Passive User Integration in Social Networking Services

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Abstract: Employee knowledge is a key asset of every corporate organization. Therefore organizations strive to preserve this knowledge in its different forms in a variety of ways. One kind of such knowledge is the network of social contacts employees develop over time, incorporating meta knowledge on who knows what. These networks depend on the active participation of employees and their usefulness is reduced by passive user groups. We present an approach that allows for better integration of passive members in online social networking services. Expanding on existing approaches we propose a tagging mechanism for single elements of a user's profile as well as an ageing and rating mechanism for these tags. We also outline an implementation of our approach.

1   Introduction

Knowledge is an important resource to organizations in general and corporations in particular. Traditionally most knowledge is passed directly from one person to another in a learning by doing fashion. In knowledge-intensive professions, however, the organizational management of knowledge using some form of information carrier is of increasing importance. This management of knowledge typically includes preservation, dissemination and creation of knowledge. Nevertheless a purely technological outlook on *knowledge management* has in many instances turned out to be short-sighted. For a variety of reasons organizations failed to capture the knowledge of their workforce even in the face of considerable technological effort. This is why, in the following, we focus on the preservation and dissemination of knowledge (creation of new knowledge is not our primary concern at this point), thinking of knowledge in a social rather than a technological context. A prerequisite for managing knowledge is its conversion from *tacit* knowledge to *explicit* knowledge. Tacit knowledge is internal to the human actor and cannot be shared by some medium. Explicit knowledge on the other hand is codified on some information carrier and can thus be preserved and disseminated.

Here, we discern two different kinds of knowledge to be converted. First there is *technical expert or object knowledge* that an employee has gathered over time. Then, there is *meta knowledge* on who knows what within the organization and across partners. The social network of these business contacts an employee has cultivated over time represents this meta knowledge. The employee knows the expertise and interests of the contacts making

up his social network and can use those contacts for himself or direct other people to persons likely to be relevant for solving a given task.

Information technologies are providing tools and methodologies supporting the conversion of tacit expert knowledge to explicit expert knowledge for some time now. These systems are known as *knowledge management systems*. They are "designed specifically to facilitate the sharing and integration of knowledge" [AL99]. With the advent of the world wide web and especially the emergence of Web 2.0 technologies new tools for managing knowledge are becoming increasingly popular. Both kinds of systems are suitable for preservation and dissemination of explicit expert knowledge.

Today support for efficiently and effectively converting tacit or meta knowledge to explicit knowledge is still in its infancy. However, with the emergence of Web 2.0 technologies new services are evolving that are promising to be supportive for this task. These are commonly known by the term *social networking services*. These services enable the creation of electronic representations of real-world social networks as well as the expansion of these social networks by electronic means. The central idea of these services is based on user profiles and connections between these profiles representing a user's social network. Typically users specify relevant information with these profiles. This information includes personal details such as names or phone numbers but also professional details such as occupations, interests or expertise. Thus this electronic representation of a user's social network depicts this user's meta knowledge, knowledge on who knows what. Being electronically available it is equally useful for preservation and dissemination of this information. However, the quality of these services heavily depends on the active participation of its users as the user profiles and the corresponding information on social networks needs to be kept up-to-date. In this paper we address the dissemination of explicit meta knowledge using social networking services and the challenges of participation and actuality.

This paper is organized as follows. First, we describe aerospace challenges and detail relevant terminology. Then we describe the potential problem of inactive or passive users that we identified from the domain of aerospace industry. This is followed by a presentation of our approach towards passive user integration to address this problem. We also outline an implementation based on the utilization of tagging. We conclude the paper with a section on related work and future work in this area.

2 Aerospace Challenges

Resulting from our work on knowledge management and dissemination in the aerospace industry we identified the following challenges: a history of non-disclosure, highly distributed and interwoven business relationships and very long product life cycles. We do not claim that these issues exclusively apply to the aerospace sector, but they are important factors when thinking about knowledge management and dissemination in this context. In the following we details each of these challenges.

For one thing, the aerospace industry is a very small branch of trade. The existence of only two major system integrators (or airframers) and a highly interwoven network of suppliers

have lead to a history of non-disclosure between participants. Every piece of knowledge is regarded a business secret and treated as such. Therefore, tacit knowledge often is not converted to explicit knowledge. The high complexity of aircraft design poses another challenge. A great many employees with highly specified knowledge from different fields of aerospace engineering contribute to the evolution of a new aircraft. This leads to a waning overview on responsibilities and on expertise of colleagues and project partners. Then, suppliers along the supply chain are not only tightly interwoven but also highly diversified. That is, suppliers are very specialized in small sections of the whole aircraft design process. Most often adjacent parts of an aircraft are designed by engineers of distant suppliers in the supply network with no direct contact. The wide distribution of knowledge across company boundaries in combination with the tradition of non-disclosure leads to large amounts of knowledge that may not be made explicit and therefore have to remain tacit. Furthermore the problem of an ageing workforce is imminent in the aerospace industry. The end of the cold war, the ensuing reduction in military spending and the resulting lay-offs meant that for a number of years hiring rates in the industry were low.Though being restructured towards the civil sector, the dent in the aerospace employees' age pyramid is still an issue. Today there are many engineers that are eligible for retirement or already retired. Therefore, much of their knowledge on former projects and results as well as their social networks are in danger of being lost for their companies. Part of their knowledge is available via old data formats, but as there was no continuous knowledge transfer much of this explicit knowledge has turned into tacit knowledge. In fact, french engineers who helped the now inoperative Concorde spread its wings are again sought for their advice in new supersonic programs. These factors result in tacit knowledge often not being converted to explicit knowledge. Hence keeping tacit knowledge accessible is immensely important and this is also where social networks come into focus as they contain explicit meta knowledge that is needed to utilize tacit expert knowledge.

3 Terminology

The term *tacit knowledge* refers to knowledge that is still embedded in people. It is transferable only via direct communication or via learning-by-doing and not necessarily ready for storage. *Explicit knowledge* denotes that fact that this knowledge is stored on some information carrier. This may either be some electronic or paper device.

The World Wide Web has recently been seeing an enormous growth of the so called *Web 2.0* and the usage of social media. Thereby the term Web 2.0 denotes the fact that users are not restricted to consuming web content but can also actively contribute to and share that content. *Social media* is an umbrella term denominating services that connect individuals in some way. The term *social* here emphasizes the fact that people mutually benefit from each other's contributions. Several different types of social media have emerged during the last years. Among them are social bookmarking and networking services which are detailed in the following. *Social bookmarking services* allow for the online storage of personal bookmarks. These may point to arbitrary resources that are available on the web. The individual bookmarks are not organized using a folder metaphor but by employing a

tagging mechanism. That is, every bookmark is assigned one or more keywords that allow for easy search and filtering. The social side of these bookmarking services manifests itself by the public visibility of all bookmarks. Looking for common tags is a useful way for finding new resources and new contacts. This is alleviated by a feature called *pivot browsing*. This means browsing an information space by selecting different reference points, the pivots. This allows for the exploration of the information space along multiple dimensions. Most systems provide at least three such pivots: the user, the tag and the resource [Smi08].

In real-life everyone maintains a social network of contacts. Online *social networking services* provide the ability to represent these off-line social networks electronically and even expand them online. Existing platforms such as Facebook[1], Linkedin[2] or Xing[3] share similar concepts for this. A new user is either invited for participation or signs up by himself, depending on the platform. He then completes the rudimentary initial profile containing fields for different personal information such as education, interests and expertise. The next step is then searching for and adding or inviting members of one's existing off-line social network. Online social networking services allow for searching and contacting other members not only based on existing contacts or recommendations, but also based on filtering the publicly available profile data for further interesting members. Unlike with off- or online address books online social networking services store just references to the profiles of the other members. This results in a directory with automatically updated profile data of the contacts, as long as these contacts keep their information up-to-date. Richter and Koch describe six basic functionalities of social networking services. These are identity management, expert finding, context awareness, contact management, network awareness and exchange [RK08].

Companies are already starting to adopt some of the new tools of the Web 2.0 era. This is known by the analogy *Enterprise 2.0* Corporate social networking services as part of these emerging *corporate social media* provide for digitally reproducing one's social network and even expanding it by searching for further contacts. They help keeping profiles of employees up-to-date as they are maintained by the employees themselves. Furthermore they enable employees to sustain weak ties[4] to other employees.

For the purpose of this paper we describe a *passive user* of a social networking service, represented by an only rudimentary profile. However he does not actively cultivate this profile e.g. by specifying certain interests or expertise. Thus his profile has a low visibility to search engines of the networking service.

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[1]http://www.facebook.com
[2]http://www.linkedin.com
[3]http://www.xing.com
[4]According to [Gra73] we discern *weak ties* such as acquaintances and *strong ties* such as close colleagues or friends.

4 Passive User Integration

Baseline Scenario. We consider a company providing an online corporate social networking service to its employees as part of its intranet site. Therein, a basic profile exists for every employee, created upon recruitment, holding rudimentary information such as name, telephone number and department assignment. Furthermore, these profiles contain additional fields for information such as expertise or interests. Employees are supposed to complement these fields by themselves. The online corporate social networking service of our imaginary company bases the identity of users on their real names. This means that every user is clearly identifiable. Millen et al. [MFK06] describe the following reasons for this which also apply here. First, it helps in discovering interests and expertise of other employees. Then real world communication regarding these interests is facilitated as everyone can easily be identified. Furthermore searching for people with certain expertise is alleviated. Finally, there is a lower possibility of misuse due to the easy identification of participants. The online corporate social networking service is intended to be the main source when searching for experts. Searches are performed based on profile information as well as personal contact networks. Having profiles with detailed up-to-date information is thereby a key prerequisite. This necessitates that as many employees as possible maintain accurate profile information.

Many young professionals today are experienced in using different types of social media to organize their business contacts, to maintain links to resources using online social bookmarking services and share gathered knowledge, amongst others. They are familiar with basic concepts of social media such as personal profiles, contact networks, tags for indexing resources or pivot browsing for exploring information. Hence they are likely to adopt these tools in a corporate environment, too [KMMS08]. An ordinary enterprise however comprises not only young professionals. There are also senior employees, experts and executives. More often than not they are equally willing to share their collected knowledge and off-line social networks. In fact we assume they have a fundamentally positive attitude towards sharing their knowledge. For various reasons however some employees (not necessarily only senior ones) may be reluctant to adopt these new social media technologies for representing and maintaining their social networks and gathered knowledge. DiMicco et al. discovered in their analysis of IBM's corporate social networking service *Beehive* that 67% of the users were actively using this service and connecting to others users [DMG+08]. That is 33% of profile owners were passive users.

The reasons for rejecting the active use of social media may be manifold and cannot simply be attributed to technological inaptitude. Senior experts started their careers mostly before the arrival of the internet and have built their social networks by traditional means. They had the time to make physical contact with many other people in the business and simply do not easily see any benefit from the use of social media. In particular the profile information of these employees will not be accurate in terms of advertised expertise and interests. Thus, others querying the social networking service are unlikely to find the profiles of those employees.

Therefore, better integration of passive (wrt. their use of social media, not their rôle in the company) members into online corporate social networks is crucial for companies.

This would contribute to fostering collaboration and communication as relevant experts would be more easily identified by knowledge seekers. Also, in the long run initially sceptical employees could be convinced by the additional return on experience these online corporate social networking services offer.

Complementable Profiles. In the previous section we described the problem of passive users within online corporate social networks and the resulting low visibility of their profiles. In this section we propose a social approach to this problem. The goal of our approach is to increase the visibility of senior experts in online corporate social networking services. This increased visibility is achieved by expanding their online social network profiles. Therefore, the general idea of our approach is to make profiles extensible by other members of the online corporate social networking service. Basically every element of such a profile could thereby be subject to extension. However, as the goal of our approach is to increase visibility of profiles by adding relevant pieces of information, stating a profile owner's expertise or interests are in focus below. This additional information would then be publicly visible to all other members by default.

Consider the following situation. In the process of solving a particular task a young professional consults the online corporate social networking service in order to identify relevant experts. However he does not find appropriate profiles matching his search. He then gets in touch with some experts by utilizing his off-line social network. One of them is finally able to provide valuable information to handle his task. Now the young professional extends appropriate elements of this expert's profile with relevant keywords that were not present at the time of his search. Both the young professional and the expert as well as other members of the networking service benefit from this action. Upon the next search query to the networking service the young professional and other members will find this expert by those new keywords. The expert on the other hand gets more visible in the networking service and his recognition as an expert is fostered.

A similar situation is as follows. Employee Alice expresses interest in a certain topic during conversation with distant colleague Bob. However Alice is known for only reluctantly maintaining her profile of the online corporate social networking service. Hence colleague Bob adds this topic to the list of interests of Alice's profile. The benefit may be mutual in this situation. Bob will find Alice more quickly in the networking service and Alice may be considered for contacting by others based on this new keyword.

5   A Tagging Approach

For realizing the aforementioned approach of complementable profiles the application of a tagging mechanism seems natural. As described by Smith [Smi08] tagging is an increasingly popular method for organizing and navigating resources. Tags are simply keywords that are attached to certain resources. They are independent of each other and there is no hierarchical order imposed. Up to now few publicly available social networking services offer the possibility of adding tags to profiles in order to organize social network contacts. With those services that are offering tagging these tags are not publicly shared but only

visible to the respective issuer. That is they are of no value to the other members of the networking service. Thus the social component is missing.

Farrell et al. describe tagging of whole profiles for organizing members of online social networking services [FLN+07]. They prototypically employ this feature in their software *Fringe*, an online social networking service developed by IBM. By combining separate social networking services, e.g. Fringe, and social bookmarking services, e.g. Dogear[5], tagging of whole profiles could be achieved. However, we argue that the resulting tagging of whole profiles is too ambiguous. The meaning of tags and the intentions of issuers would not be clearly recognizable. For example, for a given tag it would not be discernible whether it represents a skill or interest of a profile's owner. This makes it difficult for users of such an online social networking service to efficiently search for people relevant to a certain topic. An additional filtering step involving further communication would be necessary in such a setting.

For the above mentioned reasons we expand on the idea of tagging described by Farrell et al. We propose the following advancements over existing systems. Firstly, we apply tagging to individual elements of a profile. That is, the different elements of a profile are regarded as single resources that are taggable. Then, we provide a mechanism for an ageing of tags as they may represent skills or interests which may get outdated. Thirdly, we introduce a rating mechanism for tags to reflect disagreement on certain tags among employees. For the realization of complementable profiles these resources are not only taggable by the profile owner but also by other members of the social networking service. The issued tags will then be publicly visible and hence useful to all members of the service. In this way both the owner and other members utilize the same method for providing useful profile information. Profiles of passive users are thus extensible also by others. By utilizing this feature the visibility of profiles of passive users to searches within the social networking service is increased.

Basically, all elements of a profile may be subject to tagging. This includes elements such as name, telephone number, address, interests or expertise. Typically in corporate environments there exist corporate directories containing such basic information as name, telephone number and address. However in times of frequent reorganizations human resource departments are very busy keeping even these basic information up-to-date. As DiMicco et al. point out having employees maintain these information via their social network service's profile is an interesting approach [DMG+08]. Here, we focus on the cultivation and extension of profile elements such as interests and expertise. More tags attached to these elements are likely to increase the visibility of the respective profile to searches which is the goal of our approach.

Basic Functionality. As described above the basic feature of our approach is tagging of profile elements by everyone. This allows users to add tags to profile elements of other users as it seems appropriate to them. Common to the functionality of most tagging systems is also the removal of tags. That is everyone is also allowed to remove tags that he previously has issued. Thereby an important aspect of removal is the ownership of tags. In most successful tagging systems tags always pertain to a certain user of that system. That

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[5]http://www-01.ibm.com/software/de/lotus/wdocs/connection/lcdogear.html

is, a resource-centric view showing all tags for a given resource displays an aggregation of all tags of all users for that resource. Resulting from this one is only allowed to remove one's own tags from that resource. The same applies to the basic functionality of our approach.

Identity Management. The term *identity management* denotes the construction and maintenance of the users' social identities as represented in an online corporate social networking service [RK08]. This includes care for information on interests or expertise as listed in a user's profile of a social networking service. As described above, each user is only allowed to remove his or her own tags. That is a profile owner at first has no possibility to directly remove unwanted tags of others from his profile. Only by employing a social back-channel, e.g. e-mail or direct communication, a profile owner could address this issue. Farrell et al. leave the sufficiency of such a social back-channel open for debate [FLN+07]. From our preliminary research we however argue that a profile owner should nevertheless retain full control of what is displayed related to his profile.

To address this requirement we propose the utilization of a black-list mechanism. That is, a profile owner has the possibility to put certain tags on his black-list which will not be displayed in the following. To realize this black-list both opt-in and opt-out mechanisms are conceivable. With both procedures a profile owner would be notified on every addition of a new tag to his profile. Notification by e-mail is thereby a viable solution as e-mails are processed on a daily basis in corporate environments. The opt-in mechanism would then require the profile owner to approve every single tag to have it finally published on his profile. This solution guarantees total control on the extension of one's profile. The downside however is an increased workload and possible neglect by reluctant employees. This would lever out our approach as there would be no new tags on their profiles. The opt-out mechanism on the other hand only requires further action if the profile owner disagrees with the newly added tag. As the number of malevolent users should be minimal within an non-anonymous corporate social network we favor the application of an opt-out mechanism.

Treatment of outdated Tags. Interests and expertise of users of a social network service are likely to change over time. At the same time certain tags stating these interests and expertise on the online profile get outdated as well. That is, tags that were issued some time ago may not correctly state current interests and expertise. This is different to common bookmarking services which primarily store tags on specific websites. The content of most of these websites however does not change fundamentally over time. So in these systems tags are not very likely to get outdated. Two different approaches are possible to address this situation. First, outdated tags are removed by their respective issuers. This necessitates that every user keeps track of all tags that he issued. Yeung et al. identified that on average a user has 285 unique tags with the social bookmarking service delicious.com [YGS08]. Keeping that in mind it is unlikely that users will continually monitor the actuality of all their tags and that these social forces will be sufficient for effectively keeping tags up-to-date.

We propose to visually represent the age of tags. It is customary to indicate the number of identical tags for a given resource by changing its font size accordingly when displayed related to that resource. Similar to this the font color can be utilized to express the age of a

given tag. Older tags are displayed in lighter shades of gray. For this of course time-stamp information has to be stored for every issued tag. With this approach every viewer of a given profile is able to easily identify the age of the displayed tags. This applies to all tags irrespective of whether they were issued by the profile owner or someone else. To indicate continuing validity, tags also have to be renewable. This is achieved by simple re-issuing the respective tag. Interests and expertise change over time but one never completely forgets about a certain topic, be it expert knowledge or meta knowledge. In order to reflect this we propose that the fading tags will not completely disappear. This provides for searching for "old" knowledge and the preparation of a "history" of knowledge of a given profile.

Profiles of former Users. In companies today fluctuation of employees is the order of the day. This results in an increasing amount of orphaned profiles within the online corporate social network service. The treatment of these profiles poses an interesting question. Should they be deleted or should they remain in the network service? In our research we did not identify any advantages resulting from the deletion of orphaned profiles besides storage-related issues. However we envision the following advantages in preserving profiles of retired employees. For one thing it will still be possible to access their digitally represented network of contacts. Some of these contacts may still work for the respective company and thus can be contacted. Furthermore tags of the retired user will still be in place and hence help others in finding the respective resources.

Many social networking services today allow for sharing content with others within the service. The feature of sharing pictures with IBM's service Beehive for example is adopted by 5.4% of IBM's participating employees [DMG⁺08]. For privacy issues it is a matter of debate whether such shared content should also remain with the orphaned profiles. A possible solutions for this is an employee agreement that either prescribes the deletion of the whole profile or advises the employee to clean his profile. If such an agreement is missing, employees could nevertheless be encouraged to revise their profile upon retirement and to delete their shared content they do not want to persist.

Rating of Tags. In the preceding sections we postulated that the removal of tags be only allowed to the original issuer of the respective tag. A profile owner furthermore has the possibility of black-listing certain tags he does not want to be displayed. As everyone can tag any element of any profile there may arise disagreement on the appropriateness of certain tags. Consider a third user wanting to remove a certain tag from a profile for some reason. However he is not the owner of this tag. Accordingly he cannot remove this tag. To be able to express this disagreement we propose the introduction of a simple positive/negative type of rating of tags. The scenario is then as follows. A user who wants to express a positive rating for an already existing foreign tag simply issues an identical tag, too. A negative rating for a tag is realized adding this identical tag with a negative weight. The underlying system has to be able to store this negative weight accordingly.

Visualization Aspects. Smith discerns three potential views or pivot points for browsing social tagging systems, denoted user, tag and resource [Smi08]. In our approach the profile elements correspond to the resources. Displaying profiles and elements of profiles in an online social networking service therefore equals the resource view or pivot point. In this view we discern three different kinds of tags. First, there are tags that the profile owner

assigned to the respective element of his profile. Then there are tags that were issued by a different user than the current viewer. Finally there are tags that the current viewer added. For the current viewer to be able to discern these three types we propose a visualization using for example different colors. It is possible that identical tags belong to more than one of these alternatives. In that case the following precedence applies from strongest to weakest: Tags of profile owner, tags of profile viewer, tags of others.

In social bookmarking systems the frequency of tags for a given resource is most often represented in tag lists by different font sizes [Smi08]. As described previously our approach provides for both positive and negative weights of tags. Font size is insufficient for appropriately representing this. Therefore we deviate from using font sizes and propose to explicitly state both the positive and negative numbers with each tag. Having profiles tagged by others and storing the tag issuers provides for another dimension of pivot browsing. Users are then able to browse along the tag issuer dimension and contact issuers for further information on the reasons for tagging the respective profile with the respective tags.

6 Problem Issues

The application of online social networking services within an organisation is likely to give rise to different impediments, which mostly are not related to the technical issues of implementing such a system in itself but more to the application of such a system in a corporate context. They may be related to employee privacy, harassment or service misuse as well as the emergence of new hierarchies and the involvement of labor unions. For some issues such as the opt-in/opt-out strategy for tagging control discussed in Section 5 all possible solutions may be technically viable. However, from an application point of view such matters usually must be resolved as part of an agreement between management and labor representatives and are not to be decided by the system designers. Therefore the system designers' job in this case is to highlight as many potential issues as possible and provide an implementation that is flexible in such a way as to allow for an individual configuration regarding said issues.

Privacy. As pointed out earlier all issued tags in our approach are assumed to be publicly visible by default. This public visibility is considered to increase visibility of all profiles of the online corporate social networking service. That is, assigned tags are also useful to other members of the networking service. However, as Millen et al. [MFK06] point out, there is sometimes a need for privacy by users when tagging certain resources. In order to address this need our approach includes a privacy option. It is possible to mark certain tags as private and hence only being visible to oneself.

This privacy option arises from the question of who else should be allowed to see private tags. Is there a necessity for someone else to have access to these private tags? Management, admin staff and human resources could come into question, among others. Should these departments be allowed to derive further information on single employees from their issued and received tags? Farrell et al. [FLN+07] surveyed the usage of tags in their pro-

totypical service Fringe noticing a behaviour what they called *shaming*. There, users of the networking service tagged other users who did not provide a photo with their profile at that time as `no-picture-in-bluepages`. Superficially this could be seen as a social way of harmlessly pushing members towards providing a photo of themselves. However, this could also be conceived as cyber-harassment by the respective employee who does not want to provide a photo. Approaches for this problem range from relying on social back-channels as described in [FLN$^+$07] to company rules forbidding such shaming behavior within the enterprise social network.

Furthermore, consider a scenario where the management discovers that some employee Alice is privately tagged by several others of having an interest in returning home early. There are two possibilities for this. Alice either may be really going home early every day or her co-workers want to harass her. They tag her privately as they do not want to be blamed for this, knowing that management is able to see all private tags. We see this as a potential source of cyber-harassment and therefore argue that private tags should really be kept private and invisible to all other instances.

In Section 4 being tagged in a social networking service is described as being beneficial to the tagged individual. This may be true to some degree as positive tags can highlight this individual's benefit to the organization. However, the use of the number of positive tags or the individual's rank in a social network as a metric for employee assessment could lead to distorting user behavior. As it is unlikely that management will not make use of this any sort of ranking function will have to be made skewing resistant, e.g. by ignoring symmetric tagging between individuals.

Misuse. The example of Wikipedia demonstrates that systems granting their users wide possibilities for editing content are vulnerable to misuse. The tagging approach as given above is also susceptible to this. We identified two issues related to this, the addition of unruly tags and the malevolent rating of tags. We described above that our approach is based on real identity of users in the online corporate social networking service. Due to this lack of anonymity and the resulting traceability the use of unruly terms will be minimal. Continued misbehaviour is furthermore easily prevented using a black-list of terms.

The second issue of misuse is the malevolent rating of tags. Users may deliberately assign tags with a negative rating. With our approach as with most other tagging systems every user only has one vote, i.e. one tag, per resource. In enterprise environments with large social networking services infrequent misbehavior should be ruled out by what Surowiecki calls wisdom of crowds [Sur05]. That is the contribution of the many will result in the appropriate solution. However, the lack of anonymity does not help when the misuse is not committed by regular coworkers but by superiors and the wisdom of the crowds does not necessarily apply to the microcosm of a small detached department. It is obvious that some form of arbitration body needs to be established to rule in such cases.

New Hierarchies. From social networking services new hierarchies may emerge. These hierarchies form besides existing traditional corporate hierarchies which are typically represented by organisational charts. Formation of these new hierarchies is driven by the number of tags a given user issues and receives within the online social networking ser-

vice. Both kinds of hierarchies need not necessarily correspond to each other. Another possibility is the formation of hierarchies where traditional hierarchies do not yet exist. That is, employees of different companies create these new hierarchies by assigning tags to each other expressing mutually perceived skills and interests. This formation of new hierarchies is likely to be objected the representatives of the traditional hierarchies. This may be due to misunderstandings regarding the functionality of the applied social networking services and the possible loss of control resulting from their use. This scepticism is even justified to some degree since, as opposed to classical hierarchies, the new social networking hierarchies typically do not embed an analogous system of responsibilities. For these executives to embrace such services it will be necessary to show that these services are neither meant to nor capable of substituting current forms of hierarchy which still remain intact. Rather, the benefits of such services offering additional functionality for better leveraging the knowledge of employees have to be emphasized.

Labor Unions. Another issue relates to labor unions. As these organizations traditionally take care of employee rights they may see certain rights as well as the union's basis of existence compromised. Rights that were tediously carved out are raised to question. Furthermore, employees that are able to organize themselves using social media tools [Bib08] do not necessarily need to rely on formally organized labor unions. Even though it is extremely unlikely that labor unions will be entirely made obsolete, as social networks are by their very nature informal and noncommittal, Bibby recommends in his report that labor unions should deal with the new Web 2.0 phenomenons [Bib08]. On the other hand, labor unions as well as the legal representatives of the workforce should proactively be approached when implementing online social networking services within a corporate environment.

7   Implementation Considerations

This section outlines the utilization of FreeTag to realize the approach described above. FreeTag is an open-source plug-in available from Google Code[6]. It allows for the integration of tagging functionality into any suitable application. A prerequisite for applying this PHP- and MySQL-based plug-in is that IDs of resources and users of the main application have to be stored as integers. FreeTag then extends the database by two additional tables, `freetags` and `freetaged_objects`.
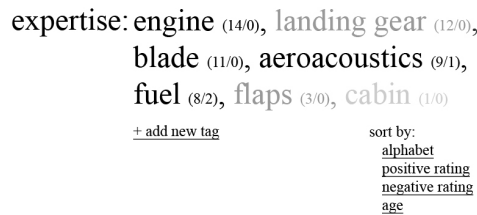
The original user interface of FreeTag for displaying tags has to be adapted. As given above the additional aspects of ageing of tags and ownership of tags are shown in our approach. The ageing of tags is represented by fading the tag color to gray. As FreeTag already provides a time stamp for every tag the display of ageing is easily implemented changing the code of FreeTag accordingly. Figure 1 depicts the visualization of the different stages of age of tags.

Furthermore our approach addresses the visualization of ownership of the different tags that are displayed for a given profile. Conceptually we propose to realize this using dif-

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[6]http://code.google.com/p/freetag

ferent colors for the tags. For actual implementation FreeTag has to be altered in order to compare the IDs of the respective viewer, profile owner and respective tag issuer. Overlaps of results are dealt with using precedence rules as given above.

As described in the previous section, users are able to rate tags with negative weights. The database table `freetagged_objects` is extended with another field as FreeTag originally does not provide for storing this property. The implementation of FreeTag is then adapted to this. That is, a means for adding negatively weighted tags is added to the user interface and provisions for storing and retrieving it are made. Two different manners for showing this rating are conceivable. Usually the font size of a tag represents the number of identical tags for a given resource. Negative weights could be reflected by reducing this number and the font size accordingly. However, it would not be possible to see the actual number of negatively weighted tags. Therefore we propose to display positive and negative weights of tags separately. In Figure 1 this is realized by showing the number of positive and negative ratings in brackets behind the respective tag. In this example this profile element was tagged with 14 positive and zero negative engine tags. Tags can be sorted alphabetically, by negative or positive ratings and age.

expertise: engine (14/0), landing gear (12/0),
blade (11/0), aeroacoustics (9/1),
fuel (8/2), flaps (3/0), cabin (1/0)

+ add new tag

sort by:
alphabet
positive rating
negative rating
age

Figure 1: Ageing and Rating of Tags

8 Related Work

Enriching corporate directories with additional information for better and more efficient expert finding is tackled in different ways. Firstly there is the approach of analyzing the content that people produce on a daily basis. John and Seligmann for example present the ExpertRank algorithm. There they base expert-finding on bookmarks issued by these experts [JS06]. The Innoraise[7] project (with the slogan *Know who knows*) deals with similar aspects of fostering collaboration and communication. There, documents processed during a user's daily work are analyzed as well.

The second approach is having the users actively contribute that additional information by transferring their social networks to an electronic representation using online social networking services. Subsequently they characterize each of the nodes of these online social networks by assigning tags to them. Farrell et al. deal with this kind of approach in their prototypical online social network service *Fringe* [FLN+07]. There the user is

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[7]http://innoraise.com/company/

provided with the ability to tag whole profiles of members of his online social network. We take this one step forward and introduce the following advancements: tagging of single profile elements, ageing of tags and rating of tags.

9 Conclusion and Future Work

In this paper we described two kinds of knowledge that need to be preserved and disseminated by every organization. For preservation and dissemination of expert knowledge there exist several tools from information and communication technology providers today. The support for digital representation of meta knowledge, knowledge on who knows what is still limited. However, social networking services are emerging for this support by allowing for electronically representing users' networks of social contacts.Based on the usage of social networking services and motivated by observations of the aerospace industry we detailed a scenario of passive users of such a system. In corporate environments these networking services are employed as means for quickly finding relevant experts for actual tasks. Some of the experts may be reluctant to maintain their profile information and thus be of low visibility within a networking system. To increase this visibility we proposed the approach of complementable profiles. The general idea is to allow users of a social networking service to extend single elements of other's profiles.

Finally we outlined the realization of our approach using FreeTag. This PHP and MySQL based open source plug-in provides for extending existing web applications with tagging. We briefly delineated the adaptation of this tool to the specific needs of our approach and presented a possible graphical representation of ageing and rating of tags.

With respect to legal implications we plan to further investigate topics such as utilization guidelines, protection of privacy and accountability. In terms of future work we intend to implement the approach described in this paper. We also hope to test our approach in a large scale industrial environment and obtain some meaningful usage data.

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