

The value of MBSE in the lifecycle of a project & how you would realise them?

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Version 1.0

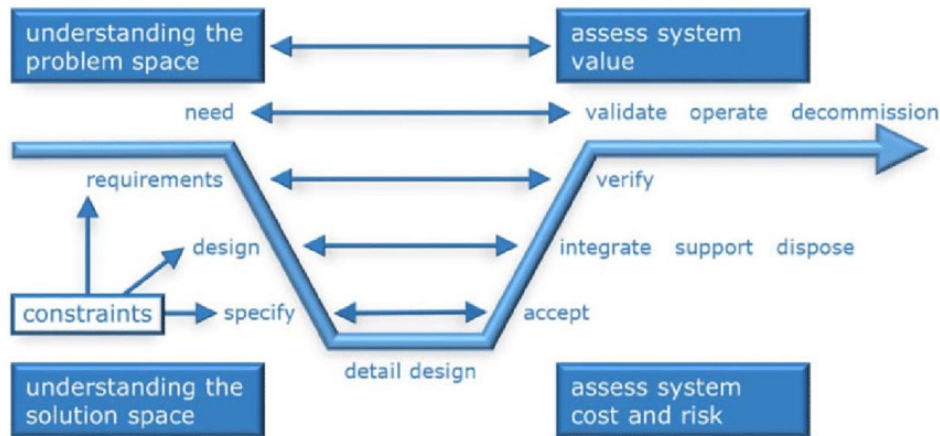
MBSE and SysML

Model-based systems engineering (MBSE), according to INCOSE, is the formalized application of modelling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases [1].

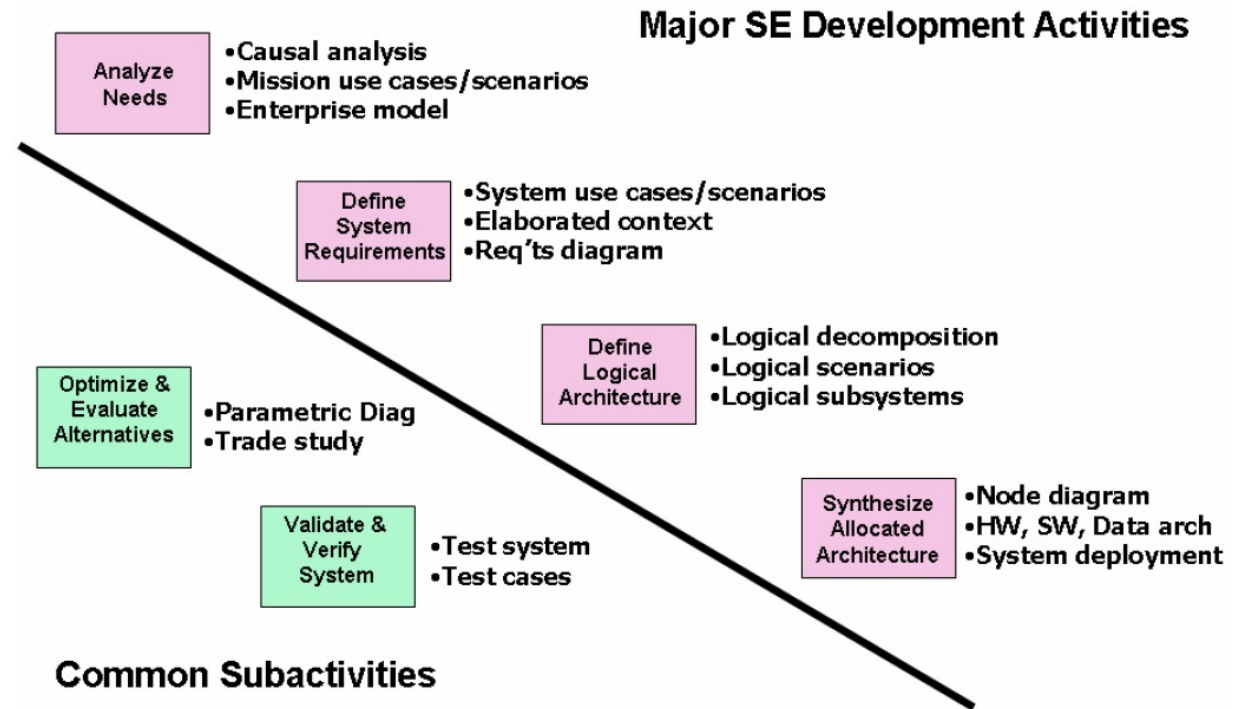
It is a systems engineering **methodology** that focuses on creating and exploiting domain models as the primary means of information exchange, rather than on document-based information exchange [2].

SysML is a general purpose graphical modelling language [3].

How does MBSE relate to V-Diagram?



[4]



[5]

Traditional SE

vs.

MBSE

- ❑ ConOps Document
 - *Concept of Operations, Systems Purpose, functions*
 - *Figures, Diagrams*
- ❑ System Specification
 - *Technical requirements*
 - *Come technical figures*
- ❑ System Design Document
 - *System configuration (system block diagram).*
 - *Figures, diagrams*
 - *Rationale for trade-offs*

- ❑ Operational and Technical behaviour diagrams
- ❑ Requirements diagrams
- ❑ Structure diagrams

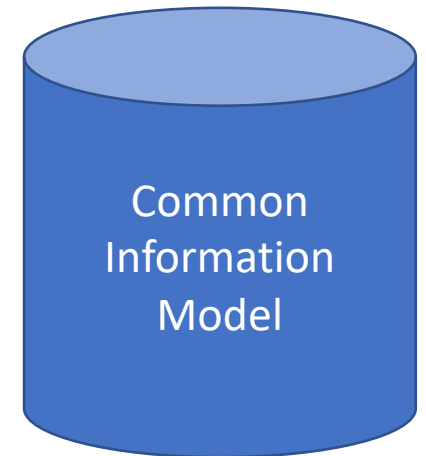
Key Principles

- ❑ Common model repository
- ❑ Common language in diagrams
- ❑ Common DB of information

[3]

Six Principles of MBSE

1. A model is an abstraction of the real world.
 - *All models are wrong, some are useful. (George Box, 1987)*
2. Know the purpose of the system model you create.
 - *Guide model creation toward a specific purpose, or it will grow uncontrollably.*
3. Use tools that allow communication.
 - *Models must communicate to be useful, so be sure that people can access the model and its information.*
4. Use an articulated and common method.
 - *People need to take part, so they must understand how.*
5. Establish criteria for the model purpose.
 - *Be able to measure how close you are to achieving purpose.*
6. Continuously evaluate the model against the criteria.
 - *Use the criteria to keep the modeling effort on track.*



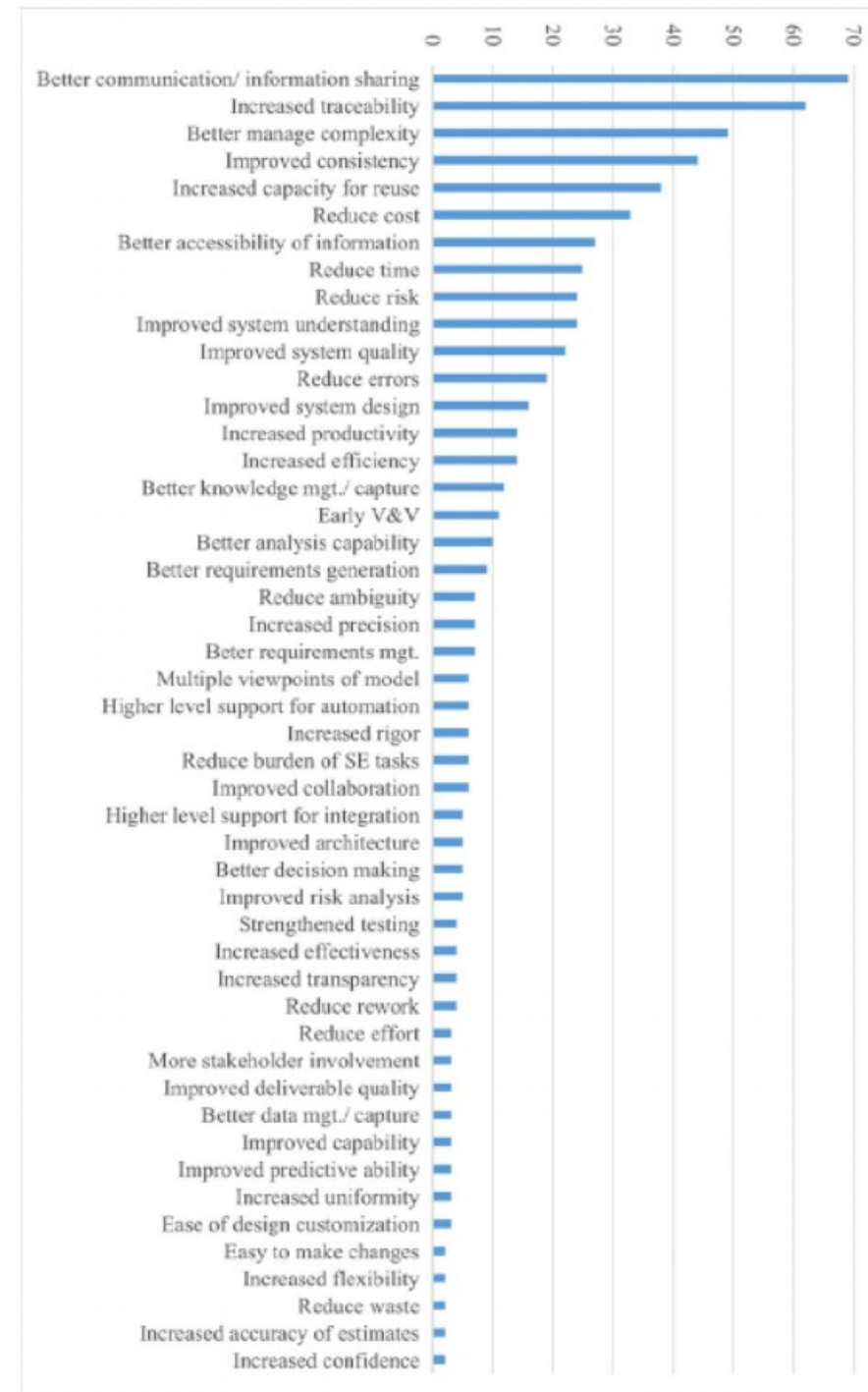
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Benefits of MBSE

- ❑ Enhanced communications.
 - *Shared understandings, multiple perspectives*
- ❑ Reduced development risk.
 - *Ongoing verification, and validation.*
- ❑ Improved quality.
 - *Completeness, traceability, integrity.*
- ❑ Increased productivity.
 - *Faster impact analysis; more effective exploration.*
 - *Reuse of existing models; fewer errors*
- ❑ Leveraging the model across the life cycle.
 - *Support training, diagnostics and maintenance.*
- ❑ Enhanced knowledge transfer.
 - *Efficient access and modification.*

[3]

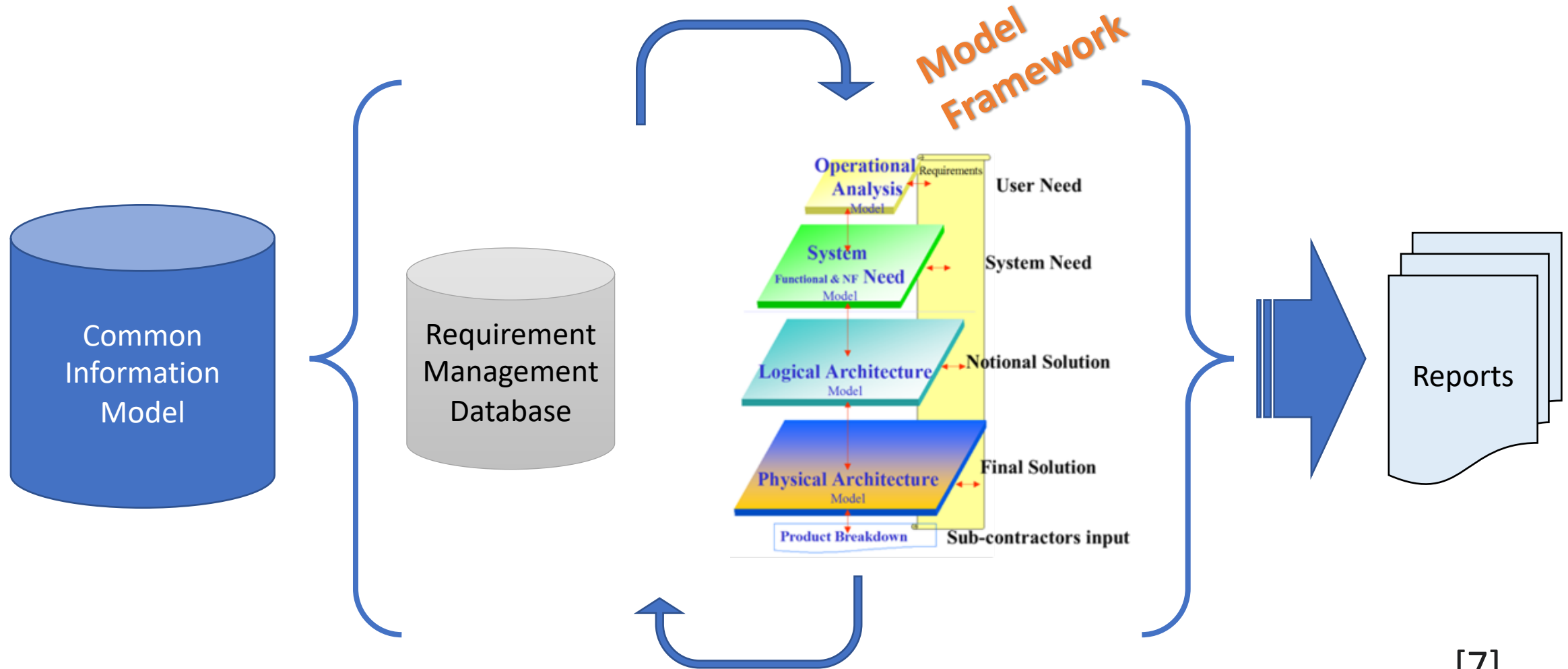
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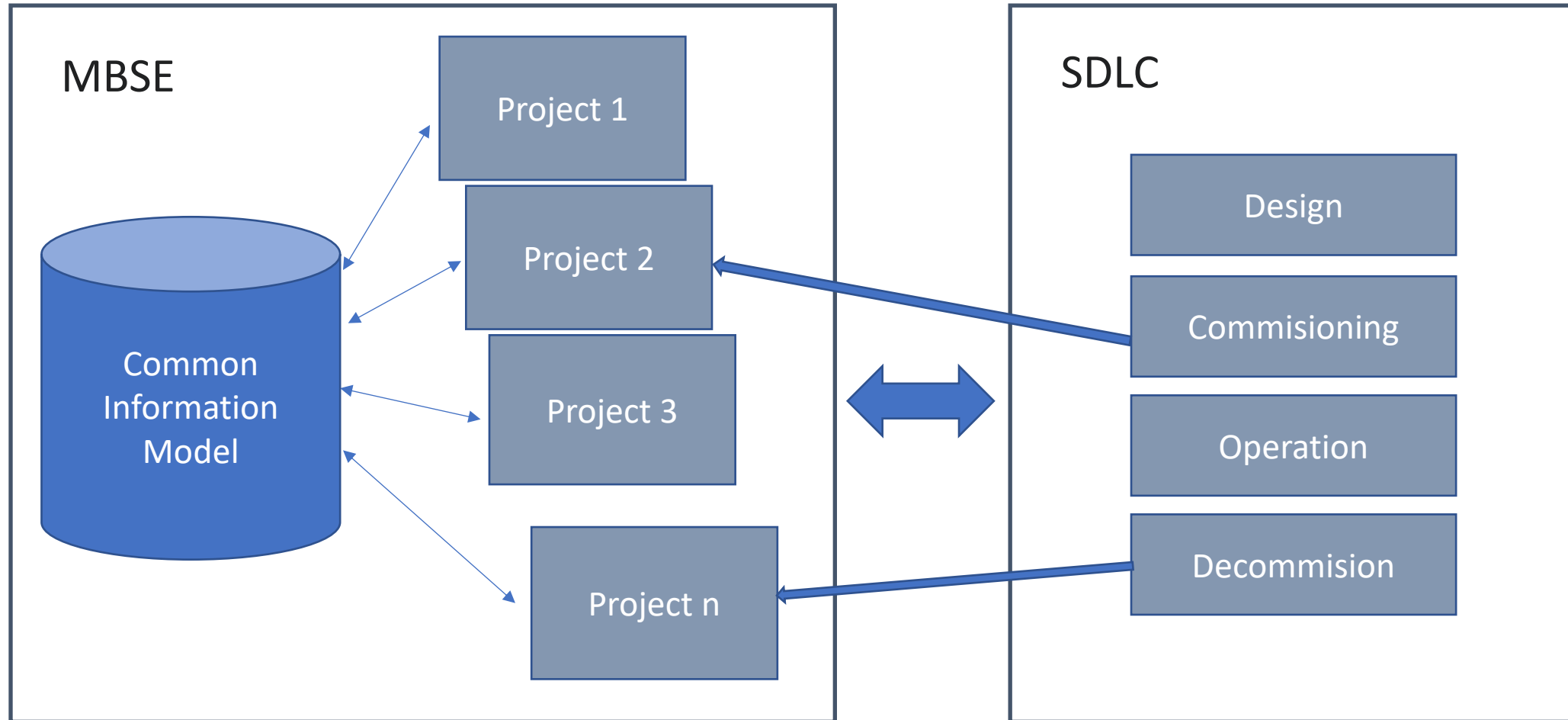
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SysML Model



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Realisation of MBSE in SDLC



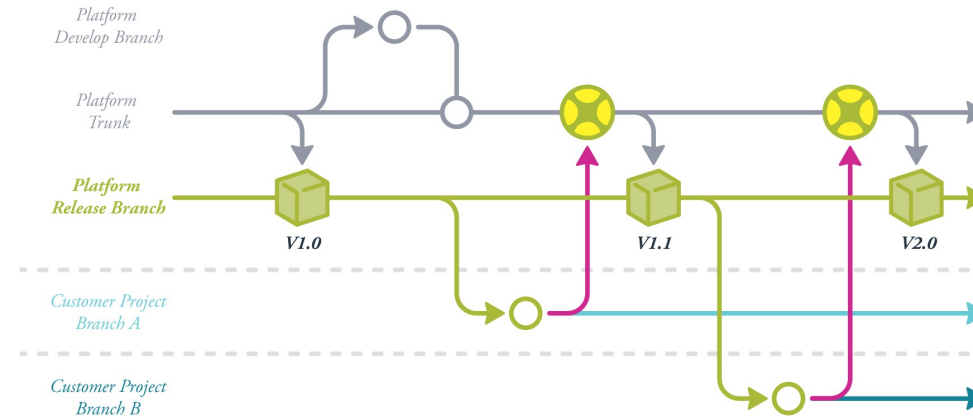
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Challenges

❑ Distributed Team Development environment

- ❑ Change Management
- ❑ Version Control
- ❑ Custom Documentation

Use of a Diff & Merge tool is nice-to-have to make necessary changes as soon as a model is checked into the central repository.



[9]

References

- [1] Model-based systems engineering, INCOSE
- [2] Model-based systems engineering , Wikipedia
- [3] Model-Based Systems Engineering with an effective modeling language, Honourcode Inc., 2015
- [4] The V-model, INCOSE, 2009
- [5] Survey of Model-Based Systems Engineering (MBSE) Methodologies, INCOSE MBSE Initiative, 2008
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- [8] Carlos Hernandez et.al, 26th European Symposium on Computer Aided Process Engineering, 2016
- [9] <https://www.lieberlieber.com/lemontree/en/use-cases-2/>