Case Study: Custom Enhancement of MBSE Tools for Easier and More Accurate Use of the Transport Network Architecture

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Overview

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Introduction

- Projects are becoming increasingly complex
- Architecture Tools are axiomatic to the success of projects
  - Such as CORE, Magic Draw, ...
  - However, tools out of the box may not always provide desired functionality
    - Unrealistic to expect them to be able to meet all possible contexts
    - Tools are more effective when customised to specific application environments
      - E.g. TfNSW
Tool Development for the TfNSW Context

• UOW SMART is working with the ASA Systems Engineering Process Network and Standards Section to apply Model Based Systems Engineering (MBSE) to meet the needs of TfNSW for High Level Planning Capability across the organisation. This includes:
  – Asset Stewardship,
  – Standards Management,
  – Support for Competency Frameworks and
  – General Knowledge Management needs.

• The work described here used Magic Draw
  – Previously chosen by ASA as the preferred tool.

• Details of this engagement in my other presentation
MBSE Tool Enablers

• Typed Object-Oriented Database
  – Enables identification of what an object is
    • Better selection of objects to apply
• Use of SysML
  – Standardises the set of types that are found as model develops
  – Formalises relationships that are found
  – Constrains the language used
    • Makes easier identification of elements
• Architecture Frameworks
  – Populated content indicates the maturity and content of the available information
    • See next slide
Overview of MBSE Environment Enhancement Types

• Distribution of data and information
  – The ability to obtain data from other sources and propagate it forward

• Standardisation of Diagrams and Structure
  – Usability functions that reduce effort and increase consistency

• Validation of the model and anomaly detection
  – Feedback functions that improve the quality of the data
Data Exchange

- **Customised DOORS Exchange**
  - Existing tools enable transfer but often require manual manipulation
  - Automate manipulation
    - reduce effort
    - ensure greater tool integration

- **HTML Export**
  - Generate a generic model representation that can be published
    - Fully navigable
    - Maintains existing web presence

- **Generic Excel Import**
  - Built for compatibility with existing tools
    - Can be an alternate path from other tools (such as DOORS)
    - Was a trial to establish the ability to manipulate Magic Draw
  - Imports from previously used structures
  - Establishes relationships to existing data where possible
Automated Manipulation

• Diagram Formatter
  – Structures diagram data to meet ASA defined standards
    • Generates consistency between users and contributors
    • Moves, colours, & resizes content

• Replication detection and merger
  – Ensures robustness when multiple users develop parts of the framework
    • Essential for stakeholder engagement
  – Identifies and merges repeated content

• Automated data integration
  – Easier to generate new content and then integrate once approved
  – Tool takes content developed externally and places into the formal model area
  – Ensures model structure is maintained
Data Quality Feedback

• Orphan detection
  – Elements can be created that are no longer in any diagrams
    • Difficult to find orphans manually
  – Moves unrepresented elements into “orphanage”
    • Human then can decide the element’s fate

• Content Validation
  – Rule-based examination of elements to ensure they meet predefined criteria

• Requirement Text Validation
  – Examines text in requirements to see if they meet best practice
Orphan Detection

This connection represents the fact that there are multiple accessways of varying types that interconnect. Accessways may be hallways, escalators, lifts, stairs, etc. Therefore, this connection represents the ability to move from one form of accessway to another (e.g. hallway to stairs).
Development of Requirements Assessment Tool

• An expansion to Magic Draw that assesses Requirement statements
  – Based on ARM from NASA and similar research undertaken at UniSA

• Requirement Assessment Algorithm
  – Model Database is searched for requirements and each requirement is tested
  – Tests are a check against words that are commonly associated with problems in requirements
  – Generates a summary report and highlights errant elements
Conclusion

• This presentation has given a number of examples of tool enhancements
  – These have been customised to meet ASA best practice and their preferences
• These enhancements result in:
  – Better usability and readability,
  – Better knowledge management and
  – Accuracy
• Also, this has addressed many reservations that have previously limited stakeholder acceptance and/or uptake
  – Effort required to develop and maintain the information
  – Benefits from that effort