A Strategy for the Integration of Software Process Support Technology into Organizations

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1 Introduction

Software processes are inherently complex. They involve a large number of different people, assuming various roles. Often, people work in different geographical locations, e.g., in different subprojects. In such a situation software development must be coordinated in order to work efficiently. Therefore, adequate support is needed for process performers. However, existing process support is often not used because introducing such a tool into an organization means a large and radical shift in technology and work procedures.

This paper describes a strategy for the incremental introduction of process support technology into organizations in order to overcome this problem and the reluctance against the introduction of new support technology and an example for a tool which allows to be introduced gradually, the Electronic Process Guide [7].

The remainder of the paper is structured as follows: The next section details the situation in software development processes, describes currently available support, and lists its deficiencies. Section 3 presents a new strategy and supporting tool to coordinate teams. Section 4 describes first experience gained with this approach. Finally, Section 5 summarizes the paper and gives a conclusion.

2 Problem

The current situation in software development is characterized by very large projects and a high number of different people with a variety of roles. This often leads to subprojects, or subcontracting of parts of the process, and consequently to teams that are distributed across sites in different geographical locations, sometimes even working on different continents. Thus, communication and information flow among the different team members is aggravated and the process may be executed inconsistently.

To still manage such processes and to ensure that those processes are consistently executed even across different locations, Process Performers need information about the process, the related artifacts, techniques used, etc. However, existing process technology is often not employed to solve these issues.

I believe that the reason why process support technology is not used is not that such a support is not used – the situation outlined above clearly indicates the need for support. However, I believe that the low number of process support technology employed is largely due to the fact that the majority of the process support which is available today is not adequate to help people perform their work.

The two major forms in which software process support is provided to Process Performers in today's environments, are process handbooks, process-sensitive software engineering environments or workflow management systems. These as well as their major advantages and disadvantages will be discussed in the next two sections.

2.1 Process Handbooks

Many organizations have standards or standard processes described in the form of printed handbooks. These handbooks should facilitate process coordination by providing 'interfaces' between different activities of the process to be performed or describing the required contents and requirements of artifacts to be produced in the process.

Paper-based process handbooks have shown to be too unhandy for the individual Process Performers. Process handbooks have a linear structure which makes them difficult to use for Process Performers. Often, the information needed is scattered across several pages which makes it hard to retrieve. A great advantage of having paper-based process handbooks is that they allow the (individual) users to attach personal annotations. However, in most cases these are only read by the copy's owner and this additional piece of process information is not shared.

For the coordination of processes (process) handbooks pose even more problems as process handbooks are difficult to update: if a new edition of the process handbook is released, all process participants in all

locations must have a copy of the new version to ensure that all of them perform the process in the same consistent way starting on the due date. Introducing a new version of the handbook would mean to collect all copies of the current handbook, and distributing the new versions to all Process Performers. This is especially an issue for companies working in distributed locations. Once a new copy of the handbook is distributed to a Process Performer, all additional information attached to the previous version, such as annotations, are lost. This often leads to situations where process handbooks are hardly ever used, or that different versions of the handbooks are used inconsistently. Thus, paper-based process handbooks are not an adequate support for distributed processes.

In order to overcome the difficulties related to updating paper based handbooks, many organizations have made their process handbooks available as files, e.g., as pdf files on their intranets. Thus, process knowledge is made accessible to everybody, even across different locations. Usually this is done by exporting documents from some word processor into Portable Data Format (pdf), Word, or Hypertext Markup Language (HTML) format. File-based versions of process handbooks can be updated and maintained with a rather low effort. However, this type of support does not allow to attach personal information, such as annotations.

A further disadvantage of process handbooks, paper or file-based, is that they provide the same level of detail, same representation, same contents, etc. for all users, regardless of whether they are novice users or experts, whether they perform the process for the first time or whether they have performed it for years.

2.2 Process-Sensitive Software Engineering Environments

Current technology (i.e., Process-sensitive Software Engineering Environments, repository with automated procedures) which coordinates people in distributed locations usually supports process performers at a detailed level of the process [5]. The technology prescribes the process at a low level which allows to integrate existing tools into the process. This type of technology can ensure the consistent usage of one process across different locations. However, experience indicates that strict enforcement of prescribed processes is too restrictive to be accepted in industry [ABEL97].

There are very few examples reported from industry on the successful introduction of process support technology. ‘Process technology has little popularity in the software industry [ABEL97]. Among the causes of this limited acceptance are:

- limited empirical evidence of the costs and benefits provided by the process-centered approach to software development, since precise, quantitative cost/benefit evaluations are still missing
- perceived risk of adoption, since process technology is relatively new and sophisticated

I argue, that there are two major reasons why the support technology is not used as much as one would expect. First, introducing a new process technology into an organization involves a large and radical change for process performers in the way they perform their tasks. Second, the introduction of a new and unfamiliar technology always implies a certain risk for the whole company.

Radical changes in working processes should be accompanied with as much motivational instruments as possible and should imply as little inconveniences as possible for the people who are affected to keep resistance low.

If a fully-automated process support tool is introduced into an organization, there is usually very little experience in the organization with a process support tool. The introduction of such a tool implies investment, not only of the tool itself. Especially, if it is not clear whether this tool really provides a solution to the problems people are even more reluctant to the investment of a new tool. The introduction of a new process support tool usually requires intensive training with the new tool – during which people are not available to perform their assigned work – in order to make sure that the tool can optimally support the Process Performers in their work. In addition, process documents have to be integrated into the new tool structure which leads to additional effort. For a company this may mean a high investment upfront, especially when it is not even clear that the tool support will really lead to better process performance.

3 New Approach

This section presents a new approach for a tool to support software processes. This approach consists of a strategy for the introduction of a support tool into an organization (Section 3.1). As this strategy requires a certain type of tool, Section 3.2 introduces a tool which can be used in conjunction with the strategy. Section 3.3 describes the benefits of this approach.

3.1 Strategy

Obviously, one reason why process support technology is not accepted and used is that the way process technology is introduced is not adequate for most organizations. People are generally reluctant to radical changes. This applies especially to changes which affect the way they

are doing their work. Thus, a stepwise and controlled approach is much more likely to guarantee the successful introduction of process support technology.

How could a successful integration of software process technology into an organization look like? On one hand, process technology should not be introduced at one shot, but I propose a sliced approach. Such an approach should start small, and can then be incremented. For instance, in the pilot phase such a technology could be applied to a sub-project, to a department of an organization, or only certain parts of the overall could be supported. I suggest to select an area which is very likely to be successful for the pilot phase. An area where success will be very likely will increase the acceptance for this type of technology. On the other hand, the technology introduced should not be completely new, but based on something which is familiar to the intended users.

However, most of the currently available process support tools do not allow such a strategy for introduction. There is no possibility to introduce them gradually, but the majority of them have to be introduced at one shot.

3.2 Tool to support the introduction strategy

This section describes a concept for a process support tool that allows to be introduced gradually, the Electronic Process Guide. A process guide is a reference document for an intended process, providing guidance to process participants in carrying it out. Process guides contain at least process definitions, and may be extended by services for browsing and searching the definitions, storing process state information, and providing expert guidance [7]. An Electronic Process Guide (EPG), is a process guide available in electronic format. The EPG concept as well as a first prototype were developed in a joint project between the Fraunhofer IESE and the Software Engineering Institute (SEI), Pittsburgh [7]. In its basic form the EPG is a hypertext-based process handbook which can be accessed over the internet using conventional web browsers. The usage of HTML [4] files and server-side scripts allows to maintain the process handbook so that it is always up to date as well as global access.

For instance, if an organization has its own process handbook, this should serve as a starting point for an EPG. Converting these handbooks to HTML files, these can be accessed using conventional web browsers. These browsers are commonly available in most companies and do not imply a large technology shift for their users.

The EPG can be extended to integrate further services. Additional files, such as templates or examples from previous projects can directly be linked to the EPG. Annotations, which can be shared among users – or only a subset of the users – can be attached. These annotations capture personal experience of Process Performers at different levels of granularity, e.g., annotations could be attached to entry criteria for certain activity (low granularity) or they could be related to a whole activity or artifact. An EPG can be instantiated, in order to reflect the status of the process so this information can be shared among Process Performers.

Altogether, an EPG provides maximal flexibility to its user regarding the information. It is up to the user to decide what information he accesses, with what level of detail, or in what notation (e.g., text or graphical), etc. An EPG provides a common interface to all process-relevant information.

For the development and introduction of an EPG into an organization the following issues have to be taken into account:

- Start with something simple, which is not too much different from what people already have, i.e., their paper-based process handbook.
- Use a ‘standard structure/format’, i.e., hypertext which can be accessed using conventional browsers; these are commonly available, cheap, most people are used to working with them.
- Before introducing the next increment, the current situation has to be evaluated, in order to introduce the ‘right’ increments. Thus, close cooperation between the target organization and the support organization is necessary

3.3 Benefits of the Approach

What are the benefits of this strategy? First, such a strategy allows the systematic development, refinement, and tailoring of existing technology, so that it matches the exact needs of its intended users. In addition to the benefit for the users, this strategy will help tool developers gain new insights into the users and the usage of process technology. Weaknesses of existing technologies can be detected and localized more easily than if a ‘complete’ technology would be introduced. However, such a strategy requires thorough evaluation of the benefits and close collaboration between the people introducing the technology and the users.

Second, a stepwise introduction can be done more systematically than introducing a new technology all of a sudden. The more complex a technology is the more difficult it is to manage, especially when it needs to be tailored to the unique context of an organization. A technology which supports very well the development processes of one organization, may not work at all in an organization with a different structure. An incremental introduction of process technology can take into account the specific situation of an organization, and can tailor the

process technology accordingly. For instance, process technology can be introduced at the same rate people are able and willing to learn, accept, and to use this technology. Process technology can be customized to an organization in a way that it brings the most benefit, e.g., if process areas with a high potential for improvement have been identified, process technology should be especially applied to those areas.

Third, this strategy is more likely to make a technology being accepted. Technology which is based on something familiar and approved is much more likely to be accepted. Users of new technology must clearly see that there is a benefit from the technology. They must not feel overwhelmed by it. The change in technology is less radical, when process performers (i.e., the people who are affected at their working level) have something familiar they can keep to. Due to the incremental approach, they also have the time to learn to use new technology. Thus, they will not feel as if something completely new is being imposed on them, but they are more likely to view the technology as something they own. If corrective actions need to be taken this can be done fast and efficient. Process technology will only be used in the long run by process performers if they feel familiar with it and if they really feel that it facilitates their daily tasks.

Being installed on web pages this tool can be used to coordinate teams in different geographical locations and ensures that process performers always have up-to-date information. By linking documents into the EPG even documents can be exchanged among different team members.

This incremental strategy may take longer than introducing process technology in one shot. However, the key issue when introducing new technology is not time, but having a functioning technology within an organization which is also being used and accepted by its intended users. As the EPG is based upon HTML it is especially applicable to support distributed processes, using the internet.

4 Experience

This section describes experience with EPGs we have implemented to validate our approach.

For the first validation, two small EPG prototypes were developed for industrial companies in order to find out about the general acceptance of this type of technology. This feedback was positive, and showed that the electronic version of a handbook is a helpful tool to help enact a process consistently. However, as both of these EPGs covered only very small portions of the process and addressed very few roles, detailed feedback could not be obtained.

The first large EPG implemented – the V-Modell-Guide – was based on a national German standard, the so-called ‘Vorgehensmodell’ [8] (Procedures Manual), or V-Modell for short. The first version of the V-Modell-Guide consisted of HTML files, which had been exported from the word documents. The V-Modell-Guide is publicly accessible (*http://www.iese.fhg.de/VModell*). In further increments we first added product templates and incorporated some changes in layout which had been suggested by users. In a second increment, mails that had been posted to a mailing list that is being maintained to support users of the ‘Vorgehensmodell’ were attached to this EPG to simulate annotations. In a third increment, we provided templates to download together with the artifact described in the V-Modell Guide. Figure 1 shows an example page of the VModell Guide.

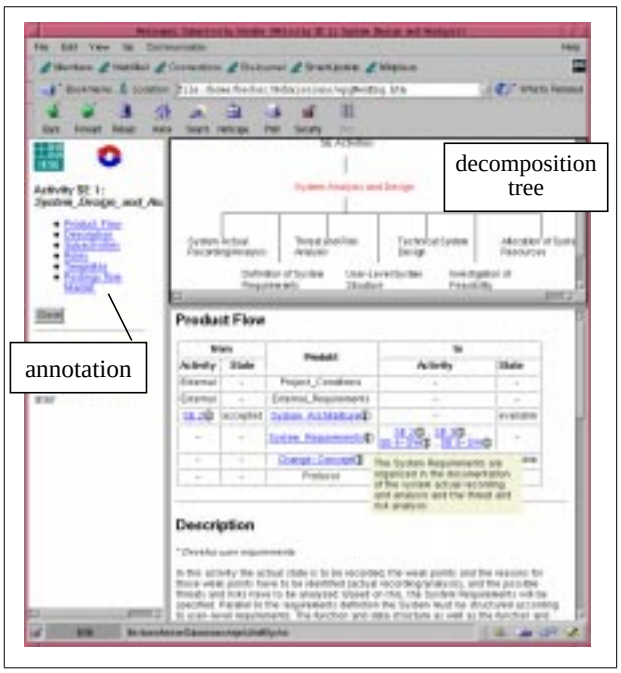

Figure 1: VModell Guide

Direct user feedback we obtained through emails indicate a high user acceptance. Especially the structure and navigation possibilities which facilitate the usage of the standard are very much appreciated. Many users asked for copies of the V-Modell-Guide to install locally, in order to avoid download times.

The experience gained with the V-Modell-Guide indicated, that the manual development and maintenance of such an EPG is too effort-intensive and error-prone. Thus, a generator to automatically produce HTML files from Spearmint™ process descriptions was developed [2]. Spearmint[1], a process modeling tool is also being developed by FhG IESE. In order to provide additional

interfaces, a newer version of this generator allows to produce XML files which can additionally be imported by word-processing systems. Figure 2 shows an excerpt of a spearmint model of A detailed account of the experience gained with the implementation and usage of this prototype can be found in [3].

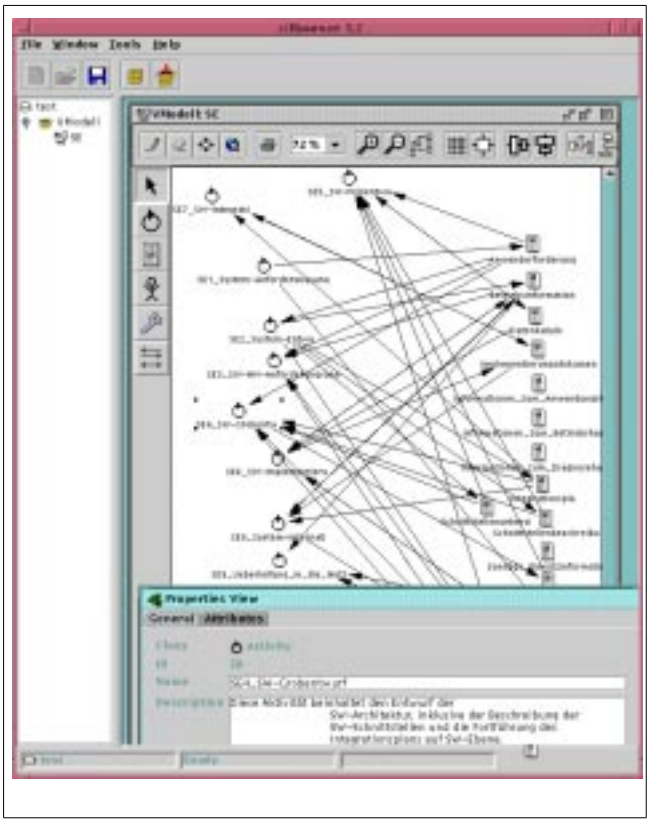

Figure 2: Spearmint model

Currently, an XML-based EPG concept is being developed in cooperation with a large multinational company. This organization has sites in locations in different continents. For this project, the aim is to explore how such an EPG can be used to coordinate projects in a multinational environment. A major point for this EPG was the need not only to provide a web-based process handbook, but also to provide the possibility to provide a mechanism to generate word or framemaker documents. For the development of this EPG an incremental approach is being followed: The first prototype is to cover only a small subset of the process and its related documents. It is planned to show this first prototype to a subset of the

1. (Spearmint = **S**oftware **P**rocess **E**licitation, **A**nalysis, **R**eview, and **M**easurement in an **Int**egrated Environment is a registered trademark of FhG IESE. Further information about the project and tools can be found at *http://www.iese.fhg.de/Spearmint_EPG*)

Figure 3: Page of EPG generated from example

future users in order to obtain early feedback on contents and design. This EPG is then gradually to be extended by integrating additional process areas, providing additional information, services, and links to external references.

5 Summary and Conclusion

This paper presents describes currently available process support. This type of process support is hardly used in industrial practice because introducing this type of tool support usually involves a radical change for process performers and a high investment for an organization. This paper suggests a sliced approach to introduce process support technology. As most existing tools only allow to be introduced at one shot the concept of the Electronic Process Guide is introduced which allows to be introduced gradually. The paper concludes with some examples of EPGs and experience with their development and usage.

6 References

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