



Tailoring RUP to a Defined Project Type: A Case Study

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ABSTRACT:

The Unified Process and the commercial variant, the Rational Unified Process, RUP are comprehensive process frameworks for software development projects. RUP defines a software development project as a set of disciplines, e.g. requirements handling, implementation etc., running from start to end through a set of project phases. A project is performed by a group of actors, each having one or more well defined roles. Each role participates in one or more activities producing one or more artifacts. A discipline can run in iterations, that is, repetitions within a phase. Activities, roles and artifacts are the basic process elements of RUP.

Key Words:

RUP, software development project, artifacts

INTRODUCTION:

However, RUP is a comprehensive framework, meaning that it is a more or less complete set of process elements that has to be tailored to each case as no project needs the complete set of elements. Jacobson, Booch and Rumbaugh says in [1] p.416: "It [RUP] is a framework. It has to be tailored to a number of variables: the size of the system in work, the domain in which that system is to function, the complexity of the system and the experience, skill or process level of the project organization and its people." Further on they say: "Actually, to apply it, you need considerable further information. So, it is clear that RUP needs to be tailored, downscaled and specialized to the context of use. Looking at literature there are not many guidelines on doing this [3], [4], [5] although the need for good practical guidelines and advice definitively is present.

While discussing adaptation of RUP, it is important to have in mind that RUP is a methodology suited for some software development projects, not all. Before you consider using RUP as a basis for your processes you should think of what you really need and what you really do not need. RUP is designed to support four basic properties of software projects: use-case based customer dialogue and documentation, an architecture focus, iterative processes and incremental product development. The idea of adapting RUP is to make it fit each specific project not losing these properties. It is important to keep the integrity of RUP as a framework. So, an adapted or downscaled variant still defines a project in terms of phases and still describes the work as a complimentary set of disciplines. However, some disciplines may be omitted or even added.

The goal of this paper is to provide others considering remodeling and adapting a process framework in general, and RUP particularly, an insight in how this has been done in a small software company. Some aspects of the specialization process seems to have been working well, others not. This paper presents the adaptation process and also gives an analysis of this process and its result. The work detailed in this article was carried out as part of a national research project in process improvement and software quality called SPIKE. SPIKE is short for Software Process Improvement through Knowledge and Experience. The participants are SINTEF, NTNU, the University of Oslo and several partners (companies) in the Norwegian ICT-industry. The industrial partners are interested in improving their development process, and are seeking concrete processes and methods to help them deliver high

quality software with shorter time to market. The paper starts with a Theoretical context, giving a brief introduction to methodologies and frameworks and various strategies of making these fit specific project needs of process support. It then describes the action research as the Research method of choice. The rest of the paper is arranged according to the research method phases; Diagnosing, Action planning, Action taking, Evaluating and Learning. Finally a Conclusion is given and Further research suggested.

SOFTWARE DEVELOPMENT METHODOLOGY AND FRAMEWORKS

The term methodology is defined as "A body of methods, rules, and postulates employed by a discipline: a particular procedure or set of procedures" by the Merriam- Webster dictionary [6]. Basically, a methodology describes how someone, e.g. an organization performs a task, e.g. software development. In a broad sense, a software development methodology describes aspects such as how to communicate with customers, sales strategy, how to describe requirements, use of tools, test practices, documentation, planning, reporting and so on. In our context we talk about methodologies for running projects with a defined customer having more or less defined goals initially. Besides describing techniques, roles etc. most methodologies are based on a set of basic values. Examples are User centric, Architecture centric, Agile, Risk driven and many more. RUP has four basic values: Use-Case Driven, Architecture- Centric, Iterative and Incremental. These values should be retained regardless of how RUP as a framework is adapted. A methodology framework is a comprehensive description of a methodology describing approximately all possible details of almost all possible processes within the scope of the framework. This means that a framework is not a description of a specific case; it is a foundation for adaptation. The challenge is how to adapt it to each case (project) and keep the basic values and features of the framework.

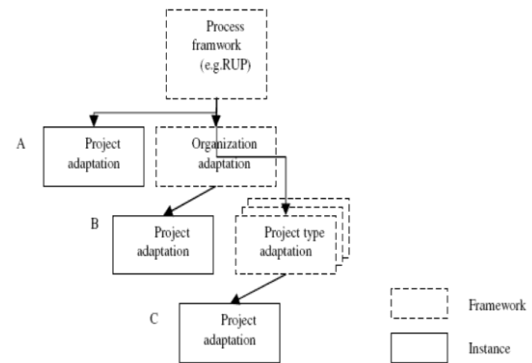


Figure 1 Three possible approaches for adaptation

ADAPTATION OF RUP

The process of adapting RUP can possibly take many forms. IBM Rational, the provider of RUP has defined the Process Engineering Process (PEP) [5]. This is a comprehensive adaptation process requiring a fairly big amount of resources (people and time). This may very well be appropriate for larger companies, but for the small ones this process may be too expensive. Adaptation of a framework, such as RUP, can take one of (at least) three approaches; see Fig. 1. The starting point is a process framework that is general and complete with respect to tasks, roles and products. In approach A, the framework is adapted, in one step, for each project, thus representing a heavy job in each case. This can be justified for large projects where the initial adaptation process itself becomes only a small part of the total amount of work being done in the project. In approach B, the organization does an up-front adaptation producing a subset of the framework, still being a framework, but now tuned to the organizations general characteristics. This is the intentional process of PEP. In approach C, the organization first identifies and describes a set of recurring project types. Having knowledge of characteristics and differences of these types, an adaptation is done for each type. No matter which approach being used; in the last step, a final adaptation is done to each case (project). The agility of this final fine tuning increases with respect to the extent of the up-front adaptation.



This is a general view of methodological adaptation or down-scaling. It applies to many types of process frameworks, including RUP. Further on, adapting RUP in practice means to decide on which process elements to keep, remove, alter or add. These decisions can be based on assumptions, experience, goals and visions. It is the quality of this underlying knowledge and experience that determines how good these decisions are. Running an adaptation process, in general, can be seen as a knowledge management activity as experience and knowledge, both tacit and explicit, is being structured, documented and communicated through the resulting software process description.

RESEARCH METHOD:

Due to the cooperative nature of this research project with company external researchers acting partly as consultants and partly as researchers, we decided to adopt action research as our approach. Avison describes action research as: "unique in the way it associates research and practice. ... Action research combines theory and practice through change and reflection in an immediate problematic situation within a mutually acceptable ethical framework." Susman described an approach to action research that is widely used today. We have adopted elements from this approach in our research project. The approach requires the establishment of a client-system infrastructure or research environment. In our case this was already taken care of through the researchers and company's involvement in the SPIKE research program. The approach further specifies five identifiable phases, which are iterated: diagnosing, action planning, action taking, evaluating and specifying learning. This report details some of our findings and experiences from the initial phases. Our coverage of the evaluating and learning phases are based on our own observations of the process so far. A more thorough evaluation will be carried out as the company takes the resulting process description into use in real projects.

In the diagnosing phase, we used semi structured interviews and workshops with key employees. We interviewed five employees concerning their general experience with projects in the company. This gave us the material to do a more focused interview with five other employees concerning their specific experience with RUP in the company. In addition to this, several work-meetings were held with the management of the company where the SPI approach was discussed. In the action planning phase, the researchers made a literature survey of the field of adapting RUP. It was decided to identify possible project types run by the company. This was done during two iterations, the first one a bottom-up approach, the second one a top-down approach. The top-down approach led to definition of three project types. In order to adapt the first project type, it was decided that the researchers should facilitate a workshop where key employees were invited to define the adapted process.

The workshop was carried out as part of the action taking phase. It was carried out over two days, since it was discovered that we needed more time than originally planned. At the first day we noted that the lack of a RUP mentor slowed the process considerably due to a lot of discussion on what was actually meant by the different concepts. At the second day, one such mentor was present, and the process was much more fluent. The result from the workshop was a coarse RUP skeleton, which was given to the company for more refinement. The company has conducted two internal workshops with its employees to refine the process. In addition they have initiated a project to put this information on a Wiki web, in order to make the adapted process available to all employees. As the project moves into the evaluation phase, the role of the scientists switches to a more observational role. We plan on following the use of the adapted process for several development projects.



By taking measures along the way we hope to be able to ascertain how successful the initiative has been for the company in its current context.

RESEARCH CONTEXT

The company described in this case is today a Norwegian software consultancy company with 50 employees, located in two different geographic offices. During the work described in this paper the company was declared bankrupt, and then restarted with new owners. The first part of the action planning and action taking described in this paper took place before the bankruptcy. The first attempt to identify project types was done, using a bottom-up approach. Just before the bankruptcy this approach was evaluated and the company and the researchers decided that this approach did not work. The company then had about 70 employees. When the company was restarted, the researchers continued to the work mainly together with the other office, but the focus was still the same, and the most actual people from the company did not change.

The company is mainly developing software systems with heavy back-end logic and often with a web front-end, typically portals. However, they also develop lighter solutions with most emphasis on the front-end. The company acts as an independent software supplier, though there are close relationships to the biggest customers. Of the 50 employees today, 35 are working as software developers. Java and J2EE are used as development platform. The domain of which the company develops software is mainly for the banking and finance sector, as well as for public sector. The company has run 50 development projects within the bank and finance sector the last twelve years, and about 30-40 projects within the public sector the last 15 years. Four employees are certified RUP-mentors acting as advisors in other SW- organizations, in addition to this they run training courses in RUP and related subjects.

The company utilizes their high competence in RUP and most projects are more or less inspired by RUP, however, the company's management has seen a need and a possibility to improve their use of RUP.

DIAGNOSING

The decision to initiate a project-type specific adaptation process was made by the company when SPIKE started. The diagnosing phase was initiated by a few workshops where an internal software development process group defined the strategy in cooperation with the authors. With the past experience in mind they decided to go for a top-down approach, starting out with the complete RUP set of process elements and then customize this set to a set of defined project types. This decision was supported by the findings in two rounds of interviews in the company.

This phase of the work was conducted mainly by three different motivations:

1. The researchers needed more insight into the company, the development organization of the company, as well as the most recent software development projects conducted by the company.
2. The company needed to be more conscious about its own use of RUP; these interviews were means in that respect.
3. The use of RUP in the company needed to be documented as a basis for further work; this includes the overall use, but also strengths and weaknesses by the use, in the view of people working in projects in the company.

Interview 1: General experiences from project work

5 employees having various project experiences were interviewed. The roles of these persons were developer/systems architect, project leader/manager, project leader, senior developer and developer/architect/DBA.



The intention of this group of interviews was to get a perception of common problems and challenges in development projects to establish a basis for process improvement initiatives in the company. The interviews revealed that the customer dialogue could be better (requirements handling and project planning). The reuse of templates could be better. It is too much documentation formalism. Estimates often fail and there is a need of better change management

Interview 2: Special experiences with RUP

Another group of 5 employees was interviewed to get a view of their experience using RUP. The role of these persons was developer, developer/project leader, developer/project leader/test leader, project leader/requirements responsible, and customer contact. All of the five had some knowledge and experience with RUP, some had participated on internal courses, and some had read literature. However, none had thorough knowledge and experience. About the practical use, it seemed that RUP was used just to a small extent, it depended on the type of project. The reason for this may be superficial knowledge of RUP and that some felt that RUP does not fit their needs. These two iterations of interviews gave no clear answer, however they indicate that RUP and the use of it can be improved. The summary from the interviews was used to decide to initiate an adaptation process as described in this paper.

ACTION PLANNING

Projects conducted by the company varied with respect to domain, degree of experimentation, technology, contract form etc. In addition, most projects were too small to initiate a project-specific specialization (ref Figure 1, approach A). However, it seemed that this company usually ran a few similar types of projects. This led to the idea to define a set of processes fitting each type of project.

The idea is that this will reduce the need of a costly up-front specialization per project and also avoid an expensive per-project adaptation. Based on this realization the company decided to try out approach C in figure 1 in cooperation with the authors. The company would define a set of project types which covered most of their projects and define a downscaled RUP to each project type. To define a set of project types we decided to hold a workshop to identify the company's three main project types based on a top down approach. The reason for selecting the top down approach was the company's previous failure to define project types based on a bottom up approach. The participants of the workshop consisted of people from the company with a complimentary and thorough knowledge of the company's software development projects, some of them were also RUP mentors. It was also decided that the participants should come up with a classification system to describe and distinguish the three project types.

Given the three distinct project types, the challenge was how to adapt RUP to each project type. There seemed to be wide agreement that adapting RUP was necessary, yet little information was available on how to actually carry out this adaptation process. What little information was available consisted of rather complex and expensive methods. Instead of using any of these methods we decided to go for a simpler and pragmatic approach. It was decided that the researchers should facilitate a workshop where key employees were invited to define the adapted process. The structure of the workshop was planned by the researchers based on their experience and input from the literature, and the participants were selected by the company based on their experience with different disciplines. After this workshop the material was left to the company to refine and document with little input from the researchers.



ACTION TAKING

The RUP adaptation itself was separated in four main phases:

- A. Defining the project types
- B. The definition of the mainstream project type
- C. Maturing the downsized RUP
- D. The initial documentation of the mainstream project activities

A: Defining the project types

We conducted a workshop where five participants from the company, representing a group with a complimentary and thorough knowledge of software development projects in general and RUP in special (some of them RUP mentors), were allowed to define three to four common types of projects. To be able to distinguish and describe the project types we defined a simple classification system. During a series of workshops a group representing all project roles identified a set of project capabilities to be used to describe the project types. A project capability, in this context, is a feature or a characteristic that is general to all projects but where the size or weight does vary. We identified 13 characteristics; business critically for the customer, technology knowledge, access to resources, risk, test environment, size, degree of reuse, contract form, project team, exposure, customer orientation, system integration and scope. The three selected types of projects were Mainstream Projects, Push-button Projects and Greenfield Projects. Here presented with a few characteristics:

Mainstream projects	Push-button projects	Greenfield projects
<ul style="list-style-type: none"> - integration with other systems are important - the technology are well known - the size are initially unclear - the risk is moderate 	<ul style="list-style-type: none"> - the technology is well known - low-risk project - well defined project size - often a fixed price project 	<ul style="list-style-type: none"> - need of extensive research and innovation - the size are initially unclear - high risk project - newer fixed price

B: The definition of the mainstream project type

We selected the mainstream project type since this was the most important type for the company with respect to earning.

The two other project types will be handled later. Originally we envisaged a workshop to define a list of RUP elements necessary for the different disciplines and phases. The result from this would be a list that needed some refinement and quality assurance before it could be documented and put into use in a project. The method we ended up with was not far from this. It consisted of two days where the focus was defined by RUP elements viewed from the point of view of either the RUP phases or the RUP disciplines. On the first day we gathered a group of employees with relevant experience from mainstream projects, meaning people that have both the theoretical and practical knowledge of RUP from projects as well as experience relevant to the defined project type. We tried to ensure that all the disciplines of RUP should be covered by the experience of the workshop participants. The process of the initial workshop was as follow:

1) The workshop facilitators (the researchers) explained the defined project type for the group and this was discussed. This was done to establish a common mindset for the rest of the work.

2) We used a whiteboard with a vertical lane for each RUP-phase (inception –elaboration – implementation – transition) to document opinions of what was especially important for each phase (based on practical experience). The workshop facilitators asked questions such as: What is usually a challenge in this type of project? What type of methodology support do you need? What has used to work well? All this to sharpen the focus of what is important for the project type and how a defined process can support it.

3) The workshop facilitators displayed a list of all RUP process elements using a video projector. A process element was a defined role, artifact or activity. The elements were ordered per RUP discipline. Starting at the top the group made decisions for each element whether to keep, remove



or alter the element. The two previous steps was used as basis for taking decisions and was referred to during the selection process. However, this turned out to be a circumstantial process. The group and the workshop leaders agreed to only focus on artifacts, thus speeding up the process to a practical level. When an artifact was removed, this implicitly also indicated how roles and activities should be affected. An example of a artifact that was decided to be deselected is 'Capsule'. The RUP documentation explains that this is an artifact "Used only for the design of real- time or reactive systems..", thus not relevant for the Mainstream project type described and discussed in step 1.

Step 3 was not finished by the end of the first day. One of the main reasons for this was that there was no RUP mentor present. Subsequently there was a lot of argument over what the different RUP concepts actually meant, and a lot of the time was spent searching for information. Another reason was that we initially tried to define artifacts, roles and activities; this took up a lot of time, thus it was decided to just focus on artifacts. Since the list was not finished at the end of the day, it was decided to spend a second day to finish the work. In the second day we only focused on artifacts and the company provided us with a RUP mentor. This time the process worked more fluently and we were able to finish the list of adapted RUP elements to mainstream projects.

C: Maturing the downsized RUP

Due to the composition of the members of the workshop, some disciplines were better covered than others. This sparked some discussion in the company on how to proceed. They found it necessary to involve more people to increase the information on certain disciplines, and it was decided that to increase the usefulness of the process it was necessary to run more iterations to gather experience from all the disciplines.

Having compiled the list of process elements the company continued the process by involving more of the employees. This to incorporate more relevant experiences and, not at least, to establish a common ownership. The focus turned from selecting/deselecting process elements at a very low level to focusing on best practices, in this case meaning to focus on vital project activities. Their next step was to define critical activities for each phase of RUP. This was done in a separate internal workshop. For each phase they held a discussion on what the critical activities were. When they agreed on an activity they found a descriptive name for it and proceeded to answer two questions: 1) What is accomplished by performing this activity? And 2) What is the risk of not performing this activity, or not performing it properly? The name of the activity and the answer to the two questions was written on a piece of paper and post-it notes and put on a large paper that covered the wall. There was one such paper for each phase.

D: The initial documentation of the mainstream project activities

Having specialized RUP, or any other process for that matter, does not complete the job. The result must be brought out to the frontline people – the project leaders, the developers, the architects and so on. They must have the information at their fingertips in the actual situation of use in a form that makes them want to use it. There is a variety of practical ways of communication this information, from simple documents, to simple web-pages, to comprehensive hypertext documentation. Rational offers an electronic process guide that documents RUP in detail (RUP Online). This is a knowledge base with a web interface that describes roles, activities and artifacts (and templates for these – all arranged within the phases and disciplines of RUP. However, RUP online is comprehensive and may be more confusing than helpful to project members in need of specific project support.



Any documentation of the process must reflect the modifications resulting from the specialization process. Instead of using the tools from Rational, the company decided to establish a simple Wiki-web with just-enough information and functionality to get the message out. This web does not resemble to the RUP-online documentation which holds a well of details. This Wiki can be seen as a common electronic whiteboard, where all users have more or less full access to the information and the rights to update it.. This Wiki Web is a company internal website that in simple terms describes the outcome of the workshops and the company internal process work. It explains the characteristics of the project type(s) so that the user can evaluate how well the variant suits the actual project and can also be used as a checklist to plan the project. The simple process documentation on the Wiki Web references RUP Online (web link) to lead the user to helpful descriptions and templates. A Wiki-Web also allows the users to add information thus being a dynamic process repository. One idea (not yet tested) is to store project experiences together with the process descriptions to offer later projects an insight into specific and relevant experience.

The resulting process description

The resulting process documentation, presented through the Wiki-web, is much simpler than we initially would think. It is more a guide into RUP than an independent complete process guide. The process definition of the Mainstream type of projects is simply a list of critical activities where each activity is defined by 1) a title stating the purpose of the activity, 2) a short description, 3) the context of the activity, 4) reasons for why this is an important activity for this project type, 5) risks by omitting the activity, 6) a checklist for completion of the activity and 7) recommended problem solving approach. All these seven parts are presented on one page. These activities are arranged with respect to the standard phases of RUP and also has some links to relevant

information in RUP Online, e.g. to templates etc. This simple description is intentionally on a high level, omitting most of the details of RUP. The Wiki-web offers this information to all project members via the intranet. A separate area is created for each project where the project members document their best practices, templates used, comments to the process. In general, this is an experience reporting tool that communicates practical experiences for a given project type to others. The case company has constituted a process group that continuously updates and refines the content of the Wiki based on real experiences being reported on the Wiki.

EVALUATING

The company did from the beginning focus on project types. During the work described here, two different approaches were tried in order to define different types of projects. The bottom-up approach was tried first, and then the top-down approach. The bottom-up approach did not succeed as it became too complex to document a big amount of project experiences and identify a few common variants of RUP. During the workshops where this approach was tried, it was clear that the participants felt that the project types in some ways were defined already, but not given. The company had an informal definition of project types, not named ones, but with some consensus among the developers what these types were. In the workshops we tried to keep the entire focus on the characteristics of the project types, and the participants were not "allowed" to state types of projects. This approach clearly made the participants frustrated, and the approach did not bring up any defined project types based on the defined characteristics. We did succeed with a top-down approach to defining a set of project types – starting by loosely naming typical types and then describe typical aspects through a workshop. The participants were told to name three project types in the beginning, and this strict introduction seems to have



helped the participants to reflect over what is really separating the different types of projects there were working on. The three types were relatively easy to identify and name. During the work these initial types were kept, and the belief that these were the important types grew. Even though the initial try with focus on project characteristics did not succeed, this attempt kept the focus on project characteristics during the whole work described here, and the participants were more conscious about what is a project type than the case might have been without the first try. The researchers therefore would like to recommend trying to keep focus on different aspects and characteristics of software projects. During the work the focus has been on one type of projects only. The company did pick the type of project which was most important with respect to earnings and risk control, and the first attempt to tailor RUP was for this single type only. This focus seems to have been an important factor when it comes to the ability to tailor RUP. Having a common, well defined, mindset makes the decisions easier and the result simpler and more focused.

In this case study, a discussion of which tool to use for the documentation and deployment of the tailored RUP was postponed to a moment when the discussion about the content of the tailored RUP was in place. Adapting and documenting RUP or any other methodological framework is not done solely using a tool. The most crucial part of such a job is to involve a broad group of people having through experience with both the framework and – not at least – practical project work. The work in this case supports this presumption. Employees in this company have knowledge of RUP above the average of what we have seen in analogous software development organizations in Norway. The work in the company shows that it is important to have a tailoring process that must be based on experience; it can be seen as a knowledge management, and documentation, process.

Despite the company's knowledge of RUP, running such a process has not been easy and straight forward at all. The strategy has changed during the course of work based on new insights and achieved results (or lack of such).

LEARNING

Our motivation intentionally was to work together with the case company to adapt the RUP. We decided to try to keep it as simple and inexpensive as possible. The two authors that participated actively in the start worked with a small group from the company, thus reducing the total time spent. We also tried to use RUP as a heavy foundation by accepting the general characteristics of the method, such as the phases and the disciplines and go straight to the low-level details; the process elements. But this did not seem to be the best way. The process did become simpler and simpler as the work progressed. This helped the involved people keeping focus on what's most important; what type of process support is really needed in the projects based on experience.

When starting out we intentionally did not take a standpoint with respect to how to document and disseminate the resulting process description. We looked into the suite of tools offered by Rational, but regardless of the rich features in those tools the company ended up with a very simple form of tool support for documentation and communication of the result, the Wiki web. In general it seems that the adaptation is best done as a simple, pragmatic process not as a heavily up-front planned and strictly managed process. It seems that the good old KISS-strategy once again have proven its superiority; Keep It Simple Stupid.

Some specific experiences from the tailoring workshops

Having good knowledge and experience is important to ensure sound decisions on how to adapt RUP.



This however presupposes that such experience is available within the organization, which was the case in the project that this paper is based on. If the overall knowledge of RUP is weak the group can be strengthened by hiring a RUP-mentor. The mentor is a certified expert that will be in position to answer questions and explain details of RUP. Having a group working through the three steps of the initial workshop should take about one working day, given that the workshop leaders have prepared the work, the focus is on artifacts from a discipline point of view, and that there is a RUP mentor present to explain any uncertainties. To ensure a good result it is vital to include people with experience from all the disciplines of RUP. Do not try to gather too much information in one single workshop. Concentrate on one issue at a time. It is important to be patient; the outcome of the initial workshops was nothing but an altered list of RUP process elements. This list has to be matured and quality assured before it can be documented and put into use in projects.

CONCLUSION

We have presented a simple pragmatic method for adapting the RUP to a specific project type in a company. The method involves a series of workshops in which the key success factor seems to have been focus. Focus both through a specific project type, specific process elements and through phases or disciplines. Another key success factor is that a workshop consists of persons with the proper experience with regards to the focus. The focus on a specific project type seems to have kept the participants on track throughout the adaptation process. It seems to have eased the process since everyone had a clear concept of what should be done in that particular project type. However, the benefits from making a project type adaptation as compared to making a project- or a company specific adaptation have yet to be evaluated. The adaptation method has been a success in that the company has come up with a simple process for their most

common project type, which has been made available for all employees. Whether this process becomes a success will be determined through further studies of the actual use patterns.

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