Roadmap to Akogrimo Convergence:

A Sample of Process Oriented Knowledge Management with PROMOTE®

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Abstract: Akogrimo is an FP6 EC-Project that implements a mobile Grid middleware. Beside the grid and mobile related challenges there are also interesting knowledge management questions to be addressed. The first knowledge management challenge is to coordinate the distributed software development of 13 partner organisations in Europe in a highly sophisticated domain. The second challenge is to support developers that want to use the open source Akogrimo middleware to build their own services on top. Both challenges are approached applying Process-Oriented Knowledge Management with PROMOTE® requiring an integration with the so-called "Roadmap to Akogrimo Convergence". This roadmap has to guide developers in moving from traditional development infrastructures to the innovative Akogrimo platform. A modelling framework supports the developers in using, adapting of integrating the Akogrimo middleware and links the above knowledge management approach. The following article introduces the modelling framework and focuses on the knowledge modelling approach. Sample models making the expert knowledge explicit are discussed and the procedure of knowledge acquisition is introduced. In this scenario PROMOTE® is used as an index to navigate within the Akogrimo knowledge.

1 Introduction

The EC-project Akogrimo [Akogrimo 06] (IST- FP6-2003-IST-2-004293) is an Integrated Project with 13 partner organisations with approximately 40 distributed developers that implement an innovative software middleware enabling mobility to grid services [Wesner 04], [Litke 04]. The main focus of this project is related to mobile- and grid technology, but beside these technical issues the project faced two interesting knowledge management challenges:

The first knowledge management challenge is the coordination and distribution of expert knowledge from 13 partner organisations. The term "service" for example had different meanings for partners in the mobile technology layers, than to the partners of the grid layers and to the partners in the business layers. The Akogrimo glossary [D2.1.1 04] was suitable only at the beginning of the project. The consistency of the

project deliverables became challenging, as after 18 month the deliverables resulted in about 3000 pages. These documents currently consists of some hundreds of UML diagrams in different formats (ADONIS®, Visio, and Telelogic TAU), about hundred slide presentations, forty workpackage descriptions, fifteen service specifications and two development environment descriptions differently stored at the partner's site.

The second knowledge management challenge is the knowledge transfer to external developers that do not belong to the Akogrimo project team. As this project results in an open source middleware that is supposed to be used by external developers, the knowledge transformation from the Akogrimo partners to external developers is a critical success factor.

The knowledge space in Akogrimo consists of BSCW [BSCW 06a] for the project partners, of the official project homepage [Akogrimo 06], of external Internet links, of file directories and databases at the partners' site and mainly as tacit knowledge in the head of the developers.

Beside the usage of the knowledge management instruments [Woitsch 04a], messengers, collaborative directories, shared desktops, telephone conferences, emails, face to face meetings and workshops the clear need to provide additional knowledge management for the project was evident.

The Process-Oriented Knowledge Management Approach PROMOTE® was introduced to make expert's tacit knowledge explicit and integrate the knowledge in the so-called Roadmap to Akogrimo Convergence. The next chapters briefly introduce the Roadmap to Akogrimo Convergence and the realisation approach with PROMOTE®. Some sample models to clarify the externalisation are introduced before concluding this text.

2　The Roadmap to Akogrimo Convergence

A key success factor of the Akogrimo middleware is the usage by external software developers that would like to use the open source platform to operate a mobile grid or to build innovative mobile grid services on top of it. To support the developer the project planned to build a guideline how to convert the developers' traditional infrastructure to the new and innovative Akogrimo platform. This guideline was named Roadmap to Akogrimo Convergence with a budget of 20-person month. In the according deliverable [D 5.4.1][1] the roadmap is defined as: "The roadmap that collects all steps – based on previous partner experiences – necessary to develop services/components of the Akogrimo infrastructure. … there are some differences in the steps on the basis of service nature ….The roadmap should represent in a schematic way (flow blocks) …".

2.1　The Modelling Framework

A graphical modelling framework has been defined to enable the Process-Oriented requirement analysis of applications, the specification of the software architecture and the externalisation of experts' know-how.
There are three different usage scenarios:

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- ***The Application Development*** scenario supports the business process oriented requirement definition [Kühn 01] and enables the integration of UML-Use Cases for service requirement definition. This modelling language is called Akogrimo Business Process Management (AKBPM) method covering all relevant business-oriented views.
- ***The Platform Development*** scenario supports the architecture of the platform using UML^{TM} 2.0 [Larman 05], [UML 2.0 06].
- ***The Service Development*** scenario provides externalised knowledge in implementing services. Developers experience has been externalised using a model based approach that act as a graphical user interface to knowledge.

The used modelling framework enables the integration of modelling languages with meta model integration patterns [Kühn 03] such as loose integration pattern, intermediate integration patterns and strong integration patterns. In Akogrimo the modelling languages AKBPM – a business oriented modelling language -, UML – a software design modelling language -, and PROMOTE$^®$ - a knowledge management modelling language are linked by a loose integration pattern.

2.2 Methodological Mapping and Knowledge Trigger

The three independent modelling languages AKBPM, UML^{TM} 2.0 and PROMOTE$^®$ have been coupled using so-called "transit model types". The mapping between the AKBPM and UML^{TM} is the model type "Use Case Diagram". The following table indicates the main idea of the methodical integration. A detailed discussion on this integration is published in the Akogrimo deliverable [D 5.4.1].

Scenario	Method	Methodical Support	Output
Application Development Scenario	AKBPM	Business processes are used to specify application requirements. Business "Use Cases" in AKBPM are linked to technical "Use Cases" in UML^{TM} 2.0	Business Service Sheets as a text document.
Platform Development Scenario	UML^{TM} 2.0	Diagrams to specify the platform architecture as well as to link to AKBPM "Use Case" models.	Deployment Diagram to identify services.

Table 1: Methodical Support using modelling methods

The final deployment diagram in UML notation triggers a software development process that is supported by PROMOTE$^®$.

Scenario	Method	Input	Knowledge Support
Service Development Scenario	PROMOTE$^®$	Deployment diagram in UML^{TM} as a trigger to start the development.	Externalised knowledge on development steps, classification, skills and tutorial material.

Table 2: Knowledge Support using modelling methods

The following sections describe the knowledge support that is linked to the business view by a special text document called Business Service Sheet, which describes the business requirements. A link to the technical view is provided by the technical description of a service.

3 The PROMOTE®Approach

This chapter briefly introduces the PROMOTE® approach [Woitsch 02] that has been used to make developers experience explicit.

3.1 The Meta Model of PROMOTE®

This section depicts the 11 model types of PROMOTE®, consisting of three overview and two pool models.

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Knowledge Map
  Knowledge Product Model
  Process Map                        Team Map
    Business Process Model             Working Environment Model
    Knowledge Management Process Model Skill Environment Model
  Knowledge Structure Model
  Knowledge Tool Model               Knowledge Resource Model
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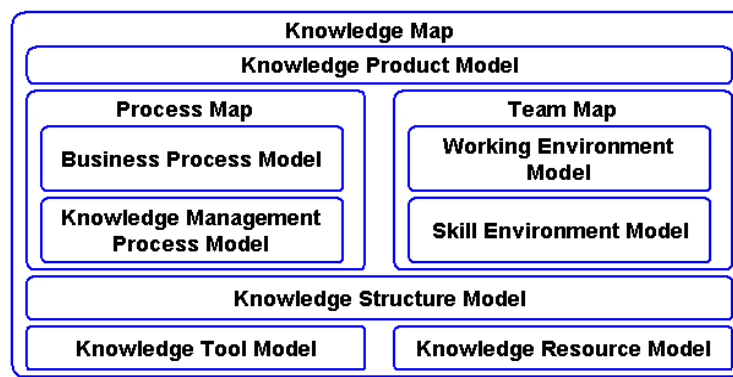
Figure 1: The description of the PROMOTE® Meta Model indicates the tree overview models like the knowledge map, the process map and the team map and the pool models knowledge tool model and the knowledge resource model.

The Knowledge Map model describes an overview on the whole roadmap. The Knowledge Product Model describes and classifies information products. The Process Map is an overview model that identifies all relevant processes. The Business Process Model describes a sequence of logically related activities. In this scenario this model type is used to define the roadmap. The Knowledge Management Process defines the knowledge flow within an organisation. The Team Map is an overview model that identifies all relevant human and organisational aspects. The Working Environment Model describes the organisational environment such as organisational units, performers and roles. The Skill Environment Model describes the skill-profiles. The knowledge structure model enables the classification of the content. It was used to distinguish between organisational, technical, human and content structures. The knowledge tool model is a pool model that collects and describes all relevant tools. The knowledge resource model is a pool model that collects and describes all relevant resources.

3.2 The PROMOTE® Method

This section introduces the method that was used to externalise the knowledge.

Initially an acquisition table was generated. In a telephone conference the feedback had been discussed and modelling workshops were arranged. The modelling workshops were held on a bilateral basis (interviewer and expert) using Web-based collaboration tools. Open issues raised during the workshop were the input for the next acquisition table. Five cycles were performed.

Beside the Internet-Workshop there were traditional face-to-face workshops. The traditional face-to-face workshops were suitable when introducing new issues but less productive when details had to be modelled.

The sequence of building up the knowledge models started first with an overview on the Akogrimo knowledge space by modelling a so-called knowledge map that indicates the main processes and knowledge structure.

In a second step, each partner described the starting point for service development. The different descriptions of the starting points resulted in the identification of key knowledge structures.

Third, the individual implementation processes were modelled using traditional workshop techniques. Based on these processes three techniques had been applied to make knowledge explicit. The first approach was to generate individual glossaries in parallel with the modelling session and to combine them at the end of all sessions to an agreed taxonomy. An interesting example was that the definition of the word service resulted in 16 different descriptions. The second approach was the identification of knowledge structures using a "FODA-like" [FODA 05] approach. The resulting knowledge structures and knowledge resources where identified. The third approach analyses process patterns. The analysis of decisions in the process was the basis for the skill profiling.

Fourth, the knowledge structures identified in the previous step were modelled in detail, before the knowledge resources such as documents or portals links have been identified. Each knowledge item mentioned in the knowledge structure was explained and related knowledge resources were collected.

Finally, a reference process was generated that merged all individual models into one process to guide the user step by step through the Akogrimo knowledge space.

4 Sample Models of the Akogrimo Roadmap

A Web-based modelling environment was implemented that realises the above-described modelling framework. The tool was called Graphical Evolution tool [D 5.4.2] providing a Web based model editor for distributed modelling, a Web-user interface for up- and download of models in the format EPC, UML/XMI and BPEL and a Web-component to browse within the models.

First a knowledge map identifying the main elements was modelled that is seen as a navigation support within the 22 knowledge models.

4.1 The Roadmap: A Knowledge Intensive Process

The "Service Development Reference Roadmap" is modelled as a business process model that describes the main phases of software development referring to sub-processes with recommend development activities. Each activity provides a recommendation and pointers to documents that support this development phase.
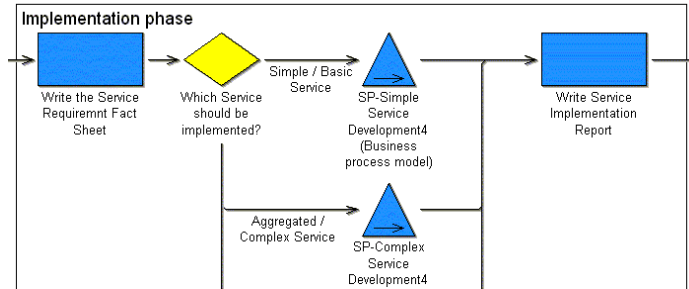

Figure 2: The Service Development Reference Process indicates the different development phases[2]

A key element in this reference process is the maintenance of the Service Fact Sheet, a concept that was introduced to enhance the software documentation and requirement specification.

4.2 The Feature Map: A Knowledge Structure

The knowledge structure "Akogrimo Features" indicates the difference between a basic Grid platform, an advanced Grid platform and the Akogrimo platform.
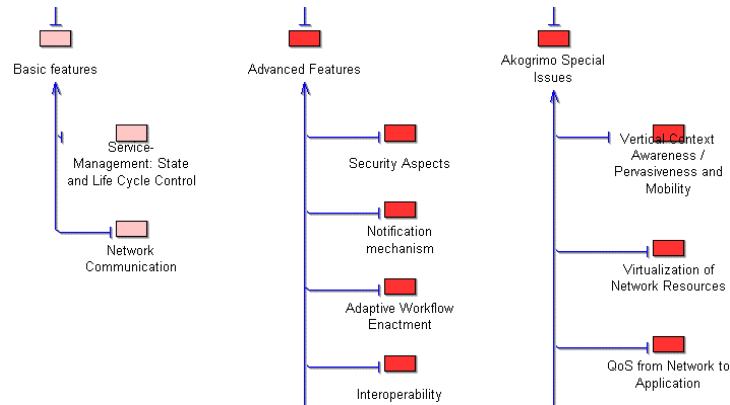

Figure 3: Shows an extraction of a knowledge structure, explaining the difference between basic, advanced and Akogrimo Grid platforms. A simple colour code – light red means less impact, dark red means strong impact – indicates the importance[2]

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[2] For a complete view on the models, please refer to http://83.65.190.82/

4.3 Skill Profiling

A Skill Profile matrix was defined based on the analysis of decisions in the business process that ended up in 10 different profiles. Each skill profile refers to knowledge structures like depicted in Figure 3 and points out the recommended skill level. The process depicted in Figure 2 provides tests, so developers can check their skill profiles and select the development path accordingly.

	Starter / Junior	Advanced / Senior
Platform Feature Skills	Application skills - Profile, Middleware skills - Profile	Application skills - Profile, Middleware skills - Profile
Application Concepts Skills	Application skills - Profile, Middleware skills - Profile	Application skills - Profile, Middleware skills - Profile
Technology Skills	Java – World skills, MS – World skills	

Table 3: Skill Profile Matrix

5   Conclusions

The PROMOTE® approach has been applied in a large software development project (1083 person month) to support distributed software development between different partners [D 5.4.2] and to externalise expert know-how in form of models.

The business requirements are specified using 41 models describing the application on top of Akogrimo in a process-oriented way. 122 UML™ models describe the key corner stones of the architecture. 22 PROMOTE® models were used to describe the knowledge space.

These models resulted in a common understanding of the partners and a synchronisation of work. The models were used as a graphical user interface for Akogrimo content.

Experienced developers benefit from this approach because the modelling workshops act as a trigger for discussions. Inexperienced developers now have a guideline to get introduces to the topic Akogrimo.

A successful demonstration after 18 month was given, showing the modelling framework, the web-based modelling tool and the content that has been generated. There was a common agreement that this approach will support the distributed development in the next development cycle. Some adaptations on the tool enriching the browsing functionality will be implemented till July 2007.

University of Zurich in reviewing the Roadmap as well as Prof. Dr. Karagiannis from the University of Vienna in mentoring the development of the Akogrimo Roadmap.

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