From MB4SE to OSMoSE

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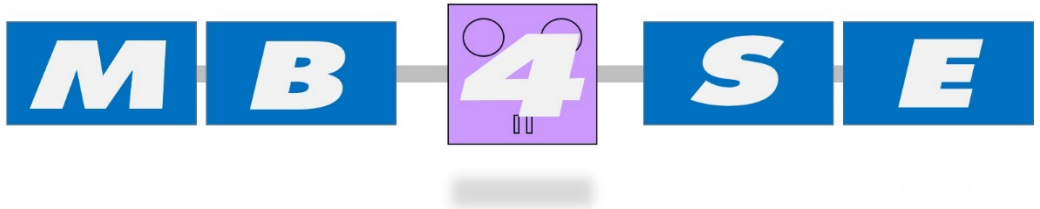
Motivation for MB4SE

- (Enable to) Deploy MBSE on European Space projects
- Many local experiences (one stakeholder, one phase, one discipline)
- Exchange and interaction are still difficult
- ESA has a role to sustain harmonization of processes and tools
- The focus is to facilitate the model/data exchange…
- … in the respect of existing industrial investments and practices…
- … in view of documenting the decisions into ECSS.



➔ **MB4SE is the community that advises how to achieve that**

Some of the MB4SE tasks

Constitute an Advisory Group

Agree on objectives

Agree on activities

Agree on the needs

Agree on what to exchange

Agree on what to share

Agree on the ontology scope, development steps

Agree on the digital infrastructure functional architecture, and interface

Advise on a R&D roadmap,

Guide the R&D activities

Define a governance

Advise standardization in ECSS

Disseminate in own organization

Promote outside organization

Spawn sub groups when necessary

Our roots are in the Sys Data Rep dossier

Harmonisation dossier ESA/IPC/THAG(2014)6

*"A **common approach to represent** and exchange this information is required at European level. Any solutions need to be compatible with existing processes, or at least identify a clear strategy to adapt existing processes when and what to exchange."*

*"the added value of improved data and technical information exchange between stakeholders will only be achieved through **harmonisation** and possibly **standardisation** in the medium term.*

*The harmonisation should result in a clear identification of the required context (need for exchange), the scope of the conceptual datamodel and its related **governance** aspects (ownership and distribution) and the possibility (or not) to agree on specific technologies."*

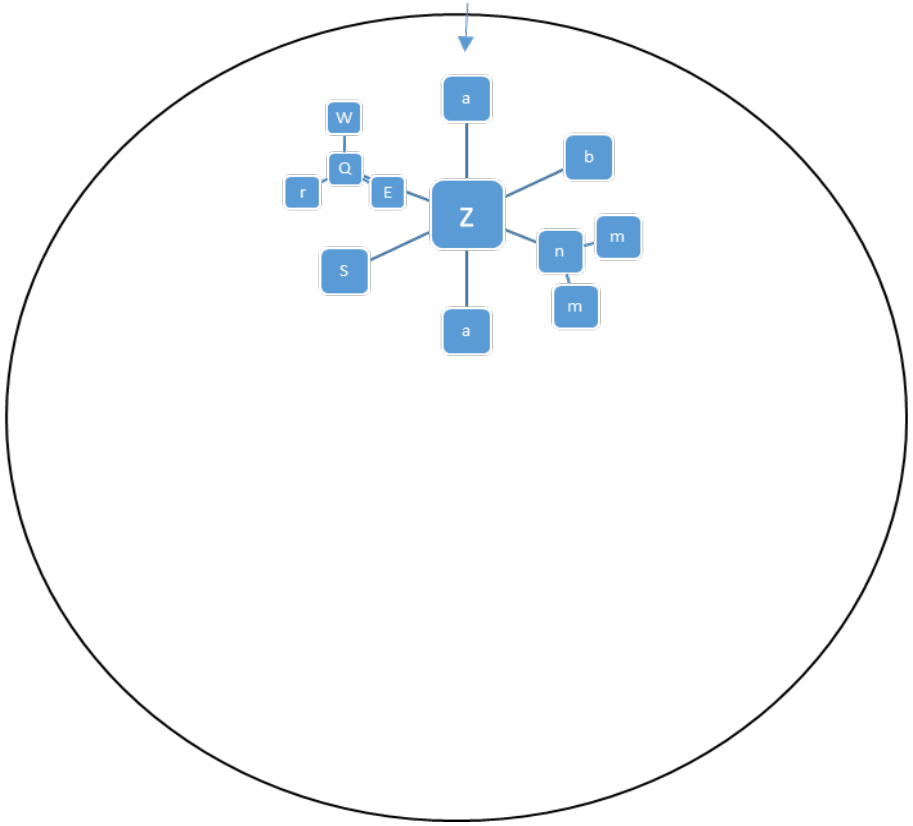
➔ **We need to define together a "global" conceptual data model**

A POSSIBLE APPROACH

ECSS Standards M, E10
SysML ESA Toolbox

conceptualisation

European Space Systems DNA



product tree,
mission/system/etc.,
verification, requirement management, reviews,

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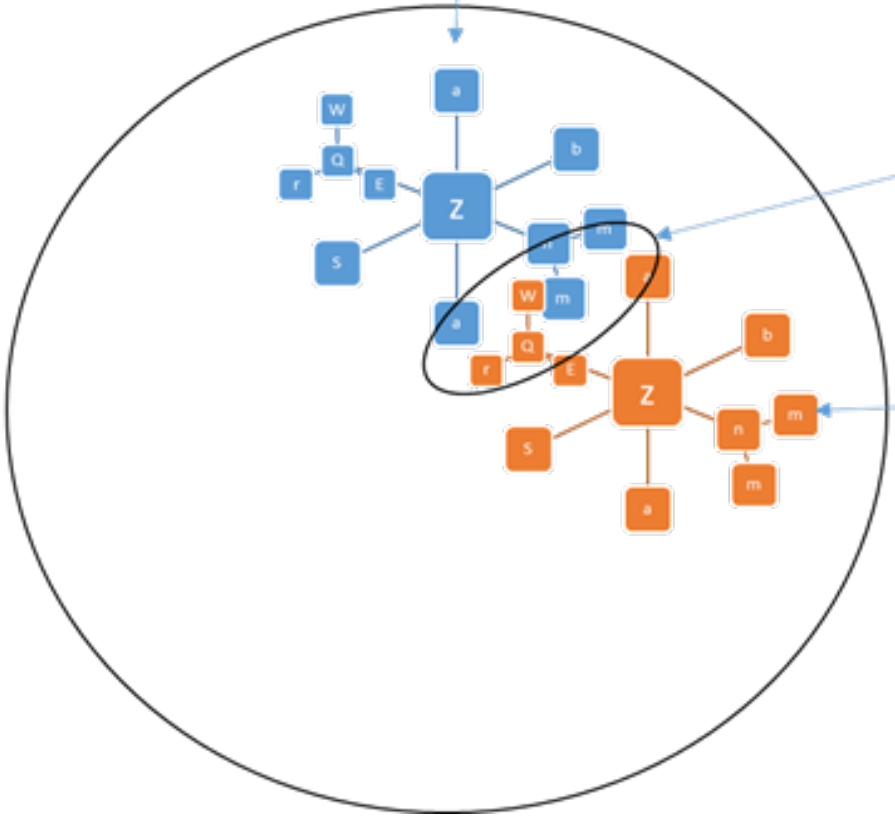

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conceptual adjustment

ECSS
E-70-41

M&C conceptual model

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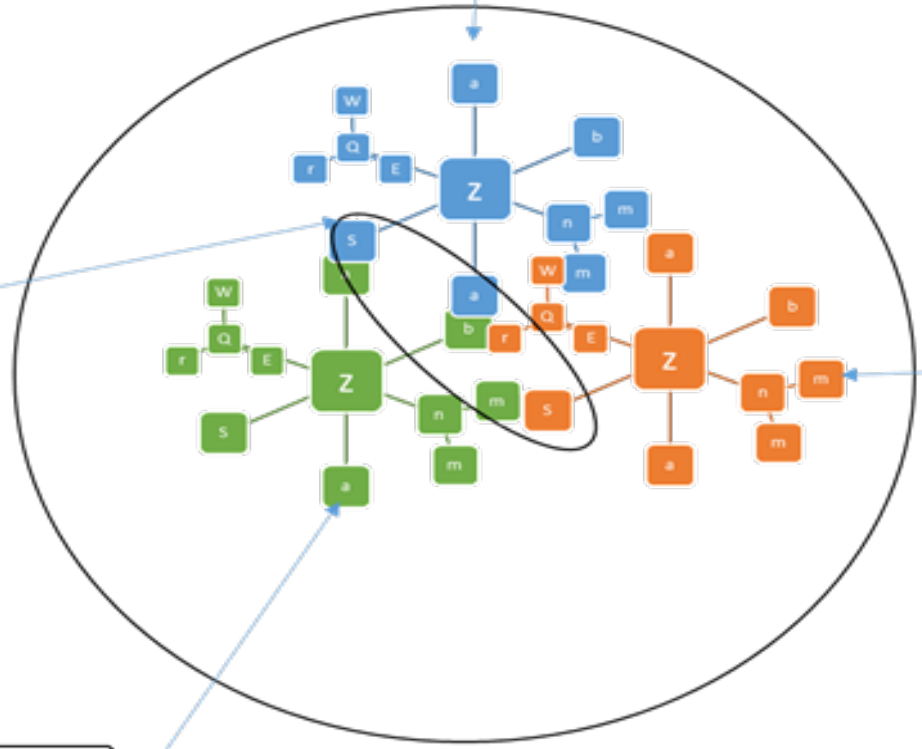

conceptual adjustment

M&C conceptual model

ECSS

Discipline meta model

conceptualisation

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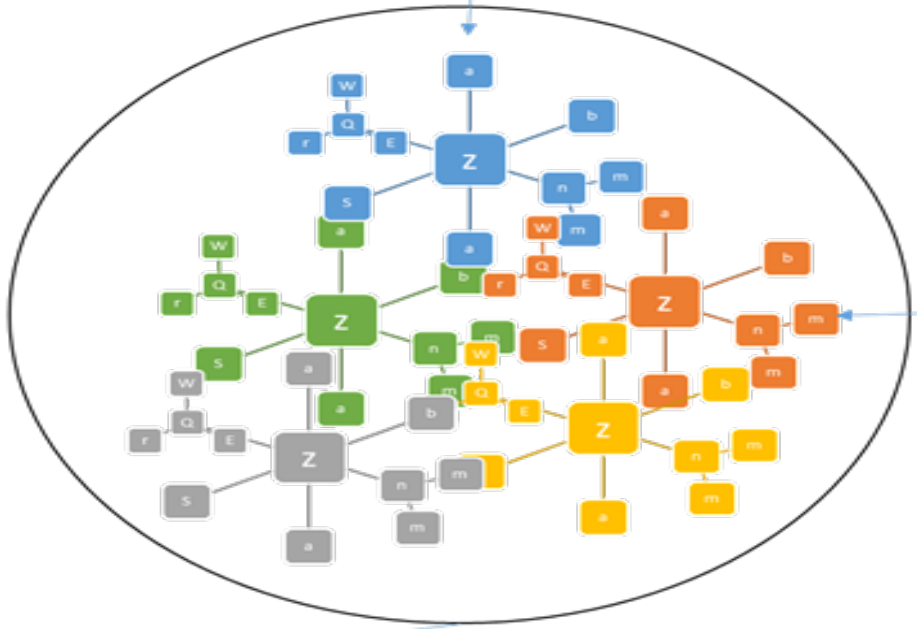

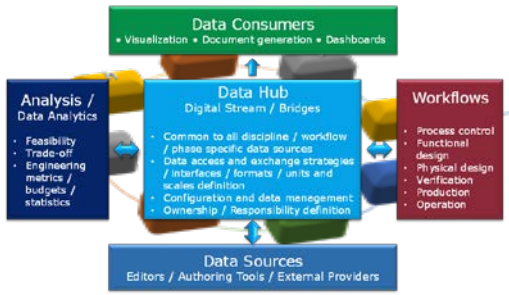

1st step toward the Overall Semantic Modelling for System Engineering

SPACE SYSTEM ONTOLOGY BRAINSTORMING WORKSHOP

The workshop objectives

1. **converge** towards a Single European Ontology ***what is it?*** for Space Projects
2. specify what is required in term of ontology definition **language**
3. identify the **development steps**:
    - for the ontology definition tool collaborative, …
    - for the space system ontology itself
    - for the utilization of the ontology in the production of solutions including exchanges
4. overall, create the Space System Ontology **governance** to ensure that:
    - all stakeholders' needs are covered
    - the Ontology is endorsed by all actors of the Space System Development and Operations

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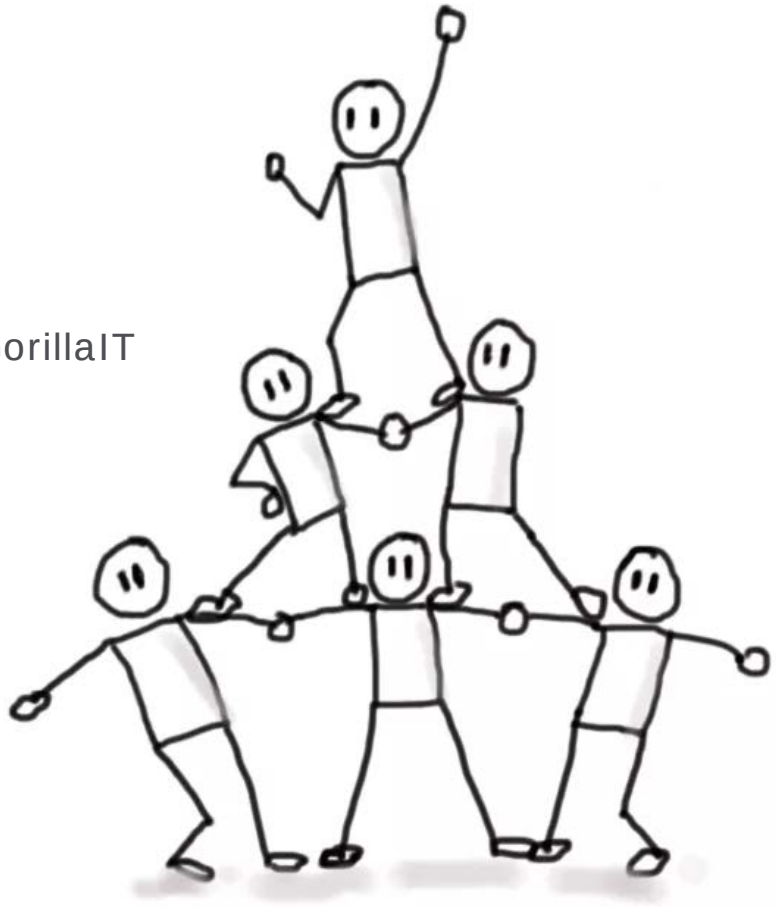
The OSMoSE project plan !

Input for these objectives

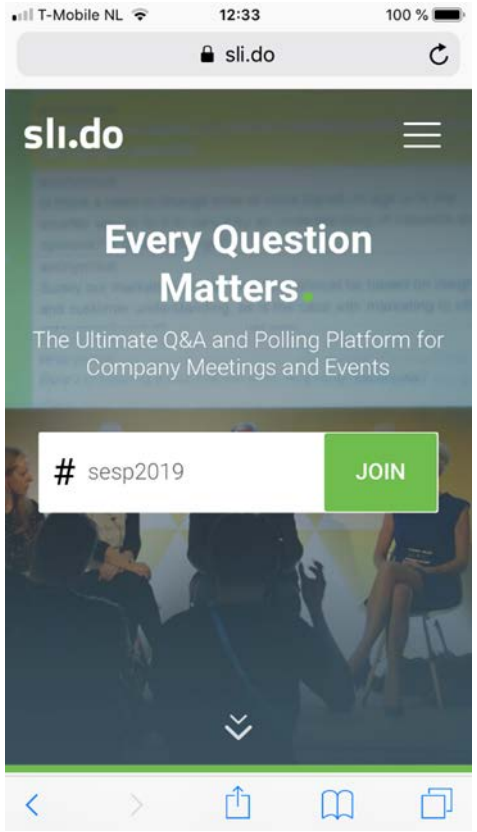
A set of presentations addressing:

- Foundations for ontologies ESA, Bolzano
- Ontology languages ORM, OWL, SysMLv2,...
- Experiences Airbus, DLR, SatSearch, ESA, CNES, IRT, TAS, RHEA, JPL, GorillaIT
- Advanced technology StrathClyde, Koblenz, Bolzano



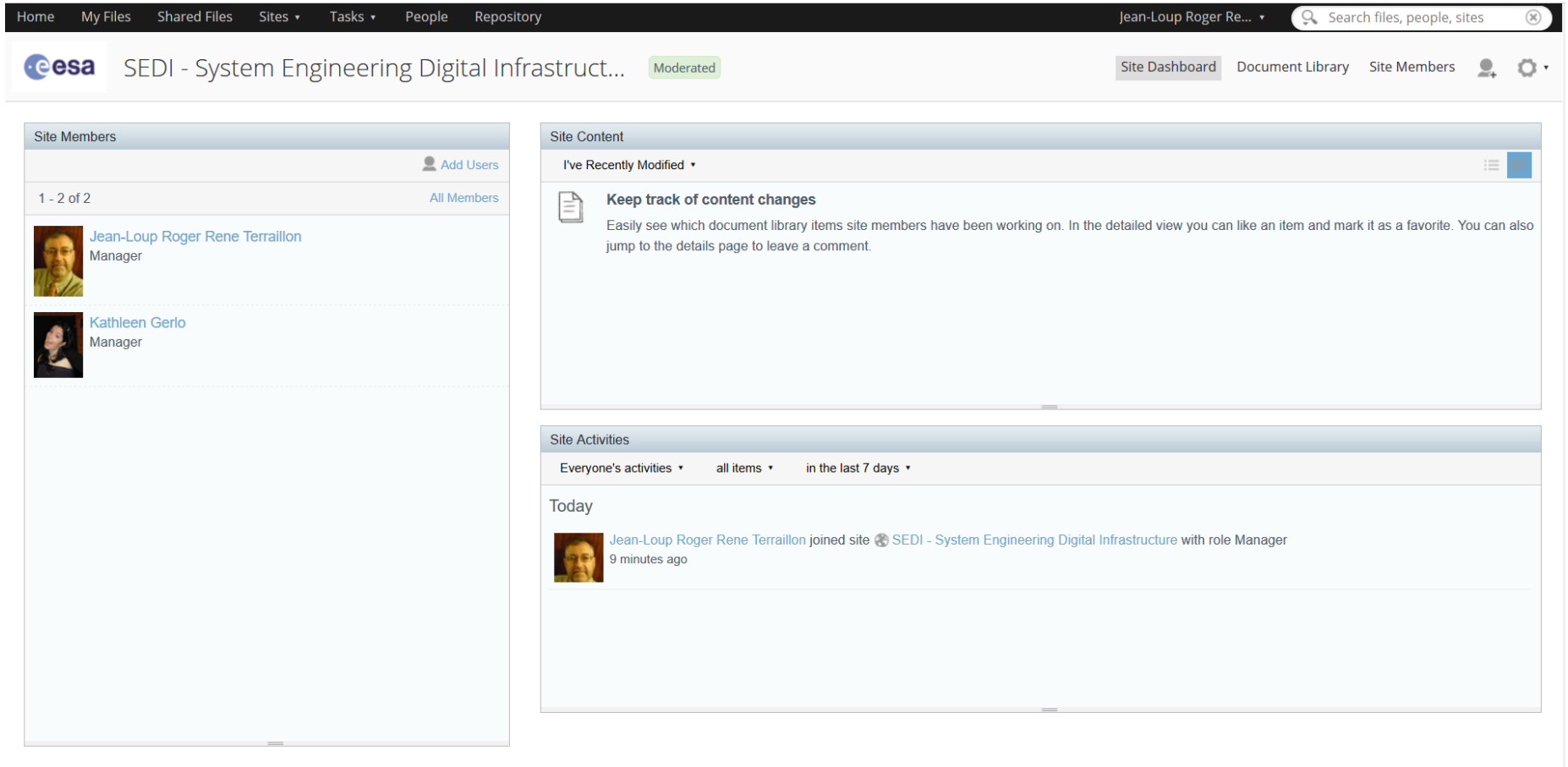
Questions

- What are the use cases of interoperability? What do we need to exchange?
- Is the ontology to be limited to what we want to exchange (only system, also domain-specific,…) ?
- What is the perimeter of the ontology (segment,…)? Do we need a “skeleton” that can be used by all? what is in it? Does it include e.g. a “requirement model”?
- After the skeleton, how to define priorities in the development?
- Are current modelling tools adequate? do we need to extend their capabilities?
- What does semantic interoperability mean? do we need to change our way to model? How can the existing be reused?
- What reverse-engineering steps are required to allow a reused system to be integrated to the "Space System Ontology qualified tools" How can tools support each partner in the qualification process of their to-be-reused solutions?
- What dimensions the Ontology shall support? Project Phases [Time], Branches and Disciplines [Scope], Stakeholders [Geography]
- Does the ontology language and methodology support intrinsically the semantic interoperability? How is semantic interoperability implemented e.g. when stakeholders are not presents at the same time?
- Can we use ontology learning to generate our ontology from ECSS?
- What is in the OSMoSE project plan / in the OSMoSE governance: the IPR management, the design authority, the deployment policy, etc.?



Alfresco repository

https://amstel.estec.esa.int/share/page/site/sedi---system-engineering-digital-infrastructure/dashboard



Conclusion

➔ Together let's develop the Space System Ontology required by the European Space Projects…

… in order to facilitate the interaction between stakeholders, to reduce risks, to reduce costs…

… while safeguarding the existing investments…

… for all of us to deploy MBSE in European Space projects…

➔ Let's prepare for a new step within ECSS, supported by the European Space System Ontology