

A People Oriented Approach to Product Line Scoping

*Enabling Stakeholder Cooperation with User Scenarios*¹

*Eelco Rommes, Philips Research
eelco.rommes@philips.com*

Abstract

Scoping is essential to the success of any product line engineering effort. The scope of a product line describes its products, domains, and reusable assets. Numerous stakeholders are influenced by the outcome of the scoping process. To get an optimal result, as well as to gain commitment to this result, these stakeholders should be involved in the scoping process. They bring with them different cultures, concerns, goals, and jargon. In order to deal with this, we propose an approach centered around *user scenarios*: short stories in natural language concerning a user's interaction with an (envisioned) system. These user scenarios roughly define the product portfolio and are used as a basis for scope refinement, domain scoping, and architecting. By collaboratively writing and selecting these user scenarios, more stakeholders can be involved in the scoping effort, leading to a higher quality scoping process and firmer commitment to its results.

1 Introduction

Product line scoping is the problem of determining what is inside and what is outside of a product line effort. In this paper, we propose an approach to scoping based on user scenarios. The main advantage of our approach is that it enables the active involvement of many stakeholders during the scoping process.

Schmid identifies three levels of scope [Sch00]:

- The *product portfolio* defines the various products that are part of the product line, and their requirements.
- The *domain scope* bounds the domain(s) that are relevant for reuse and what should be part of them.
- The *asset scope* identifies which assets should be part of the reuse infrastructure.

Our approach results in a set of user scenarios that describes the product portfolio, and can serve as a basis for domain scoping and asset scoping. We have used this approach in several practical case studies regarding product lines for medical imaging systems.

2 Scoping as a Social Problem

The scoping process has numerous stakeholders, each playing a certain role with respect to the product line. Although the actual list of stakeholders is largely project specific, we list some of the more common stakeholder roles here to hint at the complexity of the problem:

- Management: investments in the product line platform should correlate to business strategies, marketing strategies and the company's organization.
- Product managers: the product portfolio, product features, and time-to-market are all important aspects of marketing and they are all effected by the scoping effort.
- Sales persons: the product portfolio, product features, and time-to-market influence market position and sales options.

¹ This work was supported in part by the CAFÉ project (Eureka Σ! 2023 Programme, ITEA project IP0004)

- Customers: the scoping effort determines what products and features are available when, and, to some extent, their price.
- Users: scoping determines the products and features available.
- System architects: the scope of a product line influences its architecture as well as that of the separate products in the product line, by determining what functionality will be provided by the reuse infrastructure.
- Developers: developing for reuse requires different skills and processes than developing for a single application. The asset scope determines what components will be reusable and what will be product specific.
- Suppliers: the asset scope determines which components will be reusable and which product specific. This distinction influences the selection of suppliers for commercial off-the-shelf components.

So far, the problem is somewhat similar to that of finding the specification of a single product. In a product line context however, the problem becomes much harder. Typically, each of the above identified stakeholder roles is filled in by several persons. These persons may come from different parts of the organization, or even from different organizations altogether. In the ‘Integrating Product Line Scenario’ for example, even after integrating the acquired companies there might still be separate marketing, development, and management ‘blood groups’ [PLEES03]. Figure 1 hints at the potential diversity among stakeholders.

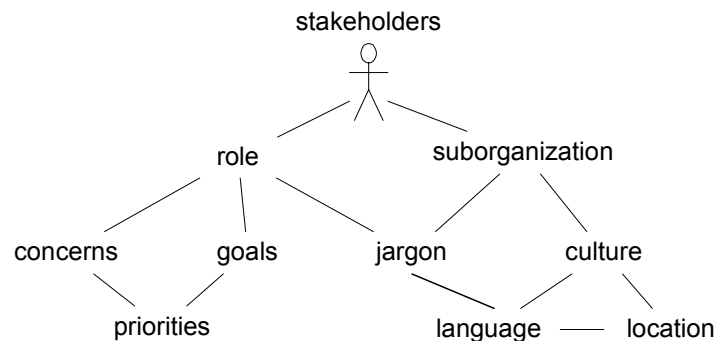


Figure 1 Stakeholder diversity

A group of stakeholders consists of all persons sharing a role and location, e.g. all application specialists for product X. By involving people from each relevant group of stakeholders, we can reach a better scoping result and gain commitment to this result among the members of these groups. Personal involvement is necessary because no single person can take all stakeholder groups into account. Moreover, commitment to an end result is barely enforceable top-down, and gets harder with the distance between people, both in roles and location. Making the stakeholders jointly responsible can raise the level of commitment as well as awareness to the concerns and goals of other stakeholder groups.

Ideally, each group of stakeholders is represented by a champion that participates in the scoping process. As Figure 1 shows, people with different priorities, visions, cultures, etc. will have to cooperate to get to an agreeable end result. This means that neither the process nor the end result can be role-specific: no UML diagrams, no marketing formulas, and no management speak should dominate the process or obscure the end result. Instead, natural language and terms from the problem domain should be used.

Representatives may be used for stakeholders that are outside of the product line organization. For example, application experts might defend the user's needs, while product managers represent their customers.

Of course, there are also risks to such massive stakeholder involvement. Endless discussion on details, bureaucracy, and design by committee are but a few. These problems can appear whenever (large numbers of) people cooperate and much was written about them and potential solutions (see e.g. [BMMM98]). The best solution depends on the desired result. If it is critical that everyone is optimally involved, striving for group consensus might be best, and loss of efficiency might be agreeable to find a solution that everyone can agree with (which is not the same as finding the solution that is best for everyone.) Alternatively, a subgroup of two or three stakeholders can be chosen to make the final call, e.g. a product manager and a system architect to balance marketing strategy and development effort.

We are now ready to define a sub-problem to the scoping problem, which is a social problem and not an economical one:

The social problem of scoping is to get different people, with different goals, concerns, priorities, cultures, and using different jargon, to cooperatively define a scope.

3 A Scenario-Based Approach to Scoping

To tackle the problem described in the previous section, we propose a scenario based approach. User scenarios are short stories describing an actor using an envisioned system to accomplish a common goal. A sentence from such a scenario could be:

Dr. Hart prepares for the intervention using a workstation. He has access to all information concerning the patient and selects the diagnostic images that should be available during the procedure.

Such scenarios describe the envisioned system in a way that all stakeholders can understand. They can capture the relevant requirements for the system, including non-functional requirements such as performance and ease-of-use.

Figure 2 gives an outline of the scenario-based approach to scoping.

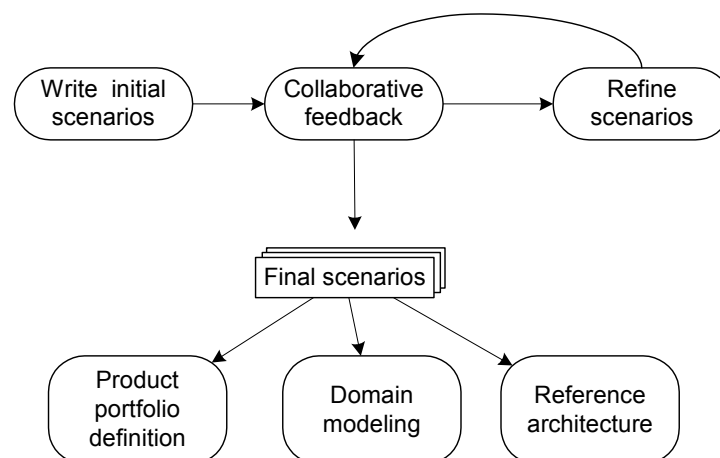


Figure 2 Scenario based scoping

The initial set of user scenarios might be written by application experts, or any other small number of people with sufficient knowledge in the application domain. These writers may interview other stakeholder representatives to gather relevant information if needed. Subsequently, the sce-

narios are reviewed by all stakeholder representatives. During review, each stakeholder representative uses his or her own specific expertise and background to judge the scenarios on three questions:

- Are the scenarios feasible?
- Are they desirable?
- Is the set of scenarios (over)complete?

If used in the integrating or reengineering context [PLEES03], the stakeholder representatives will have existing products and architectures to consider when reviewing the scenarios. This will make it easier for them to judge their feasibility and completeness. In the green field and to a lesser extent in the leveraged product line context, such references are missing. In those cases, feedback from the asset and domain scoping activities might be needed to again refine the scenarios.

There are several ways to organize this loop of writing and reviewing scenarios. A simple approach is to have a small group of writers and a large group of reviewers. In its simplest form, the reviewers send in their comments by e-mail or through one-on-one sessions with a writer. This form gives least organizational overhead, but inhibits interaction between the reviewers.

An alternative that better exploits interaction between stakeholders is to have overlapping teams that take turns in updating the set of scenarios. There is a small team of writers and a number of expert groups. The scenarios are developed in a number of sessions. In each session, the writer team and a single expert group participates. An expert group may be asked to look at a specific aspect of the scenarios. In that case it can be helpful to form the group according to that interest, e.g. ask a group of product people to look at the market value. America and Van Wijgerden describe a process for requirements modeling with overlapping groups [AW00].

A set of user scenarios captures the relevant requirements of each product of a portfolio by describing the typical use of these systems. A single scenario can deal with a single system or a multitude of systems that are used together. This depends on the nature of the product line being scoped. E.g., in one of our case studies we examined the possibilities of integration of products from several product lines. In that case, each of the scenarios dealt with representative systems from all product lines.

The final set of scenarios is used as a basis for domain scoping and asset scoping. In our case studies, we have used the scenarios to derive domain models and to develop a reference architecture, including the identification of reusable components.

4 Related Work

The work presented here is part of a scenario based architecting method currently under development at Philips Research. We have published parts of this method in papers on multi-view variation modeling [ARO03] and quantitative scenario analysis [IAOH03]. Muller describes stories as a narrative to make a product live [Mul03]. This work is in part based on the scenario-based architecting work and therefore very close to our user scenarios.

To some extent, user scenarios are related to use cases [Coc00]. User scenarios are roughly equivalent to Cockburn's *usage narratives*: stories envisioning a system in use, revealing the motivations and intentions of the actors. A use case is a contract for system behavior, and as such expressed in a more formal way than user scenarios. John and Muthig describe the extension of use cases with a variability mechanism for product line requirements modeling [JM02], but they do not address scoping.

Some methods for product line scoping have been published ([DS99], [Sch00], [Sch02]), but they regard scoping as an economical problem, rather than a social problem of communication. Our approach stresses cooperation on a shared asset describing the scope.

5 Conclusions

In this paper we have described product line scoping as a social problem, to be solved by cooperation between diverse groups of stakeholders. We have presented an approach to scoping based on user scenarios that enables stakeholders to cooperate on a shared asset, thus achieving a better scoping result and broader commitment among the stakeholders. The resulting set of scenarios serves as a basis for product portfolio refinement, domain scoping and asset scoping. We have applied this approach in several practical case studies on medical imaging product lines.

Acknowledgements

We thank our colleagues Pierre America, Cristian Huiban, Eugene Ivanov and Henk Obbink of the Scenario-Based Architecting project, Jan Gerben Wijnstra who reviewed this paper, and numerous stakeholders at Philips Medical Systems.

References

- [AW00] Pierre America, and Jan van Wijgerden. Requirements Modeling for Families of Complex Systems. In F. v.d. Linden, editor, Third International Workshop on Software Architectures for Product Families, Las Palmas de Gran Canaria, Spain, March 2000.
- [ARO03] Pierre America, Eelco Rommes and Henk Obbink. Multi-View Variation Modeling for Scenario Analysis. Accepted for PFE-5, Siena, Italy, November 2003
- [BMMM98] William J. Brown, Raphael C. Malveau, Hays W. “Skip” McCormick III and Thomas J. Mowbray. *AntiPatterns – Refactoring Software, Architectures and Projects in Crisis*, John Wiley & Sons, 1998.
- [Coc00] Alistair Cockburn. *Writing Effective Use Cases*, Addison-Wesley 2000
- [Coc02] Alistair Cockburn. *Agile Software Development*, Addison-Wesley 2002
- [DS99] Jean-Marc DeBaud and Klaus Schmid. A Systematic Approach to Derive the Scope of Software Product Lines. In *Proceedings of ICSE '99*, Los Angeles, USA, 1999.
- [IAOH03] Mugurel T. Ionita, Pierre America, Henk Obbink and Dieter Hammer. Systematic Quantitative Usability Assessment with Scenarios. In Morten Borup Harning and Jean Vanderdonck (editors), *Closing the Gaps: Software Engineering and Human-Computer Interaction*, Zürich, Switzerland, September 2003.
- [JM02] Isabel John and Dirk Muthig. Tailoring Use Cases for Product Line Modeling. In Birgit Geppert, Klaus Schmid (editors), *Proceedings REPL02 - International Workshop on Requirements Engineering for Product Lines*, Essen, Germany, September 2002.
- [Mul03] Gerrit Muller. Story How To. Available online at <http://www.extra.research.philips.com/natlab/sysarch/>
- [PLEES03] Klaus Schmid, Birgit Gepper. PLEES'03 Call for Papers. Available online at <http://www.plees.info/>
- [RSP02] Matthias Riebisch, Detlef Streitferdt and Ilka Philippow. Feature Scoping for Product Lines. In Klaus Schmid, Birgit Geppert (editors), *Proceedings of the PLEES'01*, Fraunhofer IESE-Report No. 050.01/E, Erfurt, Germany, September 2001
- [Sch00] Klaus Schmid. Scoping Software Product Lines – An Analysis of an Emerging Technology. In Patrick Donohoe (editor), *Software Product Lines – Experience and Research Directions*, Kluwer Academic Publishers, 2000
- [Sch02] Klaus Schmid. A Comprehensive Product Line Scoping Approach and Its Validation. In *Proceedings of ICSE '02*, Orlando, USA, May 2002.