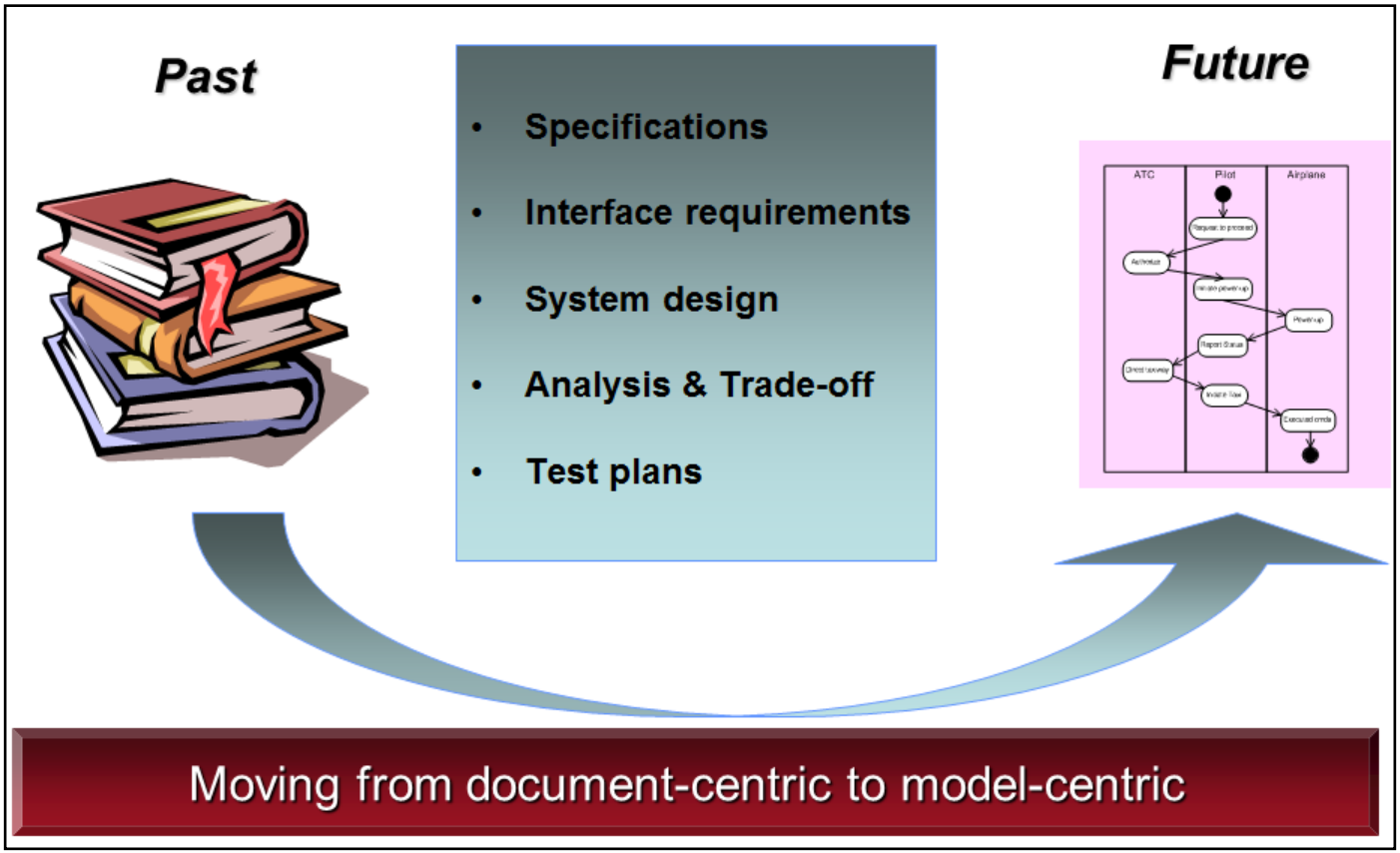
Models as a Foundation for Systems Engineering – Should We Expect a Breakthrough?

Brett Malone
Vitech Corporation
bmalone@vitechcorp.com

The Transition to Models?

Enablers **Inhibitors**

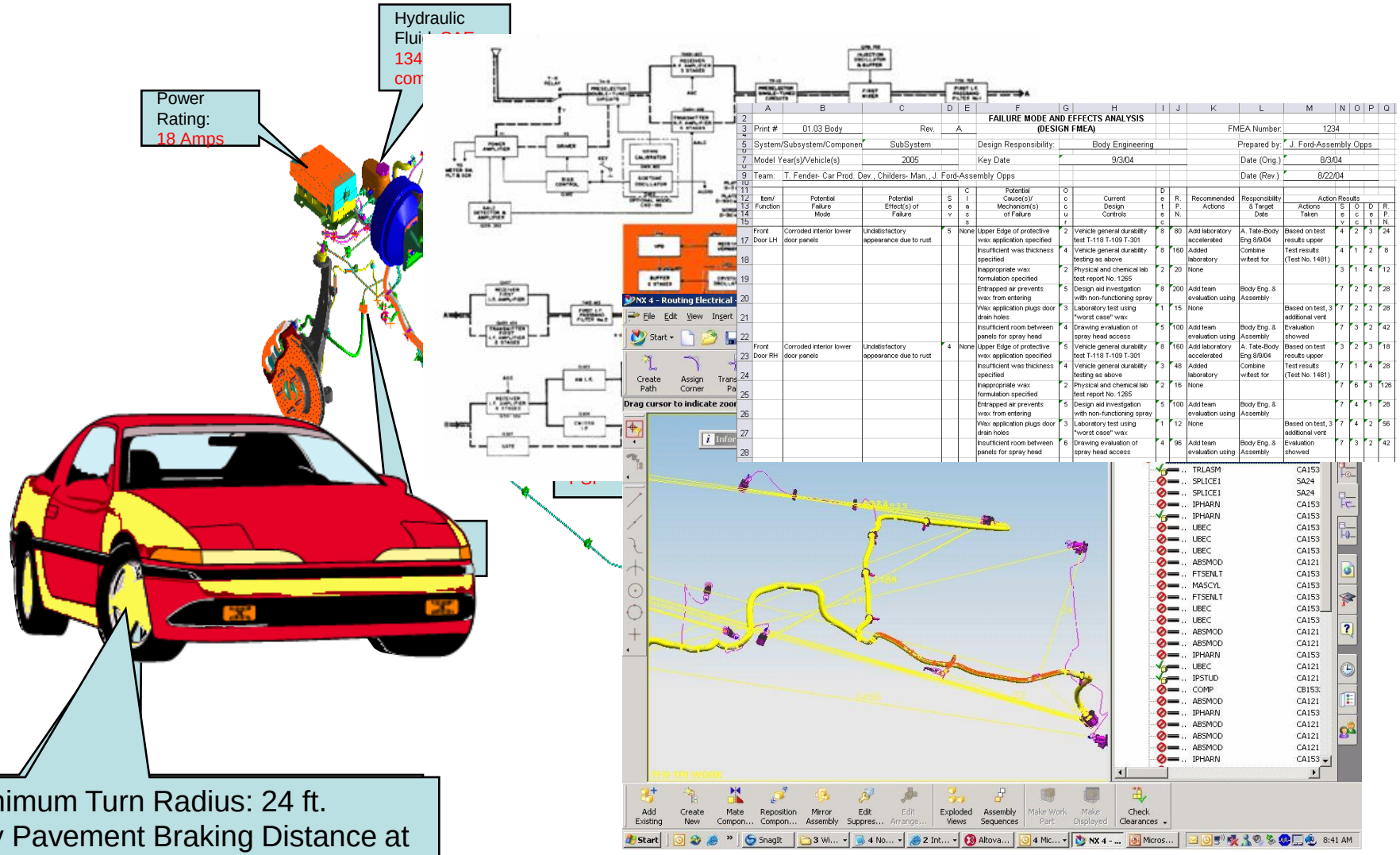
Opportunities **Threats**



MBSE transition graphic reprinted from INCOSE MBSE Workshop, February 2010

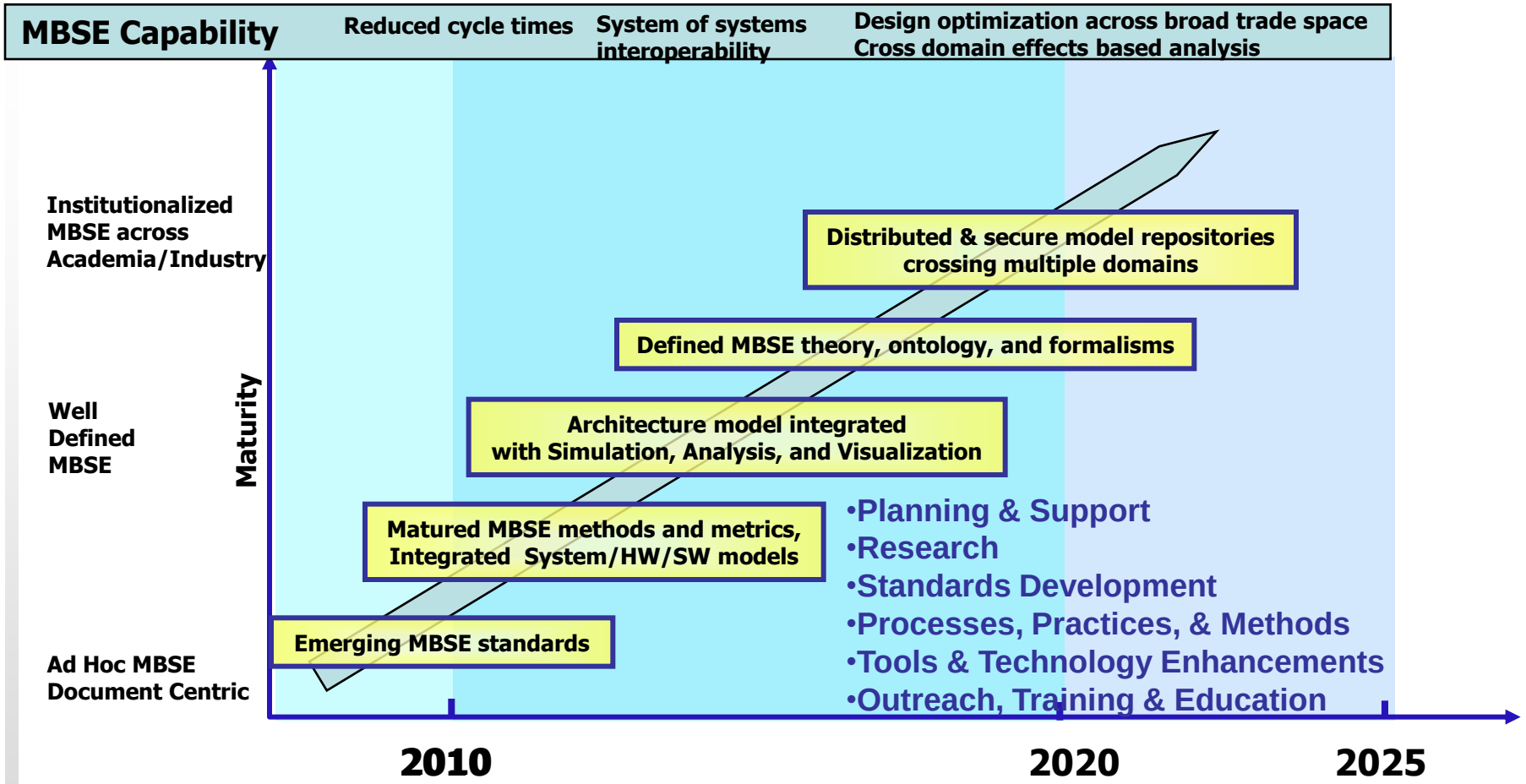
Building a Community

Casting an Initial Vision



Reprinted from INCOSE MBSE Workshop, February 2010

INCOSE MBSE Roadmap



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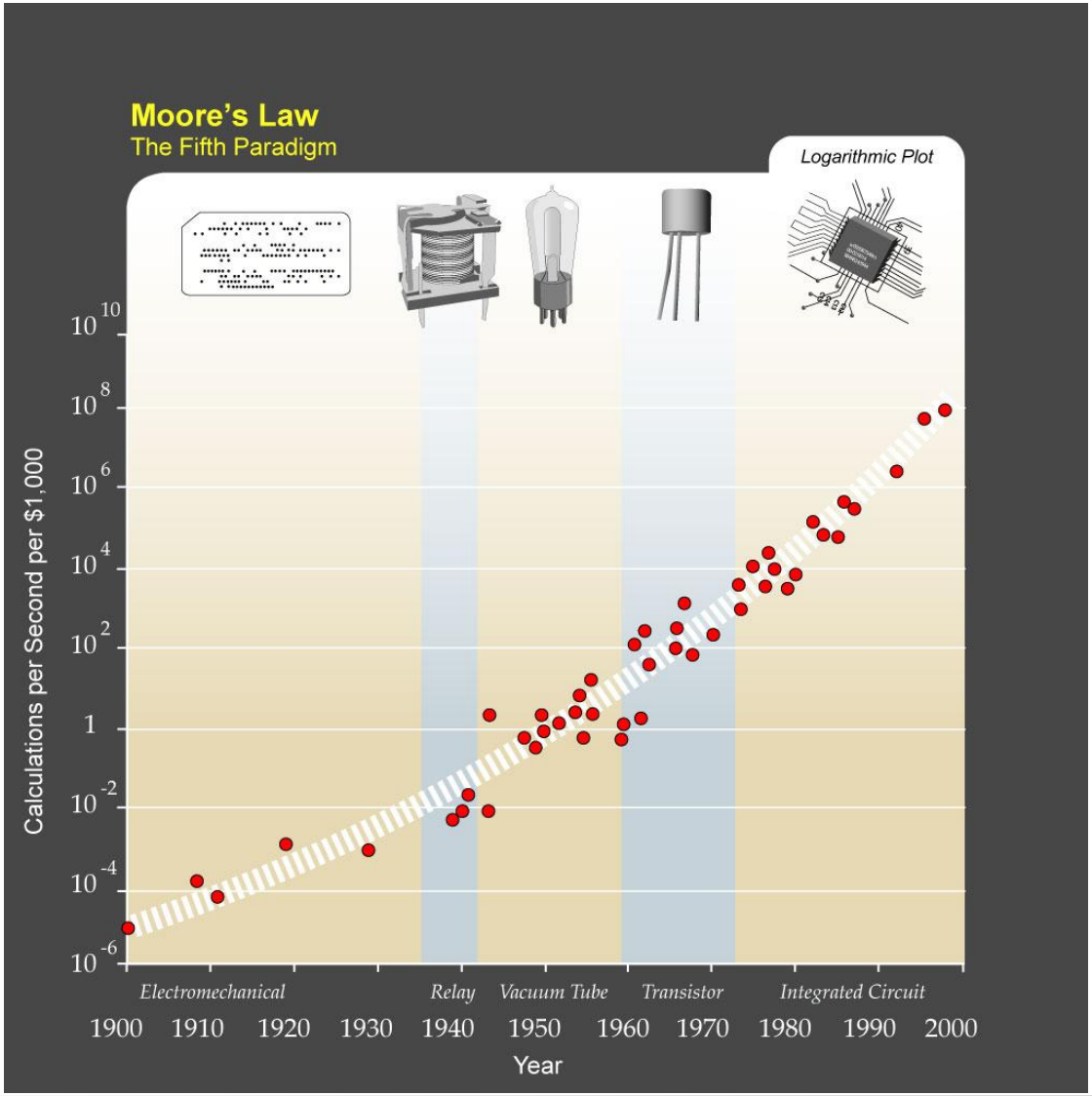
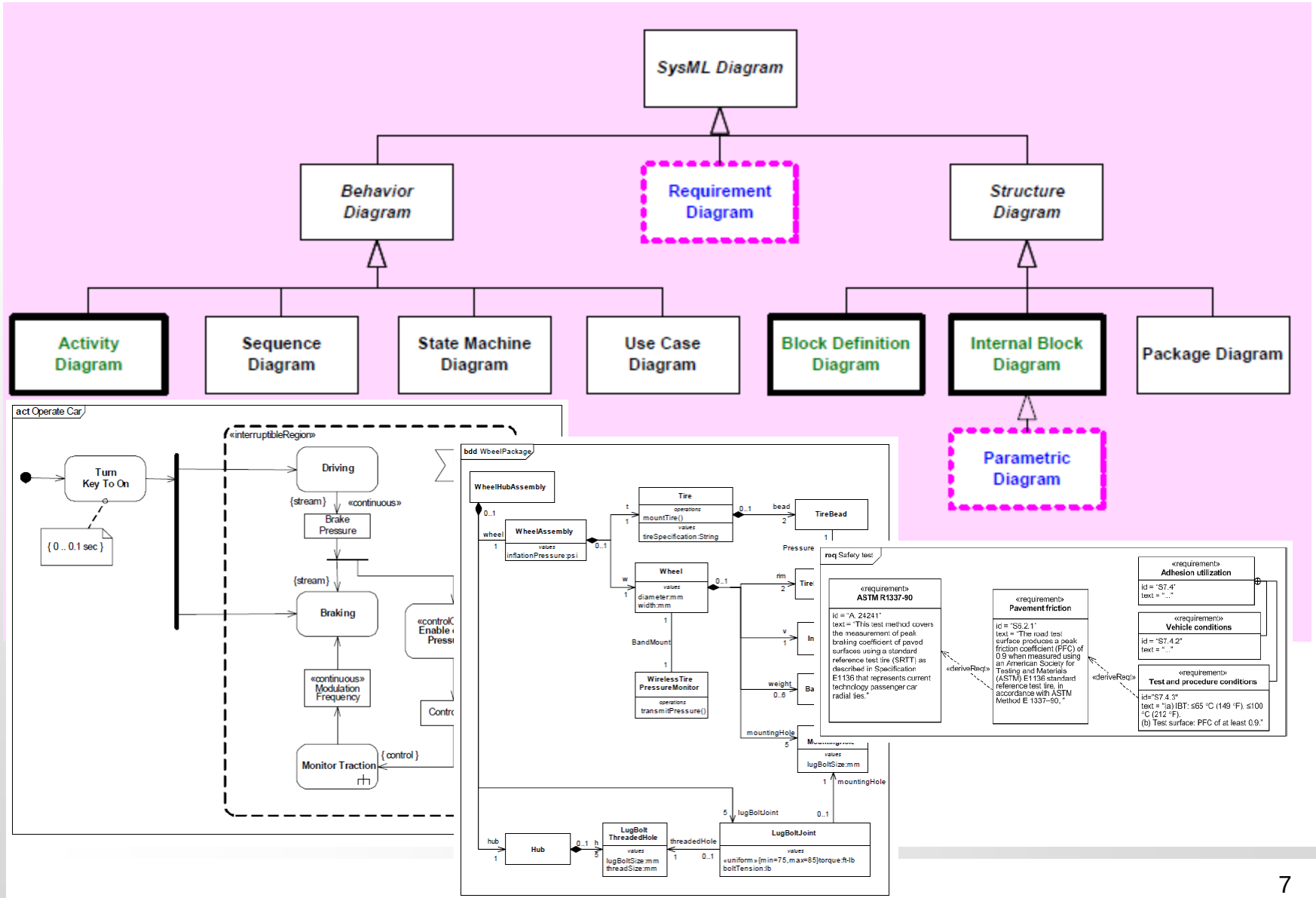
Advancing Technology

- Computing power
- Cloud computing
- Database technologies
- Reasoning engines
- …



The Development of SysML



SysML – An Enabler and a Threat?

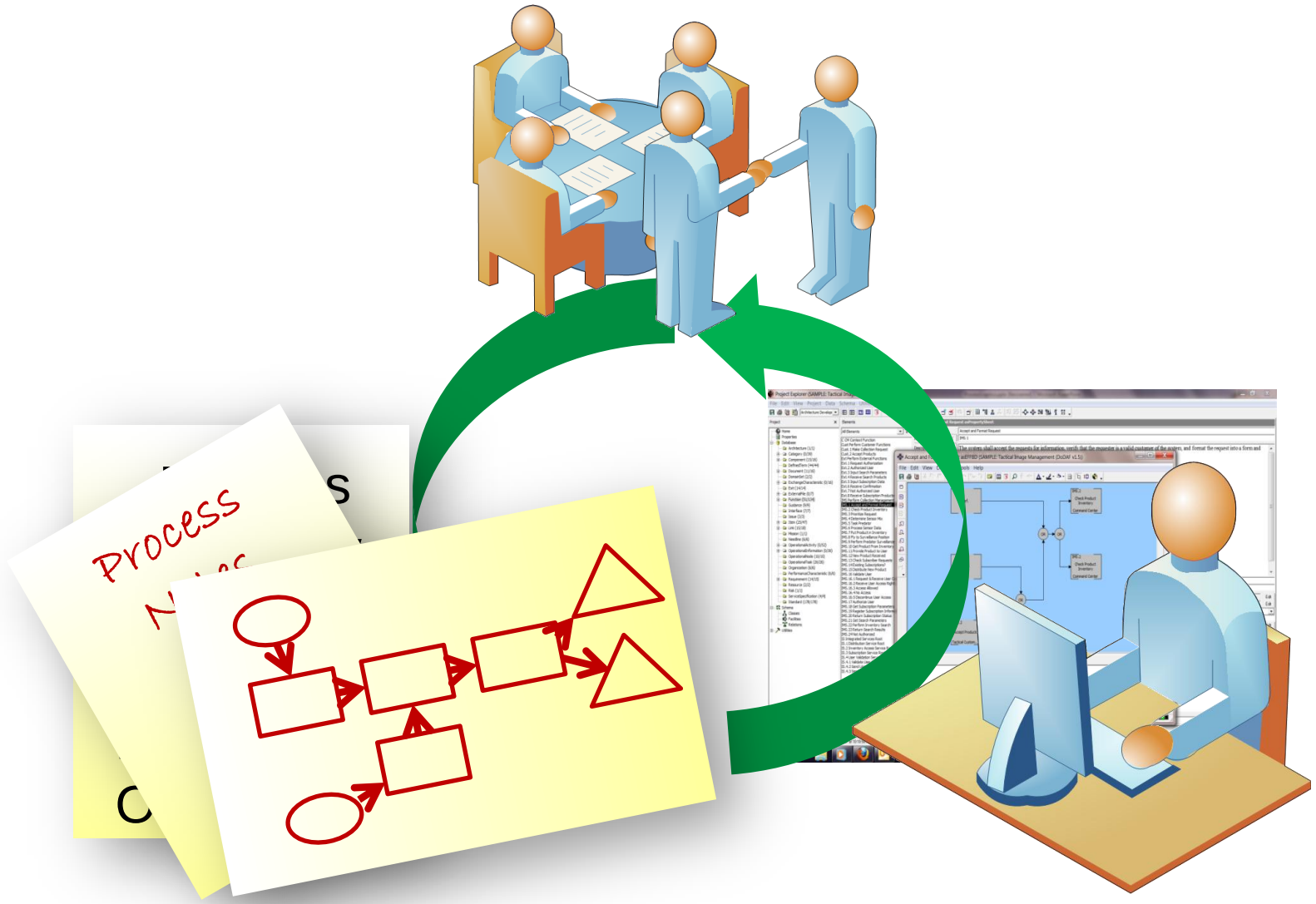
SysML as an Enabler

- A visual modeling language with semantics and standard notation
- Communication alignment with software domain

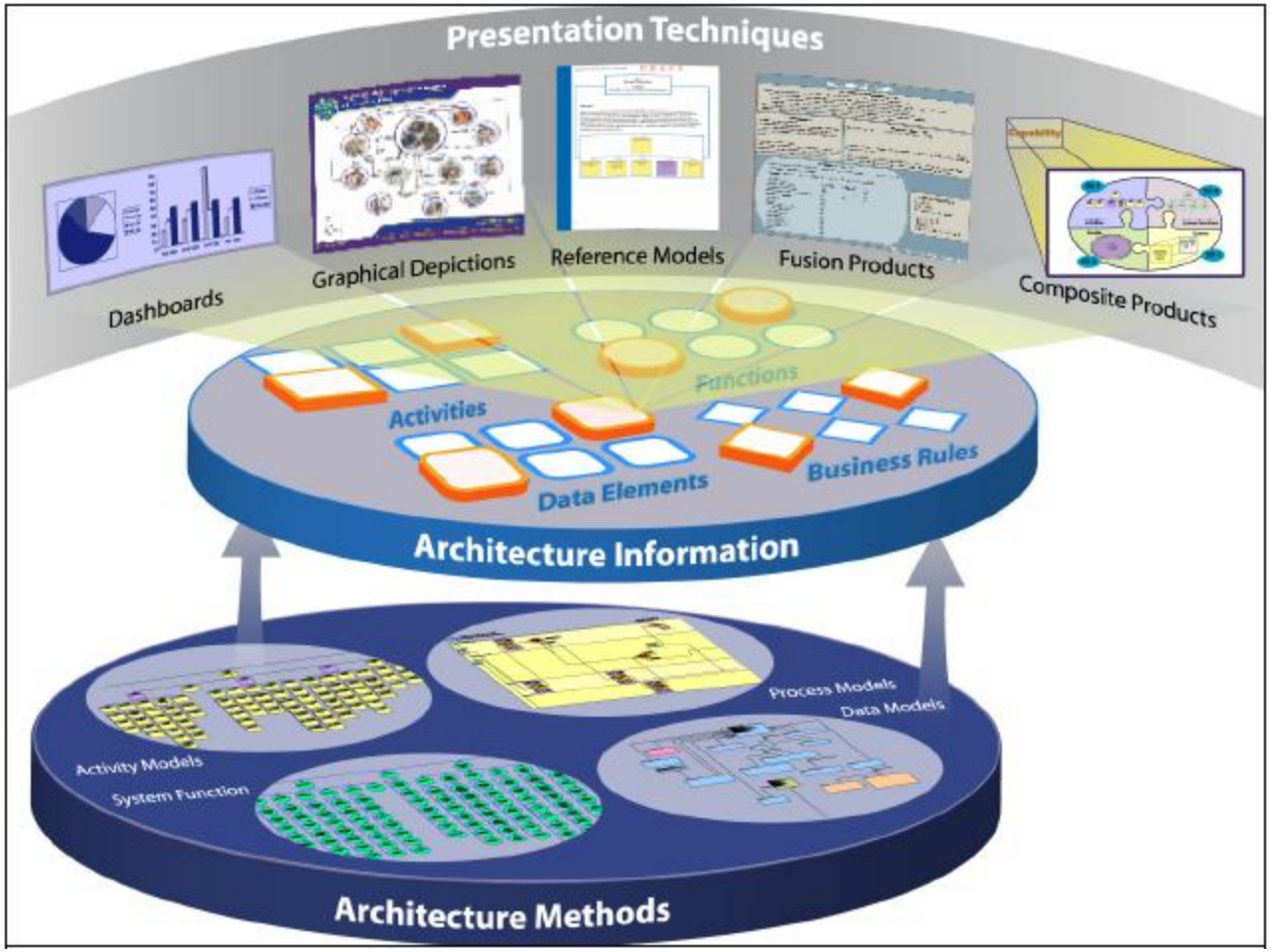
SysML as a Threat

- MBSE ≠ SysML
- Complexity of representation
- Rate of incorrect implementation (SysML treated as a series of diagrams)
- “SysML as a universal and complete representation”

Communication Mismatch: Manager, Architect, and Domain Experts



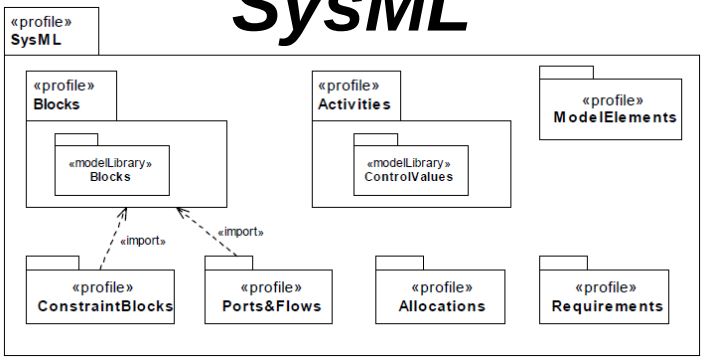
Communication Mismatch: Enabling Communication in the SME's Language



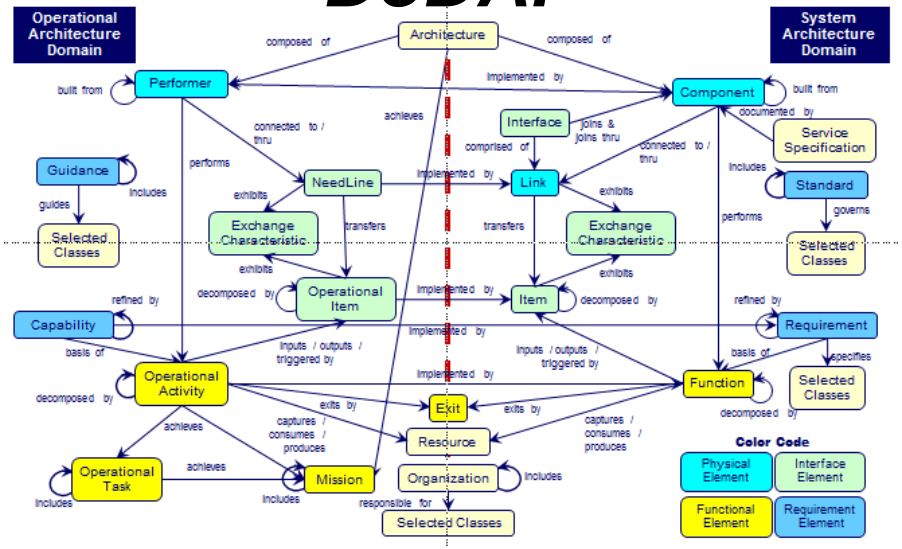
Reprinted from DoDAF 2.0

Models and Languages

SysML



DoDAF



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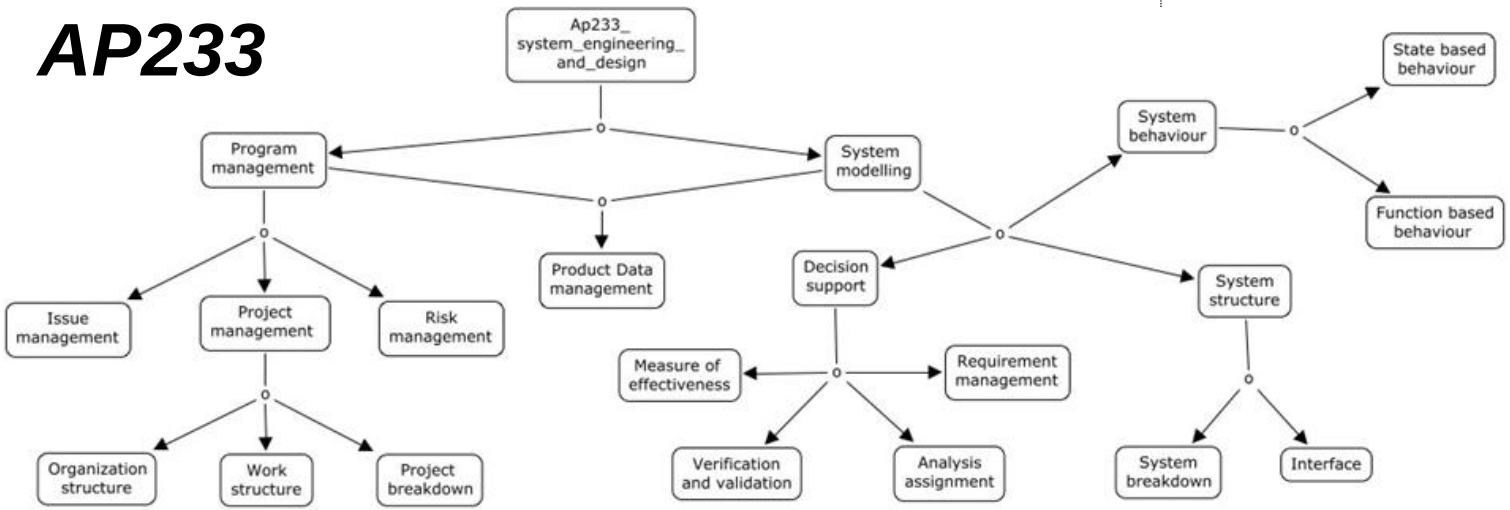
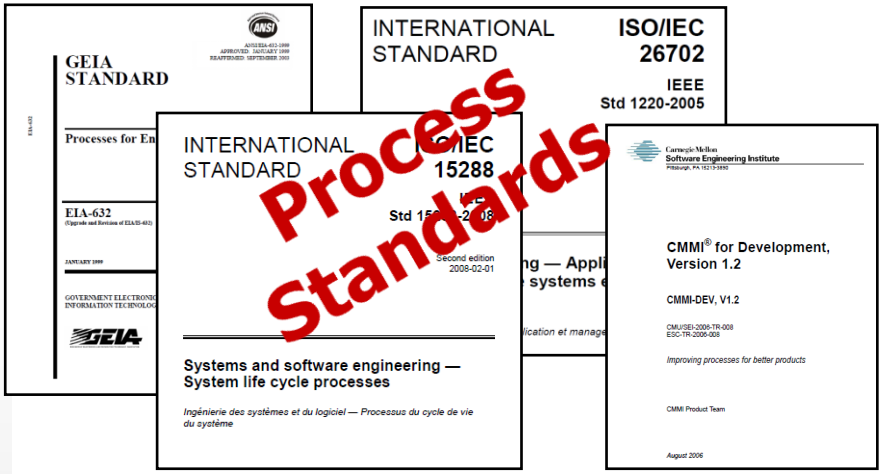
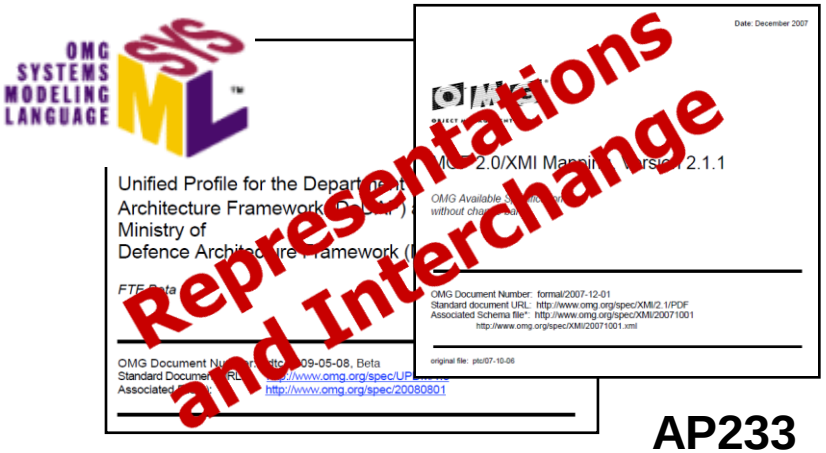


Evolution of Frameworks and Standards

NDIA
National Defense Industrial Association





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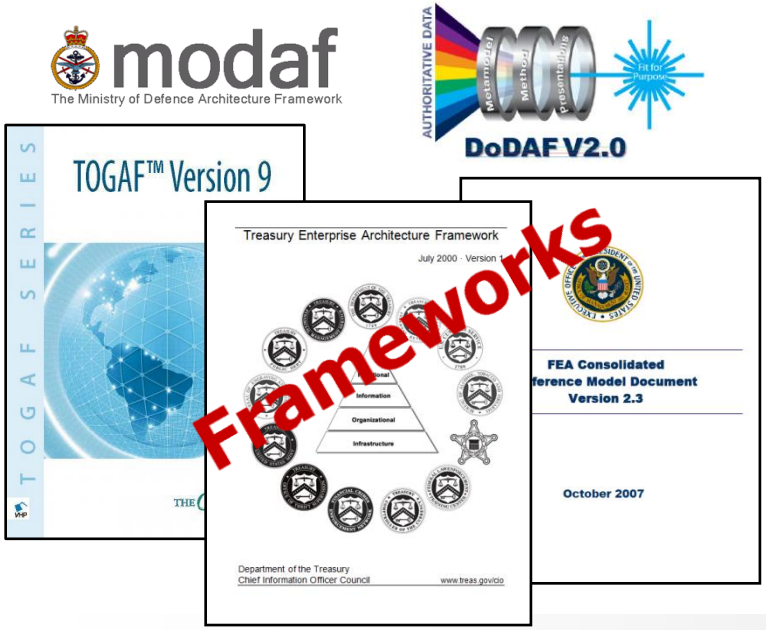
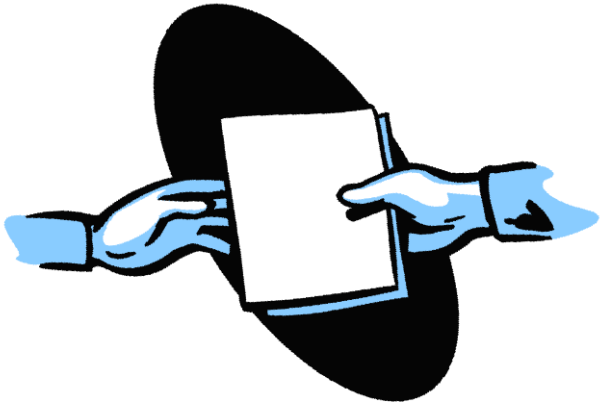
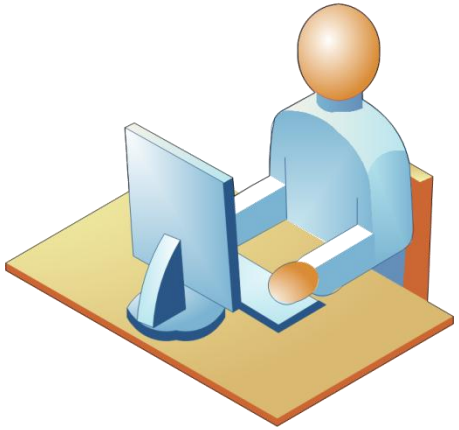


Contractual Boundaries





Expanded Vehicles for Research and Innovation

Research and innovation vehicles

- Organic MBSE Community / Working Groups
- Masters and Doctoral students (growth in SE programs)
- Systems Engineering Research Center (SERC)
- DARPA META program

For the practitioner

- Wizards, aids, and process guides
- Intelligent agents
- SE design automation
- Heuristics
- Patterns and pattern recognition
- Assisted engineering
- …

For our customer

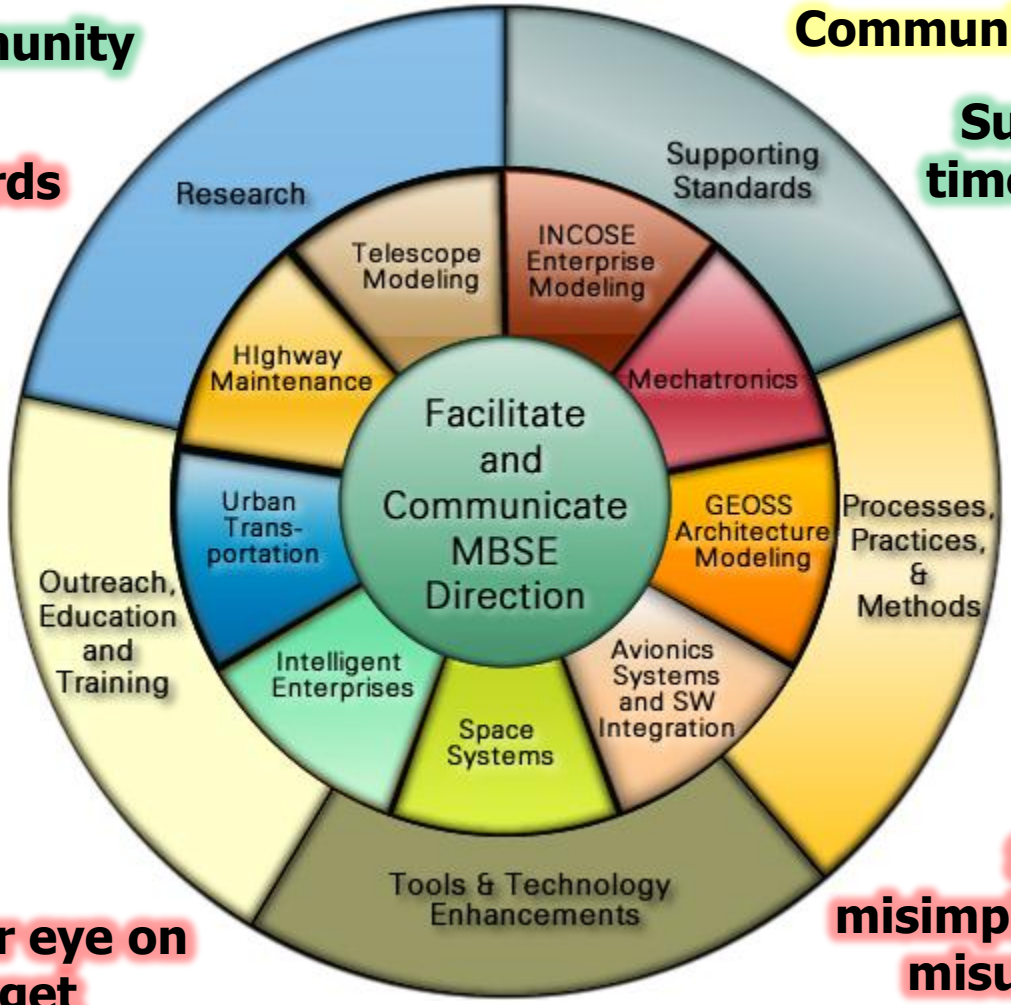
- Sensitivity analysis (requirements and requirement changes)
- Trade space capability and portfolio analysis
- Automated assurance of system integrity
- …

Changes in the Systems Domain

- The SE domain
  - COTS, GOTS, and reuse – increased emphasis on integration and reconfiguration for new capabilities
  - Intelligent, adaptive (self-evolving), and chaotic systems
  - Widely divergent system lifetimes (cell phones and submarines)
  - Compressed cycle time / accelerated time to market
  - Dominance of commercial systems
- An era of evolution
  - Influences of new technologies (biotech, …)
  - Rise of cost-effectiveness (limited government budgets, market economics in commercial domain)
  - Rise of national specialization
- The noteworthy challenges of this generation are systems problems

Begin with the End in Mind

The Path to the Future



Community

Communication

Premature standards or standards proliferation

Sufficient and timely standards

SysML as intended

Models and Languages

Expanded vehicles for research and innovation

Contractual Boundaries

Vision

Keeping our eye on the target

SysML misimplemented and misunderstood

Changes in the Systems Domain

Advancing Technology