

Engineering Ontologies & Knowledge Management

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Abstract

Engineering in general, and product development processes in particular, are knowledge-intensive practices in which multiple disciplines with dispersed knowledge sources contribute to achieving a common objective. Since knowledge-based activities are responsible for 65% to 75% of the total added value of the products in engineering and manufacturing organizations, managing them has become a crucial everyday activity in such organizations. To implement a knowledge management solution in an engineering organization some important steps need to be taken. First, a methodology with associated tools for managing the lifecycle of knowledge should be adopted. Knowledge lifecycle starts with capturing tacit knowledge from people as well as other sources. Next, based on a generic and some domain-specific ontologies, knowledge is structured and represented in an easy to understand format with the help of 3D visualization techniques. Structured knowledge is then transformed into a formal representation (i.e., a knowledge model) that is understandable by computers. Some of the knowledge models can be executed by computers to generate new knowledge that will be stored in a knowledge repository. Finally, a knowledge portal provides a single point-of-access to the knowledge repository and a set of tools for analyzing, validating, versioning and maintaining knowledge in all stages of its lifecycle.

Among the steps for implementing knowledge management solutions in an engineering organization, creating an ontology library is a very important step. An ontology library normalizes the contents of knowledge repositories based on a set of agreed-upon formal definitions for the terms and concepts in the domain of interest. It provides a knowledge backbone for an organization so that knowledge-based systems built on top of it can be seamlessly integrated. Specifically, an engineering-oriented ontology library makes it possible to extract the design intent in a product development process by providing a meta-model in which the relationships between requirements, specifications and design candidates are explicitly represented. As a result, in each design process, that is one instance of the meta-model enforced by the ontology, the rationale for specific design decisions can be traced back to their associated requirements and/or constraints.