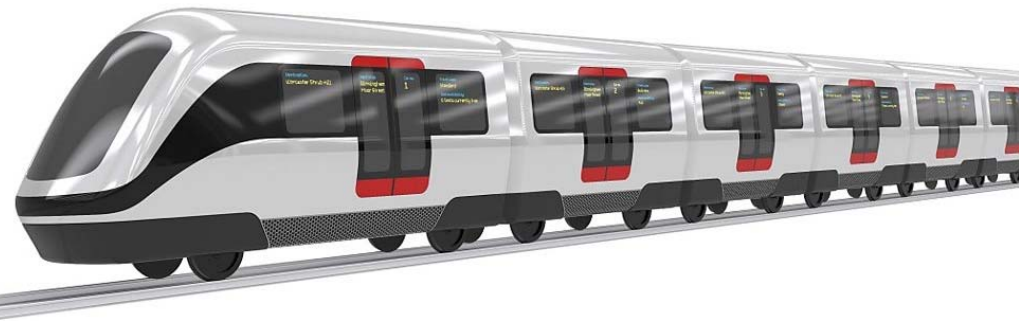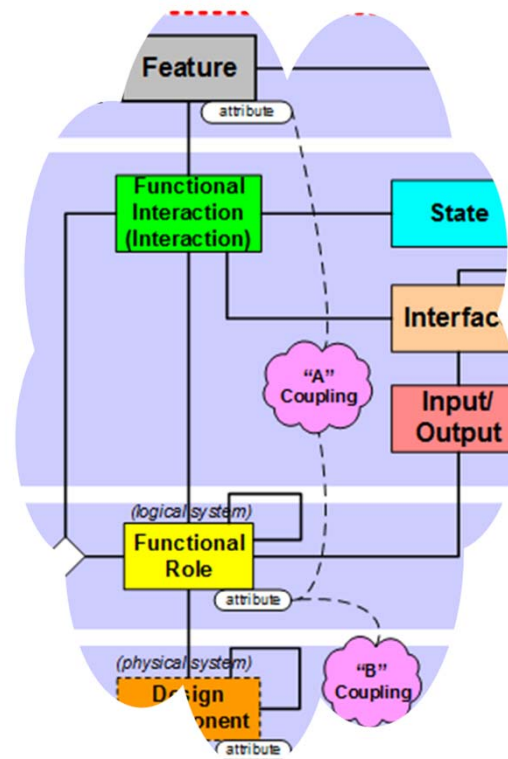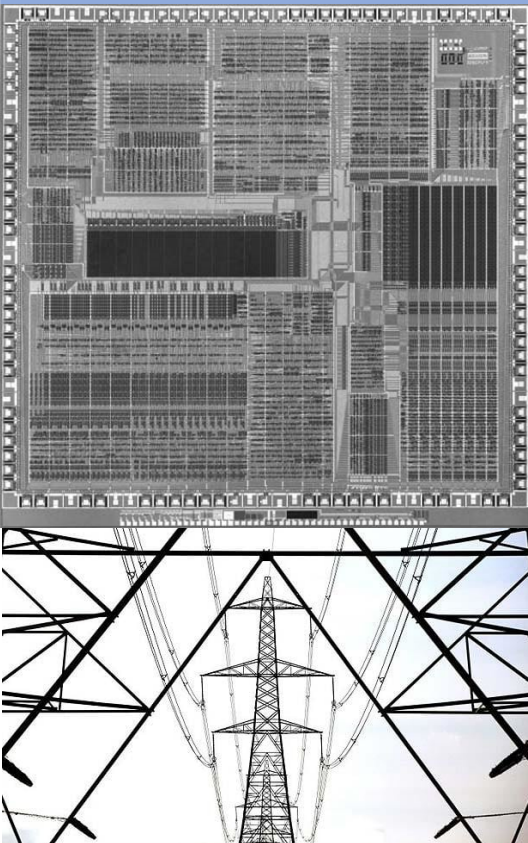V1.1.4

Round Robin:
MBSE Patterns Working Group

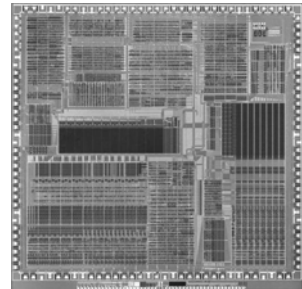2023 Annual **INCOSE** international workshop
HYBRID EVENT
Torrance, CA, USA
January 28 - 31, 2023

**Invitation to Patterns WG Meeting at IW2023**: Sunday, Jan 29, 1:00 – 3:00 Pacific Time, Salon A

Focus of
MBSE Patterns Working Group:
S*Patterns

**Configurable, re-usable system models**:

1. Models containing a certain minimal set of elements are called S*Models (S* is short for "Systematica").

2. Those underlying elements are called the S*Metamodel, which was inspired by the unmatched success of the physical sciences and impact of STEM.

3. S*Models using those elements may be expressed in any modeling language via formal mapping (e.g., in OMG SysML, or in other languages).

4. S*Models can be (have been) created and managed in many different COTS modeling tools using such diverse languages.

5. Re-usable, configurable S*Models are called S*Patterns.

6. By "Pattern-Based Systems Engineering" (PBSE) we mean MBSE enhanced by these generalized assets to enable model configuration from trusted patterns.

7. These are typically system-level patterns (models of whole managed platforms), not just smaller-scale component design patterns.

2
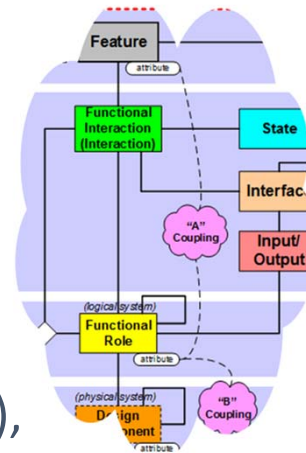
Working group projects, discussed and others

The others →

Patterns & Technologies:

1. Semantic Technologies for Systems Engineering (ST4SE) Project.
2. Adaptive Learning Ecosystem Pattern—the INCOSE ASELCM Reference Framework.
3. Universal Model Metadata Wrapper: Model Characterization Pattern (MCP), w/ASME VV Stds Cmte & V4 Inst.
4. S*Pattern Configuration Wizard.

Publications:

1. Minimal S*Models—A Primer (including S*Metamodel and its formal mappings to OMG SysML and tools)
2. S*Patterns Primer (second ed)
3. ASME Guideline for Managing Credibility of Models for Adv. Manufacturing, w/ASME VV50 Stds Working Grp.
4. AIAA Aerospace Digital Twins Case Studies Pub; Digital Twin Analysis and Planning Reference Pattern, w/AIAA.
5. AIAA Aerospace Digital Threads Position Pub; Digital Thread Analysis & Planning Reference Pattern, w/AIAA.
6. *Handbook of System Sciences*, for ISSS via Springer: Chapter: "Patterns in Science and Engineering", w/ISSS.
7. *Handbook of Model-Based Systems Engineering*, Madni & Augustine, eds, Springer, Chapter: "MBSE Patterns".
8. *INCOSE SE Handbook*, 5th Ed., for INCOSE, D. Walden et al, eds, material on S*Metamodel and ASELCM Pattern
9. Support for Vision 2035 Implementation Streams: Innovation Applications, SE Foundations.
10. *INCOSE INSIGHT,* Dig. Engg. Issue, 2022, F. Salvatore, ed, Realizing the Promise of Digital Engineering: The Innovation Ecosystem Reference Pattern for Analysis, Planning, and Implementation.

3

Semantic Technologies for Systems Engineering (ST4SE)

Suggested by S. Jenkins, H-P deKoning. TPP:
http://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:incose_patterns_wg_st4se_project_tpp_v2.0_signed.pdf
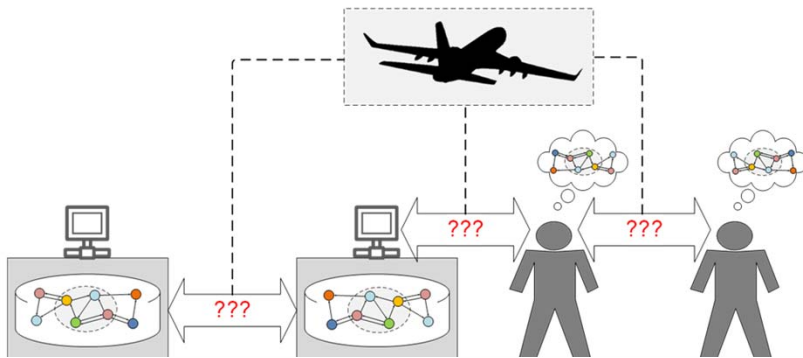
- This project combines demonstration of (1) [automated generation of consistent trustable models from trusted model-based patterns] with (2) [automated checking of human-generated models against trusted model-based patterns].

- Human beings may be the original interpreters of the meaning of models, but non-human semantic technologies have joined human interpreters of meaning.

- Information technologies that deal with model semantics (encoded meaning) include modeling languages, model authoring tools, simulation engines, web-based semantic data structures, and query and reasoning technologies.

- Semantic technologies strengthen impact of model-based semantics.

- Technical Product Plan: INCOSE distribution of data structures.

- Project Report: ➡

4

AIAA Aerospace Digital Twins Case Studies Publication and AIAA Aerospace Digital Thread Position Publication— Supported by INCOSE ASELCM Reference Pattern

AIAA-INCOSE Collaboration producing Aerospace Digital Twin
and Aerospace Digital Thread reference models, *based on ASELCM Pattern*

https://www.aiaa.org/resources/digital-twin-implementation-white-paper

https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:aiaa-aviation_dge-05-report_deic_digital_thread_position_paper_2_.pdf


Report on the AIAA DEIC Digital Thread Position Paper

Digital Thread Subcommittee
Aviation Forum, Chicago, 30 June 2022

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INCOSE Vision 2035 contributions, from WG's SE Theoretical Foundations Project

- The Patterns Working Group provided invited content on <u>SE Theoretical Foundations</u> for the *INCOSE Vision 2035* publication project, completed for IW2022.

- Publication project led by editorial team chaired by S. Friedenthal.

- Material drawn from the ongoing SE Theoretical Foundations Project of the Patterns Working Group.

- Participating in IW2023 FuSE streams

SYSTEMS ENGINEERING
VISION 2035
ENGINEERING SOLUTIONS FOR A BETTER WORLD
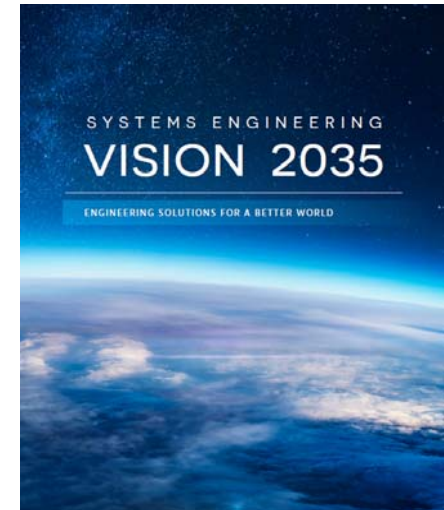
http://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:science_math_foundations_for_systems_and_systems_engineering--1_hr_awareness_v2.3.2a.pdf

Bill Schindel, ICTT System Sciences, schindel@ictt.com
V2.3.2

INCOSE

Implications for Future SE Practice, Education, Research:

SE Foundation Elements

Discussion Inputs to *INCOSE Vision 2035* Theoretical Foundations Section

(awareness version, 1 hour)

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