32nd Annual INCOSE international symposium

hybrid event

Detroit, MI, USA
June 25 - 30, 2022

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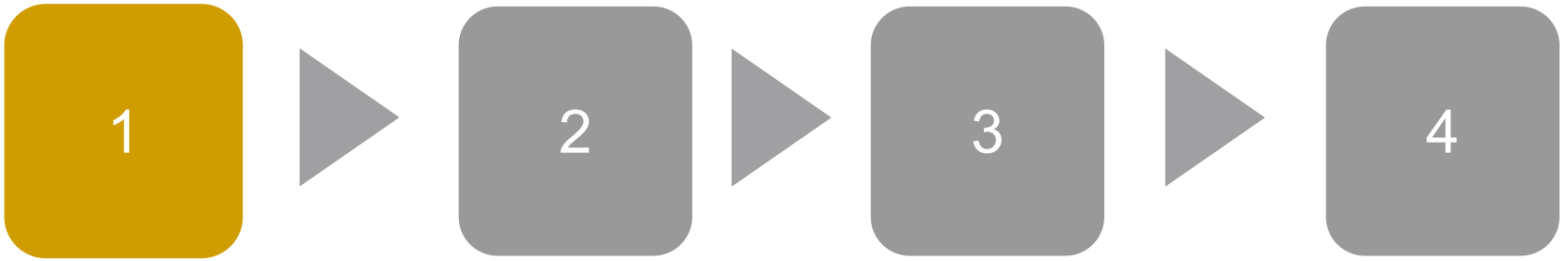
ISO/IEC/IEEE 24641:MBSSE



Introduction

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What is MBSSE?

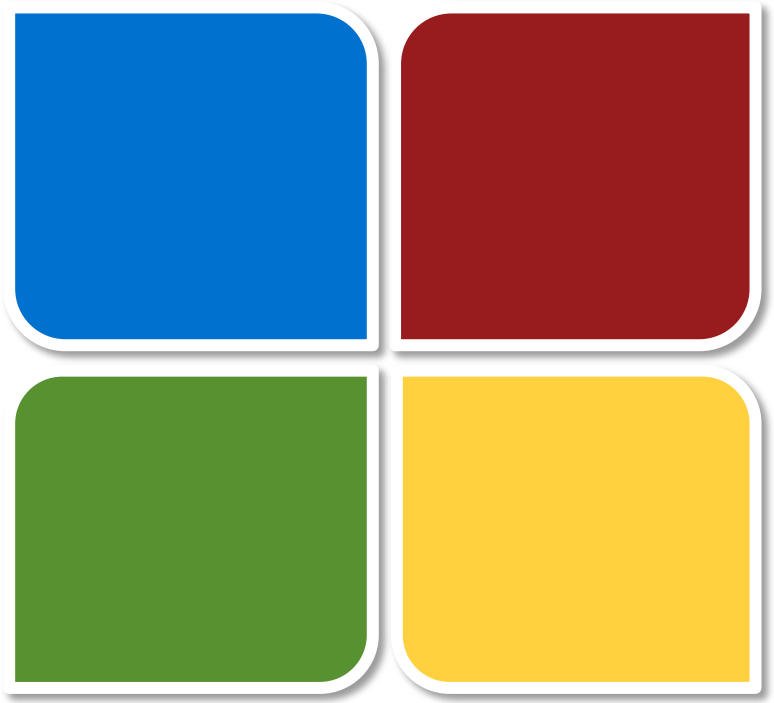
MBSSE is a Systems and Software Engineering approach centered on **evolving models**, which serve as the "**main source of knowledge**" about the system or software entity under consideration.

Goals

Improving the “Engineering capability” of an organization thanks to MBSSE

Build useful models

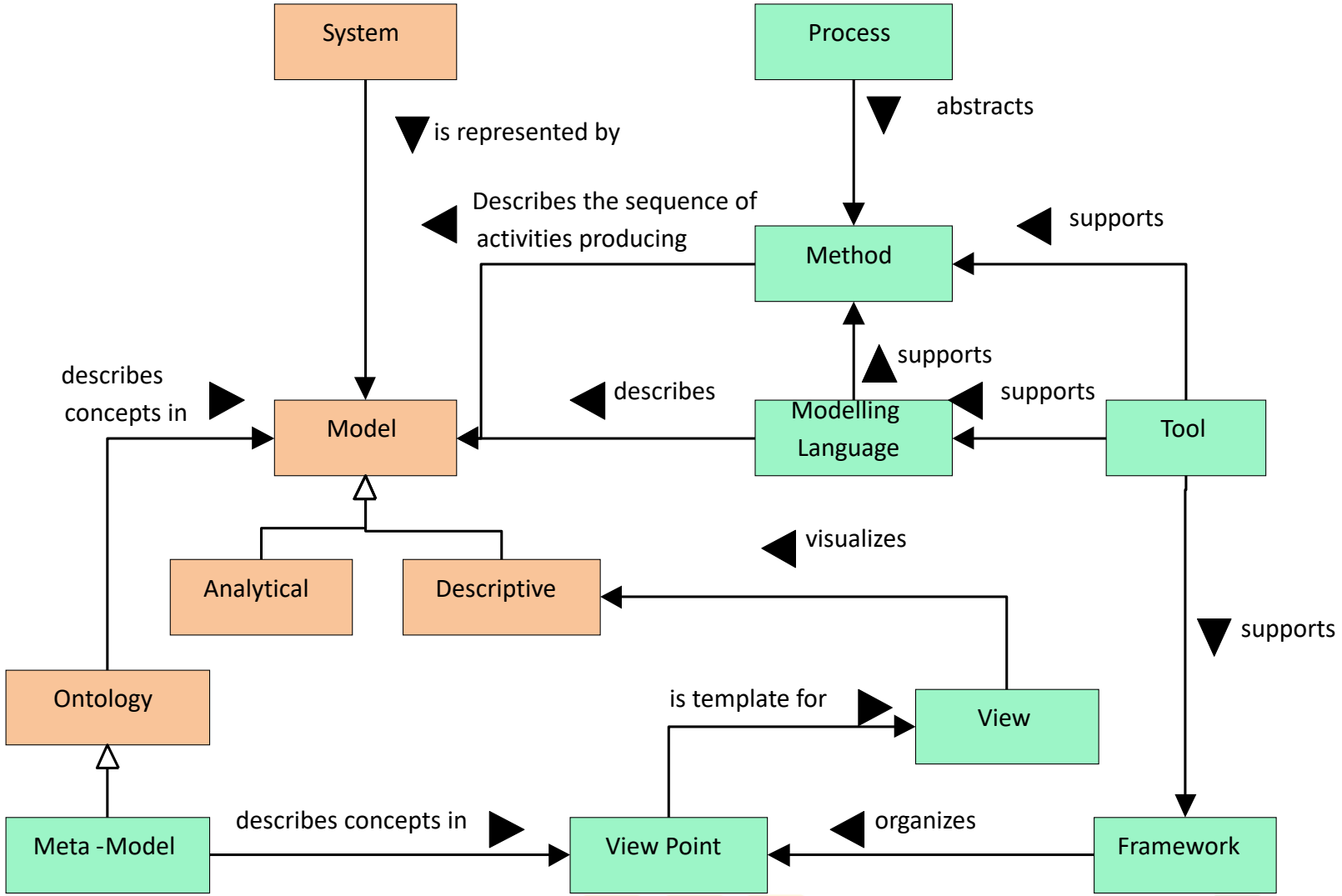
Provide only the required level of information



Continually improve the knowledge on the system of interest

Collaborative modelling, targeting understandability among all stakeholders

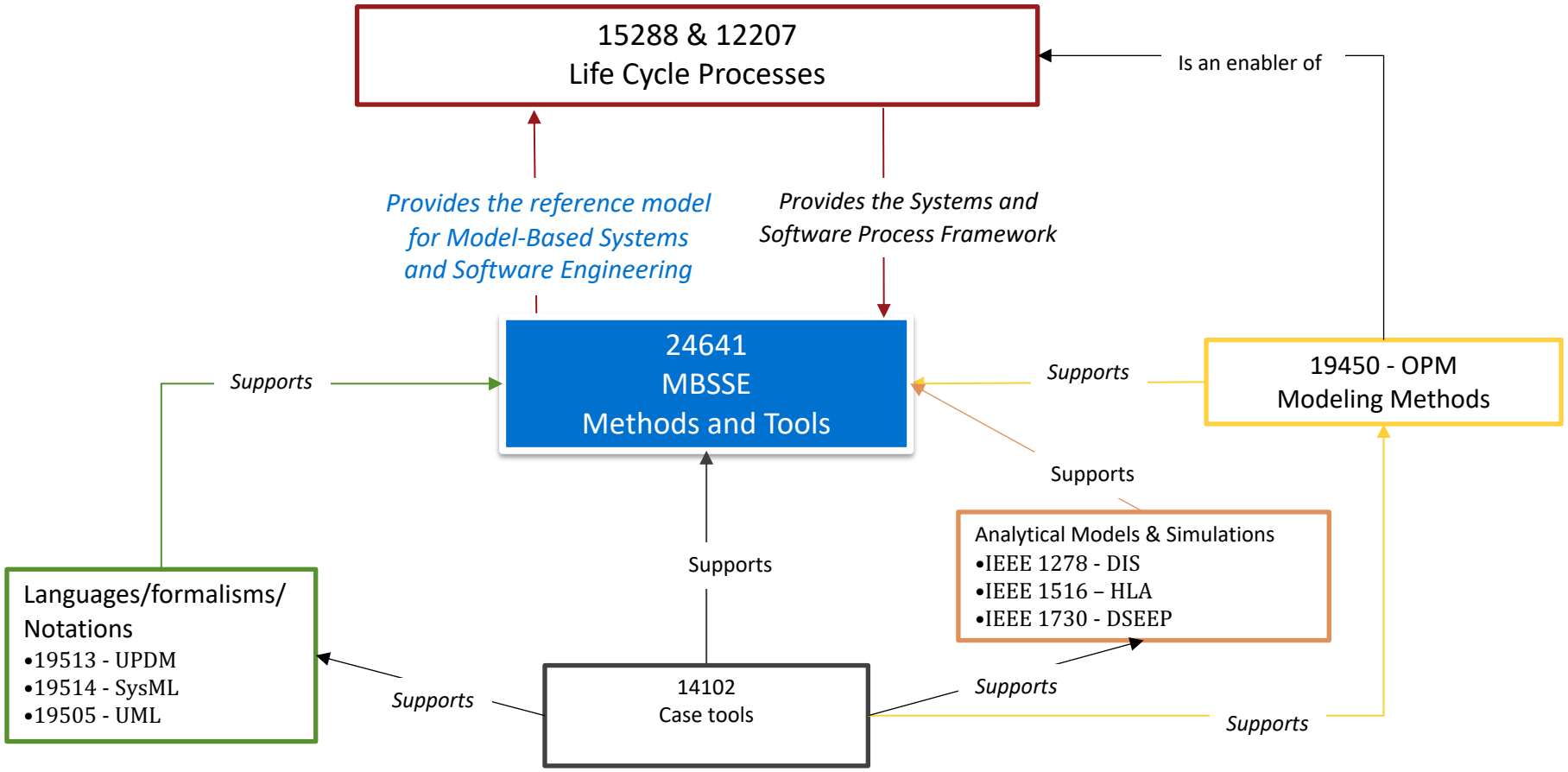
Need for this Standard



- Many standards exists and cover each of these concepts.
- Current standard Covers overall MBSSE processes at a higher level and with a focus on method and tools used for MBSSE

Source : Annex C.2

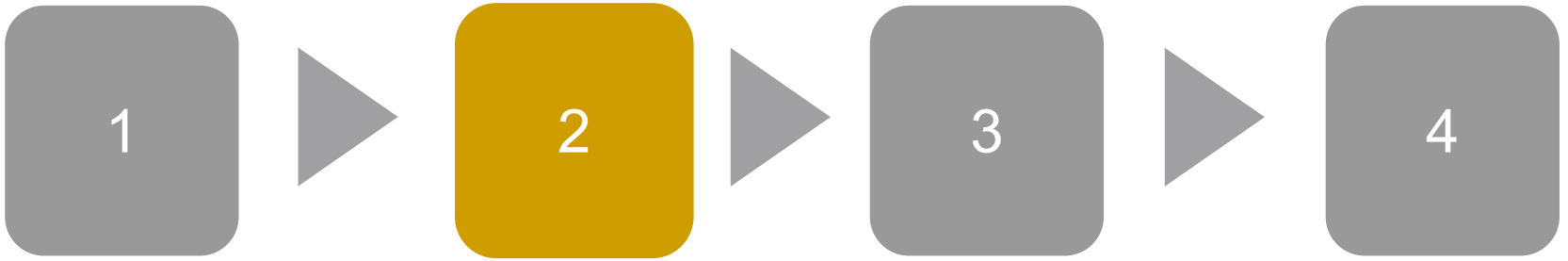
Relations to the other standards



Source : Annex E

Scope

- International Standard, developed by ISO/IEC Joint Technical Committee 1/Standardization Subcommittee 7 (Systems and Software Engineering)/Working Group 4 (Tools and Environment) detailing reference model, processes, methods and tool capabilities for MBSSE
  - Terms and definitions related to MBSSE;
  - Process Reference Model for organizing all MBSSE-specific processes;
  - MBSSE-specific processes for model-based systems and software engineering
  - Methods to support the defined tasks of each process; and,
  - Tool capabilities to automate or semi-automate tasks or methods.



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ISO Draft Review Process

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Current status

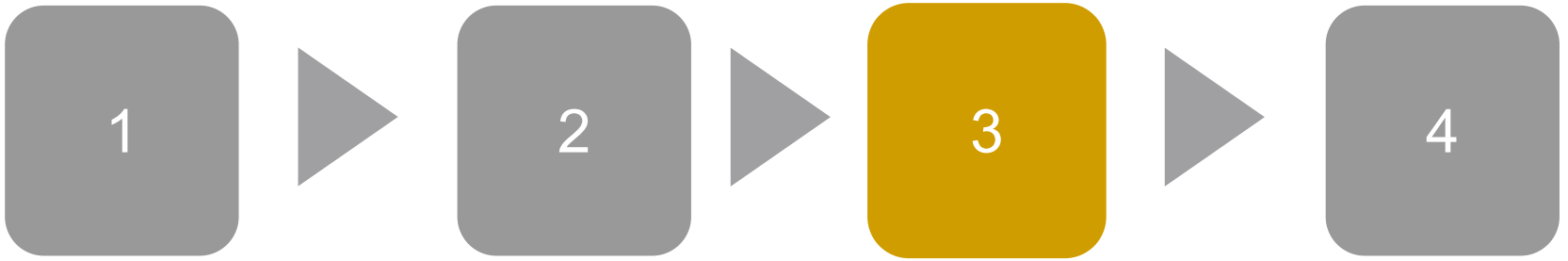
- DIS (Draft International Standard) Approved
  - 19 Votes in favor out of 22 = 86 % (requirement >= 66.66%)
  - 3 negative votes out of 22 = 14 % (requirement <= 25%)

Comment distribution

Clauses	Title	Nb (~)	Ed	Ge	Te
	Introduction				
1	Scope	2	2		
2	Normative references	1	1		
3	Terms & Definitions	24	18	3	3
4	Conformance	4	3		1
5	MBSSE Reference model	7	3		4
6	Plan MBSSE	1	1		
7	Build Models	6	6		
8	Support Models	0			
9	Perform MBSSE	5	5		
Annex A	Instantiation and customization of a MBSSE Reference Framework	2	2		
Annex B	MBSSE – System model - dimensions	3	2		1
Annex C	Models – definitions - relationships	5	4		1
Annex D	Example of MBSSE roles	1	1		
Annex E	Relationships between International Standards and ISO/IEC/IEEE 24641	4	2	1	1
Total		65	**50**	4	11
Other		12	2	6	4

Next Steps

- Prepare draft FDIS ballot document by the end of September, 2022.
- Submit final FDIS ballot document by the middle of November, 2022.
- Prepare draft CRR of FDIS ballot results by the end of April.
- Review CRR during 2023 Plenary meeting.
- Prepare IS document by September 15, 2023.



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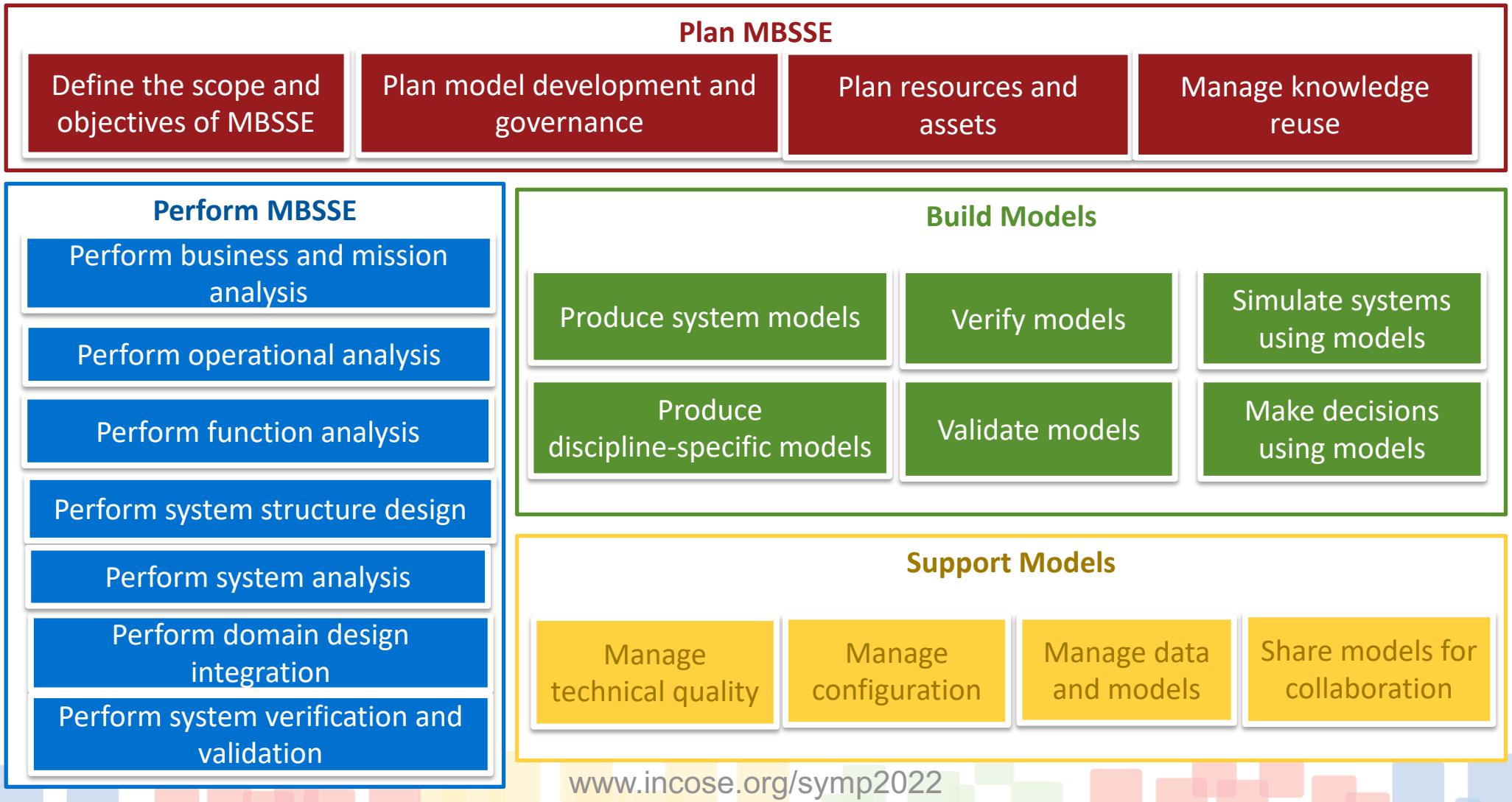
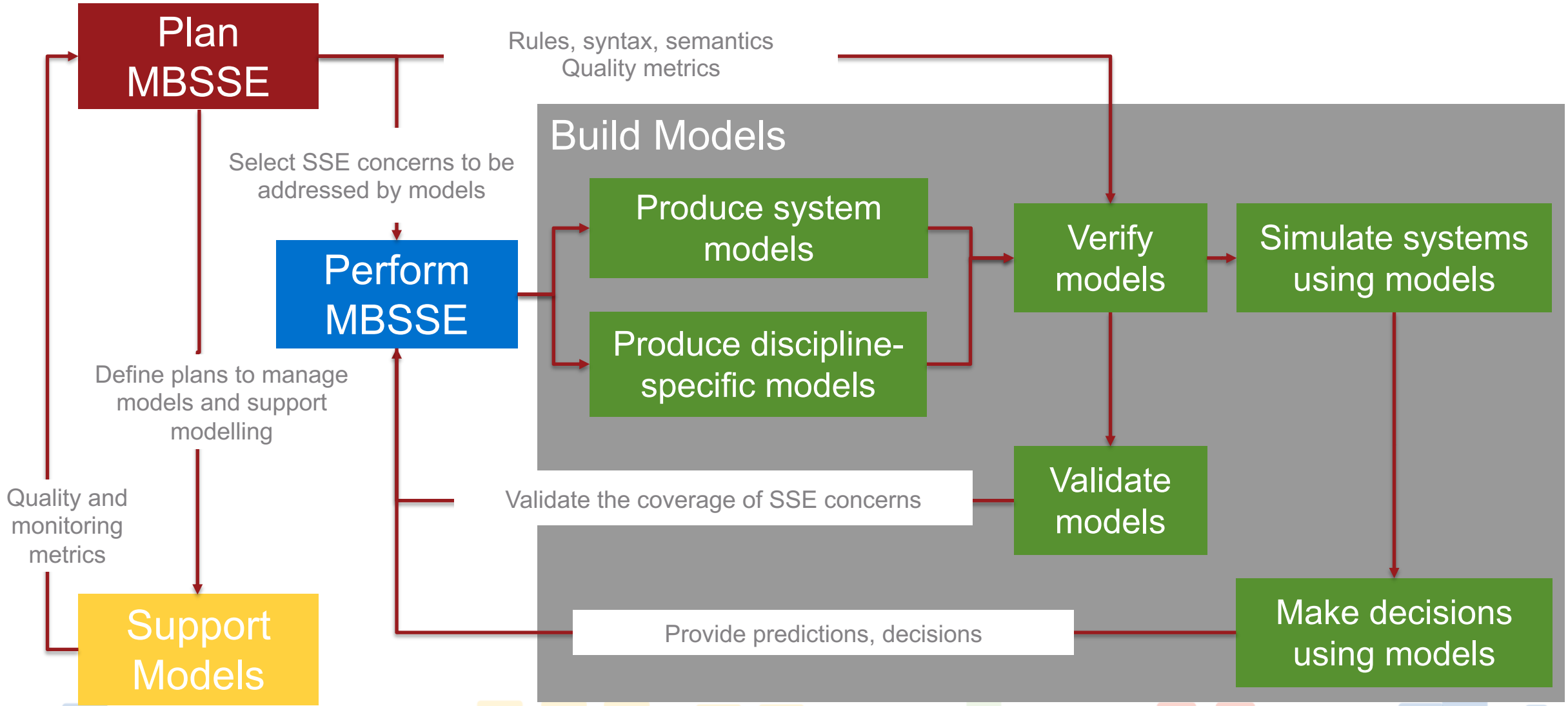
MBSSE Reference model



Reference model & relationships

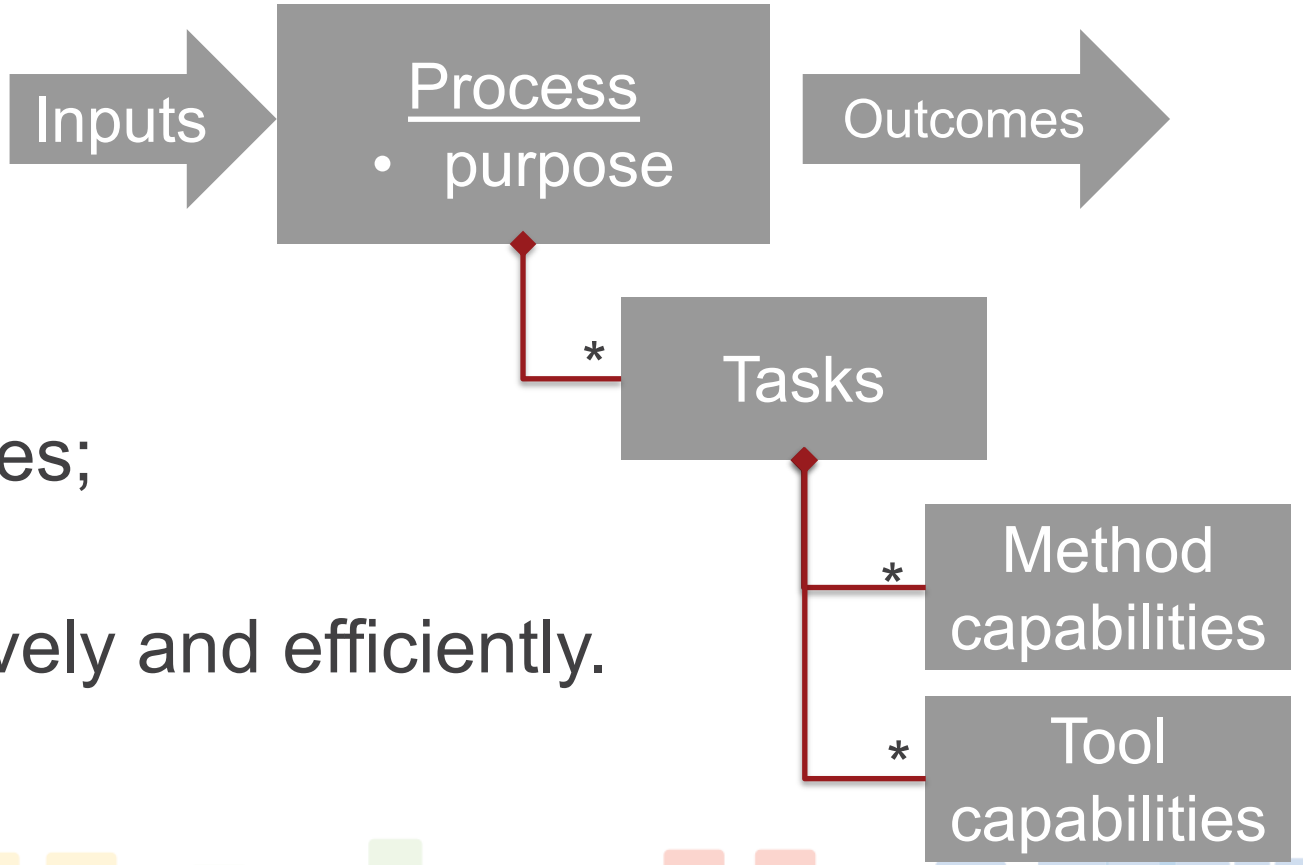


Process description

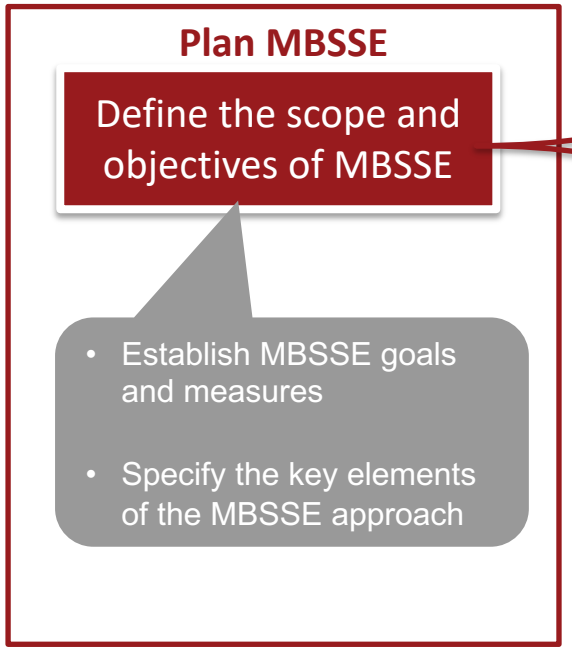
Each process is described in terms of the following attributes:

- Name of the process;
- Purpose of the process;
- Inputs to produce outcomes;
- Process outcomes;
- Tasks to achieve the outcomes;
- Method and tool capabilities

  for performing tasks effectively and efficiently.



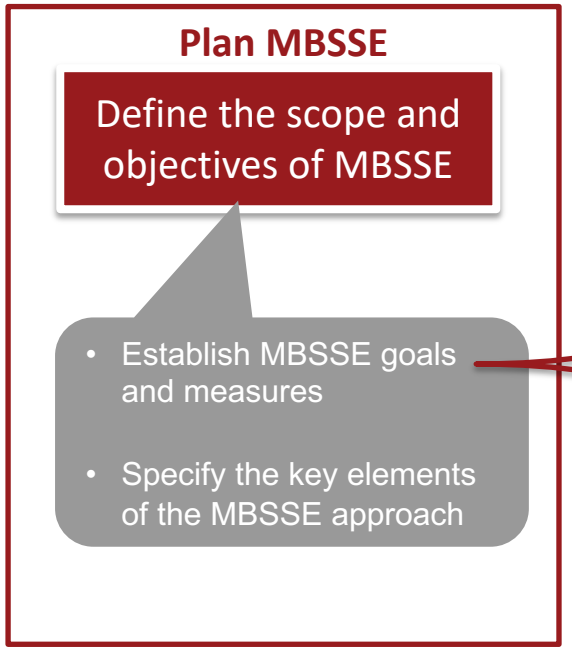
Example



Purpose

This process defines the scope and objectives of MBSSE and optimizes the value added by performing MBSSE. Tasks included in this process identify system or software engineering concerns to be addressed and the depth and breadth of models to be produced.

Example Task description



The **goal** of this task is to define and measure the MBSSE goals and strategies contributing to the successful achievement of the goals of a program or project or the organization.

a) A **method** supporting this task should contain the following capabilities:

1) Assess the current MBSSE capability within the entity (program, project, product, company): this assessment has an effect in some MBSSE goals;

2) Define collaboratively the MBSSE Objectives, progress measures, strategies, key drivers and perspectives;

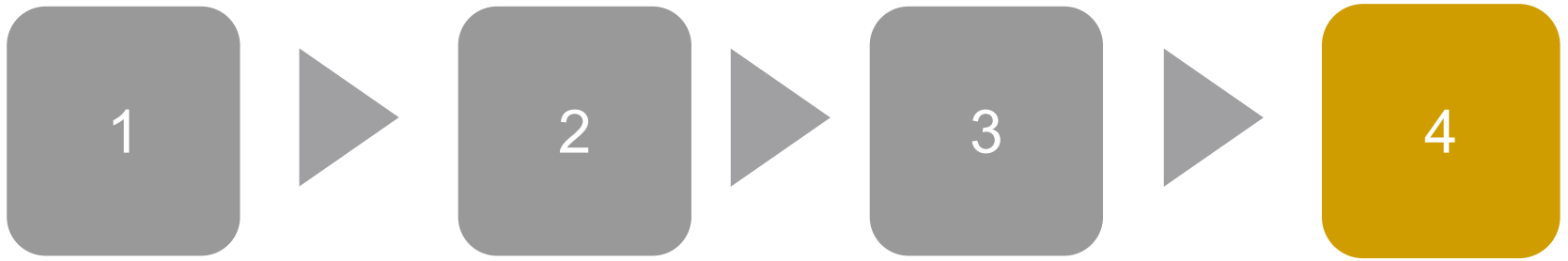
3) Define the target usages and types of users or consumers (i.e., knowledge sharing, communication, semi-formal or formal description, artefacts generation, etc.).

b) Management **tool capabilities** should support establishing MBSSE management goals by allowing the user to do the following:

1) Assess and report current MBSSE capability;

2) Access MBSSE goals and the program or project or organizational level plans;

3) Communicate the MBSSE management goals and strategies with key stakeholders by supporting channels and implemented mechanisms.



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Conclusion & Perspectives

- Strengths
- Intended use
- Gaps
- Potential extensions

Strengths

- Address both system and software engineering activities towards “collaborative engineering” practices.
- Standardize the use of models right from the early stages of system development
- Forces to identify the value of models
- It covers, not only building models to describe systems architecture, but also all the other aspects as configuration management, maintenance, interoperability, etc.
- Gives a comprehensive view on the relations to the other standards

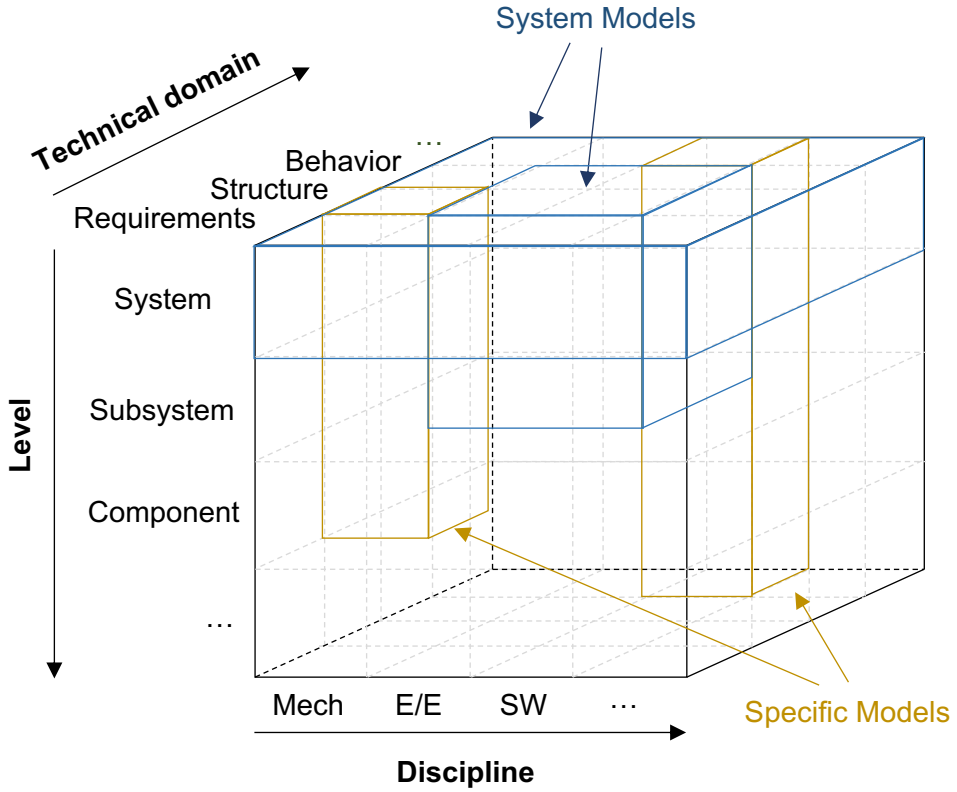
Intended uses in Enterprises

- Considering as the entry point while applying MBSSE
- Models as the deliverable work products (as other HW/SW components)
- Reference in (contractual) documents as the source of good practices.
- Basis to define the MBSSE governance
- Bringing extra rigor to the current MBSSE practices

Gaps

- As the MBSSE processes are covered at a higher level, future projects are needed to cover the gaps
- Physical or hardware modelling aspects are not enough addressed(size, habitability, etc.)
- Relationship between Models and Textual requirements are not well covered
- Need to have a tailoring approach to adapt to different industries (translating common vocabulary, acronyms, etc. into company-specific)

System Model dimensions



- Breadth: The disciplines involved in the development of a system (e.g., mechanics, electrics/ electronics, software, etc.)
- Width: Technical domains considered in the system development (e.g., requirement, structure, behavior, verification and validation, etc.).
- Depth: The degrees of detail of above dimensions on several levels through the system hierarchy.

Source : Annex B.1

Potential future projects

- Model-Based digital continuity between System architecture and software design
- Model-Based digital continuity between System architecture and hardware design
- Model-Based system analysis, verification and validation by simulation
- MBSSE Model Evaluation Framework
- MBSSE Certification
- A Guide to ISO/IEC/IEEE 24641 (MBSSE)

Future project proposal

- Methods and tools for model-based system analysis by simulation
- Rationale:
  - Many standards exist to address a particular aspect of MBSSE as processes, methods, modelling languages,…
  - ISO/IEC/IEEE 24641 standard covers overall MBSSE processes at a higher level. The extensions are required to dig in to deeper in some MBSSE processes especially when we consider discipline specific models and the models related to common activities in perform MBSSE process area.
  - System analysis, verification and validation by simulation is one of the cross cutting area which needs further development.

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www.incose.org/symp2022