

ABSTRACT

**“PROXY VIEWPOINTS MODEL-BASED REQUIREMENTS DISCOVERY: A
NEW NASA NET COURSE”**

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This technical presentation addresses the problem of “missing requirements” in systems and software requirements specification (SRS) expressed in natural language. Missing requirements for a satisfactory NASA mission are, after the fact, reasons for having NET courses that train engineers to reduce the number of ‘negative’ lessons learned, while increasing the occurrences of ‘positive’ lessons learned. Due to rapid changes in NASA technology and business frequently witnessed over time, the original requirements related material, e.g. SRS documents, often experiences the problems of missing, not available, and hard-to-locate requirements. Such problems can be further decomposed into the following sub-problems: 1) Earlier technical solutions do not consider missing requirements from multiple viewpoints; 2) SRS documents, for example, with many missing requirements typically tend to be poorly structured and maintained as well as hard-to-trace; 3) SRS documents, for example, with missing requirements represent an incomplete domain model; 4) Manual discovery (identification and incorporation) of missing requirements is highly labor intensive and error-prone. These inherent rigid sub-problems do not allow efficient adaptation of, e.g. NASA

mission, SRS changes and improvements. Most SRS documents today are plagued by a combination of one or more of these problems, and they become even more prevalent while dealing with legacy status (Alderson and Shah, 1999) SRS. Therefore, there is a strong need to develop a new methodology that can provide improved solutions to these technological problems and lengthen the life span of NASA SRS. Moreover, such a new methodology should be sufficiently well validated that it can be taught as a NASA NET training course.

In this technical presentation, a new methodology entitled “Proxy Viewpoints Model-based Requirements Discovery (PVRD)” is presented as trainable technology to partially solve this problem. Through the requirements discovery and analysis process, the PVRD methodology provides a way to construct proxy viewpoints models from legacy status natural language SRS documents. Proxy viewpoints is an approximation of viewpoints that would have been constructed if the requirements of the domain were well-engineered from the beginning of a software development life cycle by using one of the viewpoints oriented requirements engineering methods such as VORD (Kotonya and Sommerville, 1998).

The PVRD methodology consists of the application of four models: viewpoints model, enterprise model (e.g. NASA enterprises), missing requirements types categorization model, and requirements discovery and analysis model. The viewpoints model represents different perspectives or views for coverage of direct and indirect stakeholders that need to be identified and incorporated into the legacy status software system requirements. The

enterprise model provides a way of categorizing requirements based on systems engineering design process models. The missing requirements types' categorization model provides a method to project a requirements space that may contain a specific type of missing requirements. The requirements discovery and analysis model provides a method to retrieve requirements of interest by using the requirements term expansion method that automatically generates a list of "potential query terms" which assist analysts and subject matter experts in acquiring more knowledge about the domain of interest by performing a "complete search" of available requirements resources.

Based on this integrated framework, the PVRD methodology is able to create a proxy viewpoints model and provides a new way of discovering missing requirements while improving the requirements representation space through the new indexing structure that supports multiple viewpoints from many stakeholders in a large-scale complex software system.

Real large scale explanatory scenario-based case studies have been developed in the finance and information application systems domains not only as a way to validate the methodology but also to show its uniqueness and novelty and to provide exemplary guidance for researchers from academia and real practitioners from industry. Various evidence and findings that support the propositions of this study prove that the PVRD methodology provides an integrated environment that supports a requirements discovery and analysis process as well as efficient management.

This exciting new systems engineering quality assurance technology invented recently by the presenters will be presented as vital new ways to expand upon and enhance the NASA-NET and Needed Lessons Learned Courseware Capabilities.

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