Model Based Systems Engineering (MBSE) Trends

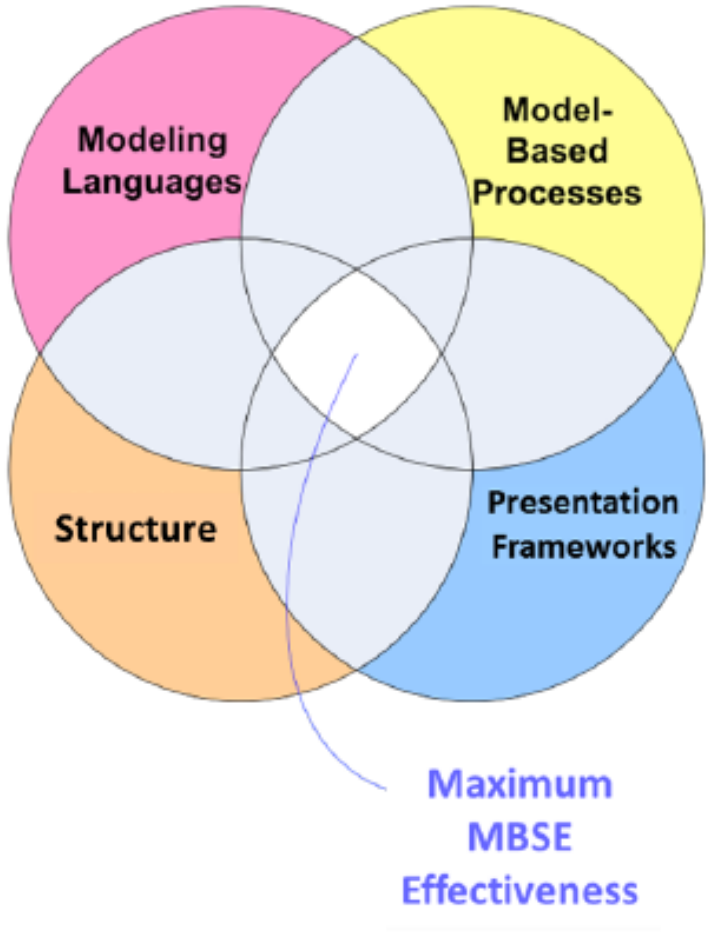
Dr. Donna Havrisik

Ms. Lisa Laurendine

Agenda

- Introduction
- MBSE and Educational Curriculums
  - Academia
  - Industry
- Future Efforts

Introduction



GRAPHIC DERIVED FROM: SySML Fourm, http://www. sysmlforum.com

Model-Based Systems Engineering (MBSE) is the formalized application of modeling (both static and dynamic) to support systems design and analysis, throughout all phases of the system lifecycle, through the collection of modeling languages, structure, model-based processes, and presentation frameworks used to support the discipline of systems engineering in a "model-based" or "model-driven" context.

Educational Curriculums being Established

- **Naval Postgraduate School (NPS) in Monterrey, CA Offers a Modernized SysEng Training Program**

Qtr	Course Title	Qtr	Course Title
1	Fundamentals of Systems Engineering (SE3100)	9	System Integration and Development (SE4151)
2	System Suitability (SE3302)	10	Systems Software Engineering (SE4003)
3	Engineering Risk-Benefit Analysis (OS4010)	11	Systems Evolution/Tech Development (SE3910)
4	Fundamentals of Engineering Project Management (SI3400)	12	Model-Based Systems Engineering (SE4930)
5	Probability and Statistics for SE (OS3180)	13	System of Systems (SE4950)
6	Engineering Economics and Cost Estimation (SE3011)	14	Engineering Systems Conceptualization (SE3201)
7	Capability Engineering (SE3250)	15	Engineering Systems Design (SE3202)
8	Systems Architecting and Design (SE4150)	16	Engineering Systems Implementation & Operation (SE3203)

SE Certificate Core Course	Fundamentals	SE Master's Core Course	Technical Domain Course	Capstone Project

Educational Curriculums being Established (cont)

- **MBSE Solutions is an Example Vendor – Providing On-Site Training with a 3-day Curriculum**

- Day 1 - Overview of Model Based Development
  - ▫ Introduction to SysML
  - ▫ Introduction to PTC Integrity Modeler
  - ▫ Generic SysML Items
  - ▫ Requirements Modeling
- Day 2 - MBSE Applications
  - ▫ Blocks (Block Definition Diagram)
  - ▫ Blocks (Internal Block Diagram)
  - ▫ Port and Interfaces
  - ▫ Constraint and Parametric Modeling
  - ▫ Use Case Analysis
  - ▫ Scenarios
- Day 3 - MBSE Practical Examples
  - ▫ Sequence Diagram [Interactions]
  - ▫ State Machines
  - ▫ Requirements Traceability
  - ▫ Traceability Allocations
  - ▫ Configuration Management
  - ▫ Collaboration in an Agile environment

New Projects continue to evolve in New Environments

- **Systems of Systems MBSE Design Applications are on the rise!**
  - **Combination of Enterprise Architect and the OOSEM process.**
  - **IBM Rhapsody and the Harmony design process.**

Future Efforts – Stakeholder Needs

- **The Lifecycle Steering Committee, a non-profit organization of MBSE experts, is defining and continues to refine the Lifecycle Modeling Language (LML).**
  - **LML is a relatively new open standard that contains visual models coupled with an ontology. LML was envisioned to be used as an alternative to SysML.**
  - **As SysML evolves, it is possible to couple SysML with LML to accomplish many MBSE goals.**
  - **The paper entitled, "Enhancing Model-Based Systems Engineering with Lifecycle Modeling Language" discusses this topic.**

Future Efforts – Stakeholder Needs (Cont)

- Research is on-going about what a major milestone review looks like in a MBSE environment.
  - To realize the efficiencies, reviews need to transition from document-based reviews to model-based reviews. Some results should be available during mid-summer.
- Stakeholders endorsing concept to explore Model-Centric Engineering. "Systems Engineering Transformation through Model Centric Engineering" presentation is releasable to the public,
  - Most of this work is being accomplished by Stevens Institute of Technology.

Future Efforts – Stakeholder Needs (Cont)

- MBSE means many things to many people.
  - The paper entitled, "Model-Based Systems Engineering De-Mystified," was developed to add some definition to the concepts.
  - The paper also presents some measures on attaining a MBSE environment, and provides an analysis to the current state.
  - The paper is a solid draft that is currently being edited.
    - Please contact Dr. Warren K. Vaneman, Ph.D. at NPS for more information!

Future Efforts – Stakeholder Needs (cont)

- **Upcoming Event: No Magic World Symposium (NMWS) 21 – 24 May, 2017, Allen TX**
  - **How to Get the Most From Your Data Models**
    - ➢**How much time do you usually spend on discovering the impact of changes coming from business?**
    - ➢**Do you need a high-level view when discussing data models with management? Or do you require very detailed information when presenting data models to technical teams?**
    - ➢**How do you develop and share data models with a distributed team?**
  - **Other Key Stakeholder Topics**

Back-Up