FACTORY-X

Factory-X

Customer Sounding Board
July 16, 2024

PART OF MANUFACTURING-X

Funded by the European Union
NextGenerationEU

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Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag

Agenda
Topics and Presenters

Topic	Presenter
Welcome & Moderation	Silke Huesmann 
Factory-X Overview & Introduction	Roland Rosen 
How do the Factory-X use cases fit into the overall picture? The Factory-X Use Cases (Overview)	Ulrich Löwen 
Use Case 2.03: Collaborative Information Logistics	Christoph Attila Kun 
Use Case 2.11: Circular Economy	Dominik Rohrmus 
The way forward regarding the Factory-X use cases	Ulrich Löwen 
Q & A	All

FACTORY-X

Factory-X

The Digital Ecosystem for Factory Outfitters and Operators

Factory-X is a Lighthouse Project for Manufacturing-X

- Building the **open** and **collaborative digital ecosystem** for Factory Outfitters and Operators upon Catena-X and concepts of Platform Industry 4.0
- Focus on **11 dedicated use cases** to extend the existing horizontal supply chain-oriented use cases and add vertical use cases to integrate the operation of shop floors
- Under the leadership of Siemens and SAP, **47 partners** are working together in this strong consortium, supplemented by **10 associated partners**
  (companies, associations and research institutions)
- **Manufacturing-X wide coordination** and establishment of an **international Manufacturing-X network**
- Project started on February 1st, 2024
- Completion of Project by June 2026

Factory-X Partners

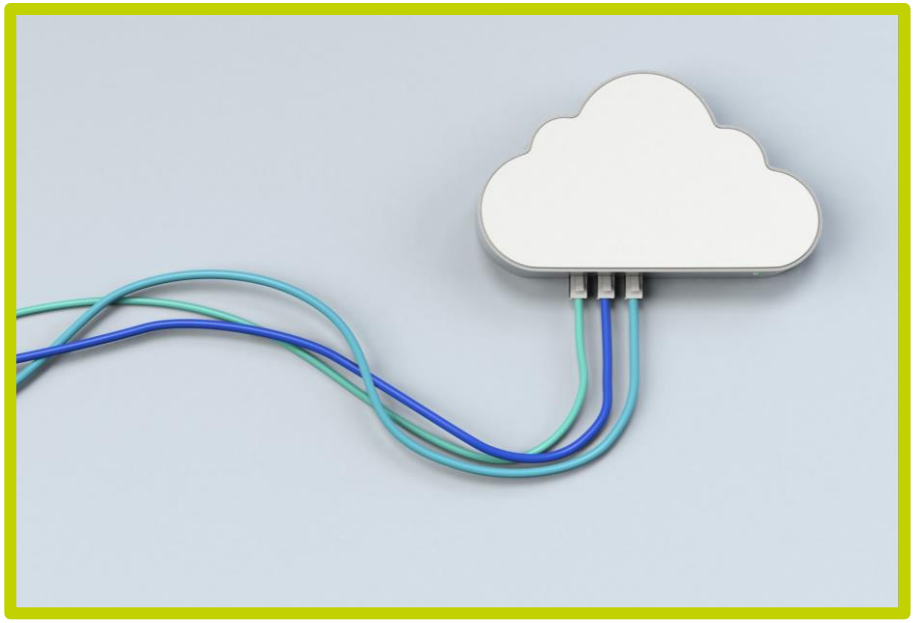
- August Wilhelm Scheer Institut
- BASF
- Berger Holding
- Catena-X e.V.
- Codewerk
- DMG MORI
- Empolis
- EPLAN
- Estainium
- Eviden
- Festo
- Fraunhofer
- German Edge Cloud
- Hilscher
- ifm diagnostic
- IFW - Leibniz Universität Hannover
- igus
- inovex
- InstaWerk
- ISW - Universität Stuttgart
- Lenze
- LNI e.V.
- Matchory
- MT Analytics
- Open Industry 4.0 Alliance
- Pakic
- Phoenix Contact
- prenode
- proALPHA
- RIF Engineering & Consulting
- Ruhr-Universität Bochum
- SAP
- Scheer GmbH
- SCHUNK
- SDFS Smarte Demonstrations-fabrik Siegen
- SICK
- Siemens
- SmartFactory-KL e.V.
- soffico
- Software AG
- TRUMPF
- T-Systems
- TÜV SÜD Chemie Service
- Uhlmann Group
- VDMA e.V.
- WITTENSTEIN
- ZVEI e.V. (FE)

Factory-X Associated Partners

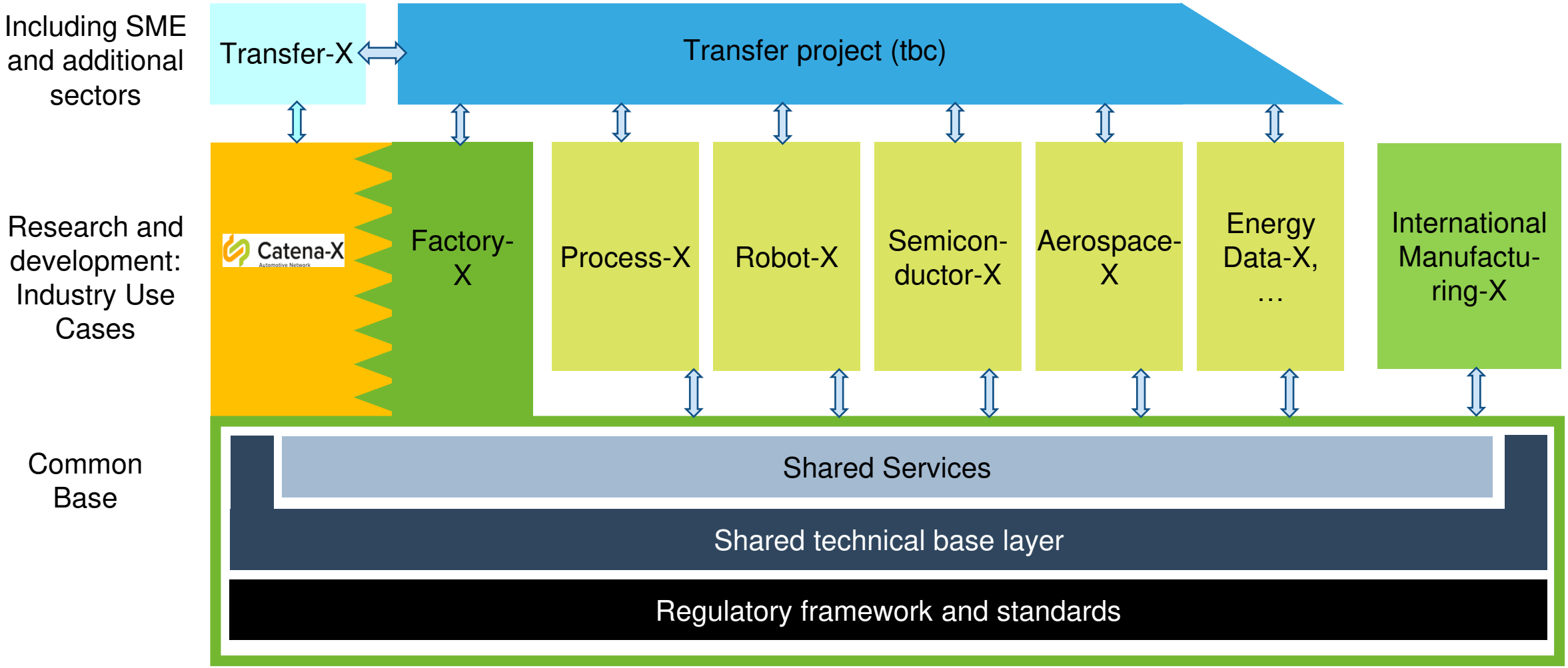
- ARENA2036 e.V.
- Arvato Systems Digital
- Bayern Innovativ
- Beckhoff Automation
- Digital Data Chain
- IDTA e.V.
- Robert Bosch
- Sharecat Solutions
- VDE e.V.
- ZVEI e.V.

Key Objectives of Factory-X

- Creation of a Factory-X digital ecosystem, considering existing standards
- Cross-manufacturer data consistency for engineering, device information and condition monitoring
- Contribution to sustainability through CO2 footprint- and energy management, as well as digital solutions to support a circular economy
- Provision of digital solutions for "as a Service" business models (e.g., marketplace/pay-per-part, remote control/monitoring)
- Traceability of materials, data, and products along the entire supply chain
- Update and change management for devices in the field



TP 4 Factory-X Kernel
Systemic approach to „Manufacturing-X“



11 Use Cases of Factory-X

11 Use Cases for horizontal and vertical data transfer

Integrated Toolchains and Collaborative Engineering

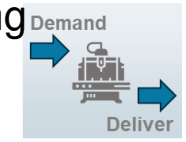
Information Update and Change Service

Collaborative Information Logistics

Condition Monitoring led Services

Modular Production

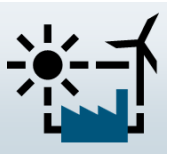
Manufacturing as a Service – On Demand Manufacturing



Autonomous Operation-as-a-Service

Traceability

Energy-Consumption and Load Management



Carbon Footprint Management

Circular Economy

Factory-X Kernel & Basis Services

Factory-X goes public
Registrierung über https://factory-x.org/

Manufacturing-X Technical Council

Was ist das Manufacturing-X Technical Council?

- Factory-X verfolgt die Zielsetzung unter Verwendung von Ergebnissen von Catena-X eine IT/SW-technische Basis (den „Factory-X Kernel“) für Software-Lösungen in Manufacturing-X zu schaffen.
- Im M-X Technical Council werden die Ansätze – entsprechend des Projektfortschrittes – vorgestellt und zu Feedback eingeladen.

Für wen ist es?

- Das Manufacturing-X Technical Council richtet sich an alle, die Interesse an der Anwendung des IT/SW-technischen „Factory-X Kernels“ haben, z.B. für die Realisierung eigener Software-Lösungen im Rahmen Manufacturing-X.

Wann? #1 war am 10.07.24

Customer Sounding Board

Was ist das Customer Sounding Board?

- In Factory-X werden für 11 Use Cases verschiedene sogenannte Business Applikationen (Software-Lösungen) konzipiert, prototypisch entwickelt und validiert.
- Im Rahmen des Sounding Board werden diese – entsprechend des Projektfortschrittes – vorgestellt und zu Feedback eingeladen.

Für wen ist es?

- Das Customer Sounding Board richtet sich an alle, die Interesse an der Anwendung, z.B. Erprobung, der Business Applikationen haben oder eigene, zu Factory-X interoperable Software-Lösungen erstellen wollen.

Wann? Jetzt!

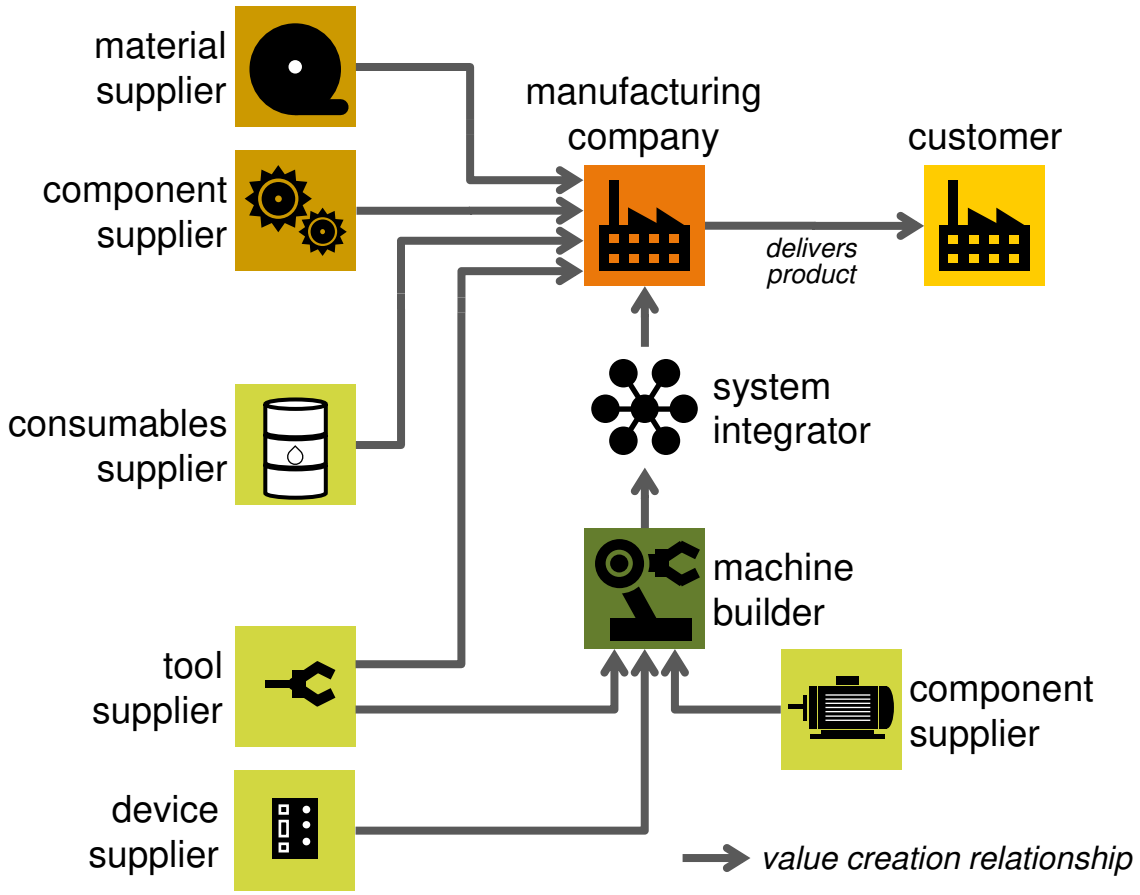
Wie geht es weiter?

Weitere MX TC und CSB werden folgen und wir streben direkten Austausch an!

How do the Factory-X use cases fit into the overall picture?

Supply Chains in Manufacturing Industries

Illustration

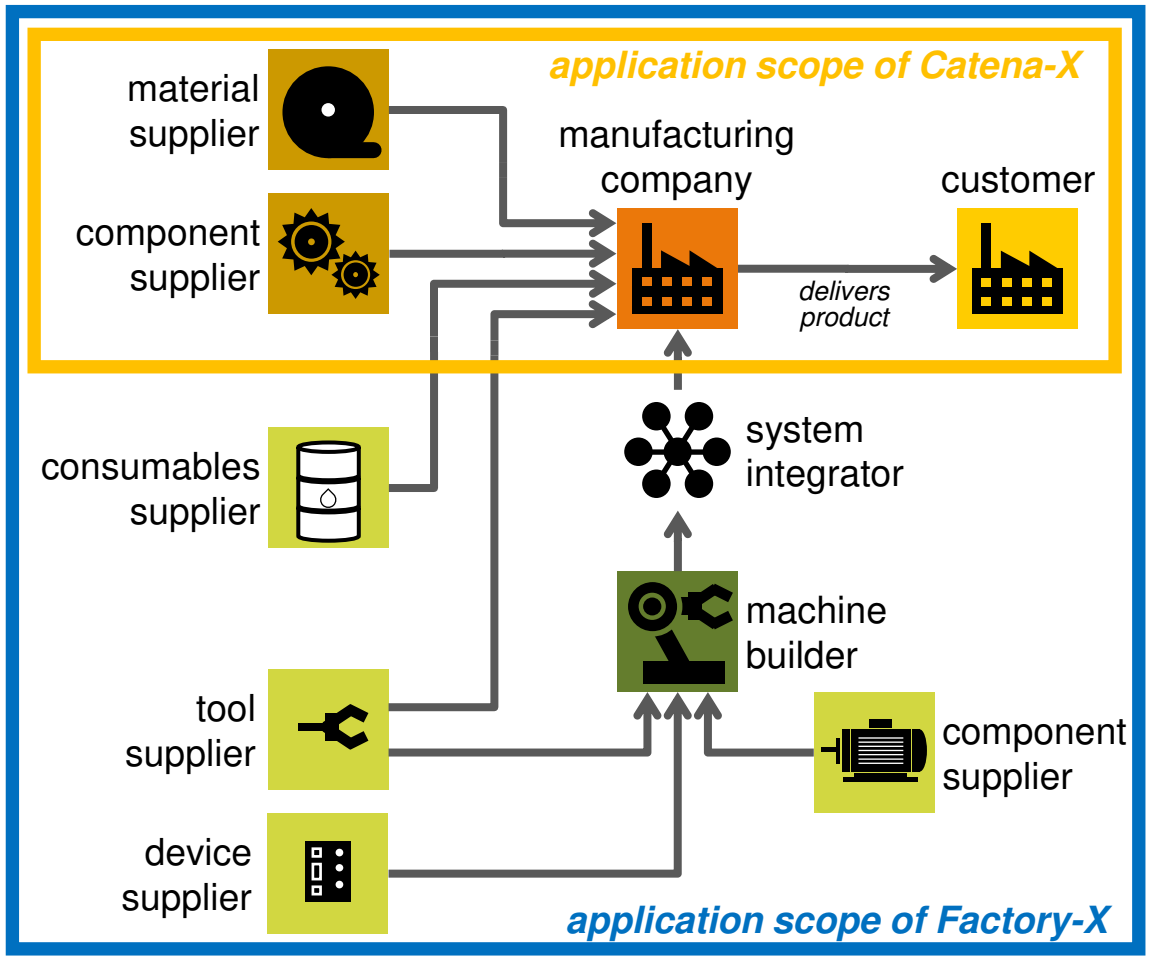


From the perspective of a manufacturing company, there are two different supply chains:

- Supply chain regarding the **product** of the manufacturing company
  - All deliveries from suppliers that are **integrated** into the manufacturing company's product
  - Application scope of Catena-X
- Supply chain regarding the **production system** of the manufacturing company
  - All deliveries from suppliers that are needed to **build** and **operate** the manufacturing company's production system
  - Expansion of application scope of Catena-X by Factory-X

Supply Chains in Manufacturing Industries

Illustration



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Overall Architecture of Factory-X: The Digital Ecosystem for Factory Outfitters and Operators

FACTORY-X

Resilience | **Sustainability** | **Competitiveness**

Digital Products and Services | **Everything as a Service**

Product Innovation Collaboration | **Production Optimiz. / Autonomous Factory** | **Supply Chain Transparency** | **Energy & CO_2-Management**

Shared services

Shared technological base layer

Regulatory Framework and Standards

The Factory-X Use Cases

Use Cases 1/3

Integrated Toolchains and Collaborative Engineering

Challenge:
Need for improved engineering collaboration by seamless integrated and interoperable engineering tool chains

Goal:
Standardized engineering tool integration & solutions for engineering automation

Information Update and Change Service

Challenge:
Transparency and consistency regarding updates of information and software

Goal:
Solutions for automated and reliable update services and common device management

Collaborative Information Logistics

Challenge:
Lack on standards for exchanging asset information across companies

Goal:
Solutions for interoperable information provision services

Condition Monitoring led Services

Challenge:
Current condition monitoring and related services cannot realize their full potential due to data sharing and analysis hurdles

Goal:
Improve processes and services, while keeping data sovereignty and cost control

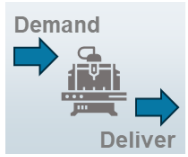
Use Cases 2/3

Modular Production

Challenge:
Simplify production set-up and control

Goal:
Solutions for self-describing machines and decentralized production process control

Manufacturing as a Service – On Demand Manufacturing



Challenge:
Enable small and medium enterprises being part of digital marketplaces

Goal:
Digitalization and automation of bidding and order execution processes for manufacturing as a service

Autonomous Operation-as-a-Service

Challenge:
Need for methods & tools for autonomous operation of machines & factories

Goal:
Solutions for smart remote monitoring and operations

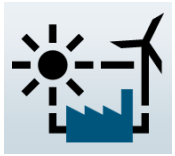
Traceability

Challenge:
Traceability of data within a factory and across the supply chain

Goal:
Solutions for management of history and usage of material, parts and products

Use Cases 3/3

Energy-Consumption and Load Management



Challenge:
Reduction of energy consumption and energy costs

Goal:
Solutions for detailed energy monitoring, energy saving features and an optimized energy and load management

Carbon Footprint Management

Challenge:
Reduce CO_2-footprint and become CO_2-neutral

Goal:
Solutions for CO_2-transparancy along entire supply chain

Circular Economy

Challenge:
Use full product transparency to transfer industrial products to second life

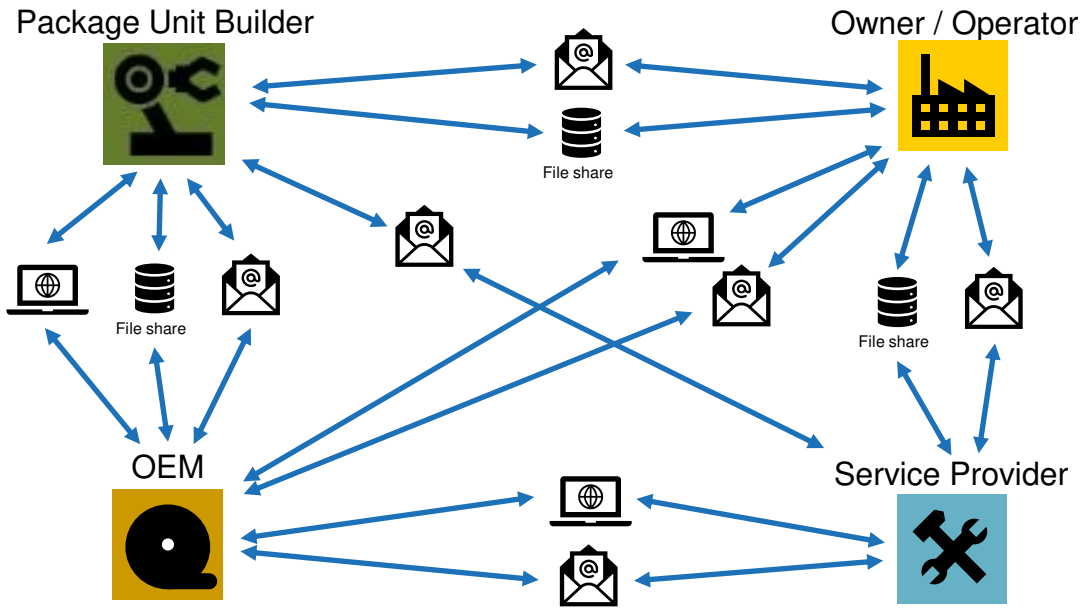
Goal:
Solutions for assessing remanufacturing, refurbishment & recycling measures

FACTORY-X

UC 2.03
Collaborative Information Logistics

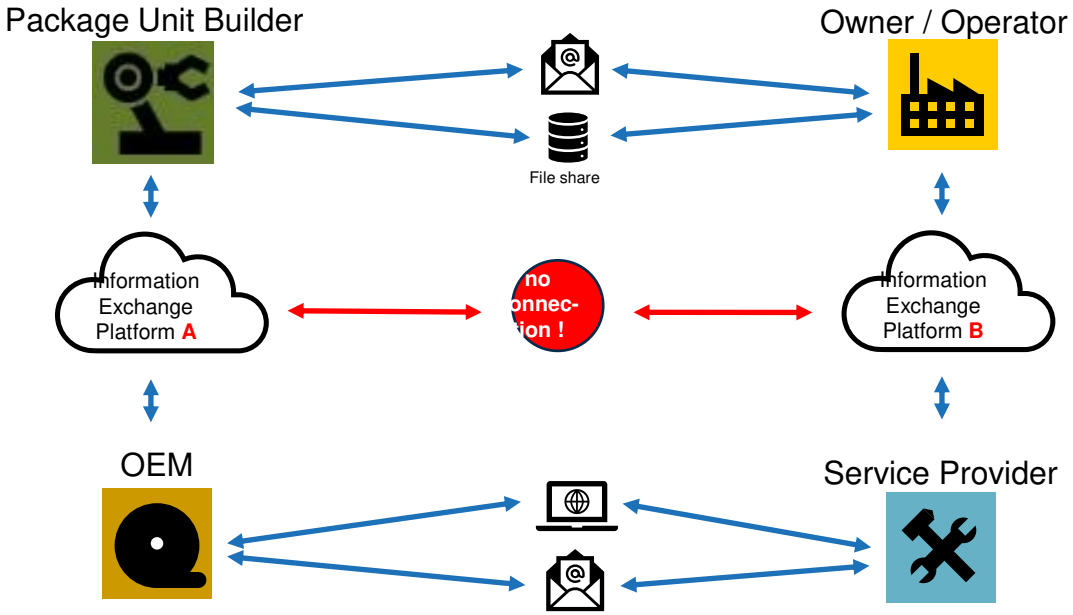
Use Case 3: Collaborative Information Logistics Motivation

Challenges in Information Logistics between business partners today



Typical, non-automated manual communication

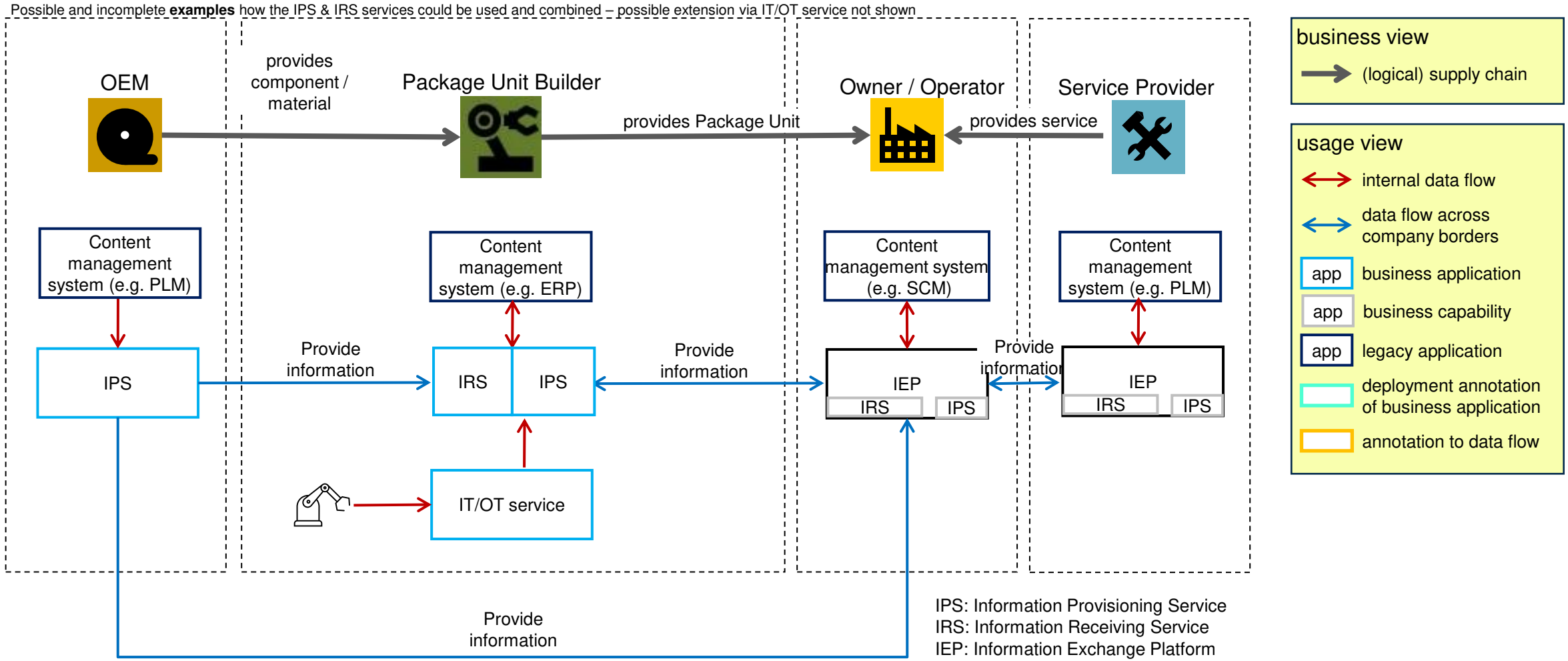
- fault prone
- slow
- not scalable
- not automatable on this technology stack



Semi-automated, mainly manual communication

- No data exchange between platforms, as they are unconnected
- Only partially scalable
- Not automatable on this technology stack

Usage View UC 3: Collaborative Information Logistics
Information Provisioning (IPS), Information Receiving (IRS) and IT/OT Service

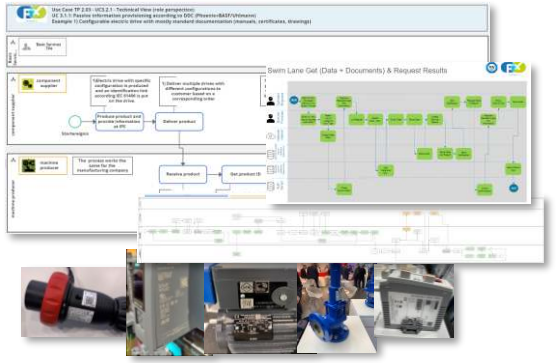


OEM / Komponentenhersteller: Hilscher, PhoenixContact, Siemens
Owner / Operator – Fabrikbetreiber: BASF
Softwarehersteller: Codewerk, SAP, Sharecat Solutions (assoziierter Partner)

Package Unit Builder / Maschinenhersteller: DMG Mori, Uhlmann Group
Service Provider: TÜV Süd Chemieservice

Use Case 3: Collaborative Information Logistics

Use Cases



- Business process descriptions (as-is and to-be)
- Example information

Technology

- Map capabilities to business processes
- Identify synergies, alternatives and gaps

Demonstrators

- Demo implementations
- Identify core elements which should be specified in standards
- Define requirements for certified applications

Results of the first 3 months in UC 3

- First demos have identified good usability of AAS
- Use cases share common elements, but differences must be considered in the technology evaluation

UC 2.11
Circular Economy

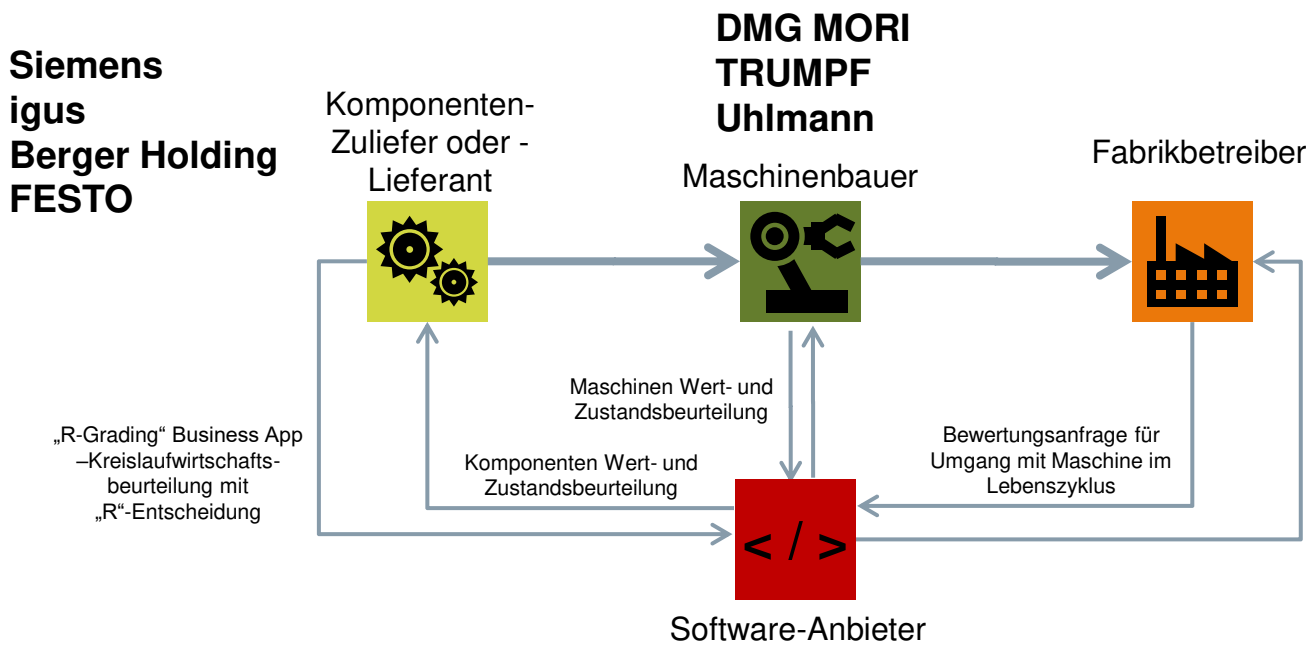
Use Case Circular Economy – wer sind wir

Fabrikbetreiber / Anwender
- KMU: Pakic, RIF
- OEM: Uhlmann, Berger

Maschinenhersteller
- OEM: TRUMPF, DMG MORI, Uhlmann

Komponentenhersteller
- KMU: igus, Berger
- OEM: FESTO, Siemens

Software
- KMU: Berger
- OEM: Siemens, TRUMPF, DMG MORI, FESTO



UC Circular Economy – Problem und Herausforderungen

Problemstellung

- Komponenten werden häufig aufgrund von Informationslücken der Fachbeteiligten oder Wartungsvorschriften ausgetauscht, manchmal unnötigerweise entsorgt oder ineffizient recycled
- Fehlende Standards und industrielle Plattformen
- Bessere Datenlage und souveräner Datenaustausch zwischen Komponentenherstellern, Maschinenbauern und Fabrikbetreibern werden Kreislauf-Geschäftsmodelle basierend auf **digitalen „R“-Informationen*** ermöglichen

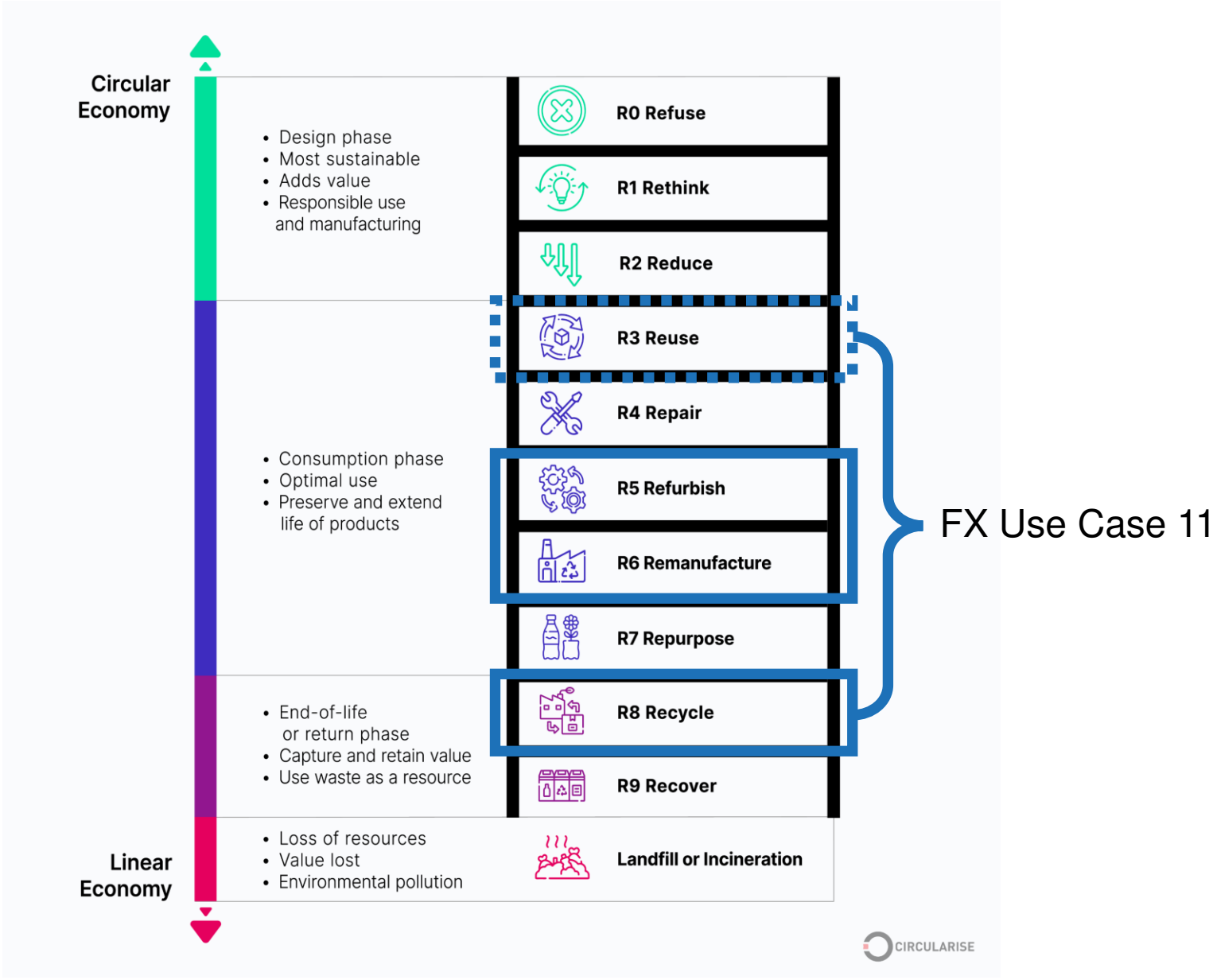
Herausforderungen

- Derzeit gibt es keine nahtlose unternehmens- und branchenübergreifende Zweitverwertung (second-life) von Produkten, Komponenten oder Materialien
- Nur wenige Komponenten oder Materialien werden industriell der Wiederverwendung zugeführt, da genaue Wertermittlung fehlt und keine Geschäftsentscheidung abgeleitet ist

*Remanufacturing / Refurbishing / Recycling

UC Circular Economy and the „R“

From
Linear Economy
to
Circular Economy



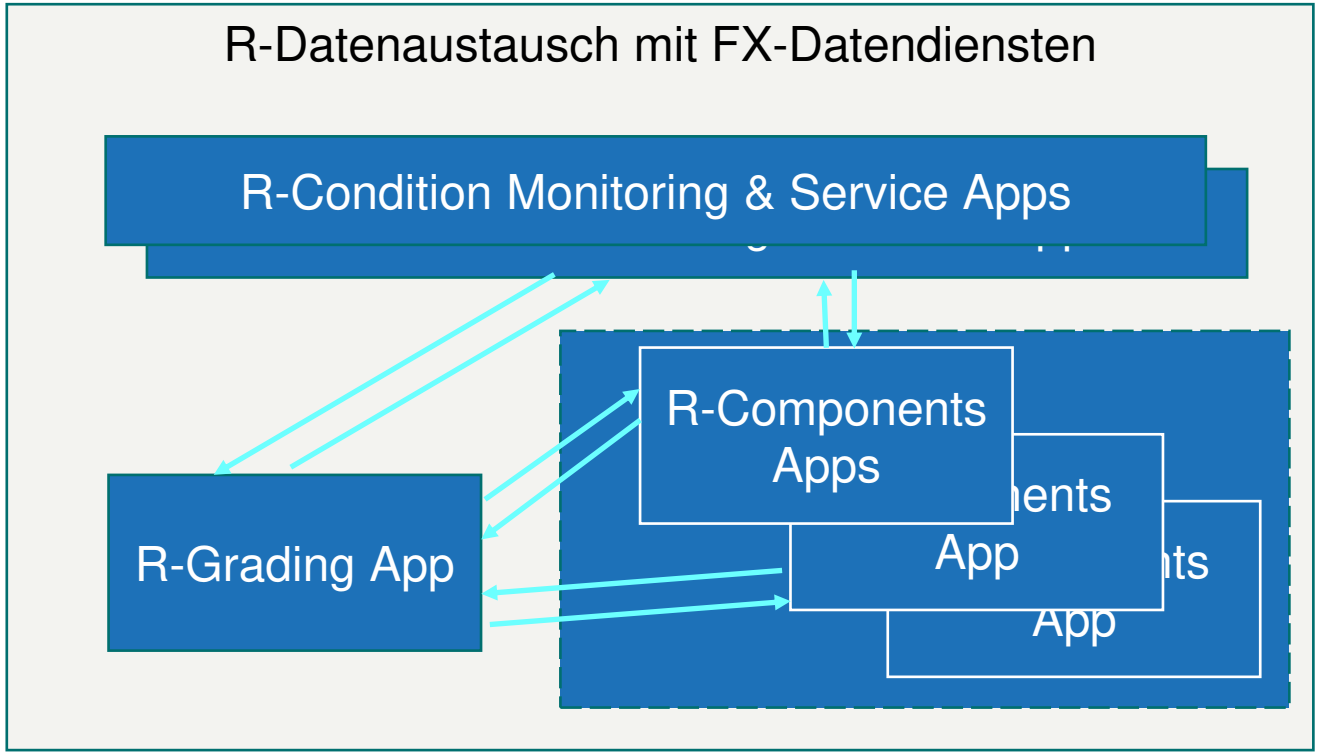
UC Circular Economy – Lösungsansatz und Vorteile

Lösungsansatz

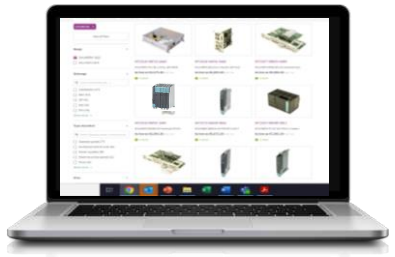
- Automatisierte Bewertung des Produktzustands und der Restleistung zum aktuellen Zeitpunkt
- Identifizierung von geeigneten Kreislaufwirtschafts-Maßnahmen über deren gesamten Lebenszyklus

Vorteile

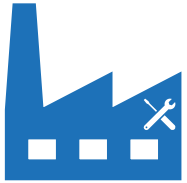
- End-to-End Prozesstransparenz über gebrauchte Komponenten und Maschinen
- Validierte Entscheidungsunterstützung für Zweitverwendung
- Umsetzung von R-Strategien in digitalen Geschäftsmodelle (Remanufacturing / Refurbishing / Recycling, etc.)



UC Circular Economy – Summary



R-Recommendations



Maintenance Engineer

System Trigger

R-Condition Monitoring App

R-Components Services App

R-Grading App

- Machine in use at owner
- Business-trigger (e.g. regular maintenance during production, breakdown, or replacement)

Usage and service data of machine

Usage and service data of components

- Calculate options to remanufacture, refurbish, reuse, recycle, etc components or machines
- Enable closing

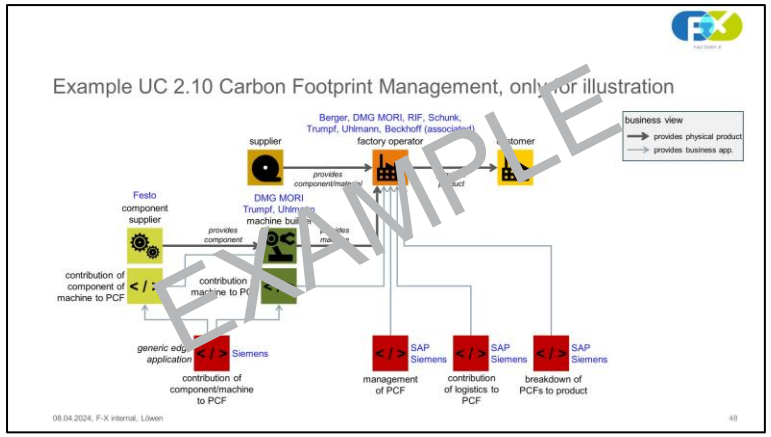
The way forward regarding the Factory-X use cases

Operative Setup of Factory-X Project: Perspective from the Use Cases

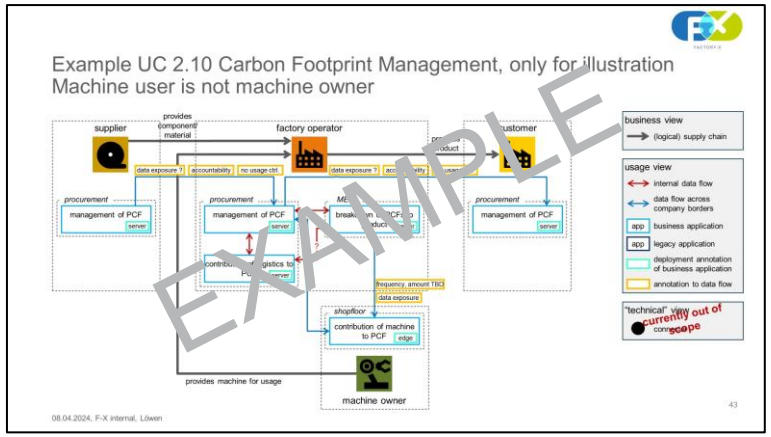
Objectives

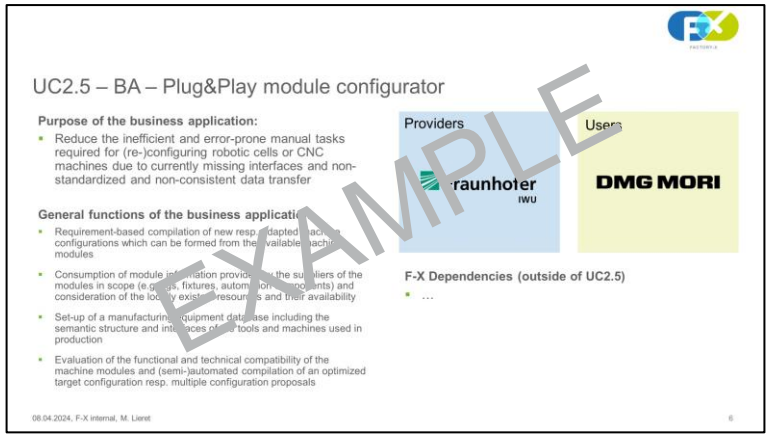
- Having a common understanding on a first draft of a business and usage view
- Views should be agreed by **all** partners in a use case
- Business and usage view described on a common methodology based on IEC 63283-2 Smart manufacturing – Use cases

First draft business view



First draft usage view





The Overall Technical Challenge in Factory-X

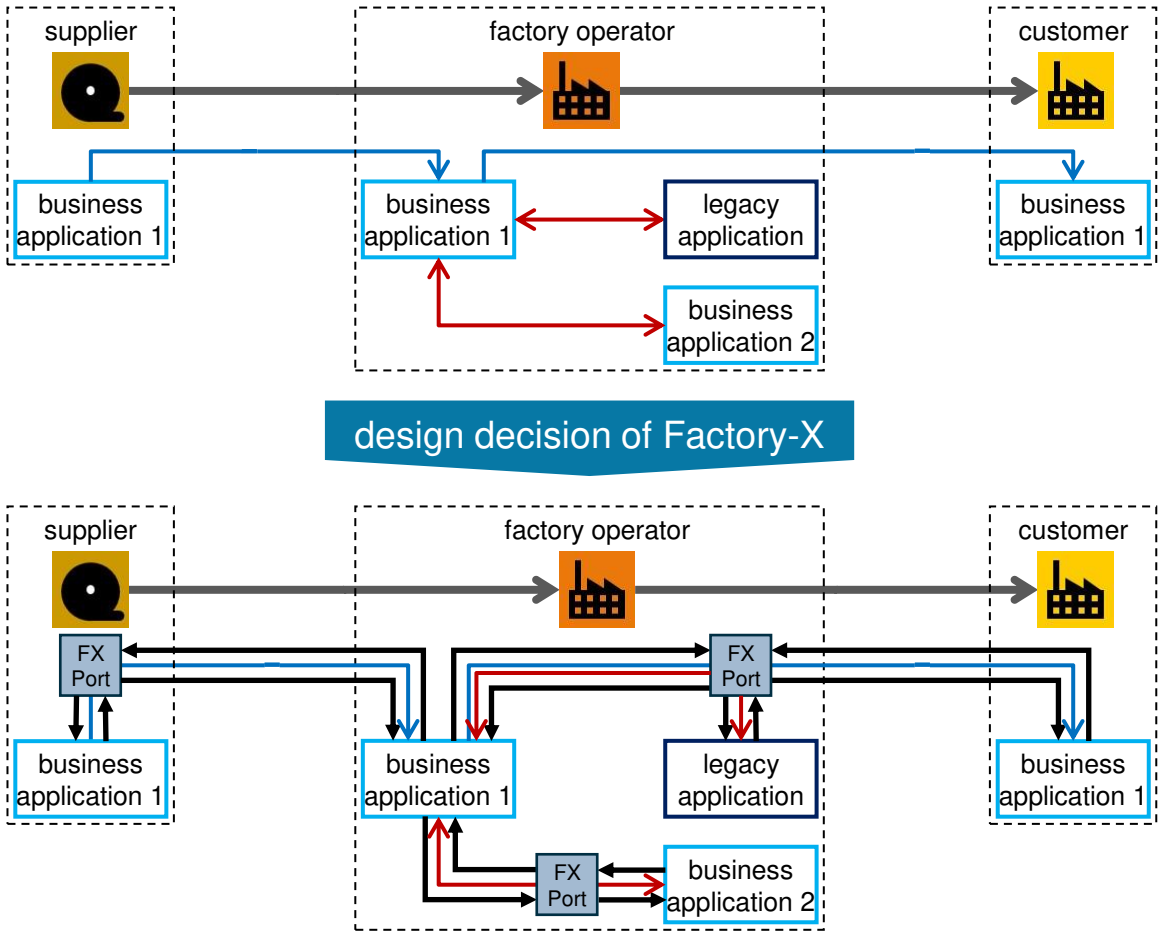
Design decision by Factory-X

- Interactions between **business applications** will be implemented in a **uniform manner** using a concept provided by TP4
- **Legacy applications** will be integrated in a **uniform manner** using a concept provided by TP4

TP4 will

- Develop such a FX Port concept
- Describe how to apply the FX Port concept
- Provide prototypical implementations of the FX Port concept

Illustration



FACTORY-X

Q & A

Thank you

Contact information:

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Backup

Factory-X
Project Organization

- TP 1: Project Management
- TP 2: Use-Cases
- TP 3: Business Models
- TP 4: Factory-X Kernel & Basis Services
- TP 5: Factory-X Operating Model
- TP 6: Transfer measures
- TP 7: Manufacturing-X wide coordination