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Model Based Systems Engineering Usability Issues

Sanford Friedenthal
3/21/10

The following are a preliminary set of key usability issues from a primarily SysML language and tools perspective. Clearly, we have a long ways to go to improve the usability of SysML in support of MBSE. Some of the usability is inherent in the complexity of system modeling, but much can be done to enhance it.

a)   Inherent complexity of supporting multiple views/perspectives. In SysML, this involves such things as keeping track of the multiple relationships betweeb structure, behavior, parametrics, and requirements. SysML does include support for network tables and trees can also be used in SysML as indicated in the paragraph included from Annex A below.

Graph and tree representations are also optional, alternative notations that can be used in conjunction with graphical symbols as long as the information is consistent with the underlying metamodel. These representations can be used for describing complex series of relationships that represent other views of the model. One example is the browser window in many tools that depicts a hierarchical view of the model. The implementations of graphs and trees are defined by the tool implementations and are not standardized in SysML at this time. However, graph and tree representations may be included in a frame with the heading designator «graph» or «tree» in bold.

b)   Potential for information overload due to the multiple features of SysML to represent a broad range of semantic content on each diagram. For example, in activities, there are annotations for optional, streaming, pre/post conditions, object state, control vs data, different action types, etc. This is a lot for an individual to learn and interpret. However, SysML does allow one to elide (i.e., hide) information on a diagram and only show the relevant aspects they want to convey.

c)   The graphical syntax is predominantly boxes, arrows, and textual annotations. A more visibly pleasing representation would be preferred that could include more interesting symbology, and perhaps iconic representation for specific user constructs, such as an image for an engine instead of a block called engine. SysML does include the ability to augment a stereotype with an image. However, we may need a more robust capability in the language to provide a standardized image library to represent many different types of user constructs. Languages such as Modelica offer a library of images that we perhaps could leverage.

d) SysML tools generally include a lot of terminology and additional information that is a carryover from UML, and should be hidden from the user in SysML. Each vendor should look at their user interface and carefully determine whether it is essential for the SysML user.

e) SysML tools could reduce the amount of steps a system modeler is required to make by incorporating certain defaults and other mechanisms that support the typical usage. For example, when creating composition relationship, the navigability, multiplicity, default role name, etc could all be set.

Usability enhancements could be directed to a couple of areas.

a) The new user who is just learning SysML. Are there ways we can significantly reduce the time to develop a basic level of competency. We have talked about defining a SysML Lite. In fact, the new SysML certification includes a basic feature set that could be a starter. In addition, we are thinking of including only a subset of the diagrams in SysML Lite such as bdd, ibd, activity, requirements, and use case.

b) The reviewer of SysML modesl. Are there ways to more effectively convey large amounts of information that is embedded in the SysML model

The approach to address these issues should consider how to influence both the language and tool vendors in the nearer term vs the long term. We have some ability influence the language in the nearer term through the SysML Revision Task Force. One could work with the tool vendors directly to guide their implementations.

One additional note is that the Diagram Definition submission is near adoption by the OMG . This may be of interest to this effort. In past efforts, the diagram standards were primarily focused on interchange of the diagram layout information as opposed to usability. I am not entirely sure what the focus of this RFP is, but I could put you in touch with some of the participants.

Finally, a task and cognitive analysis could be very helpful to better understand the challenges. This could be planned as part of longer term research efforts.

Sandy

Sanford Friedenthal
Lockheed Martin