The Robot Revolution and Industrial IoT International Symposium

December 19, 2019, Tokyo

METI (The Ministry of Economy, Trade and Industry) and
RRI (Robot Revolution and Industrial IoT Initiative)

Japan-Germany Experts Collaboration toward Industrial Revolution

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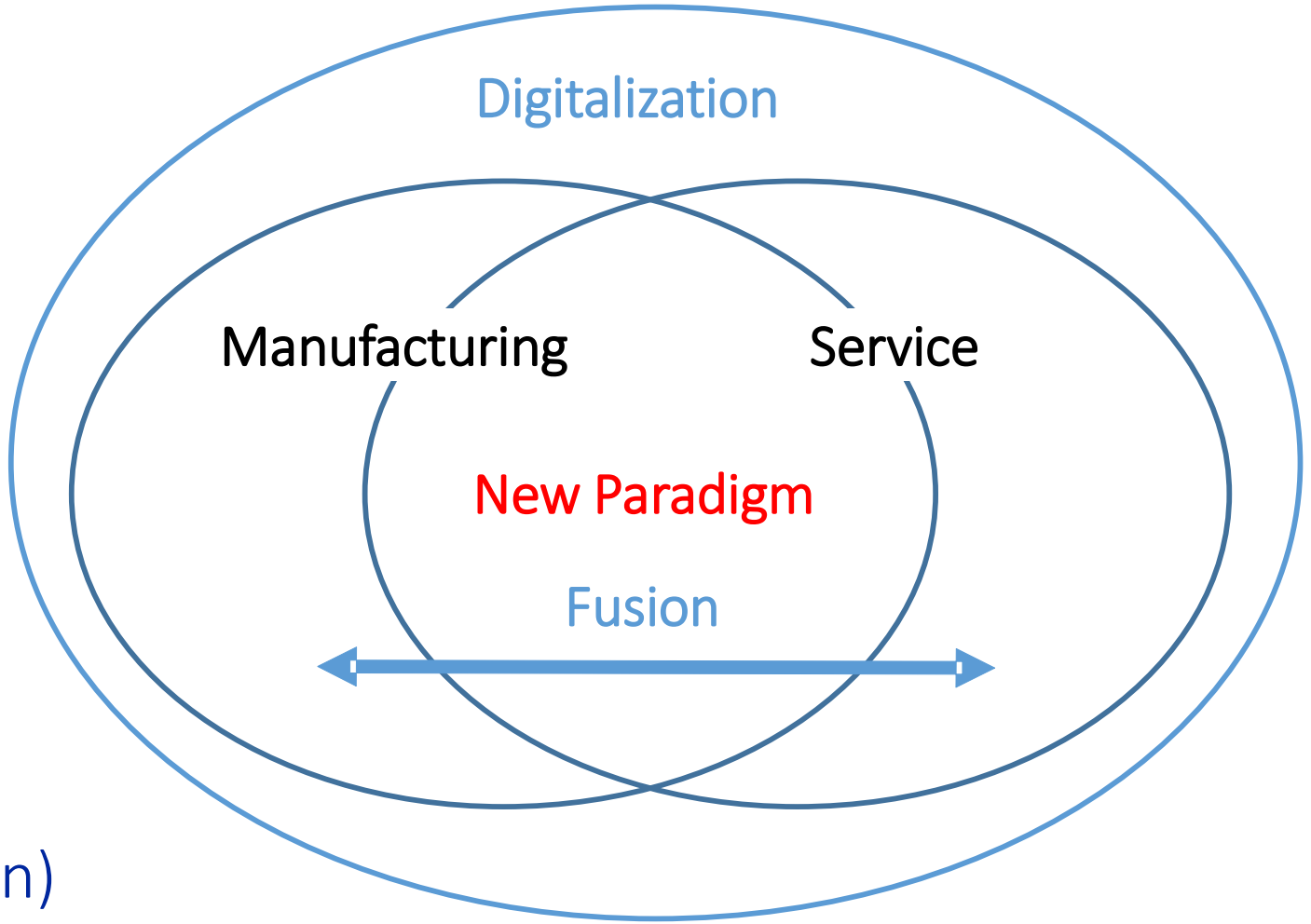
- Future of Manufacturing

Digitization
("As-Is" improvement)

Digitalization
("To-Be" innovation)

Digital Transformation
(New paradigm
New value creation)



Introduction

- New value creation by intelligent “Fusion” of “To-Be” activities
- Open eco-system with heterogeneous participants
- System of systems approach

- International standardization and security essentially required
- Importance of collaboration in non-competitive and complementary areas

- Japan-Germany collaboration for standardization and cyber security in smart manufacturing
  - Cooperation agreement by Japanese and German governments
  - Cooperation agreement by Robot Revolution & Industrial IoT Initiative (RRI) and Plattform Industrie 4.0 and

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- Japan-Germany Collaboration toward Industrial Revolution
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  - Usage View of Application Scenarios
  - Usage view of Asset Administration Shell (AAS)
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Germany-Japan IoT Collaboration

- Mar.2015
  IoT cooperation agreement in Japanese-German summit
- Apr.2016
  Japan METI and Germany BMWi signed the joint statement
  - In the statement, following items were listed as collaboration opportunities
    1. International Standardization
    2. Industrial Cyber Security
    3. Regulatory Reform
    4. SME
    5. Human Resource Development
    6. R&D

SME: Small and Medium Enterprise

Source:
METI,http://www.meti.go.jp/report/whitepaper/mono/2015/honbun_html/010103.html

Contents

Japan-Germany Collaboration in Standardization

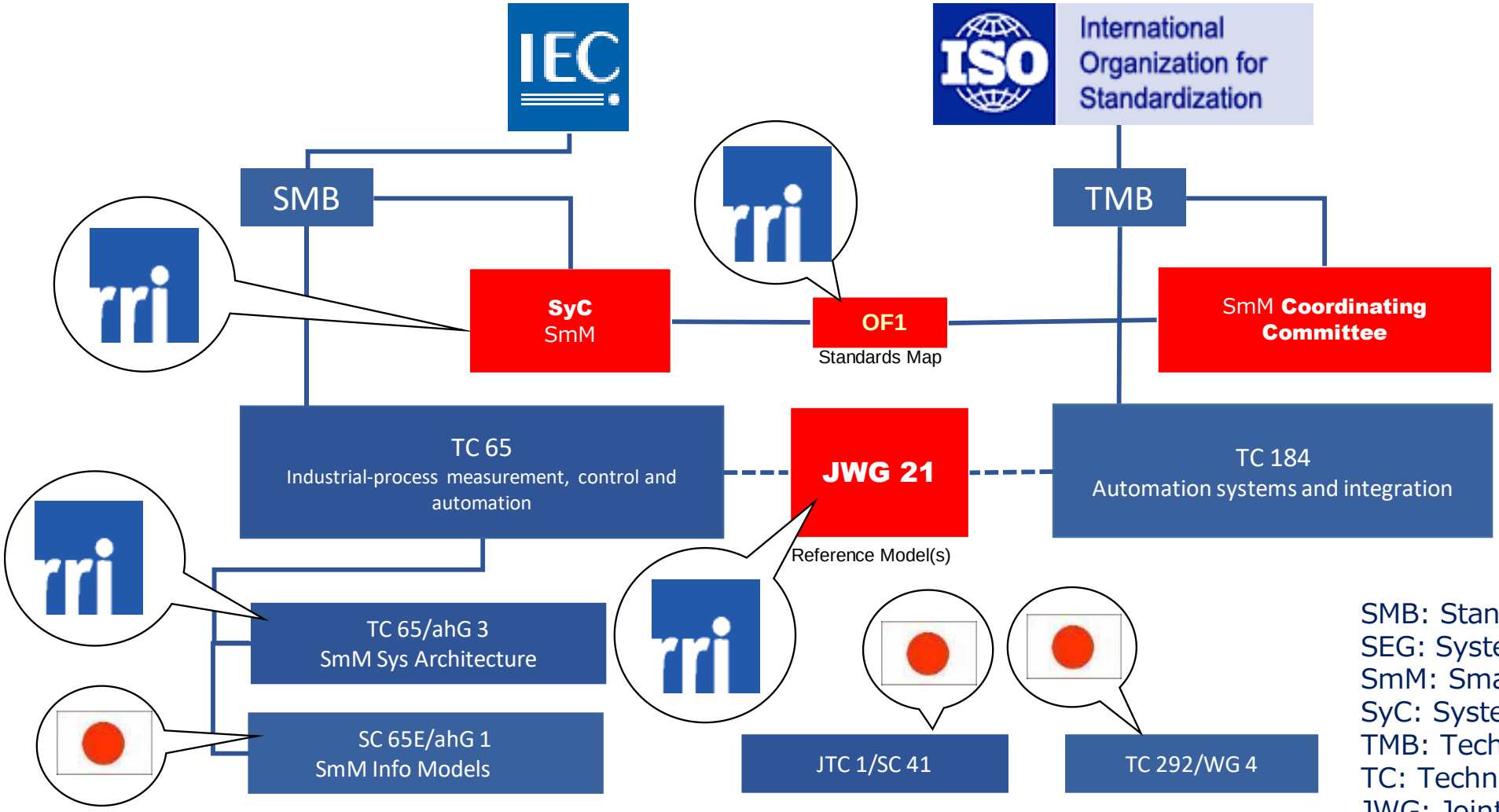
- Formation of teams of experts for standardization
- Regular web-meetings and face-to-face meetings since 2016-11

- Scope of collaborative activity:
  - Basic, general and long-term topics interesting for industry
  - Non-competitive topics

- Contribution to the international standardization: ISO, IEC
  - IEC SyC SM, IEC TC65, ISO/SMCC-IEC/SyC SM OF1, ISO/T184-IEC/TC65 JWG21
- Methodology for use case analysis toward standardization

Robot Revolution & Industrial IoT Initiative

Activity: International Standardization



SMB: Standard Management Board
SEG: Systems Evaluation Group
SmM: Smart Manufacturing
SyC: Systems Committee
TMB: Technical Management Board
TC: Technical Committee
JWG: Joint Working Group
ahG: adhoc Group
JTF: Joint Task Force

Japan-Germany Collaboration in Standardization

- Fundamental direction of Japan-Germany collaboration
  - Development of detailed use cases
  - Use of the reference models in the focused areas
  - Identification of standardization requirements

(2017-03-20)

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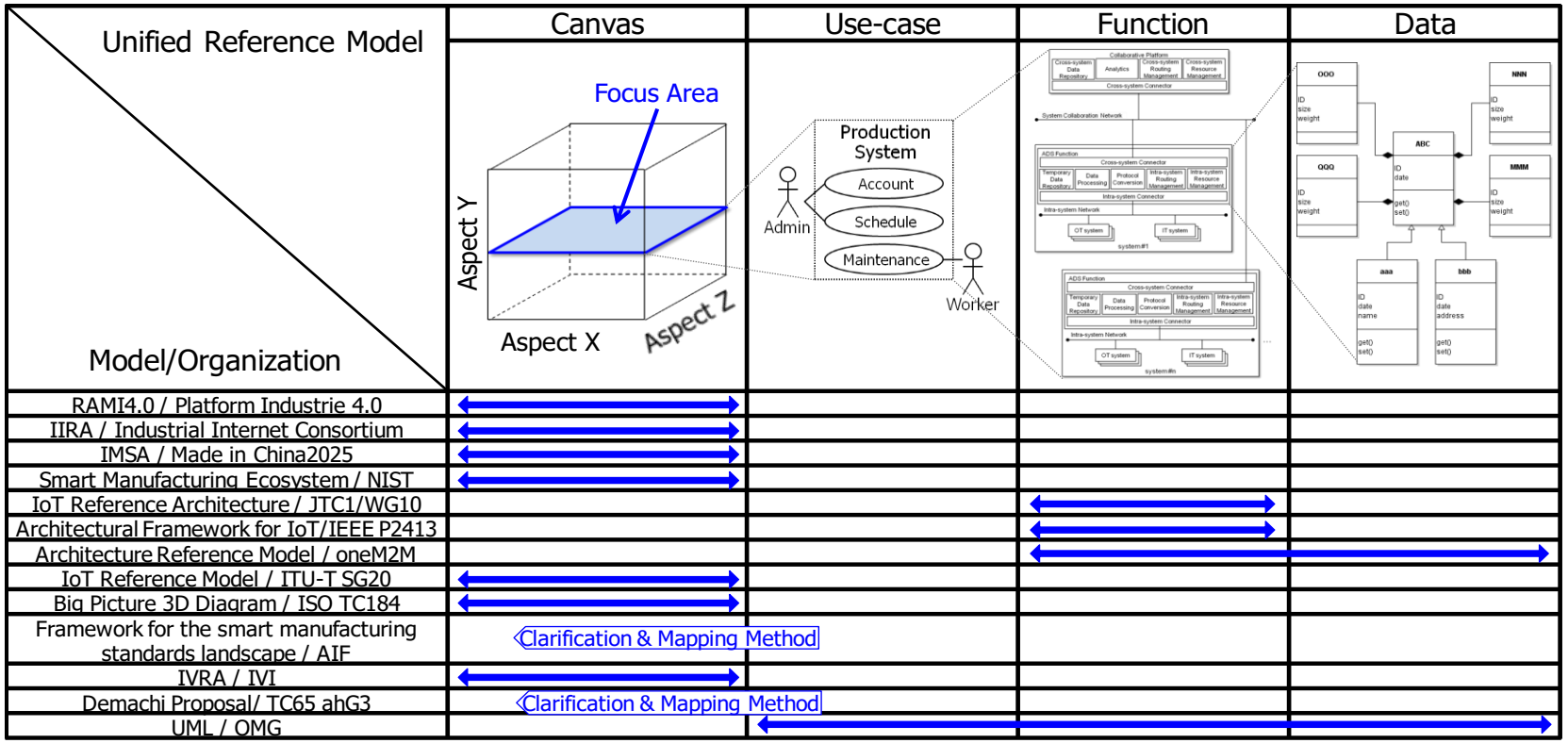
Unified Reference Model – Map and Methodology (URM-MM) (2017)

- URM-MM aims to provide map and methodology to be referred by standard developing organizations (SDOs) and standard users in open eco-system development.
- URM-MM illustrates a procedural guide that enables users to identify specific use cases that then link the relevant international standards to existing models.

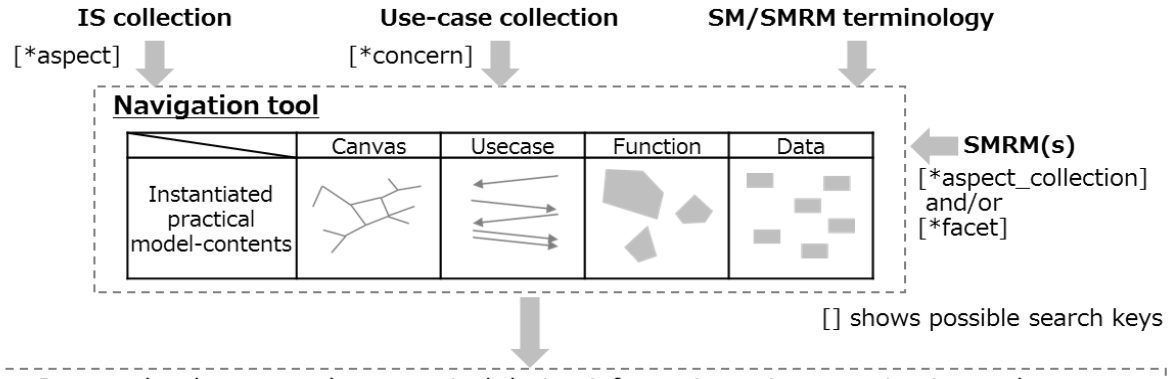


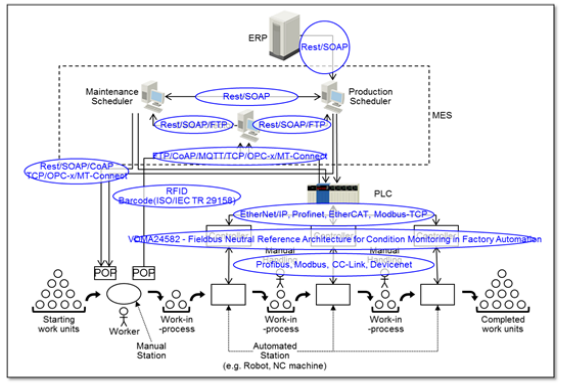
Unified Reference Model – Map and Methodology (URM-MM)

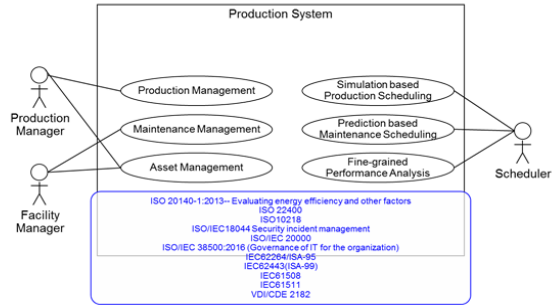
- IEC System Committee Smart Manufacturing (SyC SM) sets up Ad-hoc Group 4 (AhG4) about Navigation Tool
  - to develop and implement a “domain navigation” tool, based on requirements to be specified by IEC SyC SM using IEC SEG 7 Task Team 3 results as an initial input.
- The “domain navigation” tool will assist industry and SDO users
  - to relate their use case requirements to specific value streams, architecture views and supporting standards within the portfolio.
- AhG4 reported the requirements to SyC SM, 2019-09.

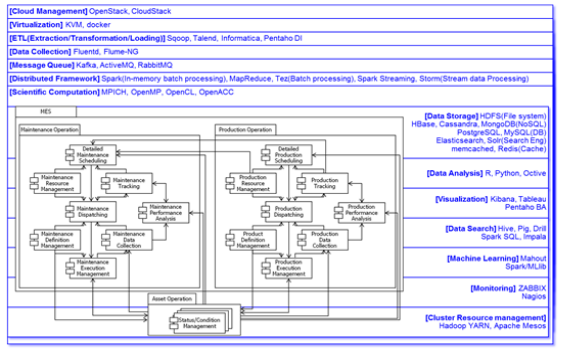
Navigation Tool for Smart Manufacturing

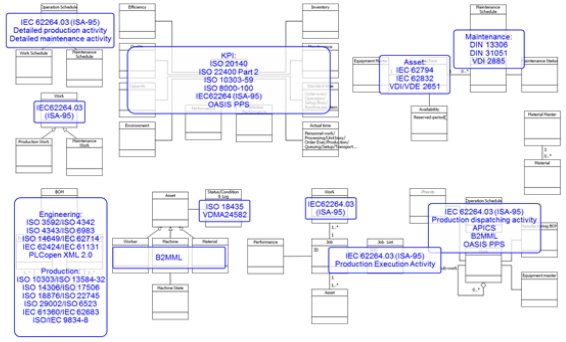
(IEC SMB/SyC SM: System Committee Smart Manufacturing)











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Top-down Approach to Standardization

- Traditionally standardization work has been done, based on the "consensus" principle, assuming that technology is already known.
- In smart manufacturing era, standardization can not start from the existing standards or technology, but from the user's high level vision and demand. Then detailed requirements are derived.
- Application scenario is a high level description for the future target.
- Requirements for standardization are derived from such high level user description in a top-down manner.
- Before going into the detailed technical discussion, it is important to agree on the requirements for target of standardization.

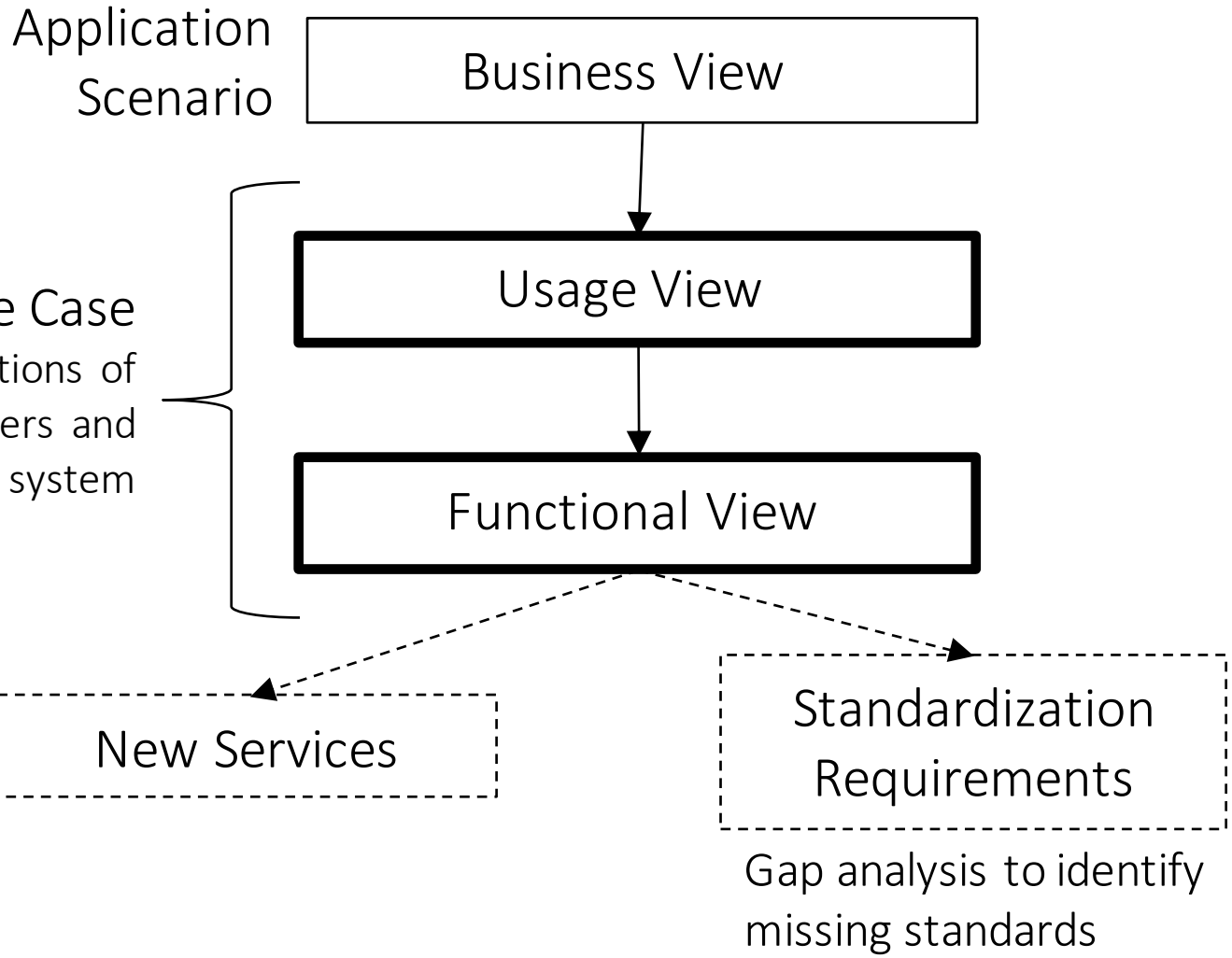
Top-down Approach to Standardization: Use Case

Top-down Approach

Possible future business scenarios

Technical use cases

New products, solutions, services
&
Standardization requirements

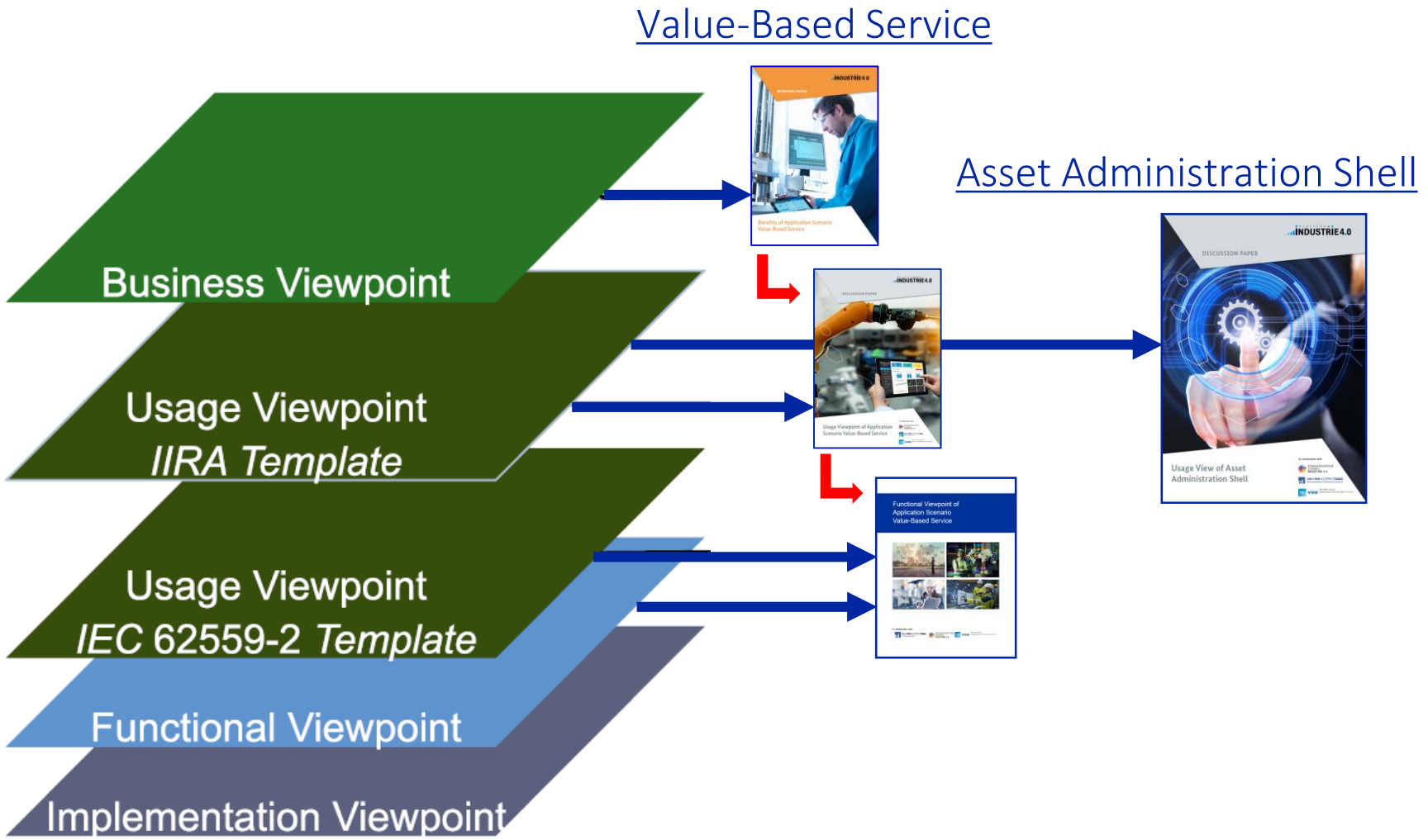


Use-Case Driven Top-down Approach: Summary

Top-down approach

The starting point is possible future business scenarios, from which more technical use case descriptions are derived.

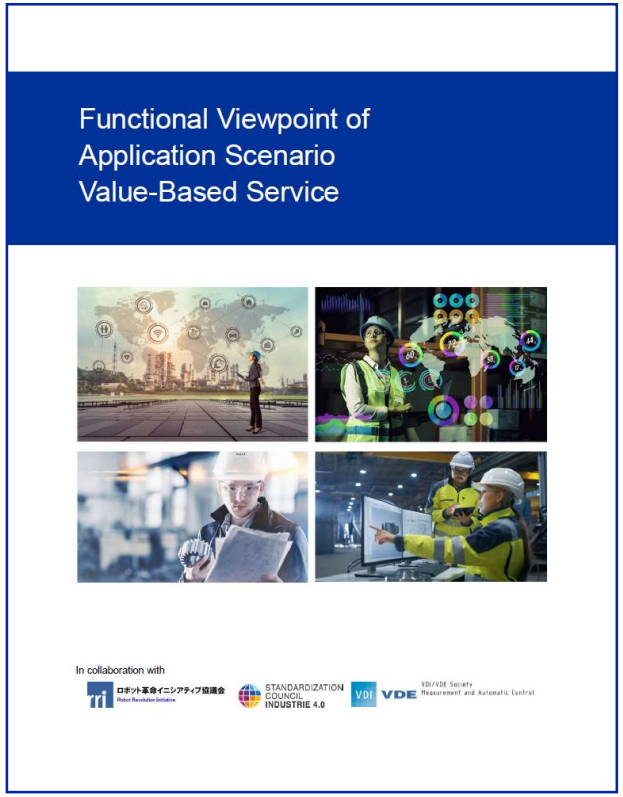
These use cases are the basis to derive new products, solutions, and services as well as standardization requirements.



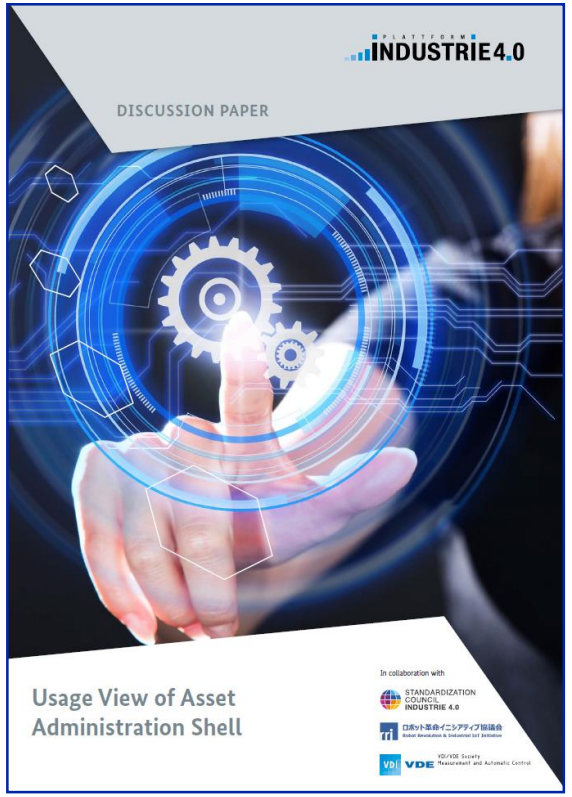
Top-down Approach to Standardization

- Usage view and functional view of use cases (since 2017)

(2018-02)



(2018-03)



(2019-02)

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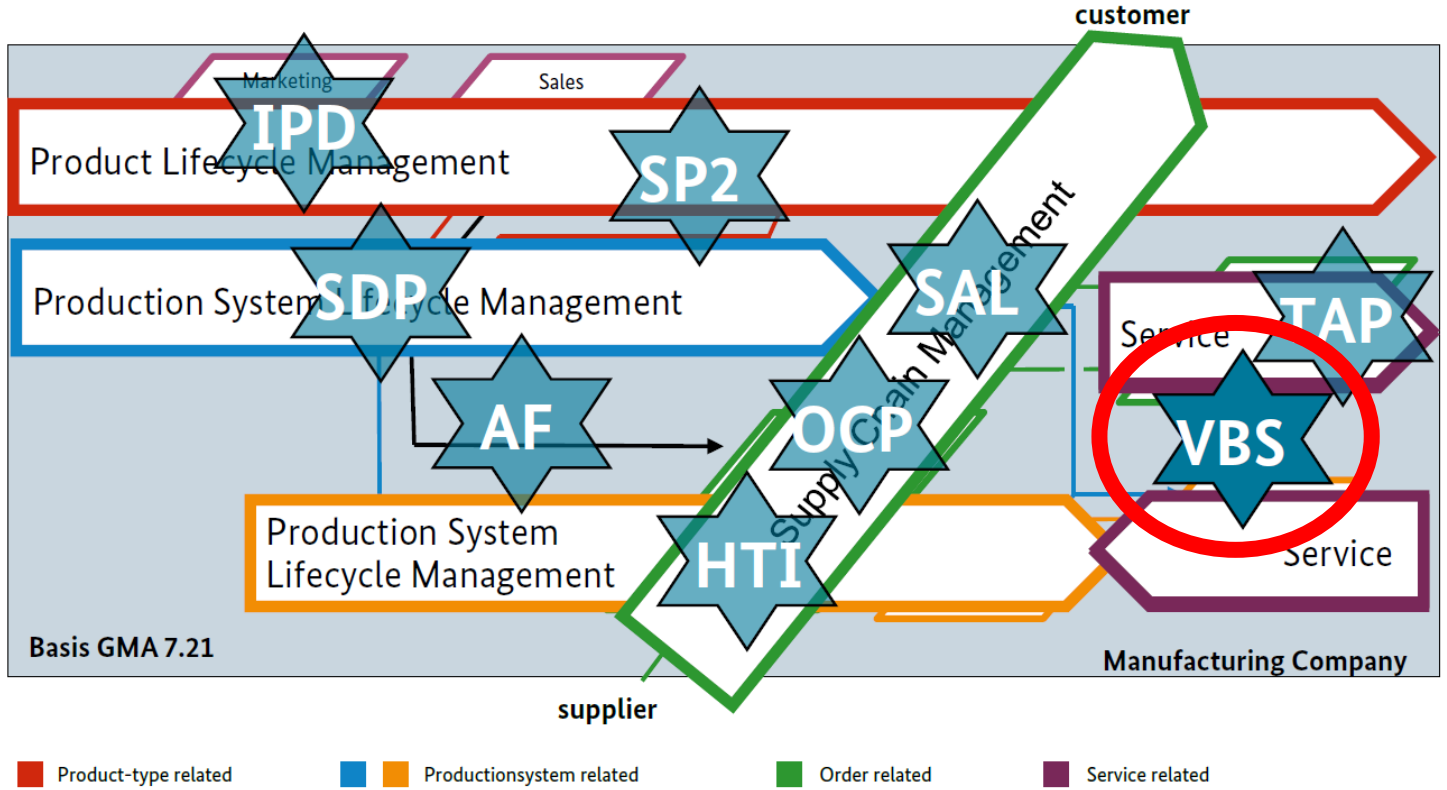
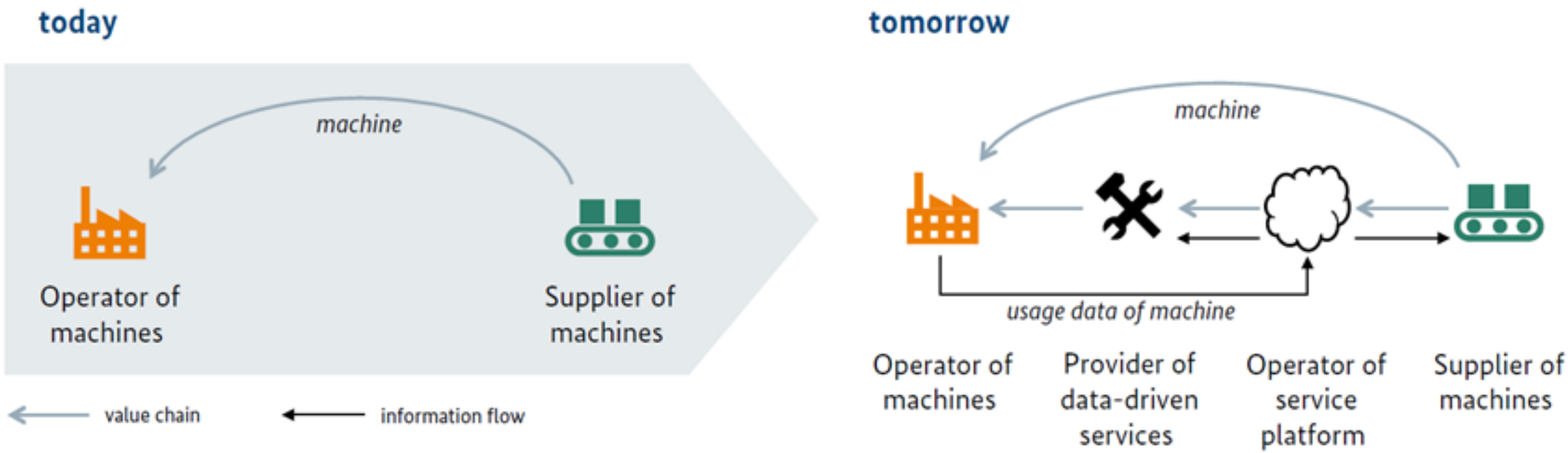
Top-down Approach to Standardization

- Application Scenario
  - describes how industry perceives its digital future,
  - indicates areas posing challenges, e.g. standards, research, security, legal framework, labor, etc.



Application Scenario “Value-Based Service” (VBS)
- Plattform Industrie 4.0 -

Usage of application scenario Value-Based Service



Source: Plattform Industrie 4.0

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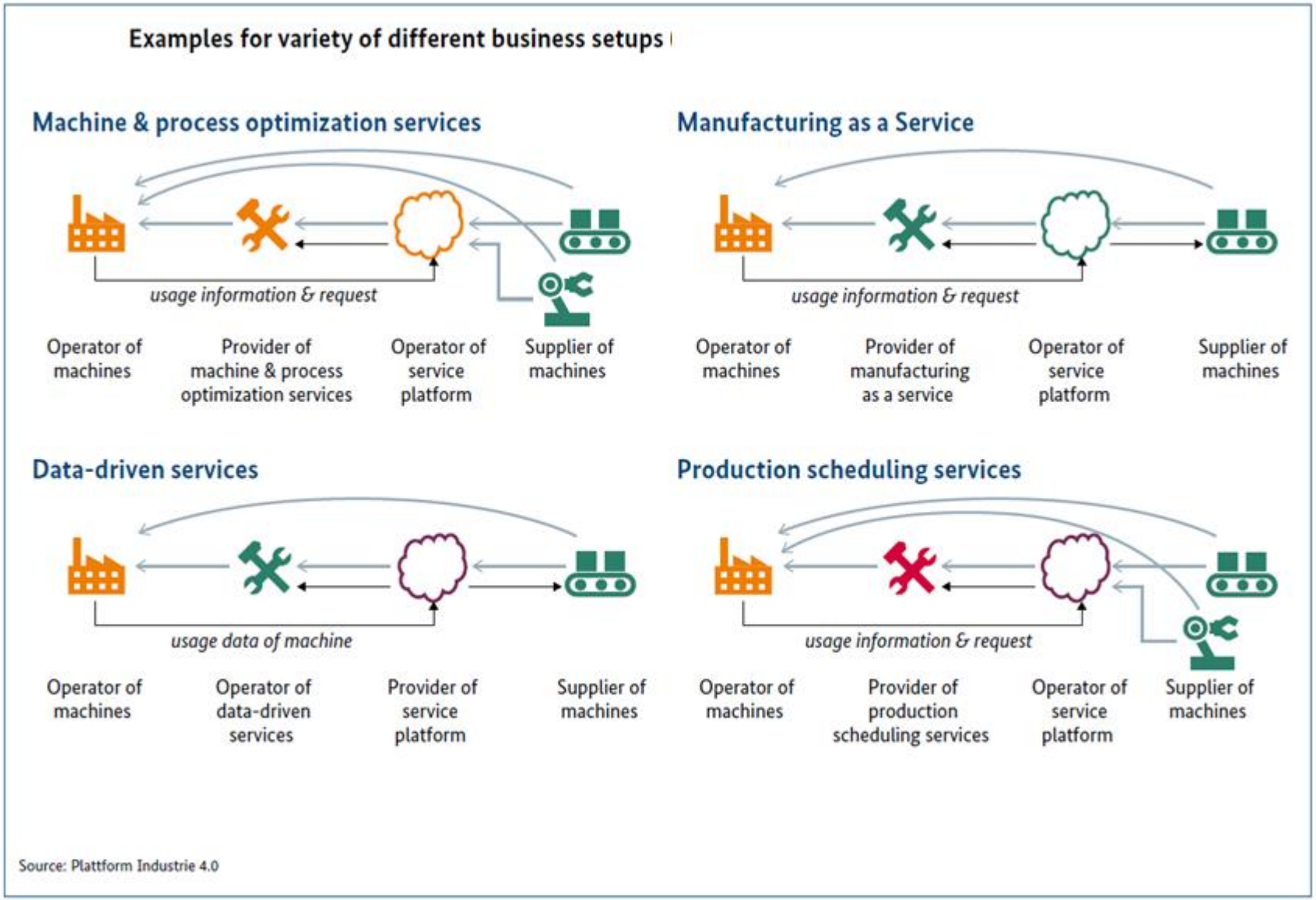
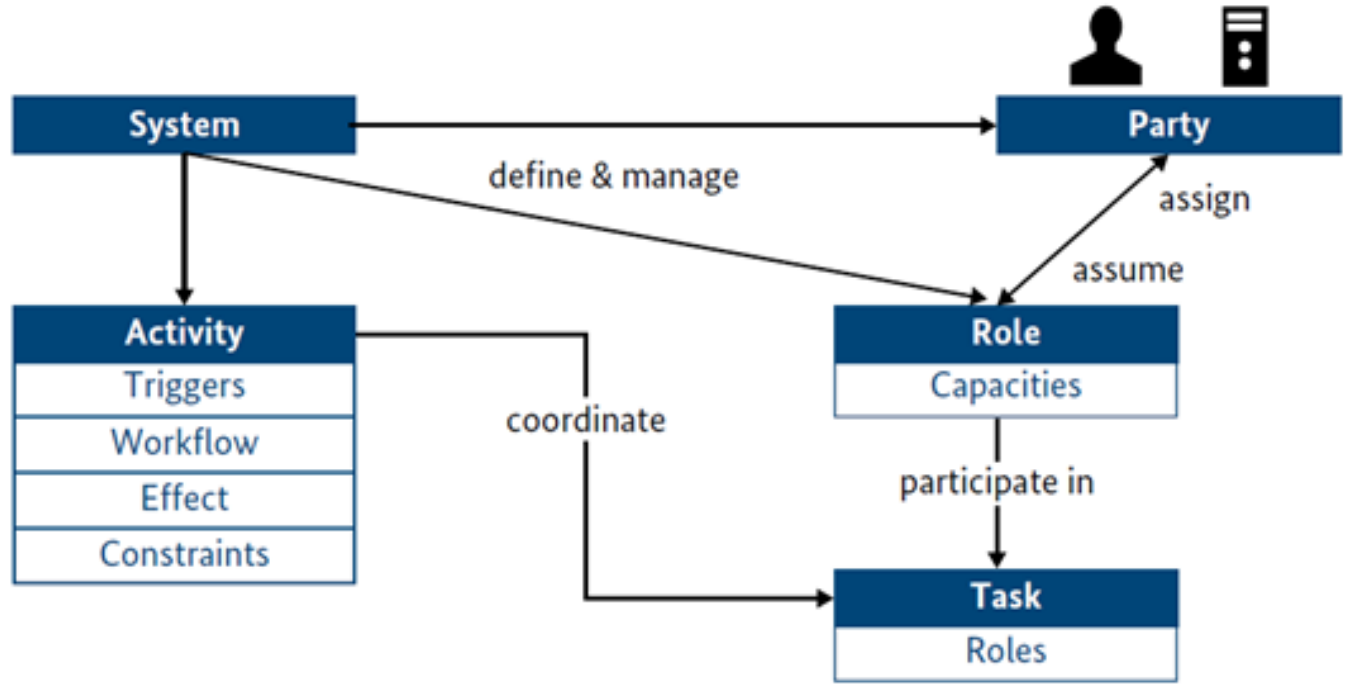


Application Scenario “Value-Based Service” (VBS)
- IIRA Framework -

: Overview of Usage Viewpoint



Source IIC

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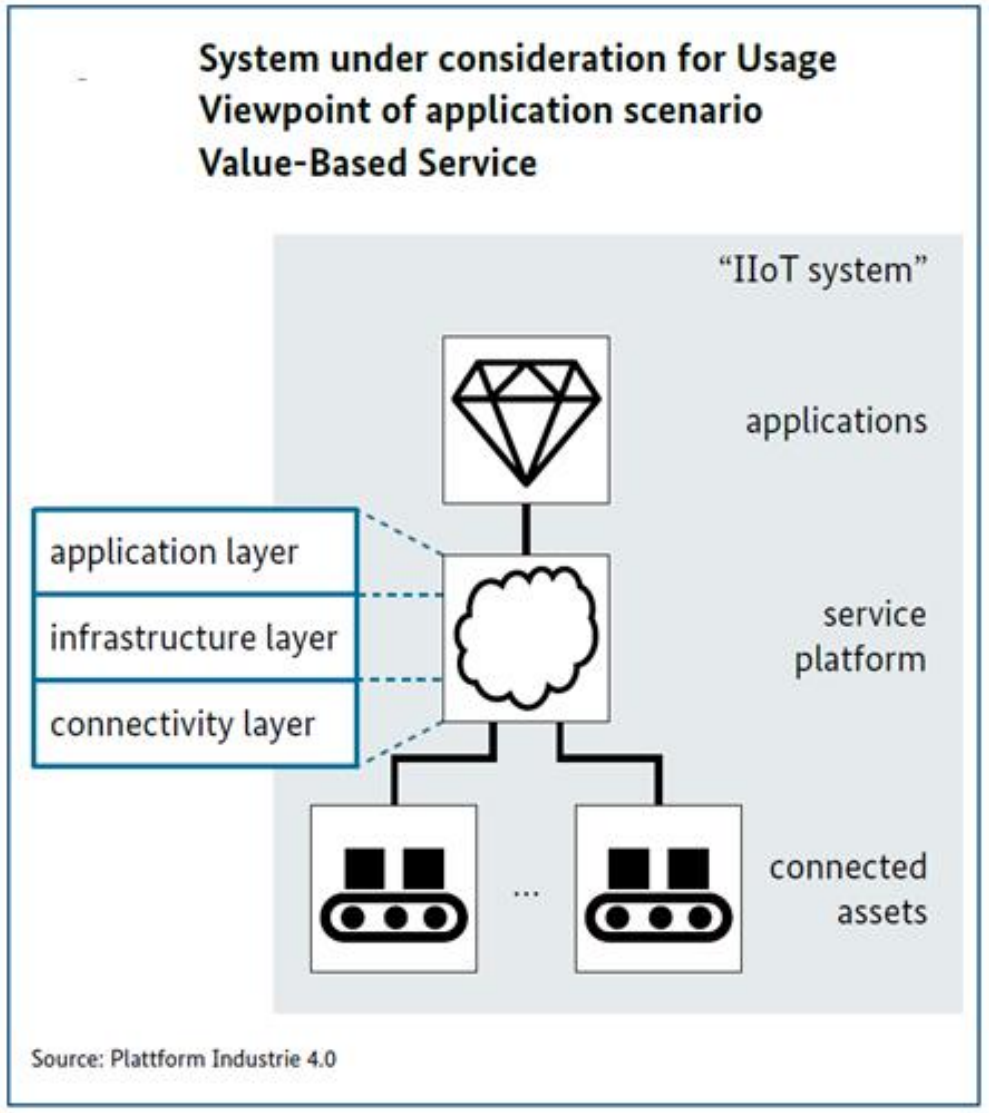

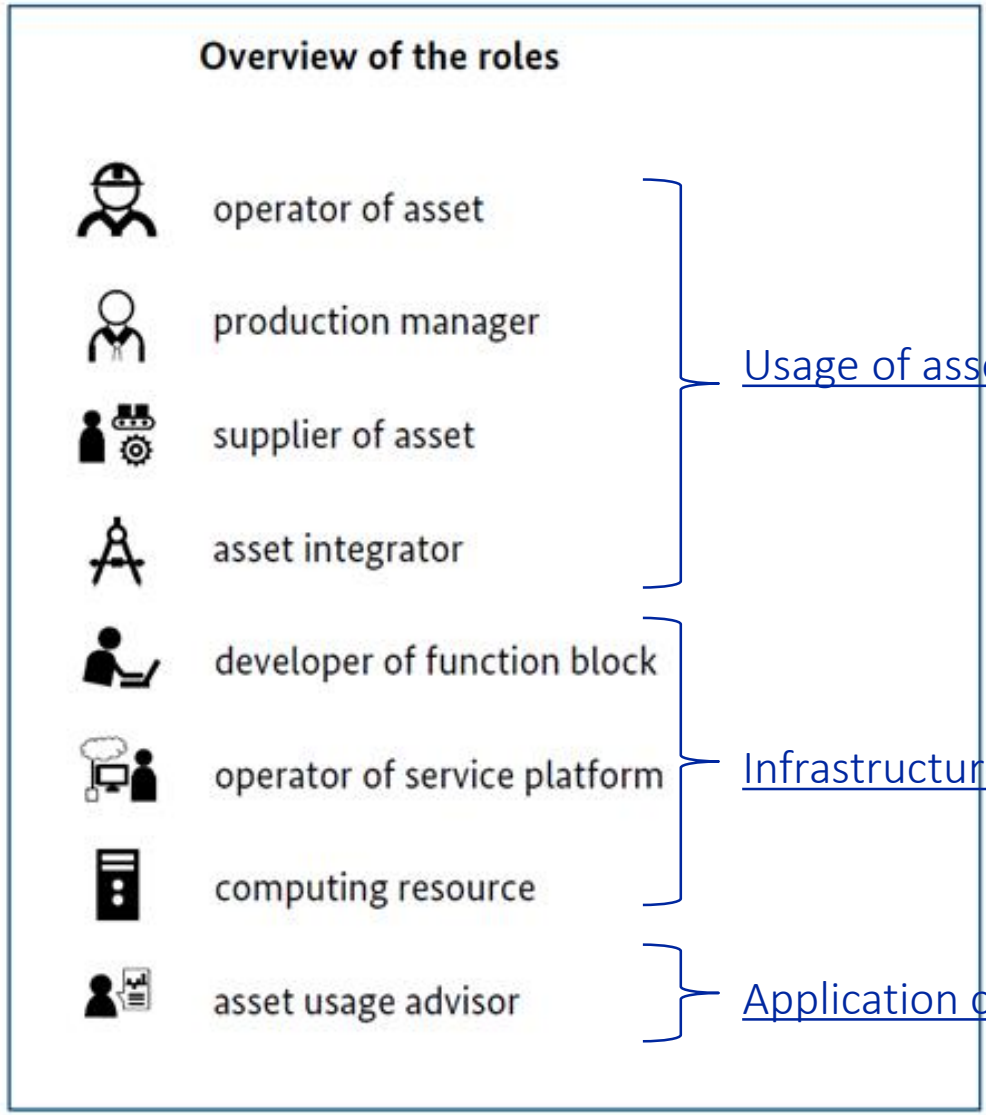

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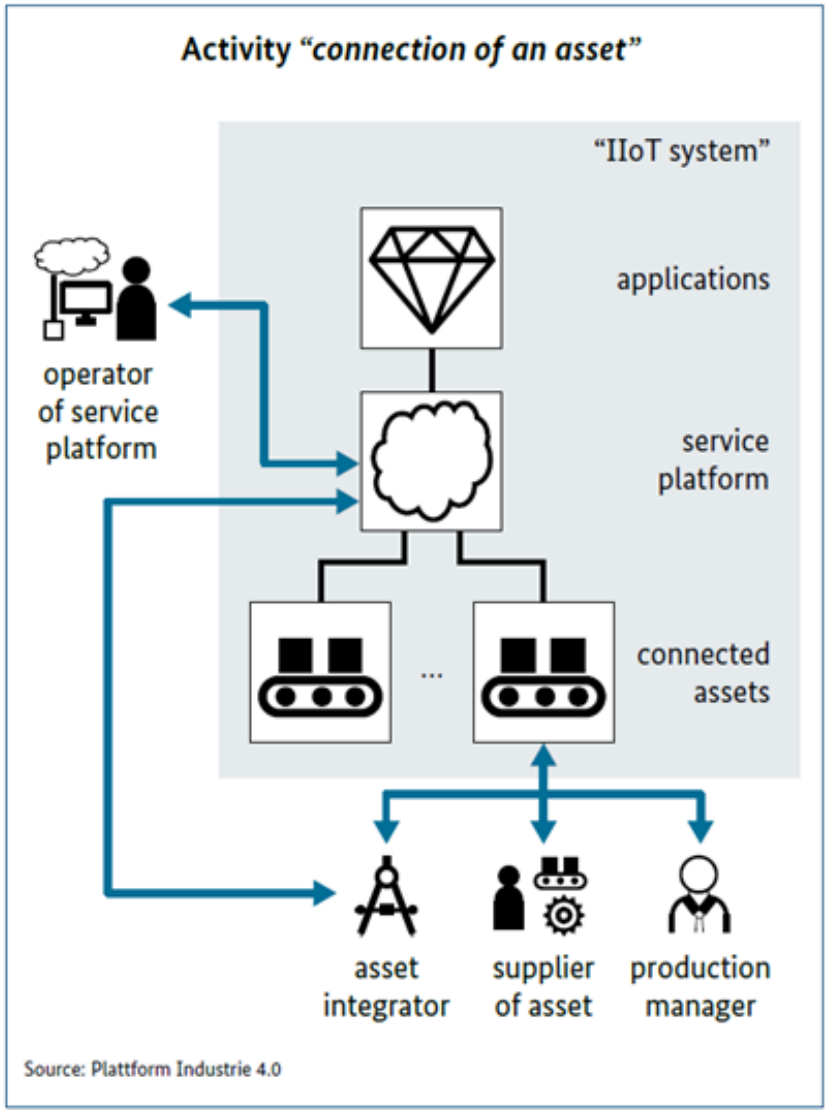
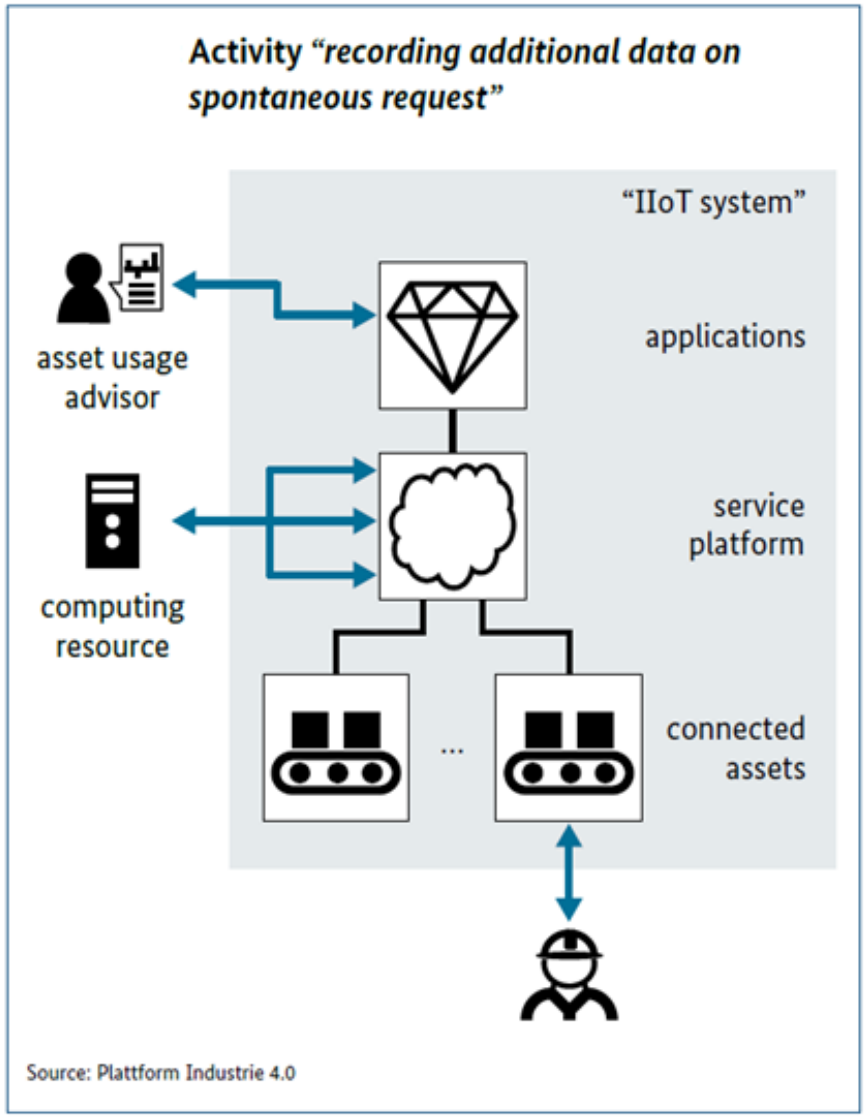
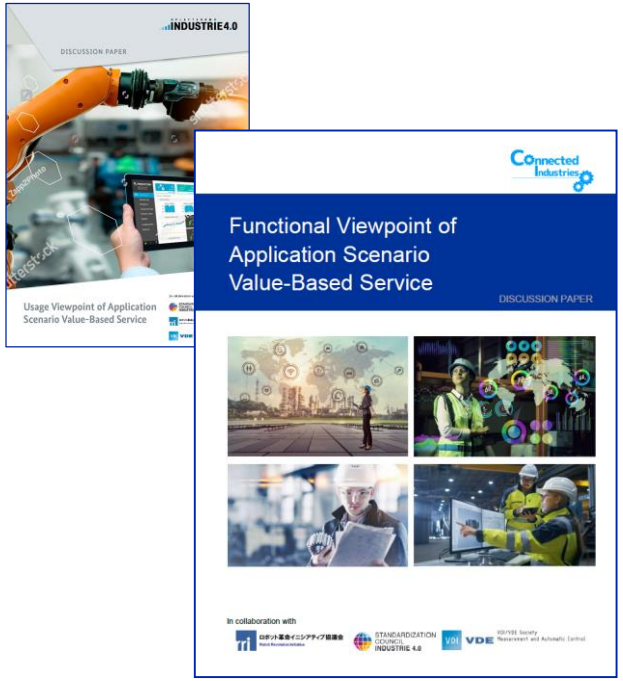




Functional View Value-Based Service

- Objectives of Functional View analysis are;
  - To be a reference for system designers who want to draw system architecture, function to work and information to share in the system, and necessary interactions between them for Value-based Service application
  - To show hypothesis cases for standard developers who analyze requirements for future system and identify standards to be developed and promoted



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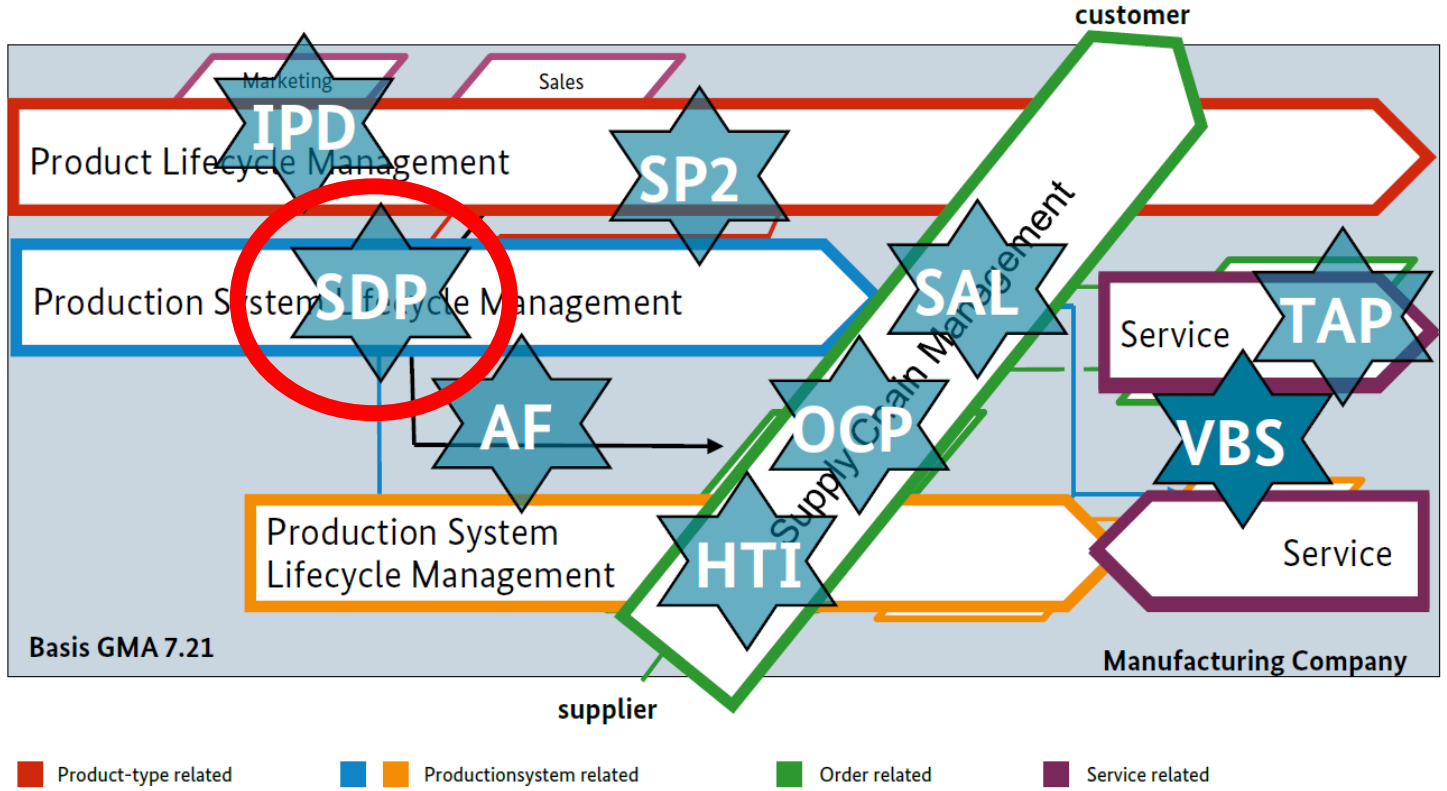
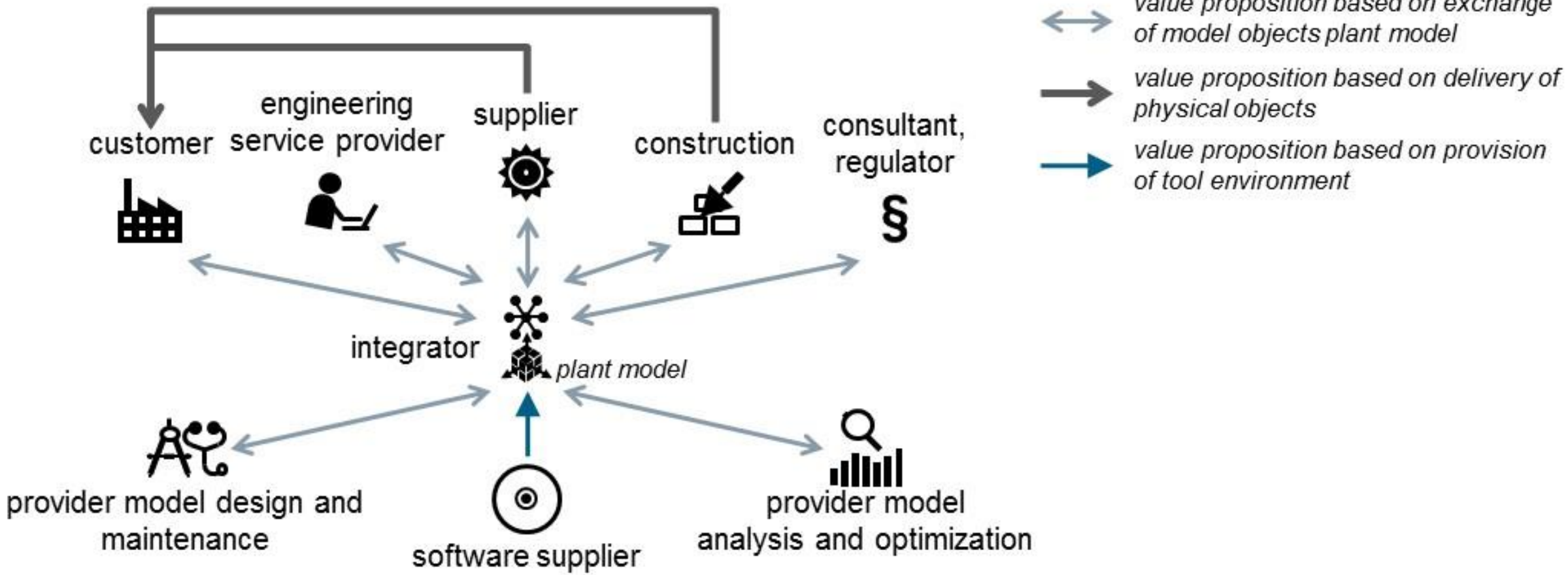
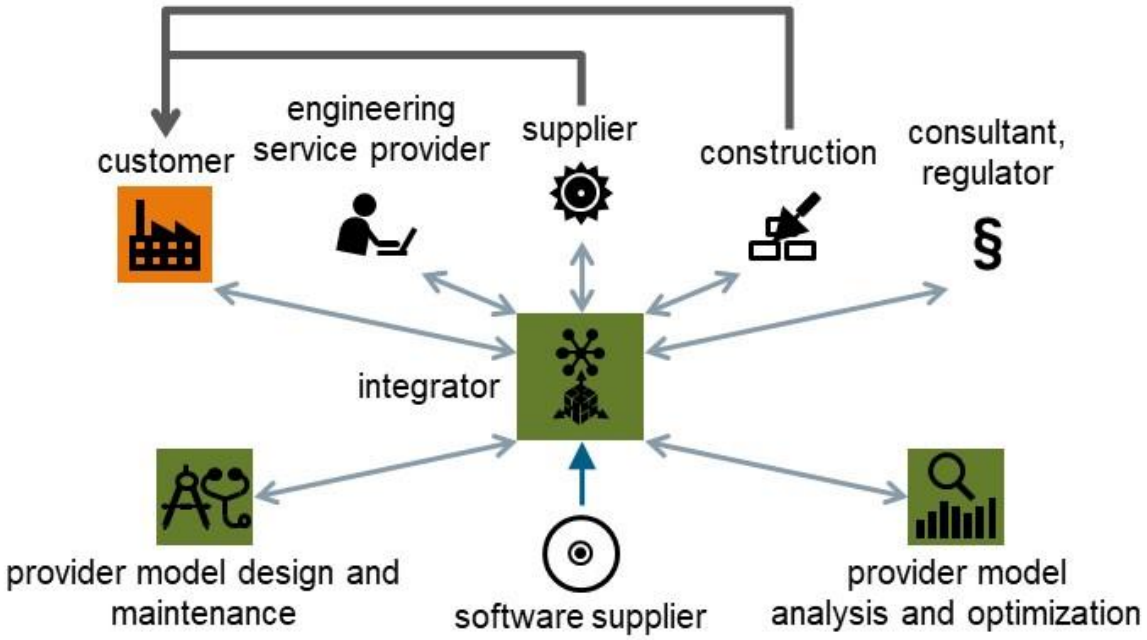


Value network according to business view of application scenario SDP

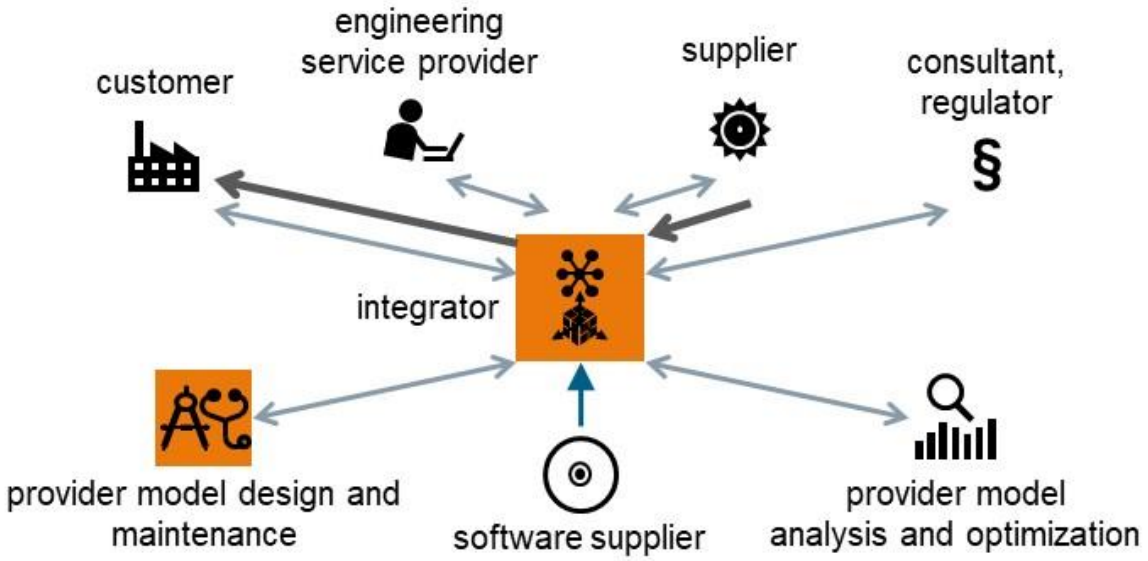


Different business exemplifications of application scenarios SDP

Exemplification "plant engineering service-provider"



Exemplification "engineer-to-order"



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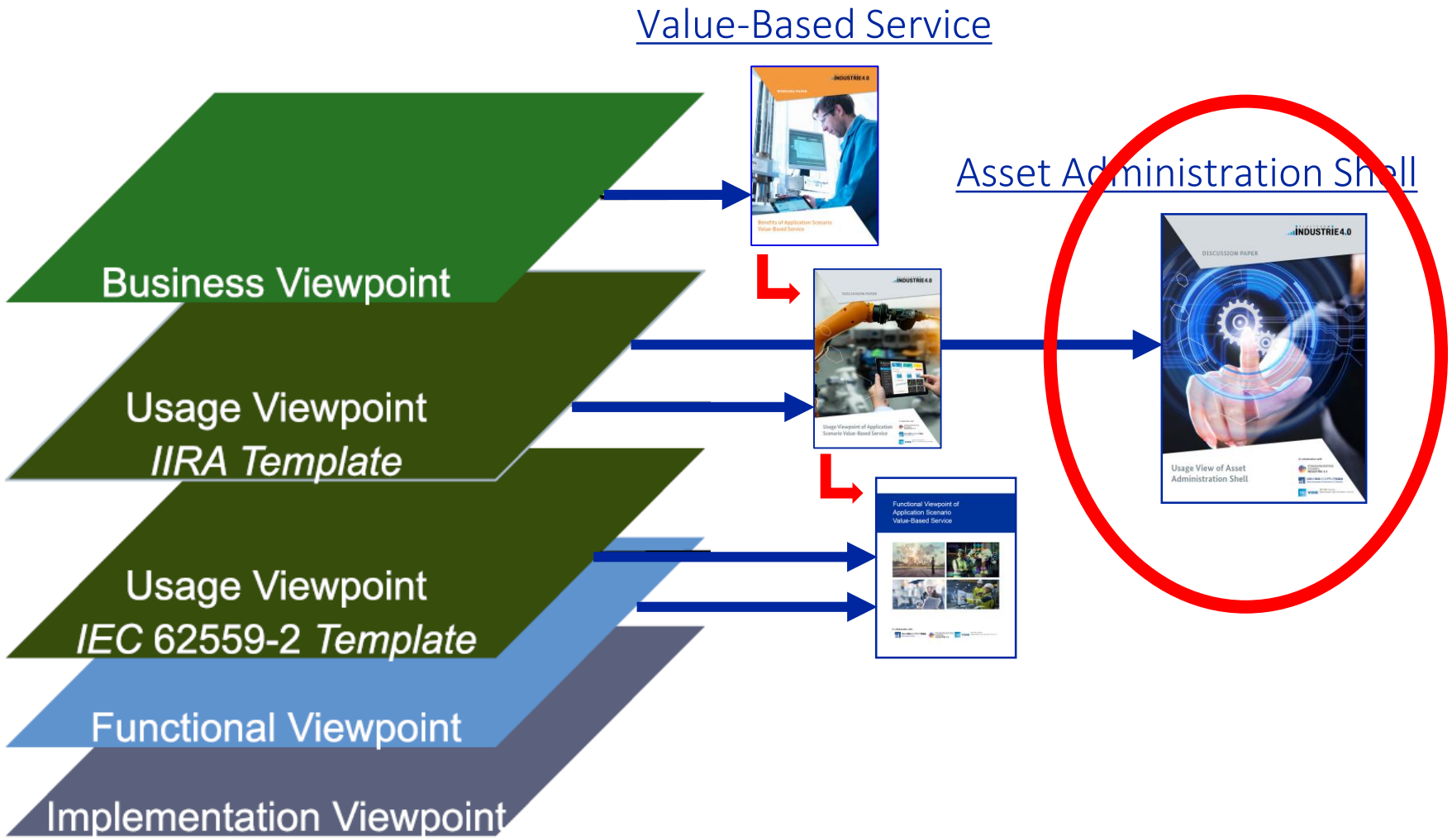
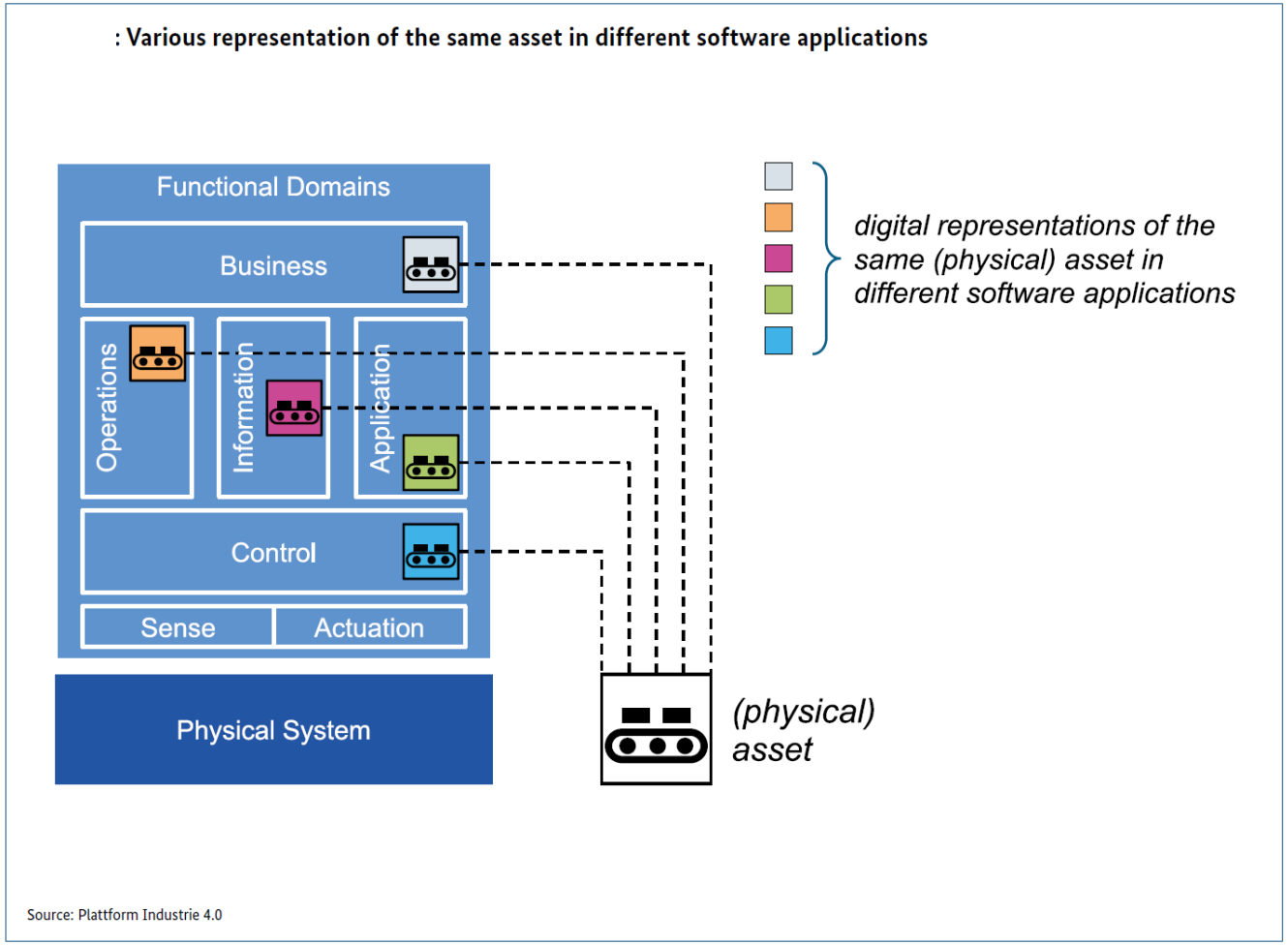


Asset Administration Shell

Asset Administration Shell is digital representations of an asset:

- Structuring the information and functions of an asset in a uniform manner
- Decoupling an asset from the application specific interpretations
- Improving interoperability of an asset

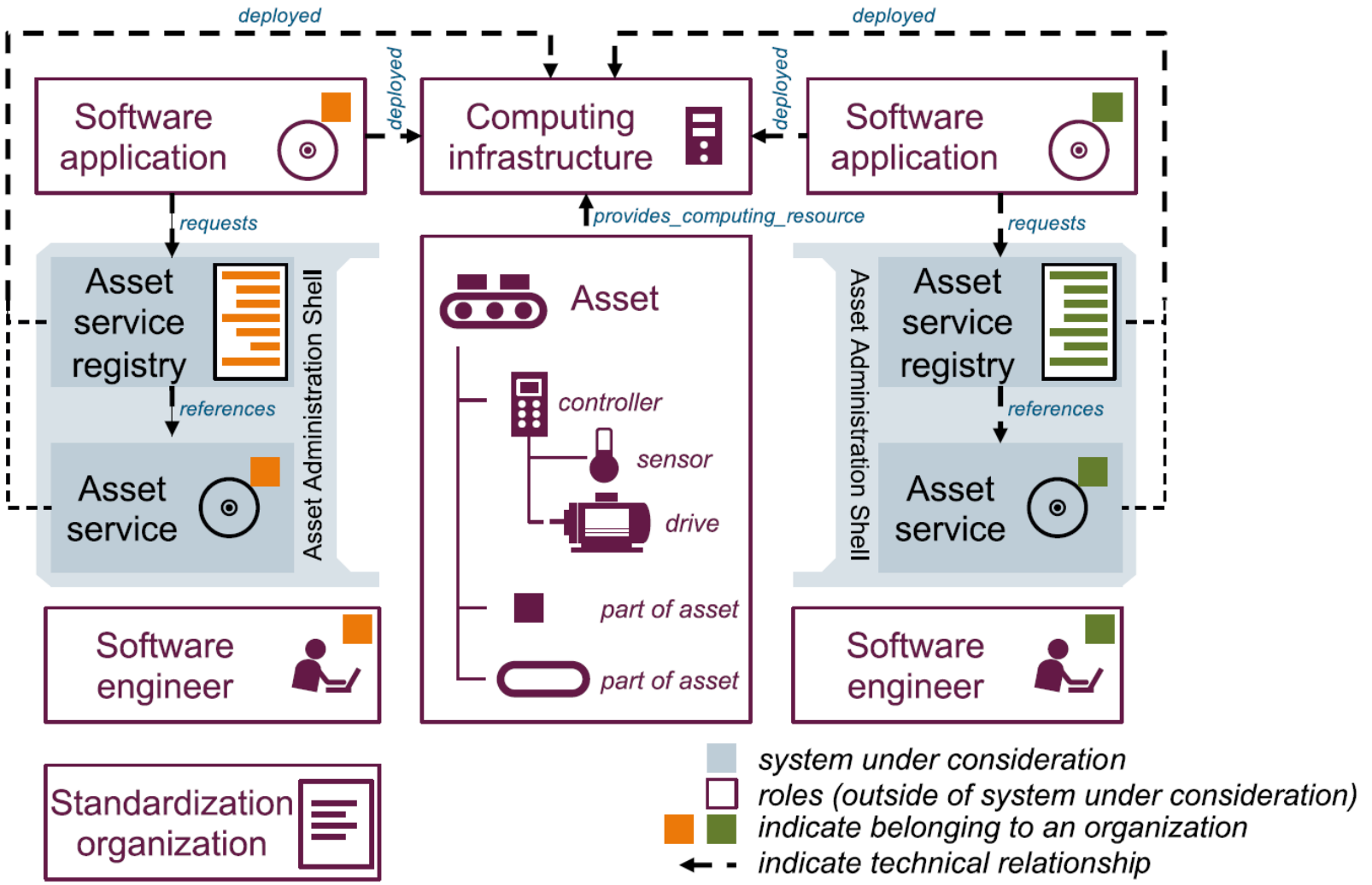


Asset

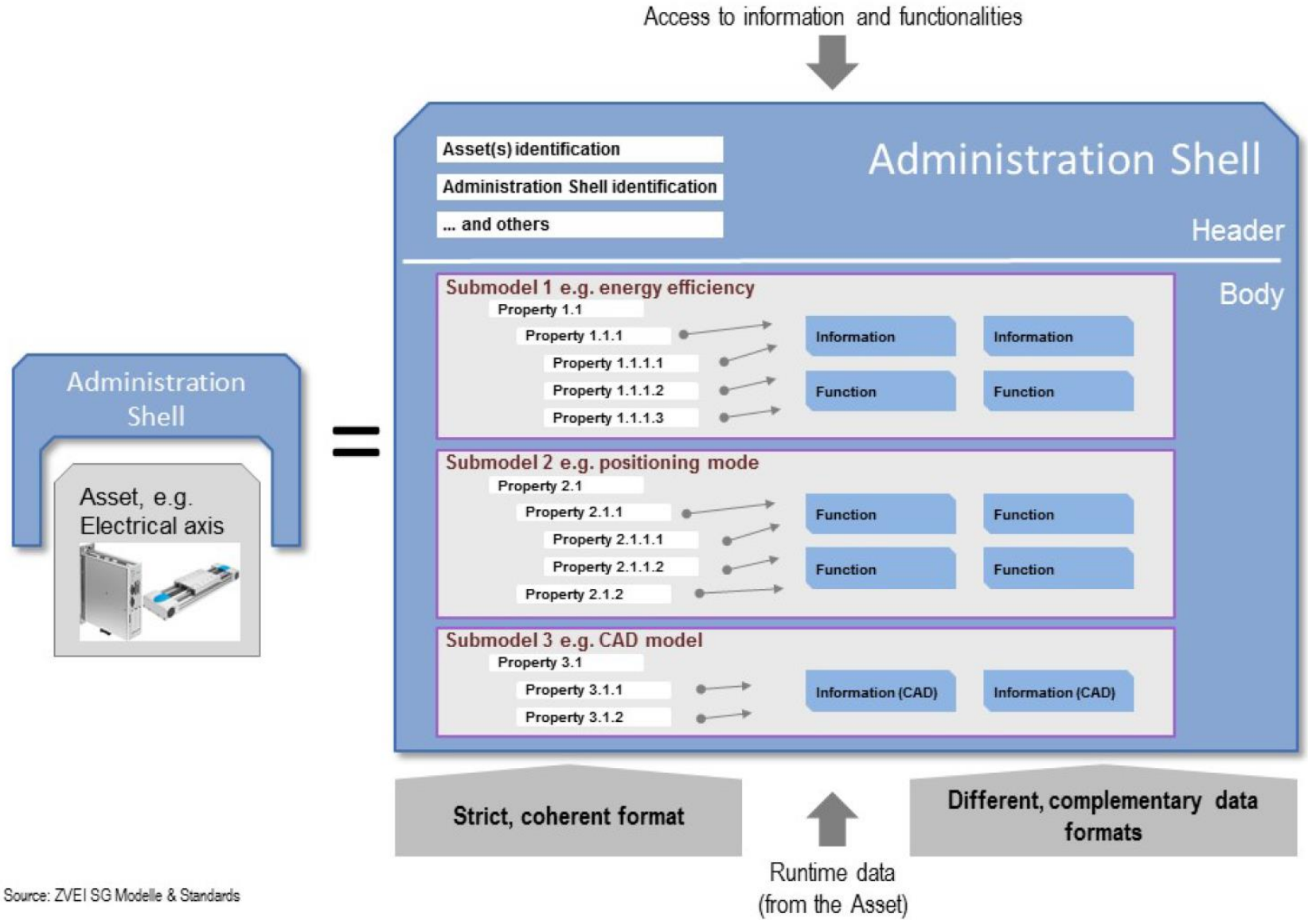
- “Asset" is defined as "physical or logical object owned by or under the custodial duties of an organization, having either a perceived or actual value to the organization“.
- Assets may be material or immaterial, and of various natures such as:
  - physical objects, for example, equipment (machine, cabinet, contactor, computer, actuator, cables, connectors, sensors ...), raw material, parts components and pieces (screw, wheel ...), supplies, consumables (paper ...), or products (final or intermediate);
  - software (firmware, applications, engineering tools ...);
  - documents (data media, life cycle documentation ...);
  - immaterial (licence, copyright, idea, plan, process definition, standards, patents, general procedure, recipe, equipment type definition, product/family type definition, production plans, project plans 194 business procedures, actual states ...);
  - information;
  - human (service technician, programmer, operator ...);
  - service ...

Overview of Usage View of Asset Administration Shell

- Asset Administration Shell as system under consideration
  - Asset service registry
  - Asset service
- Role
  - Asset
  - Software engineer
  - Software application
  - Computing infrastructure
  - Standardization organization

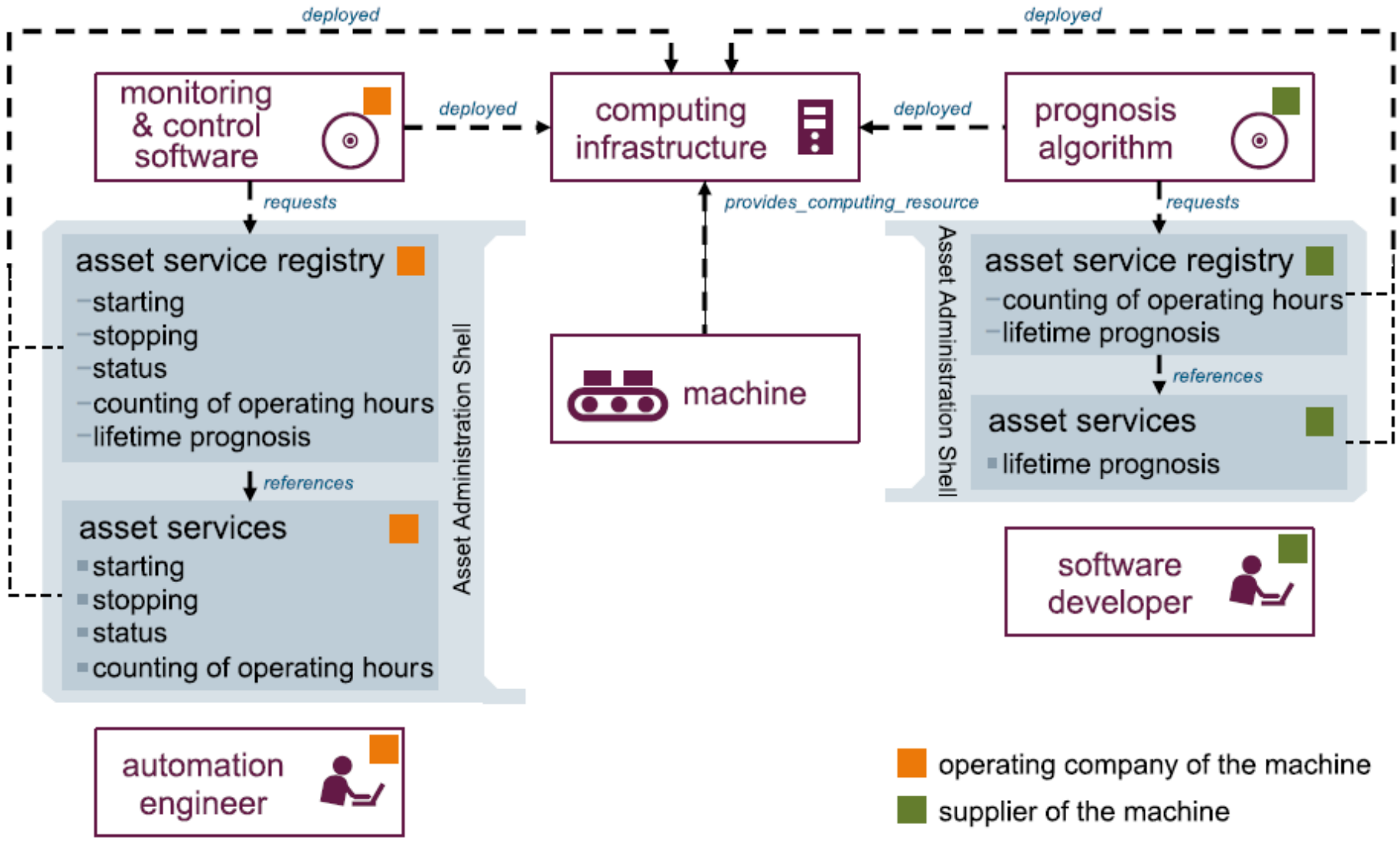


General Structure of an Asset Administration Shell

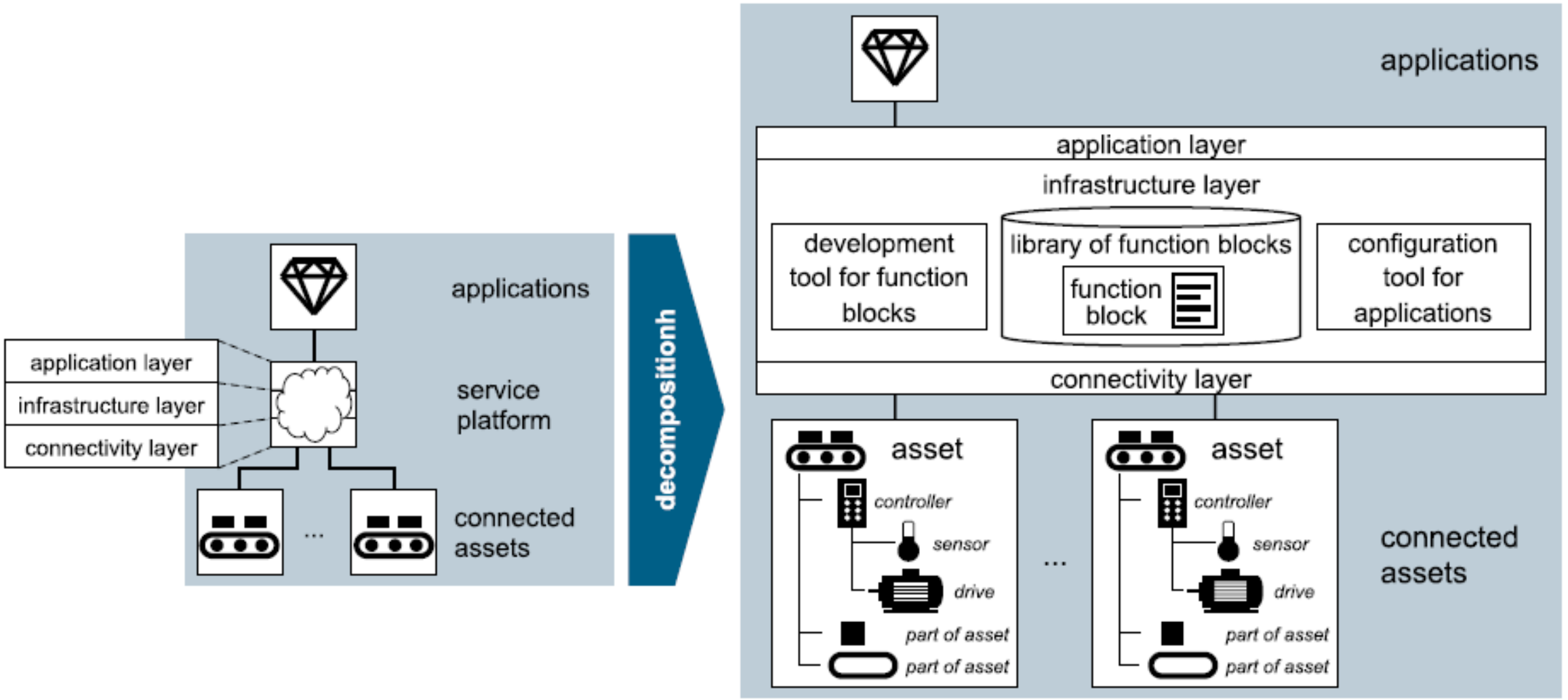


Source: ZVEI SG Modelle & Standards

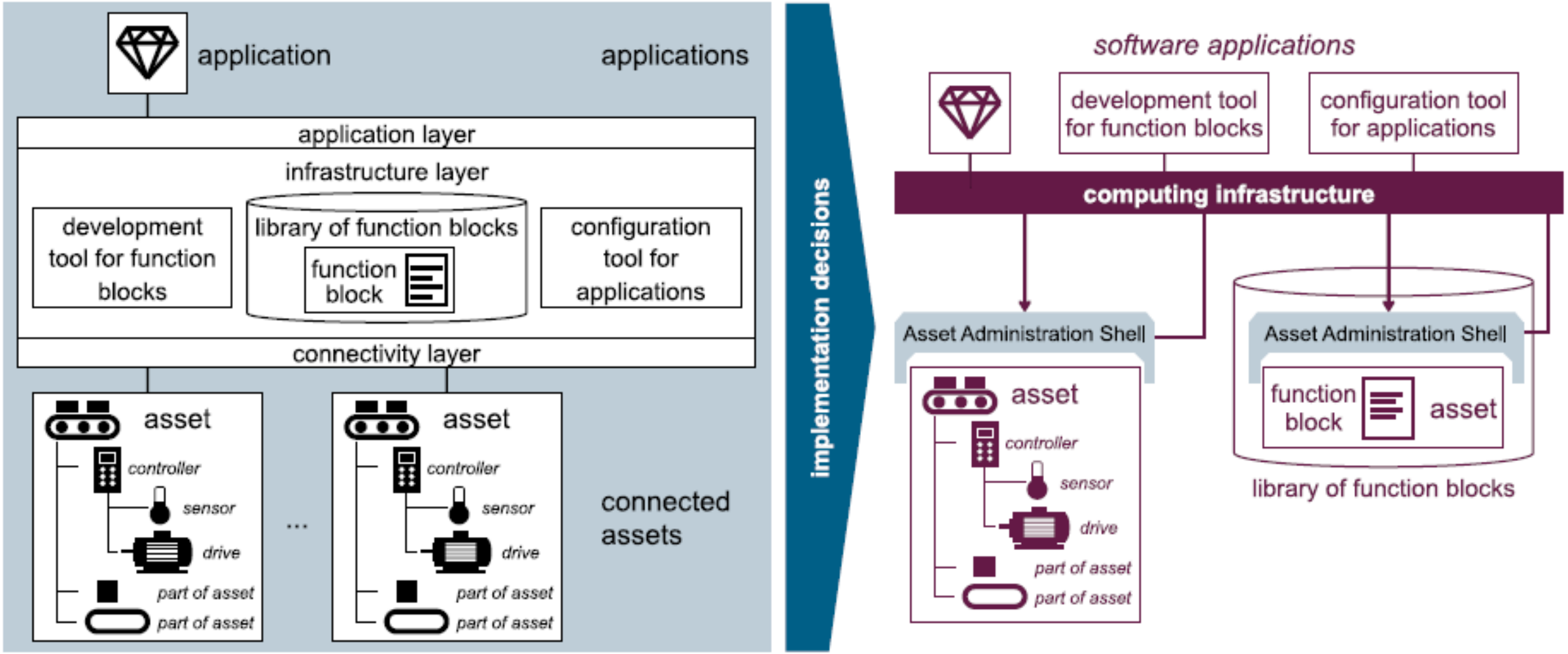
Example for Value-Based Service



Detailed Representation of System under Consideration in the Usage View of Value-Based Service



Implementation based on Asset-oriented Approach



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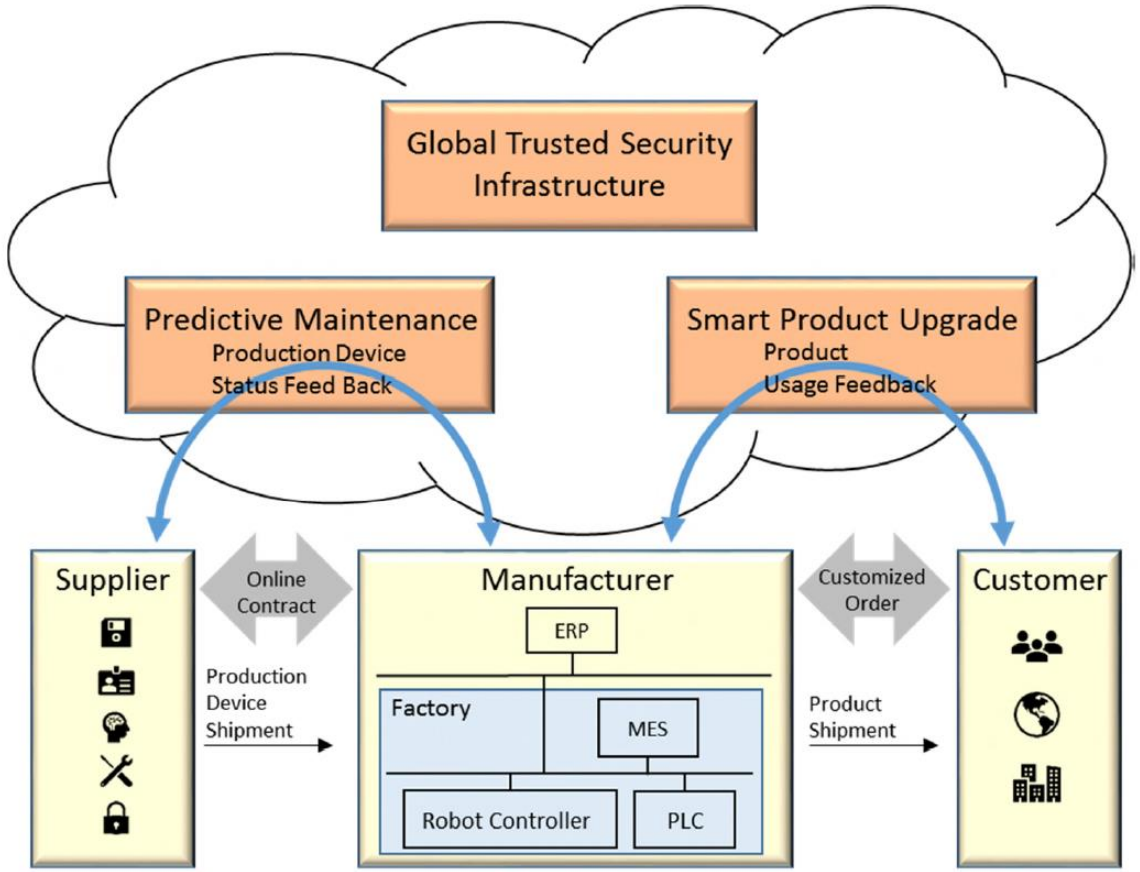
Facilitating International Cooperation for Secure Industrial Internet of Things/Industrie 4.0

- Highly automated international and global collaboration of industrial production environments is a key feature of Industrie 4.0 (I4.0).
- Production facilities will be able to collaborate with each other in an ad-hoc and automated manner across continents.
- Availability of a secure comprehensive I4.0 ecosystem is an indispensable prerequisite.
- Secure operations require trust between all parties involved.



High-level Architecture of Supply Chain in Connected Industries

Key issues for a lasting business relationship

- How to design a trusted global security infrastructure?
- Which criteria and metrics can be used to determine the trustworthiness of a company and its products?
- How is a (partially-) automated verification of trustworthiness of the business partner possible without prior discussions, confidentiality agreements and business contracts?
- How can the creation, provisioning and management of secure digital identities across countries be realized in this infrastructure?
- Is a single overarching global certificate-based process for delivering secure digital identities globally applicable, feasible, and economical?
- How can a worldwide recognition of trust service providers be organized?

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Summary

- Japan-Germany Collaboration by Plattform Industrie 4.0 and Robot Revolution & Industrial IoT Initiative (RRI) since 2016, based on the German and Japanese Government Agreement
- Top-down approach to standardization based on Usage View and Functional View of application scenarios
- International interoperability of solutions focusing on security