INCOSE MBSE Initiative - Challenge Team Wiki
https://www.omgwiki.org/MBSE/doku.php?id=mbse:ecosystems

MBX Ecosystems Challenge Team

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Overview for INCOSE MBSE Initiative

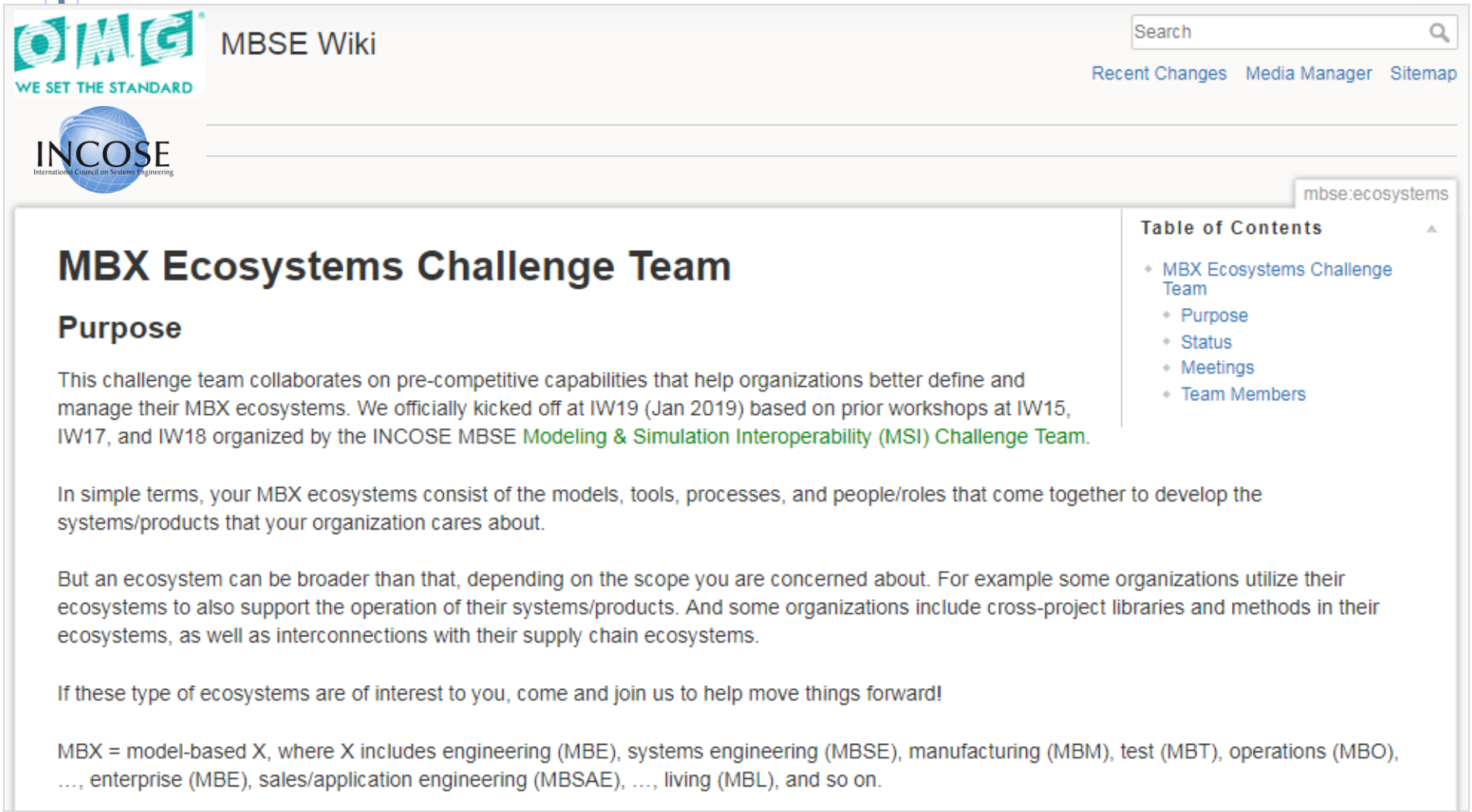
Sun Jan 27, 2019

https://www.omgwiki.org/MBSE/doku.php?id=mbse:incose_mbse_iw_2019

MBX = model-based X, where X includes engineering (MBE), systems engineering (MBSE), manufacturing (MBM), test (MBT), operations (MBO), …, enterprise (MBE), sales/application engineering (MBSAE), …, living (MBL), ...

Challenge Team Wiki @ INCOSE/OMG Site

https://www.omgwiki.org/MBSE/doku.php?id=mbse:ecosystems

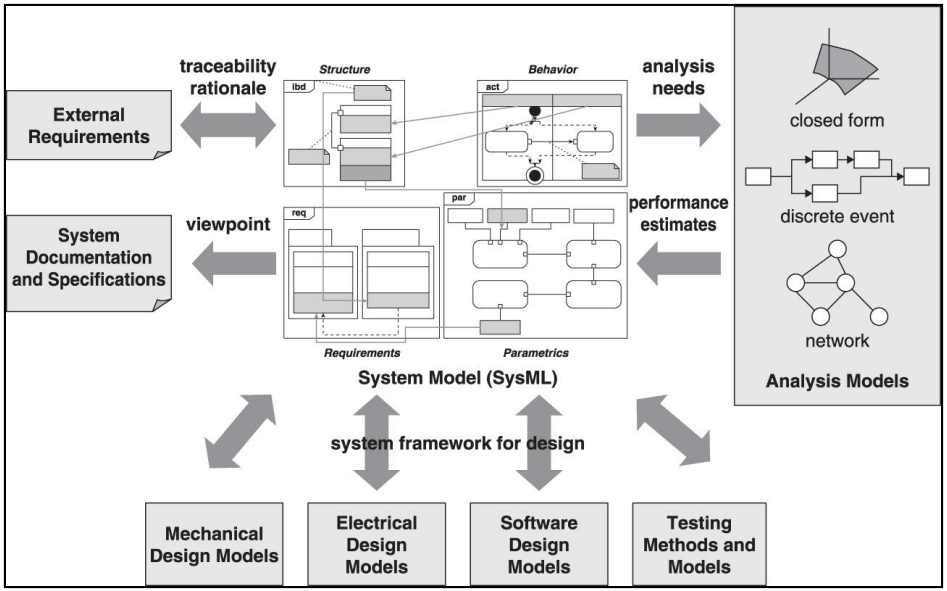


Context: What is an "MBX Ecosystem"?

SysML-based Ecosystems: Example Early Work

Generic Model Architecture in a SysML-based Ecosystem

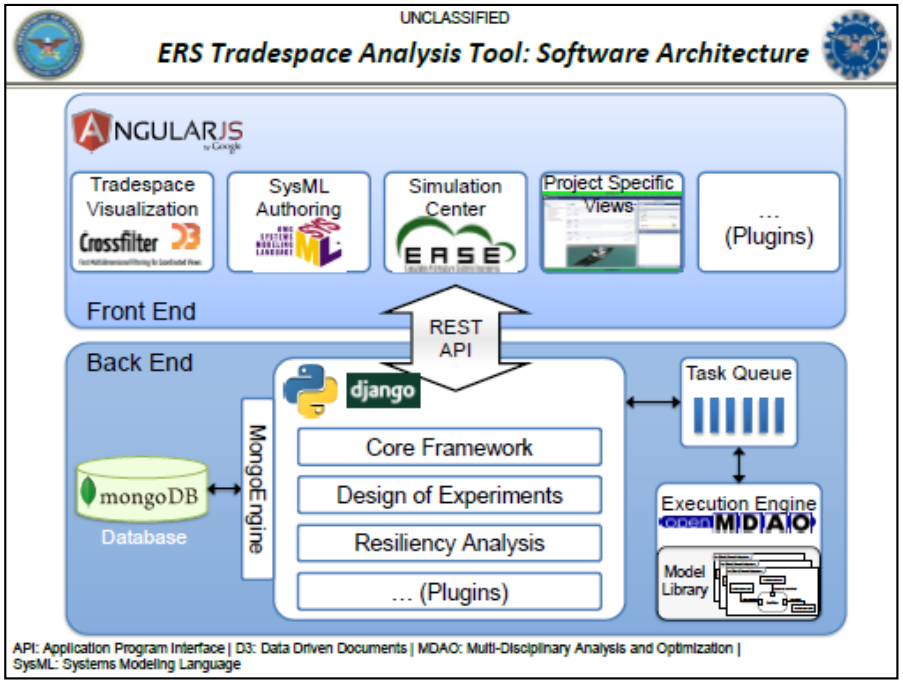
View: Framework for Models, Design/Analysis, and Traceability



Source: [Friedenthal et al. 2012]

FACT/ERS Environment *(example MBX ecosystem for trade studies)*

View: Software Implementation Architecture



Source: [Ender et al. 2014]

Context: What is an "MBX Ecosystem"?

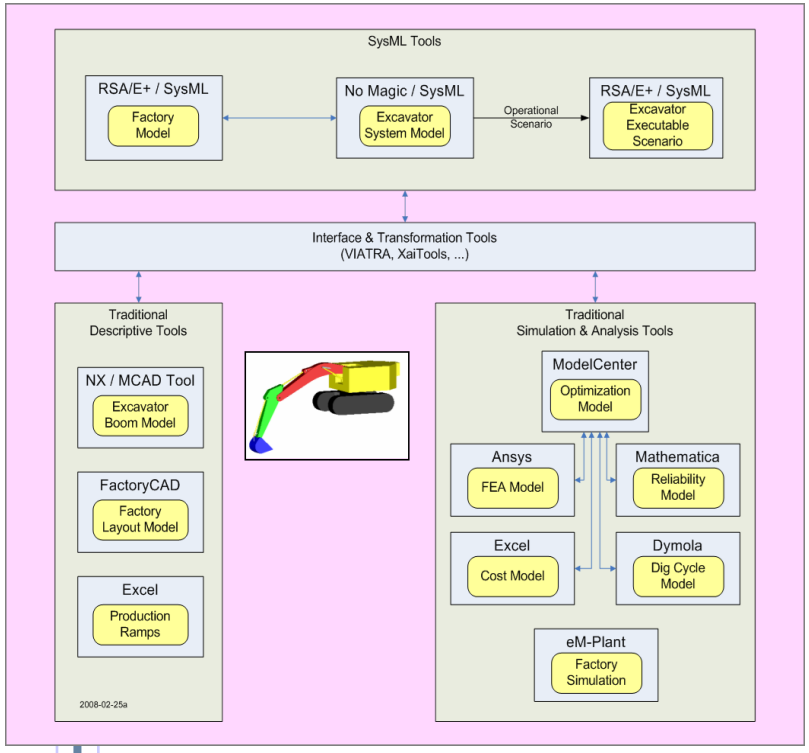
Early Example in INCOSE MBSE Initiative

Prototype SysML-based MBX Ecosystem for Excavator Systems

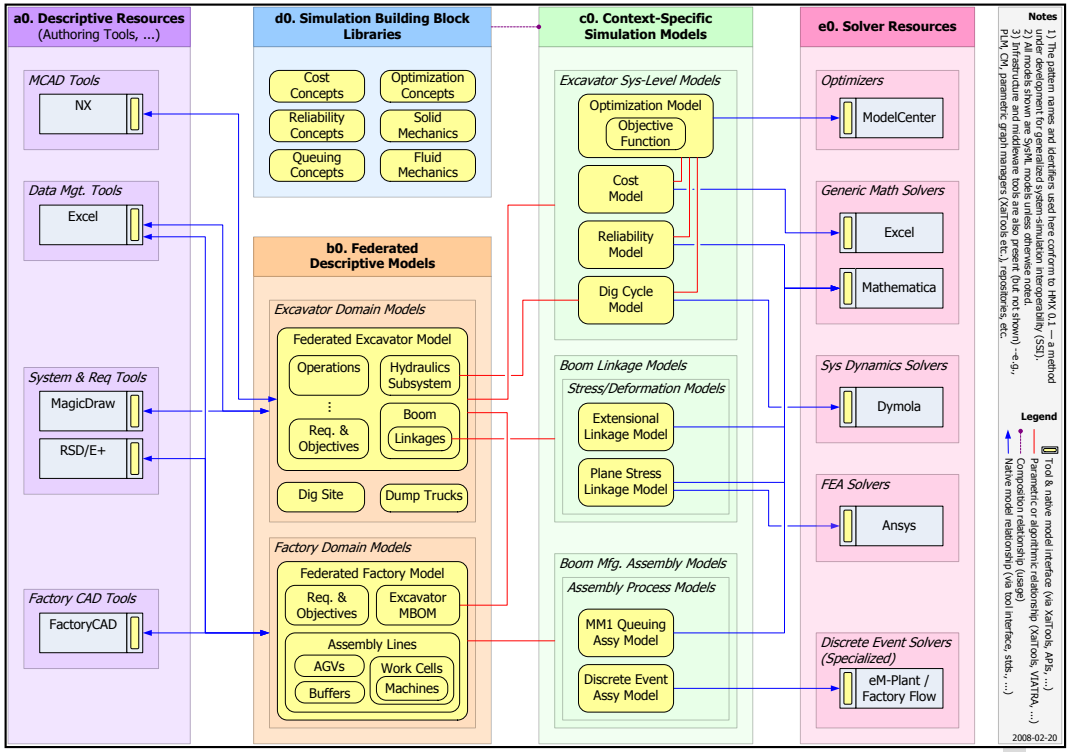
Case study c.2008-2010 in Georgia Tech project sponsored by Deere and Lockheed Martin

http://www.pslm.gatech.edu/projects/incose-mbse-msi/ including presentations at IW09 and IW10

View1: Tool Categories (with coarse-grain connections)

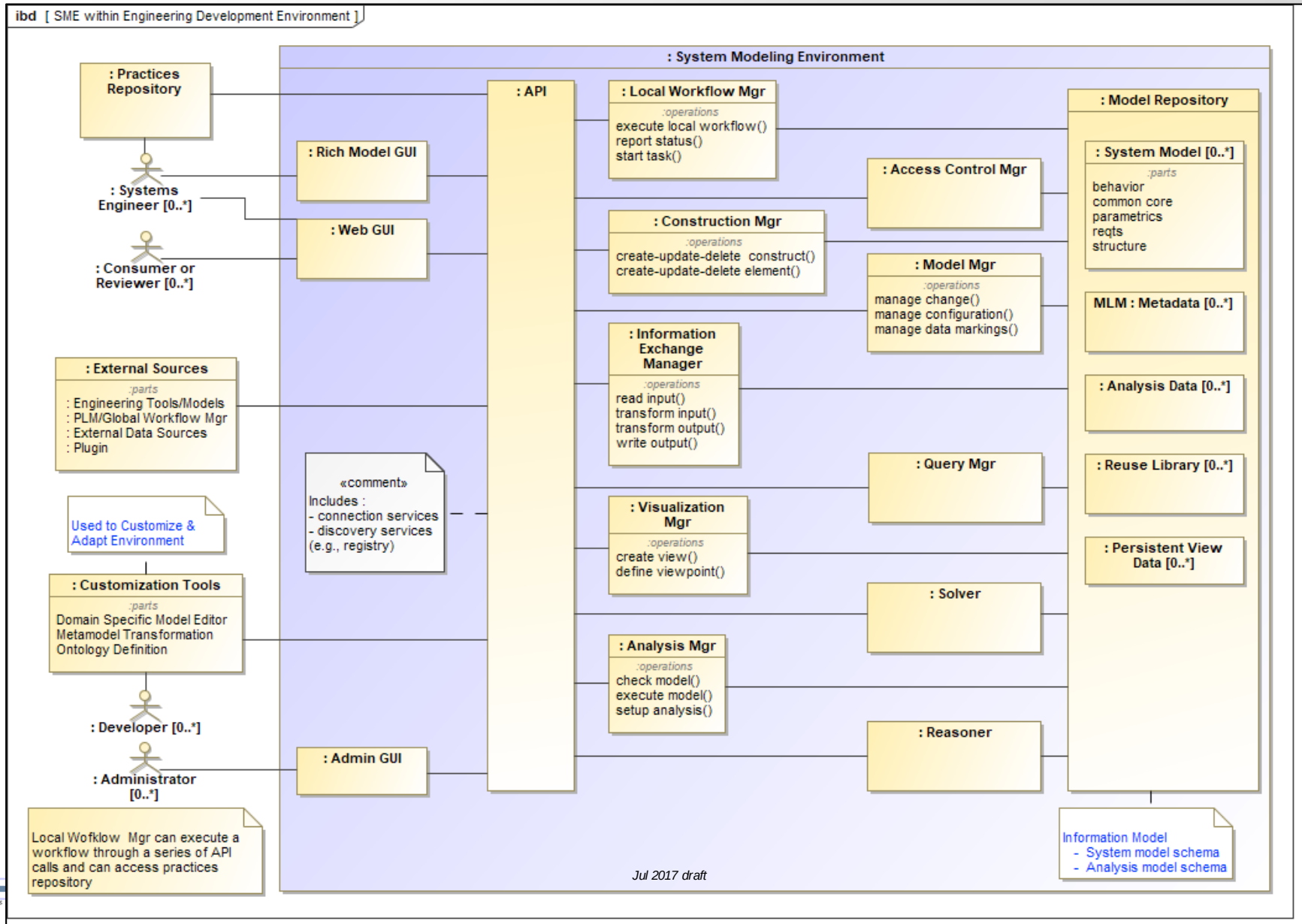


View2: Model Architecture - Patterns & Tools (with medium-grain connections)



Context: What is an "MBX Ecosystem"?

Generic Example - OMG SysML v2 RFP (*SysML model excerpt*)



Context: What is an "MBX Ecosystem"? *(cont.)*

Context & Terminology (Informal)

MBX Ecosystem Management

- MBX, where X = MBE, MBSE, MBM, ...
- Ecosystem = combined system of tools, models, products, repositories, interconnections, people, processes, workflows, ... [a "system of systems" - largely computer-based]
  - Level 1 – Overall ecosystem for organization X
  - Level 2 – Division sub-ecosystems
  - Level 0 – Level 1 in a global ecosystem with interfaces to ecosystems of customers, suppliers, regulators, ...
- Management = handling all ecosystem lifecycle phases
  - Vision/concepts, prototype, preliminary design, detailed design, deployment, maintenance, updates, migration, decommissioning
- Therefore, treat your MBX ecosystem as a system!
  - Apply systems engineering principles ("Alpo" approach) w/ ecosystem know-how
- Similar terms: system development environment, decision support system, modeling & simulation framework, ...

Source: SysML 101 short course [www.pslm.gatech.edu/courses]

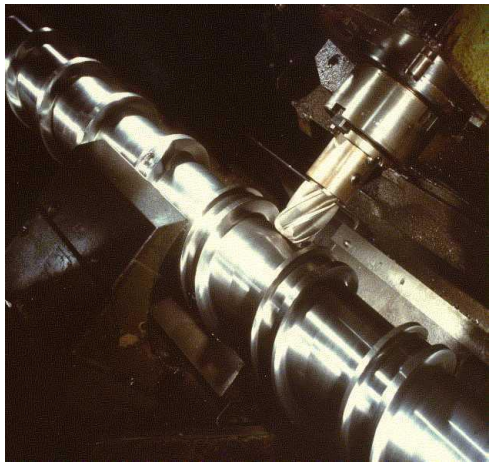
Context: What is an "MBX Ecosystem"? *(cont.)*

MBX Ecosystem Metrics & Objectives

Benefits of SysML-based MBE/MBSE Approach

Primary Impacts *enterprise MOEs* *(measures of effectiveness)* *ecosystem MOPs* *(measures of performance)* **Enabling Capabilities**	Reduced Time	Reduced Cost	Reduced Risk	Increased Understanding	Increased Corporate Memory	Increased Artifact Performance
Increased Knowledge Capture & Completeness			■	■	■	■
Increased Modularity & Reusability	■	■	■	■	■	
Increased Traceability			■	■	■	
Reduced Manual Re-Creation	■	■	■			
Increased Automation	■	■	■			
Reduced Modeling Effort	■	■				
Increased Analysis Intensity			■			■

Precision Knowledge for the Model-Based Enterprise



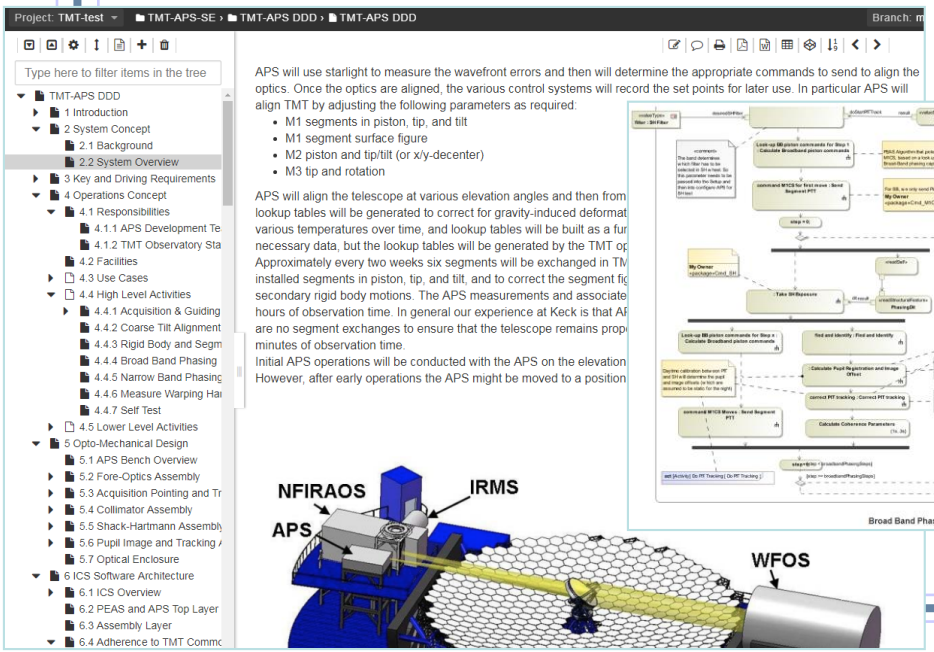
Source: SysML 101 short course [www.pslm.gatech.edu/courses]

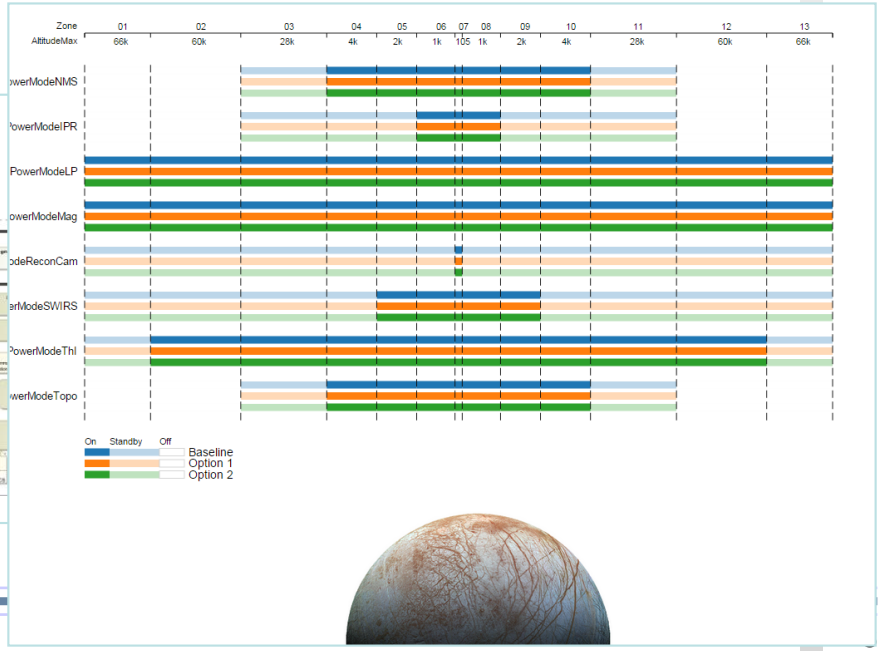
OpenMBEE: An Open Framework for MBX Ecosystems

www.openmbee.org

Simplified View:

- A practical combination of commercial tools and open-source tools within an extensible framework
- Includes “model-based wiki”-like capabilities
  - Exposes rich underlying SysML models as web pages
  - Engages project members who do not know SysML





Ecosystems/OpenMBEE Community Info

www.openmbee.org

- ~200 participants in email list / google group
- ~35 participants in biweekly webcons (started ~Feb 2017)
- ~45 participants in biweekly developer webcons
- Formalized as a Challenge Team in the INCOSE MBSE Initiative (Jan 2019)
- Semi-public OpenMBEE instance (*thanks to No Magic, Inc*)
  - Used for collaboration on work by OMG / INCOSE / etc. (pre-competitive topics & resources)

OpenMBEE Users: Deployments as of Jan 2018

(per responses from participants in IW18 workshop - Jan 23, 2018)

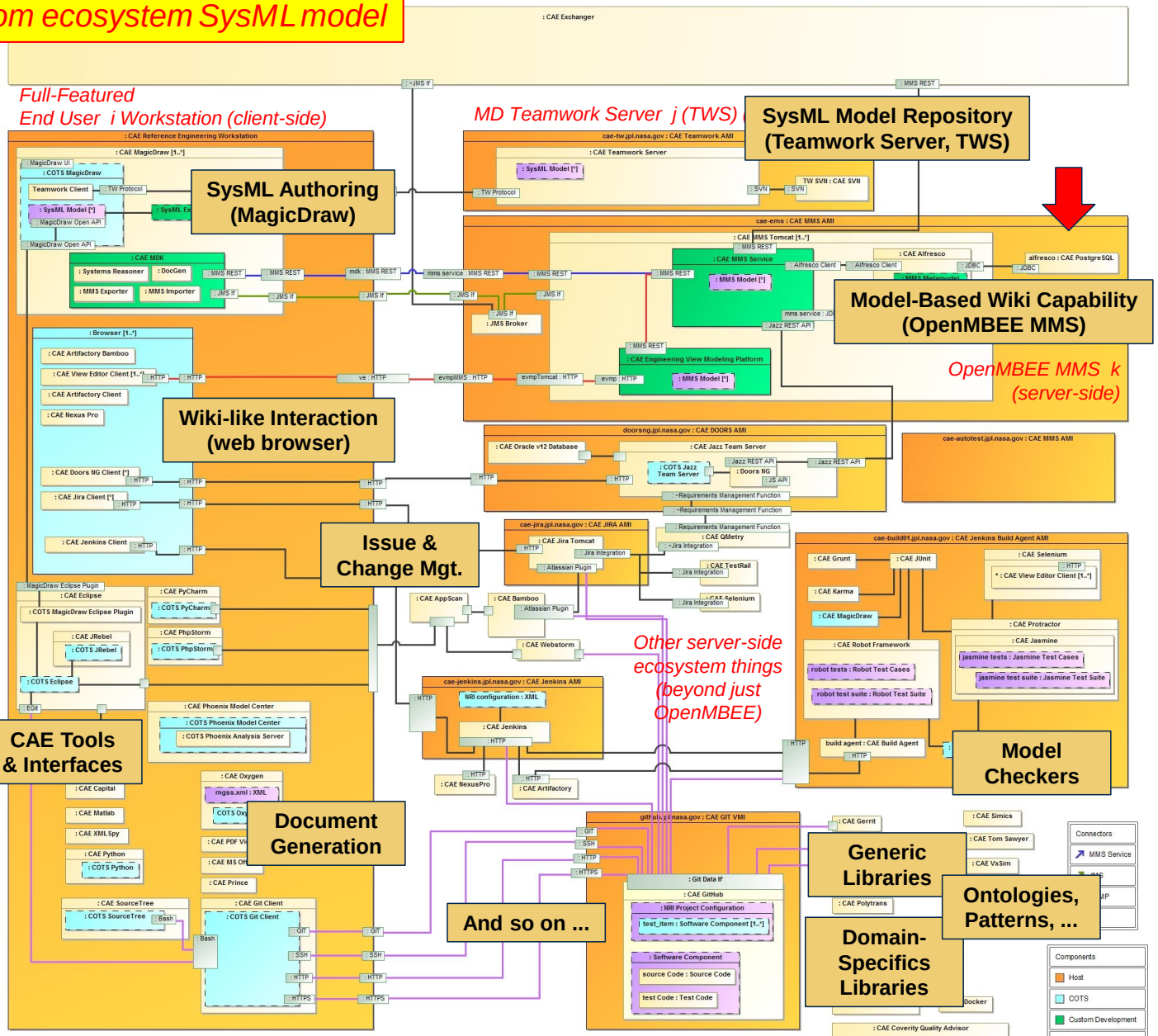
Organization	Projects Using OpenMBEE	OpenMBEE Deployment Status
Boeing	Various programs (*it is their enterprise model-based solution*)	Production
Ford	Various pilots	*Pilot*
GT/ASDL	~5 research projects/demos	*Pilot/Demo*
GTRI	Various projects (*after setup is ready*)	*WIP*
Lockheed	Various programs	Production
NASA JPL	~8 main flight projects (Europa Clipper, Mars 2020, Mars Sample Return, ...)	Production
OMG [1]	SysML 1.x spec; SysML v2 SST proposal	Production
Stevens/SERC	Several research projects/demos	*Pilot/Demo*
www.tmt.org [1]	Thirty Meter Telescope (TMT)	Production

[1] = Using openmbee.org semi-public instance

Context: What is an "MBX Ecosystem"?

Example Production Ecosystem @ JPL Using OpenMBEE

Excerpt from ecosystem SysML model



Source: Excerpt from R Karban's presentation at NMWS 2016

Join us at IW19!

Mon-Tue Jan 28-29, 2019

- See Challenge Team wiki for agenda specifics
  - *https://www.omgwiki.org/MBSE/doku.php?id=mbse:ecosystems:iw2019*
  - Includes overviews of production ecosystems at Boeing, ESA, JPL, Lockheed, …

Day/Time	Group	Location
Mon 8:00-17:30	MBX Ecosystems & OpenMBEE	Salon E
Tue 8:00-16:30	MBX Ecosystems & OpenMBEE	Salon F/G