

The V-Modell Guide: Experience with a Web-based Approach for Process Support

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Abstract

In many software developing organizations handbooks prescribe how the development processes are to be carried out in order to provide support during process performance. However, these process handbooks often are not accepted by their intended users. This paper presents a new concept for the representation of process information and process support, the Electronic Process Guide, or EPG for short. One specific instance of the EPG, the 'V-Modell Guide' is introduced. We report the experience related to the implementation of the two major increments during development as well as with the usage of the V-Modell Guide.

1 Introduction

Software development processes are so complex that Process Performers cannot cope with this complexity unless they are adequately supported, that is, provided with the process knowledge they need to perform their tasks. Company-wide intranets provide an ideal infrastructure for such support – even if different branches of the organization are in geographically separated areas. Ideally, people share a single explicit source of knowledge.

The two major forms in which process knowledge is made available to Process Performers in today's environments, are process handbooks and workflow management systems.

In many organizations, official or organization-specific standards have to be adhered to in order to support Process Performers. However, paper-based process handbooks have shown to be too unhandy for Process

Performers. They are laid out linearly and are difficult to maintain. In addition, process handbooks are often long and the information chunks can only be tracked down with considerable effort. This can cause process handbooks to be infrequently, if ever, consulted – mainly because they are not accepted by the intended users. 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. If a new edition of the process handbook is released, all process participants must have a copy of the new version to ensure that all of them perform the process in the same consistent way. Often this is not the case. Instead, different versions might be used in parallel in an organization or project. Personal notes from previous versions can only be incorporated into the new version with considerable effort.

For process handbooks to be practical they must be available on-line in order to overcome some of these deficiencies. We know of several organizations which currently implement intranet process handbooks in order to make the process knowledge accessible to everybody concerned. 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, they hardly allow to attach additional information, such as personal annotations or notes.

As yet, the available support mostly takes the form of Process-Centered Software Engineering Environ-

ments (PCSEEs) or Workflow Management Systems (WFMS). These systems have some notion of process state, and a process description (i.e., process program) which is interpreted or executed by a so-called process engine. WFMS and PCSEEs are criticized as being too rigid, thus not flexible enough. From a number of projects it has been reported that introducing process support in a company can fail because the technology shift is too big or the support is simply inadequate [6]. WFMS and PCSEEs require fine-grained, well-defined process descriptions to work. This type of process technology can only be employed to provide support for fine-grained activities [1] and does not give much freedom for user choices. Moreover, most existing tools focus on managing process state data at a very detailed level of activities and fail to give the larger context in which these activities take place. The user interface is mainly determined by the tools used in the process. Sometimes, standard windows are used for communication between user and process engine (e.g., task list or agenda, or a dialog window to start a process) which in general provide a minimum of information. However, software processes are large and complex, and therefore Process Performers need additional context information and no prescription of what to do next. Developers often perform several processes in parallel (e.g., while the compiler runs, they write some test data), or even do not think about what process they perform at the moment. They want to still have control over process support.

We believe that some of the technologies developed in the PCSEE and WFMS communities can be used to support industrial software development on a large scale. However, when these technologies are newly introduced, the technology shift is too large. An incremental approach is required which would allow a step-wise introduction of process support tailored to the organization and its specific characteristics thus allowing to improve user acceptance. We propose to start with the obvious: moving paper process descriptions to the intranet. In the next steps, more features can be added to the system, such as annotation services or access to templates and examples for process documents.

The absence of process state information and execution of process descriptions in this first iteration requires a shift from process *enactment* to process *guidance*. A process guide is a reference document for an intended process. An Electronic Process Guide (EPG), is a process guide available in an 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]. (Further information on the EPG concept can be found at: <http://www.iese.fhg.de/epg>.) The EPG is a hypertext-based process handbook which can be accessed using conventional web browsers. In addition to making updated information immediately available to all users, the usage of HTML [3] and server-side scripts allows to attach additional information, such as templates or annotations which can be shared among various users. It is up to the user to decide what information he accesses, with what level of detail, and in what notation (e.g., text or graphical).

The EPG concept allows an incremental approach to introduce process technology into an organization. Starting with the obvious, that is, implementing the process handbook on the company's intranet, the process description can be decorated with additional information. Step by step services are added to enhance support for Process Performers, like agendas or access to templates. Thus, the process handbook shifts from the pure process documentation to a structure allowing access to all project-relevant information.

In several improvement projects conducted by FhG IESE at industrial organizations, EPGs have been installed on their corresponding. In addition, a national German standard, the 'Vorgehensmodell', ('V-Modell' for short) was implemented as an EPG (<http://www.iese.fhg.de/VModell>). This allowed us to find out more about how such a piece of technology can support Process Performers.

This paper recounts experience from carrying out the first step of setting up an EPG and summarizes the lessons learned when opening up process knowledge in this form to the whole audience of the Internet.

This paper is structured as follows: The next section gives some background information about the German standard 'Vorgehensmodell'. Section 3 explains how this standard was implemented as an EPG. Section 4 describes user behavior with the V-Modell Guide. Finally, Section 5 concludes with a summary and outlook.

2 The German 'Vorgehensmodell'

The German 'V-Modell' [4] ('Procedures Manual'), is a national German process standard (similar in structure to MIL-STD 498) with complementary method and tool selection handbook. The first version

of this standard was developed in 1992 by the German Department of Internal Affairs in cooperation with a consulting firm, the *Industrie- und Anlagenbetriebsgesellschaft* (IABG), Ottobrunn, Germany. In 1997, the updated version, 'V-Modell 97', appeared. The V-Modell is not only used in cooperations with the German Ministries of Defense or Internal Affairs where it is mandatory. A lot of small and medium-size companies in Germany, Austria, and Switzerland also employ the V-Modell or a tailored version of it as their company-specific standard. In addition, a mailing list is aimed at information exchange among users of the V-Modell and the developers of the standard. Consulting is provided for organizations who introduce the standard, and annual meetings take place as a forum to exchange experience with the V-Modell among the users.

The text of the V-Modell is publicly available, e.g., on the Internet (<http://www.scope.gmd.de/vmodell/> in German, or <http://www.scope.gmd.de/vmodell/en/> and <http://www.informatik.uni-bremen.de/~uniform/gdpa/> in English), as a book [4], or as a Word-file on CD-ROM. In addition, many books describe how the V-Modell can be best introduced into an organization, e.g., [5].

The printed version of the V-Modell has some 190 pages, plus an additional 50 pages for the appendix. It describes four submodels, 44 products, 23 roles, and 103 activities. Many organizations have their version of the V-Modell made available to the Process Performers, as a printed version or in PDF format. However, these versions suffer from the same restrictions as outlined earlier.

3 The IESE V-Modell-Guide

In order to find out more about user behavior when using process guidance, we decided to implement the V-Modell 97 in the German language as a prototype EPG, the V-Modell Guide. It can be accessed on the internet at <http://www.iese.fhg.de/VModell/>.

Altogether, we developed two major increments. Based upon Word files which had been provided by the IABG we developed the first – basic – version of the V-Modell Guide and made it publicly available on the Internet in March 1998. The major design principles guiding the development of the V-Modell Guide were the following:

- Display the process in a modularized way, that is, display process entities one by one.

- Give as much orientation as possible. For every element this required an extra frame to show its breakdown structure and a frame to show its internal structure.
- Allow for many possible kinds of navigation between elements. This principle resulted in a large number of highly interlinked files.
- The V-Modell Guide should contain all information from the original document, plus information which could be generated from the document, such as an overview of what role participates in what activities.
- In order to keep the amount of technical issues at a minimum the version provided had to be read-only and was not directly to be modified by users.

In the V-Modell Guide the information is displayed in the window of a web-browser. Roles, activities, artifacts, and submodels each are shown in their own windows. These windows have the same structure for the four element types.

Figure 1 shows an activity as example from the first version of the V-Modell Guide. In this version, each window consisted of the following four frames:

- The left frame displays an overview for the current element, its internal structure. The overview allows to directly navigate to the main information units in the description frame.
- In the top frame, a graphical overview shows the hierarchy of the current element. This graph is sensitive, i.e., allows navigation to displayed elements. Each graph was created manually.
- Below the top frame, the description frame contains the major information units, such as product flow, role assignment, or activity refinement. The process information is structured according to the process modeling schema presented in [9].
- The glossary at the bottom gives short descriptions for information referred to in the description frame. This should spare the user to navigate between different windows in order to obtain the information needed. For example, clicking on the entry for producing activity *SE2* in the description window, for instance, would display the short description of *SE2* in the glossary.

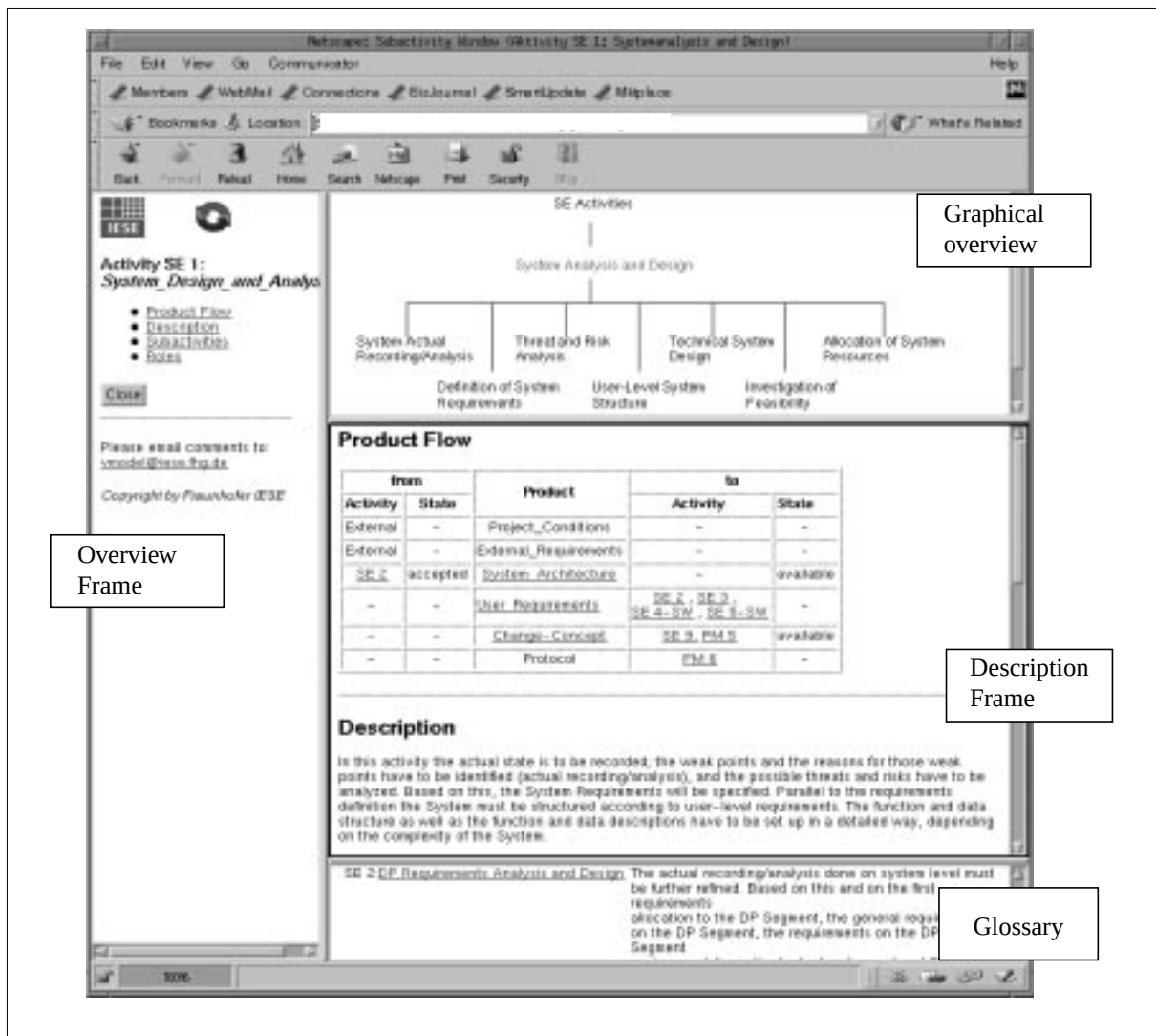


Figure 1: Example activity from the first version of the V-Modell Guide

In the second version the V-Modell Guide was extended with additional information, such as annotations and templates.

For the annotations, messages from the mailing list were attached to the corresponding process elements. An on-line archive of the mailing list is maintained at <http://www.v-modell.iabg.de/maillst.htm>.

For instance, if someone had asked an email question regarding the activity *System Design and Analysis*, this email plus the replies were attached to this activity. These emails could give explanation about this activity in addition to the text in the standard. The authors of the standard had provided template files which we attached to the corresponding artifact descriptions in the V-Modell Guide. These templates can be downloaded by the

users as needed. Thus, additional information is made available in the context where it is required. Users do not have to search for the information but it is directly shown to them whether any additional information is provided and where they can get it. Additionally, the usage of the glossary was facilitated. Glossary information is now shown as tool-tip information, i.e., when users rest the mouse pointer on the -icons. Clicking on the on the -icon navigates users to a whole page providing glossary information. The implementation as tool-tip also allowed to enlarge the area of the description frame in which the core information is shown.

The effort to develop the first version of the V-Modell Guide took about two person months. Since the text had already been available in Word format, the effort

pany's intranet, in order to avoid network latency. In addition, a copy of the V-Modell Guide will appear on a CD with tool demos related to the V-Modell. These tools will be published together with a book on the V-Modell in Summer 99.

The low response rate to the questionnaire we had provided with the V-Modell Guide did not allow us to derive usage profiles or find out how people utilize the V-Modell Guide. Therefore, any information about user behavior could only be deduced by analyzing the log files of the web server. Consequently, the numbers given here can only reflect general trends and do not give a sound data analysis.

More than half of the sessions were conducted from Germany (top-level domain 'de'), about 10% each from the German-speaking countries Austria and Switzerland. Interestingly enough, about 10% of the sessions could be identified to be from non-German-speaking countries. The rest could not be clearly identified. (As a 'session' we counted all accesses from one computer within one day. In order to single out people who had accidentally hit the page, we only took sessions into account which concerned more than six web pages. Accesses from search engines were not counted. Altogether we analyzed 477 sessions between April 1998 and December 1998.) About 24% of the sessions came from research and academia, the rest from company-specific computers. The major access times are during the working hours, from 9 to 11 am and from 1 pm to 5 pm, with peaks at 9 and 10 am, 1 and 2 pm, and at 4 pm. In general it can be said that weekend days and holidays have far lower access rates than working days. The majority of the users visit again: out of the 477 sessions observed only 181 are single sessions from that domain, that is, limited to a single day. The web page which was announced as the official introductory page (<http://www.iese.fhg.de/VModell>) and which is referred to from other web pages is the entry point for most users. This holds equally for users who come for the first time and for those who visit again. The introductory page is also the most frequently used page of the whole V-Modell Guide. The majority of the sessions analyzed cover between 15 and 60 pages, the longest sessions visited 468 and 662 pages.

It can be deduced from the direct user feedback, duration, time, and number of returned visitors, that people actually use the V-Modell Guide to support them in their daily work.

5 Summary

As a general remark, this experience showed us that it was possible to implement process information in our new EPG concept. The positive feedback gained shows that the EPG concept is a means to represent complex process information and therefore support Process Performers in their tasks. However, the effort for the implementation of electronic handbooks is relatively high, so that the manual creation of electronic handbooks is very likely to be too cost-intensive for most industrial organizations. As a consequence, FhG IESE has implemented a generator for the process modeling environment Spearmint™ [2] which is also being developed by FhG IESE. (Spearmint = **S**oftware **P**rocess **E**licitation, **A**nalysis, **R**eview, and **M**easurement in an **I**ntegrated Environment is a registered trademark of FhG IESE. Further information about the project and tool can be found at <http://www.iese.fhg.de/spearmint>.)

This generator allows to export Spearmint process models into EPG format. This avoids the time-intensive task of creating a high amount of files and links within the EPG. In addition, the usage of the process modeling environment gives the possibility to check a process model for consistency and quality prior to generating an EPG version of the process. An applet is generated which, in an explorer-like style, permits navigation through and selective hiding of subtrees in the hierarchy. However, complex graphical diagrams like Statecharts can not be produced by the generator. Figure 3 shows an example artifact page of an EPG completely generated from a Spearmint process model.

6 Outlook

In addition to the high effort for creating EPGs the high effort for maintenance is an issue. When changes are made which affect the whole EPG (e.g., changing the overall structure), all files have to be modified manually, and a lot of links have to be changed. In order to avoid this type of problems in future, Spearmint is currently extended in a way to allow export of process models of models in XML format [8]. The usage of style specifications, such as Cascading Style Sheets or XSL files could make it easier to adapt the representation to different user needs and to increase the maintainability [8] of an EPG. For instance, the product flow information could, depending on the specific needs of the user, be represented as a table, including state information about the products, or as a bulleted list.

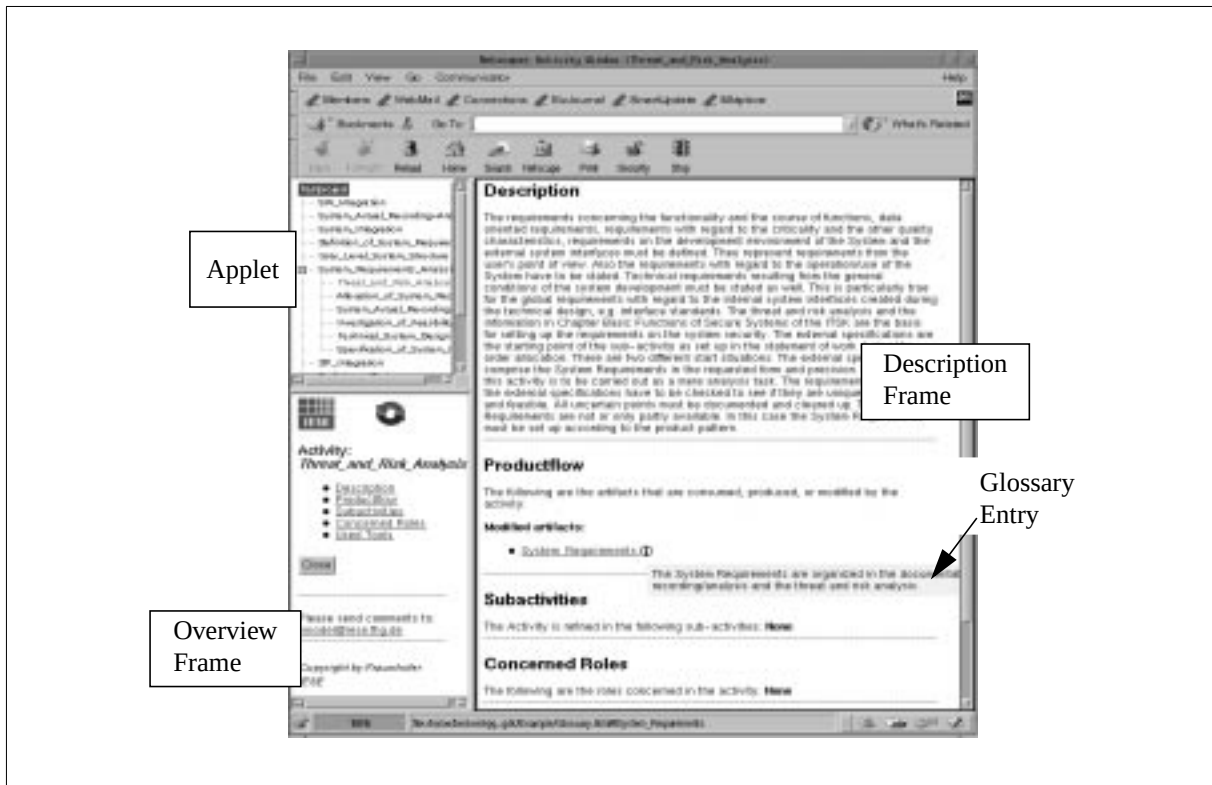


Figure 3: EPG, generated from a Spearmint process model

Data export to XML is also a key in providing paper printouts from the content of an EPG. Processing of tagged information can be used to generate references in the text, or tables of activities and artifacts. This service is important because some people still will require a paper version of the process definition (e.g., assessors to check mark), or just for ease of access when being abroad.

For future increments we plan to include information about the current process state. Such information will allow to provide process participants more specifically with the process information they may need in their context and situation. State information can even be used to coordinate process teams working in different geographical locations. A first solution for representing a simple process state, now in its prototyping phase, offers the users a checklist of the activities and input artifacts which they can check off as completed. This allows users to track processes. The marks are stored in a database to make them persistent so that resuming work is facilitated.

Further work will also be done in the area of process tailoring. By using tailoring tools we see an opportunity

for process descriptions to be modified according to a project's needs very easily.

In general, there will be always usability studies be conducted in order to improve the user interface and to provide the services most valuable to Process Performers.

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8 References

- [1] Jim Arlow, Sergio Bandinelli, Wolfgang Emmerich, and Luigi Lavazza. A fine-grained process modelling experiment at british airways. *Software Process-Improvement*

- and Practice*, 3(3):105–131, November 1997.
- [2] Ulrike Becker-Kornstaedt, Dirk Hamann, Ralf Kempkens, Peter Rösch, Martin Verlage, Richard Webby, and Jörg Zettel. Support for the Process Engineer: The Spearmint Approach to Software Process Definition and Process Guidance. In *Proceedings of the Eleventh Conference on Advanced Information Systems Engineering (CAISE '99)*, Heidelberg, Germany, June 1999. Lecture Notes in Computer Science, Springer-Verlag.
 - [3] Tim Berners-Lee and Daniel Connolly. Hypertext markup language: A representation of textual information and metainformation for retrieval and interchange. Technical report, CERN and Atrium Technology Inc., July 1993.
 - [4] Adolf-Peter Bröhl and Wolfgang Dröschel. *Das V-Modell*. Oldenbourg, 1995.
 - [5] Wolfgang Dröschel, Walter Heuser, and Rainer Midderhoff. *Inkrementelle und objektorientierte Vorgehensweise mit dem V-Modell 97*. Oldenbourg Verlag, München – Wien, 1998.
 - [6] Volker Gruhn and Juri Urbainczk. Software process modeling and enactment: An experience report related to problem tracking in an industrial project. In *Proceedings of the Twentieth International Conference on Software Engineering*, pages 13–21, Kyoto, Japan, April 1998. IEEE Computer Society Press.
 - [7] Marc I. Kellner, Ulrike Becker-Kornstaedt, William E. Riddle, Jennifer Tomal, and Martin Verlage. Process guides: Effective guidance for process participants. In *Proceedings of the Fifth International Conference on the Software Process*, pages 11–25, Chicago, IL, USA, June 1998. ISPA Press.
 - [8] John E. Simpson. *Just XML*. Prentice Hall, 1998.
 - [9] Richard Webby and Ulrike Becker. Towards a Logical Schema Integrating Software Process Modeling and Software Measurement. In Rachel Harrison, editor, *Proceedings of the Nineteenth International Conference on Software Engineering Workshop: Process Modelling and Empirical Studies of Software Evaluation*, pages 84–88, Boston, USA, May 1997.