34th Annual INCOSE international symposium

hybrid event

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Unlocking Value in MBSE – Consistent Data Extraction & Visualisation from SysML Models with Rule-based Analysis

Introduction

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- Advocate of Model-Based Systems Engineering & Enterprise Architecture.

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- Previously a Systems Engineer at QinetiQ & BAE Systems.
- Specialty is Model-Based Systems Engineering.

Problem Statement

- Easy to create data, harder to extract value from well-formed system models.
- Difficulty in enforcing consistency in engineers' modelling styles. Focus on syntax and style.
- No systematic way to gain engineering and business value as a by-product of MBSE.
- True data-driven engineering processes require the data held in system models. Decision makers require access to proprietary tools.
- Impedes effective engineering project management.

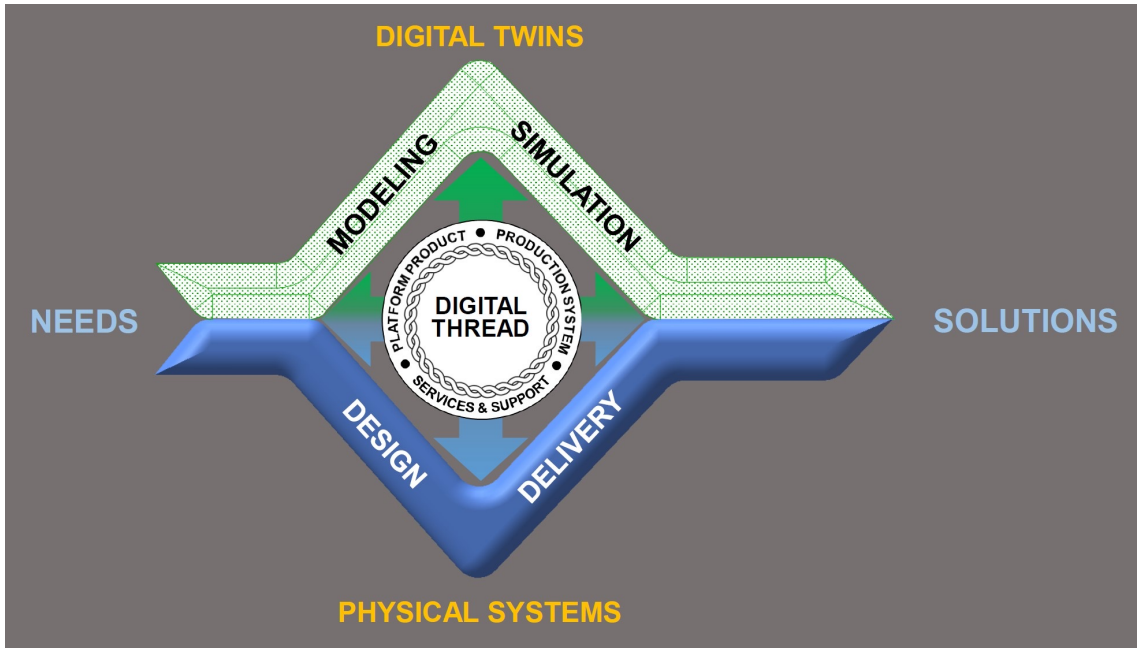
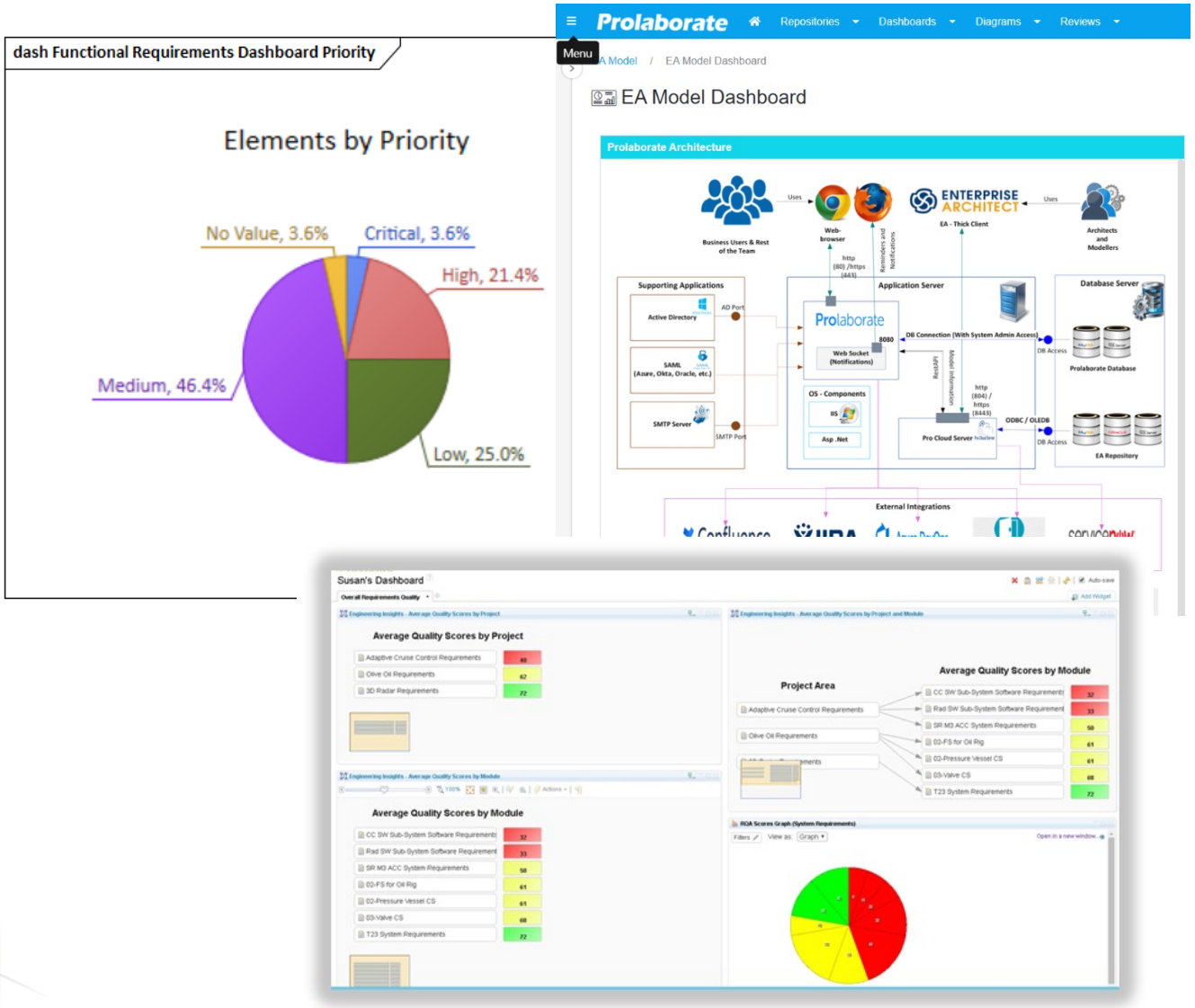


Image: Boeing

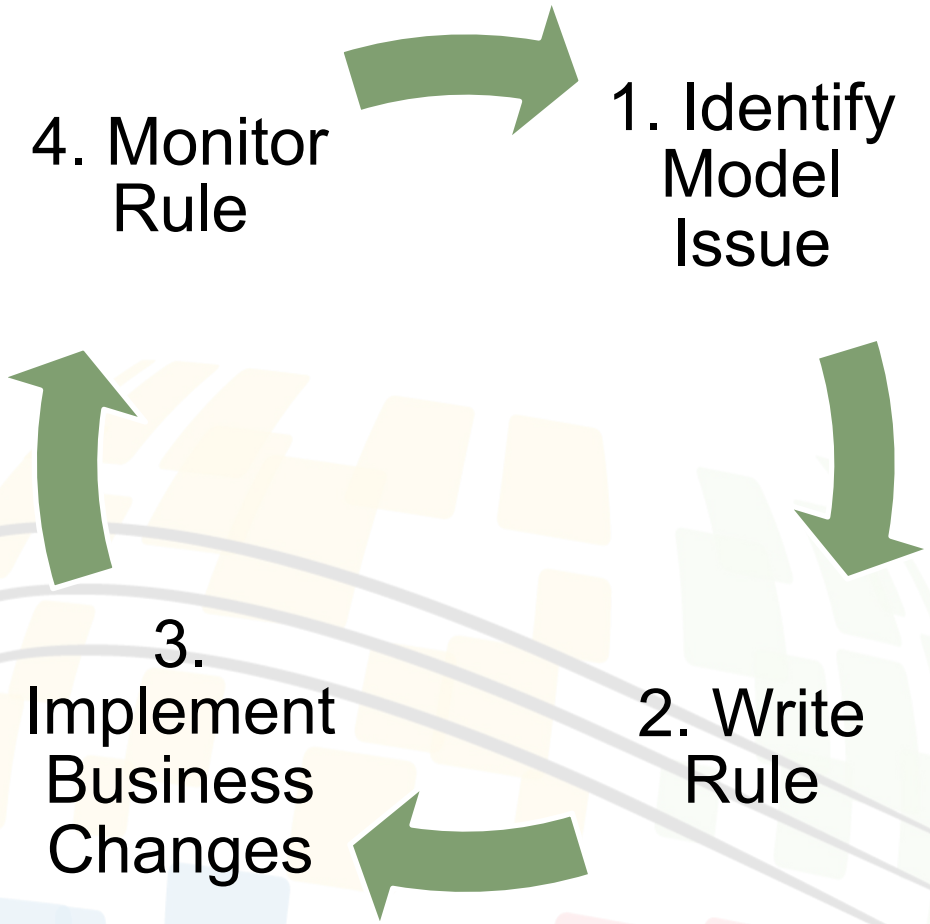
Current Capabilities

- Tool vendors have mixed data analysis options.
- Even fewer options for cross-vendor, standards-based analysis.
- Modelling standards are mature enough to enable rich business-intelligence collection.



Images (Clockwise): [1] Sparx EA [2] Sparx Prolaborate [3] IBM DOORS

Rule Based Analysis - Approach

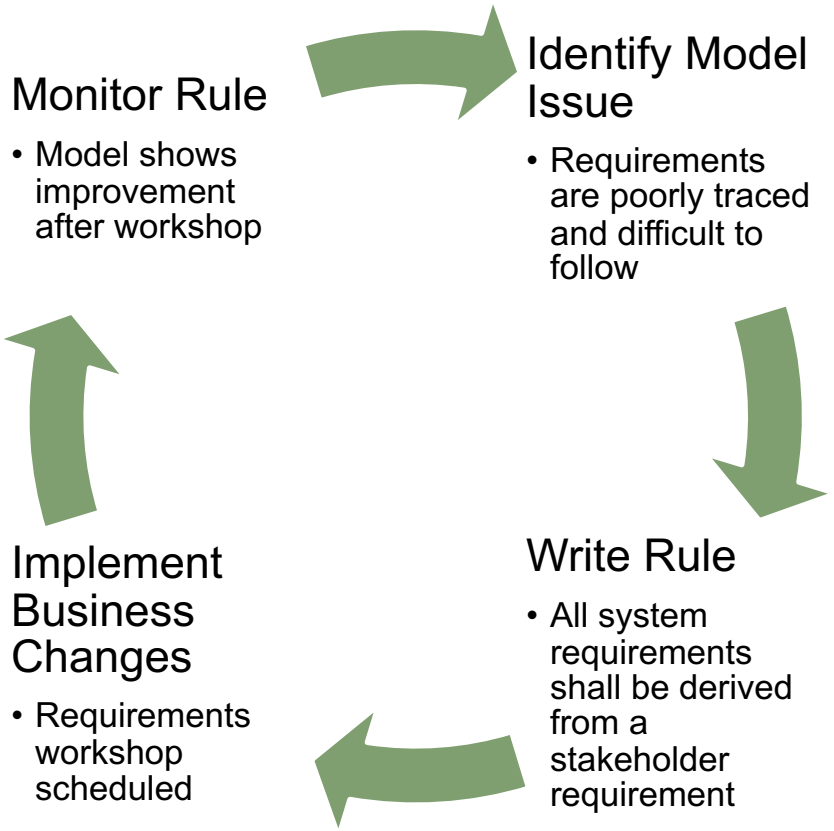


- Solution: Rule-based analysis approach.
- Rules are defined and constantly checked.
- Goal: Improve system models by showing a reduction in rule violations.
- By clearly defining rules, this targets improvements to actual problem areas (not broke, don't fix…).
- Comparable to test-driven software development:
  - "Unit-tests" for the system model.
  - Proportion of model covered by a rule equivalent to "code-coverage".
  - Tests before the model is complete, uncovers defects immediately.
  - Tests written after an issue is found to prevent recurrence.

Rule Based Analysis - Approach

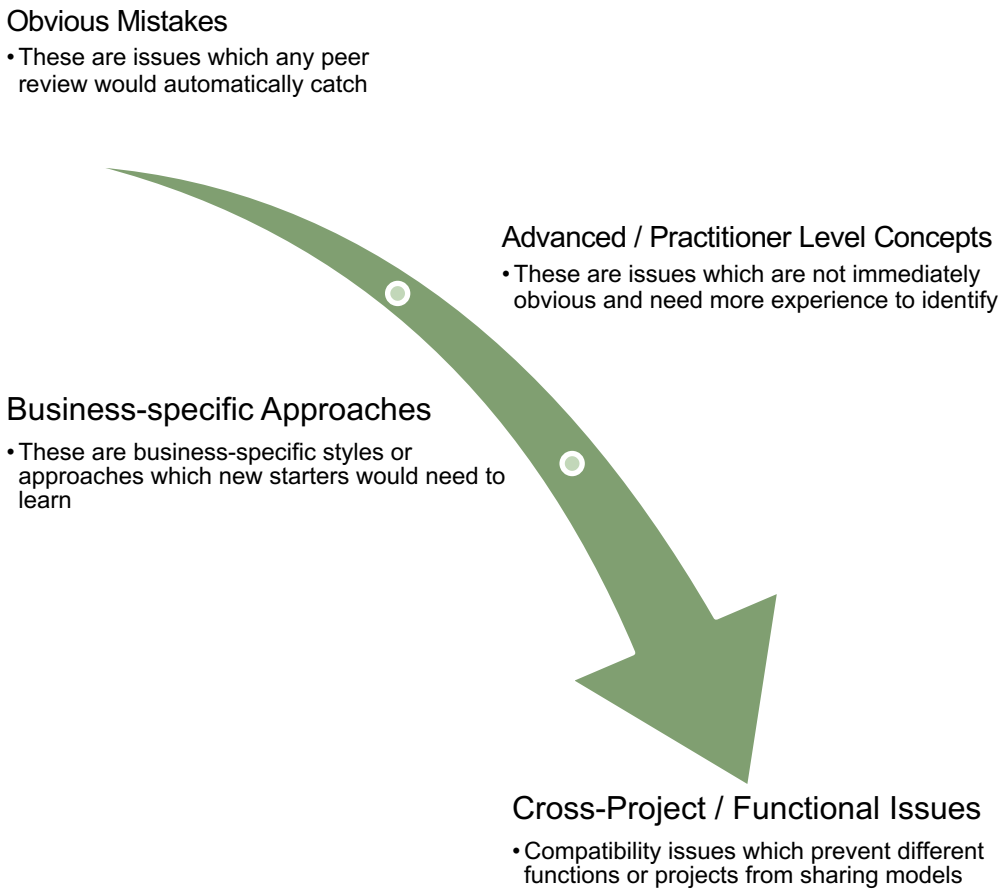
- The approach can be described simply as:

1. Identify issues that need correcting.
2. Write a rule which prevents the issue from occurring.
3. Make a change in the business which should correct this issue.
4. Check that the rule is positively affected by the business change.

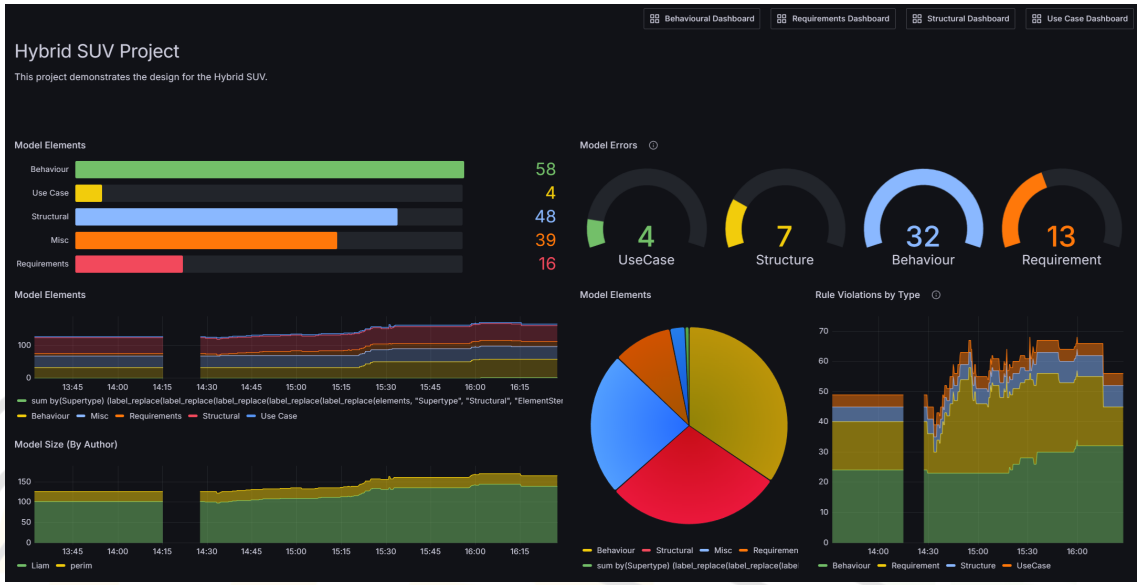


Rule Based Analysis - Approach Example

- Hierarchy of value as rules are defined.
- Initial value is reducing peer review:
  - Obvious mistakes - mandatory relationships missing.
  - Modelling tools normally do this - SysML Validation checkers.
- Later value in unlocking nuanced issues which are difficult to detect:
  - Extended attributes being used incorrectly, accidental custom properties or stereotype / profile errors.
- **For every new issue, a rule is written to find every similar occurrence (present or future).**



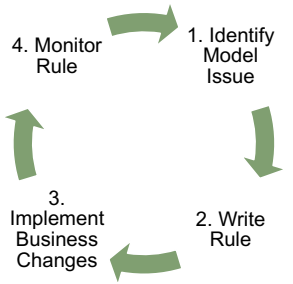
Demonstration



- Demonstrate the rules and metrics using a mock Hybrid SUV project:
  - Not about the specific rules, but the *approach* of defining a rule and seeing it affect a modelling task.
- Applicable to any modelling tool or model type, this example uses:
  - Sparx EA SysML model.
  - Prometheus and Grafana as the query and visualisation back-end.
- Everything shown is open-source 3rd party software and a how-to guide is in our GitHub (*perimehmet/mbse-metrics*)

Summary

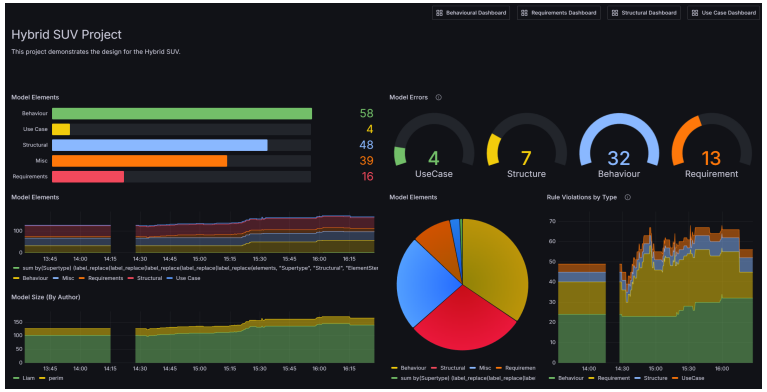
- Difficult to extract value from SysML models due to inconsistent modelling styles and a systematic approach, hinders progress.
- Varying data analysis options with current tool vendors, limited integration. Modelling standards are mature enough to enable business intelligence collection.
- Rules are written when an issue with the model is identified. Encourages a review of business processes.
- Initial value in reducing peer review, later value in identifying nuanced difficult to detect modelling issues.



Conclusion

- A methodology to define rules that allows for consistent data extraction and visualisation of system models.
  - Visualise and measure progress – Model readiness for review.
  - Identify and fix mistakes – Improve system model.
  - Consistency amongst engineers.

- Tool and model style agnostic. Visualisation and querying tools are open source. Github: perimehmet/mbse-metrics



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