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The UML™ for Systems Engineering Initiative

This is the first in a series of articles on the Systems Engineering for UML Consortium, (SysML). This article will give the background to SysML and its goals and guidelines. Future articles will look at specific areas and review projected changes to UML to support Systems Engineering.

Overview

The UML has, since its adoption in 1997, proved immensely popular with software engineers to the point where it is now the only widely used visual modelling language for software engineering. In the past, UML's software focus has discouraged many system engineers from adopting it in earnest. However, many Systems Engineers believed the UML to be sufficiently flexible and robust to support extensions to address the needs of systems engineering. One of the strengths of UML is its built-in mechanisms for specializing the generic forms of its modelling elements to more application-specific variants. Collectively, these provide a capability for UML "Profiles" that package specific terminology and substructures for a particular application domain. Exploiting this has the potential to achieve a *"standard modelling language for systems engineering to analyse, specify, design, and verify complex systems, intended to enhance systems quality, improve the ability to exchange systems engineering information amongst tools, and help bridge the semantic gap between systems, software, and other engineering disciplines."* (www.omg.org)

Consequently, the decision was made by the Object Management Group (OMG) to pursue UML for systems engineering. This was made following a series of discussions at the INCOSE International Workshop in January 2001. Dave Oliver represented INCOSE at the OMG Technical meeting in July '2001, to initiate a liaison with the OMG to support the evolution of UML for Systems Engineering. At the meeting, the Memorandum of Understanding between OMG and INCOSE was signed, and the Systems Engineering Domains Special Interest Group (SE DSIG) was chartered with Sanford Friedenthal as the chair. The SE DSIG kickoff meeting was held on September 13, 2001 in Toronto.

In March 2003, the OMG issued a Request for Proposal (RfP) for a customized version of UML suitable for Systems Engineering written by the SE DSIG. Here's part of the introduction to the RfP:

"This Request for Proposal solicits submissions that specify a customization of UML™ for Systems Engineering (SE). The customization of UML for systems engineering is intended to support modeling of a broad range of systems, which may include hardware, software, data, personnel, procedures, and facilities. The customization of UML for SE should support the analysis, specification, design, and verification of complex systems by:

- ❖ *capturing the systems information in a precise and efficient manner that enables it to be integrated and reused in a wider context*

- ❖ *analyzing and evaluating the system being specified, to identify and resolve system requirements and design issues, and to support trade-offs*
- ❖ *communicating systems information correctly and consistently among various stakeholders and participants”*

Now, five months after issuance, it looks likely that there will be only one technology submission, called SysML. The SysML consortium (www.sysml.org) has a broad range of members, including system engineers, tool vendors, government organizations and academic institutions. ARTiSAN Software Tools is an active member of the SysML consortium.

The UML for SE initiative is a very important step forward in persuading system engineers to use UML and the timetable for adoption of UML for SE is correspondingly aggressive:

Event or Activity	Actual Date
<i>Platform Technical Committee (PTC) votes to issue RFP</i>	<i>March 28, 2003</i>
<i>Letter of Intent (LOI) to submit to RFP due</i>	<i>September 8, 2003</i>
<i>Initial Submissions due and placed on OMG document server (“Three week rule”)</i>	<i>October 27, 2003</i>
<i>Voter registration closes</i>	<i>November 17, 2003</i>
<i>Initial Submission presentations</i>	<i>November 2003 meeting</i>
<i>Preliminary evaluation by Analysis and Design Task Force (ADTF)</i>	<i>November 2003 meeting</i>
<i>Revised Submissions due and placed on OMG document server (“Three week rule”)</i>	<i>March 29, 2004</i>
<i>Revised Submission presentations</i>	<i>April 2004 meeting</i>
<i>Final evaluation and selection by ADTF Recommendation to Architecture Board (AB) and PTC</i>	<i>June 2004 meeting</i>
<i>Approval by AB Review by PTC</i>	<i>June 2004 meeting</i>
<i>PTC votes to recommend specification</i>	<i>June 2004 meeting</i>
<i>Board of Directors votes to adopt specification</i>	<i>August 2004</i>

The UML for SE specification will include standard UML diagrams with applicable extensions for UML for SE, and other diagram types as needed. One example is the System Context Diagram, which includes a depiction of the input/output flow between the system and/or components, and the elements in its environment. Artisan has argued for many years that this diagram is essential to good Systems Engineering, and indeed has been available in its tool, Real-time Studio for the past 5 years. Other models include, parametric models, requirements relationships, causal analysis, verification models, and decision trees. Finally, it has become clear that many of the key requirements of the RfP, will be far more easily met using UML 2.0 rather than UML 1.5 as a basis. For example, structure diagrams and the sequence diagram extensions.

My experience of the SysML consortium and its members makes me very confident that our submission, when adopted as a standard by the OMG, will facilitate the rapid uptake of UML by the majority of the systems engineering community. However, it should be noted that systems engineers in many organisations are already using UML 1.X to great effect and that if you are already thinking about adopting UML you don't necessarily need delay adoption until the standard emerges in 2004.

If you have any questions, please feel free to email me at MatthewH@Artisansw.com. More information on SysML in general can be found at www.sysml.org.