FACTORY-X

Factory-X

Customer Sounding Board
March 5th, 2026

PART OF MANUFACTURING-X

Supported by:
Federal Ministry for Economic Affairs and Energy
Funded by the European Union
NextGenerationEU
on the basis of a decision by the German Bundestag

Agenda
Topics and Presenters

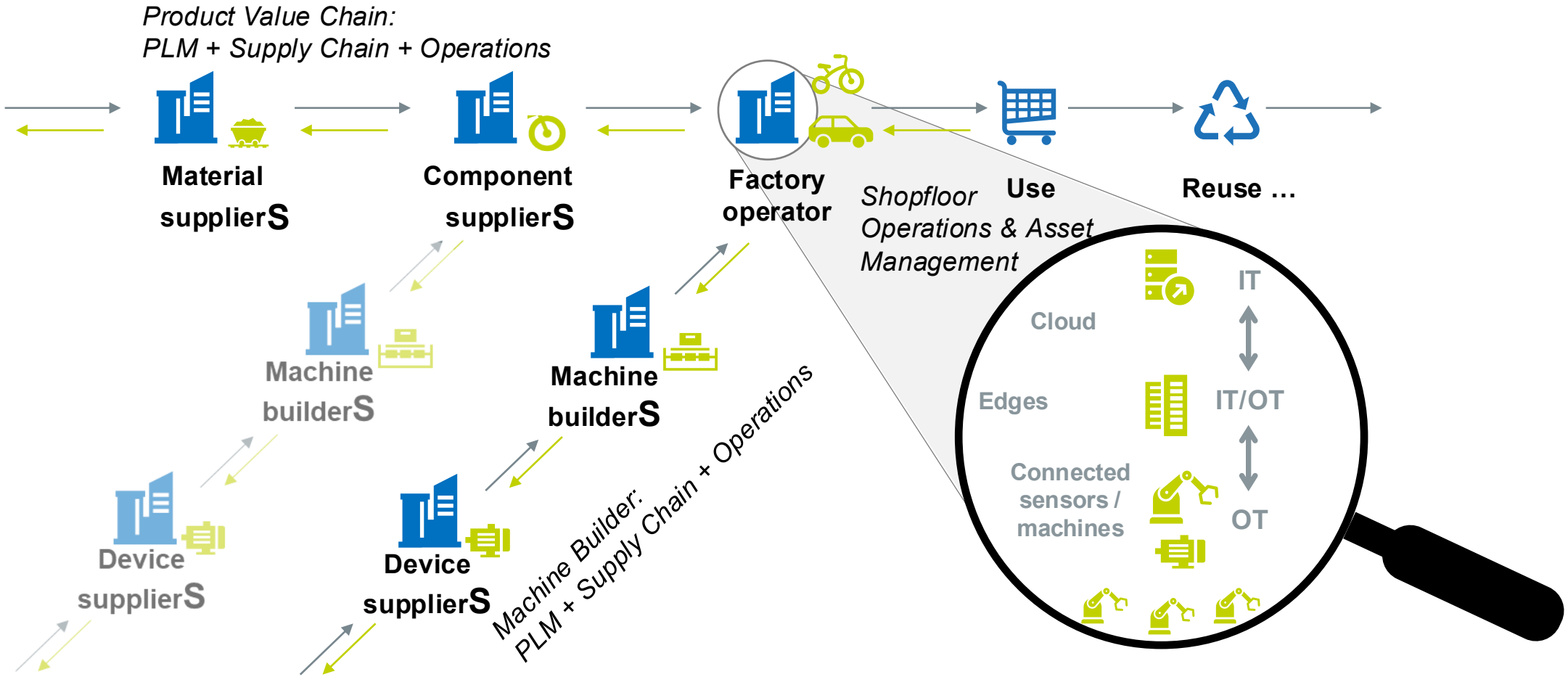
Topic	Time	Presenter
Welcome, Introduction & Moderation	5 min	Silke Huesmann Roland Rosen  
MX-Port configuration “Leo” from an application perspective	15 min	Ulrich Löwen 
Use Case - Collaborative Engineering & Integrated Toolchains	15 min	Björn Sautter 
Workstream 2 - Engineering and Manufacturing of Electrical Systems	15 min	Mirko Löffler 
Workstream 1 - Conception and Design of Automation Solutions	15 min	Johannes Hoos 
Workstream 3 - Virtual Commissioning and Simulation	15 min	Sascha Schaper 
Discussion & Closing	10 min	All

Factory-X

The Digital Ecosystem for Factory Outfitters and Operators

Factory-X
Our Scope and claim

Building the foundation of an open and collaborative digital ecosystem for factory outfitters and operators!



The Factory-X Consortium

FACTORY-X

Industrial Partners

ARVATO SYSTEMS, BASF We create chemistry, berger, codewerk, DMG MORI, Empolis, EPLAN, FESTO, GEC, hilscher, ifm, igus, inovex, InstaWerk, Lenze engineered to win, matchory, ANALYTICS, OPEN INDUSTRY 4.0 ALLIANCE, PAKIC, PHOENIX CONTACT, prenode, Proalpha, RIF Engineering & Consulting, SAP, Scheer, SCHUNK, sdfs, SICK Sensor Intelligence., SIEMENS, soffico, software AG A SOFTWARE GMBH BRAND, TRUMPF, T Systems, TÜV SÜD, UHLMANN GROUP BEYOND PACKAGING, WITTENSTEIN

Associations & Research Partners

August-Wilhelm Scheer Institut Digital Research, Fraunhofer, IFW Institut für Fertigungstechnik und Werkzeugmaschinen, ISW, RUHR UNIVERSITÄT BOCHUM, RUB, smartFactory KL, Catena-X, ESTAINIUM Association, LNI4.0 LABS NETWORK INDUSTRIE 4.0, VDMA, zvei electrifying ideas

Associated Partners

ARENA2036, bayern innovativ Innovation leben, BECKHOFF, BOSCH, Digital Data Chain Consortium, EVIDEN, IDTA, Sharecat, STANDARDIZATION COUNCIL INDUSTRIE 4.0, zvei electrifying ideas

11 Use Cases of Factory-X

11 Use Cases for horizontal and vertical data transfer

Integrated Toolchains and Collaborative Engineering

Information Update and Change Service

Collaborative Information Logistics

Condition Monitoring led Services

Modular Production

Manufacturing as a Service - On Demand Manufacturing

Autonomous Operation-as-a-Service

Traceability

Energy-Consumption and Load Management

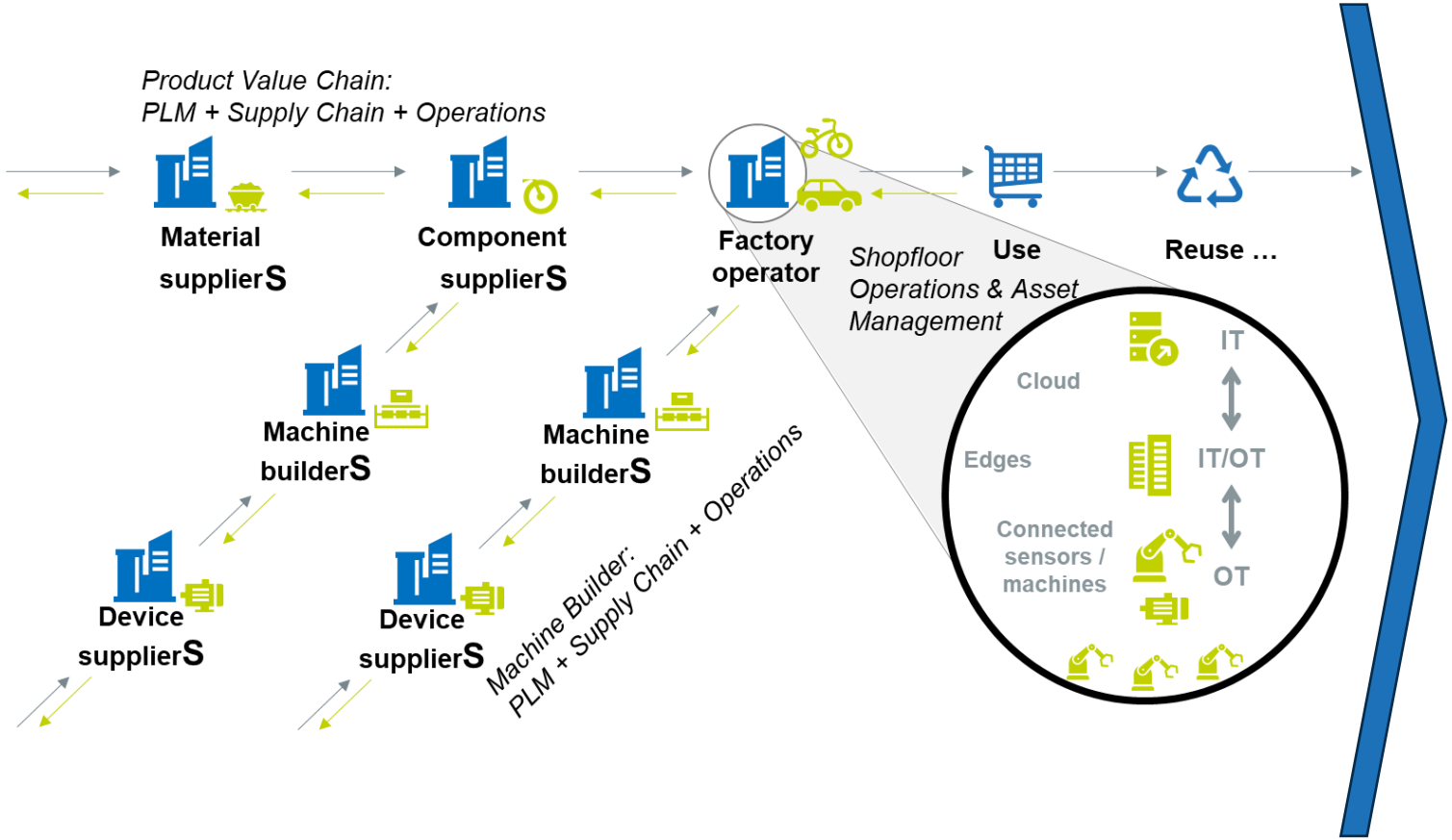
Carbon Footprint Management

Circular Economy

Factory-X Kernel & Basis Services

“One size fits all” does not work. We need a modular approach to achieve interoperable data spaces

The Factory-X Continuum



Foci of MX-Port Configurations

Supply Chain oriented
“HERCULES”

PLM +
Operations Mgmt. for Production Equipment
“LEO”

Operations Mgmt. for Production Equipment
“ORION”

Factory-X goes public
Registration over https://factory-x.org/

Manufacturing-X Technical Council

What is the Manufacturing-X Technical Council?

- Factory-X aims to create an IT/SW technical basis (the „Factory-X Kernel“) for software solutions in Manufacturing-X using results from Catena-X.
- In the M-X Technical Council, the approaches are presented – depending on the project progress – and feedback is invited.

Who is it for?

- The Manufacturing-X Technical Council is aimed at anyone who is interested in the application of the IT/SW technical “Factory-X Kernel”, e.g., for the implementation of their own software solutions within the framework of Manufacturing-X.

When? #6 – was on Tuesday, March 3rd 2026

Customer Sounding Board

What is the Customer Sounding Board?

- In Factory-X, various so-called business applications (software solutions) are designed, developed as prototypes and validated for 11 use cases.
- In the Customer Sounding Board, these are presented – depending on the project progress – and feedback is invited.

Who is it for?

- The Customer Sounding Board is aimed at anyone who is interested in using, e.g. validation, the business applications of the use cases or who wants to create their own software applications that are interoperable with Factory-X.

When? #6 Now!

What‘s next?

Meet us on the Hannover Fair, hall 13 on the Platform Industry 4.0 booth.

Way forward to M-X DATA ECOSYSTEM

Factory-X
- MX-Port Hercules
- MX-Port Leo
- MX-Port Orion

Factory-X proposal for
- Governance „M-X Verstetigung“
- Operating Model
- Set of common rules

Catena-X

CHEM-X

Semiconductor-X

Railway-X

Aerospace-X

Further data spaces

TODAY

M-X Governance

M-X DATA ECOSYSTEM
(set of interoperable data spaces)

TOMORROW

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Governance MX-Port “Leo”

Ulrich Löwen

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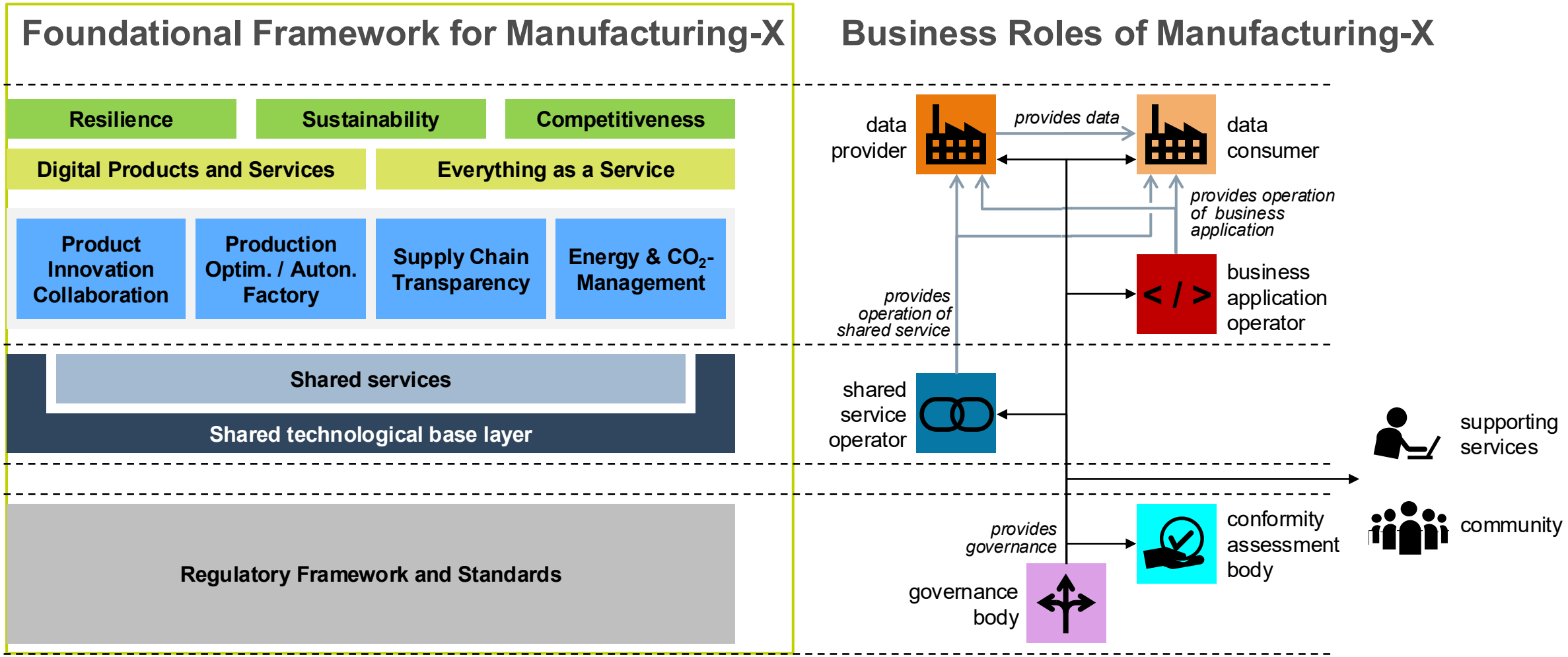
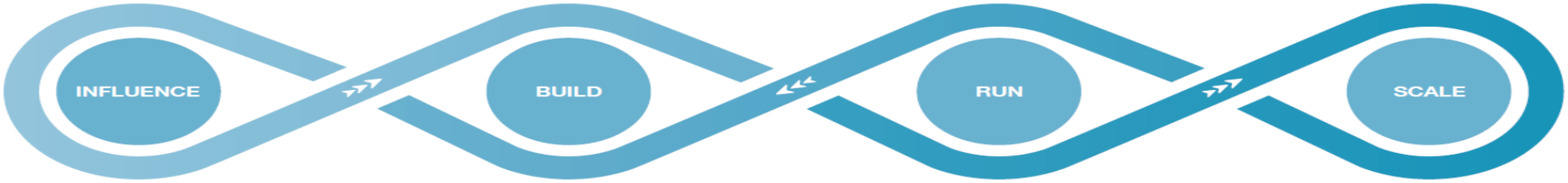
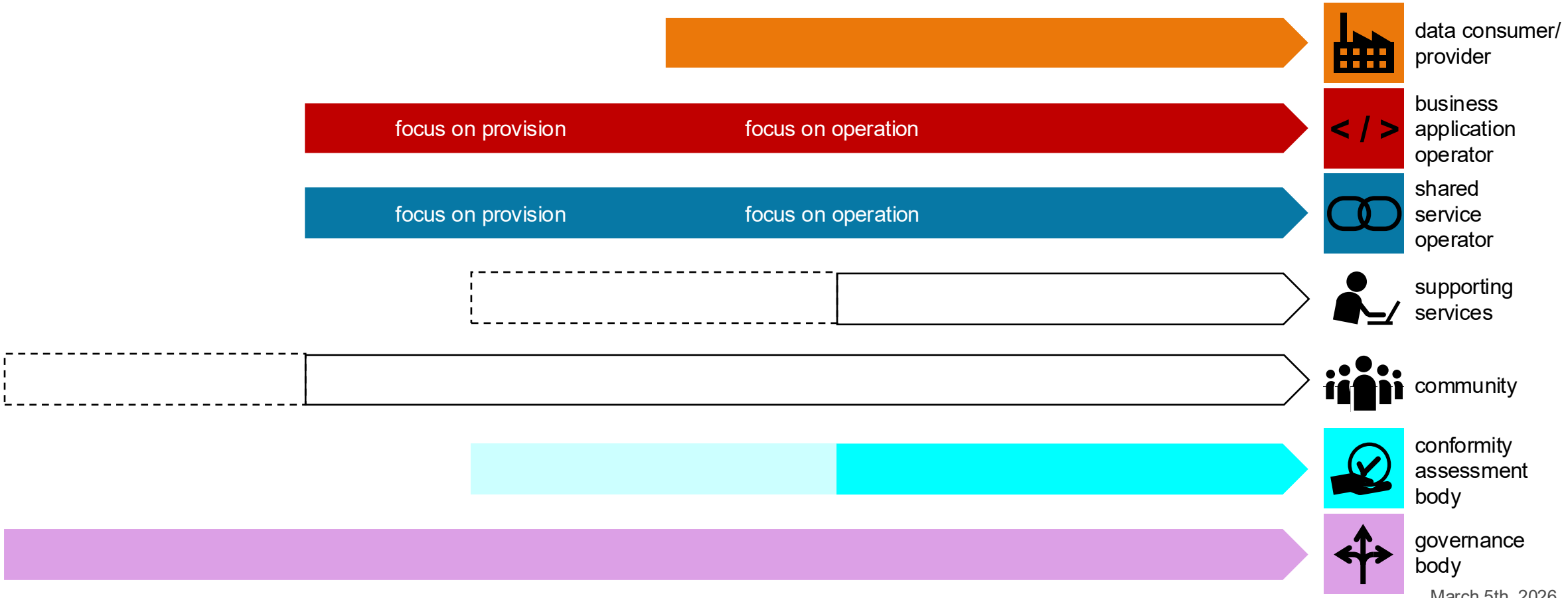
Scope of Business Roles in Relation to the Foundational Framework for Manufacturing-X



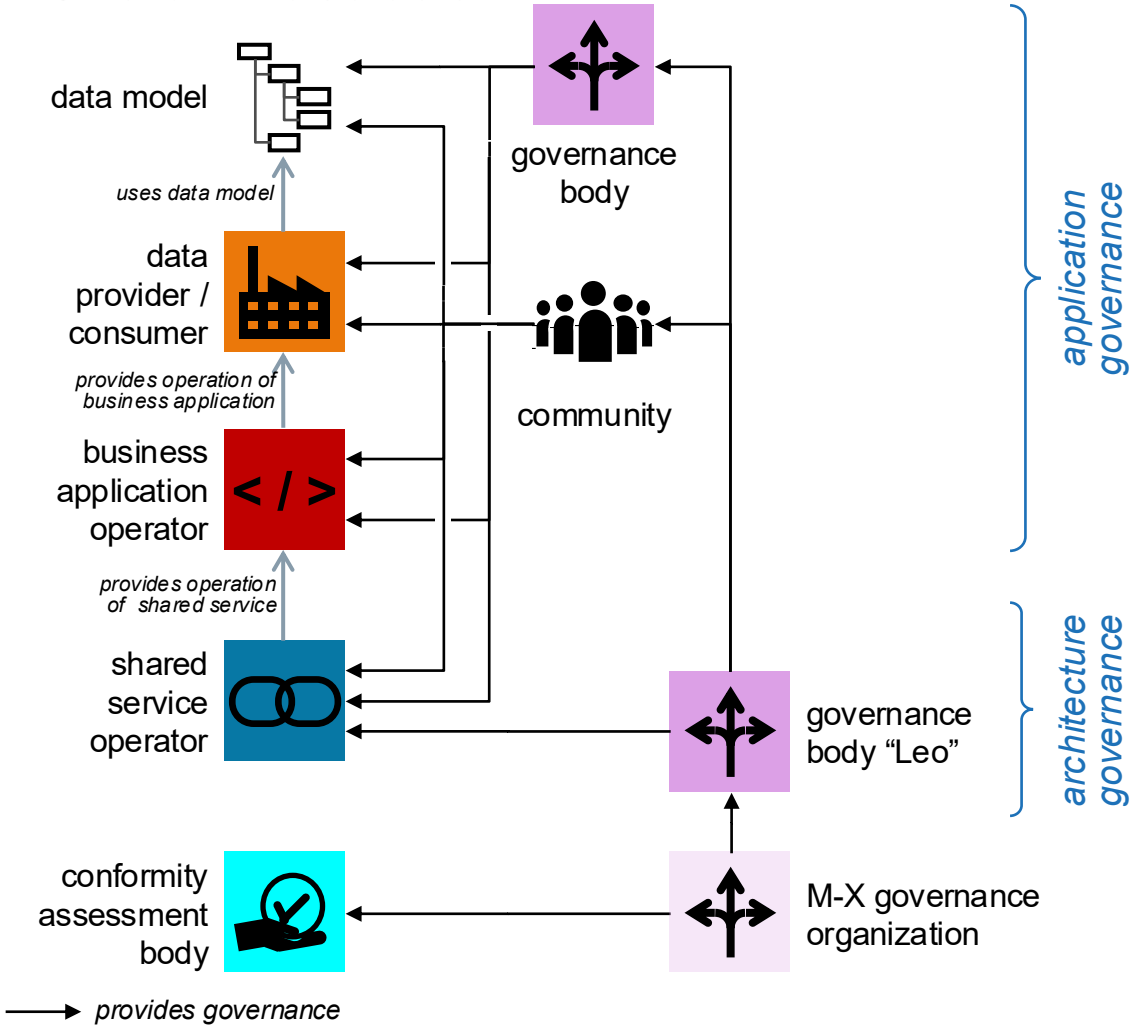
Main Scope of Business Roles in Relation to Development of Industrial Data Ecosystems





Overall governance of MX-Port configuration “Leo”

Overall illustration



Overall guiding principles

Governance under M-X governance organization (as discussed in TP7)

Separation of “Leo” governance into

- **Architectural governance** for
  - Shared services of MX-Port configuration “Leo”
  - Governance bodies or communities assuming application governance
- **Application governance** can be assumed by **any** governance body or community

Conformity assessment body

- Certification regarding **technical entities** (data models, business applications, shared services) defined by Leo-specific governance bodies / communities
- Certification regarding **processes** not intended to be specific for MX-Port configuration “Leo”

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Use Case – Integrated Toolchains and Collaborative Engineering

Björn Sautter, Johannes Hoos, Mirko Löffler, Sascha Schaper

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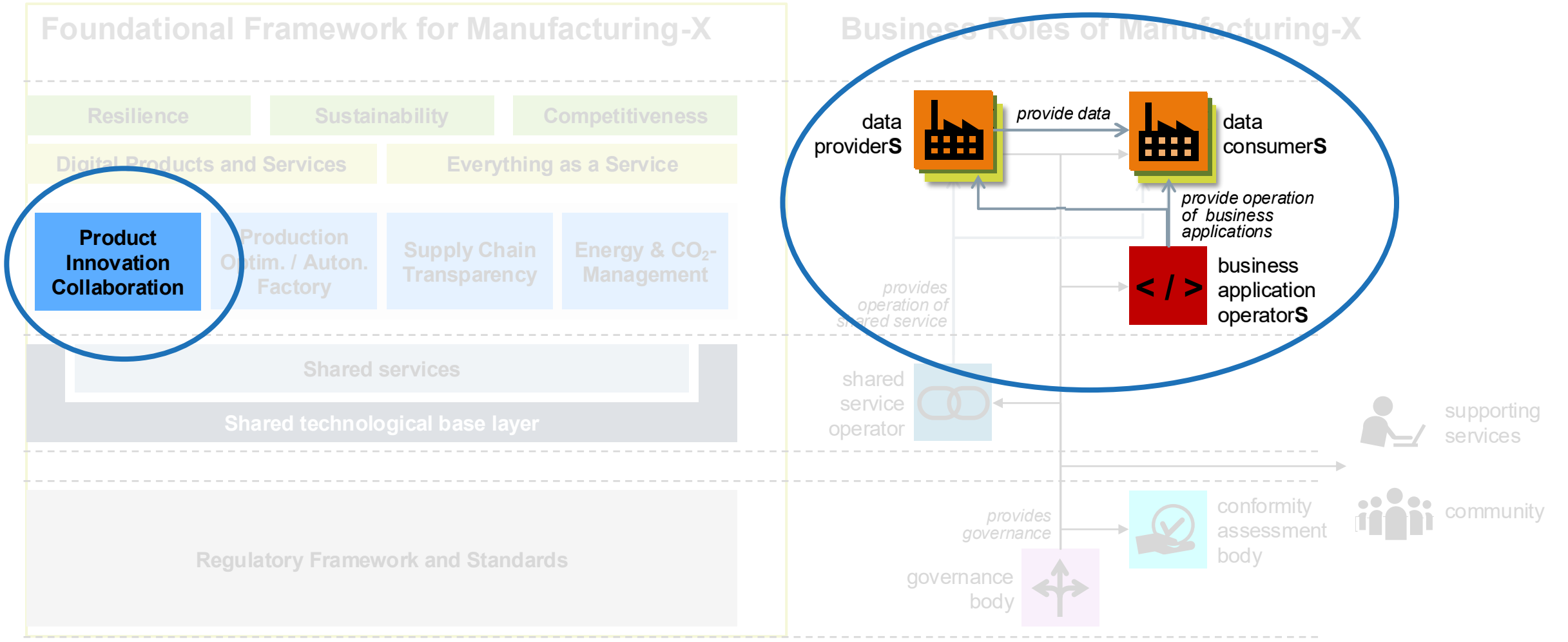
Scope of the Engineering Use Case in Factory-X

Collaborative Engineering with seamless data exchange along toolchains



The Engineering Use Case in Factory-X

Integrated Toolchains and Collaborative Engineering

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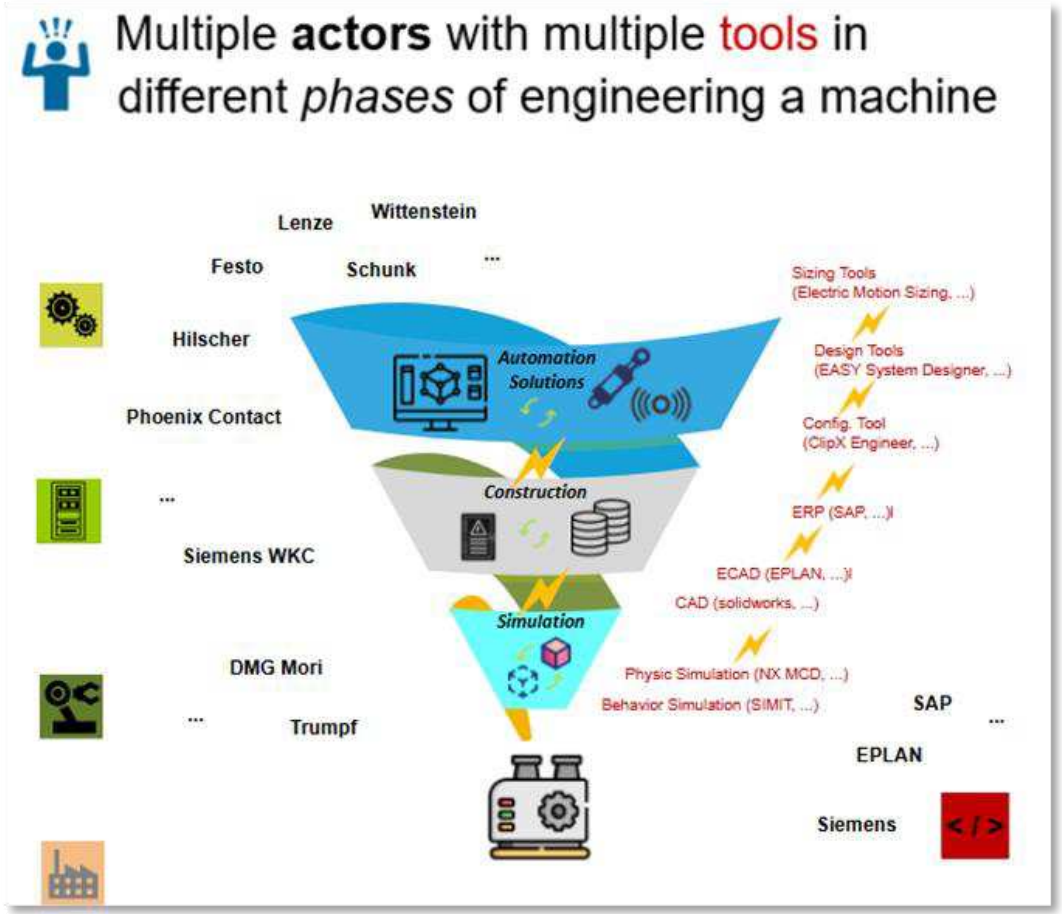
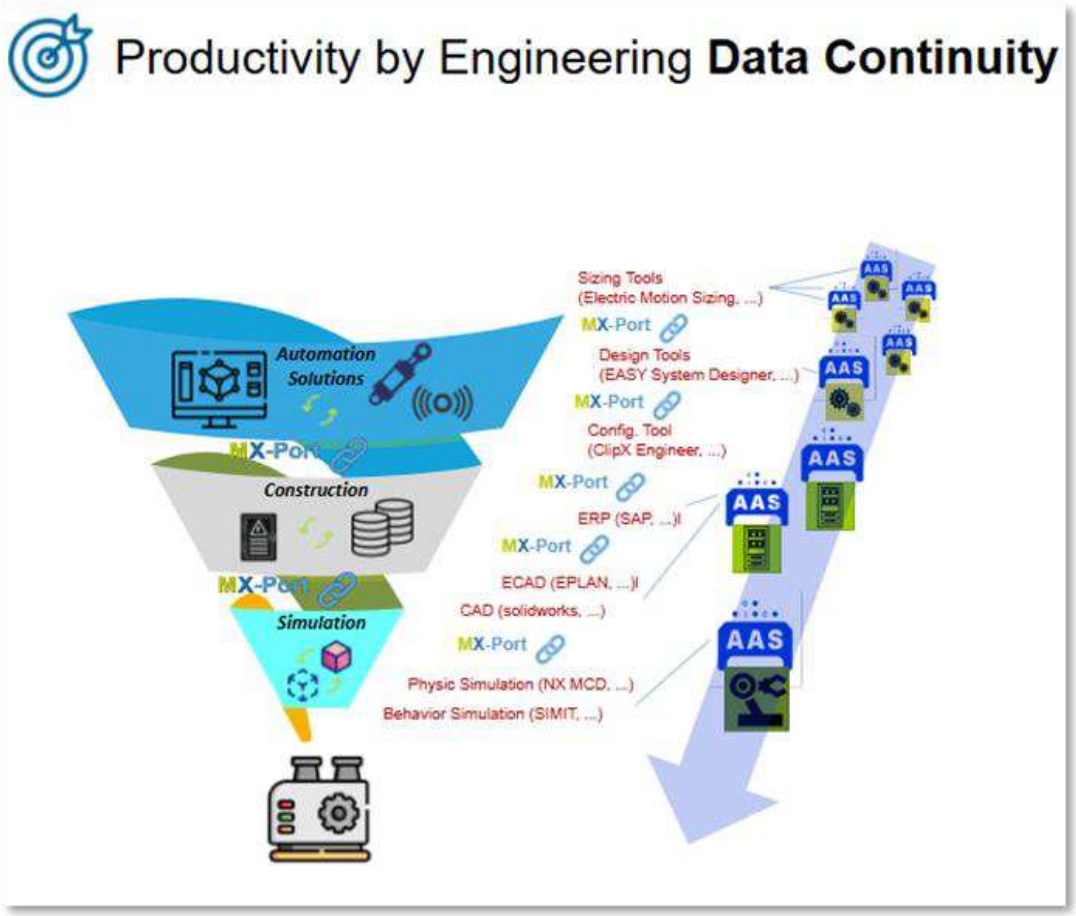
From **Challenges** …

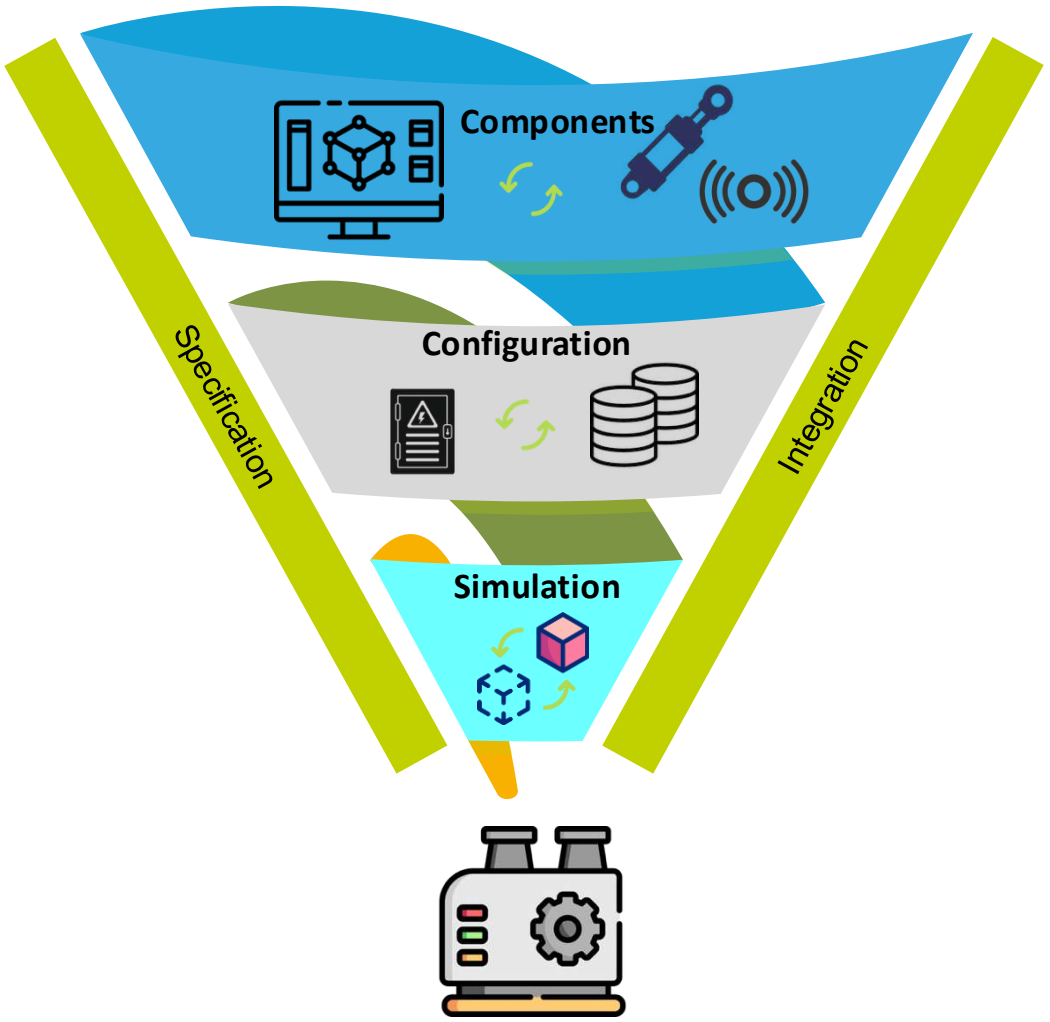


…to **Solutions.**



Integrated Toolchains & Collaborative Engineering

Productivity by Engineering Data Continuity



The Goal

- Increase **productivity of engineering** processes
- Facilitate & accelerate **collaborative engineering**
- **Integrated Toolchains** for digital engineering from virtual solution finding and configuration to simulation

The FX Solution in Detail

- Data continuity along integrated vendor-independent toolchains based on **common standards**
- Collaborative use of engineering data based on a **trusted framework (MX Port)**
- **Digital twins** for simulating and optimizing production processes and systems during life cycle

Integrated Toolchains & Collaborative Engineering

Need for interoperable exchange of information in Collaborative Engineering

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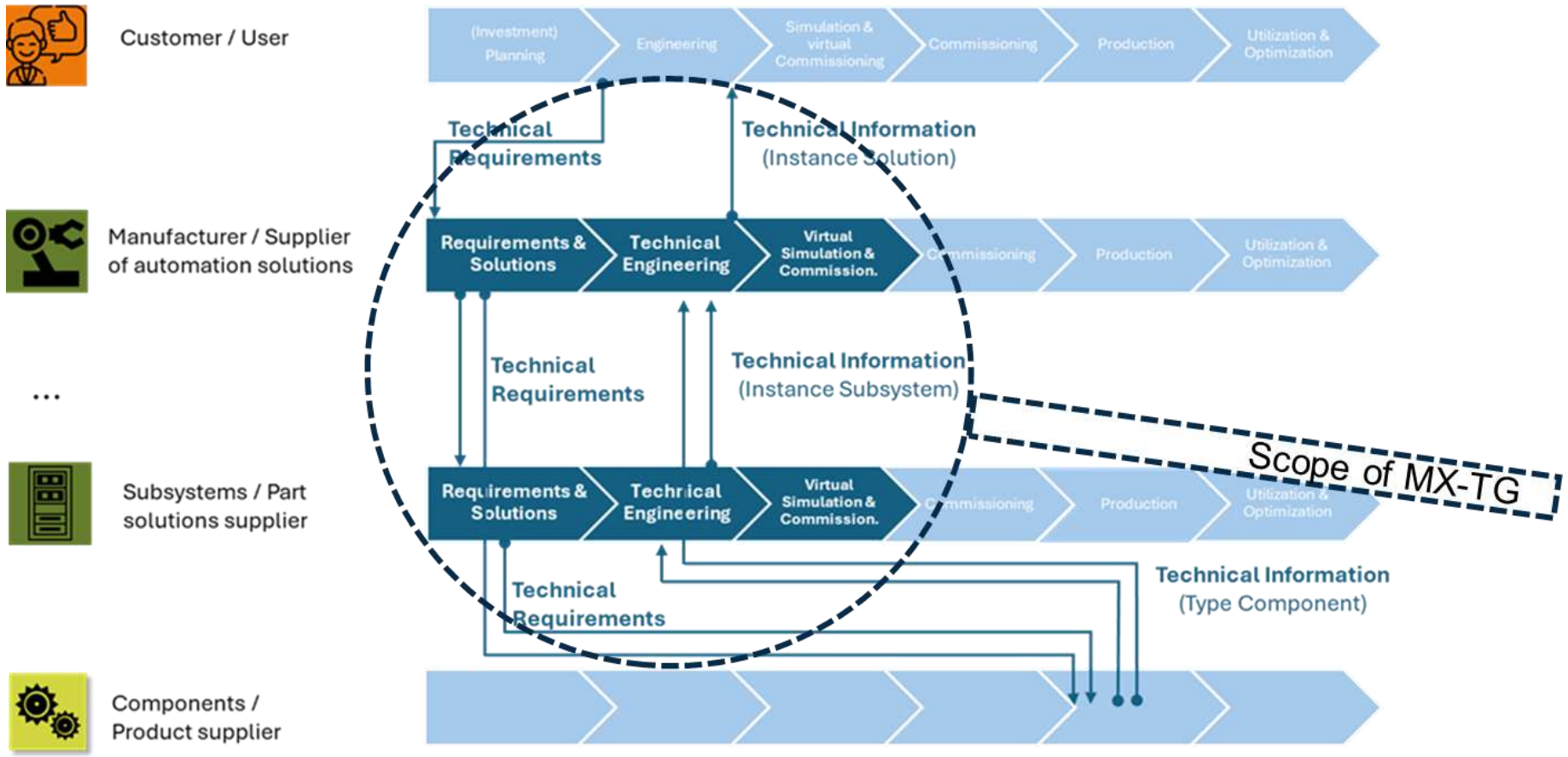
Information Exchange along Collaborative Engineering Partners and Phases:



COLLABORATIVE ENGINEERING

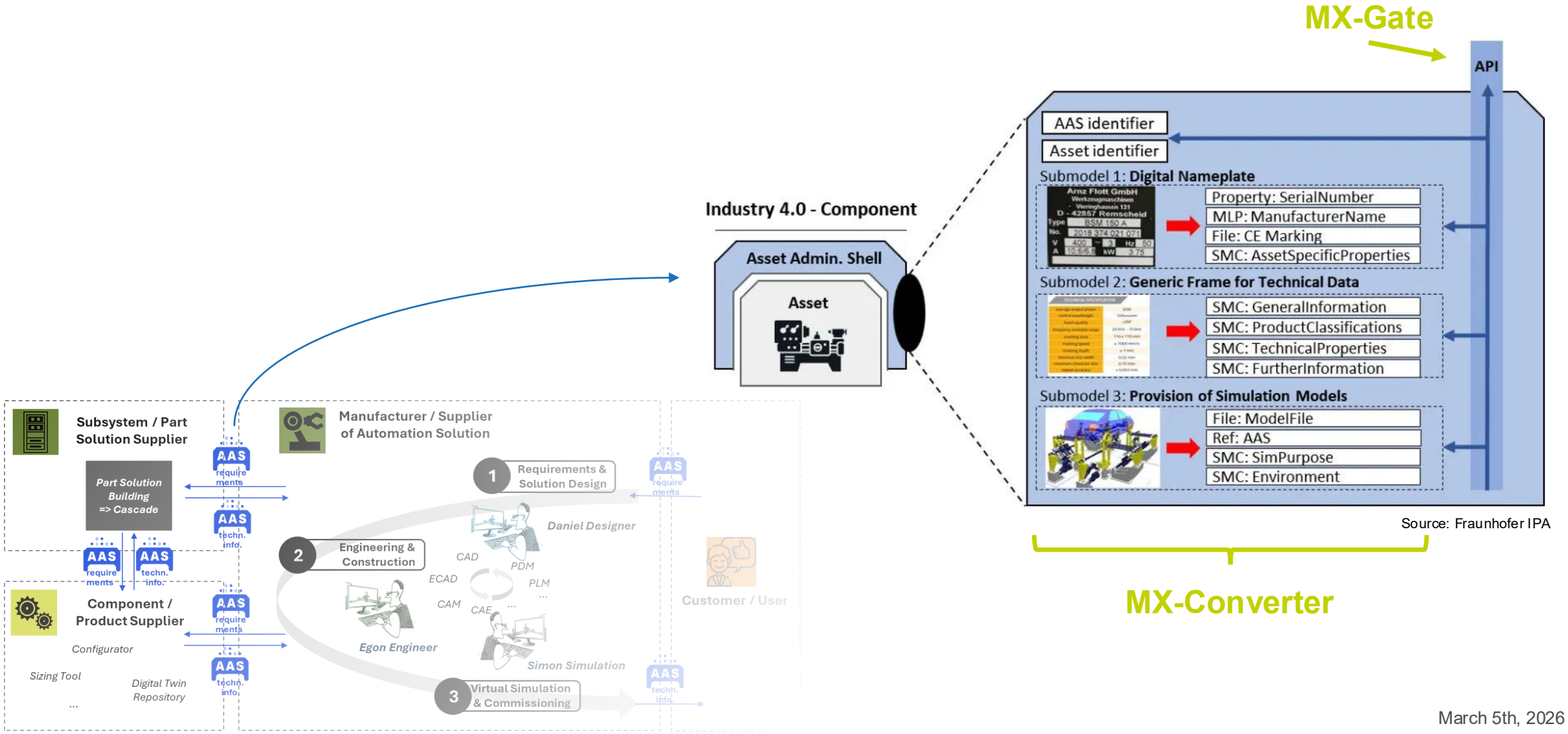
Why & How to use AAS for Collaborative Engineering?

Whitepaper (Version 1)

Manufacturing-X
Guidance Board

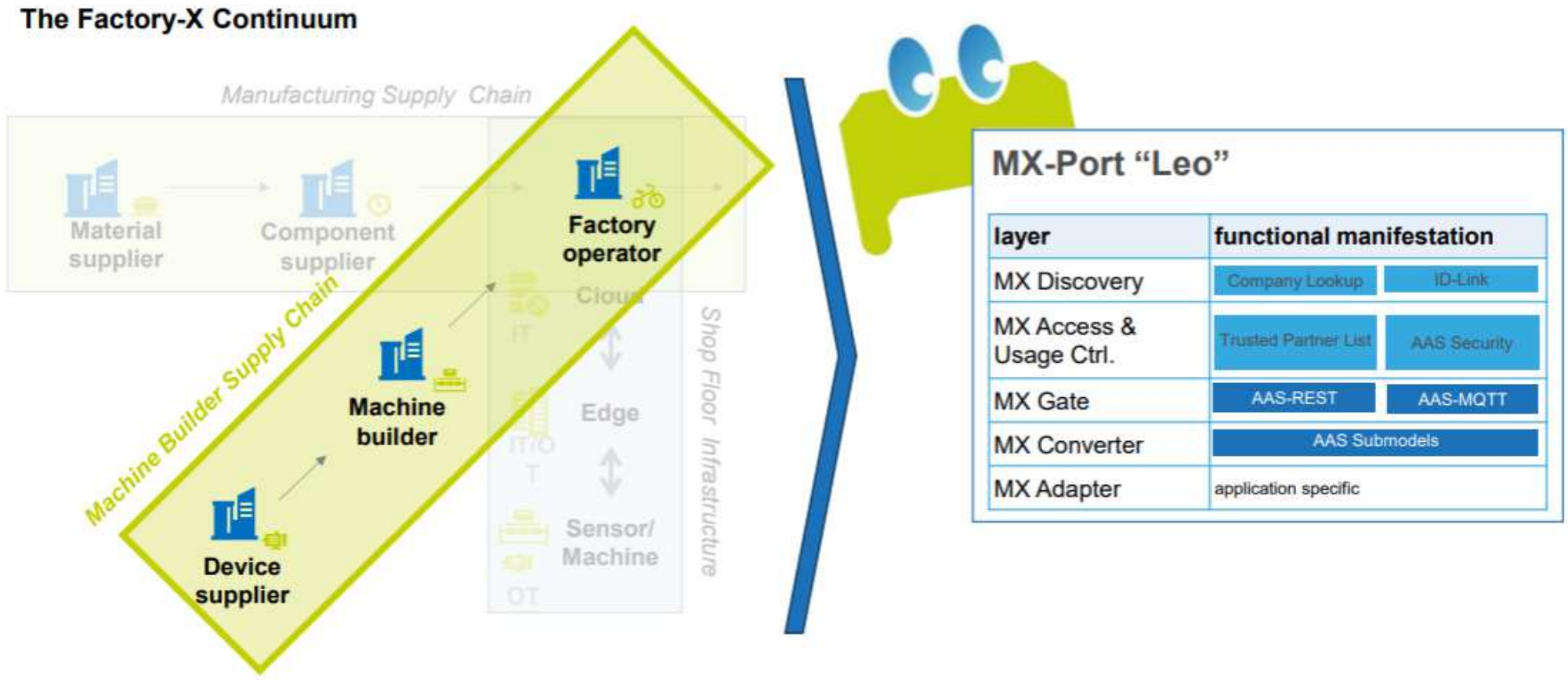
Integrated Toolchains & Collaborative Engineering

Asset Administration Shell (AAS) as standardized representation of Digital Twin



Integrated Toolchains & Collaborative Engineering

AAS as a key element of MX-Port “Leo” in the Machine Builder Supply Chain



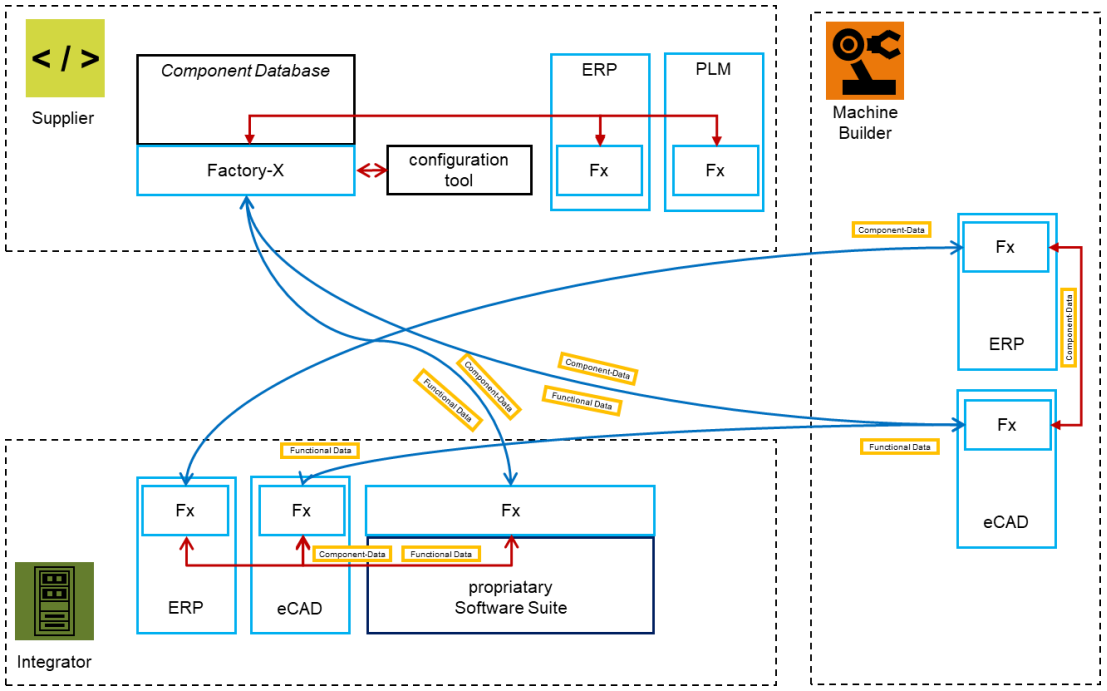
MX-Port “Leo”

layer	functional manifestation	
MX Discovery	Company Lookup	ID-Link
MX Access & Usage Ctrl.	Trusted Partner List	AAS Security
MX Gate	AAS-REST	AAS-MQTT
MX Converter	AAS Submodels	
MX Adapter	application specific	

Workstream 2
Engineering and Manufacturing of Electrical Systems (ELK)

Workstream 2 (ELK)
Overview

Usage View



Why?

- increase productivity by data continuity

How?

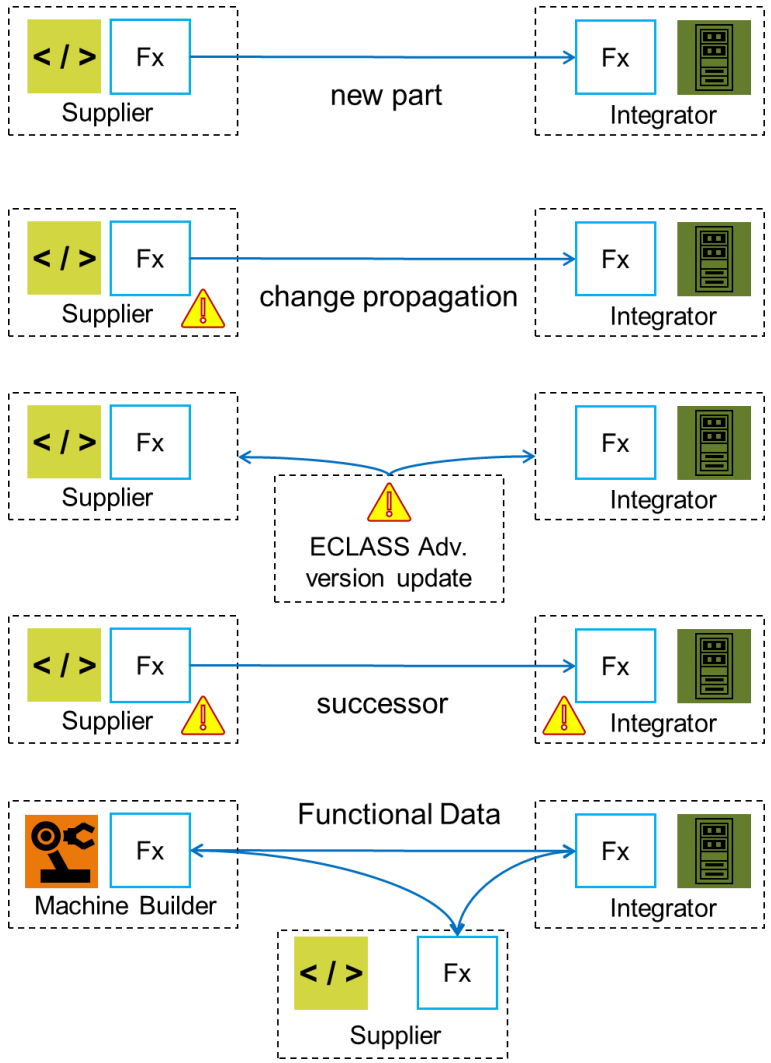
- based on real world user stories in electrical engineering, as-is analysis are made and the necessary target-state is derived
- clear focus on productivity raise by data continuity

What?

- representing the user in an engineering toolchain along different companies and different (engineering) software tools given
- What is needed in the daily life of an electrical engineer and which comfort needs a new solution to be accepted from the market?

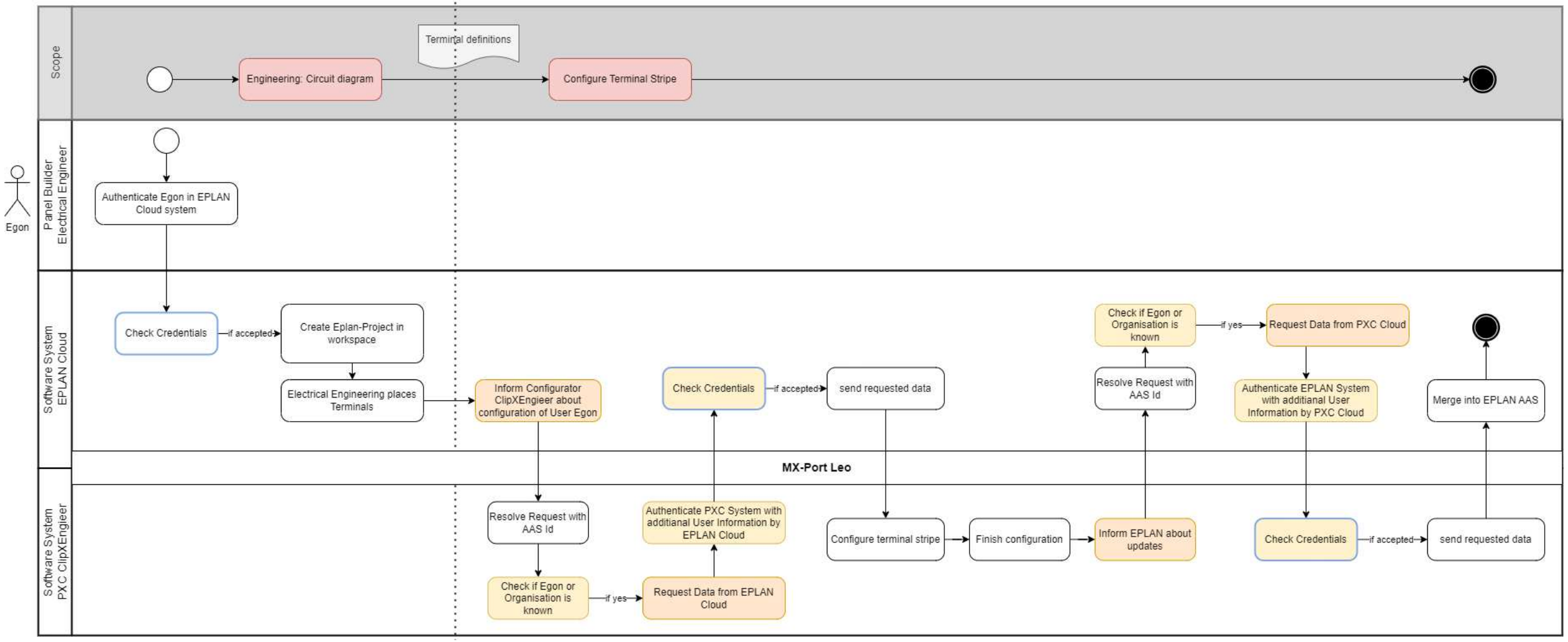
Workstream 2 (ELK)
Our User Stories

1. I have a new part in my project and need technical data.
2. Changes?!? A known component has been changed by supplier, wholesaler or software provider. How am I informed?
3. Semantics, e.g. ECLASS Advanced, is updated. How to handle different versions?
4. A used product will be outdated and replaced by a new one. How do I handle this?
5. I'm part of a supplier network and need to exchange functional data between eCAD systems and/or configuration tools in different legal entities. How to?



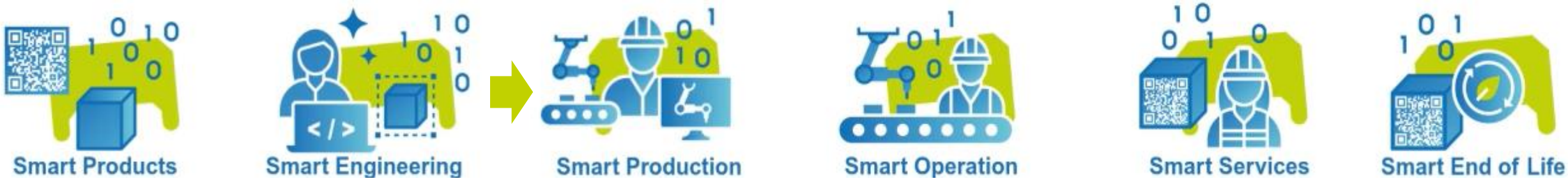
Workstream 2 (ELK)

Swimlane Diagram – from Integrator to Supplier via EPLAN using MX-Port LEO



Workstream 2 (ELK)

Value Added of AAS-based Data Exchange in Product Life Cycle

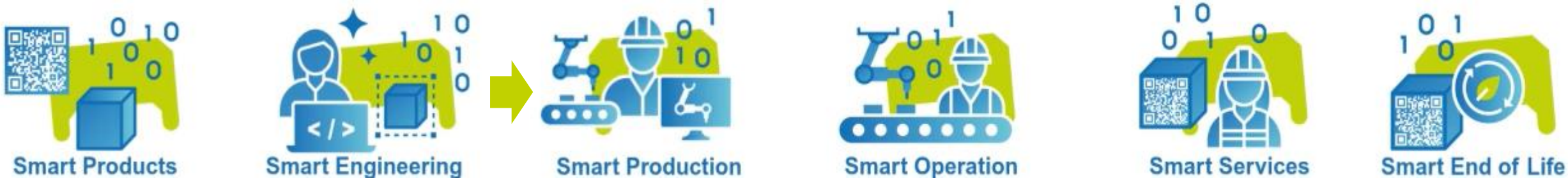


Data continuity along the entire supply chain!

The data from smart engineering is passed on to the production stakeholders via the MX-Port “Leo” and can also be used in assembly.

In this step, the purely digital twin is transformed into a physical product.

Workstream 2 (ELK)
Value Added of AAS-based Data Exchange in Product Life Cycle



as-is

- **Time consuming processes**
  - searching for component details
  - searching for 3D-macros
- **Time consuming data transfer**
  - transfer from electrical drawing to layout planning
  - transfer from drawings to configuration software of component suppliers
  - transfer from IT-systems to machines
  - transfer of data to blue collar workers

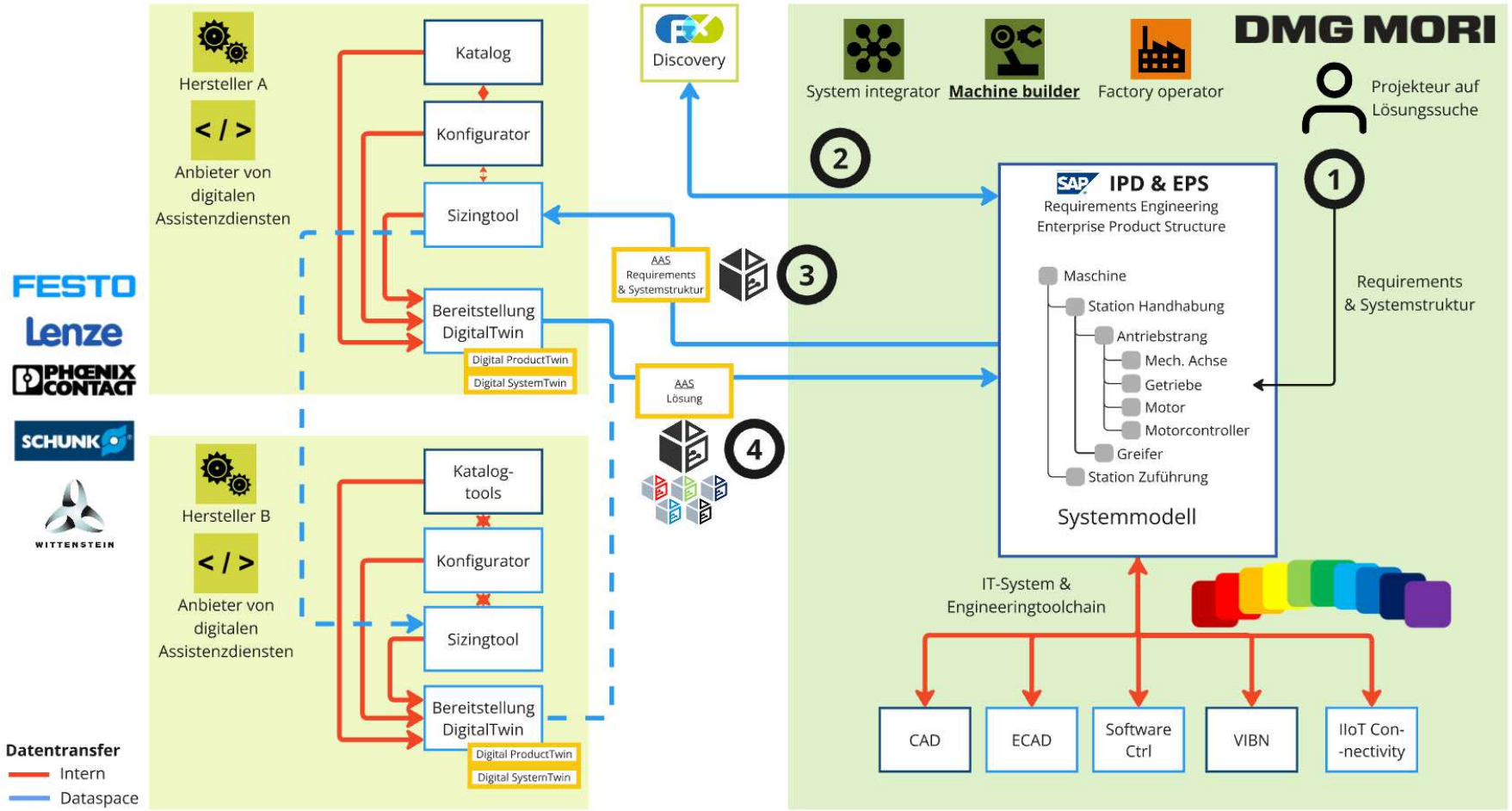
to-be with Factory-X

- **Data runs seamlessly** between systems in house and from suppliers, based on AAS and MX-Port technologies
- **Easy to integrate configuration software** based on AAS and MX-Port technologies
- Huge **rise in productivity** by eliminating wasted time for searching and transferring

Automated access to functional data, e.g. circuit diagram, via AAS

Workstream 1
Conception and Design of Automation Solutions (AUT)

Workstream 1 (AUT) Overview



What?

Simple and efficient solution finding

Why?

Simplicity

Efficiency

Quality

How?

Requirements Engineering

Automatic discovery of vendor services

Semiautomatic solution finding

Workstream 1 (AUT) Overview

Digital Twin

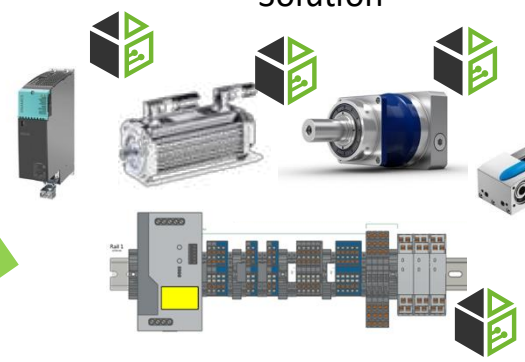
Create system model based on requirements

Engineer looking for solution

Automation Problem

Simplified, efficient and vendor independent solution finding with high quality

Solution



Integration into machine builders IT- and Engineering system

Workstream 1 (AUT)

Value Added of AAS-based Data Exchange in Product Life Cycle


Smart Products

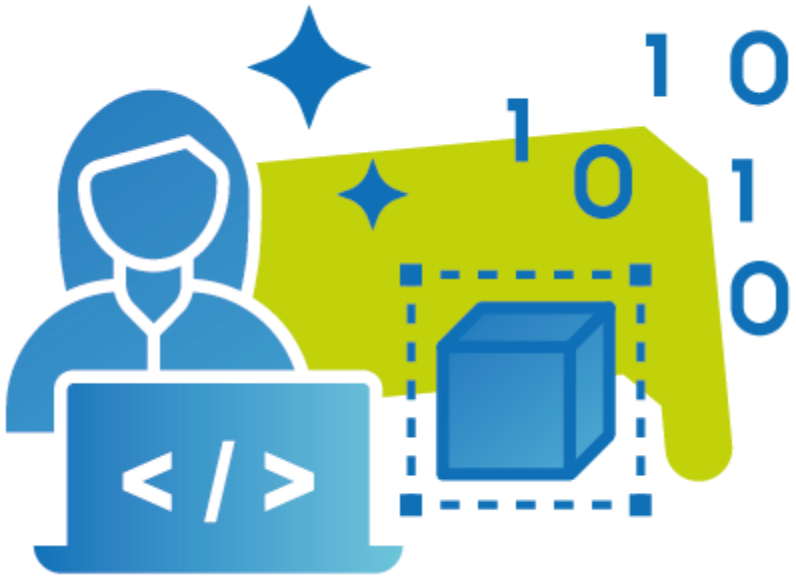

Smart Engineering


Smart Production


Smart Operation


Smart Services


Smart End of Life



Seamless engineering: fast and efficient!

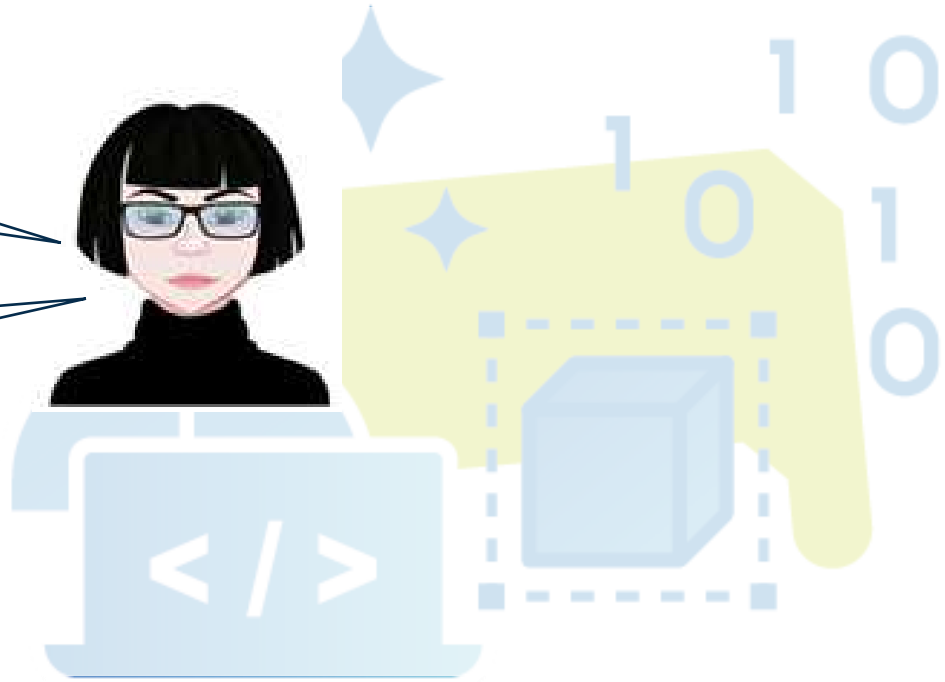
Smart engineering systems can work with current product data across companies using standardized data models (AAS).

Using MX-Port “Leo,” product data can be accessed in a standardized manner across manufacturers and integrated into their own systems.

Workstream 1 (AUT)
Value Added of AAS-based Data Exchange in Product Life Cycle

Hi, I am Dora Designer. As a **mechanical engineer** I am working with a multitude of engineering tools, disciplines and partners, and I suffer from digital discontinuity.

How can I **improve data continuity for seamless e2e engineering** and make my work easier, better, faster and thus more cost-effective?



Workstream 1 (AUT)
Value Added of AAS-based Data Exchange in Product Life Cycle

as-is

- **Time consuming and manual work**
  - **Searching** in different product catalogs and configuration in various supplier-specific tools
  - **Transfer & integration** of product data in different engineering tools in manifold formats
  - **Coordination** and versioning of collaborative engineering products

to-be with Factory-X

- **Quick & easy solution finding** and configuration across multiple suppliers at your fingertips
- **(Semi-)automated & reliable data integration** in engineering tools in standardized format
- **Easy coordination** and automated versioning of collaborative engineering projects

Smart Products

Smart Engineering

Smart Production

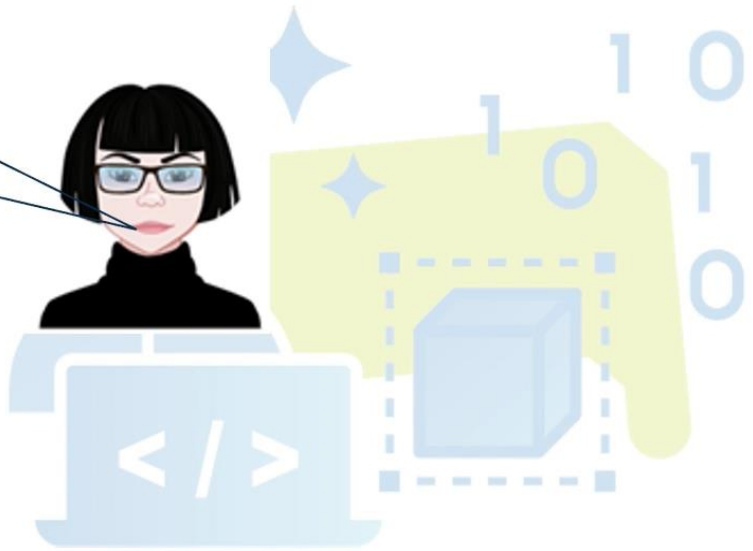
Smart Operation

Smart Services

Smart End of Life

I need a linear movement with

1. Mass = 1,5 kg
2. Stroke = 100 mm
3. Time = 2,3 sec



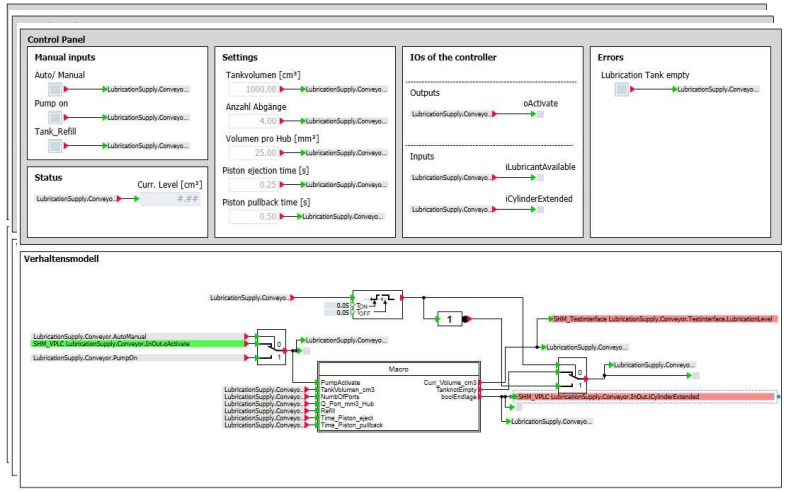
Workstream 3
Virtual Commissioning and Simulation (SIM)

Introduction
Software-in-the-Loop Simulation for Virtual Commissioning

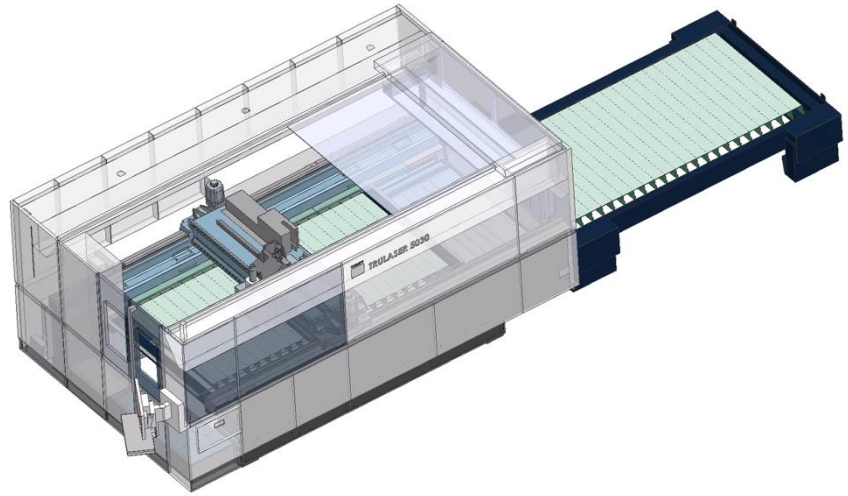
Virtual Control

Simulation Model

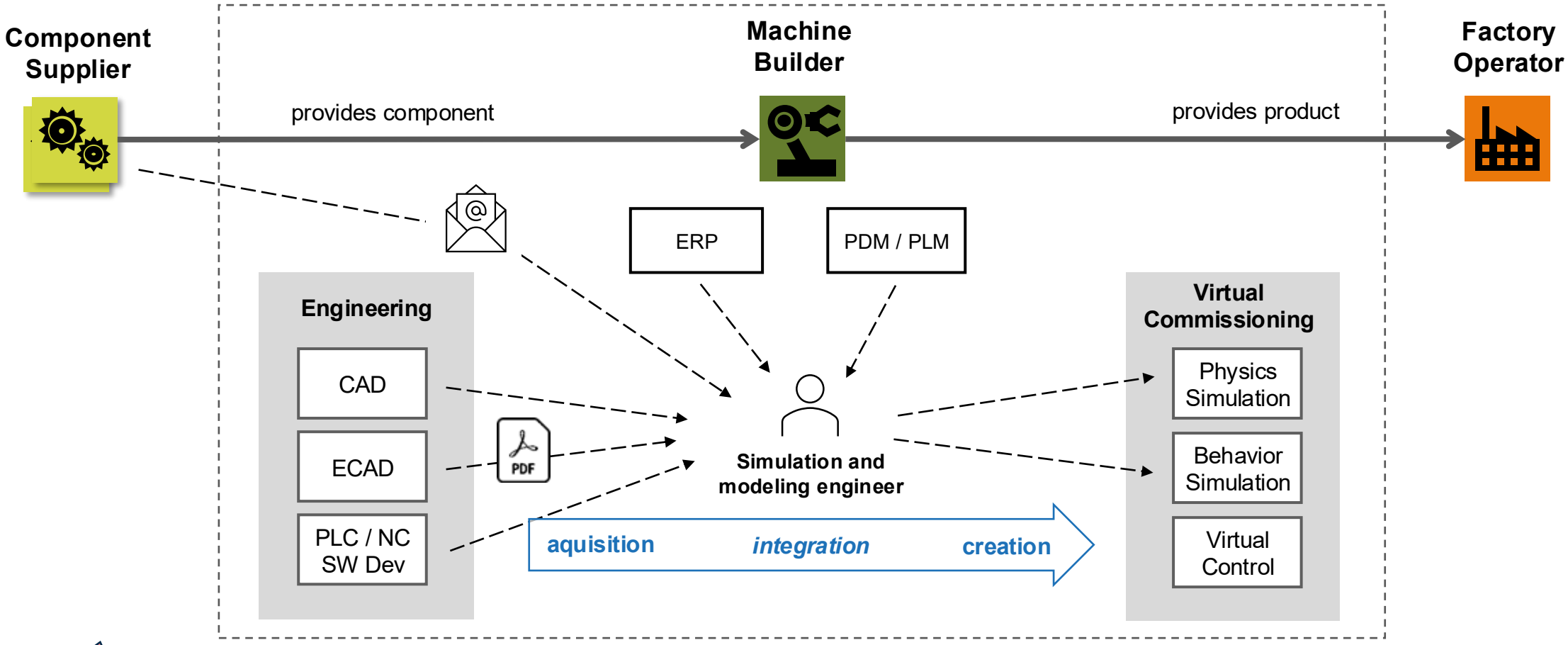
Behavior Simulation Model



Physics Simulation Model

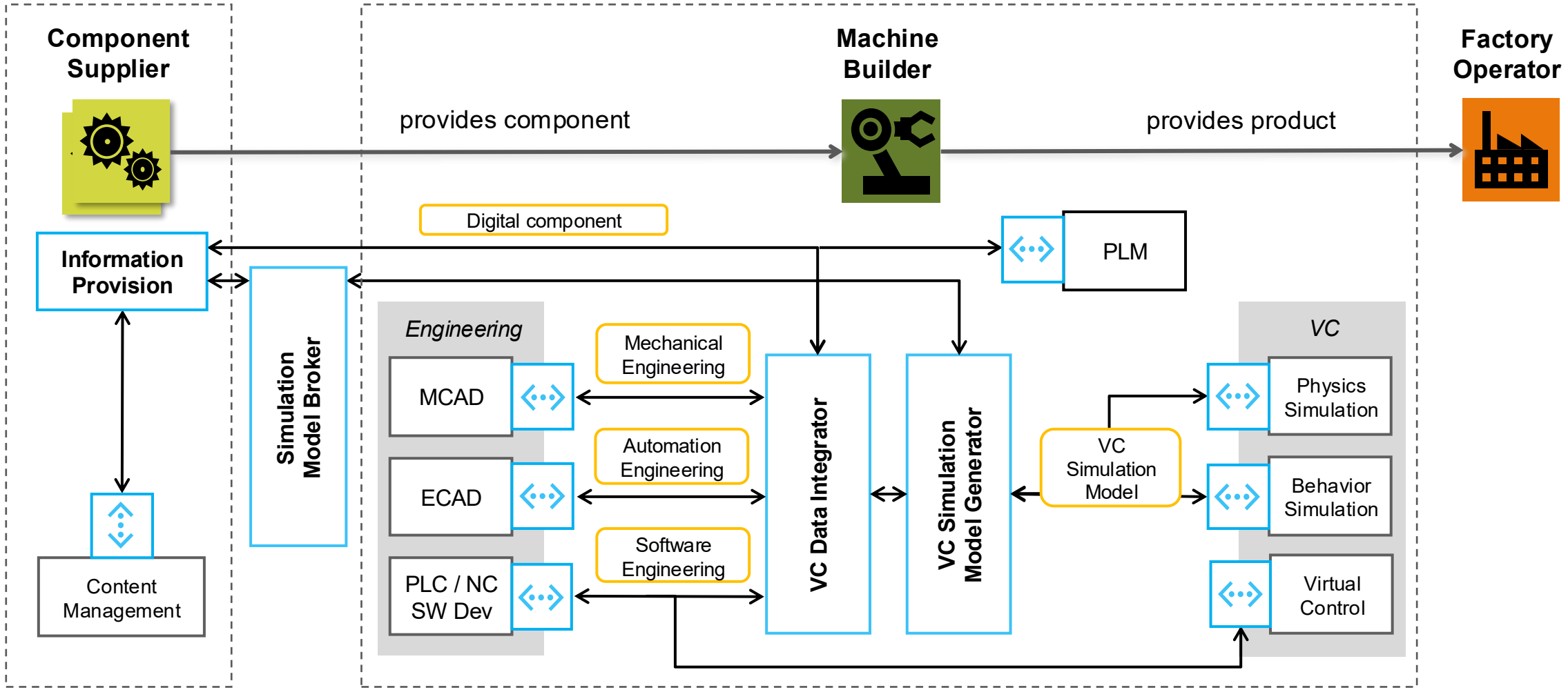


Introduction
Missing interoperability in the engineering toolchain

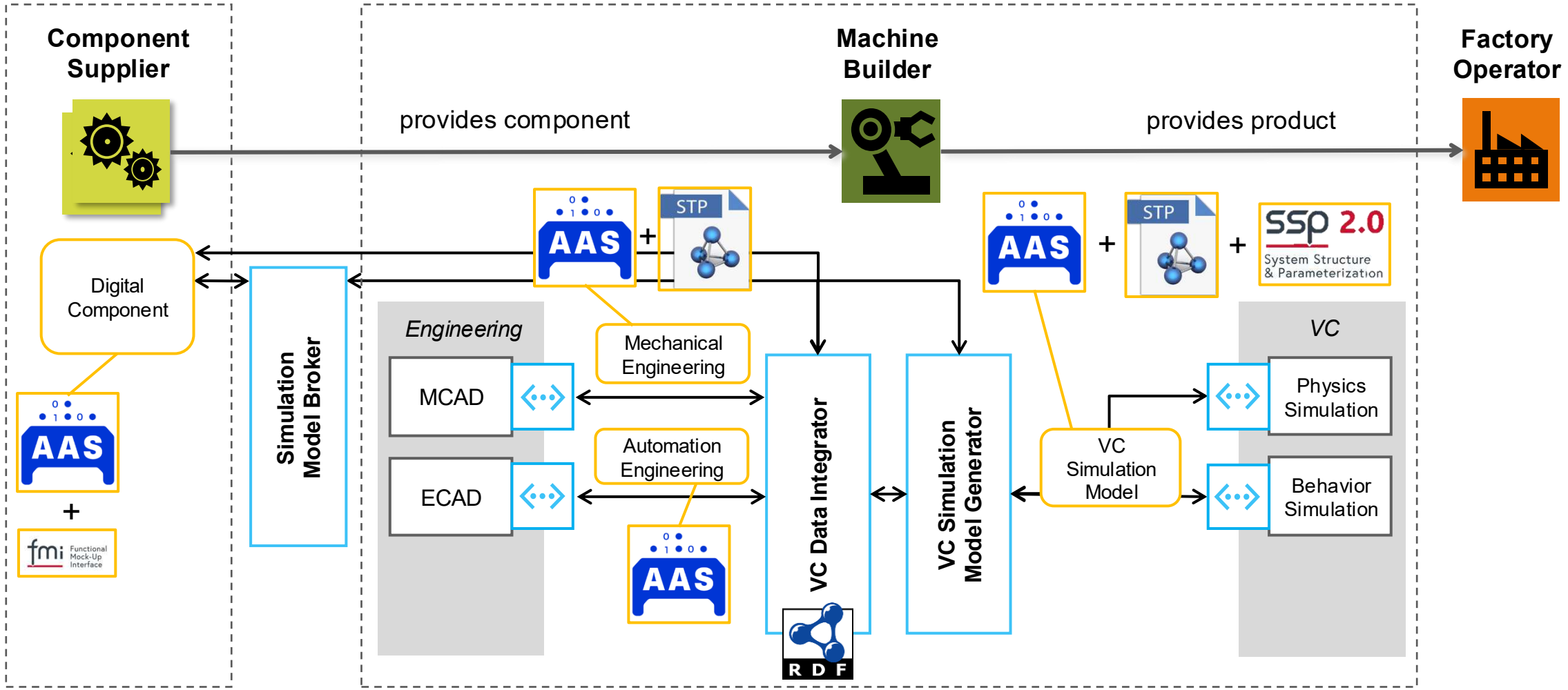


Elaborate effort for simulation model creation limits the potential of virtual commissioning

Concept for behavior simulation model generation
Integrated engineering toolchain



Concept for behavior simulation model generation
Selected technologies, formats and standards



Concept for behavior simulation model generation
Ontology-based integration of mechanical and electrical engineering

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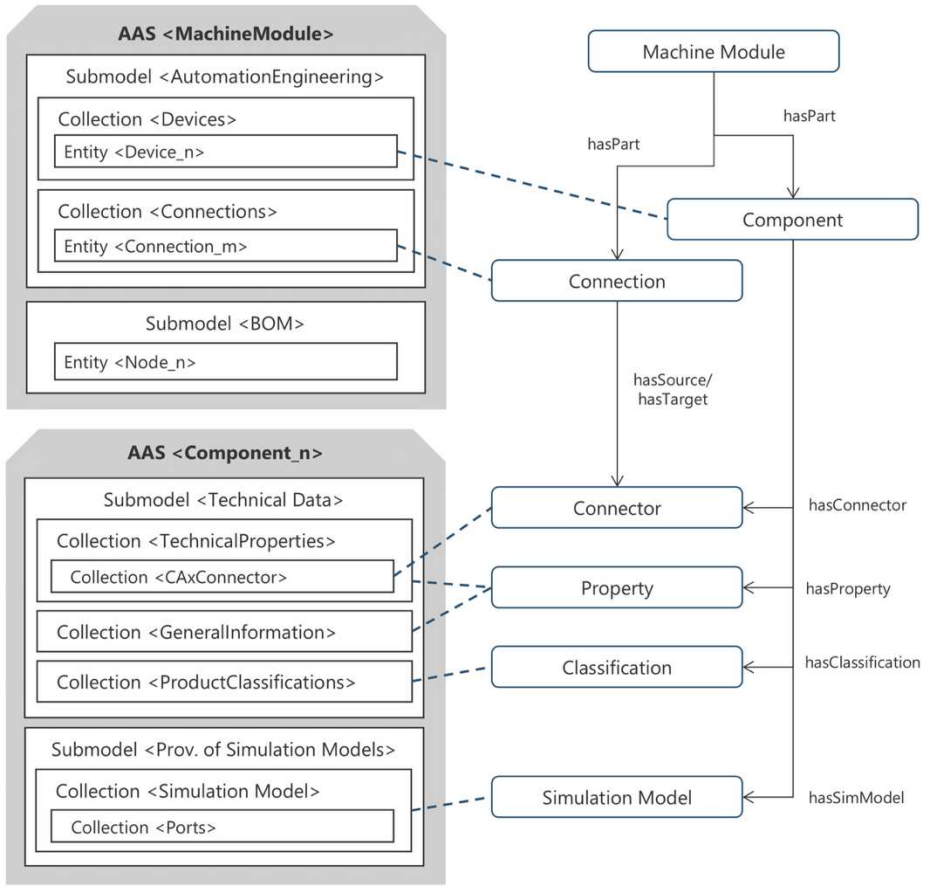
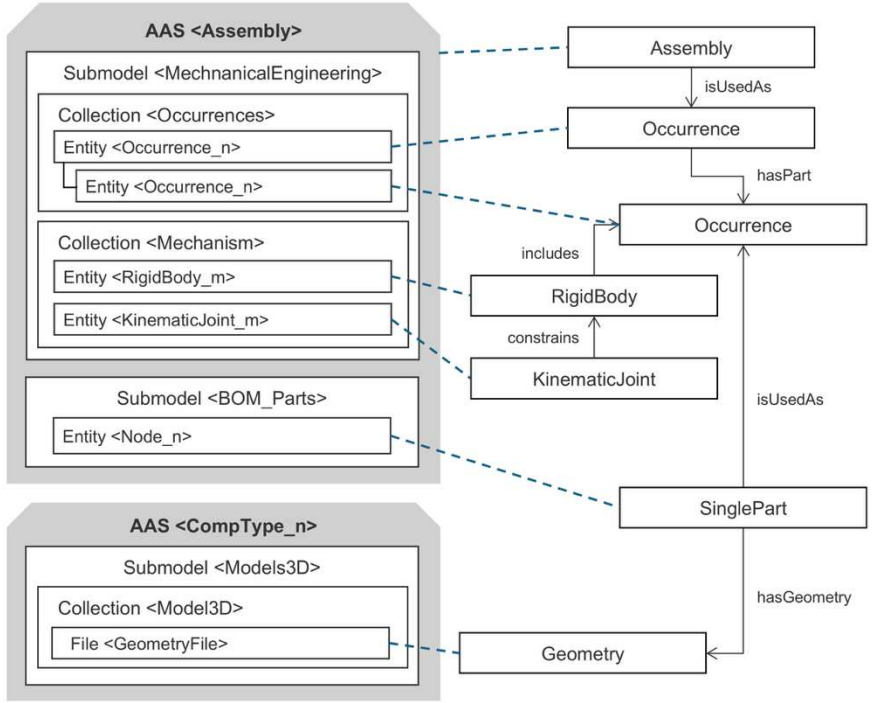
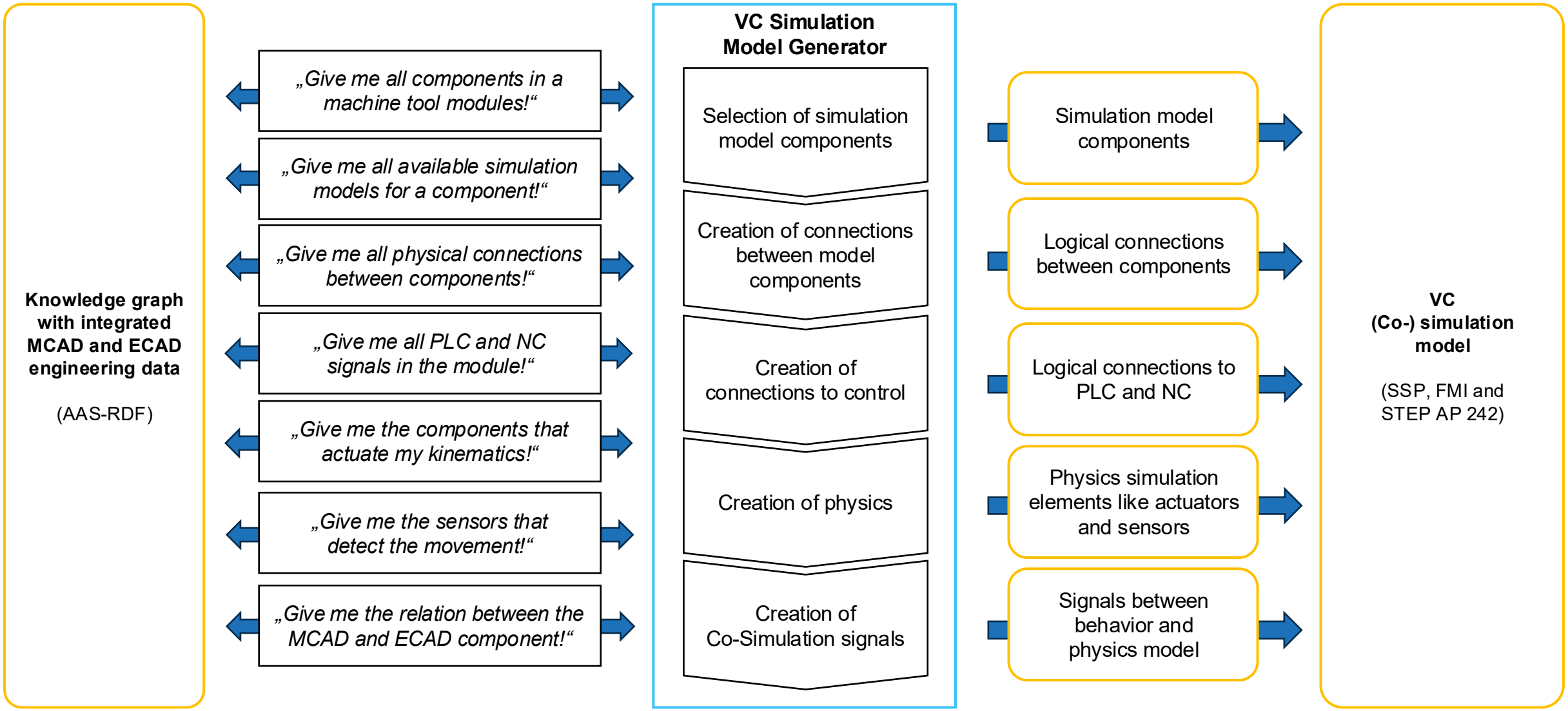
Automation Engineering (ECAD)



Mechanical Engineering (MCAD)



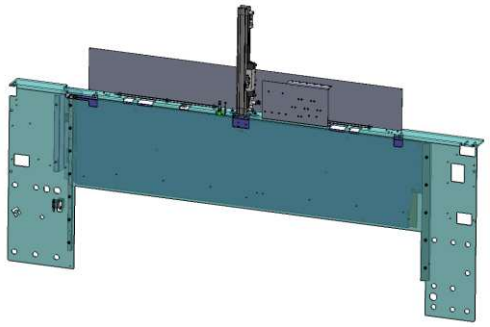
Concept for behavior simulation model generation
Simulation Model Generator



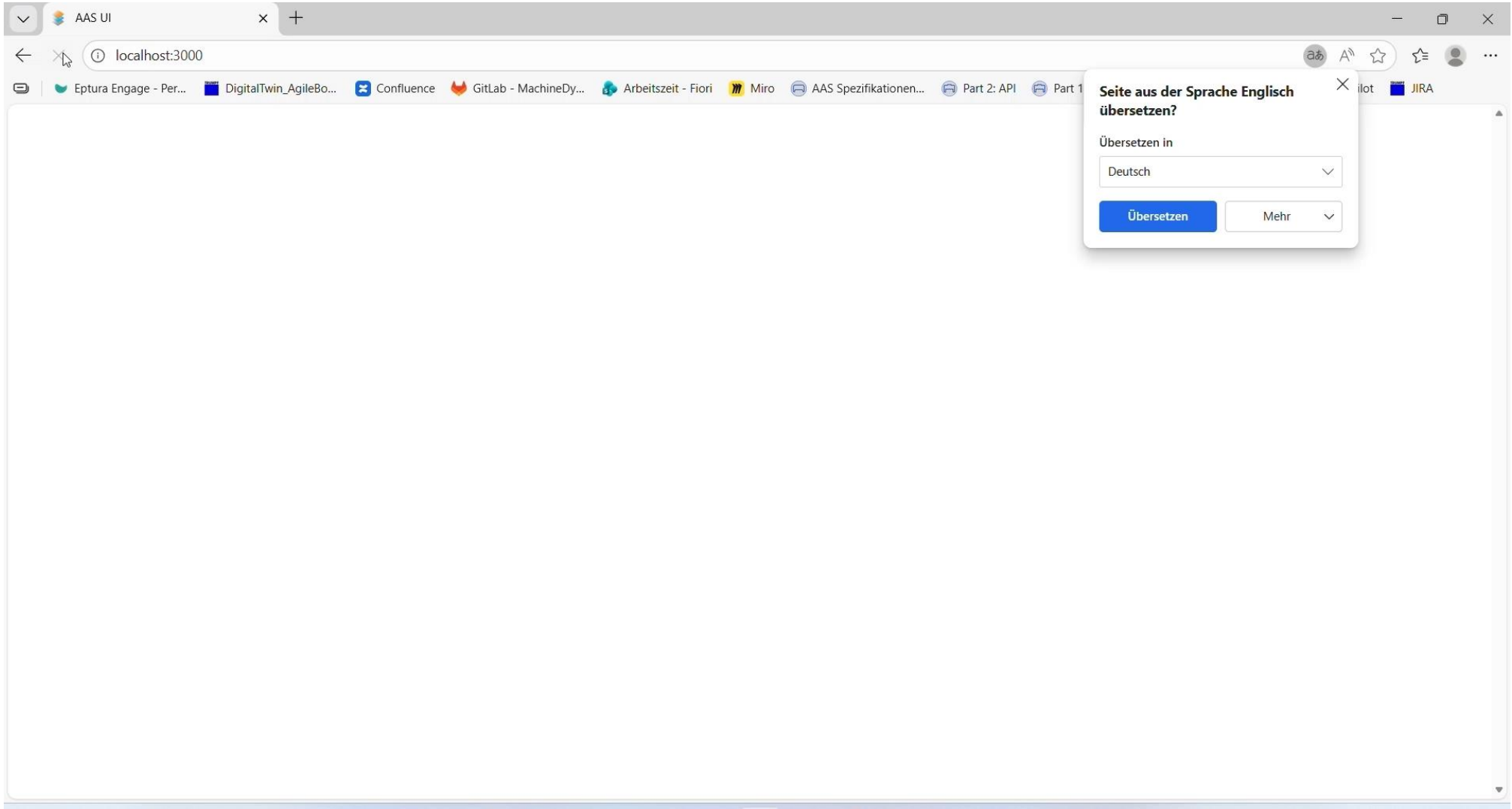
Realization
Example from a laser cutting machine tool

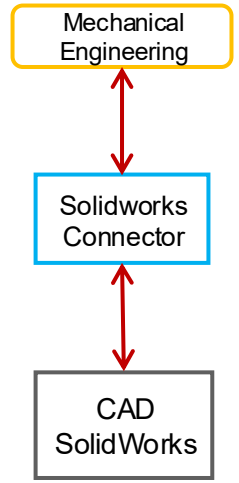
Lateral Air Blast Module
with electro-pneumatic components

Pallet Gate Module
with electro-pneumatic and mechanical components

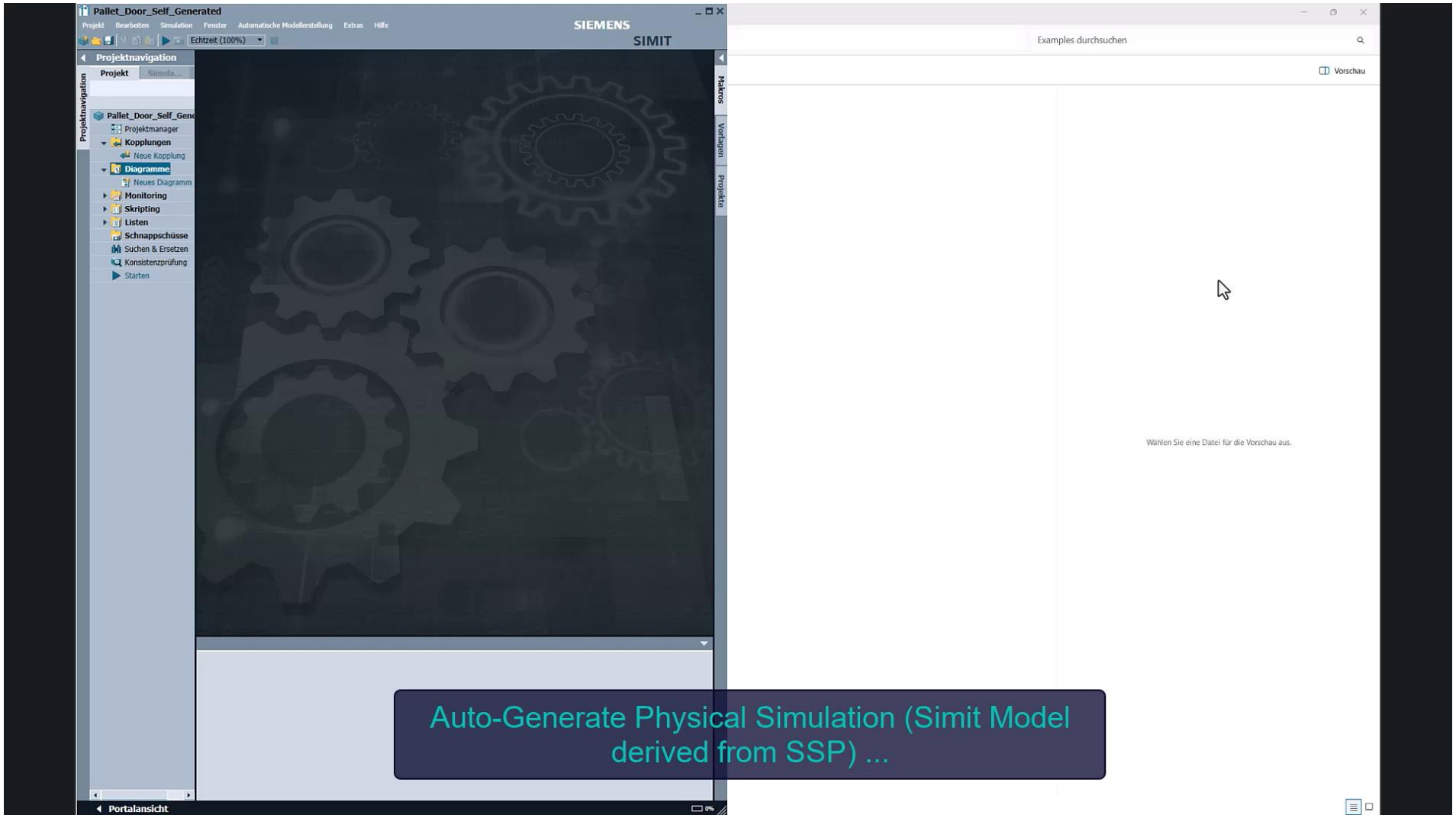


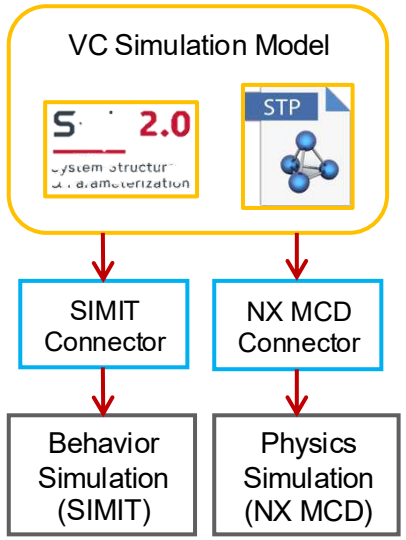
Realization
Solidworks Connector with AAS Basyx SDK





Realization
Simulation Model in Target Tools





Conclusion
Efficient virtual testing through automatic model generation

FACTORY-X

Contribution

- End-to-end engineering tool integration using data pull instead of file push
- Concept was verified with engineering data of a real machine tool module
- Semantic technologies (e.g. RDF & SPARQL) enable flexible usage of information from multiple AAS submodels
- Combination of STEP AP 242, SSP and FMI is suitable to store all information for the target simulation tools

Outlook

- Evaluate LLM usage to improve concept
- Expand validation to further examples

FACTORY-X

Q & A

Thank you!

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