Analysing Requirements for Virtual Business Alliances – the case of SPIKE

Christian Broser, Christoph Fritsch, Oliver Gmelch, Günther Pernul, Rolf Schillinger and Sandra Wiesbeck *)

Department of Information Systems, University of Regensburg, Germany
*) IT-Inkubator Ostbayern GmbH, Germany
{christian.broser | christoph.fritsch | oliver.gmelch | guenther.pernul | rolf.schillinger}@wiwi.uni-regensburg.de
sandra.wiesbeck@it-speicher.de

Abstract. More and more companies are realising that business is best carried out in project-based virtual alliances and are intensively networking and collaborating with partner companies. This requires convergent, adaptive, and interoperable IT environments ready to support flexible, loosely coupled networked enterprises, anywhere, anytime - regardless of heterogeneous systems and applications in use. In this paper, a methodology for gathering and analysing user requirements is applied which is specifically tailored for incorporating multi-party views such as necessary for the development of collaboration platforms to support virtual alliances and to prove its significance in a real-world case study. The work presented is performed within the SPIKE project, focusing on the technical, methodological and organisational support of short-term and project-based business alliances between organisations of all types and sizes.

Keywords: collaboration, networked enterprise, virtual alliance, collecting and engineering requirements

1 Introduction

Today's organisations face big challenges such as globalisation, shorter innovation cycles, increased competition, and the negative effects of the current financial crises. To continue being successful on the market and to achieve sustainable competitiveness, organisations have to adapt their ways of doing business. Moving from entrenched thinking and practice to flexible and agile business networks in terms of virtual partnerships across organisation's borders with anybody, anytime and anywhere represents an extremely promising way [1]. This is also diagnosed by recent surveys done for example by AT&T [2] or the Gartner group [3]. Both predict a significant increase of virtual business alliances among partner organisations in the near future. In most economies, small- and medium-sized enterprises (SMEs) represent the biggest fraction of enterprises. For instance, in the European Union, SMEs comprise 99% of all companies [4]. Virtual partnerships enable them to open up new business opportunities, to stay competitive and thereby to better manage existing and upcoming challenges. Frequently, SMEs are specialised and extremely innovative in particular areas but are restricted to offer their services to local customers only. Acting in virtual partnerships – for example, with larger internationally-acting enterprises – may enable them to provide their competencies on a larger global scale and thereby to enter new markets.

Successful virtual collaborations depend on different factors such as skilled employees, integrated processes and extensive use of information and communication technology (ICT) [5]. Although ICT has been identified as an essential aspect for virtual partnerships by several authors (for example [6] or [7]), currently available technologies still lack powerful integration of heterogeneous environments across the partner sites, support of interoperable business process management, the potential to execute inter- and intra-domain workflows, the security and trust of the collaboration platform, and a proper user- and access rights management across domains. To overcome the situation and to provide an integrated solution for collaboration support are hence the goals of the SPIKE project.

The main goal of this paper is to apply a methodology for gathering and analysing user requirements which is specifically tailored for incorporating multi-party views such as necessary for virtual alliances and to prove its significance in a real-world case study. The remainder of the paper is structured as follows: In section 2 we present an overview and the vision of our SPIKE project. This is followed by the applied methodology for requirements gathering (section 3) and a general discussion of the SPIKE requirements (section 4). Section 5 contains the prioritisation of the requirements according to their importance and significance in the SPIKE project. Finally, section 6 concludes this paper with a project status report and an outlook on future work.

2 The case of SPIKE

The goal of the SPIKE[1] (Secure Process-oriented Integrative Service Infrastructure for Networked Enterprises) project is to deliver a software platform for the easy and fast setup of short-term (up to about 6 months), project-based and loosely coupled business alliances among partner organisations. The SPIKE vision includes a 3-layered architecture of a business alliance (see fig. 1). On a top level, all the organisational and legal prerequisites, which are necessary before the business alliance may start, are negotiated. The second level is the conceptualisation of the business alliance. Usually, a project-based collaboration starts with a common goal of all alliance partners. In order to reach the goal, a high-level strategy is agreed upon among the alliance partners, which in later steps is further refined into a detailed business process specification. The responsibility for the different parts of the business process is shared among alliance partners and the partner having the best qualification for a certain task may be in charge for its accomplishment. Developing the global strategy and further refining it into a detailed business process specification is the second layer of the SPIKE architecture. Layer 3, the SPIKE service layer, consists of mapping instruments responsible for assigning proper (web) services to business process tasks, particularly retrieving, selecting, orchestrating, managing and executing them in a controlled way. Layers 2 and 3 are supported by the SPIKE technology. In particular they are supported by a (web) service specification and enactment infrastructure, ontologies and semantic services, interfaces to business process modelling and a workflow management system, a security sub-system, the identity management infrastructure and a SPIKE portal engine.

[1] www.spike-project.eu

The SPIKE solution will encompass a semantically enriched service-oriented infrastructure including a virtual semantic service bus for workflow control and handling and transformation of messages. At the enterprise interface level, a collaborative process portal approach will be delivered, capturing the user's working context and seamlessly transmitting it to other applications and services in the alliance. This will also enable integration of legacy systems via tailored portlets and connectors. Special focus is given to the security and identity management issues involved. The solution will include an easy-to-administer security infrastructure for the business alliance which will consist of basic and advanced security services. Additionally, federated identity management and administration of digital user identities and privileges across organisational boundaries is another major issue. A strong focus on the security and identity management aspects is necessary because of the focus on "project-based" collaborations, meaning that alliance partners possibly are competing simultaneously in other projects not part of the alliance. Additionally, further improvements of the state-of-the-art in the fields of workflow management in combination with dynamic and semantically enhanced selection of service instances, integrating enterprise portals and cross-organisational communication infrastructures are expected.

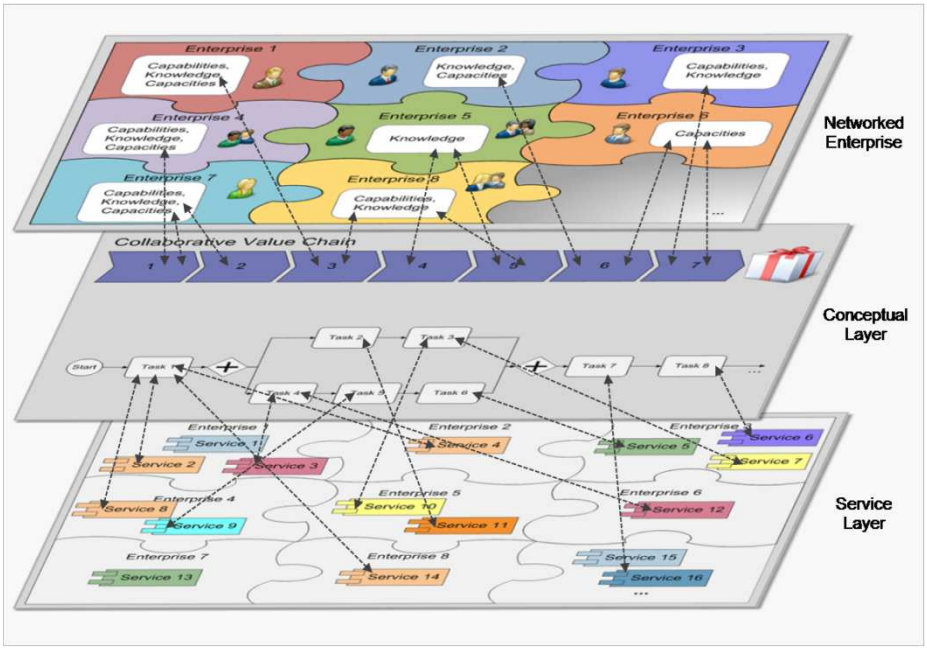

Fig. 1. SPIKE's virtual business alliance

3 Requirements Analysis

It is generally understood that collecting and analysing the requirements is critical to the success of any system. For SPIKE, the general methodology developed by Maguire and Bevan [8] was applied for the requirements analysis. Based on their

findings, the general process for the requirements analysis is performed in four steps which are supported by different analysing techniques accordingly:

1. Information gathering: Background information about stakeholders and processes is gathered. It may be supported by stakeholder analysis, secondary market research, task analysis, or field studies.
2. Identification of user needs: After stakeholder identification, an initial set of user requirements can be identified. User surveys, interviews, scenarios, and use cases as well as workshops are means to collect these basic user needs.
3. Envisioning and evaluation: On the basis of the initial user needs, a prototype (software- or paper-based) is developed. This helps in validating and refining the requirements. It may be further supported by brainstorming, card sorting, and affinity diagramming.
4. Requirements specification: Requirements are specified in compliance to some standardised way. For this, a clear statement of design goals, a prioritisation of the requirements, and measureable benchmarks against which the design can be tested should be documented. Task/function mapping, requirements categorisation, and prioritisation are techniques supporting the requirements specification.

3.1 Strategy and Methods to identify SPIKE Requirements

For SPIKE, the user requirements analysis was conducted in close cooperation with potential future users and by means of the strategy illustrated in Fig. 2, which is described in more detail below.

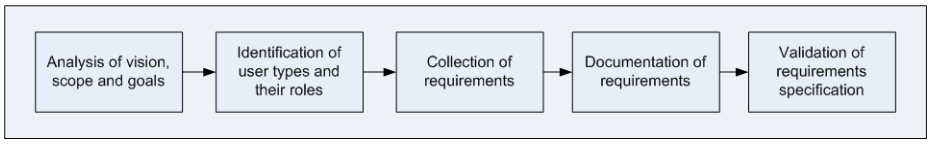

Fig. 2. Strategy for the user requirements analysis

1. Vision, scope and goals. A clear understanding of the context in which the SPIKE system will be operated, its purpose and goals need to be determined and formulated. At the end of this phase, all stakeholders must have the same picture of what the project is about. For SPIKE, the result is that the SPIKE system will serve as collaboration platform having its main scope on (1) outsourcing parts of the value chain to cooperation partners and similarly embedding fragments delivered by alliance partners, (2) fast reaction, easy and fast setup of virtual alliances, (3) flexibility, for short-term and project-based virtual alliances mainly, (4) security, as alliance partners may cooperate in some projects but compete in others.

Furthermore, some additional advanced building blocks were defined: *Federated identity management*, with special focus on mapping users and their privileges among different domains; dynamic composition of *workflows across sites* by means of selecting predefined remote services or dynamic service selection during runtime; providing a common user interface, making use of innovative *portal technologies* and overcoming different data and service formats by employing an enterprise *service bus* and *semantic mediation.*

2. User types and roles. During an analysis of the potential stakeholders of the SPIKE system, the different user types and their relation to the collaboration platform were identified. The outcome resulted in the following types of stakeholders:

The *technology provider* is responsible for setting up the platform as well as related technologies and ensures the successful design, deployment, operation, maintenance, and decommissioning of SPIKE hardware and software assets. A *portal administrator*'s obligation is to maintain basic data and functions to run the collaboration platform's service portal and to create user accounts for service providers and administer their access rights. The *content manager* is in charge of the functionality of the collaboration platform's portal. For him, close cooperation with alliance partners' business areas is essential in order to transit their requirements to user portlets. The *service provider* offers SPIKE services to other companies. He must provide necessary information such as description or pricing for a specific service via the service catalogue. Furthermore, this stakeholder maintains the legal contracts (access rights for service users of a specific service, duration of the contract) and uses the reporting/auditing functionality of the portal to monitor the use. The *service requestor* makes use of a specific service of a service provider via the collaboration platform. The role of *service executors* can be played by software or human beings. *Service executors* are responsible for the execution of a requested service. The *service locator* is responsible for identifying the respective provider of the requested service.

3. Collection of requirements. After all stakeholders and their roles have been identified, the actual gathering of requirements starts. To support this phase in SPIKE, several instruments are applied: A *use case analysis* based on pre-defined application cases turned out to be very effective for gathering requirements. Analysing use cases lead to the description of tasks which have to be carried out by the final system. For the description of the use cases, a template was applied. A *questionnaire*-based survey was conducted by representatives of the stakeholders. Additionally, *interviews*, meaning face-to-face meetings, were conducted with selected participants of the survey in order to clarify inconsistencies as well as to gain additional background information. *Workshops* and *round table* discussions turned out to be very efficient to discuss ideas and exchange opinions between users and developers. Several workshops and round tables with interested companies have taken place to discuss and refine potential requirements.

In addition to the identification of user requirements by the abovementioned methods, further market research was applied to identify user needs and relevant technical literature. Moreover, public information about related projects, such as Crosswork[2], Ecolead[3], Trustcom[4], and others has been analysed.

4. Documentation. After the collection phase, a structured documentation of requirements is essential. In SPIKE, they were assigned to pre-defined types (see section 4). To end up with a standardised documentation, a software requirement specification document, acting as template for the specification has been employed.

5. Validation. Validation ensures that the asserted requirements meet the original goals. As a first step, a prioritisation of the identified requirements was performed.

[2] http://www.crosswork.info/
[3] http://ecolead.vtt.fi/
[4] http://www.eu-trustcom.com/

Furthermore, a check against selected quality criteria such as preciseness, completeness or robustness was conducted and led to the deletion and revision of some requirements.

3.2 Strategy and Method to analyse SPIKE Requirements

The requirements collected are stated in a requirements document which is subject to further analyses. In SPIKE, requirements validation has been carried out using the requirements analysis strategy illustrated in Fig. 3.

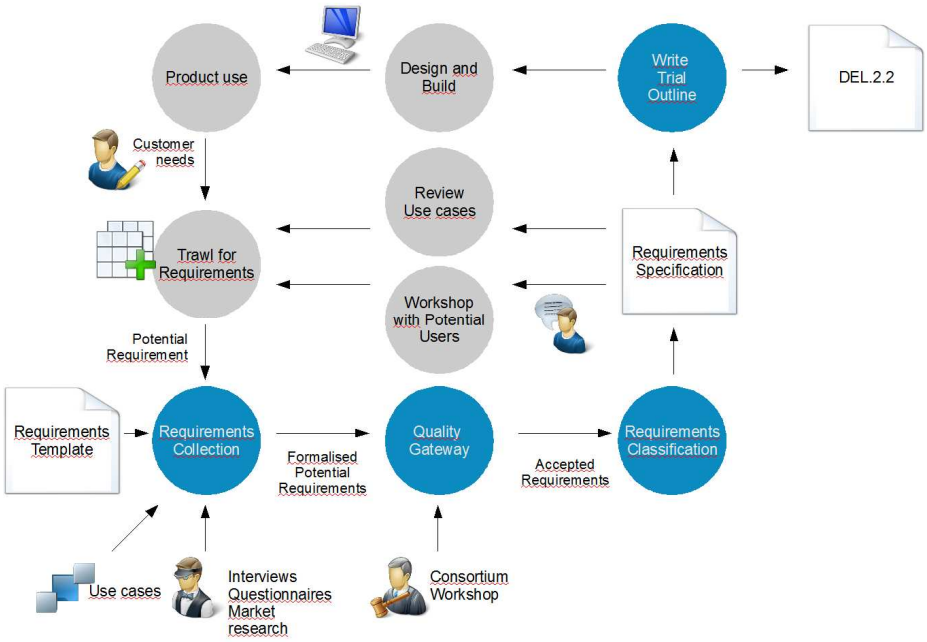

Fig. 3. Requirements Analysis Strategy

The process of analysing user requirements in SPIKE starts with the activity stated in the lower left corner of Fig. 3, passes several phases and finally ends in the requirements specification document (DEL.2.2) shown in the upper right corner. Enabling several iterations to refine and update the achieved results, the requirements analysis is rather a lifecycle than a process. Throughout the lifecycle, use cases and market research are important elements for analysing the requirements. Each single requirement must pass a quality gateway and is reviewed during workshops. Only requirements successfully passing the gateway are still considered and subsequently classified according to predefined requirement types. The analysed requirements serve as initial input for the specification of a SPIKE “functional sketch”, which is passed to the stakeholders for verification.

Relating the SPIKE approach to [8], only minor differences may be determined. We start with an additional phase in order to get a common understanding of the context. Maguire and Bevan’s information gathering and user needs identification

phases are fully included in our strategy and supported by different methods. As the outcome of SPIKE is rather an experimental prototype than a market-ready product, their step "envisioning and evaluation" by an early prototype is of less importance for SPIKE; however, our prototype may serve this purpose well in case it is decided to commercialise the project outcome later. Their final step is also included in our methodology, leading to the final requirements documentation.

4 Categorisation of Requirements for Collaboration Platforms

In order to allow for easier lookup and handling, a categorisation of requirements has been performed along the axes user requirements, usability requirements, and organisational requirements. User requirements merely focus on the functionality aspects of the system; usability requirements include aspects such as level of effectiveness of the system, the efficiency and user satisfaction or the comfort with the system, while organisational requirements target the implication on the individual organisation when introducing a collaboration platform such as SPIKE.

Altogether, almost 100 requirements were collected, whereof sixty were classified as user requirements, thus forming the strongest category. In the following subsections, the categories are discussed on an abstraction level. For a list and a more detailed view, we refer to the SPIKE website[5].

4.1 User Requirements

This type of requirements resulted from the intended users, including both functional and non-functional requirements. A characterisation of the predominant topics is presented below.

Requirements concerning *workflow management*. Users requested to be able to specify and automate execution of individual activities along a process chain. Consequently, a system supporting inter-domain workflows is expected to consist of different tools, for example a workflow engine, process definition tools, links to applications, workflow enactment services as well as administration and monitoring facilities.

Support for *communication* among the alliance partners. This includes both asynchronous and synchronous means for contacting cooperation partners. For synchronous communication, instant messaging and videoconferencing facilities were mentioned predominantly. Also, team communication facilities were discussed, allowing individual groups to share appointments, invitations to group meetings as well as upcoming tasks and milestones automatically.

Another group of user requirements focuses on *integration aspects*. In this context, the primary concern is the integration of legacy applications within virtual alliances, thus referring to Windows-/X11-based as well as mainframe-based applications. Besides, integration of existing SOA was mentioned as a requirement for collaboration platforms, which can be explained by the huge momentum that was created by SOA in the past [10]. Moreover, integration of ERP software and access management products (e.g. Novell Identity Manager, Firepass, Juniper, Tarantella,

[5] Please find a complete list of requirements at http://www.spike-project.eu/index.php?id=136

etc.) was mentioned as a requirement in order to upload configuration data into partner companies' directories.

Another topic addressed is *content management*, again raising the need for team support in terms of joint editing capabilities, enabling users to collaboratively work on content. Content creation has to be kept highly flexible, allowing for usage in different scenarios without any restrictions beforehand. Likewise, semantic capabilities were appreciated, enabling reuse of content generated in different manners.

Security aspects have been identified on different levels: (1) Identification, authentication and authorisation – providing controlled access to the platform and the services offered by third parties. (2) Digital signatures - supporting a fast setup and legal binding of actions in a provable/undeniable fashion. (3) Secure document transfer between individuals within the alliance, supporting confidentiality on different levels (i.e., connection- or data confidentiality). (4) Document encryption – assuring confidentiality and integrity of documents used within SPIKE.

It turned out that users expect to use the collaboration platform from *different devices* (i.e., desktop as well as mobile devices), thus requiring data synchronisation facilities and off-line capabilities in situations where no network connection is available. This also imposes the need for *platform independence* on the client side.

Another important aspect addressed is single-sign-on, inducing the need for *federated identity management* (IdM) of users from partner companies. As collaboration platforms should be open to all types of enterprises, interoperability with existing IdM solutions based on existing standards such as SAML, SPML, and XACML at the individual companies' premises plays a crucial role.

4.2 Usability Requirements

In order to reduce the probability of human errors, an *intuitive user interface* was demanded. At the same time, online help shall be available for key functionality, supporting the user in unclear situations. *Performance* is another issue, meaning that the system should react within predefined response times, taking into account different types of connections to the platform (i.e., ISDN, etc.). Additionally, *fault tolerance* is demanded: Malfunction of a single component may not terminate the whole SPIKE system and should therefore result in a notification of the users only.

4.3 Organisational Requirements

Federated identity management, as already discussed in section 4.1, also requires consideration of the *privacy aspects* of users, allowing individuals within an alliance to control or influence what information related to them may be collected and stored and by whom and to whom this information may be disclosed.

Also, a *structured deployment process*, imposed by the platform administrator, is necessary from an organisational perspective. This implies fallback scenarios during the rollout of new versions of the platform, which is a requirement for high availability operation. This also includes a defined workflow in order to compare changes between individual versions of the platform in case an update of the platform is rolled out. At the same time, the deployment process has to ensure that unintended changes in the runtime environment cannot be performed by unauthorised persons.

Organisational requirements also impose an *alliance-specific administrator* in order to carry out the setup of an alliance. This administrator should not be granted access to the business logic of the alliances (data being worked on in individual workflows, tasks, external applications). However, administrative personnel from alliance partners may be granted limited administrative privileges.

Time to market was also identified as a key requirement of a collaboration platform. Thus, quick start-up time of an alliance is of utter importance. From an organisational perspective, this means that all legal aspects before the actual start of a business alliance should be able to be carried out rapidly. At the same time, the goal of minimising time to market requires that all potential alliance partners be supported on a technical level, meaning that integration and definition of business processes should be as easy as possible.

5 Requirements Assessment and Prioritisation

The requirements presented above form the basis for the design and further development towards an implementation of SPIKE. Therefore, it is critically important to assess and prioritise them. Our approach to guarantee periodic review of identified requirements has already been laid out in section 3.2. Prioritisation of the requirements depending on their importance is carried out alongside the axes *MUST*, *MEDIUM*, *LOW*, and *FUTURE* carefully as it is generally understood that requirements have a big impact on software functionality, acceptance, and applicability ([11], [12]).

As the requirements originate from several sources and are derived from several independent user groups and usage scenarios, completeness and applicability of the requirements were assessed by the composition of comprehensive use cases, each of them combining several requirements from different sources. By combining independently surveyed requirements from different sources, we were able to detect gaps in the list of requirements and to discover and add missing ones. During this process, varying significances of requirements even within single clusters were observed.

The SPIKE project will put much emphasis on the area of security, both among alliance participants as well as of the platform itself. The start-up time for virtual alliances was also identified as a requirement in the *MUST* priority, along with federated identity management. Also, the topic of workflow-enactment plays a crucial role for SPIKE, as well as all integration aspects.

At the other end of the scale, the issues of deployment as well as the initial configuration process of a collaboration platform or issues of system operation are currently not regarded as a major concern and are therefore treated with low ("*FUTURE*") priority. This is probably because SPIKE is targeting at the realisation of an operable prototype and not a commercial solution.

6 Conclusion and Future Work

In this paper, a methodology for gathering and analysing user requirements is applied which is specifically suited for incorporating multi-party views such as needed for the development of collaboration platforms and to prove its significance in the real-world case study SPIKE. It was argued that it is critically important to elicit

requirements from the beginning on and to constantly improve and manage them during the software development process. Based on the requirements found, the SPIKE system architecture, technical building blocks, and components have already been specified and software development is about to start.

The SPIKE platform is going to be developed in an iterative process with several development cycles, each of them leading to a pilot application, giving SPIKE's stakeholders the opportunity to redefine their needs prior to further development. Problems arising during the evaluation of each trial phase are expected to be addressed in the development cycle subsequent to the trial phase. Finally, note that the results presented in this paper are neither conclusive nor exhaustive. They rather mark intermediate results to be subsequently implemented and verified to take another step towards a comprehensive and competitive business alliance support.

Acknowledgement

The research leading to these results is receiving funding from the European Community's Seventh Framework Programme under grant agreement no. 217098. The content of this publication is the sole responsibility of the authors and in no way represents the view of the European Commission or its services.

References

1. Van Heck, E., Vervest, P.: Smart Business Networks – How the Network Wins. Communications of the ACM, vol. 50, no 6, pp. 29--37 (2007)
2. AT&T Knowledge Ventures: Collaboration across borders, http://www.corp.att.com/emea/docs/s5_collaboration_eng.pdf
3. Gartner Says Worldwide Web Conference and Team Collaboration Software Markets Will Reach $2.8 Billon in 2010, https://www.gartner.com/it/page.jsp?id=507717
4. Thompson, K.: The Networked Enterprise. Competing for the Future Through Virtual Enterprise Networks. Meghan Kiffer, Tampa (2008)
5. Alt, R., Smits, M.: Networkability of organisations and business networks. In: Proc. of the Fifteenth European Conference on Information Systems (ECIS), St. Gallen, Switzerland, pp. 119--130 (2007)
6. Kasper-Fuehrer, E., Ashkanasy, N.: The interorganisational virtual organisation: Defining a Weberian ideal. International Studies of Management & Organisation, vol. 33, no. 4, pp. 34--64 (2003)
7. Abuelmaatti, A., Rezgui, Y.: Virtual team working – Current issues and directions for the future. In: Proc. of IFIP Pervasive Collaborative Networks, vol. 283, pp. 351--360 (2008)
8. Maguire, M., Bevan, N.: User requirements analysis. A review of supporting methods. In: Proc. of IFIP 17th World Computer Congress, Kluwer Academic Publishers, vol. 226, pp. 133--148 (2002)
9. ISO 9241: Ergonomics requirements for office work with visual display terminals (VDTs), International Standards Organisation
10. Pettey, C.: Gartner Says SOA Will Be Used in More Than 50 Percent of New Mission-Critical Operational Applications and Business Processes Designed in 2007, http://www.gartner.com/it/page.jsp?id=503864
11. Prause, C.R., Scholten, M., Zimmermann, A., Reiners, R., Eisenhauer, M.: Managing the Iterative Requirements Process in a Multi-National Project using an Issue Tracker. In: Proc. 2008 IEEE Int. Conference on Global Software Engineering, pp.151--159 (2008)
12. Davis, G.B.: Strategies for Information Requirements Determination, IBM Systems Journal, vol. 21, no. 1, pp. 3--30 (1982)