THE BEAUTY OF SIMPLICITY
Ubiquitous Microblogging in the Enterpise

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Abstract: Microblogging has become a primary trend topic in the World Wide Web. Compared with the history of blogs, wikis and social networking services, its adoption in commercial enterprises seems to be the next logical step. However, in the case of enterprise microblogging there is not only the possibility of copying the public web's functionality. In enterprise scenarios the mechanism of microblogging could have much more use cases than its public pendants, i.e., 'tweeting' processes, machines and software. We systematically develop a scenario for ubiquitous microblogging, which means a microblogging space including human and non-human information sources in an organisation. After presenting a conceptual description we discuss examples for the approach. Based on a comprehensive study of existing literature we finally present a detailed research agenda towards ubiquitous microblogging for enterprise information management.

1 INTRODUCTION

Business users have to deal with a high variety of information sources and business processes. Especially knowledge workers and managers face the dichotomy of information overflow on the one hand and the need for staying informed on the other hand. With activity streaming, RSS and vendor-driven solutions like Salesforce Chatter we currently see the appearance of a new paradigm of enterprise information allocation following a subscription model. Users do not have to define information needs for IT departments or have to call special transactions in ERP systems to get the needed information. Instead, they subscribe to information related to a certain person, a business process or an information object.

The most popular implementation of such subscription approach in the public internet is the microblogging service Twitter. It is an impressive example of an unorganised system of information sources which can be handled by the user with a simple following/un-following principle. The research vision of ubiquitous microblogging (short form is #ubimic, the '#' relates to the so-called hashtags in Twitter) presented in this paper links to these characteristics and describes a scenario where every kind of information source is represented by a

microblog. This paper describes this approach from a conceptual point of view as a way of information allocation in enterprise information systems. The #ubimic vision from a computer science point of view has already been described in Böhringer & Gaedke (2010).

In doing so, we answer the following research questions:

– What does ubiquity mean in enterprise microblogging contexts?
– How and why could ubiquitous microblogging be useful?
– What are open research issues to meet the vision?

The aim of this paper is to aggregate current developments of microblogging technology to a comprehensive vision of future microblogging, named ubiquitous microblogging due to its all-embracing character. Following this goal, we started in section 1 by identifying and motivating the problem. Section 2 presents an overview of microblogging and defines the objectives of a ubiquitous microblogging solution inspired by current Web 2.0 applications. Chapter 3 demonstrates the approach with examples from Twitter. Due to the highly dynamic research field and the early research stage of our approach we provide a comprehensive evaluation of our concept

in discussing open research questions on the way to its realisation based on existing work.

2 BACKGROUND AND OBJECTIVES OF UBIQUITOUS MICROBLOGGING

2.1 Microblogging

The principle of microblogging is best known via Twitter, its most famous application. Members have their own public microblog where they can post short updates. Other users can be 'followed' by adding them to one's personal network. An aggregated view of all updates by followed microblogs appears in chronological order on the user's start page. Microblogging services often support a wide range of contribution possibilities. For example, messages to Twitter can be posted via mobile text messages, desktop clients or several third-party applications.

Parallel to the adoption beyond internet users, Twitter and microblogging in general became a subject of research. Due to its unique approach, researchers from different disciplines are interested in the topic. Two general kinds of research works can be identified in the existing body of knowledge: A first group contains research which explains the approach using statistical description (Java et al. 2007, Krishnamurthy et al. 2008, Huberman et al. 2009, Hughes & Palen 2009, Zhao & Rosson 2009) or in building theory for predicting user behaviour (Barnes & Böhringer 2009, Günther et al. 2009). The second class deals with microblogging in special use cases and is mostly design science or case study oriented as these works go beyond Twitter and develop further approaches for supporting, e.g., enterprise information management (Böhringer & Richter 2009, Barnes et al. 2010) and e-learning (Ebner & Schiefner 2008, Skiba 2008) with microblogging applications or research technological foundations (Passant et al. 2008, Sandler & Wallach 2009, Assogba & Donath 2009).

We will discuss these existing works on microblogging in detail in section 5 as we develop an agenda for further research.

2.2 Ubiquitous Microblogging

The new term of 'ubiquitous microblogging' leans on the well-known research field of 'ubiquitous computing'. While the latter understands ubiquity in the sense that artificial computing devices are everywhere in the real world (Abowd & Mynatt 2000), the meaning of ubiquitous microblogging is that of real world objects being integrated and represented in an artificial computing space. In our definition, ubiquitous microblogging means a microblogging system including 'everyone and everything' in an organisation, which means that information from every human and non-human information source is represented via microblogging. Therefore we borrow the conceptual meaning of 'ubiquitous' in the sense of its Latin origin 'everywhere'.

Weiser (1991) in his vision of ubiquitous computing stated that 'the most profound technologies are those that disappear'. Figuratively speaking, this is also true for ubiquitous microblogging as the goal behind our approach is to hide the complexity of information access in the real world by providing a flat information space accessible by the easy following-mechanism. This leads to the objectives of a solution for ubiquitous microblogging: following the core microblogging approach it should support a maximum of ease of use with nothing more necessary for usage than to understand the natural principle of following and un-following other people or information sources. The main task for an information system for ubiquitous microblogging therefore is to provide this simple access to manifold information sources in the required information space (i.e., an organisation) and make the underlying complexity 'disappear'. Table 1 provides a summary of the final objectives resulting from the discussed specifications of microblogging in a ubiquitous understanding.

3 EXAMPLES

The best source of evidence for the described scenario of ubiquitous microblogging is Twitter. Example A in figure 1 shows a humidity sensor, which posts status updates from a tomato plant. Example B shows a simple example of a software programme connected to Twitter (in this case the software testing framework of a research group at our university tweets its current status). Example C shows the Twitter stream of Tower Bridge in London, where each posting contains information about the current action (closing/opening), the ship which caused the action and the ship's direction.

The examples listed have one thing in common. They represent highly specialised information sources which are not from interest for a broad

Table 1: Objectives of a solution for ubiquitous microblogging.

Origin of objectives	Objectives
Objectives based on microblogging properties	O1: Ease of use O2: Ease of understanding (following-mechanism) O3: Social networking functionality O4: Possibility for interactive communication between the channels O5: Open access to the platform (API, mobile clients et cetera)
Objectives based on the ubiquitous approach	O6: Integration of multiple sources within the system boundaries O7: Access to external information sources (i.e., Twitter)
Objectives based on the enterprise context	O8: Filtering and re-composing of content (Böhringer & Richter 2009) O9: Searching and analysing microblogging content (Barnes et al. 2010)

Figure 1: Examples of ubiquitous microblogging on Twitter.

public. However, for some stakeholders they provide important information. As the publisher of the information does not know, who these stakeholders will be, microblogging with its following-mechanism provides a simple and elegant way of information allocation.

When transferring this thought to a business environment, it is clear that, at virtually any time, potentially new information requirements can evolve, which could be covered by a ubiquitous microblogging system. Existing research on microblogging in enterprises confirms this effect of unanticipated information reuses through their use of public distribution (Böhringer & Richter 2009, Barnes et al. 2010). Research discusses this phenomenon as Serendipity (Vinoski 2008.

4 OPEN RESEARCH ISSUES AND FUTURE AGENDA

The developed scenario of ubiquitous microblogging produces a number of open research questions in a wide range of disciplines. In the following paragraphs we aim to provide a research agenda towards the successful utilisation of ubiquitous microblogging with a focus on the enterprise context. In order to provide a foundation for further research, we explicitly formulate and address research tasks.

4.1 Understanding Microblogging

Microblogging can be seen as a unique phenomenon. It is an extremely simple tool and yet it has gained sustainable success. Many researchers in the field of information systems and computer science – the paper's authors included – have not perceived the platform's potential until recently. Since the benefits of microblogging therefore seem to be hard to determine in a logical and deductive way, using the reverse approach and exploring the phenomenon is an important research task. Questions like 'How do people use microblogging?' and 'Why do people use microblogging?' are a reasonable source of knowledge on aspects of ubiquitous microblogging.

A large part of existing research is based on statistical description of Twitter. In an early paper,

Java et al. (2007) present a topology of various uses and usage intentions on Twitter. They further find that Twitter's users extend the Twitter question, 'What are you doing?' by including information sharing (e.g. URLs) and normal conversations on the platform. Further statistical studies of Twitter were presented by a number of researchers including Krishnamurthy et al. (2008, identification of different user types) and Huberman, Romero and Wu (2009, networks on Twitter).

Going one step further, some research has been conducted to develop behaviouristic models for explaining the 'why' in microblogging (Barnes and Böhringer 2009, Günther et al. 2009). However, with only two existing works on modelling microblogging behaviour, there is no established research framework yet. Clearly, there is a need to understand the underlying principles of microblogging services like Twitter in order to design and implement successful expansions like ubiquitous microblogging.

R1: Build and test predictive models for user behaviour in microblogging services.

Enterprise adoption of microblogging is in a very early stage of development. Therefore, there are not yet many users in the enterprise context, which would be a prerequisite for broader studies of the area. As an alternative, existing cases should be investigated in detail. Hence, the case study method is a reasonable research methodology for learning about microblogging in enterprises. To the best of our knowledge there exist only two research case studies (Böhringer & Richter 2009, Barnes et al. 2010), yet. Collecting and analysing more cases and conducting multi-case analyses are important future research tasks.

R2: Conduct case studies and multi-case analyses.

4.2 Technical Issues

There is significant potential in supporting users in searching the 'hair stack' for important information (objective O9). For Twitter there exist a number of small applications for visualisation and text mining. However, they are prototype implementations and are not integrated to each other or well-documented. From a scientific point of view, little research has been done in this area. Only Assogba and Donath (2009) argue for a stronger visual support of microblogging users and present a platform for 'visual microblogging'.

Further, the user would benefit from support by automated agents understanding the semantic meaning of the information. For this reason, Passant et al. (2008) present a concept for semantic microblogging. However, the main question for the enrichment of text with semantic information is user acceptance, which is an important point in microblogging as a medium that is mainly based on the ability to publish information fast and easily. An alternative to semantic markup of microblogging postings is to understand the meanings of natural language using Natural Language Processing (NLP). However, it can be questioned how effectively NLP could work on the very short, often informal and possibly flawed microblogging postings. First experimental prototypes have demonstrated the basic feasibility of the approach (see, for example, the service akibot.com).

R3: Support users with visualisation and analysing functionality including semantic richness.

4.3 Conceptual Issues

Our approach of ubiquitous microblogging implies challenging conceptual issues. An important feature of microblogging is the chance to interact with other microbloggers. However, in a microblogging space with actors like machines, sensors and processes, this is hard to achieve (objective O4 conflicts with O6). A user might want to ask '@machineR2D2 when is your next maintenance due?'. As discussed above, text mining/NLP could be a possible solution, but it is questionable whether the technology is mature enough to achieve a good reliability. A solution could be to divide microblogs in unidirectional and bidirectional blogs. Unidirectional blogs like @machineR2D2 could be associated to a bidirectional channel, like the microblog of the machine's technician, for providing a backchannel. The research challenge here, again, is solving these problems with respect to simplicity and transparency for users.

Another level of complexity evolves due to the usage of mashups. Mashups could be very useful for fulfilling O8. However, if mashups re-arrange postings and are published as new microblogs, the same posting exists twice. For example, a mashup could aggregate all the microblogs of a machine park's devices and filter for the keyword 'error'. The result of this mashup could be a new microblog '@machine_errors'. Problematic in this scenario is that the same event occurs in two microblogs, which could lead to distorted analyses and double

appearances. There are two possible solutions: First, it could be defined that the original posting can only occur in one, the original, microblog (i.e., @machineR2D2) and all other re-postings including mashups (i.e., in @machine_errors) should be handled as retweets. Second, from a conceptual point of view, microblogs could be seen as sets of postings and therefore set operations could be applied to microblogs (mashups could be expressed as basic operations like intersections and unions). Although if a posting belongs to two sets double appearances are precluded as both sets refer to the same one element. While the second alternative could be more elegant from a mathematical point of view, its intuitive understanding for the users might be questioned.

Further conceptual challenges include the integration of existing information systems and reliable rights management structures. Our short discussion of conceptual issues shows that there might not be the optimal solution from scratch. As most of the problems do not exist on Twitter or other known platforms, future works have to involve experimental research on these issues.

R4: Conduct experimental research in order to find reasonable solutions for conceptual issues.

4.4 Business Issues

There is a clear lack of research concerning the business value of microblogging. To our knowledge there are no ROI studies or use case analyses. While significant savings and increasing efficiency can be expected because of the rapid information dissimilation, the reduced email traffic, as well as awareness effects (Böhringer & Richter 2009, Barnes et al. 2010), the potential negative impacts of microblogging on productivity because of distraction and 'useless' information (both phenomena are described by Barnes et al. 2010) has not yet been addressed properly.

The huge success of Twitter suggests that the positive effects clearly outweigh the negative. However, although many professional users such as freelancers, media workers, researchers and IT professionals use Twitter, the microblogging service clearly is shaped by (semi-)private contents, which leads to 'fun' as a positive effect for the users. Fun, though, might not be a reliable factor in ROI calculation.

R5: Develop and apply suitable methods for ROI calculation for (ubiquitous) microblogging systems.

4.5 Management, Law and Ethics

Other research questions focus on the social consequences of a ubiquitous microblogging scenario. From an organisational perspective, due to the direct flow of information a change in corporate culture and an at least virtual flattening of hierarchies could be expected. Further, a particularly interesting research question is the change in communication behaviour because of microblogging. In their case study, Barnes et al. (2010) report that users see microblogging as an efficient way to close their tasks. Following this observation, in posting their information users would have finished their information duties. However, according to the classical communication model (sender-receiver), with only posting information into a microblog, communication has not taken place until the receiver reads it. This means that, in opposition to traditional media like the telephone or email, the (potential) recipients of information are responsible for finding and reading the pieces of information. The possible advantage of this mechanism is that receivers of the informational content can also be people who would not have been anticipated by the sender and therefore unexpected communication could take place. However, it also could happen that users overlook important information. It must be questioned if the possibility of 'lost' information is acceptable in the enterprise context or if this scenario can be excluded by appropriate solutions (i.e. in using optional addressing).

R6: Research consequences of microblogging for corporate organisation and communication.

Finally, there are a lot of unsolved questions from legal and ethical perspectives. Is it ethically acceptable that managers judge their team members by their status postings? Do we lose human relationships if we foster microblogging usage? Can microblogging usage be obligatory against a background of privacy and data protection? Can humans and machines communicate on the same level? On the other hand there are significant advantages in terms of law fulfilment and ethical standards: these include the fulfilment of documentation and archiving requirements, process transparency and equal access to information.

R7: Explore and discuss ethical and legal consequences of (ubiquitous) microblogging.

5 CONCLUSIONS

The presented concept of ubiquitous microblogging as allocation principle for multiple enterprise information sources is a research vision. The listed open issues show that there are many tasks on the way towards its realisation. We are going to test the vision in different use cases. We are currently running projects with RFID sensors in a LEGO-based factory and Arduino-based mobile sensors. Further, in case studies and experiments in Twitter and enterprise microblogging applications we are trying to understand how microblogging is applied at the user side (Barnes and Böhringer, 2009; Barnes et al., 2010). Finally, we are working on technological foundations for ubiquitous microblogging and therefore cooperate with different vendors of microblogging technology like the SAP-related ESME project, the microblogging-based artificial intelligence system Akibot and the enterprise microblogging system Communote.

The community around the idea of ubiquitous microblogging is organised around http://ubimic.org. We encourage other researchers to contribute and discuss their ideas there or on Twitter using the Hashtag #ubimic.

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