Functional Analysis of Enterprise 2.0 Tools: a Services Catalog

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Abstract. In recent years a new class of integrated web-based enterprise tools emerged facilitating team collaboration and knowledge management. In this paper we provide a detailed analysis of their concepts and services. We examined the following commercial and open source Enterprise 2.0 tools in detail: *Alfresco Share, Atlassian Confluence, GroupSwim, Jive SBS, Liferay Social Office, Microsoft Office SharePoint Server, Socialtext, Tricia.* Thereby, we derived an unifying multi-dimensional classification and evaluation framework. For each dimension we identified several technical criteria to characterize the functional capabilities of a given tool. Based on this schema we conduct a detailed evaluation for each particular tool. This work contributes to a better technical understanding of this emerging family of enterprise applications, highlights strengths and weaknesses of existing tools and identifies areas for further system research and development.

Key words: Enterprise 2.0 Software, Social Software, Web-based Collaboration, Knowledge Management Systems

1 Motivation

In the last years a new class of collaboration tools emerged, which use so-called Web 2.0 technologies [8] to foster team collaboration and knowledge exchange. Since the objective of these tools is to adopt technologies and services proven successful on the Internet within enterprises, these are called Enterprise 2.0 tools [3, 7]. As of today, there is a large number of applications in this category [4]. Those are complex integrated web-based tools, which offer a broad range of Web 2.0 concepts, like wikis, blogs, calendar, file share, search, and tagging.

An organization that wants to move towards 'Enterprise 2.0' is left the difficult decision which tool to choose. So far little guidance on how to classify and evaluate those tools exists. Comparing Enterprise 2.0 tools remains a challenging task because of the following reasons:

1. The tools differ greatly in the content types they support. On the one hand, there are simple tools, which concentrate on few concepts (e.g. wikis, files).

On the other hand, there are applications, which offer a broad range of content types (e.g. calendar, tasks, issues, news). Since the only description of the tools available is in the form of natural language marketing whitepapers, one has to dive deeply into those descriptions to identify the differences.

2. There is no agreed upon description of services an Enterprise 2.0 tool has to deliver. In [7] the following core services are identified (SLATES): search, links, authoring, tags, extensions, signals. Unfortunately, these terms are fuzzy and not used by all tools the same way. Since there is no uniform and detailed catalog of services available, comparing tools is difficult.

These difficulties and the observation, that there is a growing market for those tools [10] are the starting point for our work. The goal of this paper is to provide a detailed analysis of the concepts and services offered by existing Enterprise 2.0 tools based on a unifying multi-dimensional classification and evaluation framework.

In a first step, we had to choose, which applications to include in our initial analysis. The goal was to evaluate a representative set of relevant tools. As a first indicator we had a look at the Gartner magic quadrant in [4]. Since 2007 some new tools emerged, which we had to take into account. We focused our selection on big players, and additionally included Tricia[1], a tool developed by members of our group.

Finally, we decided to evaluate the following applications (in alphabetical order): Alfresco Share[2], Atlassian Confluence[3], GroupSwim[4], Jive SBS [5], Liferay Social Office[6], Microsoft Office Sharepoint Server[7], Socialtext[8], Tricia.

Due to space limitations, it is not possible to include all detailed results of our analysis in this paper. We will focus in the following on presenting our methodology as well as the catalog of services we created. The complete results can be found online at [2]. The online resource is intended to be expanded by additional tools in the future.

This paper is organized as follows: Section 2 gives an overview of related work. We then elaborate in Section 3 on how we analyzed the content types supported by each tool. In the Sections 4 and 5 we introduce a catalog of services, which we used to evaluate Enterprise 2.0 tools. In Section 6, we present the methodology of how we evaluated the given tools against the catalog. The paper concludes with a summary and an outlook.

[1] http://www.infoasset.de
[2] http://www.alfresco.com/products/collaboration
[3] http://www.atlassian.com/software/confluence
[4] http://groupswim.com/products/collaboration-software
[5] http://www.jivesoftware.com/products
[6] http://www.liferay.com/web/guest/products/social_office
[7] http://www.microsoft.com/Sharepoint/default.mspx
[8] http://www.socialtext.com

2 Related Work

As shown in [6], Enterprise 2.0 tools are in the long-standing tradition of groupware and CSCW applications. In [9], a comparison of six commercial and academic CSCW systems is presented.

As already mentioned, [4] classifies 25 tools using alongside the non-functional dimensions *ability to execute* and *completeness of vision*. As a result, each tool falls into one of the quadrants *challengers*, *leaders*, *niche players*, and *visionaries*. Two tools are classified as niche players, two applications come out as visionaries, and the great majority of tools has been classified as challengers.

There are some publicly available tool comparisons, which focus on tools for specific functionalities: WikiMatrix[9], ForumMatrix[10], Blog Comparison Chart[11]. These comparisons focus on one particular content type (wiki, forum, and blog).

Furthermore, there is work towards identifying services, Enterprise 2.0 tools should provide. In [7] the following services according the SLATES acronym are identified:

1. **Search** is required to find content objects,
2. **Links** connect and relate content objects,
3. **Authoring** makes it easy to contribute new content,
4. **Tags** form a bottom-up categorization system,
5. **Extensions** can be used to automatically compute recommendations,
6. **Signals** create awareness for the activities of other user.

In [5], an extension of SLATES is proposed, which in addition puts emphasis on the *social*, *emergent*, *freeform*, and *network-oriented* aspects. Nevertheless, as already mentioned in Section 1, these service descriptions are quite fuzzy and cannot be used to compare concrete Enterprise 2.0 tools in an objective manner.

3 Content Types

From a technical point of view an Enterprise 2.0 tool provides collaboration and communication services by many of *content objects*, e.g. wiki pages, blog posts, comments, files. Each application comes with a set of predefined *content types*, which realize the concepts provided by the tool. To get an overview of the capabilities of a given tool, it is helpful to first understand the supported content types and their associations.

As a first step in our survey, we therefore identified the core content types of each investigated tool and modeled them using a UML class diagram per application.

As it turned out, it is useful to differentiate between *core* content types, and *orthogonal* content types, which are needed to implement the services described

[9] http://www.wikimatrix.org
[10] http://www.forummatrix.org
[11] http://www.ojr.org/ojr/images/blog_software_ comparison.cfm

in Section 5. Examples of orthogonal content types are *rating, tag, version.* To keep the models clean and simple, orthogonal content types are not modeled in our class diagrams, but rather discussed in Section 5. In the following, we will use the shorter term content type to mean core content type.

Due to space limitations, we cannot present the models of all surveyed applications here. As an example, the model of the content types provided by GroupSwim is shown in Figure 1. The models of all analyzed tools can be found online at [2].

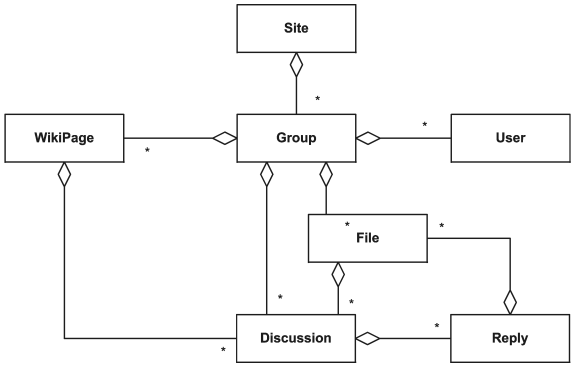

Fig. 1. Groupswim

Different tools use different terminologies for conceptually similar content types. In our models, we use the terminology introduced by the given tool.

4 Towards a Services Catalog

An Enterprise 2.0 tool provides for all of its content types *services* to make the content objects accessible. In the following we describe, how we created a services catalog, which can be used to compare and relate these tools. The basic idea of our approach is to analyze existing tools and to capture existing implemented services.

To narrow this task down, we only consider functionality provided out-of-the box by the main distribution of each tool. Several applications (e.g. Atlassian Confluence, Microsoft Office Sharepoint 2007) are complex extensible platforms and provide extensibility via a plugin mechanism or open APIs for third-party extension. These enhancements are not considered in our study.

As a second restriction, we only consider services, which are visible to the end-user. Therefore, maintenance and configuration services are not part of our services catalog.

Furthermore, we focus on a functional analysis. Non-functional aspects, such as e.g. cost, extensibility, performance, deployment type, ease of implementation,

etc., are not regarded. These dimensions could be additionally included in a later version of our schema.

Initially, we gathered all available services of the investigated tools. Indeed, most of the applications support similar services, but the terminology used often varies, e.g. the creation of tags vs. the assignment of labels. Therefore, we consolidated these similar concepts to a general service description and extracted short service names, e.g.:

Private Tags: The usage of *private* tags is supported. Private tags are only visible to the creator and not to other user of the tool.

This representation of the service short name (italic) followed by the general service description is used in the services catalog presented in Section 5.
In some rare cases we extended the service description to a more complete and more reasonable specification from a technical point of view. For example, Microsoft Office SharePoint 2007 gives access to the *title* property of an MS Office document. Adapted from that, we inferred the more general service description: Access and manipulation of all file metadata, e.g. title, description, author, etc. Based on this generalized service description, we evaluated the implementation of these services for all given tools. Our methodology for this evaluation is presented in Section 6. Overall, we derived 49 Enterprise 2.0 core services.

Since some of the inferred services are similar to each other, we arranged them into 13 more general categories. For instance, the category 'Link Management' contains services dealing with the handling of references (links) between content objects.

Based on the identified 13 service categories, we determined two reasonable services not supported by any tool at all. These services are relevant from our point of view, hence we decided to exclude them from the core services catalog. Nonetheless, these services are described in Section 5.4.

We observed, that the context of a given service is either focused on content objects, or on aspects concerning the user of a tool. We therefore classified the 13 categories in *content-centric* (cf. Figure 2) and *user-centric* (cf. Figure 3). Nevertheless, a few services cannot be assigned to exactly one of these classes. Those services are part of a third class *orthogonal* (cf. Figure 3), called orthogonal services.

5 Services Catalog

A service description, a classification, and a service context constitute the dimensions of our services catalog. The following section introduces the catalog in detail.

5.1 Content-Centric Services

Authoring A significant Enterprise 2.0 tool characteristic is the collaborative web-based creation and manipulation of content respectively content objects.

We categorize all services dealing with this process as 'Authoring'.

WYSIWYG-Editor: The content creation process is assisted by a hypertext editor. The editor enables users to create plain text and additionally provides functions to enrich this content with markup (e.g. HTML, wiki markup) for layouting purpose. We expect the editor to be a WYSIWYG-Editor (What-You-See-Is-What-You-Get), i.e. changes on the contents' layout are immediately visible for the user. The editor enforces a strict separation of content and layout. Nevertheless, power users sometimes prefer being able to edit the underlying markup manually. For this reason, an advanced view is provided to enable modifications of the markup language directly. If HTML is used as the underlying markup language, the system has to take measures to prevent Cross-Site-Scripting (XSS) attacks. Finally, sections from Microsoft Office documents can be pasted into the editor, thereby transforming the original layout to the corresponding markup language (as far as this is possible).
Support for tables, images, and media objects: Beside text, tables, images, and rich media objects (video, flash, and mp3 objects) can be embedded using the editor.
Input support for link creation: To reference other content objects or container objects links can be defined. The WYSIWYG-Editor assists the creation of valid links to all existing types by giving suggestions.
Autosave: When editing hypertext, an autosave functionality automatically creates server-side backups to prevent changes get lost in case of a broken Internet connection. Moreover, if the user leaves a page with pending changes without saving the changes, a corresponding warning message is shown.
Description of all content objects by rich markup text: In contrast to 'WYSIWYG-Editor', where the requirement is the general existence of a WYSIWYG-Editor, we claim here, that all content objects can be described using hypertext in the exact same manner. Additionally, the WYSIWYG-Editor provides a set of predefined styles for layouting purpose.
Spell checking: To increase the contents' quality, the editor provides spell checking functionality.
Concurrent Editing: To prevent concurrent conflicting edits, the system gives a warning message, if a user starts editing a page, which is currently being edited by someone else.
Offline Editing: Even if no Internet connection is available, all content objects can be modified offline. In this case the edits are stored locally on the client machine. When going online the objects are synchronized with the backend. The editing experience in the on- and offline mode should be as close as possible.

Link Management Link management are services dealing with the handling of references to content (e.g. wiki pages, files) and container objects (e.g. wikis, directories).

Human-readable permalinks for all content objects: All content objects are ref-

erenced by stable, human-readable URLs, so called *permalinks*.
Stable URLs for containers and actions: Container objects, collections of objects, and actions are referenced by stable URLs. Collections are e.g. last modified wiki pages, blog posts by user xyz.
Labeling of invalid links: The system recognizes and highlights invalid links. This is visible in the WYSIWYG-Editor.
Search for invalid links: To detect invalid links, the system provides a search mechanism. This helps keeping the system clean of broken links.
Automatic propagation of link updates: If the URL of a content object changes (e.g. by renaming a wiki page or a file), this change is propagated and all affected links are adapted to the new URL. Links to deleted objects are highlighted automatically as being invalid.

Service Context	Service Category	Service	Vendor							
			Alfresco	Confluence	GroupSwim	Jive SBS	MOSS	Socialtext	Tricia	Liferay
Content-Centric	Authoring	WYSIWYG-Editor	◔	◕	◕	●	◕	●	●	◑
		Support for tables, images, and media objects	◔	◕	●	●	◑	◑	◑	◑
		Input support for link creation	○	◕	◕	●	○	●	●	◑
		Autosave	◔	●	◕	●	○	◔	●	○
		Description of all content objects by rich markup text	◔	◑	●	○	◕	◑	◑	◑
		Spell checking	○	○	●	●	●	○	○	◑
		Concurrent Editing	○	○	○	●	○	◕	○	○
		Offline Editing	○	○	○	○	○	◕	○	○
	Link management	Human-readable permalinks for all content objects	◔	◑	◑	◔	◕	◔	●	◔
		Stable URLs for containers and actions	◑	●	●	●	●	◔	●	◑
		Labeling of invalid links	○	●	◑	◑	○	◔	●	○
		Search for invalid links	○	○	○	○	○	○	●	○
		Automatic propagation of link updates	○	◑	●	●	○	◑	●	○
	Tagging	Tag support for all content objects	●	◔	●	●	○	◑	◕	◕
		Input support for tag creation	◑	◕	◕	●	○	◕	◕	◕
		Tag usage overview	◑	◕	◕	●	○	●	○	○
		Private Tags	○	●	○	○	○	○	○	○
	Search	Full-text search over all content	◔	●	●	●	●	◔	●	◔
		Search content of files	●	●	●	○	●	○	●	●
		Highlighting of search hits	○	●	◑	●	●	●	●	○
		Advanced search operators	●	●	○	●	●	●	●	◑
		Sorting	◔	◔	◕	◔	◕	●	◑	○
		Filtering	○	◕	◕	◕	◕	○	◕	○
	Version management	Safety net through content revisions and audit trail	●	●	●	●	●	◑	◑	◑
		Annotation and classification of revisions	○	●	◑	◑	◔	◑	◑	●
		Human readable presentation of revision differences	○	◑	●	●	◕	◑	●	◑
		Restore	●	●	○	●	●	●	●	●
		Access control for versions	○	○	○	○	○	○	●	○
		Undelete	○	○	○	○	○	○	○	●
	Desktop integration	File access	●	◔	○	○	◔	○	●	◔
		Metadata	○	○	○	○	◔	○	○	○

Fig. 2. Ratings Content-Centric

Tagging Tagging constitutes the process of collaboratively building a bottom-up categorization system. This subsection considers tagging services for content objects.

Tag support for all content objects: Multiple tags can be assigned to all content objects. The only exception concerns the tagging of persons. We do not expect this service be available to prevent misuse.
Input support for tag creation: The system supports the creation of tags by showing existing tags and their usage frequency (e.g. by font size or number).
Tag usage overview: An overview of all existing tags shows the usage frequency numerically and visually as a tag cloud.
Private Tags: The usage of *private* tags is supported. Private tags are only visible to the creator.

Search This category subsumes services regarding finding content.

Full-text search over all content: A unified text search over all content objects exists. Comments, tags, and attributes of the content objects are included in the search as well.
Search content of files: The full textual content of files is searched.
Highlighting of search hits: Occurrences of the search terms are highlighted in the search results using a clear representation.
Advanced search operators: The text search features AND, OR, and NOT operators, wildcards, and search for phrases are supported.
Sorting: The default sorting of the search results is by relevance. Additionally, it is possible to sort by last modification date and by last modifier.
Filtering: The search results can be filtered by content type, tags, modification date, and modifier.

Version Management The category Version Management contains services concerning tracing the evolution of the content objects within their life-cycle.

Safety net through content revisions and audit trail: For wiki pages and files a version history is maintained, which includes information about modifier and modification date.
Annotation and classification of revisions: The modifier may provide a version comment for each change. It is possible to categorize changes according to their importance.
Human readable presentation of revision differences: The system highlights differences between versions in a clear and understandable way.
Restore: It is possible to restore old versions.
Access control for versions: The version management takes access control settings into account: versions adopt their access control setting when they are created and enforce this setting later on.
Undelete: It is possible to restore even deleted wiki pages and files. This also recovers the complete version history.

Desktop File Integration Desktop file integration is about services dealing with the direct and flexible access to files stored in the Enterprise 2.0 tool.

File Access: Additionally to web access, files can be accessed using standardized protocols, like SMB, WebDAV, and FTP.
Metadata: Embedded file metadata (e.g. in Word, PDF, JPG documents) is adopted and can be accessed and manipulated.

5.2 User-Centric Services

Access Control Services dealing with authorization management for content objects are part of this category.

Creation of groups and invitation of new members by users: Users can create new user profiles and user groups and invite new members according to given membership policies.
Uniform, flexible, and fine granular access control concept for all content types: A uniform, flexible and fine granular access control concept exists. This is uniform and consistent for all object types.
Functional groups for access control: Functional groups are used for definition of access rights (cf. 'Uniform, flexible, and fine granular access control concept for all content types'). During the assignment of functional groups input support is provided.
Content of any type may be made available for anonymous users: It is possible to make content of any type available for known as well as for anonymous users.
Smooth transition between the usage modes not logged on and logged on: The system provides a smooth transition between the usage modes not logged on and logged on. i.e. the primary requested resource (e.g. page) is accessed after successful login.
Spam avoidance: The system provides mechanisms to prevent spam attacks. Captchas (visual and audio) are used for all objects anonymous users can contribute to. This feature is not relevant, if anonymous user are not supported at all.

Feedback Feedback considers services for the management and exchange of opinions.

Comments to content of any type: Users can write comments to content of any type. The creation of comments can be disabled.
User ratings: It is possible to rate the quality of any content object. This can be disabled.
Anonymous post of comments: Anonymous user may post comments to content of any type. This feature is not relevant if anonymous user are not supported at all.

Service Context	Service Category	Service	Vendor							
			Alfres-co	Con-fluence	Group-Swim	Jive SBS	MOSS	Social-text	Tricia	Liferay
User-Centric	Access control	Creation of groups and invitation of new members by users	◔	○	●	●	◕	●	●	⋆
		Uniform, flexible, and fine granular access control concept for all content types	◔	◑	◔	◔	●	◔	●	⋆
		Functional groups for access control	○	●	○	○	●	○	●	⋆
		Content of any type may be made available for anonymous users	○	◕	◑	○	○	●	●	⋆
		Smooth transition between the usage modes *not logged on* and *logged on*	○	●	○	○	●	●	●	⋆
		Spam avoidance	○	○	●	○	○	○	○	⋆
	Feedback	Comments to content of any type	◔	◑	◕	●	◔	◑	◕	◕
		User ratings	○	○	●	○	○	○	○	◕
		Anonym post of comments	○	●	○	○	○	●	●	⋆
	Social Networking	Support for social network building	○	○	○	●	●	○	○	○
		Fine granular access control for user profile properties	○	○	○	○	●	○	○	○
	Awareness	Tracking of other users' activities	○	○	●	●	○	●	○	○
		Tracking of activities on content and container objects	◔	◕	◕	●	●	◕	○	◕
		Support for different message channels	◔	◑	●	●	◔	●	○	◔
	Usage Analytics	Usage statistics down to the level of individual content items	○	◕	○	○	◔	○	○	○
		Search words statistics	○	○	○	○	◕	○	○	○
Orthogonal	Consistent GUI	Consistent presentation of actions and views	◕	◑	●	●	◕	◕	●	◕
	Personalization	Adaptable look&feel for certain functional areas	○	●	○	○	●	○	●	○

Fig. 3. Ratings User-Centric and Orthogonal

Social Networking This category is dealing with services about the informal aggregation of user groups.

Support for social network building: Users can build up a social network, i.e. they can set them in relation to each other by inviting other users to be a 'friend', 'colleague'. The invitation can be accepted or rejected by the invitee.
Fine granular access control for user profile properties: Every user may provide a profile page with personal information. Parts of the profile (e.g. sensitive attribute of the user) page can be protected against objectionable access.

Awareness Awareness subsumes services about tracking system activities.

Tracking of other users' activities: Users can track the activities of others users or user groups.
Tracking of activities on content and container objects: Users can track the activities on content and container objects.
Support for different message channels: Users can configure different channels for receiving messages for tracked activities. These channels are: dashboard, RSS, and e-mail.

Usage Analytics All services dealing with statistical analysis are included in this category.

Usage statistics down to the level of individual content items: The system provides statistics for the usage of content. Thus, it can be evaluated how many users accessed a certain content object, the frequency of access and the access point of time.
Search words statistics: The system provides statistics, which search words led to the site.

5.3 Orthogonal Services

Consistent graphical user interface This category regards usability services and handling of the graphical user interface.

Consistent presentation of actions and views: The graphical user interface is consistent and clearly structured. For all object types the presentation of actions and views is uniform.

Personalization Personalization comprises services dealing with the adaptivity of the system according user needs.

Adaptable look&feel for certain functional areas: The user can customize certain functional areas of the graphical user interface. Additionally, an existing corporate design can be integrated overall.

5.4 Additional Services

Usage Analytics
Referer statistics: The system keeps track of pages the accessing users came from.

Feedback
Searchable and sortable ratings: User ratings can be used as filter and sorting criteria in the unified search.

6 Rating Methodology

Based on the introduced services catalog, we performed an evaluation of eight Enterprise 2.0 tools. In this process, we evaluated the capabilities of all tools with regard to all of our services. Thereby we applied ratings between 0 and 4, 0 stands for no capabilities, 4 stands for complete coverage of the service. In case a service is only partially covered by a tool (i.e. a rating between 1 and 3), we provide a detailed explanation of what exactly is missing (cf. Figure 4). These explanations are available at [2]. We do not comment on services having full capabilities as well as those achieving no score at all.

As described in Section 5, some service descriptions are more general than the capabilities of all tools. This implies for some services, that no tool obtains the full score, e.g. for service 'Metadata' in the category 'Desktop File Integration'.

In the following, we give an example of a concrete service evaluation. In the sample we consider the core service 'WYSIWYG-Editor' within the category 'Authoring' (cf. Figure 4). Jive SBS, Socialtext, and Tricia have full capabilities,

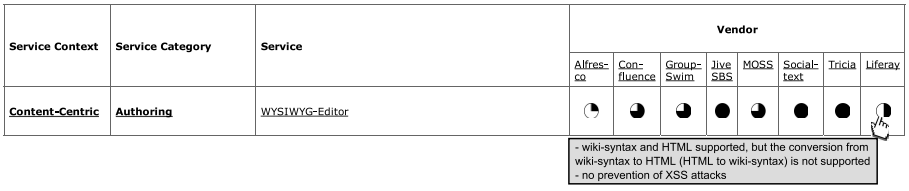

Fig. 4. Ratings for WYSIWYG-Editor, Authoring

so they get a full rating and no explanations are necessary. The tools Alfresco, GroupSwim, Microsoft SharePoint, and Confluence do not support *paste sections from MS Office documents*, so pasting from these document types either removes all formatting information or in some cases inserts unwanted style information into the target content. Additionally, no manual markup editor for power users is provided by Alfresco, as demanded by the service description. The WYSIWYG-Editor used in Liferay supports wiki-markup as well as HTML. Unfortunately, the conversion from wiki-markup to HTML and vice versa is not supported, so when changing the representation, markup information is lost. Furthermore, the manual HTML markup editor does not prevent XSS attacks. The resulting ratings are visualized in table 4. The ratings (0-4) are presented in a visual pie chart representation.

We did not calculate a total rating for each service category, because this would imply to define weightings for all service ratings. The decision of how important a particular service is, remains to the user of the evaluation framework.

For several reasons we cannot obtain a rating in some cases, e.g. caused by the occurrence of errors in the test scenario. This services are marked with a * character (cf. table 3).

The complete analysis with all additional explanations can be accessed online at [2].

7 Conclusion and Outlook

There is a growing market for Enterprise 2.0 tools and it is difficult to compare existing tools against each other. Our paper on the one hand increases the transparency of this market by providing a methodology for comparing given tools. On the other hand, we applied this methodology and actually compared eight relevant tools.

We see potential to improve our existing methodology and comparison in the following points:

1. To broaden our analysis we will analyze more tools. Specifically, we want to analyze the IBM Lotus tools family [12].
2. To improve our analysis we are in the process of getting feedback from the tool vendors. This feedback will improve our services catalog as well as the actual ratings for the tools.
3. An interesting extension of our comparison would be to also incorporate non-functional criteria, such as e.g. deployment options, performance, scalability.

In order to increase the ratings transparency we will make our test scenarios publically available. Thereby, the independent evaluation of tools by means of the services catalog is facilitated for companies which want to move towards Enterprise 2.0. Furthermore, we will provide screenshots in case a service is only partially covered by a tool (i.e. a rating between 1 and 3) online at [2].

Since this survey was mainly conducted in the beginning of 2009, it will be interesting to watch, how current versions of the considered tools as well as new emerging tools in 2010 affect the stability of the services catalog and the particular ratings. Specifically, we will analyze the capabilities of Microsoft SharePoint 2010 [13] in order to capture the evolution of the services catalog and to compare the evaluation results with those of the MOSS 2007. It will also be interesting to examine, whether the services identified in Section 5.4, will be implemented in current tools.

Furthermore, based on the identified services and categories, it could be lucrative to conduct empirical studies on how effective their actual use is. Thereby, the experience gained from industry cases [1] could be included.

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