MBSE2022
REALISATION, EXTENSION AND UTILISATION OF THE SYSTEM FACTORY

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Speaker
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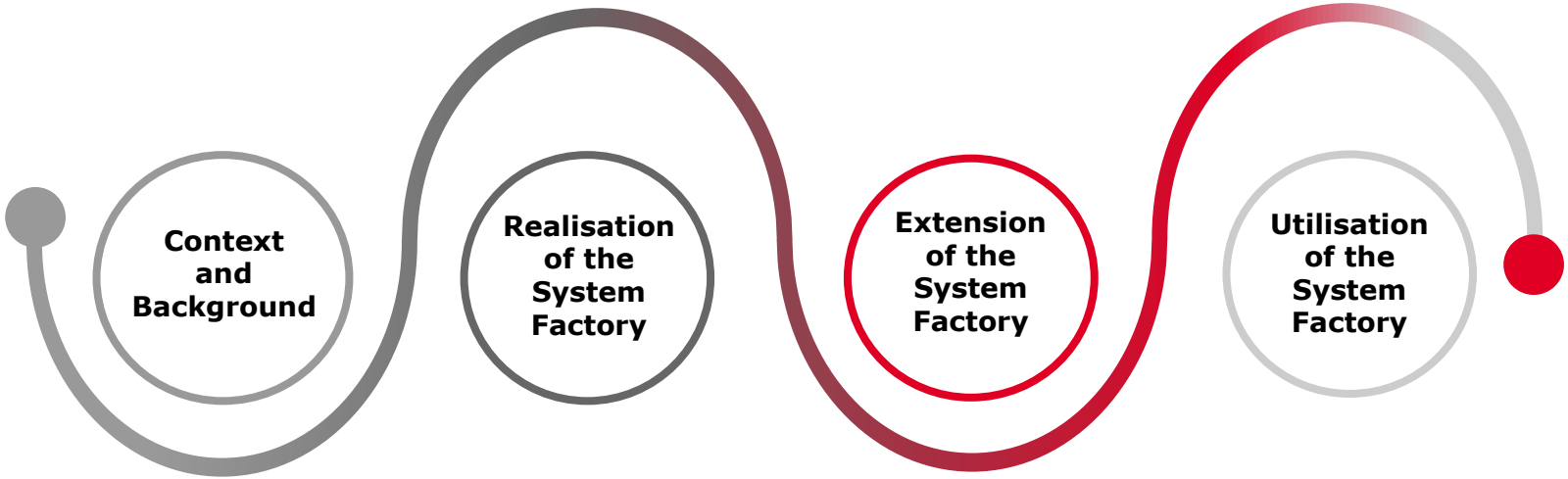
Content Structure



REALISATION, EXTENSION AND UTILISATION OF THE SYSTEM FACTORY

1. **Context and Background**
2. Realisation of the System Factory
3. Extension of the System Factory
4. Utilisation of the System Factory within the Extended Enterprise
5. Conclusion

CONTEXT AND BACKGROUND
THE SYSTEM FACTORY

What is the System Factory?

- System Engineering **infrastructure to support MBSE developments in Space Projects**
  - **Motivation:** Together with the **Space System Ontology** and by integrating the **Data Hub**, the **System Factory** will **enable interoperability** within and between organisations
  - **A Reference Logical Architecture** can used by the MBSE Community to see which activities can be subjected to be implemented with MBSE
  - **Organisations can define their own System Factory implementation** based on proprietary or commercial solutions

How is being designed?

- The architecture of the System Factory is specified using **Capella** and **ARCADIA method**
  - This was a design decision, other MBSE tool and method could have been selected

ARCADIA

Capella™

- Agile approach among the partners involved

Who is designing it?

- Two sequential ESA activities:
- **SASyF** (2020-2021) -> **MBSE2021**

esa

gmv

AIRBUS DEFENCE & SPACE ThalesAlenia Space OHB

- **SASyF4ESA** (2022)

Where is it available?

- Released under ***ESA Community License***
- ESA ESSR (must be first logged-in):

  https://essr.esa.int/project/specification-and-architecture-of-a-system-factory-sasyf
- Capella html export is also available for non-Capella Users

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REALISATION OF THE SYSTEM FACTORY

Types of Physical Architectures

Organisations Physical Architecture

1. Instantiated for LSIs **ADS, TAS, OHB** & ESA (i.e. a total of 4)
2. Represents **current state-of-practice** and it is **internal to each organisation**
3. Traces back to the System Factory reference Logical Architecture

R&D Physical Architecture

1. Based on R&D activities led by ESA and Industry focused on advancing MBSE technologies
2. Represents **current state-of-the-art**

Extended Enterprise Physical Architecture

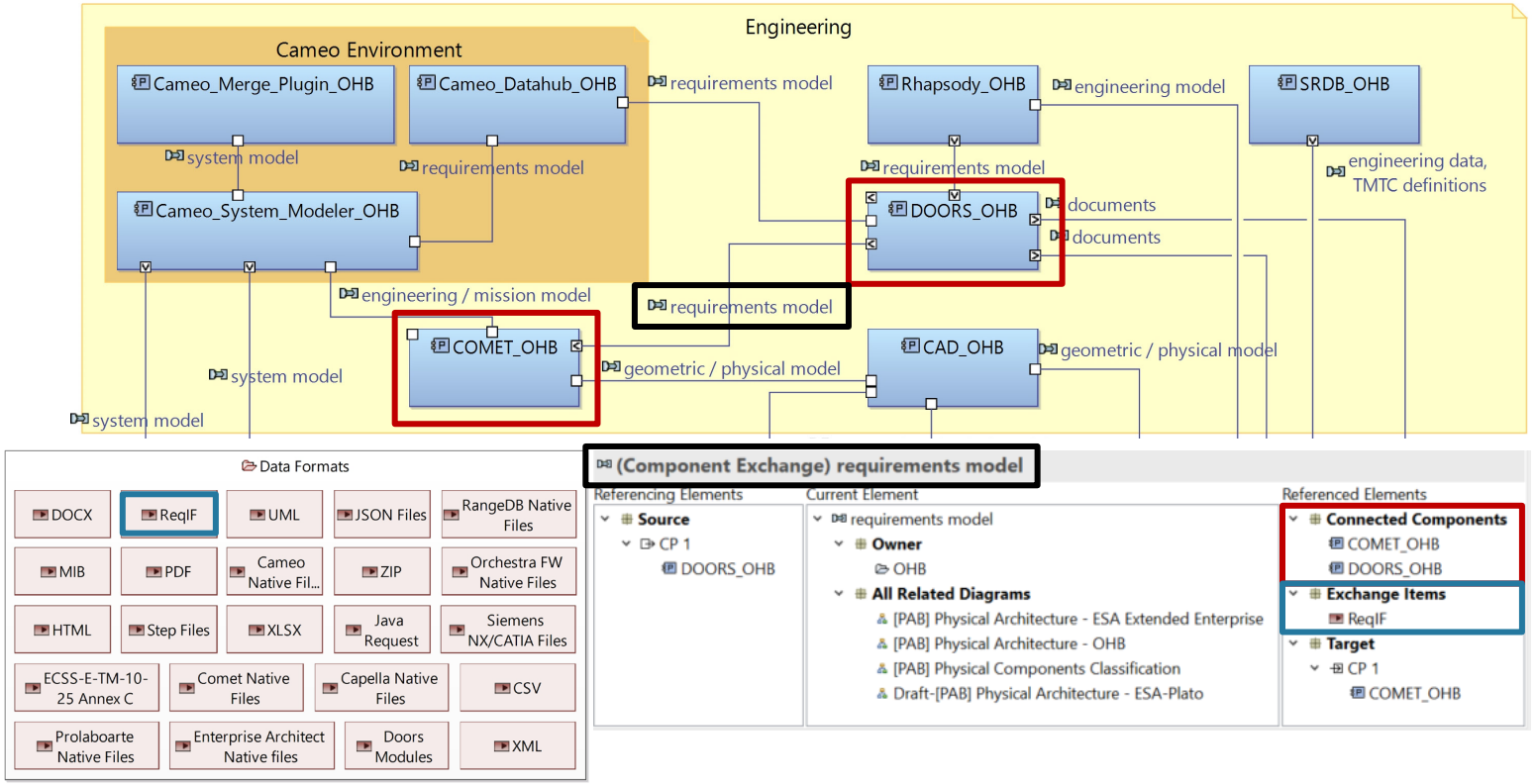
1. Represents the **envisioned long-term System Factory implementation**
2. Ensures interoperability between System Factories across the Extended Enteprise

- Exchanged Artefact **e.g. Requirements Model**
- Exchange Format **e.g. ReqIF**
- Exchange Direction **e.g. Source / Target Tools**
- Tool Functional Classification **e.g. Requirements Management Tool**

These Physical Architectures provide the Model User with a snapshot to guide toolset selection decision making

REALISATION OF THE SYSTEM FACTORY

Example: Organisation's Physical Architecture



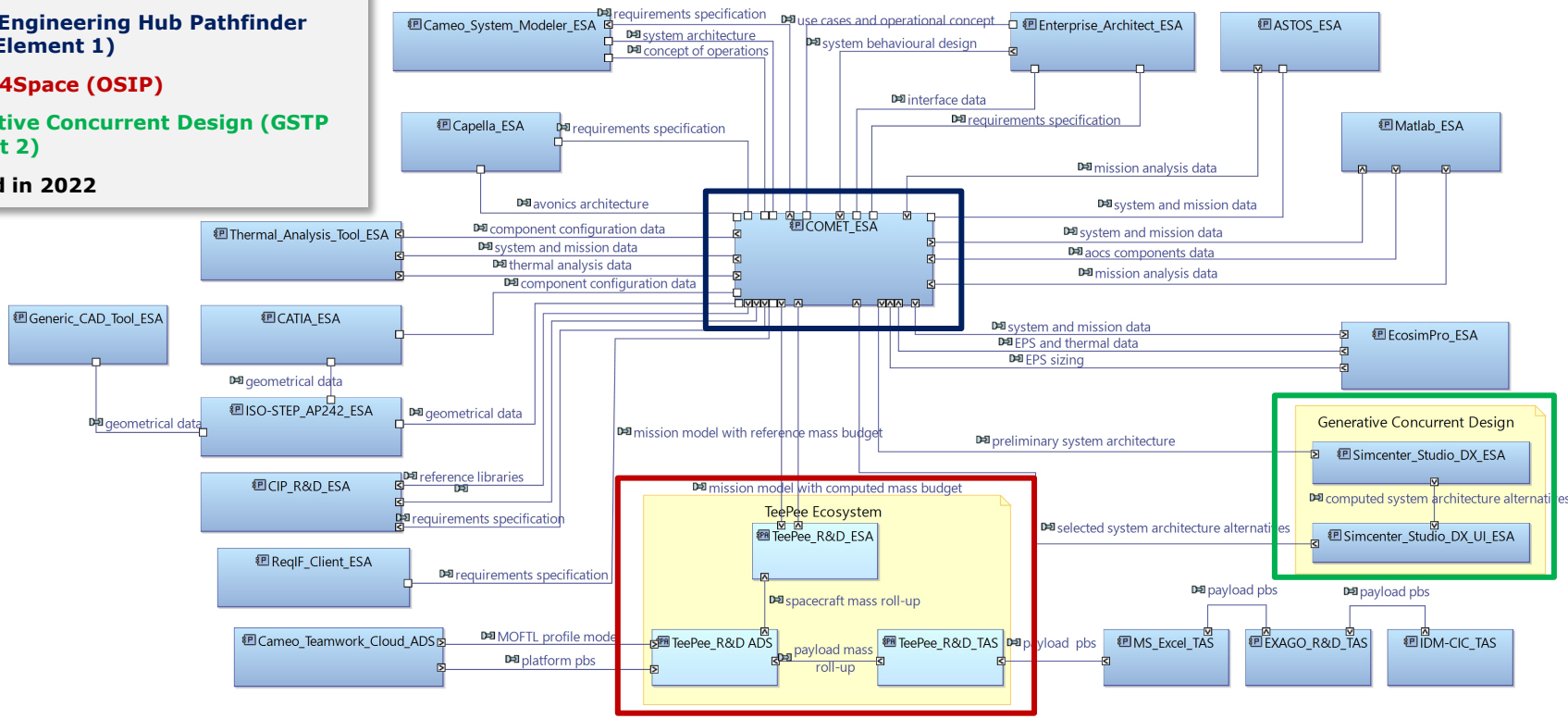
REALISATION OF THE SYSTEM FACTORY

Example: R&D Physical Architecture

R&D Physical Architecture:

1. **Digital Engineering Hub Pathfinder (GSTP Element 1)**
2. **TeePee4Space (OSIP)**
3. **Generative Concurrent Design (GSTP Element 2)**

all finished in 2022



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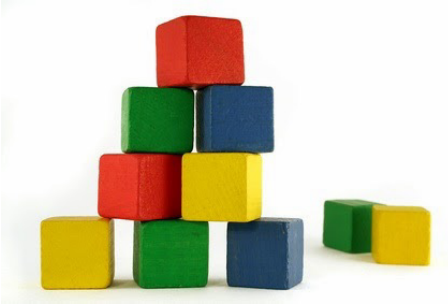
EXTENSION OF THE SYSTEM FACTORY

Related MBSE Activities

System Factory builds on...	developed under...
R&D Projects Focused on Technologies	• AI-Powered Digital Assistant • Augmented Reality (ARCE) • ...
R&D Projects Focused on Tools	• Generative Concurrent Design • TeePee4Space • Digital Engineering Hub Pathfinder • ...
Data Hub	• Model-Based Engineering Hub
Space Systems Ontology	• Space Systems Ontology Development (SSOD) • ...

and many more



Collaboration is key to effectively place the building blocks together

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UTILISATION OF THE SYSTEM FACTORY
Scope

Use Scenarios

- System Factory use within an Organisation
- System Factory use across Organisations (i.e. Extended Enterprise)

⇒ These uses are combined in an Extended Enterprise-related Use Case

Limitation

- Identification of Model-Based Engineering Hub minimal elements required to display a meaningful Use Case (e.g. user authentication and data security, Space Systems Ontology evolution… are not addressed at this point)

Characteristics

- This System Factory Physical Architecture implementation serves as a reference to understand how it is to be used in the context of the Extended Enterprise
- Local instantiations of this Physical Architecture will vary from organisation to organisation to accommodate the specific tools that are connected to the Hub in each organisations context

UTILISATION OF THE SYSTEM FACTORY

Reference System Factory Instantiation Concept

MBEH: Model-Based Engineering Hub

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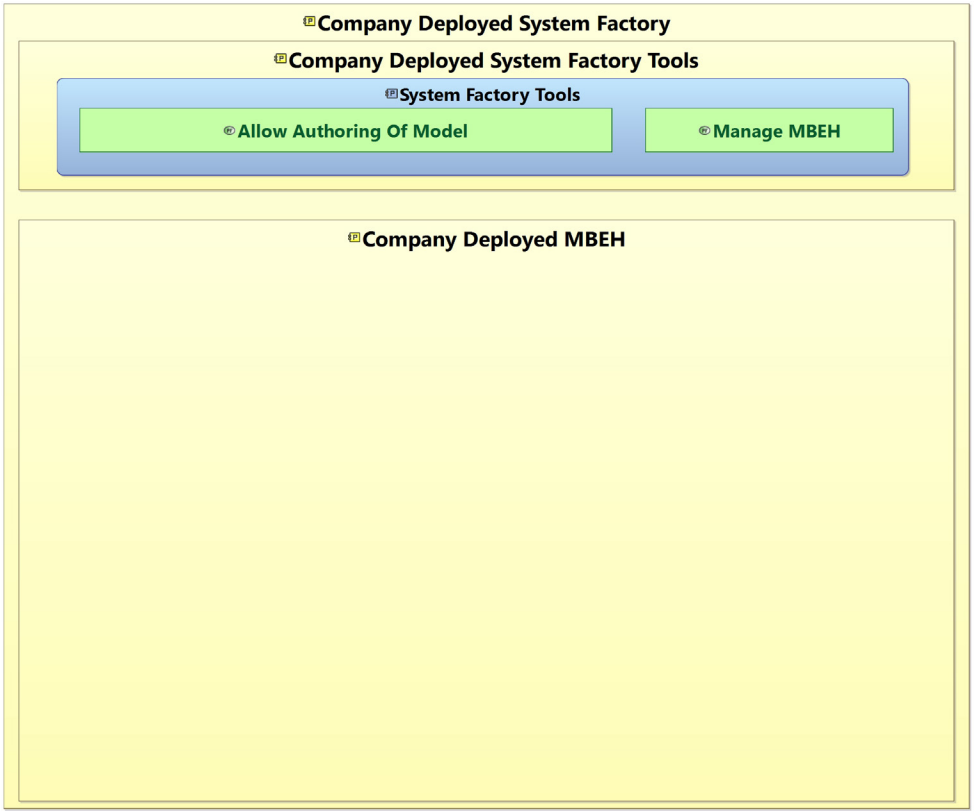
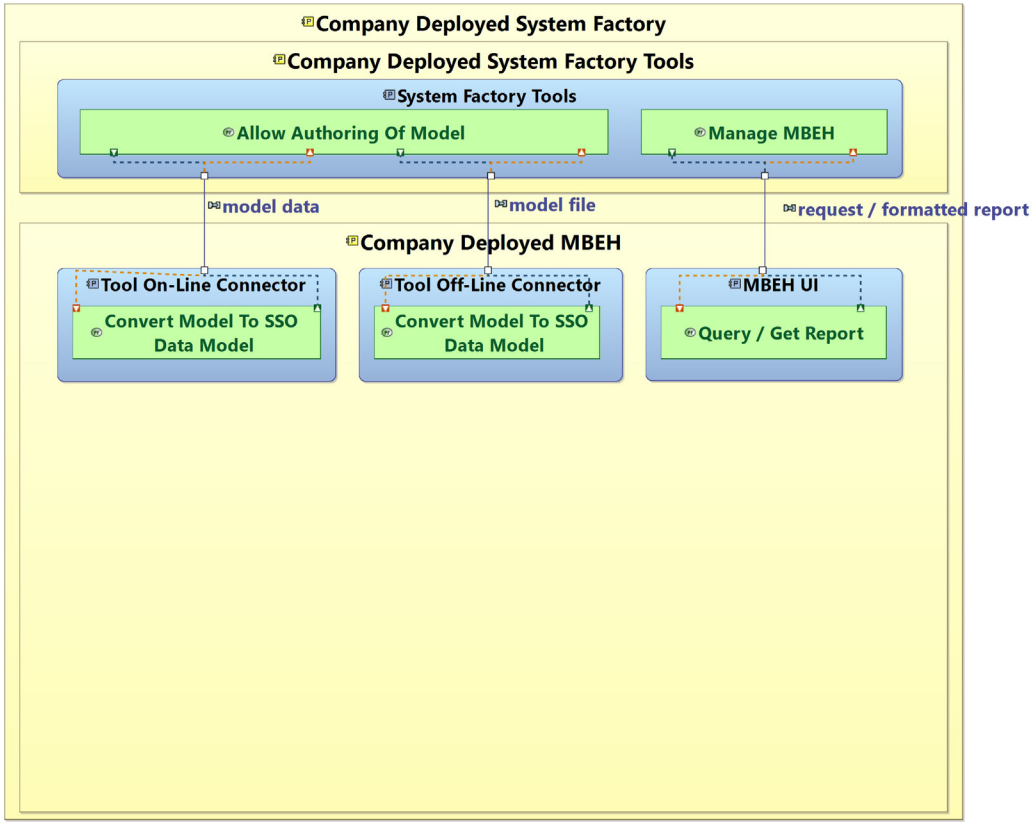


UTILISATION OF THE SYSTEM FACTORY

Reference System Factory Instantiation Concept

MBEH: Model-Based Engineering Hub

SSO: Space Systems Ontology



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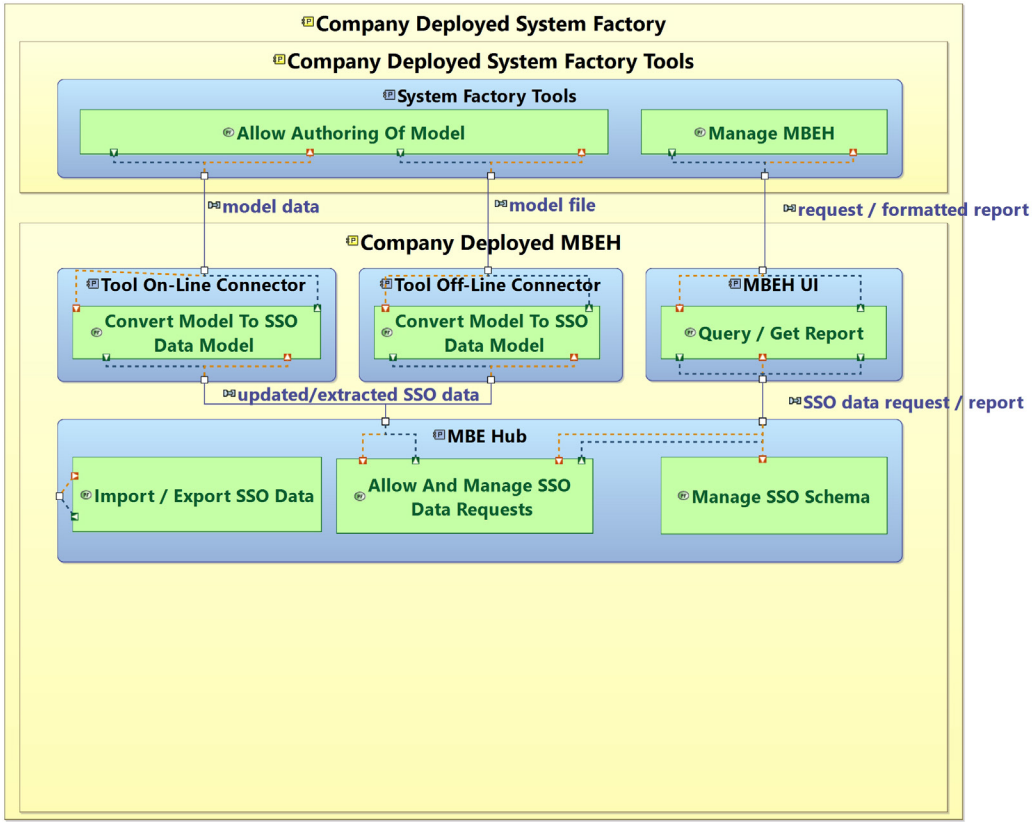

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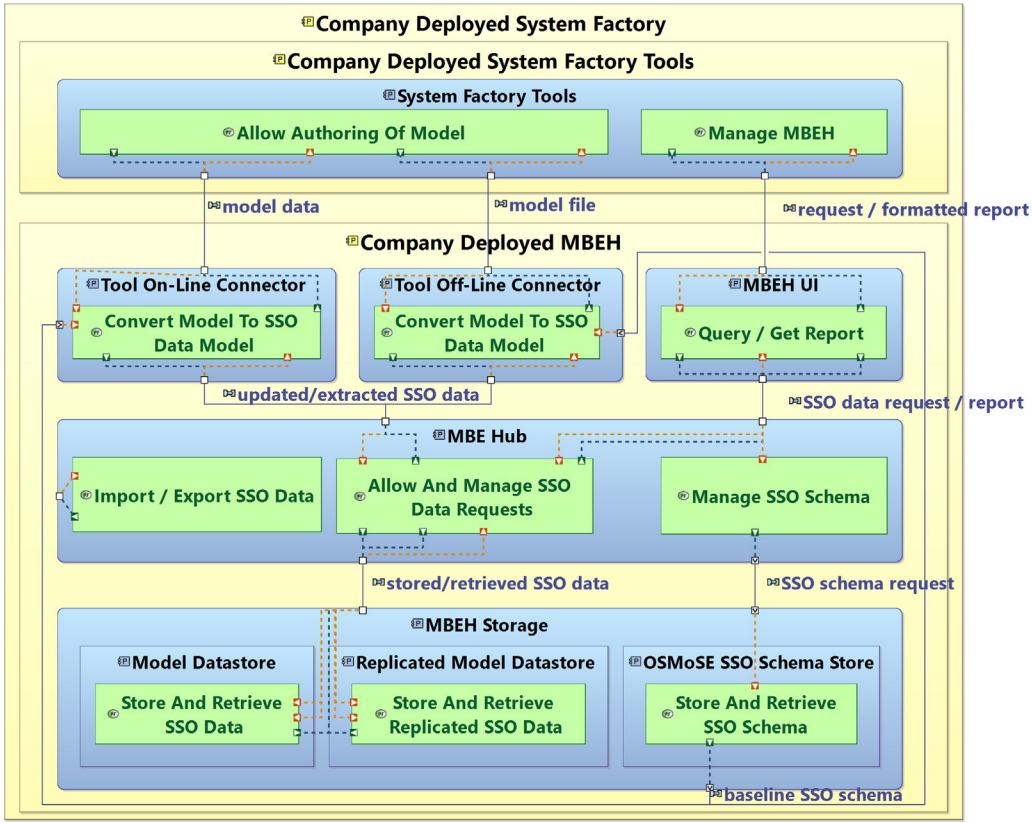
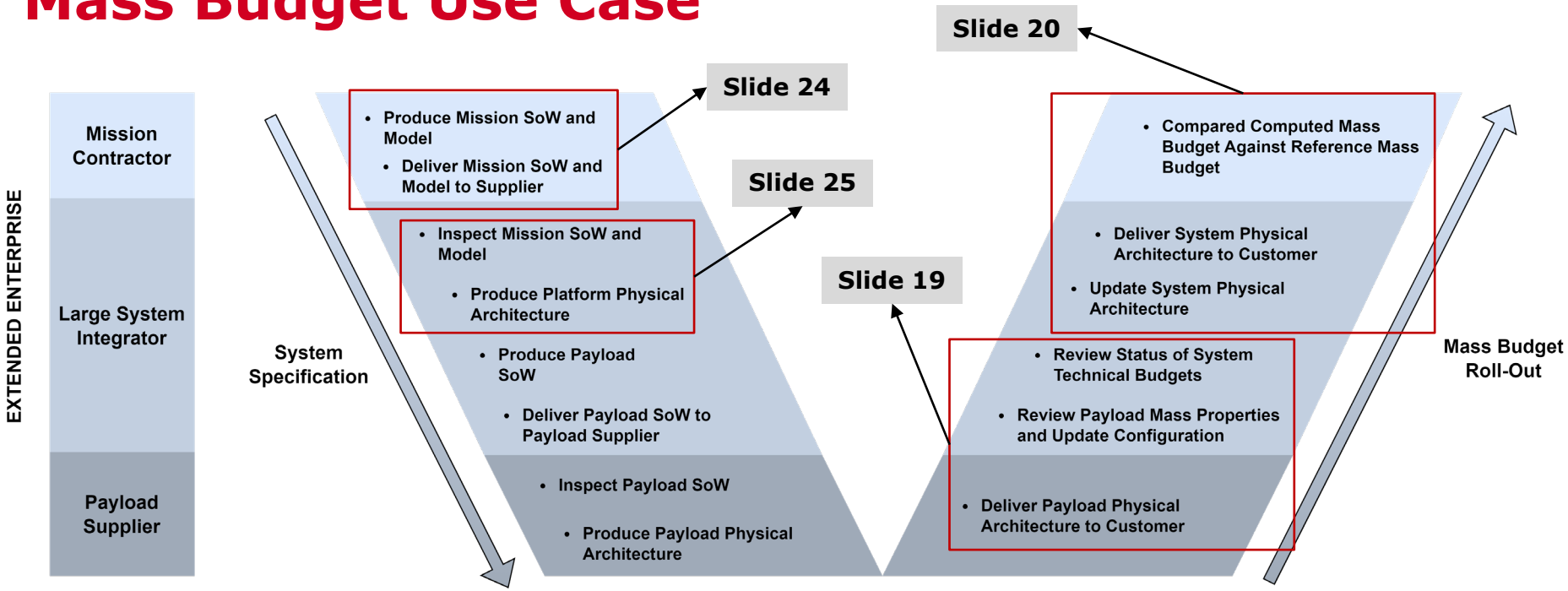


UTILISATION OF THE SYSTEM FACTORY

Mass Budget Use Case



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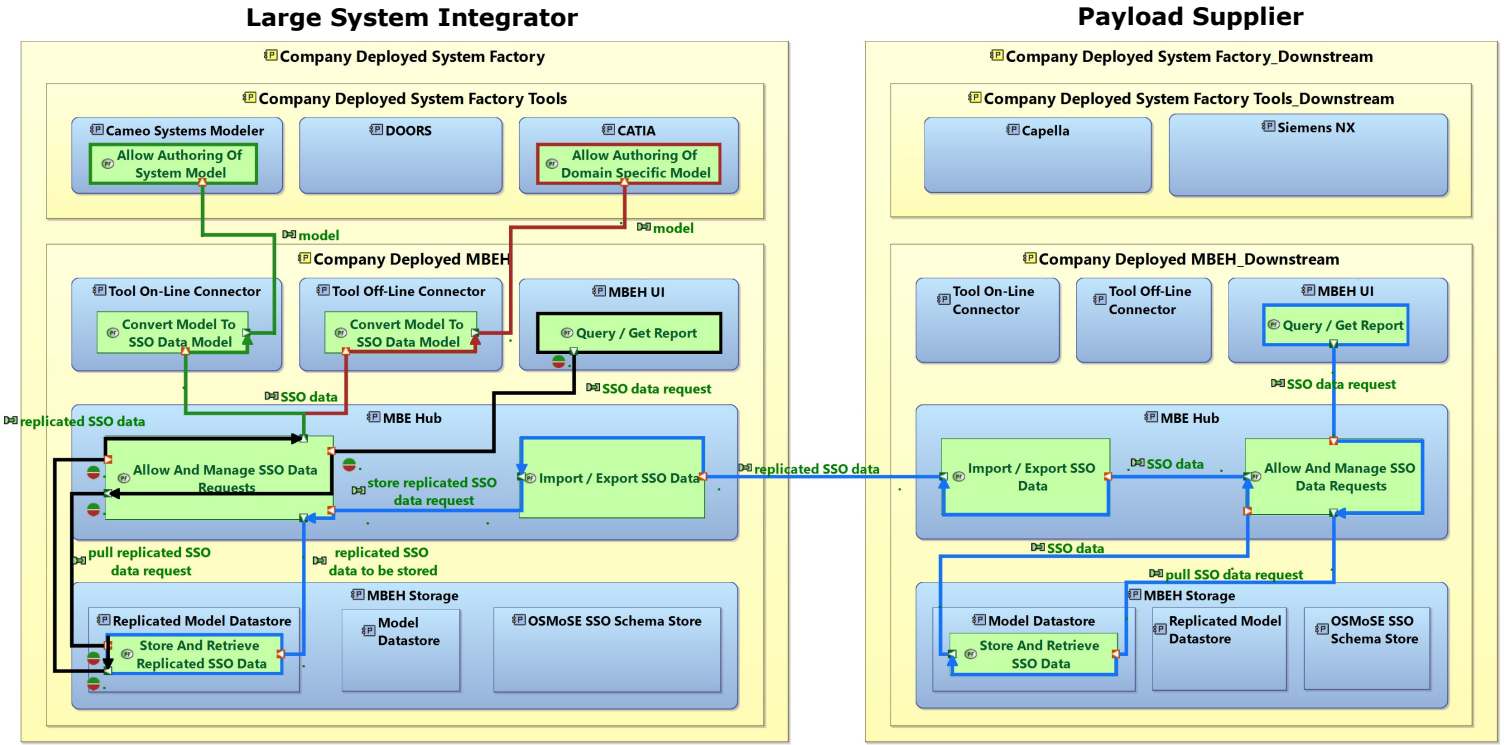

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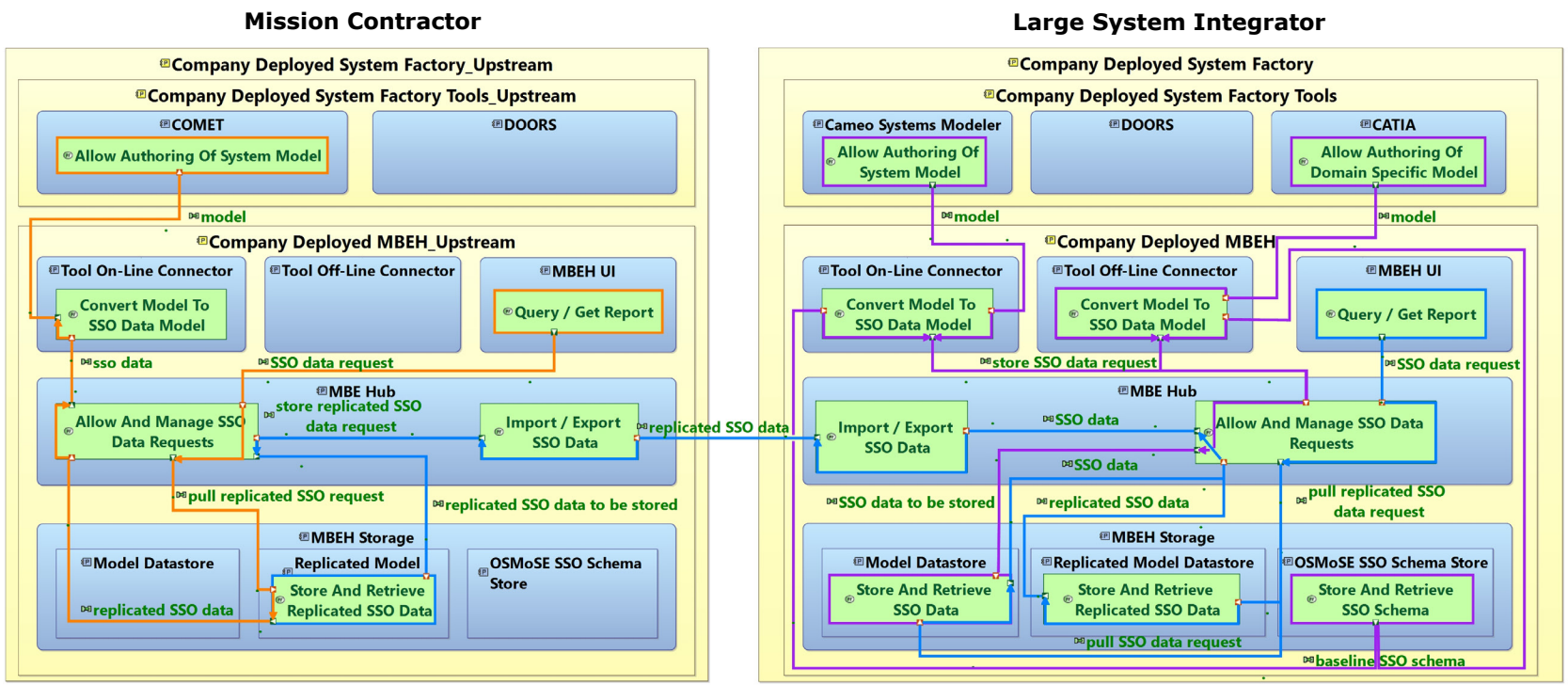

Update System Physical Architecture

Deliver System Physical Architecture to Customer

Compare Computed and Reference Mass Budget

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CONCLUSIONS AND REMARKS

Wrap-Up

Conclusions

1. **System Factory Organisations and R&D Physical Architectures** can be used as a **reference** to see current state-of-practice and state-of-the-art**.** They evolve as new advances in MBSE technologies are made
2. **Alignment between related MBSE activities** is key to assure System Factory building blocks are integrated effectively
3. Use Case-driven validation of the presented System Factory Extended Enterprise Physical Architecture is a **first step and an enabler to ensure future interoperability within and across Organisations**
4. **Collaboration is a key element** for this alignment and validation

Remarks

1. The System Factory model (Capella model and html export) can be found at **https://essr.esa.int/project/specification-and-architecture-of-a-system-factory-sasyf**
2. Its usage is not limited to LSIs but also **encouraged for SMEs aiming at implementing an MBSE approach** for some of their Systems Engineering activities

Thank you

SASyF4ESA Points of Contact

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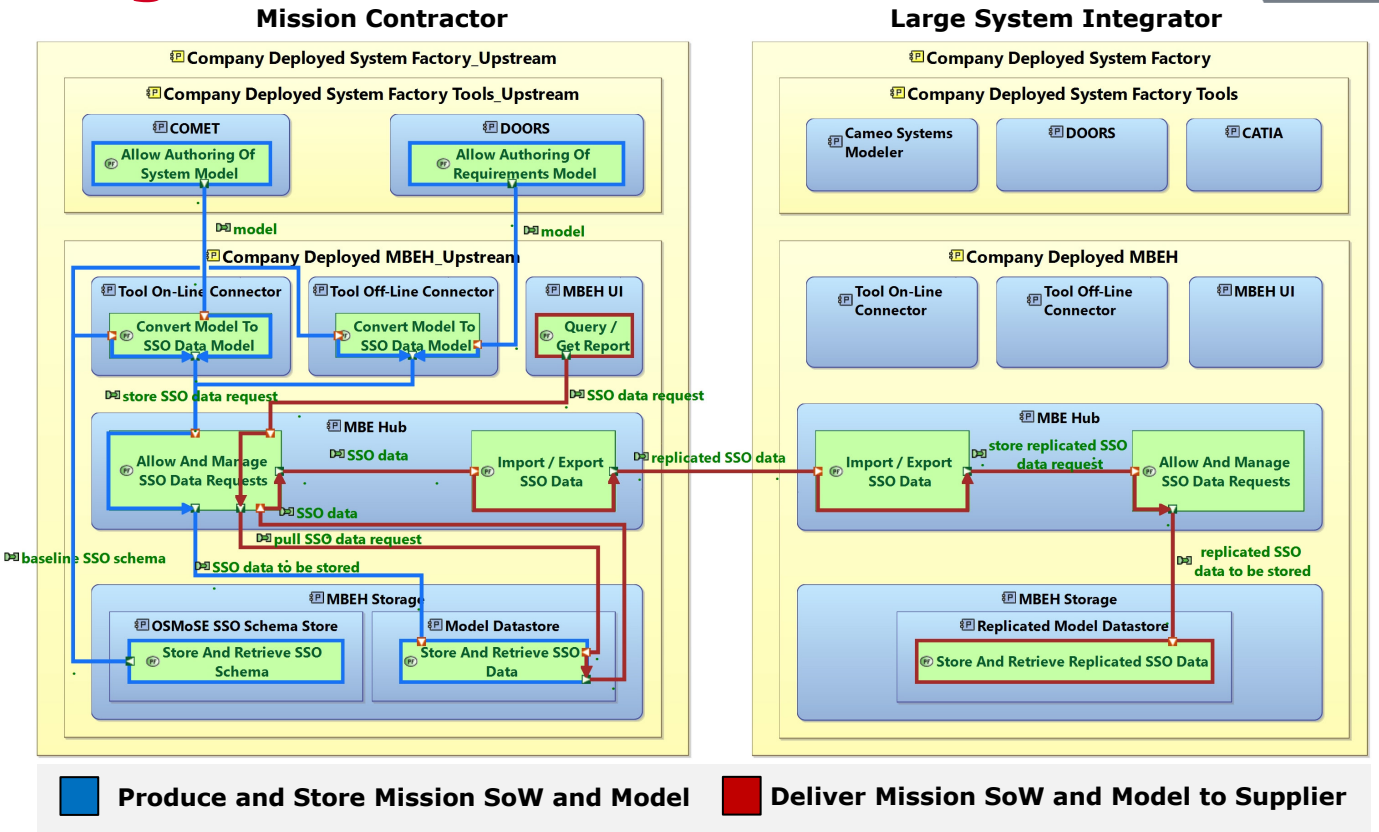
ADDITIONAL MATERIAL

Mass Budget Use Case



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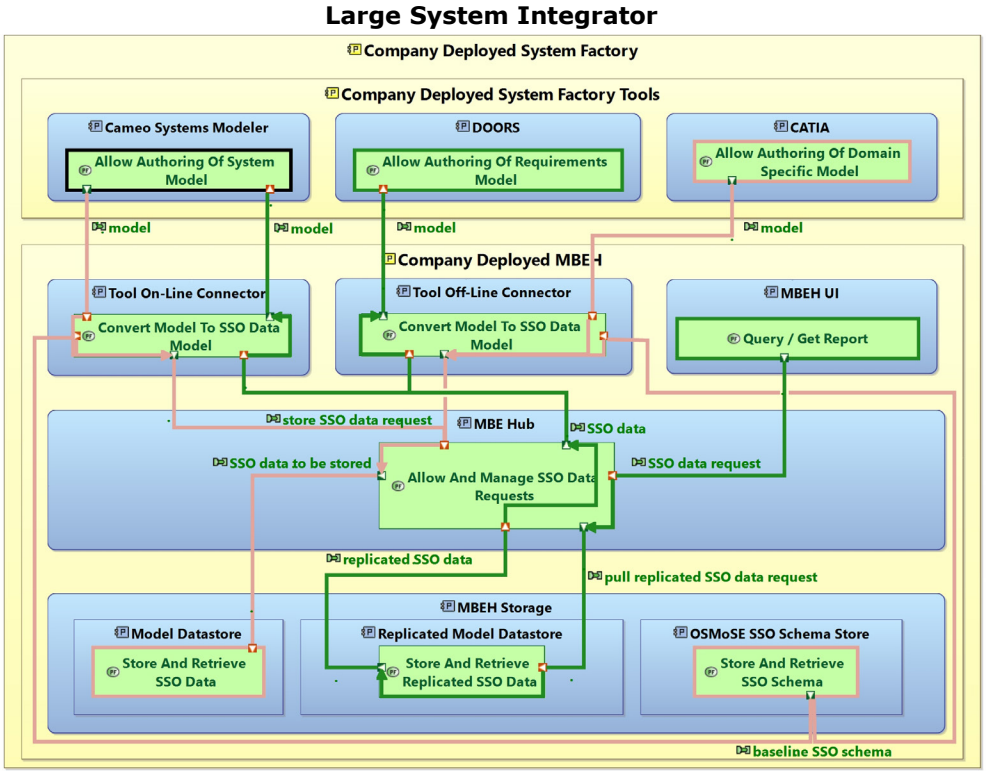

Inspect Mission SoW and Model **Produce and Store Platform Physical Architecture**