

Requirements on Tailoring Product Line Development Processes

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1 Motivation

Product lines offer a high level of reuse and have been successfully used in the industry [4] and are an option to modernize software systems. The continuous derivation of applications based on a product line requires the continuous change and adaptation of the product line to new and changed customer requirements without breaking existing product line application. This is a steady modernization of the product line and its derived applications. Despite the success of product lines, the development of software with the product line approach is still in its early stages when it comes to the analysis and assessment of a product line development process to enable the initial tailoring of the process and continuous adaptation to its changing environment. Development process tailoring towards an enhanced CMM level can result in a development effort reduction of up to 21% [1].

The importance of a product line for a company is given by its large number of generated applications. Thus, any changes to the environment or the derived applications require a holistic view, analysis and adaptation of the product line and its development environment. *Process lines* [3] are a structured approach to handle several similar product line development processes, tailor and derive development processes. A process line manages the models of methods and development processes. Given the complexity of methods and processes their management with the modeling approach is a vital necessity.

This position paper presents requirements for the tailoring step of product line development processes based on process lines and concludes with the proposal of enhanced process lines.

2 State of the Art and Resulting Requirements

Standard process models are not yet capable of handling the domain/application engineering separation of a product line development. Domain engineering deals with development of common and variable assets which are integrated in a product line framework. Application engineering uses the product line framework with a user-selected set of variable assets [4]. The two processes relate to each other via a repository for the

common and variable components.

Tailoring a product line development process based on a process line should address the context of the project, expressed by project, organizational, product, personnel, political, and technical parameters as stated in [2] and [5]. Although a tailoring activity is part of the process line approach, the decision support for the feature selection is still immature [4].

The first step towards a decision support for tailoring a product line development process based on a process line are the requirements to be addressed for such a decision support. The combination of [2], [5], and own experiences results in the following list of tailoring requirements:

- RE00: *Team size*. The different roles present in processes need to be shared/distributed amongst the given team members. For product lines, we need to elaborate on the minimal set of roles mapped to individuals to succeed with a project with the required quality level (see RE04).
- RE01: *Resources*. Any shortage on resources might lead to the deletion of tasks, reduction of deliverables in number, in the level of detail, or in the formality level. For product lines, development tasks need to be prioritized and structured according to an organizational and a customer view, although their goals might not be the same. Thus, any reduction of development process elements should be analyzed according to its impact on the corresponding stakeholder goals.
- RE02: *Global distribution* of the team. Several languages need to be supported as well as different cultural needs, e. g. the level of process documentation detail is different across countries. In effect, product lines require a multi-level view on globalization. A single product line project can have differently tailored development processes which need to be maintained within their originating process line.
- RE03: *Standards* (e. g. IEC61508). The documentation of the development process has to meet the required standards. The standards differ between countries and domains, what causes the

standards themselves to form a part of the variability model of the process line.

- RE04: *Quality level of the development.* For a higher quality level, deliverables could be added, reviews could be enhanced, or scoping steps in the project could be re-adjusted. Quality requirements should be mapped to development tasks. In combination with the above mentioned stakeholder goals of RE01, the impact of changing goals can be analyzed.
- RE04a: *Quality within the requirement phase.* Enhance the number of iterations, meetings, documents. Again, a quality mapping as in RE04 is needed.
- RE05: *Politics, company internal.* Re-evaluate the business drivers more often to ensure the commitment of the management. Add development tasks to enhance the involvement of the management. Product lines developments are typically spread amongst several organizational parts in a company. Thus, all the different politics and strategies are required to be integrated into a model.
- RE05a: *Politics, in different countries / cultures.* Different legal environments require an additional synchronization task towards a legal variability model. This model should be connected with RE02. In addition, a product line development process needs frequent consistency checks to address the changing legal environments.
- RE06: *Technology is unknown.* A prototyping task could be added or enhanced, training might be needed, additional test tasks are needed, or the quality parameters for the testing steps need to be adjusted. A product line development process should be tailored according to the project specific hardware/software dependencies which should be part of the process line.
- RE07: *Dynamic Tailoring* requires indicators to be in place to notice the needed tailoring changes as soon as possible. Given the long living nature of product lines, tailoring of the product line development process is a dynamic, on-going activity.

3 Conclusion

The current support for tailoring product line development processes using process lines is given by the variability model of the process line. As an example, it could be realized as feature model. With this model the presented requirements can be addressed. The role concept can be realized as feature tree (RE00), the key issues of standards can be related to features

(RE03), and quality attributes can be represented as features (RE04, RE04a) as well. The goals of stakeholders (RE01, RE05, RE05a) or organizations can be modeled using goal models, which now become part of the process line.

The process line manages development methods, which are related to tools and technologies (RE06). This relations need to be enhanced to support the optimization of the development process in relation to the development environment, used technologies, and the above mentioned goal model. Finally, the tailoring step is embedded in the management activities of the process line, as initial tailoring for new product line development projects, as maintenance activity for existing projects, and as part of an optimization activity to map a product line development process/environment to a given set of input parameters.

As result of this paper, a process line enhancement is proposed to address the requirements of the product line domain. First, a tool model will capture tool parameters to enable their relation to the development methods of the process line. Second, a goal model is used to manage the organizational parameters. In combination, the process line, its development methods, the tool model and the goal model will result in an enhanced process line capable of generating complete developers environments (development process and development environment). With such a process line the analysis and reasoning on the impact of changes is possible and will keep the consistency of the process line, what is subject of our future research.

References

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