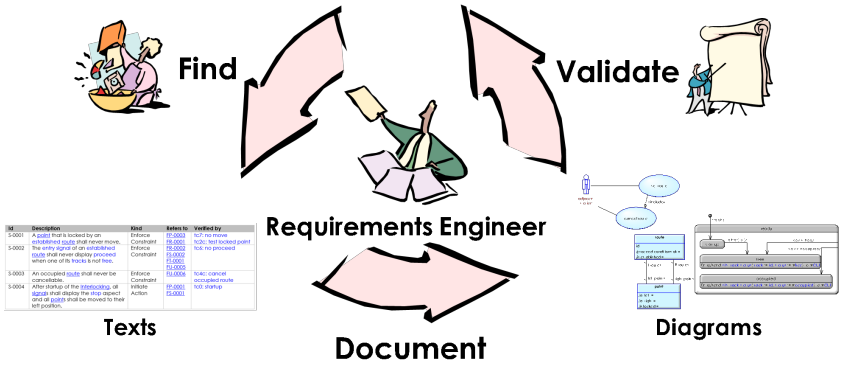
Model-based Requirements Engineering: Validation by Execution

Model-based Requirements Engineering (MBRE)

Overview

Requirements engineering is the continuous process of **finding**, **documenting**, and **validating properties and features** of a desired solution in order **to achieve some goals**. Doing requirements engineering in a model-based fashion means to describe those properties and features as individual pieces that

- are **understandable** for all relevant stakeholders
- **may be validated** with respect to the intentions of the stakeholders
- are **realizable** within given project constraints
- are **reusable** across systems, system variants, and projects
- are **traceable** to their sources as well as to their realizations.



Finding requirements means elaborating the needs of the environment of the system to be realized as well as capturing the relevant knowledge of the experts in the relevant domain. This also includes identifying the relevant stakeholders as well as the proper delineation of the system's context and scope.
Documenting requirements in an appropriate modeling language helps the requirements engineer to understand the domain and raises important questions early. Formal modeling languages and corresponding tools foster internal consistency of the set of requirements.
Validating requirements ensures that the intentions of the important stakeholders of the system are properly captured by the requirements and that any disagreement among them is resolved by finding a consensus.

Executable requirements for early validation

Formalizing requirements so that they are immediately executable enables early validation and ensures that the "right thing" is being built. **KnowGravity has the unique capability to develop executable requirements** by employing executable UML (xUML) to produce executable and testable requirements. xUML is a simplified "**reduced to the max**" variant of the Unified Modeling Language that is specifically designed for requirements engineering. Utilizing this technique is particularly helpful in the following situations:

- A system shall exhibit complex dynamic behavior such as industrial control systems or information systems with complex business logic
- The functionality to be provided to the users of the system is unclear and needs to be elaborated in quick iterations
- A high reliability system is mission- or safety-critical and demands extensive testing

MBRE as a Service

Employees of KnowGravity are proficient in various techniques to find and validate requirements. They are also familiar with a set of modeling languages that appropriately fit the needs of many projects and the people involved. Specifically, KnowGravity may help you to carry-out the following MBRE-related activities:

- Collaborative elicitation of functional and non-functional requirements for a new system or for changing an existing system, including effort estimation and impact analysis
- Functional prototyping with executable requirements to validate complex functionalities or to explore functional variations
- User interface prototyping to explore and evaluate user acceptance to formulate requirements that ensure a consistent user experience
- Identify large-scale requirements reuse across system and product families
- Systematic derivation of traceable safety and security requirements from a risk analysis to achieve compliance with relevant standards
- Improve the quality of an existing set of requirements in terms of comprehensibility, consistency and reusability
- Introduce a change management process for controlled requirements management
- Setup of a professional requirements management infrastructure including tooling
- Analyze and optimize the system's environment
- Generate a high quality precise system specification/documentation

Typical Applications

Typical examples for efficient application of MBRE include:

- Complex heterogeneous systems comprising of both, hardware and software
- Mission- or safety-critical systems
- Product families with many variants and configuration options
- Software systems with complex functionality with lots of functional variants
- Systems with long lifecycles and frequent updates
- Systems developed in an offshoring/outsourcing context

Related Services

In addition to model-based requirements engineering, KnowGravity offers the following complementary services:

- The xUML Starterkit offers a fixed price proof of concept for executable specifications in the customer's domain
- Model-based Risk Analysis (MBRA) to focus requirements elicitation on the most critical safety and security risks
- Training, consulting and doing Model-Based Requirements Engineering (MBRE)

Why KnowGravity?

- KnowGravity has comprehensive engineering experience in a wide spectrum of systems, domains and techniques
- All employees of KnowGravity are modeling experts for business systems as well as for technical systems and are proficient with many domain specific modeling languages
- KnowGravity is an active OMG member in several modeling working groups and supports OMG's SEMAT/ESSENCE approach for agile project management
- KnowGravity has developed its own modeling tools (KnowEnterprise®, KnowDocs™, CASSANDRA) out of the need of its customer projects

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