MBSE Community of Practice

The Path Forward:
Supporting the Emergence of Usability in the Community of practice

Context

• MBSE Initiative:
  Collaborative effort to facilitate MBSE development
• Usability is a key issue
• Desired:
  – Easy to learn
  – Efficient to use
  – Structures & Processes easy to remember
  – Easy to avoid mistakes
  – High satisfaction among users
• Assumption:
  – MBSE is “Fit for intended use”
  – Assumes wide range of capabilities
Major Results:

Preliminary Use Case Analysis

- Preliminary Use Case Analysis
  - 35 use cases including:
    - Orienting team to a design problem
    - Requirements Tracing
    - Design Review
    - System Integration
  - Use cases span lifecycle
  - Most emphasized: Library based architectural modeling
    - Components
    - Rules
    - Patterns
  - Use cases were preliminary in nature:
    - At most, high level scenarios
    - Many “User stories”

Why We Need Detailed Use Cases

- We need to identify all of the actors / stakeholders
- We need to be able to lay out the sequence in detail to support
  - Tool development companies
  - Process developers
  - People learning new aspects of MBSE usage
  - Language developers
- We need to identify all of the objects / features of objects being manipulated
  - For usability evaluation, including usability testing
  - To identify usability issues with the structure of models
  - For tool development
- We need to share good strong examples with each other, so that we can
  - Discuss them
  - Learn from each other
  - Manifest emergent insights that come through dialog
  - Move forward, together
NASA’s MBSE challenges (CSER)

- Vision of the future engineering environment:
  - Model-based artifacts
  - Seamless data flow
  - Distributed teams

- Major Issues:
  - Complexity
    - \( N^2 \) Interactions within a system or worse
    - Nonlinear growth of interfaces
    - SoS environment for integration
  - Verification and Validation have become significantly more difficult
  - Long Lifecycle – Models critical for decision support at every phase
  - Greater use of simulation creates transparency issues with
    - Validity & Scope of assumptions
  - Deterministic modeling hides significant uncertainties
  - Transparency

“All models are wrong, some are useful.” George Box

NASA MBSE Challenges (cont.)

- Efficiency, accuracy, cost effectiveness
- Current methods are “wetware” intensive
- Rapid & effective teaming
- Integration of discipline oriented tools
- Capturing design rationale
- Lossless integration across organization and tool boundaries
- Supporting operations with design data
- **All current implementation schemes do not fully meet data & interoperability requirements**
- Better integration with test & evaluation
- **Collaborative SE needed**
  - Libraries of parts
  - Incremental refinement of models through lifecycle
  - Rapid and diverse teaming
The NASA issues continued -- Where's all the DATA?

Organizations have their own data centers that are not integrated to support a large Program

Resulting in Different naming conventions
Different PLM structures
Different……


Product Model Integrates:
- Build Strategy
- System's Geometry
- System's Requirements
- Test and Verification Planning
- Operations Planning

Supports Developing Data One Time to use for the full Lifecycle
The Problem We Face

• Most large organizations face MBSE Challenges similar to NASA
• Taken in the aggregate from Use Cases and NASA:
  – Over half of the Use Cases assume significant integration of the MBSE env.
  – Over half of the Use Cases assume significant collaboration.
• To be usable, an MBSE Environment requires basic functions that make it “fit for use,” frequently including integration and collaboration support.
• SysML tool license trend:
  – Exponential growth
  – Strong evidence of perceived value
• We don’t know where MBSE environments are going
• The Learning Curve is exponential
• The integration and collaboration support assumed in the use cases and needed by many organizations do not exist, today.
• Our Resource limits are very real
  
  There’s a mismatch between the need and the resources

Finessing the Resource Challenge

• We’ve been working essentially as a project

• Insight:
  
  “Usability is an emergent quality.”
  
  – Ron Lyells

• Idea: Organize as a Community of Practice
  – Let expertise and leadership emerge naturally
  – Create a vast Internet-based collaboration
  – Needed: a space where people can practice, share, participate...
Key Thrust of the MBSE CoP

- Trust the MBSE Community of Practice
  - Support them
  - Facilitate them
  - Empower them
- Develop and Manage the Collaboration Environment
- Role of MBSE Usability Team
  - Create exemplars
    - Use Cases
    - Processes
    - Models
    - Measurement of Usability
  - Focus attention on excellence
- Who is the MBSE Community of Practice? We are.
- Who is the MBSE Leadership? You are.

Aspect of the MBSE Collaboration Space

A Place where people can:
- Talk about what they’re doing
- Share examples
  - Process
    - Tips
    - Techniques
  - Models
  - Tools
- Meeting place with tool vendors where they can get
  - Feedback
  - Observe work of leading practitioners
- Self Organizing
Examples of Internet Collaboration

• Wikipedia
  – Encyclopedia of Topics
  – Not a forum
• Google Groups
  – Dialog
• Google Code
• Google Sites
• Can we combine them?
• Weekly Meetings are desirable with discussions led by members of CoP
  – Ex. What is a library
    • Library Example
    • Discussion

What we can do now

• The proposed solution includes previously planned efforts
• Develop a detailed use case exemplar arch w/ libraries:
  – The detailed use case
  – The library needed for the use case
  – The model that the use case manipulates
• Develop other high value use cases as exemplars.
• Additional efforts, including:
  – Further discussion of: A shared vision
  – Presentation & dialog with the whole team
• Develop our own collaboration environment.
  – Core Capabilities that include a critical mass for initial use
  – A path toward full capabilities
  – Support Dialog about Artifacts
• Improve the working document
The MBSE CoP Collaboration Environment

- **Issue**: We need a supportive collaboration Environment for the MBSE CoP
- **Exemplar**: David’s preliminary investigation of GITHUB and Google Code
- **Tasks**: Identify candidates, examine them, build a consensus, choose, then:
  - **Implement**:
    - Initial Seed
    - Manage Growth
- **Set of Requirements**:
  - CM Support
  - Capability to Access and Publish Models
  - Capability to Access and Publish Documents
  - Support for Dialog
  - Strong support for Dialog linked to Artifacts (Models, Documents…)
  - Usability (Need definitions for this particular effort)
  - Other… (The set of requirements is definitely within the CoP’s purview.)
- **Issue Lead / Coordinator**: David Lempia

For further thought:

- **Collaboration Environment Issues**
  - Getting the collaboration infrastructure to **critical mass**. (What would constitute critical mass in this case?)
  - Attracting participation /building
  - Making the entry bar for participation low
  - How to design all this in such a way that people naturally add their creativity and it grows in a healthy way to go beyond the initial vision. (Design for emergence)
  - Incentives for participation:
    - The joy of participation
    - Social
    - Recognition – “Usability Heroes”
    - Awards
    - Prizes
Summary

- Use Case Analysis → Serious Mismatch between size of need and resources
- Insight: Usability is Emergent
- Solution:
  - From organizing as a project,
  - Move to organizing as a Community of Practice
- Our Role:
  - Build exemplars
  - Focus attention on excellence as it emerges from contributions
- What we can do now:
  - Develop Our MBSE Collaboration Environment
  - Develop Use Case Exemplars
    - Library-based development of Architectural Model
    - Others (There’s really no limit.)
  - Meet at International Symposium – Event Lead: Ron Lyells

“Let a thousand flowers bloom.”

Backup Slides
Using an Exemplar to Demonstrate a Practice

- **Exemplar** – An example of best practice in a domain
- **Structure of an Exemplar**
  - Objective of the Practice (Problem to be solved)
  - Task List – A list of the major tasks needed to solve the problem
  - The Example – Step by step description of how an engineer solves a specific problem, using specific references to domain objects.
  - Key Knowledge & Insights needed to accomplish each task
  - Key Skills & Techniques needed to solve each task
  - Tools that are useful in accomplishing the tasks
  - Artifacts – Inputs, Outputs and Intermediate Work Product
  - Tacit – Example Objects ground the exemplar in a “real world” practice
- **Supplementary Structure**
  - Key Competencies – Key abilities demonstrated by the exemplar
  - Connections to Key Issues / Themes in the domain

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Working Paper → Further Development

- Working paper is expected to keep evolving
- Problem section OK, but
  - Tighten it
  - Add nuances
- Integration section is soft - Ron
- Example needed for problem section – David
- People aspect → training processes should be mentioned
Roles

- Monitoring
  - Deduce
  - Summarize
  - Facilitate Next Steps

MBSE Usability Collaboration

David Lempia
MBSE Collaboration

- A place to share exemplars (ideal example model or pattern)
- discussions tied to each exemplars
- A place to publish exemplars
- A place to view exemplars (web compatible format)
- A place to discuss exemplars (tie discussion to exemplar)
- Support various SysML model types
  - Artisan RTS, Enterprise Architect, Magic Draw, Papyrus, Rhapsody, ...
- Configuration management

Possible solutions

- GitHub (https://github.com/dlacres/mbse_usability)
- Other Ideas?