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Monograph: Technology-Enhanced Learning (published jointly with Novática*)

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Mobile Social Software for Professional Communities

Ralf Klamma and Matthias Jarke

Professional Communities start to make extensive use of Web 2.0 tools and platforms to enhance their knowledge work. But, with the Web 2.0 and the new computing capabilities in the mobile ubiquitous Internet, the relationship between professionals in their closed communities and amateurs in the Web 2.0 is debated again. We show here a living community around the United Nations Educational, Scientific and Cultural Organization (UNESCO) world heritage of the Bamiyan Valley in Afghanistan which tries to find an intermediary position between highly trusted work in the cause of cultural preservation and protection on the one side, and communication with a public audience and investors in the sustainable development of the Bamiyan Valley on the other. Our mobile Social Software scenario Virtual Campfire assembles some tools we developed for this community in a common research and development framework.

Keywords: Communities of Practice, Multimedia, Social Software, Ubiquitous Computing, Web 2.0.

1 Introduction

"Today I travel back to Kabul by plane together with the Italian rock engineers who are to examine the condition of the back wall of the Buddha niches. [...] In a joint visit on the site together with the ICOMOS restorer and the Italian experts the success of the previous consolidation works is confirmed. All of us are convinced that further security measures have to be implemented in the next phase. A mayor (sic) threat for the whole site is the permanent ongoing erosion process of the cliff, which weakens and washes out the soft components of the conglomerate material." - Architect Georgios Toubekis from RWTH Aachen University reports his experiences and findings in his travel blog on <www.bamiyan-development.org>.

The main difference between Web 2.0 and Web 1.0 is the idea that computers are more media than tools. The term "Social Software" characterizes this best. Social Software is well known by examples like the digital image sharing platform Flickr <<http://www.flickr.com>>, the digital video sharing platform YouTube <<http://www.youtube.com>> or the social bookmarking platform del.icio.us <<http://del.icio.us>> and can be broadly defined as environments that support activities in digital social networks [1]. Digital social networks are a connected social graph of human and non-human (media) actor representations mainly realised by means of computer-mediated communication. Because of Social Software, professionals or knowledge workers [2] face dramatic changes in the way they work. Knowledge work can be defined as using your intellectual and social capital to create new knowledge on some media. Knowledge work is not performed in isolation but in communities where knowledge workers create, share, and deploy embedded in a social context.

Wenger et al. [3] defines: "*Communities of Practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge*

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and expertise in this area by interacting on an ongoing basis". The current state of Social Software and its use for knowledge work is at a very early stage. While it is quite obvious to most observers that as mainstream knowledge work uses Social Software, the consequences of using Social Software in professional communities has also impacted on the relationships between amateurs and experts. A second observation is that Social Software is becoming mobile. Major research and development initiatives are realizing mobile broadband access to the Internet, strengthening this significant trend. Mobile Social Software will be a major topic for the near future. The citation from the travel

Cultural and Technological Shift by Social Software		Impact on Knowledge Work	Impact on Professional Communities
Web 1.0	Web 2.0		
Personal website and content managements	Blogging and wikis User generated content Participation	Microcontent Providing commentary Personal knowledge publishing Establishing personal networks Testing Ideas	Social learning Identifying competences Emergent Collaboration Trust & Social capital
Directories (taxonomy) and stickiness	Tagging ("folksonomy") and syndication	Ranking Sense-making Remixing Aggregation Embedding	Emergent Metadata Collective intelligence Wisdom of the Crowd Collaborative Filtering Visualizing Knowledge Networks

Table 1: Impact of Web 2.0 on Knowledge Work and Knowledge Management

blog of our colleague which opened this paper shows that knowledge work supported by Social Software has not only to be designed for well equipped office workers but also for road warriors, trippers, the new mobile "Digital Bohemia" and for knowledge workers like our colleague who are trying to preserve our cultural heritage in Afghanistan.

In the following we discuss our observations in more detail. After that, we describe very briefly some new research tools. A case study of the Bamiyan Development Community will illustrate our approach as well as Virtual Campfire, a scenario for realizing mobile Social Software for professional communities.

2 Knowledge Work Goes Social Software

According to the McKinsey Global Survey of how businesses are using Web 2.0 [4] 75 % of the executives in companies believe that Web 2.0 technologies and business processes [5] help to manage collaboration internally in the two equal areas of product development and knowledge management. After many years of experience with successful and less successful organizational knowledge management projects most experts are sure that knowledge management failed not because of technology but because of the top-down and mistrust based management approaches of higher management [6]. Why should the situation be radically different in the Web 2.0? In the debate on Web 2.0 most people agree that the technology behind Web 2.0 is neither new nor very advanced. It is claimed that the mindset of people has changed. We would argue that it is not the mindset which has changed but the majority of the Web 2.0 users are very different from the users of the Internet 10 years ago. Due to the massive availability of broadband connections millions of new users are using the Web 2.0 in a very different way to users of the Web 1.0. One of the main drivers is Social Software which allows users to do things online (like sharing digital images or digital videos) in a very convenient way. Among these new users are also professionals who are changing their work styles to use the new possibilities. Here,

we want to summarize the impact of some Social Software attributes on knowledge workers and on professional communities in general (cf. Table 1).

1. Projects like Wikipedia create knowledge *prosumers*, who play a role of both producer and consumer, and participation become essential by replacing old-fashioned content management systems with wikis and blogs in organizations. Users play a significant role besides merely providing content in Web 2.0 and we have to identify their new competences. Especially, through new media like blogs and wikis, emergent collaboration of knowledge workers could be encouraged with new functions like the creation and testing of not worked out ideas in personal knowledge networks.

2. Hard to maintain knowledge directories and taxonomies in companies are now replaced by tagging mechanisms creating so-called "folksonomies". Interoperability between content and services is realized by syndications tools (RSS) solving the old problem of "sticky" data, that cannot be taken from one application to another. But does Web 2.0 provide an effective approach to knowledge management among individuals, organizations and communities?

Many knowledge management initiatives at the moment are the mere transfer of Web 2.0 into existing knowledge management strategies. Even worse, technically overambitious approaches which led to many failures in the first wave of knowledge management of the 90s return in the guise of the new king "Social Software". Why not discover the power of multimedia story-telling for the Web 2.0? Why not combine the powerful concepts like communities of practice and emergent metadata?

3 Social Software Stimulates New Debate about Expert Cultures and Amateur Cults

The books "The cult of the amateur" [7] and "The Wisdom of the Crowds" [8] revived an old debate about the relationship between true experts and ambitious amateurs in scientific and professional disciplines. In spite of the valu-

able contributions of amateurs to the body of knowledge at any time, e.g. palaeontology, professional communities define themselves often through high quality assurance entrance barriers for their communities. Professional communities tended to communicate within traditional media like journals, magazines and dedicated Web 1.0 media like mailing lists. The advent of the Web 2.0 is challenging this relationship again. Old projects of the enlightenment movement like encyclopaedias have been revitalized by wiki technologies like the Wikipedia project <<http://en.wikipedia.org>>. But Wikipedia as an amateur project constantly seeks for support from professional communities. On the contrary, expert portals constantly seek for more attention among non-experts for getting more metadata, since metadata in the form of tags has turned out to be the coin of the Web 2.0 age. One very new example is the cooperation between the digital image sharing platform Flickr and the US Library of Congress. Everything labelled as "2.0" nowadays is facing the same challenge of redefining the relationship between experts and amateurs, e.g. Museum 2.0, Journalism 2.0, etc. Even, if we have yet to test the sustainability of many of those endeavours we have to define new forms of collaboration between amateurs and experts. Communities of practice have always been dealing with this. Why not scale the concept of legitimate peripheral participation to social networks like Facebook <<http://www.facebook.com>> or MySpace <<http://www.myspace.com>>.

4 Social Software Meets the Ubiquitous Multimedia Internet

More and more professional communities profit from the growing access to high bandwidth Internet connections. Even professions without any technical background are transforming their professions based on the Web 2.0. Especially the support of fieldwork, knowledge work in underdeveloped countries with missing national communication infrastructures and mobile multimedia have been neglected so far in the discussion about Web 2.0 for knowledge work. For many professions it is quite usual not to sit in a heated office with a fully IT equipped work place, but to work mobile. While road warriors or trippers were supported by mainstream Social Software providers with at least basic office functionalities like word processing and spreadsheets, advanced communication and computing needs for mobile communities are yet not addressed except for research prototypes. Further problems of context-aware computing communities are yet not addressed by the software. The ad-hoc organization of collaborative work in a remote place needs support for wireless transportation platforms and mobile ad-hoc networking solutions, for context-detection with mobile devices and a level of computing experience similar to standard office desktops. Especially in underdeveloped countries access to mobile services is complicated and therefore, we do not find good solutions there yet. The Aachen based excellence cluster UMIC <<http://www.unic.rwth-aachen.de>> tries to address these problems by providing solutions for the following problems: mapping mobile Web

services on mobile IP architecture especially designed for underdeveloped countries, provision of context aware adaptive peer-to-peer information management and delivering high quality mobile multimedia. Especially the latter is very important to break the linguistic fixation of existing solutions for mobile context-aware computing.

5 Research Tools for Mobile Social Software

To understand the impact of mobile Social Software on knowledge work and professional communities we have to leverage existing knowledge management theories for communities into a Web 2.0 world. If computers are regarded more as media in the Web 2.0 we have to address the new forms of communications which are possible in the Web 2.0. As already mentioned this has already started by adding a "2.0" behind everything. But how can we go beyond the too simple and boring idea of "Let's do a wiki / blog on XYZ"? What are the challenges raised by Social Software? Here are some of the research challenges we want to address:

1. How can we handle the unfortunate situation that behind many media artefacts on the Web 2.0 we find no single authoritative authors, but sometimes complex structured or even anonymous groups of editors?
2. How can we measure the trace of the complex edit history and the networked structure of many media artefacts against the goals and intentions we set in knowledge management projects?
3. How can we support the static and dynamic analysis of small mobile communities as well as large networks with more than a million actors and several millions of realized relations?

To give initial answers to the questions raised we have developed a common analysis framework for Web 2.0 based knowledge management. In addition to the above mentioned theoretical works we introduce:

- **social network analysis (SNA)** [9] as a set of measures for social relations,
- **static and dynamic visualization of graphs** as a way of creating evidence,
- **the actor-network theory (ANT)** [10] as a way to deal with complex agency,
- and the **high level goal oriented modeling formalism i^*** [11] for making Web 2.0 knowledge work goals and intentions explicit.

Also, ethical and legal issues have to be addressed because of privacy and data protection. Our goal is the lightweight and flexible formalization of knowledge domains and processes [1].

6 www.bamiyan-development.org: A Case Study of a Professional Community

The joint aims of the Bamiyan Development Community is the preservation and development of the Bamiyan Valley in the Islamic Republic of Afghanistan. The valley, in the heart of the Hindu Kush Mountains, is perhaps best known for the tragic demolition of the two Buddha statues

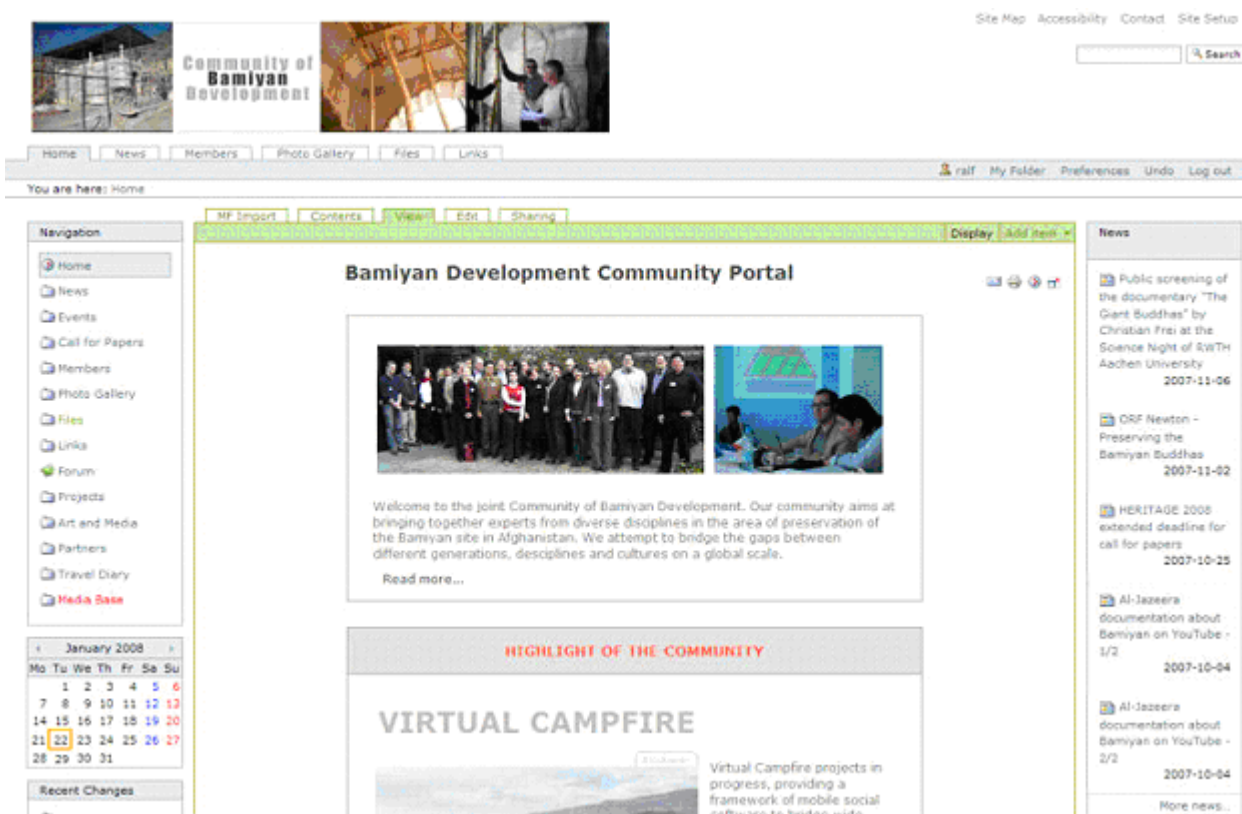


Figure 1: Screenshot of the Community Website of the Bamiyan Community <<http://www.bamiyan-development.org>>.

which are listed among UNESCO's World Heritage Sites. This part of Afghanistan's cultural heritage, and its preservation, can have a major impact on sustainable tourism and economic development for the whole region. But destruction is deep and the destroyed Buddha statues are only the visible tip of the iceberg. The civil war in Afghanistan for more than 20 years, and the Taliban regime, destroyed among others the national science structures and many archives located in Afghanistan.

What happened in Afghanistan? Scientists and professionals who fled from the oncoming war took part of the then paper-based archives with them, scattering those archives all over the world. The generation of scientists and professionals trained and working before the war is now reaching retirement age. Afghan scientists, and professionals trained in other countries, are coming to Afghanistan to help rebuild scientific infrastructures and management of the cultural heritage. While the older scientists and professionals have at least some archived knowledge about the status quo of Afghan sites and monuments before the war, young scientists and professionals use modern information technology and new scientific methods to actualize the knowledge about the sites and the monuments. In order to bring both together, they need a channel to communicate and cooperate among them. Thus, an international and intergenerational cooperation was initiated, because no cul-

tural heritage management work was done over two decades on site in Afghanistan during the civil war. To address the gap between the experiences accumulated by the prior generations and those collected recently we have created a community portal which is accessible via <<http://www.bamiyan-development.org>> (cf. Figure 1).

With the community portal, and the related databases and tools, the community members collaboratively produce and consume different media including photos, videos, drawings, books, etc. supporting cultural heritage management which consists of documentation of sites with significant interest, evaluation of appropriate conservation measures and the monitoring of the means applied. To support the community and attract the public we have created various advertising materials such as a trailer video and some expert interviews with community members which are taped on digital video and shared via the portal.

Figure 2 is a social network visualization of the Bamiyan Development community (persons are represented by rectangles and agencies by ellipses). Under the UNESCO guidelines of the International Coordination Committee (ICC) for the Safeguarding of Afghanistan Cultural Heritage, several governmental and non-governmental organizations around the world actively engage with national institutions and experts. Within this framework the International Council on Monuments and Sites (ICOMOS) coop-



Figure 2: Visualization of the Bamiyan Development Social Network.

erates with both the Aachen Center for Documentation and Conservation (Prof. Dr. Michael Jansen) and the Department of Information Systems (Prof. Dr. Matthias Jarke) of RWTH Aachen University, with funds from the German Foreign Office. Together with local partners, such as the Society of the Preservation of Afghanistan Cultural Heritage (SPACH), we organize professional training for the Department of Archaeology and Historical Monuments of the Afghan Ministry of Culture. These activities are supported by a new generation of scholars and students from the Kabul University. Many community members with different tasks and levels of profession including fieldworkers, researchers, project or campaign officers, cultural bureaucrats etc. work in a mostly distributed work setting world wide.

The following example illustrates the professional work of the communities. Researchers, engineers and other professionals document the status of the niches of the Bamiyan Bhudda in the Bamiyan Valley during a campaign. They

make use of special measurement equipment for 3D-ster-eometry and widely available devices such as Global Positioning System (GPS) enabled camera systems. All resulting materials, e.g. digital images with additional stored GPS coordinates, will be requested by a mobile multimedia database on a laptop of a researcher. The international community can immediately access the materials by the community information system. They can tag the materials and they can relate (re-mix, embed) information in other documents. But only after clearance of the images through community experts can some of the images can be released to the public by sharing them with tools like flickr.com to raise the interest of the public for the restoration work in the Bamiyan Valley.

7 Virtual Campfire: A Mobile Social Software

In order to make knowledge sharing a success for any kind of professional community, independent of size or domain of interest, a generic community engine for Social

Software is needed. After some years of experience, with the support of professional communities two different products emerged: a new reflective research methodology called ATLAS (Architecture for Transcription, Localisation, and Addressing Systems) [12] and a community engine called LAS (Lightweight Application Server) [13]. The research challenge in ATLAS was to incorporate the community members as stakeholders in the requirements and software engineering process as much as possible. In the end, all community design and engineering activities should be carried out by the community members themselves, regardless of their technical knowledge. While this ultimate goal of taking software engineers out of the loop is rather illusionary in the moment, we have targeted realizing a generic architecture based on the research methodology. It allows community members to understand their mediated actions in community information systems. In its reflective conception the community information systems based on ATLAS are tightly interwoven with a set of media-centric self-monitoring tools for the communities. Hence, communities can constantly measure, analyse and simulate their ongoing activities. Consequently, communities can better access and understand their community need. This leads to a tighter collaboration between multimedia community information systems designers and communities.

Within UMIC we have developed this complex scenario of a mobile community based on our real Bamiyan Development community, and the ATLAS/LAS approach. Virtual Campfire is an advanced scenario to create, search, and share multimedia artefacts with context awareness across communities. Hosted on the basic component the Community Engine, Virtual Campfire provides communities with a set of Context-Aware Services and Multimedia Processor Components (cf. Figure 3) to connect to heterogeneous data sources. Through standard protocols a large variety of (mobile) interfaces facilitate a rapid design and prototyping of context-aware multimedia community information systems.

The successful realization of a couple of (mobile) applications listed as follows has proved the concept and demonstrated Virtual Campfire in practices: MIST as a multimedia based non-linear digital storytelling system; NMV as a MPEG-7¹ standard based multimedia tagging system; (Mobile) ACIS as a Geographic Information System (GIS) enabled multimedia information system hosting diverse user communities for the cultural heritage management in Afghanistan; and finally CAAS as a mobile application for context-aware search and retrieval of multimedia and community members based on a comprehensive context ontology modelling spatial, temporal, device and community contexts.

All these applications employ the community engine and MPEG-7 Services within the Virtual Campfire framework. Other services and (mobile) interfaces are applied according to different communities' requirements. Virtual Campfire is running on Wireless Mesh Networks to apply high

¹ Multimedia Content Description Interface. It uses XML to store metadata, and can be attached to timecode in order to tag particular events. <<http://en.wikipedia.org/wiki/MPEG-7>>.

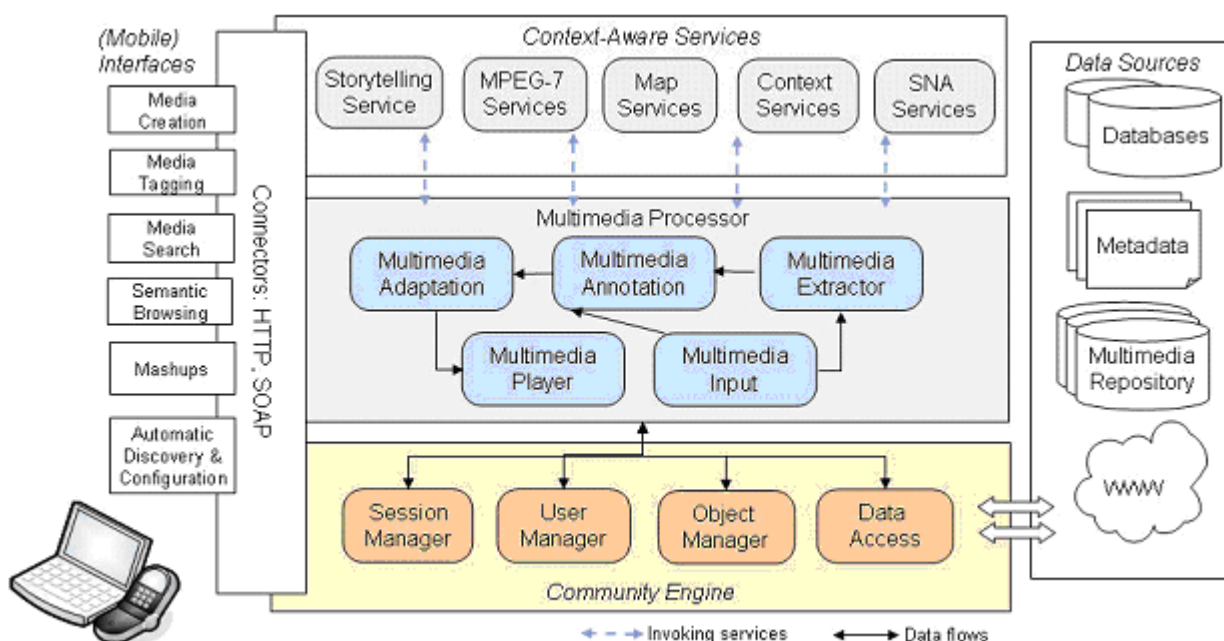


Figure 3: Virtual Campfire Scenario Architecture.

and stable network data transfer capability, and low cost, in developing countries.

8 Conclusions and Outlook

The development of mobile information systems for communities of professionals in different application domains is a challenging issue for several reasons. The community engine has to reflect the social learning processes taking place, which differ from community to community. Even more, the mobile information system has to cope with the needs of the digital media and the related communication/collaboration tools. Furthermore, communities are usually not able to express their needs in the very beginning of information system usage.

Thus, the communities themselves a learning experience in specifying their needs usually also using Web 2.0 media like blogs and wikis. In addition, multimedia technologies and the Web 2.0 are rapidly developing, thus creating new requirements on hardware and software. In combination with a trend for multidisciplinary knowledge work and research novel approaches for flexible, evolving, adaptable, and interoperable community engines are required. Mobile Social Software for professional communities therefore needs to reflect the nature of the underlying community processes and their discourses but also open itself to an interested public audience and passionate amateurs providing their spare time for increasing the value of research significantly.

Consequently, the question is: How to design and orchestrate community information systems in order to fully exploit the features of the Web 2.0? With the Virtual Campfire scenario we want to show an early example for mobile Social Software serving both the needs of trustful community communication and collaboration on the one hand and the use of community materials to communicate with a greater audience. Therefore, we invite everybody to join the Bamiyan Development Community and participate in the protection and the development of our cultural world heritage.

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