Networked Knowledge - Networked Media: - Bringing the Pieces Together

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The book title Networked Knowledge - Networked Media reflects on the convergence of Social Media and the Semantic Web. When these developments became popular a few years ago it was a simple co-existence between the two, but in the meantime they have increasingly melted making it impossible to think of knowledge technologies without thinking of the Semantic Web.

Semantic Web principles have not only proven applicable at the technological level solving problems such as data integration and data quality management, but have also proved their applicability at the service level networking knowledge and people across diverse media, supporting search and retrieval, recommendation, collaboration and even trust and accountability issues. Although basic frameworks and infrastructures are essential prerequisites for this, it is not the technology per se but the added value derived from it that convinces about the practical relevance of the Semantic Web. But how good can networked knowledge be without people creating, using and sharing it?

Since the emergence of the Web 2.0 actively generating and sharing knowledge has become a common practice. The technological enabler to this are Social Media including Wikis, Weblogs or Social Networks. Initially almost exclusively used by experts and geeks, today Social Media are widely accepted and common in educational, research and business contexts. However, as we can witness at the moment only the combination of Social Media and the Semantic Web brings both developments to their full potential.

Conceptual Foundations

The term "networked knowledge" exemplifies several important facets of knowledge: first, in a "knowledge society" knowledge needs to be connected in order to generate new knowledge or innovation, which can be realised by Semantic Web technologies. Second, knowledge also needs to be shared among people in order to be used effectively, and much of this sharing is based

on collaboration, social software, and social networks. And third, knowledge is never isolated but always embedded in a context, connected with other information.

Where "networked knowledge" mostly describes networks on a conceptual level, the corresponding term "networked media" addresses the technological feasibility of integrated information and communication environments that connect and explore knowledge distributed over several systems and locations. Additionally the term also indicates that nowadays, we are not only speaking about connecting textual content but about connecting different media like video and audio content, images, documents, and facts to create novel software applications that support diverse knowledge processes.

Both notions are deeply rooted in the understanding of the computer as a medium and its multiple connotations. Networked media refers to several epistemological concepts that have accompanied the evolution of the computer as an information and communication device. First, pioneers like Vanevar Bush (1945), Douglas Engelbart (1962) or J.C.R. Licklider & Robert W. Taylor (1968) created the idea of the "scientific workplace", where the computer aids complex workflows and enhances the cognitive capabilities of its users. Second, thinkers like Sherry Turkle (1984), Donna Haraway (1991) and Howard Rheingold (1993) drove the attention to the human-computer-interface and the role a networked computer plays in constructing identities and virtual communities. Third, theoreticians like Manuel Castells (1996) created the vision of a networked society, in which connected computers provide the viral infrastructure - the Information Superhighway (Al Gore 1994) or the European Information Society (Martin Bangemann 1994) - for all sorts of social transactions. And finally we can witness a new branch of discourse that reflects on the ongoing integration and transformation of private and public life in terms of normative changes of privacy, property, labour and social relations by authors like Yochai Benkler (2006) or Rishab Ayer Gosh (2005).

Given this vast richness of theoretical reflexivity it is interesting to observe that one of the still dominating notions in contemporary computer science is rooted in the "scientific workplace" tradition. It seems that with the ongoing technological progress old ideas finally become technologically feasible and ready for the masses, opening new challenges of technological, political and economic nature. This trend is best exemplified by the discourse about the Semantic Web, where proponents like Tim Berners-Lee (2009) regularly refer to aspects of knowledge media and cognitive enhancement through human-computer-interaction to explain the practical value of it.

Contributions of This Book

The volume aims at supplying practitioners as well as academic and industrial researchers with fundamental knowledge about technologies, methodologies and tools for building networked knowledge applications. Consequently,

contributions of the book are grouped into the chapters Frameworks and Infrastructure, Application Areas and Use Cases.

In the first part of the book on *Frameworks and Infrastructure* the individual chapters present tools and technologies, which lay the foundation for the implementation of networked knowledge and media applications. RDF and RDF-based knowledge representation techniques evolved into industry standards for developing networked knowledge and media applications. Hence, Orri Erling and Ivan Mikhailov present current developments of one of the most advanced RDF knowledge stores - Virtuoso. A framework, which uses Virtuoso as a persistence layer is the Semantic Task Management Framework (STMF) presented in a paper by Ernie Ong, Uwe V. Riss, Olaf Grebner and Ying Du from SAP research. It represents a platform for establishing a task-oriented ecosystem for desktop applications built on top of it. A framework which addresses the heterogeneity and diversity of networked knowledge representations is the AUTOMS-F framework for the synthesis of ontology mapping methods as presented by Alexandros G. Valarakos, Vassilis Spiliopoulos, and George A. Vouros. AUTOMS-F facilitates rapid prototyping and adapts some well established programming design patterns for the development of synthesized mapping methods. The OntoWiki framework for the development of Semantic Web applications is presented in a chapter by Norman Heino, Sebastian Dietzold, Michael Martin, and Sören Auer. Besides being a Semantic Wiki it supports the rapid development of customized Web applications based on Semantic Web standards such as RDF, RDFa and SPARQL. ARS/SD: An Associative Retrieval Service for the Semantic Desktop aims at improving retrieval performance in a setting where resources are sparsely annotated with semantic information and is introduced in a chapter by Peter Scheir, Chiara Ghidini, Roman Kern, Michael Granitzer and Stefanie N. Lindstaedt. The first part of the book is concluded by a chapter on GRISINO - an infrastructure integrating Semantic Web Services, Grid Computing and Intelligent Objects. GRISINO aims at facilitating next generation distributed, networked applications and is presented by Tobias Bürger, Ioan Toma, Omair Shafiq, Daniel Dögl, and Andreas Gruber.

In the second part on *Application Areas* selected applications of networked knowledge and networked media are introduced. In the first chapter of this part Rico Landefeld and Harald Sack discuss how collaborative Web-Publishing can be realized using a Semantic Wiki. They showcase their Maariwa architecture and implementation, which particularly aims at dramatically simplifying the semantic annotation and textual Wiki content. In the next chapter Milorad Tosic and Valentina Nejkovic present an approach how Wiki technology can be employed for collaborative semantic tagging. The use of semantic representations for facilitating the collaboration of communities of practice is discussed in a chapter by Amira Tifous, Adil El Ghali, Alain Giboin and Rose Dieng-Kuntz from INRIA. The problem of explaining modeling errors in description logic ontologies is addressed by a chapter by Petr Kremen and Zdenek Kouba. The quality of instance data is

addressed by a contribution from Stefan Brüggemann and Fabian Grüning, which uses ontologies providing domain background knowledge. Tatiana von Landesberger, Viktor Voss and Jörn Kohlhammer investigate how networked knowledge based semantic search and visualization can support the exploration of time-series data in the conweaver system. The sentiment dimension of networked knowledge is explored by Stefan Gindl, Johannes Liegl, Arno Scharl and Albert Weichselbraun in a chapter, which presents an evaluation framework as well as an adaptive architecture for automated sentiment detection. Better ontology management support in corporate lifecycles is tackled by the contribution of Markus Luczak-Rösch and Ralf Heese, which incorporates adaptive knowledge engineering techniques such as Wikis, Weblogs and the like. Managing the end-user access to networked knowledge by means of a semantic policy management environment is the concern of a chapter by Anna V. Zhdanova, Joachim Zeiß, Antitza Dantcheva, Rene Gabner, Sandford Bessler.

The *Use Cases part* of the book showcases some concrete application scenarios of networked knowledge and media technologies. The first chapter by Heiko Paoli, Andreas Schmidt, and Peter C. Lockemann explores how business service descriptions can be obtained in user-driven ways based on semantic Wiki technology. A contribution by Bo Hu, Srinandan Dasmahapatra, Paul Lewis, David Dupplaw and Nigel Shadbolt applies networked knowledge management in the context of pervasive health care systems. The chapter by Antonis Papadimitriou, Christos Anagnostopoulos, Vassileios Tsetsos, Sarantis Paskalis and Stathes Hadjiefthymiades presents the POLYSEMA approach for integrating semantic technologies with Interactive Digital TV. Last but not least, a chapter by Jörg Niesenhaus and Steffen Lohmann is devoted to the application of networked knowledge in the domain of computer game development.

Outlook and Future Challenges

After more than 10 years of research and development aiming at transforming the Web of documents into a Web of interconnected knowledge we observe that this transition will rather be an long-running evolutionary process than a rapid technological revolution. While the contributions in this volume already address many of the upcoming issues, there are several key areas that we think will need to receive significant attention in the future:

Web-scale data integration. Current Semantic Web applications run mostly in isolated environments and are concerned with building consistent knowledge structures in limited domains. The big promise of the "Web of Data", however, still remains to a large extent unaddressed. Initiatives like Linking Open Data offer first ideas how such web-scale data integration can be realised, but work in this area is currently still in its infancy and many issues are

not yet tackled. Challenges in this area include efficient distributed querying and reasoning with several sources, dealing with inconsistencies, uncertainties and contradictions, finding relevant linked data sources, or performance in working with huge amounts of data.

Reasoning and querying. Current reasoning on the Semantic Web is mostly focused on a very particular scenario: checking consistency of the formalised knowledge. However, not only will data on the web scale inevitably be always inconsistent, users will also demand for other kinds of reasoning that is actually much more useful for them: deriving new knowledge, representing rule-based knowledge, presenting relevant knowledge, etc. are all reasoning tasks that have not been addressed much in research and even less in applications.

Semantic search. Searching for content is still either classical full-text search or a structural search over the formalized knowledge. Arguably, none of these kinds of searches are very semantic (at least from a user perspective), and they also cannot really be combined. Semantic search is a big challenge indeed, because it is one of the few points where semantics inevitably need to be exposed to the ordinary user, but it still needs to be easy to use. There are a number of different approaches from different research fields towards this issue, e.g. statistical approaches like Latent Semantic Indexing or NLP approaches like POS tagging, but up until now none of them really reaches the goal of an easy-to-use semantic search.

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