SysML v2 Transition Considerations – An industry (LM) perspective

INCOSE IW 2024
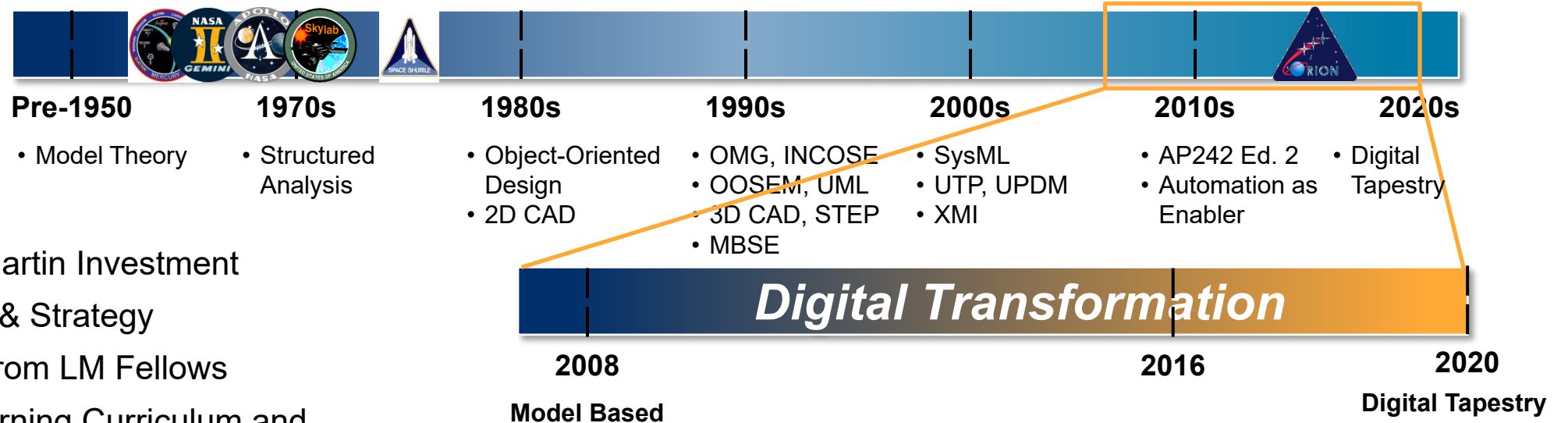
January 28, 2024

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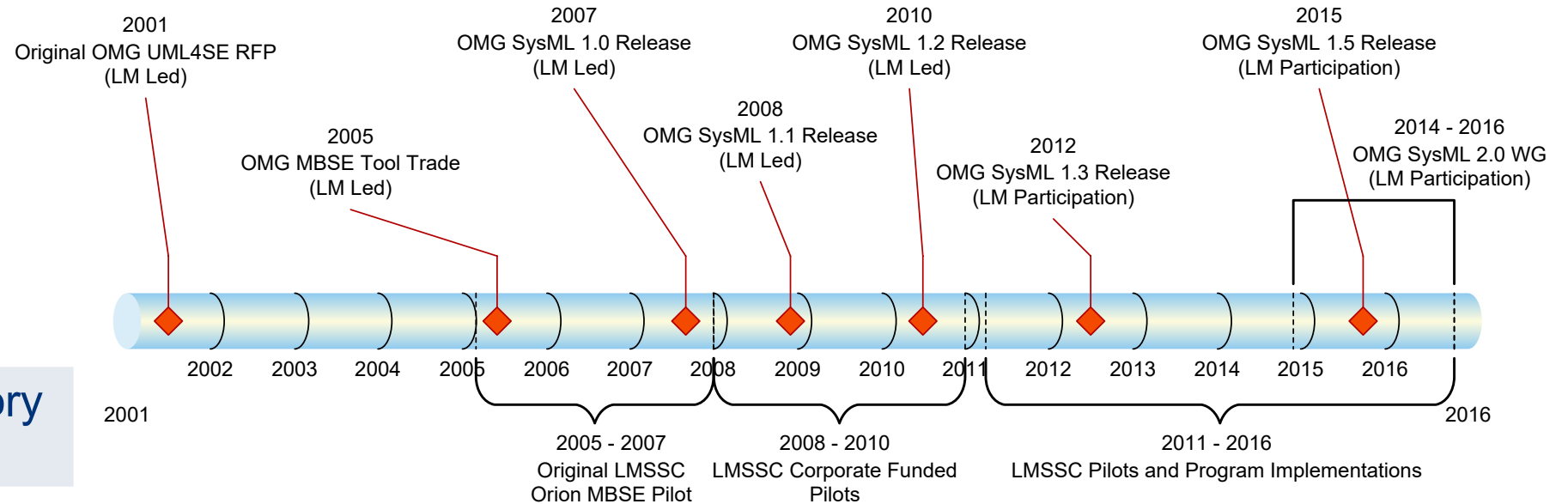
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History of MBSE @ Lockheed Martin

Pre-1950	1970s	1980s	1990s	2000s	2010s	2020s
• Model Theory	• Structured Analysis	• Object-Oriented Design • 2D CAD	• OMG, INCOSE • OOSEM, UML • 3D CAD, STEP • MBSE	• SysML • UTP, UPDM • XMI	• AP242 Ed. 2 • Automation as Enabler	• Digital Tapestry

- Focused Lockheed Martin Investment
- Corporate Alignment & Strategy
- Technical Expertise from LM Fellows
- Incorporated into Learning Curriculum and Development Tracks

Digital Transformation

2008	2016	2020
Model Based		**Digital Tapestry**

Relatively long history with SysML

2001
Original OMG UML4SE RFP
(LM Led)

2005
OMG MBSE Tool Trade
(LM Led)

2007
OMG SysML 1.0 Release
(LM Led)

2008
OMG SysML 1.1 Release
(LM Led)

2010
OMG SysML 1.2 Release
(LM Led)

2012
OMG SysML 1.3 Release
(LM Participation)

2015
OMG SysML 1.5 Release
(LM Participation)

2014 - 2016
OMG SysML 2.0 WG
(LM Participation)

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

2005 - 2007
Original LMSSC
Orion MBSE Pilot

2008 - 2010
LMSSC Corporate Funded
Pilots

2011 - 2016
LMSSC Pilots and Program Implementations

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LM SysML v2 Activity

- SysML v2 RFP

  - Provided LM-based input from "Pain Points" discussion in San Diego to initial RFP

  - Funded some initial work on KerML

- SysML v2 Submission Team

  - Participating in multiple tracks of submission team

  - Contributing to solution in some key areas (KerML, executability)

- Industry

  - Communication of SysML v2 goals, status objectives with industry groups (NDIA, INCOSE local chapters)

Needs based on LM experience implementing SysML v1

Improvements important to implement LM SE process with a model-based approach

Part of a larger, broader corporate-wide push for Model-Based Engineering

Investing v2 to better meet MBSE needs

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Thoughts on Key Features in v2

- Standardization of APIs and Data Model

  - Major issue for interoperability between SE tools, and other engineering tools

  - Multiple types of visualization modes

- Improved language constructs (UML meta model dependencies)

  - Makes modeling and information gathering from models easier

- Support for usage-based modeling approach

  - Most things are not completely new designs from top-down

- Improved integration of important SE key concepts (e.g. time, complex value types, etc.)

  - Needed to cover more of the SE process space (e.g. reliability)

Desire both tool interoperability and integrate-ability to realize Model-Based Engineering goals

Improvements for better adoption

More complete applicability across the SE processes

Anxiously awaiting v2-based tools to improve LM MBSE

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V2 Preparation and Planning

- Conversation and Communication with Tool Vendors

    - Understand plans/timelines for v2 implementations

    - Piloting opportunities

- Cross-LM v2 Implementation Working Group

    - Familiarity with v2 intent and current implementation

    - Establish sandbox environments to practice with SST implementation

    - Assess impacts of v2 on home-grown tools, current MBSE practice/guidance, training, etc.

    - Pilot improved integrations with other engineering tools

Coordination with vendors/customers very important part

Impacts more than just tools

Almost 20 years of history and technical debt

"Early" planning to understanding how to take full advantage

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Major challenges to LM adoption of v2

- Tools

  - Plugins/scripts, 2nd order tools (doc gens), non-LM other tools (validation suites, etc.)

- Process

  - Impact on methods, guidelines, etc.

- Training

  - Non-trivial revamp (modality and content, #'s, approach)

- Adoption

  - Customers, vendors, classified environment migrations

Significant impact to a number of support functions for programs

Vendors and open source communities may drive timing

Extensions will take even longer to implement

Culture change is in mid-swing and will be disrupted by v2 (in good and bad ways)

Synchronizing all the timelines will be very complicated and need to be informed by impact analysis

Actions Taken

- Organizational Engagement

  - Established an LM-wide working group (~10 people, small hours)

  - Skilled and unskilled from a variety of backgrounds

- Industry Engagement

  - DoD Working group

  - INCOSE/OMG/NDIA/AIAA – many opportunities to share/learn

- Vendor Engagement

  - Across a number of modeling tool vendors (a lot of change)

  - 3rd Party tool vendors

- Organized Piloting of Implementations

Engagement with a number of groups helps provide the perspective needed to meaningfully predict what the future will look like

A number of key elements (tools, best approach, understanding) are still in flux and require iterative introspection

Planning and organization key to gaining understanding EARLY

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What We've Learned So Far

- Start with a plan – DoD WG template is a great place to start (add method, and process)

- Early deep dive on v2 – many had not been engaged

- Vendor implementations will still be key (features, data management, etc.)

- Bi-modal modeling (graphical + textual) positive change (esp. for SysML newbies)

- V2 Features received well (user-focused, decomp, etc.)

- Don't underestimate the scope of change

- API implementation will still mean BIG progress

In the main, the charges are really good

Still room for vendor innovation and distribution

Reasons for change and new features are still relevant. Maybe more relevant

Begin now to gain understanding. More than you may think.

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What We've Learned So Far – cont.

- Encountering Questions with spec's implementation (namespace, model interchange, etc.)

- Training will need significant change (not necessarily a v2 issue)

- Coordination at a program level will be the key to success in transition

- Not sure if mixed modes (v1 and v2 models) will work

- Simple, effective model migration is a large lever

- More revolution on horizon (interop, granular management, concurrency support, etc.)

Unexpected changes cropping up

Some technical issues, but many non-technical issues surfaced

May be more revolutionary (in a good way) than expected

Community interaction integral to v2 implementation success

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Summary

- V2 is very much needed and wanted (can't come soon enough)

- Many things are needed to take advantage (more than we thought)

- Effort must be planned for organizations of any size to adopt (lots of coordination to do)

- Communication and cooperation with customers/vendors will be a key to adoption (early and often)

- Embrace the change

Still, vive lá SysML!!