

The Requirements Engineering (RE) activity is crucial in software engineering. A failure when defining the requirements of a system could increase the costs of the entire product development process. This problem is even more critical in the Software Product Lines (SPL) development, since the definition and specification of requirements must deal with a new dimension: requirements variability. Requirements variability is specified during the domain engineering process, in which variability points are defined so as to distinguish which requirements will be common, and which will be variable. These variability points are resolved during an application engineering activity called requirements derivation in order to obtain the requirements for a specific product.

Another paradigm that is widely applied in SPL Development is Model-Driven Software Development (MDS). MDS can reduce production costs by increasing software reuse. Despite this fact, the RE approaches for SPL found in literature have some weaknesses. Many of the current approaches represent the variability information in the requirements models, thus reducing the requirements' readability. Moreover, the RE approaches for SPL used during application engineering are normally limited to deriving the product requirements from the SPL requirements and do not indicate how to represent non-existent requirements in the SPL: the delta requirements. This has an undesirable effect on the flexibility of the approaches.

The aim of this thesis is to define and validate an RE approach in the context of SPL that will support the definition and specification of the requirements of an SPL, allowing them to be derived from the requirements of a product using the MDS paradigm, and also supporting the definition and specification of delta requirements.

In this context, we have defined a process called FEDRE. During domain engineering, strategy definition and requirements specification obtained from model features are used. During application engineering, the derivation and validation of product requirements ensure that requirements meet customer needs. The necessary delta requirements could be specified, when they will be required, with the aim to prevent that product requirements are limited to a mere combination of LPS requirements.

Moreover, a technological approach based on a MDS strategy was defined. During domain engineering, the variability of the SPL and the requirements variability are represented as multi-model views, and traceability relationships are established among them. During application engineering, the product configuration is defined and the requirements of the product to be built are derived using a strategy based on model transformations.

The process proposed in FEDRE has been validated using two quasi-experiments. In the first quasi-experiment, the SPL requirements were specified with the aim of validating the FEDRE domain engineering guidelines. According to the results, FEDRE was perceived as easy to use and useful as regards specifying the requirements for an SPL. In the second quasi-experiment, the requirements of a product were validated with the aim of verifying whether the customer needs were covered. In the case of their not being covered, the participants specified the delta requirements. Most of the subjects were able to correctly identify what needs were covered and which requirements had to be added as delta requirements.

This dissertation contributes to the field of development of SPL by providing a process and technology, along with an automated and generic approach with which to define and specify requirements in SPL environments.