PLM Roadmap & PDT EMEA

Digital Transformation

Gothenburg, Sweden 18-19th of October 2022

Per Söderberg

Our history

A young company ...

Siemens Energy was first listed on the Frankfurt Stock Exchange on September 28, 2020 – and is now an independent company.

Our history

… with a strong heritage

In 1866, engineer and company founder Werner Siemens discovered the dynamo-electric principle. With this, he laid the foundation for modern electrical engineering, first enabling electricity to become part of our everyday lives.

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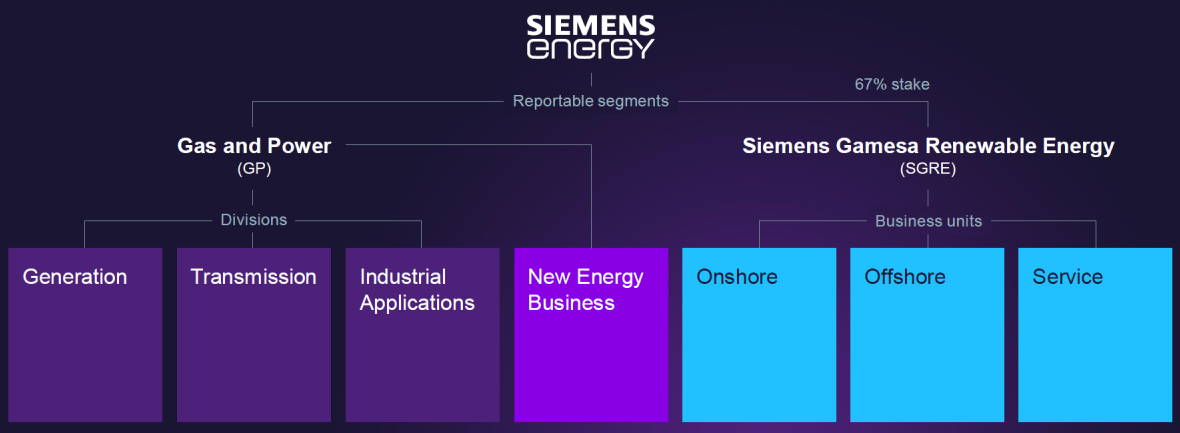
Company structure



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Our Divisions

Industrial Applications

Supporting industrial operators to navigate the energy transition.

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The innovative solution partner for the Oil & Gas, Fiber, Marine and Process Industries, across the entire energy value chain.

Worldwide #1 or #2 in the fields of rotating equipment, electrification, automation, digitalization (READ).

More than 79,000 units installed worldwide – maintained by READ lifecycle service offerings that make up 60% of the Division's revenue.

Leading innovations in additive manufacturing, automation, and decarbonization, e.g., hydrogen and green fuel production, up to 100% H_2-capable gas turbines, as well as digitalization, e.g. cyber security, and cross-industry solutions.

Multiple legacy processes and IT landscapes

Incomplete data from legacy systems

Legacy fleet data in physical documents

M&A adds complexity to the IT Landscape

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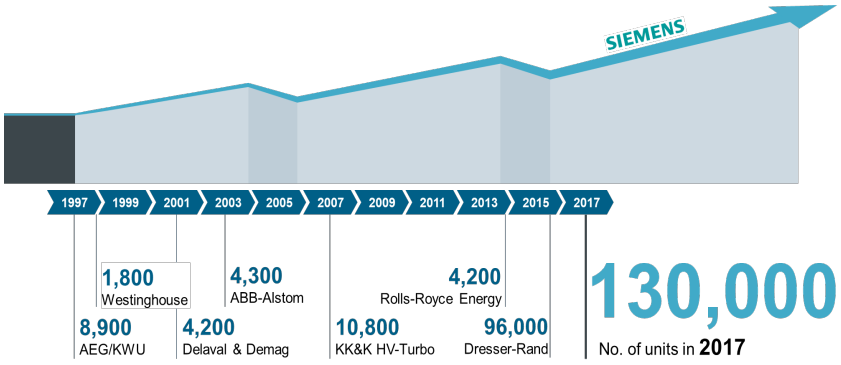
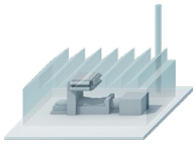


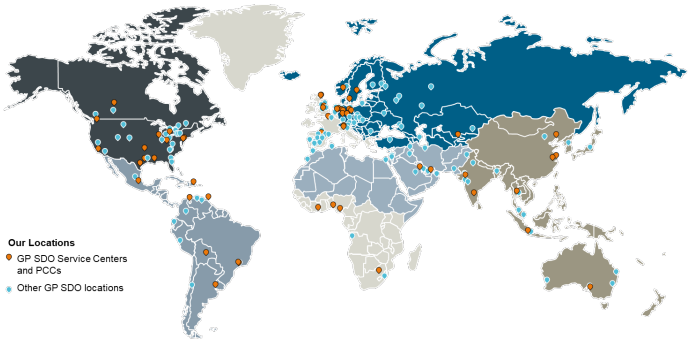
Industrial applications
Strong Footprint in All Industries



	Industrial	Power Generation *)	Oil & Gas
	• Chemicals • Pulp & Paper • Manufacturing	• Electric Power Utility • Independent Power Producer • Municipality	• Up-Stream • Mid-Stream • Down-Stream
Installed fleet (units)	**~26,000**	**~7,000**	**~53,000**
Installed fleet (%)	**~30%**	**~8%**	**~62%**

*) Only Service
New products with Generation

Operational Fleet of +86.000 machines installed in 169 countries



20 Product types
3 Competence Centres
Gas turbine

31 Product types
8 Competence Centres
Steam turbine

9 Product types
3 Competence Centres
Compressor

6 Product types
3 Competence Centres
Generator

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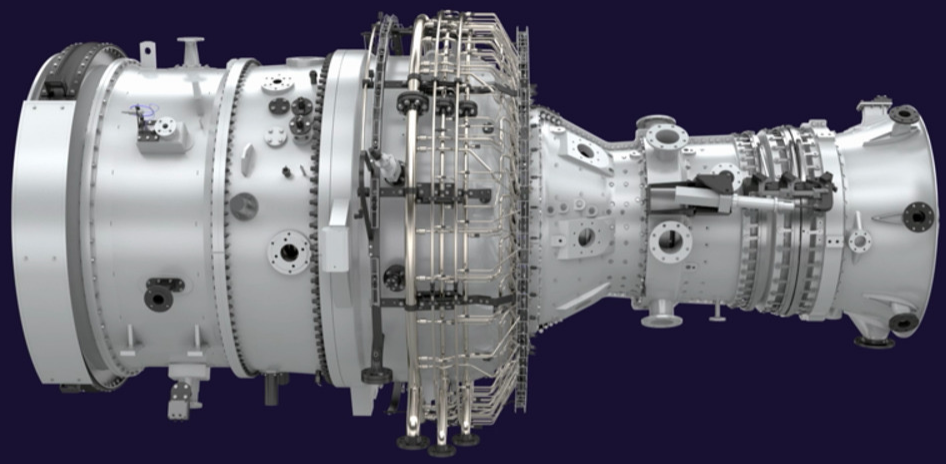


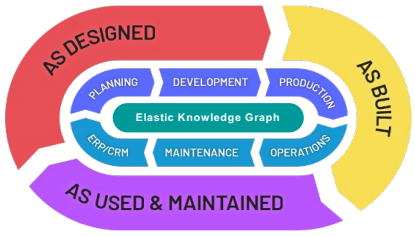
Industrial Metaverse
Why should we care?

Industrial Metaverse
Why should we care?

Re-using the best configuration to get the best profitability

Monitoring of progress and cost against forecast to preserve profitability

Business Development tool to select best in class OEMs and operators	Re-use operational data in **Virtual Provisioning**	Design Reviews to show **forecast performance** + **Smart Assets co-creation**	Supply chain risk and optimisation
Use of data from existing installations and site surveys to design new plant / installations			Re-use of best practice to improve project planning, commissioning and certification
Digital Service Design Platform (sell data & insights)			VR/AR SOP Training & Certification
Configurable analytics algorithms as a service			Collaborative remote support / diagnostics during project
On-site use of drones and digital tools for remote inspection and visual monitoring			Safety Incident Reduction
Remote monitoring, control and operations of installations (unmanned operations)	Fleet based data harvesting, based on site specific DTs	Improved commissioning / hand-over & documentation VR / AR customer training	Advanced algorithms for detecting imminent failure, dust or ice build up



Predictive Maintenance Remaining Useful Life & Spare parts strategies

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50%
UPTIME INCREASE ON FIELD SERVICE MAINTENANCE EVENTS

65%
REDUCTION IN ONSITE TRAINING EFFORT

45%
REDUCTION KNOWLEDGE SHARING EFFORT

Creating the Industrial Metaverse: Siemens Xcelerator + NVIDIA Omniverse

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NVIDIA's Omniverse, which offers **real-time**, full-design **fidelity photorealistic visualization**, with Siemens Xcelerator's **real-world engineering** and **physics-based simulation** to deliver the industrial metaverse.

This enables **industrial companies of all sizes** to create **closed-loop digital twins** with **real-time performance data**, ideal for **running simulations and AI-accelerated processes**.

Advanced applications such as autonomous factories that rely on intelligent sensors and connected devices.

Manufacturers can better respond to customer demands, reduce downtime, and adapt to supply chain uncertainty while achieving sustainability and quality targets.

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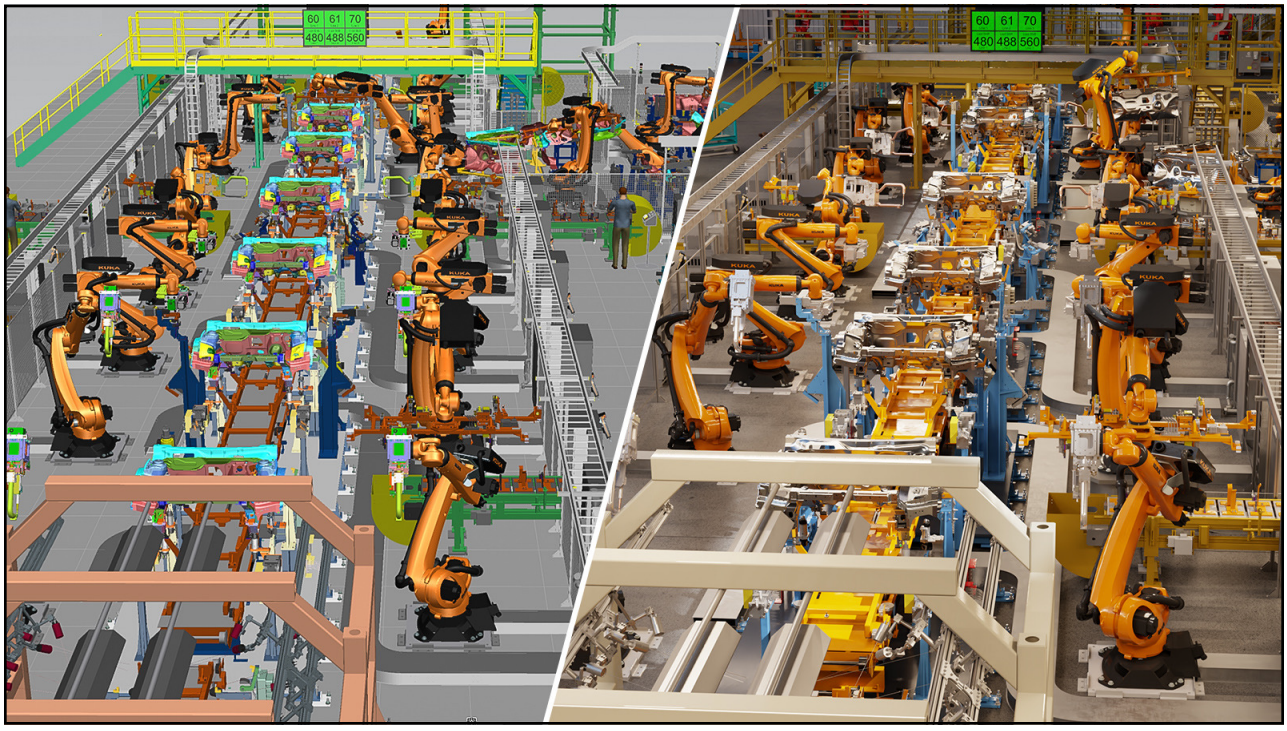
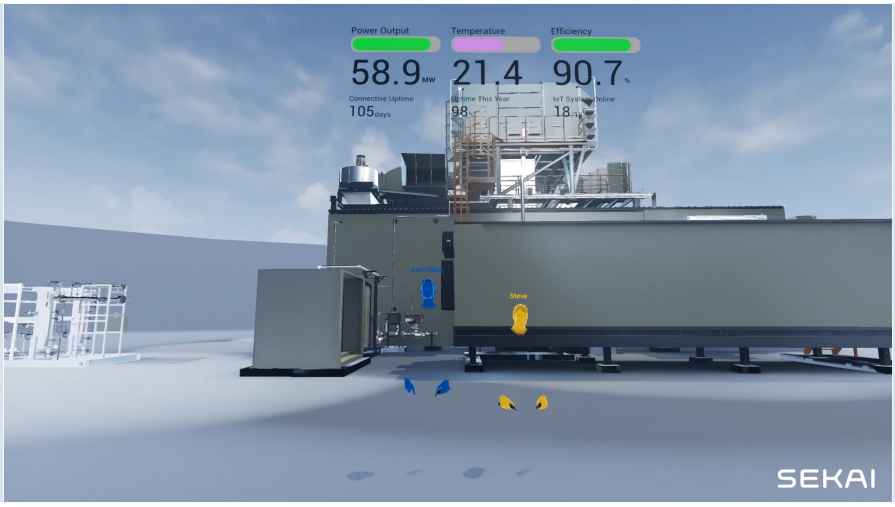


SGT-800 Overview
Mechanical and Functional Exploration



SGT-800 Overview
Washing Training

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Industrial Metaverse
Digital Transformation Challenges

Industrial Metaverse
The Challenges of Data

Maintain

Scalable catch of change.

1. Changes made by Customer
2. Changes made by Siemens

Operate

Conventional platforms don't scale, gaming does.

1. Federated digital twin platform
2. Continuous data feeds (IoT and Simulations)
3. Legislation
4. New business models

Create

Cheap production.

1. Basic DT does not bring substantial value to our customers
2. Plant services (analytics) bring value to the customer
3. Low cost to create digital twins is essential

Data

Reliable data is not available.

1. New delivery data incomplete (vendors);
2. Data in documents (older machines);
3. Fragmented IT landscape.

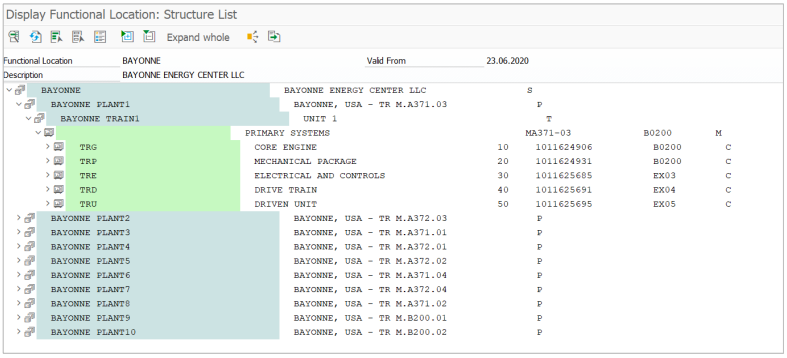
Data in documents

With an ageing operating fleet, older machines' data is only available in documents that vary in format.

In modern machines, 80 % of the data we need for the Industrial Metaverse is still in documents.

3D models exist for most machines since 2005, not for older machines

The Challenges of Data
Reliable data is not available



1) Examples: manufacturing, assembly and purchasing processes.

Fragmented IT Landscape

Consolidation of instances of different software's ongoing (e.g., from 26 SAP systems to 3).

Historically we have connected systems P2P in a costly manner and therefore not always done.

Used systems are often data silos with limited capabilities to share data.

Data created to serve the delivery process[1] is not good enough:

- Additional data is needed to build the Industrial Metaverse.

Data needed for a digital twin often is spread in different systems.

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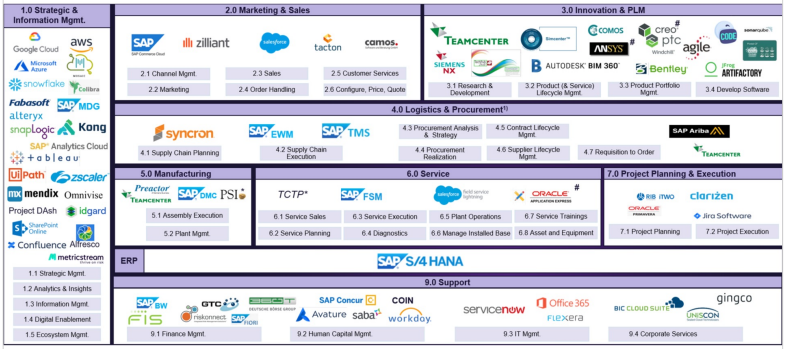
The Challenges of Data
Reliable data is not available



1) Examples: manufacturing, assembly and purchasing processes.

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Industrial Metaverse
How we intend to solve the challenges

Industrial Metaverse
The Solution: Data Democratization

Data Marketplace
Make Data available.
1. Data Catalogue.
2. API Catalogue.
3. Access to data.

Neutral Data Model
Common language to reduce complexity
1. Complex data landscape of +10.000 data models
2. Data transformation foundation (developers).

Data Governance
Make Data reliable.
1. Manage new data requirements.
2. Measure and govern data quality.
3. Decentralized data product development

Enterprise Data BUS (Microservices)
Standardized and reusable data products
1. Access to data outside backbone systems
2. Correlate/add/transform data.
3. Data discovery.

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Data and API Catalogue

Different areas need to be addressed in our Digital Transformation Journey:

We need to change focus from application to data;

The data marketplace makes reliable data available;

To create reliable data a mindset change is needed.

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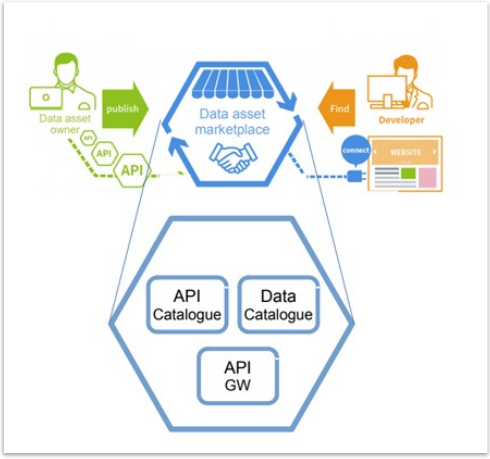
The Solution: Data Marketplace (Data democratization) Make Data Available



The Neutral Data Model

All systems/partners have their own data model +10.000 different data models to handle currently

The neutral data model is needed to create a common language which will reduce complexity

Will enable us to receive/deliver data in any format

We use standards for the neutral data model:
1. ISO 15926-14
2. ISO/IEC 81346-1
3. More standards will be added.

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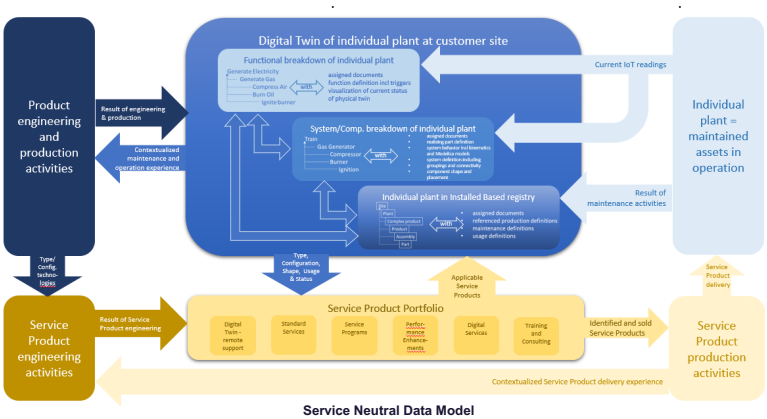
The solution: Neutral data model
Common language to reduce complexity



Service Neutral Data Model

Data models in digital format

To support the development of data products, data models need to be available in digital format

We have chosen to use ontologies and knowledge graphs

Neutral data model is the foundation and needs to be created early

Step by step approach – create additional data models when they are needed

Foundation for data product
- Usage requirements
- development
- quality assurance

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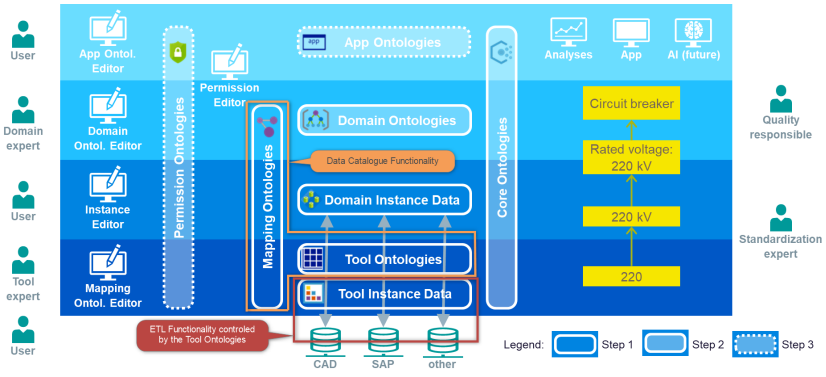
The solution: Neutral data model
Common language to reduce complexity



Data Democratization

A mindset switch from application focus to data focus needs to be organized.

Decentralized development of reusable data products needs to be governed

Data governance contributes to Digital transformation with:

- Data product standardization & reusability
- Data product requirement collection
- Drive development of data products
- Data reliability

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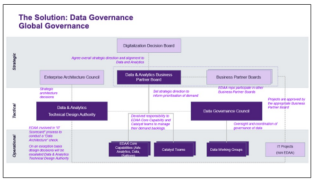
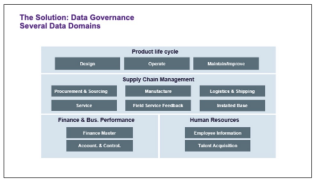
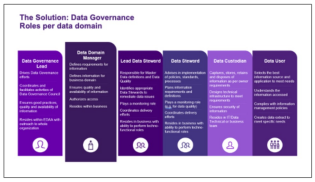
The Solution: Data Governance Make Data Reliable







1) Examples: manufacturing, assembly and purchasing processes.

Network of APIs deliver Data products

Backbone systems ensure data quality for their own purpose;

Changing systems to fulfil all data requirements is expensive;

A layered approach with APIs to handle Supply, Curation and Demand is needed.

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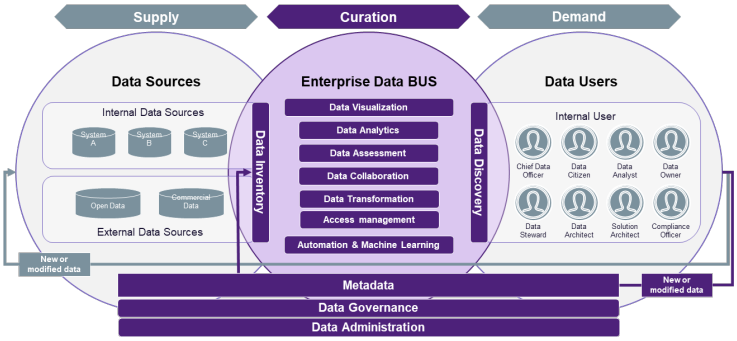
The Solution: Enterprise data BUS Standardized and reusable data products



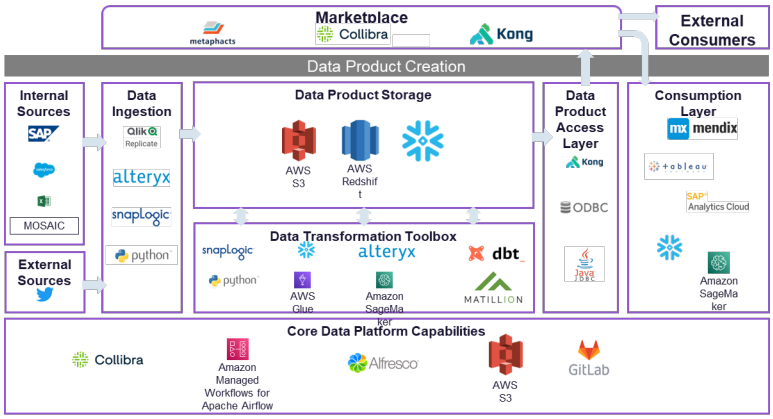
Used technologies (current state)

We intend to cover:
- Internal/external sources;
- Data ingestion;
- Data lakes;
- Transformation;
- Quality assurance;
- Access management.

The target is to create data products available in the data marketplace.

No more point-to-point integrations, reusable data products are needed to scale.

The Solution: Enterprise data BUS Standardized and reusable data products



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Industrial Metaverse
Key Take Aways

Industrial Metaverse
What should you take from this presentation?

1 Digital transformation

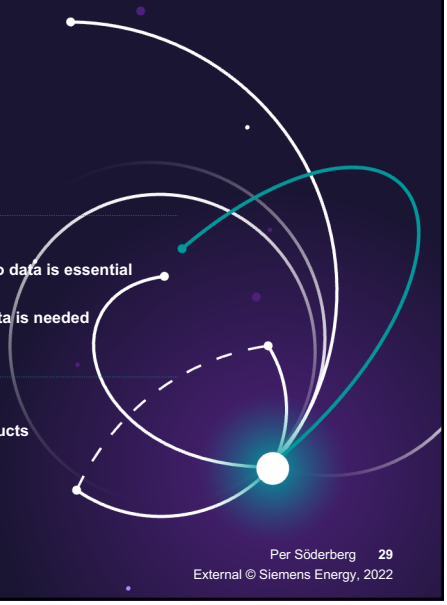
- Needed for any digital products (such as Metaverse)
- Data dememorization is essential – you need to make reliable data available
- Technology is needed, but more important is management backing, new business capabilities and change drive

2 Data availability/reliability

- With main portion of data in documents, capability to extract/transform documents into data is essential
- Data reliability can only be ensured at the source. Data quality KPIs covering all data requirements to govern creation/maintenance of data is needed
- Neutral data model is needed to handle complexity

3 Enterprise data BUS

- Move from point-to-point integrations to a network of reusable/standardized data products
- Global access management (Covering Enterprice data BUS and IT systems)



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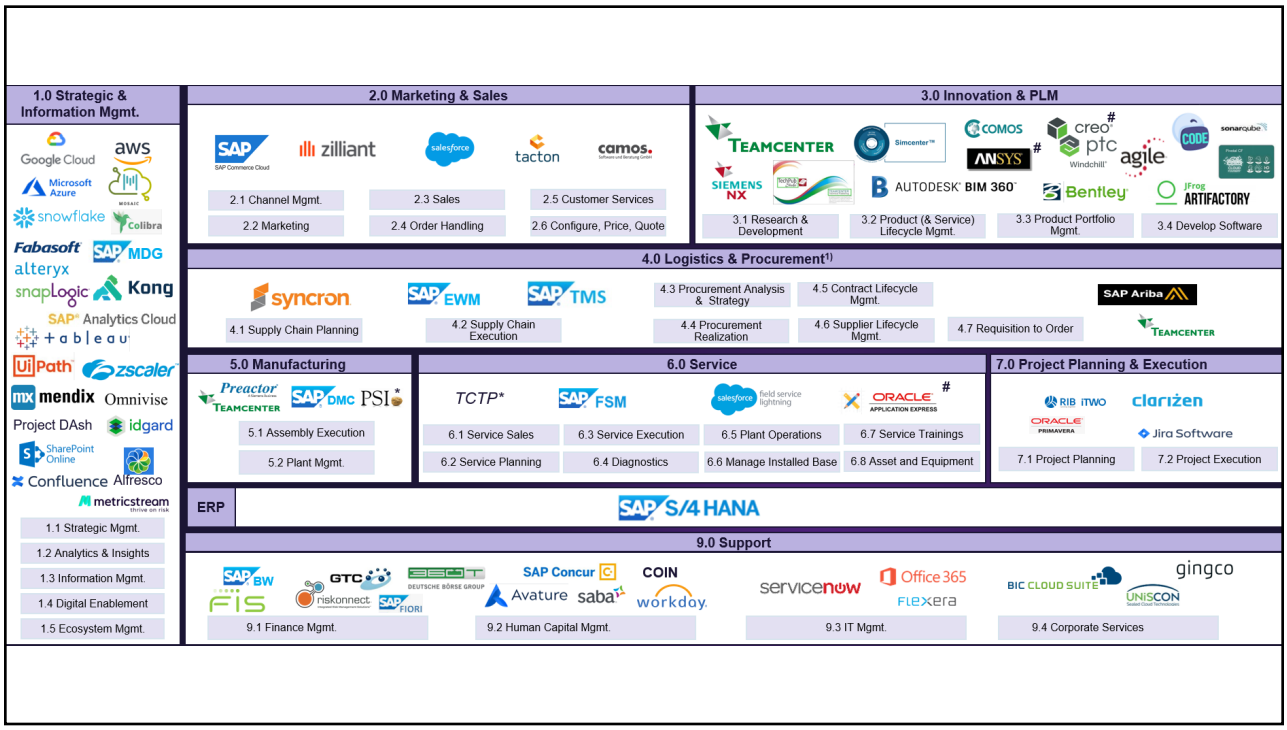
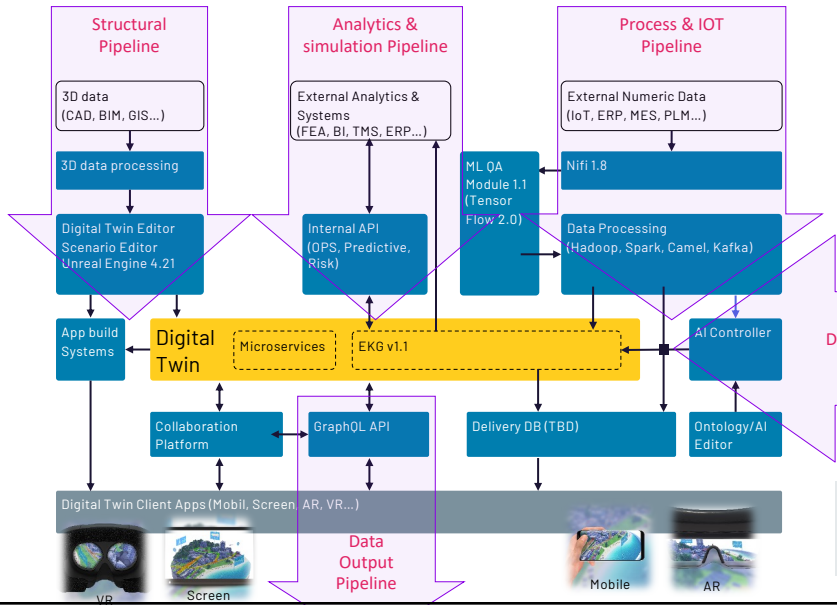


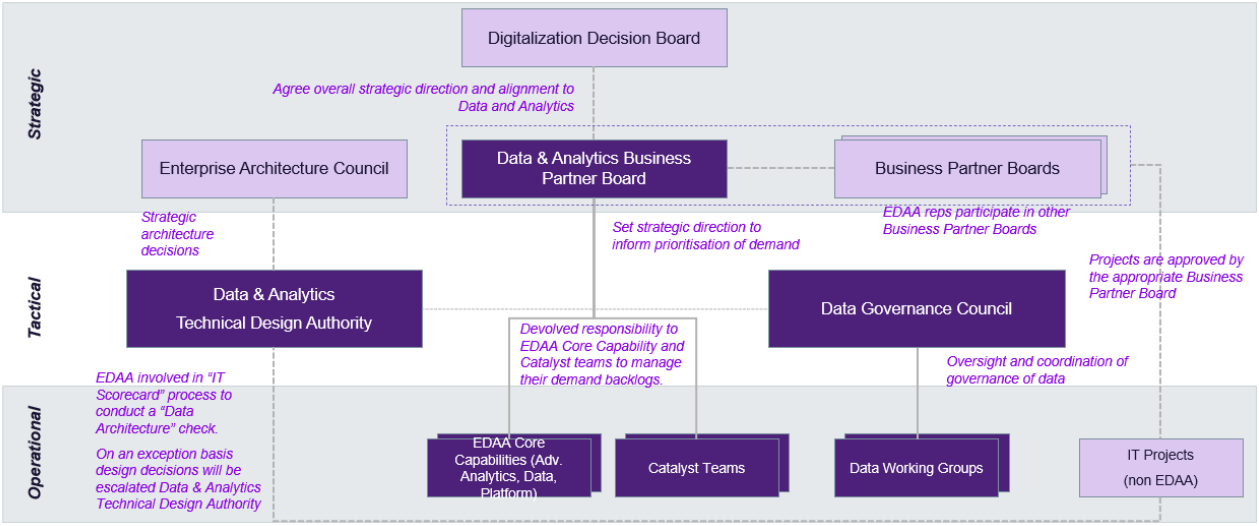
Industrial Metaverse
Data Foundation | IT Landscape



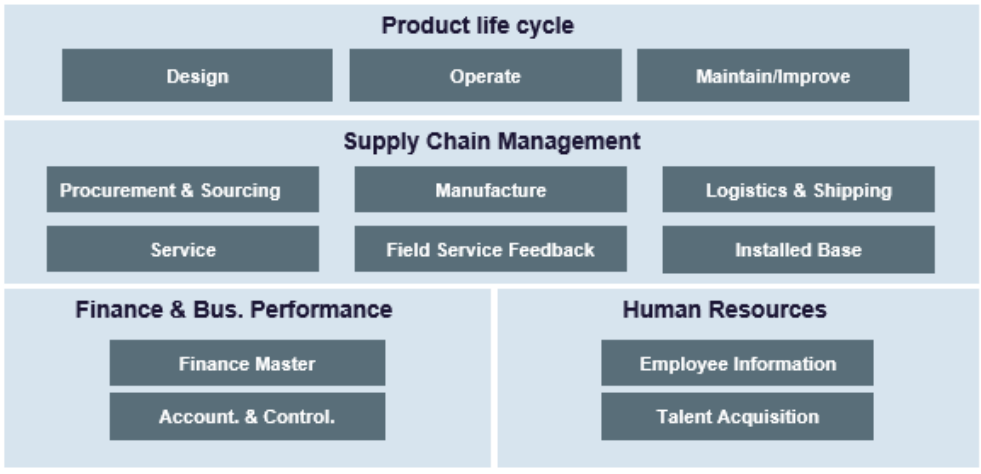
- Leverage the data you already have, without changing source systems
- Create the context to democratise your data and knowledge

- Expose any data to internal apps or sell data to customers
- Build digital and immersive apps

The Solution: Data Governance
Global Governance



The Solution: Data Governance
Several Data Domains



The Solution: Data Governance Roles per data domain