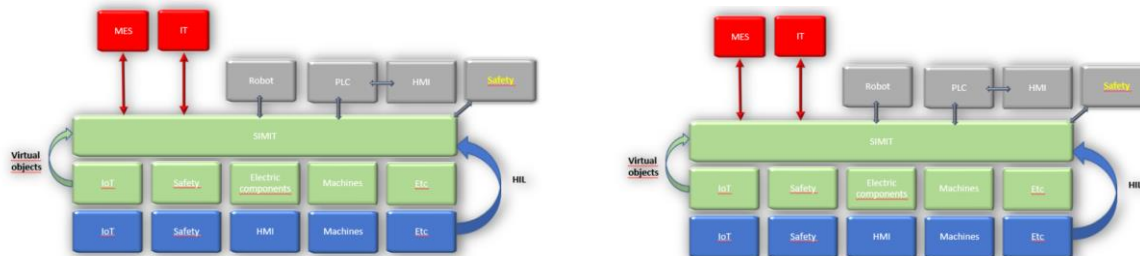
Factory level



Line level



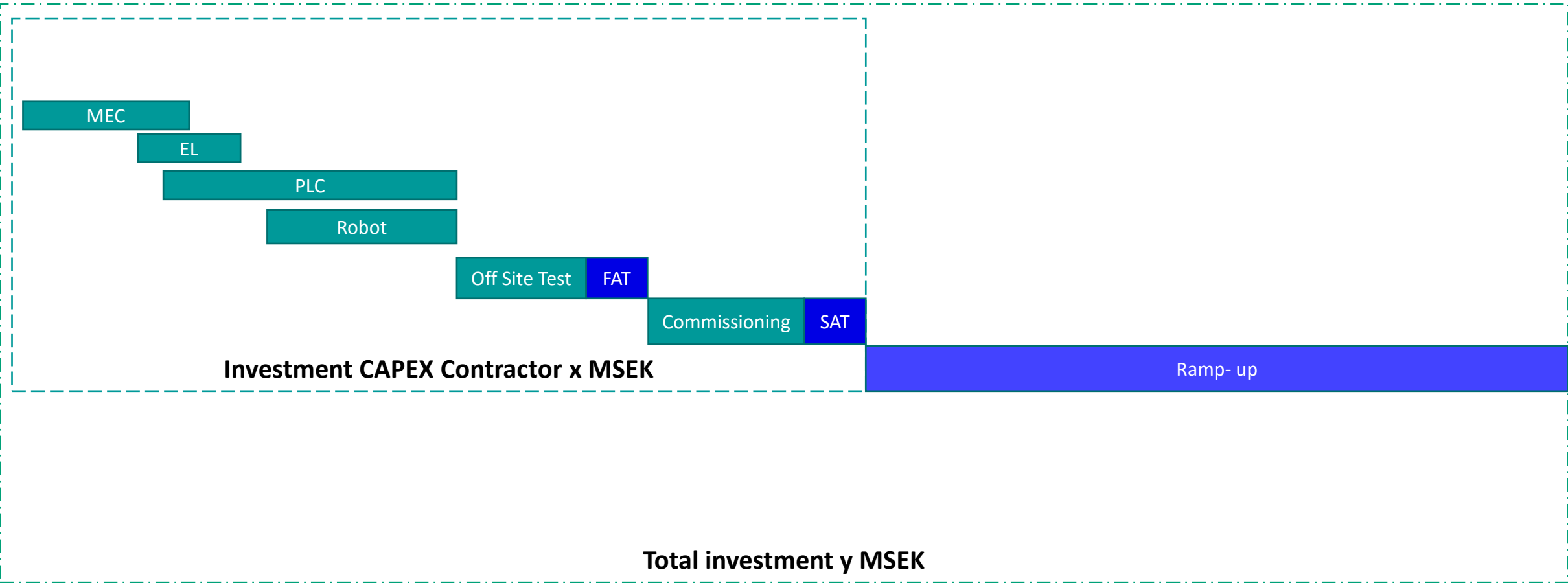
Cell level



Ordering and Project Way of Working

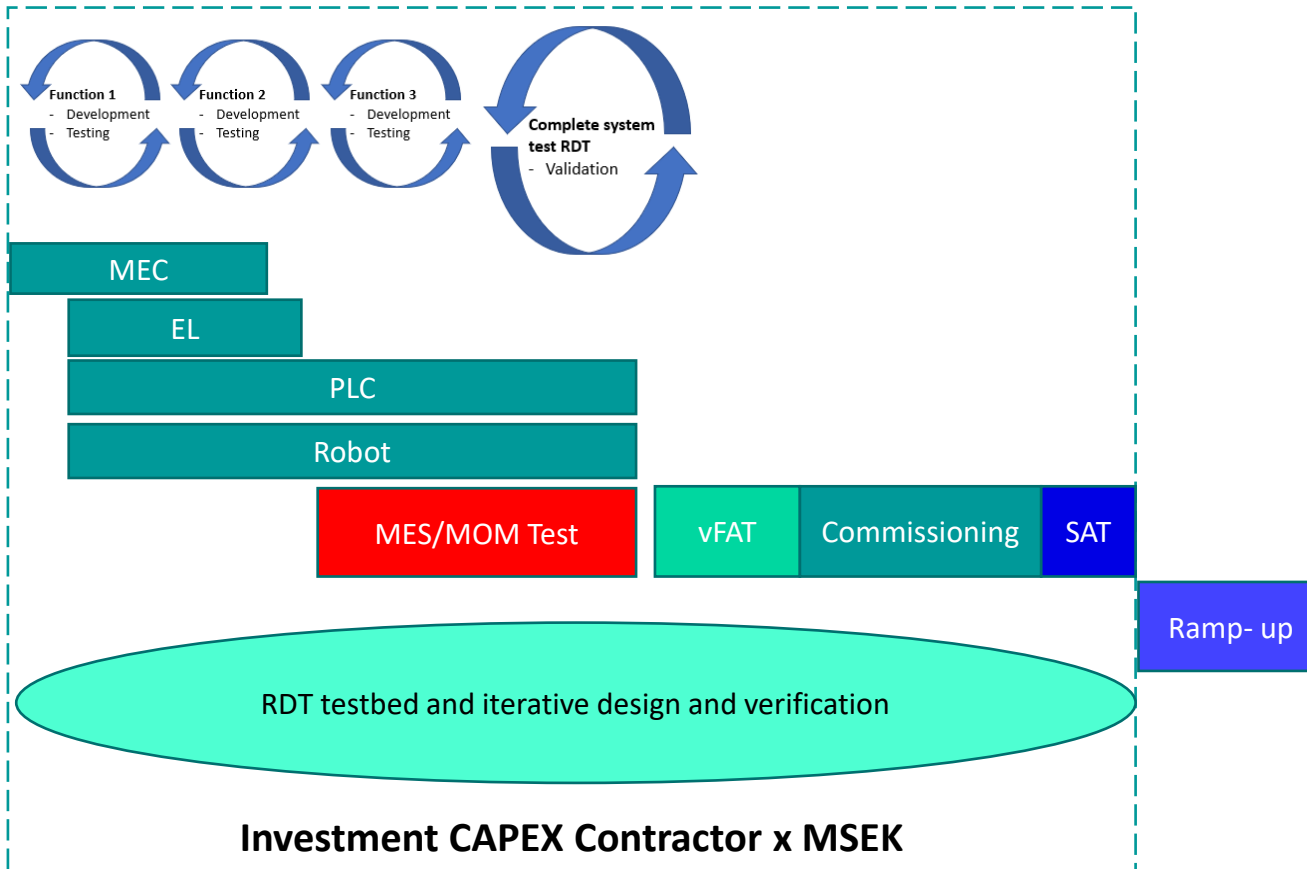
-Today's waterfall model

v1 v2 v3 v4 v5 v6 v7 v8 v9 v10 v11 v12 v13 v14 v15 v16 v17 v18 v19 v20 v21 v22 v23 v24 v25 v26 v27 v28 v29 v30 v31 v32 v33 v34 v35 v36 v37 v38 v39 v40



New Agile RDT Way of Working

v1 v2 v3 v4 v5 v6 v7 v8 v9 v10 v11 v12 v13 v14 v15 v16 v17 v18 v19 v20 v21 v22 v23 v24 v25 v26 v27 v28 v29 v30 v31 v32 v33 v34 v35 v36 v37 v38 v39 v40



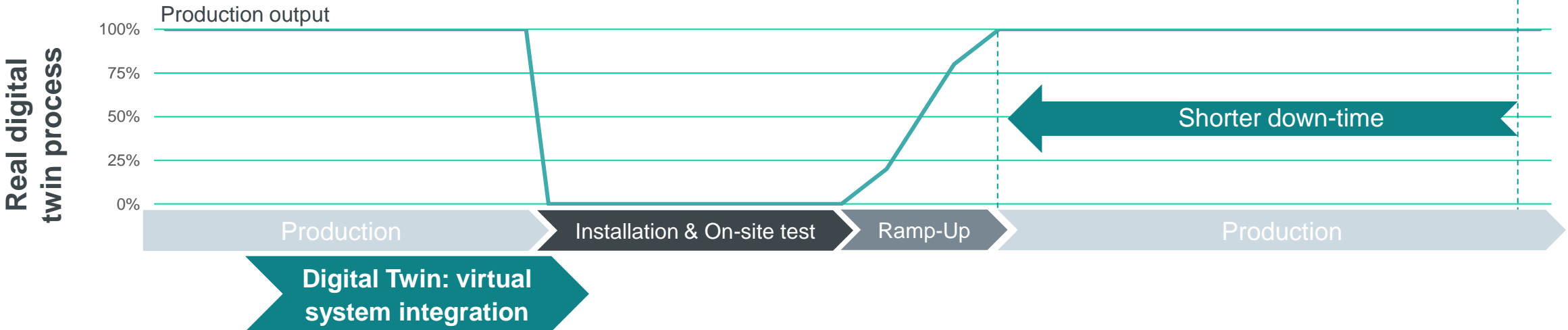
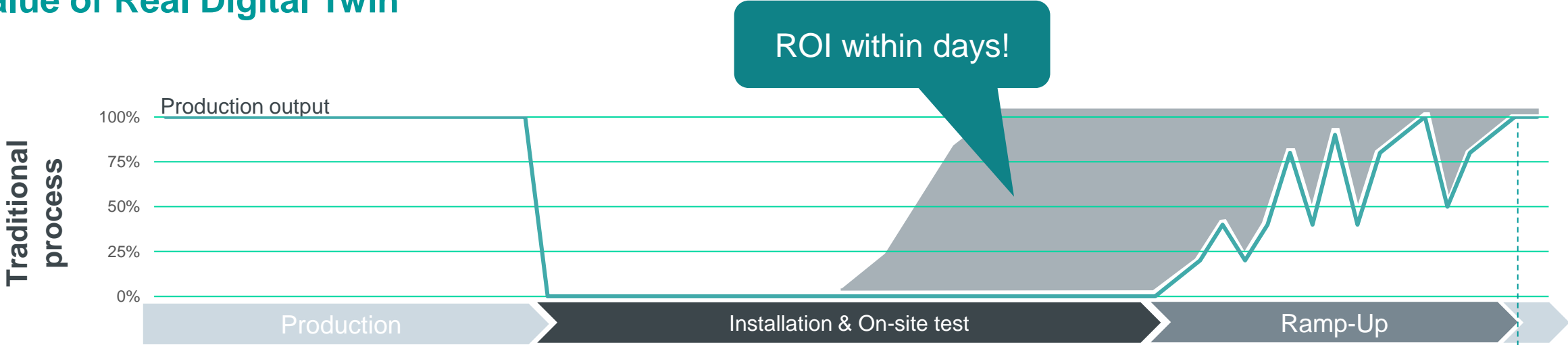
Total investment cost y MSEK

Result

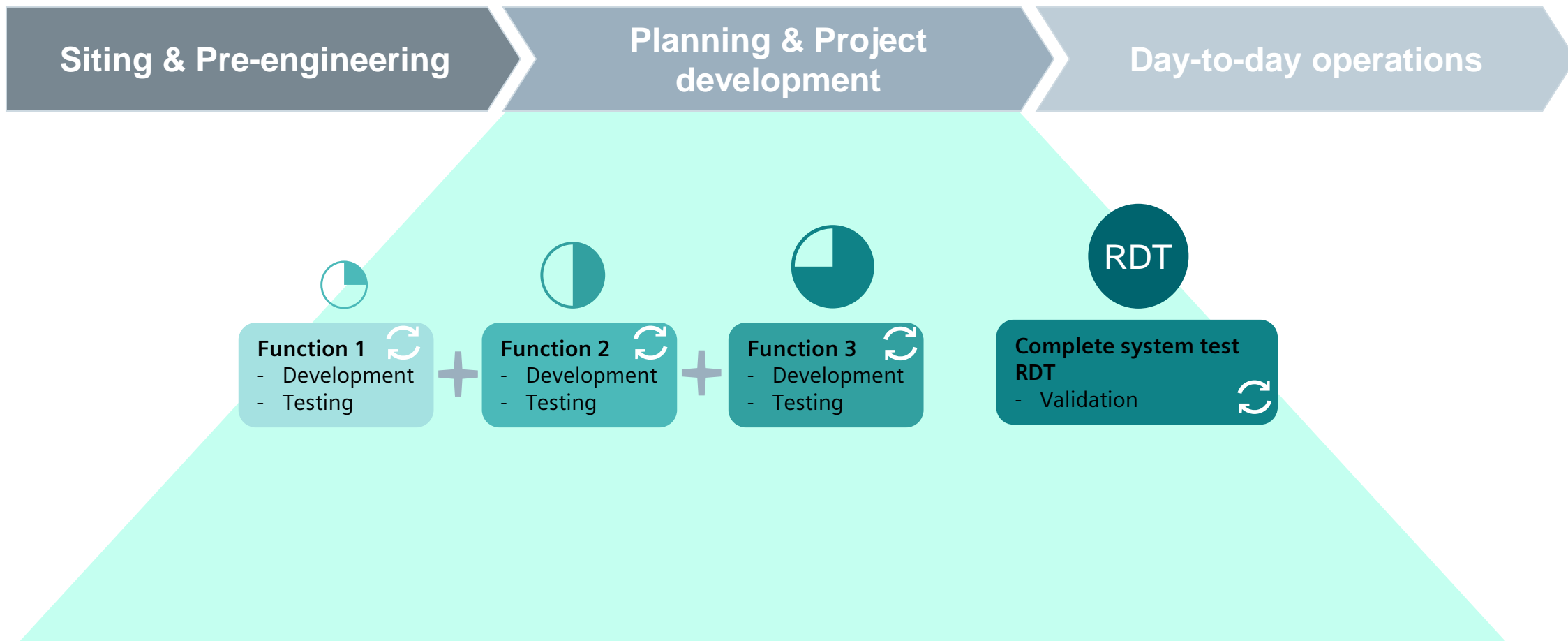
- Reduced total cost
- Better quality
- Digital Twin

-xx MSEK

Value of Real Digital Twin



Real Digital Twin – Applicable over complete Asset Lifecycle



Virtual Components



Project navigation

- Project
- Configuration
- SPEAR
- Project manager
- Couplings
- Charts
- Robot cell
- 10 - ROBOT GRIPPER
- 11 - RING MAGAZINE BUFFER
- 17 - TURNING STATION
- 18 - PALLET MAGAZINE
- 19 - PAPER MAGAZINE
- 2 - HONING
- 20 - DMC
- 3 - DEMAG
- 4 - WASHER
- 5 - CHM
- 6 - EDDY CURRENT
- 7 - LASER
- 8 - OUTPALLET
- 9 - INSPECTION STATION
- HMI_PANEL
- HMI TEST
- Knappdosa mini
- Knappdosa 2D
- Processlevel
- Monitoring
- Scripting
- Lists
- Snapshots
- Find & replace
- Consistency check
- Start

Robot cell

Properties

Property	Value
Name	NDT CELL
Width	1075
Height	700
Scale	1 px : 1 mm
Background image	

Diagnosics

- L_PNPD_Diag
- L_Life_bit
- L_Entrance_request_robot_cell
- R42
- R43
- R44
- R45
- R46
- R47
- L_Ring_loaded
- L_Ring_unloaded
- L_Reset_Sequence
- R53
- R54
- R55
- R56

User components

- Eddy3
- Honing
- HoningSignal
- Honingtest
- Knappdosa
- Knappdosa2D
- KnappdosaM
- Pump

Project components

SPEAR

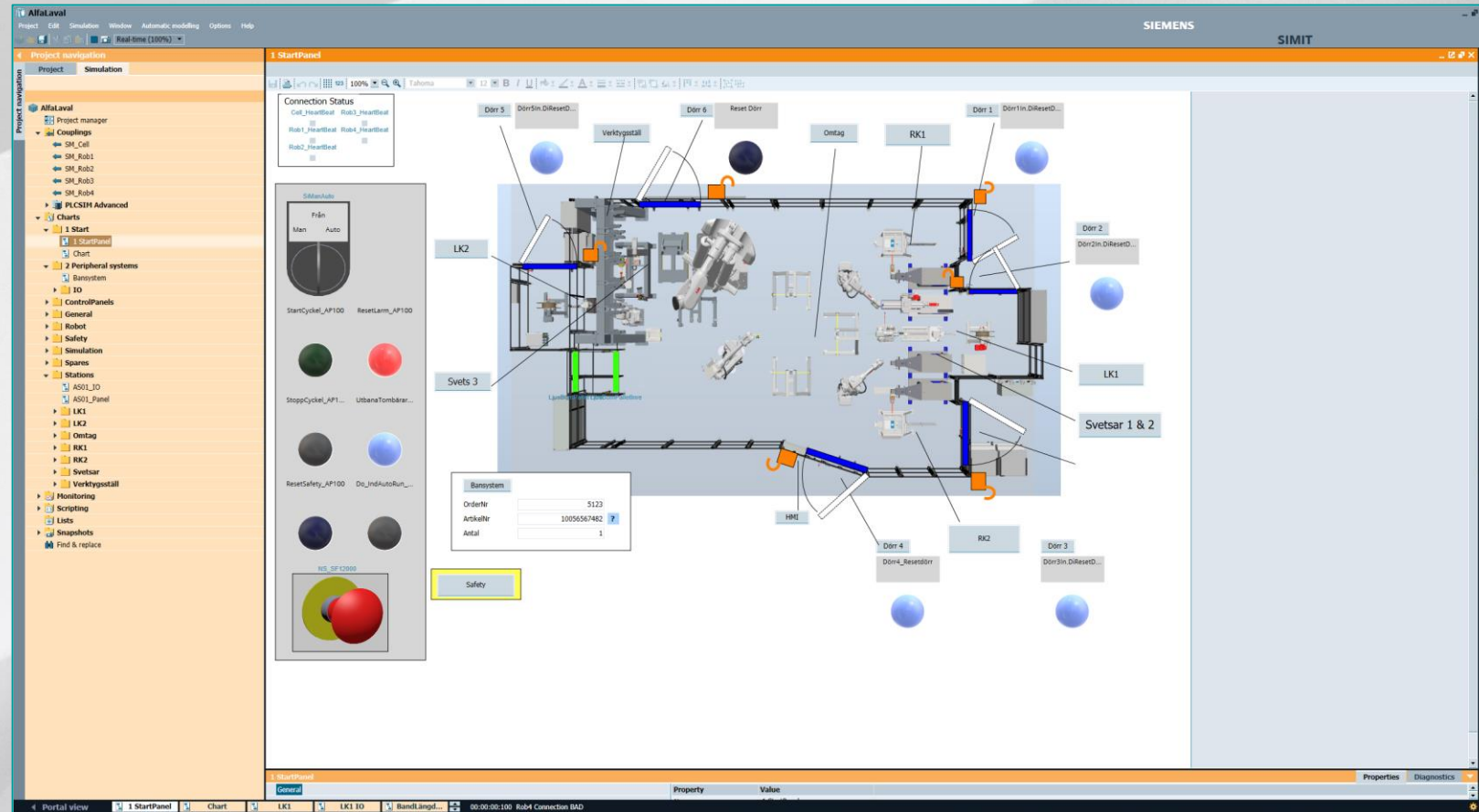
Preview

- L_PNPD_Diag
- L_Life_bit
- L_Entrance_request_robot_cell
- R42
- R43
- R44
- R45
- R46
- R47
- L_Ring_loaded
- L_Ring_unloaded
- L_Reset_Sequence
- R53
- R54
- R55
- R56

OUR TOOLS

SIMIT Simulation Platform

All equipment in the cell is modelled and visualized in the Cell overview with links to the individual virtual components.



OUR TOOLS

SIMIT Virtual components

Each virtual component in SIMIT have their I/O connected to the corresponding tag and simulate the signal behavior of the real components.

The screenshot displays the SIMIT software interface with several windows:

- SVETSVAKT 3**: A 3D model of a welding machine. To its left is a control panel window titled "Svetsvakt3" with buttons for Start, Reset Fault, E-Stop, Ready, Wrong, Lock/END, and State.
- ÅTERLEDARE**: A 3D model of a gripper. To its left is a control panel window titled "ÅterledareGripOppenSensor" with buttons for LK2_ÅterledareGrip and LK2_ÅterledareStatus.
- Bandlångsservo (TECNAWeldingController)**: A window showing internal states like RIC1-4, Timer, Program Number, and buttons for Start, Reset Fault, PLC E-Stop, Ready, Wrong, Internal E-Stop, and Reset State Machine.
- Bandlångsservo (FestoCMMF-AS-M3_M0)**: A window showing a detailed I/O list for a servo motor, including Drive Enabled, Ready, Warning, Fault, Stop, Jog Pos, Jog Neg, E-Stop PLC, Actual Position, and Actual Velocity. It also features a "Switched On" indicator and a "Safety Stop" button.

ONE OF OUR TOOLS

SIMIT Component Type Editor

The virtual models of the equipment is developed in SIMIT CTE with signal definitions, signal response and HMI.

The components behavior is programmed with C-code which is executed by SIMIT during the simulation of component.

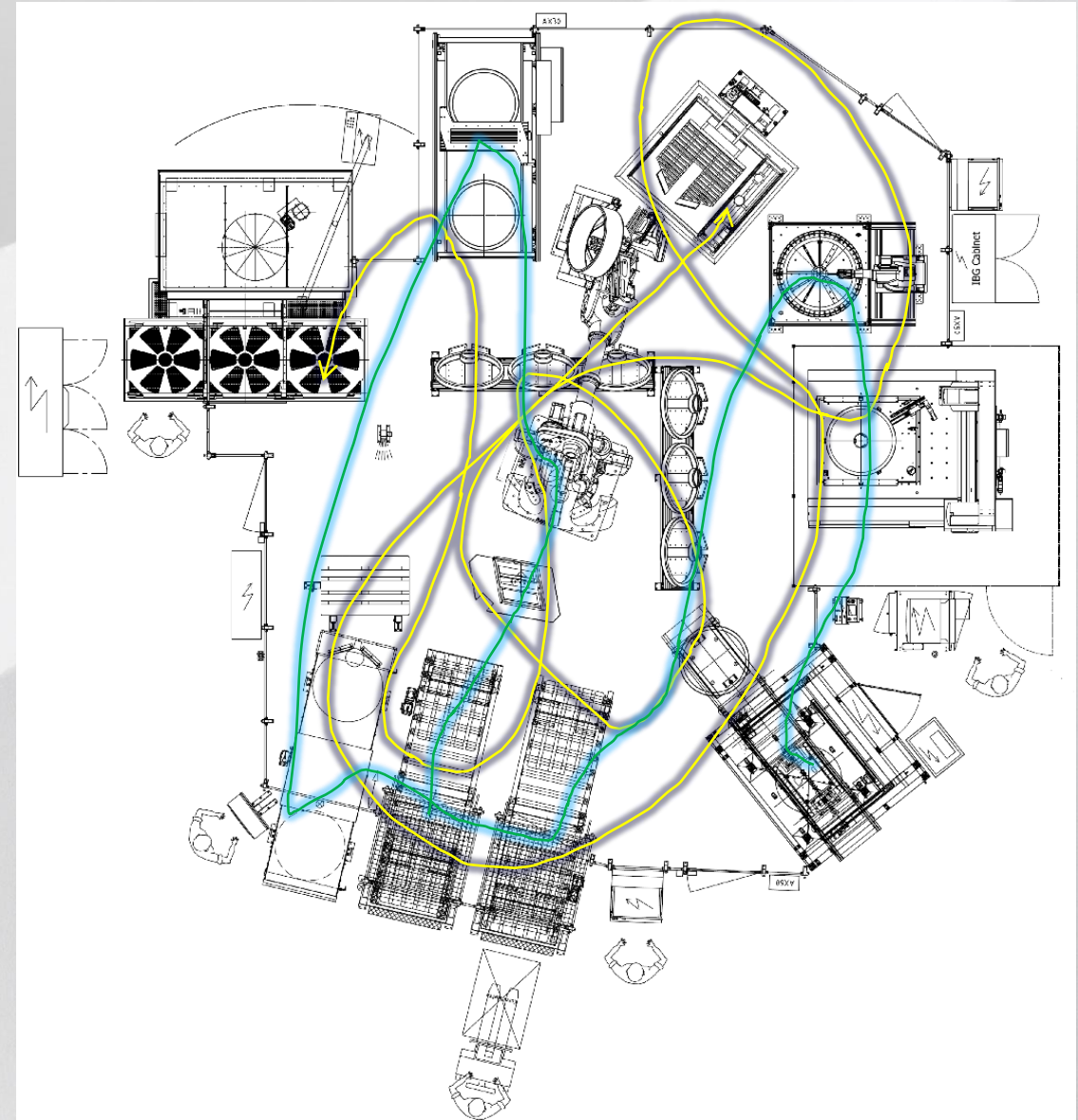
The screenshot displays the SIMIT Component Type Editor interface, which is used for developing virtual models of equipment. The interface is divided into several panels:

- Navigation Panel (Left):** Shows a tree view of the component structure, including General, Connectors, Parameter, Behavior (States, Initialization, Cyclic calculation), Functions, Topology, and Visualization (Basic symbol, Link, Operating window).
- Code Editor (Top Right):** Displays C-code for the 'Cyclic calculation' component. The code includes signal definitions and logic for handling life bits, robot cell entrance, and emergency stops.
- Connectors Panel (Bottom Right):** A table listing the component's connectors and their connection types.
- HMI Configuration Panel (Right):** Shows a graphical representation of the component's HMI, including a 'Live bit' section with 'auto' and 'Reset_Sequence' indicators, and a 'PLC SIGNALS' section with various signal indicators like 'set robot outside machine', 'set loading', 'set unloading', 'machine ready for entrence', 'load workpiece', 'unload workpiece', 'Alarm', 'PLC Emergency Stop', 'Cell safety OK', 'Disable Signals', 'machine ready for robot', 'loading', and 'unloading'.

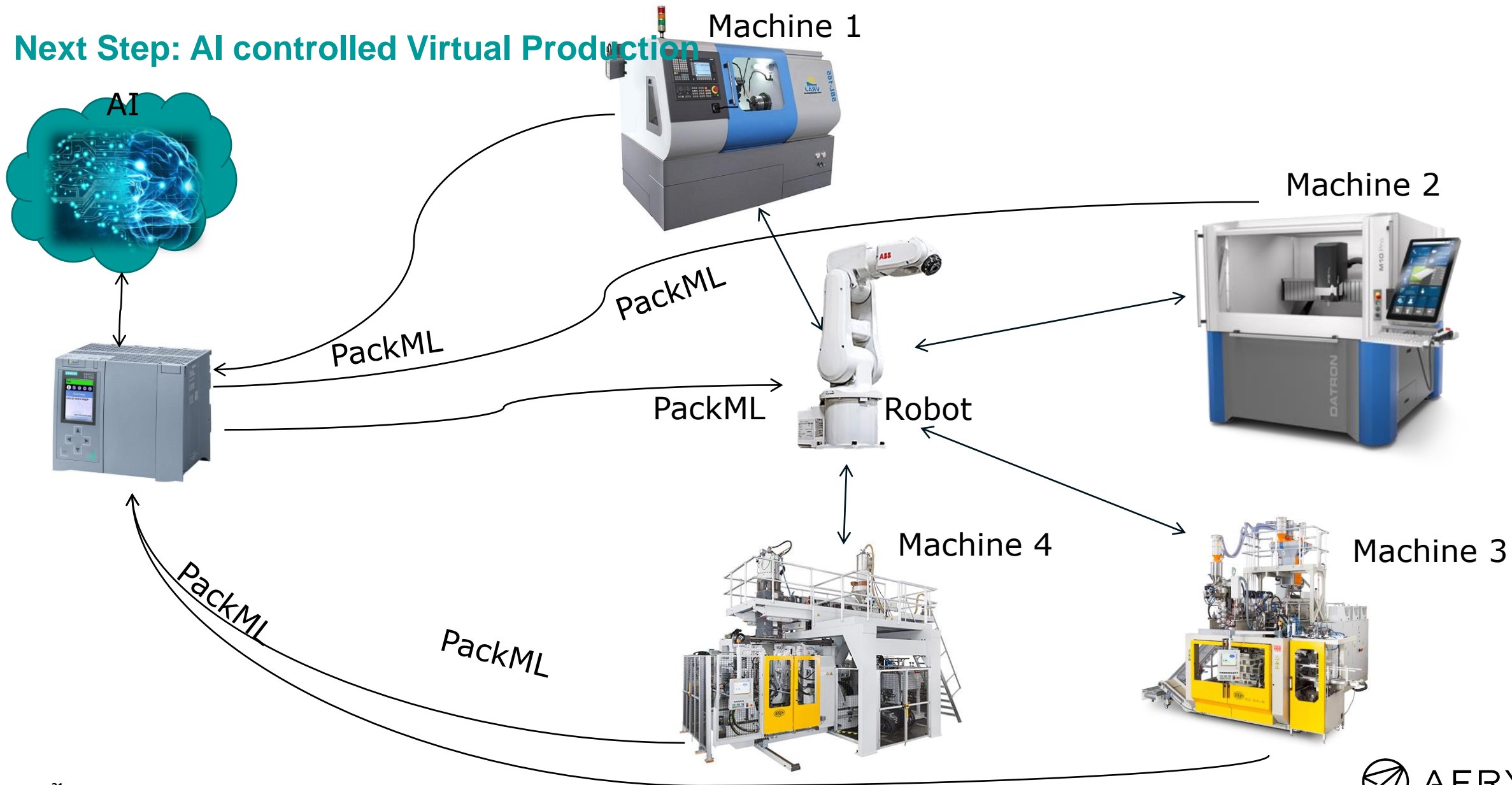
Name	Connection type
I_PNPD_Diag	integer
I_Life_bit	binary
I_Entrence_request_robot_cell	binary
R42	binary
R43	binary
R44	binary
R45	binary
R46	binary
R47	binary
I_Ring_loaded	binary
I_Ring_unloaded	binary
I_Reset_Sequence	binary
R53	binary
R54	binary
R55	binary
R56	binary
R57	binary

Smart material handling cell

- Unique Products
- Parameter driven production control
- Possibility for parallel flows
- Multiple possible paths
- Independent resources
- Interrelated production flows
- Shifting bottlenecks
- Potential to optimize flow
- Standard interface between control system and machines



Next Step: AI controlled Virtual Production

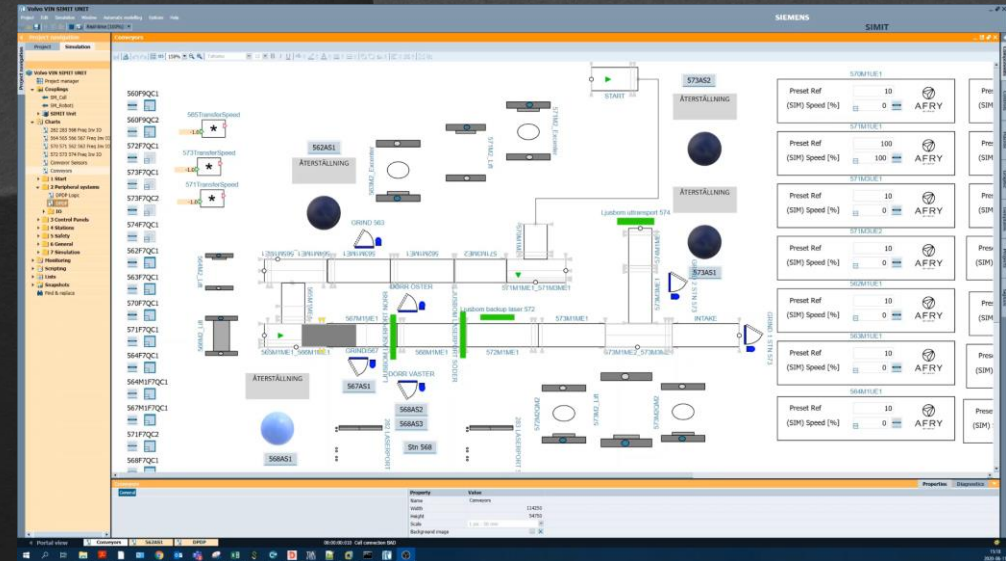


RDT – Baseline emulation with SIMIT

The customer was worried that the new functions would not be finished in time due to a short commissioning and test phase. Therefore it was decided that a RDT of the site would be created with main aim to be able to test the code for the conveyor system, lifting tables, safety concept and integration to adjacent system.

Business case using RDT

Estimated time saved to at least 2 workdays of troubleshooting the PLC code, by using the RDT. This means a two workdays delay in production start with a loss of approximately 1 car/minute. Estimated savings in MSEK.



RDT – Emulation Robot cell with VR, graphics and physics

RDT – Food&Pharma



RDT – Different usage examples

Operator Training in VR



[Real Virtual Commissioning Part 3 Operator Training - YouTube](#)

HIL – Machine validation



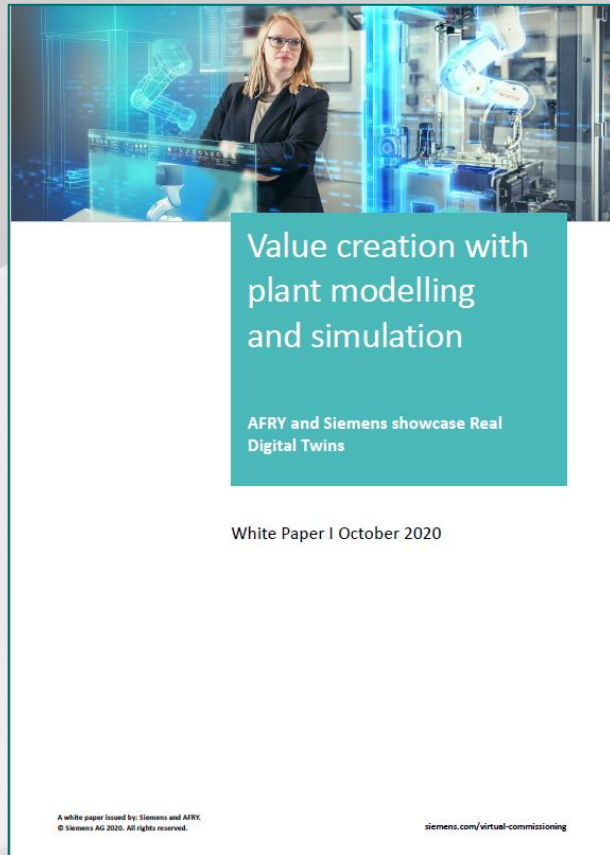
[Real Virtual commissioning with Hardware In The Loop - YouTube](#)

MES/MOM realtime test



<https://youtu.be/LlqrTbGgbE>

Value Creation with Plant Modeling and Simulation



www.siemens.se/simulering

How to start?

Think big, Start small

It's really easy, start with one object!

<https://afry.com/en/competence/real-digital-twin-framework>

Real Digital Twin

Real Virtual Commissioning - and more

The Game Changer

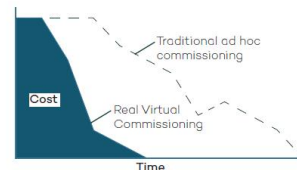
Using a Real Digital Twin of your production for commissioning and ramp-up can save you a lot of trouble, and up to 75% of the costs compared to traditional commissioning and ramp-up ad hoc.

What is a Real Digital Twin?

Real Virtual Commissioning (RVC) creates an exact digital twin of your production system including machines, sensors and actuators. It enables control of the reality through emulating plant modifications in a 100% accurate digital copy of your production environment before making changes to the actual plant.

With RVC, you can run 100% of operational testing without production stops when building or modifying a plant, which eliminates unnecessary downtime (both planned and unplanned) during commissioning and ramp-up.

Financial Benefits



The net achieved effect: a saving up to 75% to the costs and time of traditional practices.

Working with RVC Drives Value

- Faster** RVC reduce risk and saves time.
- Better** Increased performance and profits.
- Safer** Use the digital twin to train operations and maintenance staff. Avoid the risk of downtime or revenue loss.

Simulation vs. Emulation

A simulator copies something from the real world into a virtual environment - often to give you an idea about how something works. It simulates the basic behavior but doesn't necessarily abide to all the rules of the real environment that it simulates.

An emulator, on the other hand, duplicates the thing exactly as it exists in real life. The emulation is efficiently a complete imitation of the real thing - it just operates in a virtual environment instead of the real world.

Typical Surprises Found During Ramp-Up and Production

- Machines interfaces i.e. measuring devices
- Operator interaction
- ERP data exchange
- MES/MOM data exchange
- Specifications not 100%
- Sequences
- Unusual modes
- Unpredicted dependencies

Experience Your Digital Twin in Virtual Reality

The digital twin is built in 3D and using VR glasses you can step into your future production system and experience all aspects of it.



Based on Siemens technology

Think Big, Start Small

To stay in front, your company will have to start the digital journey to a more architectural approach and work cross-functional to find the issues that occur between competences.

It's important to think big and have great visions, and a good idea to start small and measure the savings in one area at a time. AFRY can help your company point out the direction and take the first step.

Simulering

Real Digital Twin – 12 mars, 10:00-10:45

I dagens webinarium om **Real Digital Twin** har Andreas Buhlin från AFRY presenterat deras koncept RDT, som bygger på Siemens simuleringsmjukvaror. Han har även berättat mer om tekniken som ligger bakom lösningarna, arbetsmetoderna de använder sig av, samt visat ett par praktiska exempel.


Du har även fått insikt och kunskap om hur det med hjälp av simulering är möjligt att:

- Minska riskerna för ökade kostnader som kan uppstå vid förändrar i produktion
- Undvika blandad kvalitet och skapa bättre produktionslösningar
- Öka produktiviteten i produktion genom att virtuell optimering i en säker, riskfri miljö
- Reducera time-to-market med krav på snabbare omställning i produktion

| Frågor?

Vårens webinarier om simulering och virtuell driftsättning

Din digitala väg till snabbare, smidigare och mer kostnadseffektiv utveckling och tillverkning



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Real Digital Twin

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Junior arbetskraft till senior –
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Snabb driftsättning och ökad
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Rundbordssamtal om simulation
och produktion

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Country Product Manager
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Andreas Buhlin

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