



# SIEMENS DIGITAL MANUFACTURING / COMPLEX EQUIPMENT

Use Case No 11

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*Involved Partners: University of Oslo*

# Providing technology solutions to address the greatest challenges of our time

## Healthcare system

Aging society  
 Personalized healthcare  
 Affordable healthcare

Population growth  
 Increase in chronic diseases

## Digital transformation of industry, infrastructure and mobility

Competitive industries  
 Productivity

Efficient infrastructure  
 Sustainable use of resources

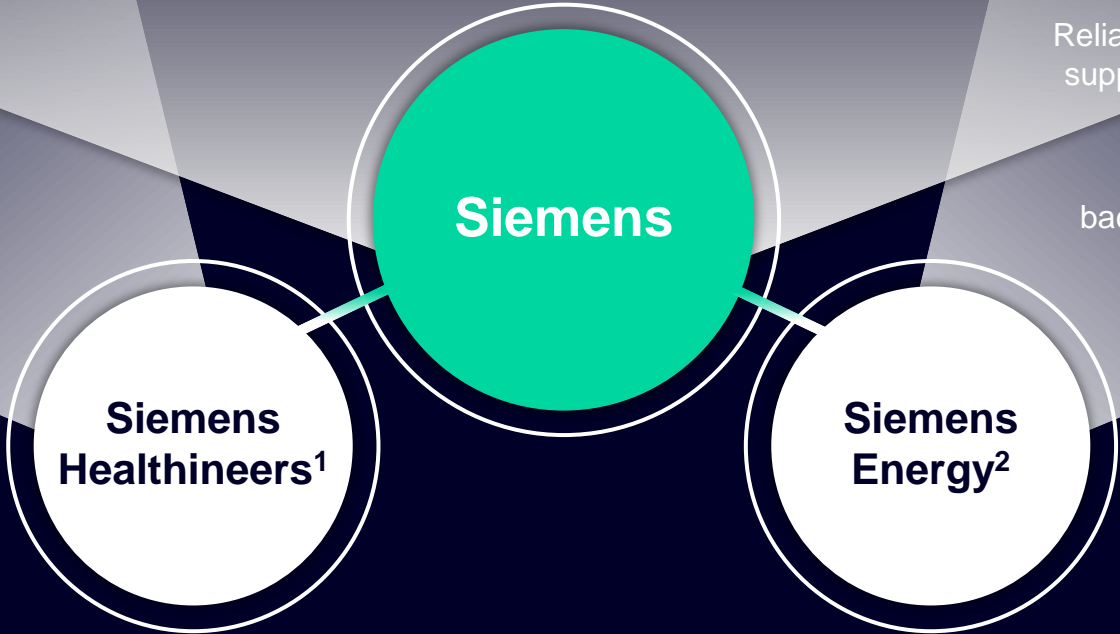
Economic growth  
 Prosperity

## Energy transition

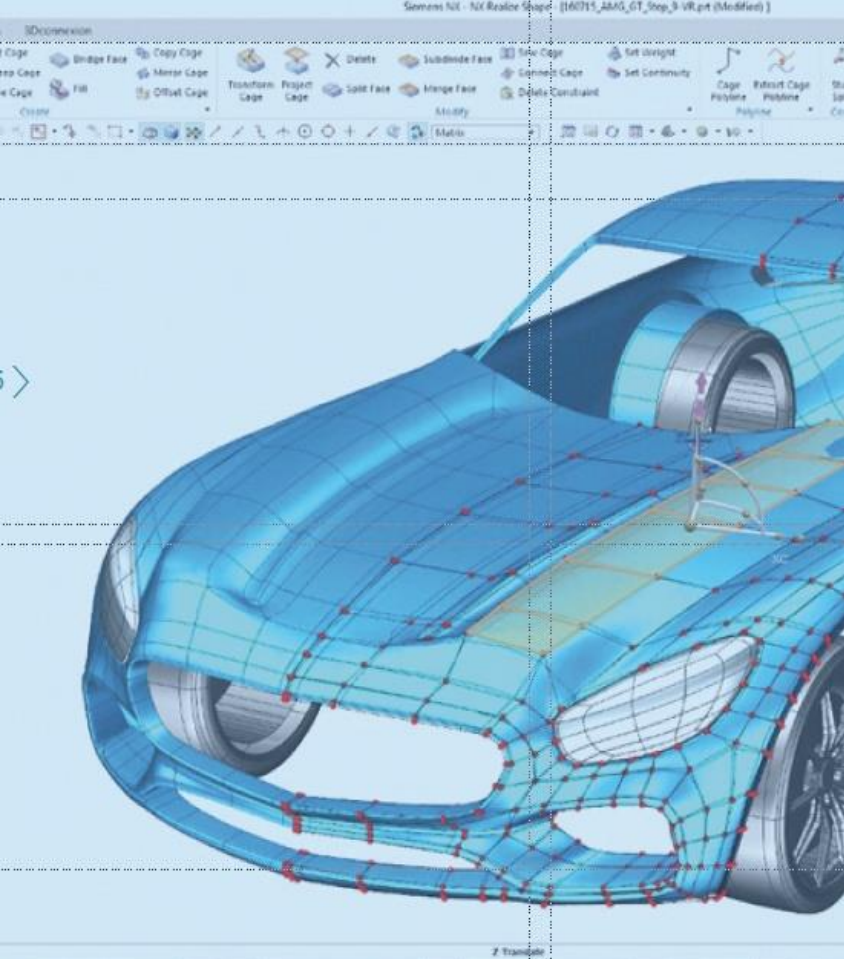
Distributed energy systems / Grid edge  
 Reliable supply  
 Energy backbone for society

Increasing demand  
 Energy efficiency  
 Hydrogen / sector coupling

Climate change / decarbonization



1 Publicly listed subsidiary of Siemens | 2 Publicly listed associate



We commute in cars designed with **Siemens software** ...



... built in factories running on **Siemens automation** ...



... charged by a renewable and decentralized **Siemens smart grid**.





We work in **smart buildings** that keep us comfortable and healthy ...

... with a **carbon neutral footprint** that keeps the planet healthy as well.





We travel on **Siemens trains ...**



... and on planes brought to life  
using **Siemens technology.**



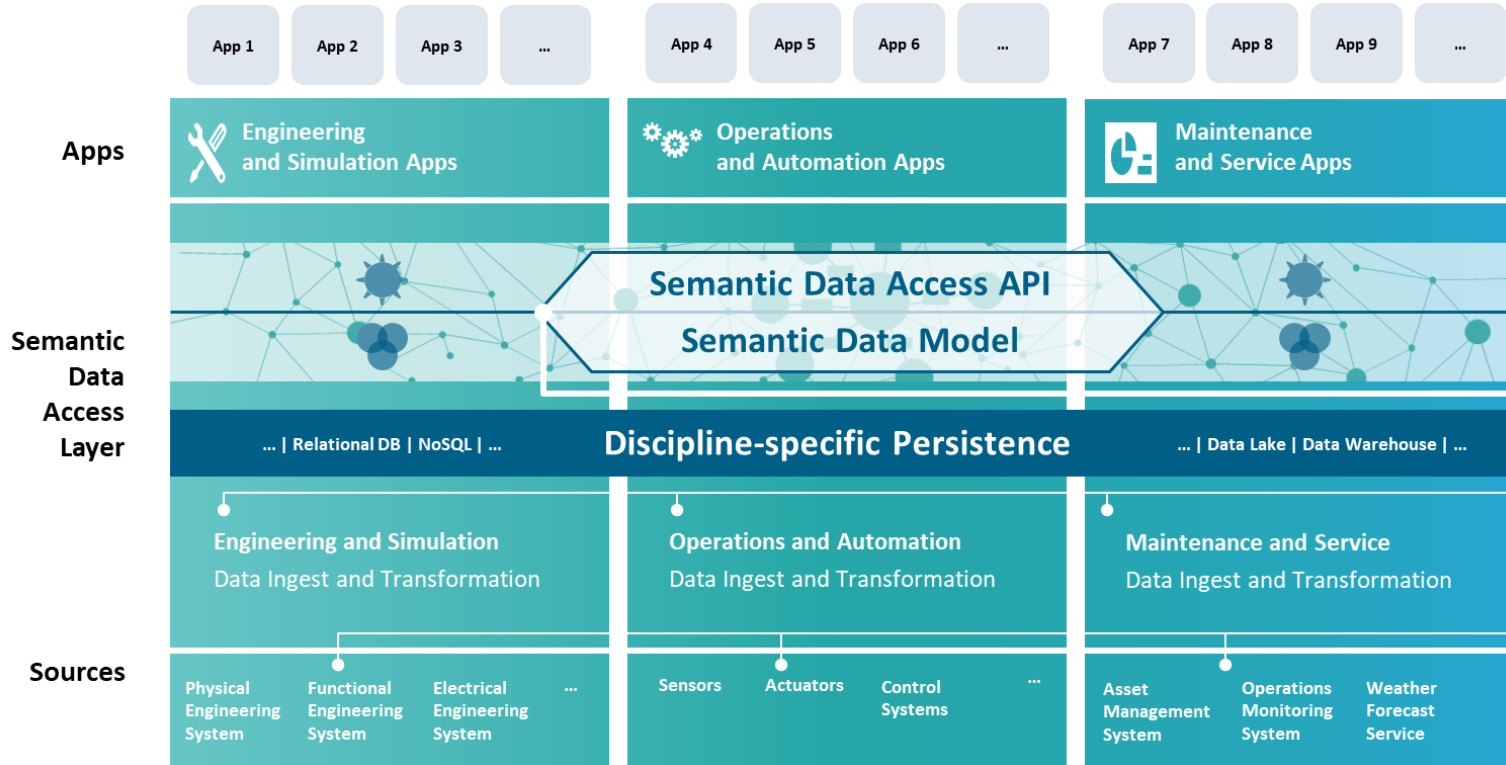
We rely on **lifesaving drugs** sped to market ...




... thanks to **Siemens innovations.**



# SIEMENS DIGITAL MANUFACTURING







 — Siemens goals: Provide a data layer as part of our IOT platforms that reduces application/customer-specific data provisioning and integration costs

# Ontologies in Siemens Use Case

We aim at a library of shared, reusable data models

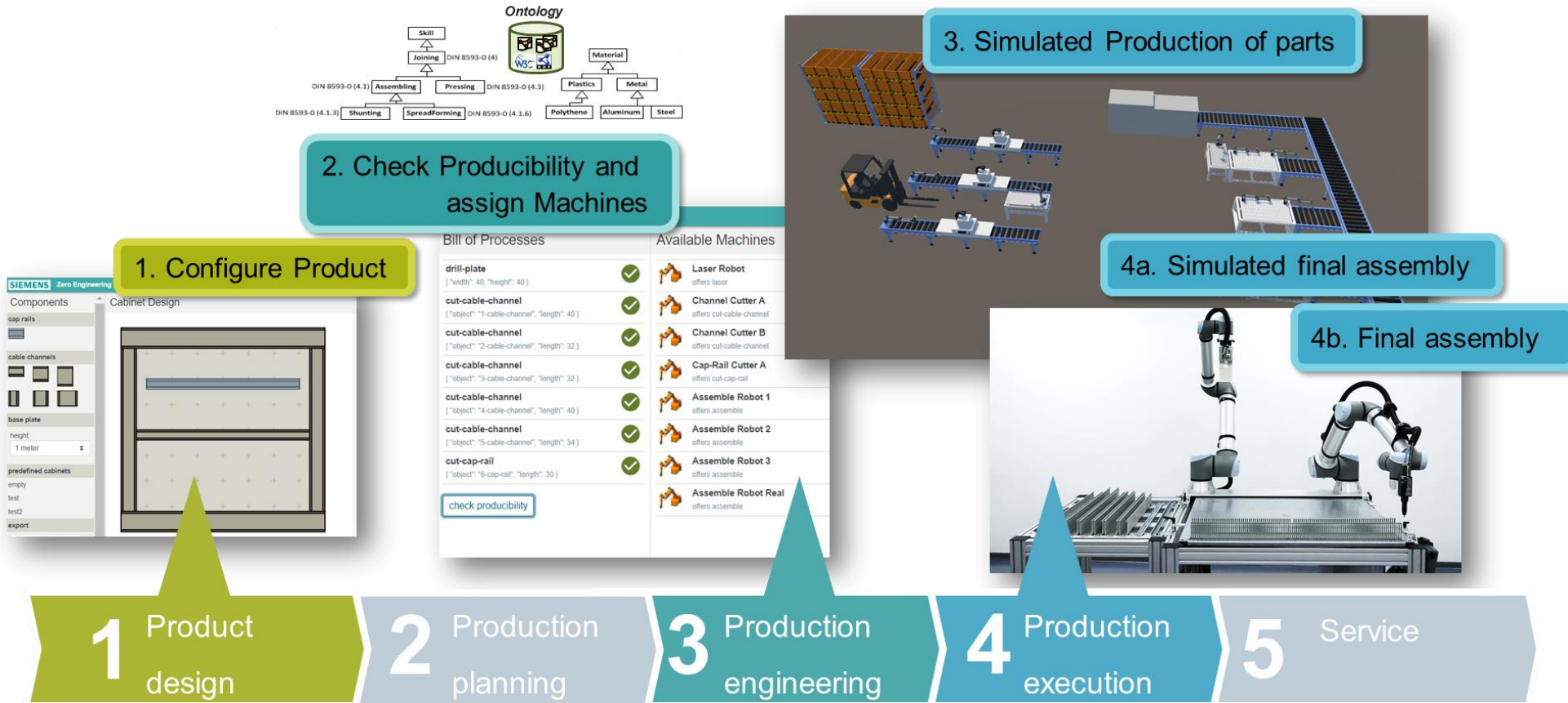


	<b>Industry Standard</b>	A growing core ensures model quality and interoperability!!!
	<b>Siemens Core</b>	

-  **Building**
-  **Energy**
-  **Rail**
-  **Production**

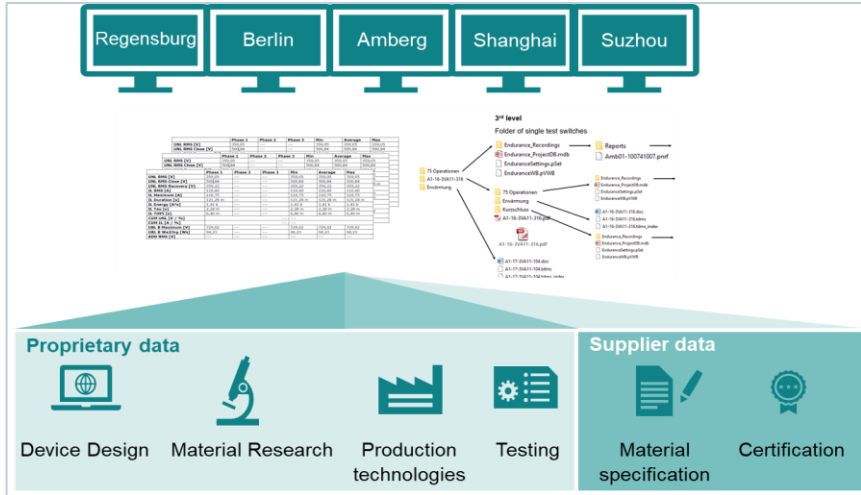


# Demonstrator Example: Skill-based manufacturing



Zero Engineering: From Product Design, Production Engineering to Production Execution

# Demonstrator Example: Knowledge Graph for Materials



## Use case scope

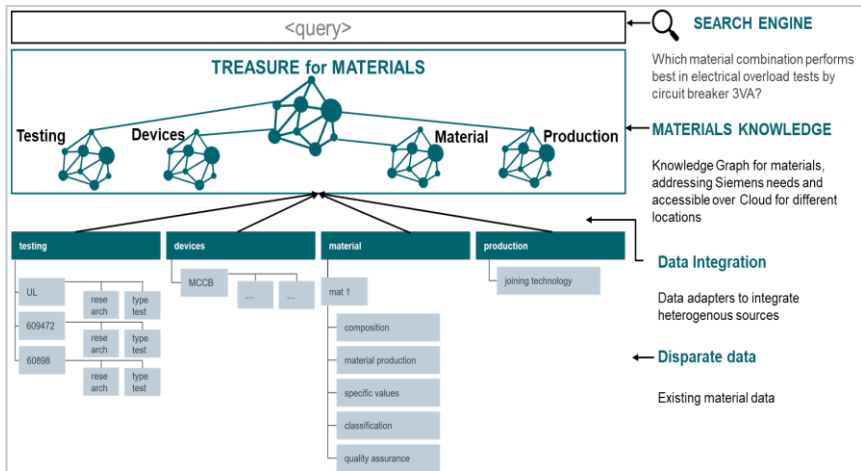
- Make data stored on servers worldwide ready for the digital enterprise by structuring it, making it machine interpretable, sharable, and analyzable

## Challenges

- Different data format (pdf, txt, emf...), storage structure and locations (unit systems)
- No material data request possible (usually one expert holds the knowledge)
- Waste of productive hours, duplicate tests, delays & uncertainties in design/simulation
- Legal liabilities

## Impact: connect the physical and digital world

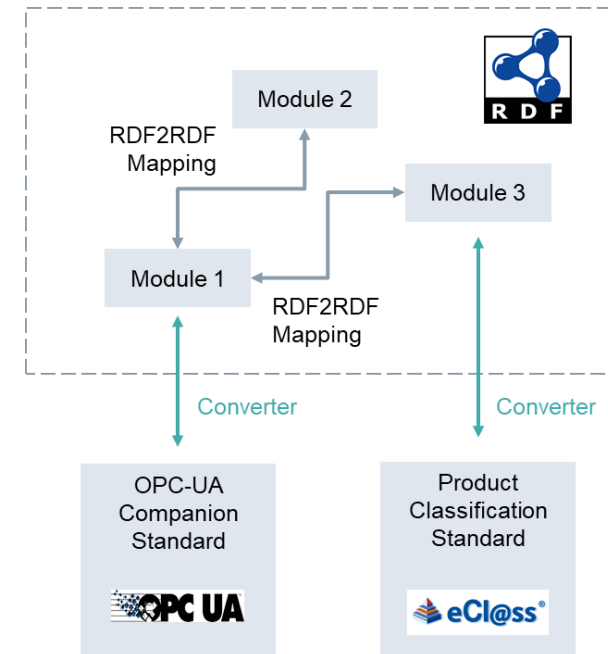
- Shorter development of new materials
- More flexible production
- Better performance and reliability
- Resource traceability and efficiency/reduction of waste



# Use case requirements

- Core questions in Siemens use case
  - The ontology library should support various modelling languages / standards (e.g. OPC-UA, eCl@ss, etc.)
  - Decentralized maintenance with shared responsibilities across company
  - Scale usage by enabling domain experts to take ownership of models, easy-to-use tools required
  - IP sharing and licensing across partner ecosystem necessary
  - Mixed inner and open sourcing strategy depending on domain / level of ontology
  - Integration of open data models and industry standards

## Example: Integration of domain standards using mappings and converters





# Main expected benefits

- Overview of existing industry ontologies with relevance for Siemens, potential for becoming part of library
  - Material data models
  - Equipment / O&G data models (e.g. CFIHOS)
  - Building data models (e.g. BIM)
  - Energy data models (e.g. CIM)
  - Automation data models (e.g. AutomationML, OPC-UA Companion Standards, etc.)
- Best practice for data model governance as well as modelling tools (also for domain experts)
- Guidelines and best practices for modelling, modularization and maintenance
- Training material for developers and other stakeholders



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