

Role-Based Wiki for Reuse of Off-the-Shelf Components

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Abstract

IT companies are confronted with a huge, growing Off-the-Shelf (OTS) marketplace containing incredibly large amount of diverse, partial, ephemeral, sometimes tacit and not always trustable information about OTS components. Our empirical studies illustrate that different users, such as OTS evaluator, OTS integrator, system tester, and system maintainer, need different information and knowledge about OTS components when facing different scenarios. Although a few companies are using mini-wikis internally to manage and share OTS related knowledge, knowledge sharing across companies is rare. Searching existing web portals or sites of OTS components is time consuming and often does not bring systematic knowledge. This position paper proposes role-based wikis to organize OTS components related knowledge in a systematic way. One motivation of constructing such a wiki is to provide necessary knowledge for different users to help them reduce risks. Another motivation is to provide a global centralized platform, so that OTS users can systematically share their knowledge across organizations.

1. Introduction

An International Data Corporation survey from early 2007 revealed that more than half of software developers used components in developing their most recent projects [1]. The reuse and integration of Off-the-Shelf (either being Commercial-off-the-Shelf (COTS) or Open Source Software (OSS)) components have also grown steadily in all public and private sectors. A survey in Norway shows that, by 2006, 68% of all software companies reuse OTS components to make new software systems [2].

To successfully reuse and integrate OTS components in software products, project members need to grasp related information, knowledge, and

experience about the OTS components being or to be used. Our European surveys and interviews [3] on OTS component-based software development illustrate that:

- Different project roles need different kinds of knowledge. For example, component evaluators want to compare the functional or non-functional attributes of possible OTS candidates. Component integrators want to access code examples to prepare for local integration of components. System testers and maintainers would like to get advice about debugging and to know the possible evolution of OTS components.
- Knowledge sharing across software organizations is rare. Some companies have processes or mechanisms to share OTS component-related experience and knowledge within companies. However, few of them exchange knowledge with external actors.

Although there are large amounts of information or knowledge about certain OTS components stored on the Internet, this information is organized in diverse ways and is scattered. It has been noted that many web sites provide knowledge of a particular software component, such as NetBeans, separately without any integration of this knowledge [4].

Wikis are means to create collaborative websites and to facilitate knowledge management for certain communities [5]. In this paper, we propose to take advantage of wiki functionalities to establish role-based wikis for OTS components.

2. Limitations of current public OTS component information repositories

Software reuse requires the existence of some sort of information repository to register and search for candidate software.

On Internet now, there are many portals or individual web sites that hold information and knowledge of COTS or OSS components to enable their reuse, such as:

- Individual websites of COTS vendors or OSS projects.
- IT consultancy companies, such as Gartner or Forrester, that play an important role in selling expert support and market monitoring.
- Open source technology organizations, such as Freshmeat, TheServerSide, and OpenCores, that promote open source community projects.
- Domain-specific portals, such as CMSmatrix and WikiMatrix, which allow searching component information.

However, these approaches, which generally aimed at building, maintaining, and browsing software components repositories, have suffered from lack of user-oriented knowledge and a heavy “fill-up” investment upfront [6]. An additional problem is the incomplete, unreliable, and inflexible characterization of components [7]. Close assessment of these resources reveals several weaknesses of knowledge or information in them [6]:

- Scattered and non-structured information: most of them only provide some basic descriptions of OTS components plus keyword search, which will result in non-structured and semi-structured information (in the best cases). As OTS related information is scattered across many portals, re-users may have to search several of them. Using a general search engine (e.g. Google) usually results in huge amount of non-structured links.
- Weak structured collaboration: although some of the portals offer collaboration features, such as email lists, bulletin board, blogs, or even mini-wikis, information there is not structured to help specific users under specific scenarios.
- Facilities for incremental community building are weak: important social factors to attract and support trustful user participation are ignored. This situation also arises for other types of repositories, such as company-internal experience bases for software improvement [8].
- Business-related bias: several sponsored repositories are heavily biased towards their benefactors.

3. Role-based OTS wikis

A wiki is a Web-based system to facilitate collaborative creating and managing of Web pages [5].

Experience from using wikis in small and medium companies to manage internal knowledge shows that wikis can efficiently eliminate the following problems [4]:

- Information is distributed across several sources with different search interfaces.
- Low confidence in knowledge created and transferred.

To address the shortcomings of managing OTS component related knowledge, we propose using global OTS wikis to provide a single point of entry to simplify knowledge storage and retrieval. As the volume of knowledge about a popular OTS component may be far more than the knowledge managed in a small or medium size company, we propose role-based OTS wikis to go beyond the internal mini-wiki in [4].

The essential idea of role-based wikis is to offer “the right knowledge to the right person”. Thus, it is vital to identify the diverse roles and their needs. The knowledge in OTS wikis will be organized based on possible usage scenarios of different roles in a software project. The identified roles and associate knowledge are shown in Table 1.

First of all, role-based wikis will ease the knowledge search by using semantic wiki technologies [9]. Semantic wikis focus on extending the traditional wiki’s flexibility by addressing structured data, and can be used to “*simplify navigation and collaboration by semantic annotations*” [9].

In addition, role-based wiki will support the formation of Communities of Practice (CoP) [10]. CoP refers to the social process of learning that occurs when people have a common interest in some subjects and would like to collaborate over an extended period to share ideas, find solutions, and build innovations [10]. One fundamental reason for applying CoP theories in the role-based wikis is to facilitate the incremental build-up of content from the very beginning, and to avoid the huge and often prohibitive start-up costs and delays associated with conventional massive, reuse-oriented repositories. CoP around role-based wikis will attract different roles that have a special interest in a particular domain of components to share knowledge, and to peer-review the shared knowledge. This will enable software re-users, providers, and developers work collectively and cooperatively in an open source-like environment, organized into special-interest communities for obtaining, sharing, storing, evolving, and retrieving component-specific knowledge and experience. It will also foster dissemination of reusable software artifacts and make available strategic meta-information on the overall OTS field [11].

Table 1. Roles in OTS component-based development and example of knowledge they needed

Role	Knowledge needed
High level manager	<ul style="list-style-type: none"> -Strategic “make vs. acquire” decision support. -License and legal issues of possible OTS candidates. -Marketing trend of a specific software domain. -Existing customers of a specific OTS candidate.
OTS evaluator	<ul style="list-style-type: none"> -Platform/hardware needed to integrate/use the OTS candidates. -Compatibility of an OTS candidate with other components in the system.
OTS integrator	<ul style="list-style-type: none"> -Code examples to integrate OTS a particular component. -Possible side-effects of using a particular OTS component. -Contact persons of COTS vendors or OSS communities when technical problems occur.
OTS maintainer	<ul style="list-style-type: none"> -The release plan of OTS candidates. -Evolution suggestions from OSS communities and COTS vendors.
OSS community or COTS vendor	<ul style="list-style-type: none"> -Feedback from users. -Suggestions from users for future development.

4. Discussions

Here, we will discuss how role-based wikis solve the shortcoming of existing OTS websites and portals.

4.1. How to centralize the scatted information and knowledge?

The role-base wiki is not intended to replace the current OTS portals and web sites. It just provides a single point of knowledge entry through semantic wiki technologies. The components themselves and further descriptions can still reside in providers’ repositories. The role-based wikis may be viewed as a knowledge management system or “add-on”, which is capable of extracting actionable meaning from structured meta-information and unstructured information, such as free text in blogs and discussion fora. The attempts to deal with this issue could be to exploit the use of ontology, web intelligence and data mining techniques to dynamically exploit existing information.

4.2. How to facilitate knowledge sharing and encourage collaboration across companies?

Based on the open source collaboration spirit and principles of CoP participation, we expect an incremental growth of content in the wiki.

Such a wiki working as a single-access point to all this information could be perceived as valuable asset and therefore is expected to attract shared participations. In addition, the information will be structured according to evolving wiki usages, and therefore will promote better knowledge catching and sharing.

A critical aim for many OSS projects is to obtain a “critical mass [12]”, i.e. to get enough contributors of a project to support the evolution of the project. We do not regard this as a challenge to role-based wikis. First of all, the main target population of the role-based wikis is the re-users of OTS components. If the number of re-users of a specific component cannot reach a “critical mass”, it means that the market share of the component is too low and it is therefore not necessary to build a wiki for such a component. Second, once several role-based wikis have been built and demonstrated for the most popular OTS components and get recognized by re-users, more and more COTS vendors and OSS developers would be attracted to use such wikis as a free media channel to advertise their products. Third, the role-based wikis will provide a global knowledge sharing platform, so that re-users from different organizations can freely sharing their experience of a certain component. Such global wikis may soon provide more information than the existing internal mini-wikis.

4.3. How to avoid vendor-bias and provide trustful information?

Since anyone can add or change any content in a wiki at any time, there is no way to figure out whether the information in a wiki is true and representative. In the case of OTS component-based development, one possible issue is that the COTS vendors may input biased information about their products in wikis.

To avoid this problem, one possible solution is to apply a wikiscanner tool [13], which can identify editors of wiki data through their IP addresses. Another possible solution is to assign wiki contributors a wiki trust rating [14], and give high a trust rating to contributors whose edits tend to remain fairly stable. The third possible solution is to supply a mini-search engine to triangulate judgment comments on a given component with corresponding comments in other

portals. For example, if one contributor concludes that a particular component is reliable, OTS component wikis will then provide a link to a mini search engine, so that the re-user can get more information about reliability aspects of the given component from other portals. By having such a cross-checking feature, it will be difficult for vendors to give biased comments, unless they can edit all information in other portals.

4.4. How to deal with possible legal issues?

The role-based wikis will perform a role as a distributor of information instead of a publisher of information. According to the law of USA, the distributors of information are not normally held liable [15]. Thus, we do not think the possible improper information of OTS components published on an OTS component wiki will bring libel to the wiki itself. According to the official English wikipedia policy, “*it is the contributors’ responsibility to ensure that material posted on wikipedia is not defamatory* [16].”

5. Conclusions and future work

OTS related knowledge is heterogeneous and spread in multiple repositories. Reusing such knowledge is difficult, because several sources have to be searched manually and related information is not well integrated.

By organizing OTS component related knowledge in role-based wikis, we can:

- Personalize the knowledge according to different possible knowledge usages.
- Facilitate knowledge searching and automatically extract information from related resources.
- Encourage knowledge sharing across global organizations, possibly foster CoP.

Currently, a prototype of such a role-based wiki is done [17]. We are working with industrial partners to apply European research grants in order to get finance support to implement and demonstrate such wikis.

6. References

- [1] International Data Corp.: “Application Development Software”, 2007, www.idc.com/getdoc.jsp?containerId=IDC_P644.
- [2] Sommerseth, M.: “*Component Based System Development in the Norwegian Software Industry*”, Master’s thesis, Norwegian University of Science and Technology (NTNU), 2006.
- [3] Li, J., Conradi, R., Slyngstad, O. P. N., Bunse, C., Torchiano, M., and Morisio, M.: “Development with Off-the-Shelf Components, 10 Facts”, to appear in *IEEE Software*, 26(2), March/April, 2009.
- [4] Rech, J., Bogner, C., and Haas V.: “Using Wikis to Tackle Reuse in Software Projects”, *IEEE Software*, 24(6):99-104, Nov. /Dec., 2007.
- [5] Wiki: <http://en.wikipedia.org/wiki/Wiki>
- [6] Ayala C. P.: “*Systematic Construction of Goal-Oriented COTS Taxonomies*”, PhD thesis, Technical University of Catalunya, 2008.
- [7] Jeffrey, S. P.: “Populating Software Repositories: Incentives and Domain-Specific Software”, *Journal of Systems and Software*, 30 (3):187-199, 1995.
- [8] Dingsøy, T., and Conradi, R.: “A Survey of Case Studies of the Use of Knowledge Management in Software Engineering”, *Journal of Software and Knowledge Engineering*, 12(4):391-414, 2002.
- [9] Sebastian, S., Francois, B., Joachim, B., and Malte, K.: “Semantic Wikis”, *IEEE Software*, 25(4): 8-11, July/Aug. 2008.
- [10] Wenger, E., McDermott, R. & Snyder, W.M.: “*Cultivating communities of practice: A guide to managing knowledge*”, Cambridge, MA: Harvard Business School Press. 2002.
- [11] Ayala, C., Sørensen, C.F., Franch, X., Conradi, R., Li, J.: “Open Source Collaboration for Fostering Off-The-Shelf Components Selection”, *Proc. of the 3rd Intl. Conf. on Open Source Software” (OSS 2007)*, Spring Boston, vol. 234, pp. 17-30.
- [12] Marwell, G. and Oliver, P.: “*The Critical Mass in Collective Action: A Micro-Social Theory*”, Cambridge University Press, Cambridge, England, 1993.
- [13] Wikiscanner: <http://en.wikipedia.org/wiki/WikiScanner>.
- [14] Wikitrust: <http://trust.cse.ucsc.edu/>
- [15] Libel on the Internet (Feb. 2009): http://www.law.buffalo.edu/Academics/courses/629/computer_law_policy_articles/CompLawPapers/holland.htm
- [16] Wiki:Libel (Feb. 2009): http://en.wikipedia.org/wiki/Wikipedia:Libel#cite_note-0
- [17] Aaslund, K., Larsen S.: “*OTS-Wiki: a Web Community for Fostering Evaluation and Selection of Off-The-Shelf Software Components*”, Master’s thesis, Norwegian University of Science and Technology (NTNU), 2007.