

Input to SysML v2 Requirements October 31, 2015

1. As chair of the Model Management WG, Lonnie VanZandt recommended the following paper for consideration as an input to the requirements for SysML v2 (refer to Lonnie email below dated Oct 31, 2015, and link to recommendation and paper):

A documentation framework for architecture decisions

U. van Heescha,b,*, P. Avgerioua, R. Hilliard c

Available online October 2011

Some preliminary general and specific observations from Sandy Friedenthal are included below based on a cursory review of the paper:

GENERAL OBSERVATIONS

- Paper provides 4 Decision Viewpoints along with the supporting meta-model and modeling notation that is intended to provide a framework for architecture decisions. The framework provides traceability among decisions, including rationale, impact, and chronology.
- Viewpoints include:
 - Decision Detail viewpoint mainly addresses concerns related to decision rationale
 - Decision Relationship viewpoint focus on relationships between decisions
 - Decision Stakeholder Involvement viewpoint allows one to explicate the relationships between stakeholders and decisions
 - Decision Chronological viewpoint was developed to satisfy the remaining temporal concerns in decisions
- Key concepts include.
 - Decision and its state (e.g., approved, rejected, ..)
 - Decision Group
 - Alternative
 - Rationale
 - Concern
 - Stakeholder
 - Decision relationship (caused by, depends, excludes, ...)
 - Decision sequence, actions,
- Consider these concepts as an input to SysML v2 Concept Model which will form the basis for SysML v2 requirements.
- The MMWG needs to determine which of these concepts explicitly relate to the scope of model management, and update the model management white paper baseline accordingly

SPECIFIC OBSERVATIONS

- A critical systems engineering activity is conducting trade studies among alternatives that include:
 - Assumptions
 - Alternatives
 - Criteria
 - Objective function
 - Decision outcome (i.e. selection)
 - Rationale

- There is a large body of knowledge from theory and practice that is available on trade studies and decision analysis that should be included in the concepts for SysML v2.
- In the original UML for Systems Engineering RFP from March 2003, the following related requirements were included, but not implemented in SysML v1.

6.6.1 Topology

UML for SE may provide the capability to model a network of nodes connected by arcs, which include the following features:

- Properties can be associated with an arc or node.
Note: **In typical decision analysis**, the path (arc) attributes can include an attribute with a probability distribution, which represents the likelihood of the path, and one or more additional attributes, whose value is determined by expressions representing the cost associated with the path.
- Model elements can be associated with an arc or node.
Note: **In a typical tradeoff analysis, design alternatives** can be associated with different nodes.

Note: This provides a generalized graph to represent **decision trees**, and other general-purpose models to aid in analysis.

6.6.3 Trade-off studies and analysis

UML for SE may provide the capability to support trade-off studies and analysis with the following features:

- Describe **alternative models** that may use common modeling elements.
Note: This may include a reuse library of predefined components, functions, parametric models, etc.
- Describe **criteria** for evaluating the alternatives, along with their weighting.
- Model the **effectiveness measures** and corresponding **optimization function**, to assess how well the alternatives satisfy the criteria and weighting.

Note 1: The optimization function may be represented using a parametric model.

Note 2: The solution to the topology requirements in 6.5.6.5 may be integrated with the solution to these requirements.

- In the current SysML v1.4 specification, the following related concepts are included:
 - Stakeholder
 - View
 - Viewpoint
 - Concern
 - Rational (along with integration with analysis models through parametrics)
 - Problem/Issue

- Some key missing concepts that should be included in the SysML v2 concepts are:
 - Trade study and its attributes noted above
 - Decision making under uncertainty including risk concepts
 - Concepts from the referenced decision framework that support decision traceability
 - Stakeholders who contributed to the decision outcome
 - Stakeholders impacted by the decision outcome
 - Relationships among decisions
 - Decision outcome chronology
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- Many of the concepts in the referenced decision framework are not limited to architecture decisions, but can apply more generally to any decision and to other concepts. For example, the *caused by* relationship also applies to failure analysis where one failure can be caused by another. (Note: caused by relationship should support logical combinations of causes such as and, or, nor, and not)

The above is a response to the following email from Lonnie VanZandt:

From: incose-mbse-mmwg@googlegroups.com [mailto:incose-mbse-mmwg@googlegroups.com] **On Behalf Of** Lonnie VanZandt

Sent: Saturday, October 31, 2015 3:12 PM

To: INCOSE-MBSE-MMWG

Subject: INCOSE-MBSE-MMWG: An "Activity Page" to record our Suggestions on the Evolution of Notations to support MLM

<http://www.omgwiki.org/MBSE/doku.php?id=mbse:modelmgt:notations>

As we have discussed, Sandy and Laura Hart from the OMG SysML Specification community have asked our team (as well as others, of course) to forward them suggestions for the evolution of the next generation of SysML that would support Model Lifecycle Management.

The link above offers a convenient place to record such suggestions. Please understand that you are individually encouraged to contribute your suggestions without the overhead of a peer review or editorial process. As a team we can "curate" the suggestions to make more formal, more consensual recommendations to the SysML community. Also, appreciate that at all times, the traditional processes for feeding change requests into the Object Management Group remain available to each individual and this is not a decree to anyone to alter their established and preferred practices.

To seed the collaboration, I wrote down one such suggestion. Visit the link to see the format and content that I offer for these suggestions.

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