

Research Statement

Ulrich Norbistrath

Have you ever been annoyed with the number of credit cards and keys you must carry with you? Have you wondered why you need so many remotes, pads, and cell phones to interact with your home? Have you ever forgotten a password or wondered how secure all these different passwords you use in the Internet really are? Have you ever wondered if these things could be all replaced with something simpler but still be secure? If you answer any of these question positively, you have an idea where my ubiquitous computing-based research is directed. The solutions I develop in my research are aimed at taking care of the mess of credit cards in our wallet, removing the list of passwords from our screens, protecting us better from traps in the Internet, and simplifying our life at home and while traveling. The key, I use for these solutions is the combination of various behavioral and smart devices-based recognition technologies, mobile and cloud computing, and software configuration methods applied from my doctoral work.

In addition, I have started building a research record in the area of information management. I am working on analyzing and giving support to the “information overload problem”. If people ask nowadays “Did you get my email?”, “Do you tweet?”, “Are you on Facebook/Whatsapp?”, we are usually shockingly reminded of all the messages in our inbox with which we still have to deal. We probably have experienced that Facebook was fun in the beginning – networking with old friends or even spying on them and seeing what they are just doing was a nice and entertaining way to kill time. We are facing a message and information overload problem. My current research in information management evaluates technologies and their integration through user studies for complex search tasks¹, graph based storage, interactive user interfaces and data exploration, pre-categorization through text mining, and topic prediction improvement through machine learning, to make these message and information overload problem easier to manage. Also here, using cloud resources to facilitate deep search plays an important role.

Research background

I have foremost always been a practitioner. I like programming in any programming language and like setting up and integrating systems. My education was at a university (RWTH Aachen University, Germany) which is famous for his engineering science and spirit. This engineering and can-do mentality has shaped my ideas and views on research and teaching. I have always preferred projects which have or have a potential industrial application

In my master thesis, I developed the first in language network extension of the Haskell programming language². After working two years in industry in the field of data warehousing and network integration, I started my PhD³

1 Singer, G., Norbistrath, U., Lewandowski, D. (2012). *Ordinary search engine users carrying out complex search tasks*. Journal of Information Science.

2 Huch, F., Norbistrath, U.: *Distributed Programming in Haskell with Ports*, 2000, Springer, Lecture Notes In Computer Science, Vol. 2011, Selected Papers from the 12th International Workshop on Implementation of Functional Languages, Pages: 107 - 121, ISBN 3-540-41919-5

3 Norbistrath, U.: *Konfigurierung von eHome-Systemen*. PhD-thesis, 293 pp., Tartu University Press, ISBN 978-9985-4-0519-2

For an English reference look at: Ulrich Norbistrath, Christof Mosler: *Functionality Configuration for eHome Systems*. 16th International Conference on Computer Science and Software Engineering (CASCON'06), Toronto, Canada, 16-19

at the chair of Software Engineering at the RWTH Aachen University, Germany. My doctoral research investigated a new way to efficiently set up smart home systems. I dealt with model driven engineering, graph transformation, service oriented architectures, and generic component based programming.

As a postdoctoral research fellow at the University of Tartu, I developed the Friend-To-Friend (F2F) Computing paradigm and worked on adapting scientific applications to our Playstation 3 cluster. F2F Computing⁴ allows the setup of spontaneous networks suitable for scientific and social interactive applications from your instant messenger with your contacts and your friends' contacts. In a lot of educational and small research projects we favored this approach over a classic Grid or costly cloud deployment because of the spontaneity and the low administrative effort required. I won a grant to acquire a 16 machine Sony Playstation 3 cluster and was involved in adapting the parallel linear equation solver for sparse matrices (DOUG) to this architecture.

Current research

Being at home at various different disciplines in computer science and making use of my strong background in graph transformation, I started my own research group in Estonia in information systems focusing on analysis and support of complex search and discovering new relations in messages to enable graph based exploration and browsing of messages. In this research, I have supervised two PhD students. One successfully carried out user studies and analyzing the behavior of people solving complex search tasks. Together with this student I published 13 papers on complex search. He successfully finished his PhD in the end of 2013 under my active supervision, while I was already working at Nazarbayev University. The other student approached me on a conference and after some exchanges with his primary supervisor, we agreed that I would be his second supervisor. He is continuing the work of the first student, building a search support tool and a graph-based visualization of search trails. We have already published three further papers on our experiments with this tool.

My activities in terms of research and teaching in home and building automation as well as mobile computing have brought me back to my roots in software engineering, software configuration, and component-based programming. My research in the area of mobile authentication demands knowledge of all these fields and also employs techniques from cloud computing, data mining, and machine learning. In the frame of this projects, I am also involved in the European Framework 7 project "tabula rasa", dealing with counter measures for attacks on biometric systems.

As side projects I have started working with augmented and virtual reality based projects. I have prototyped an augmented reality tag game with my Kazakh students and I am working on an augmented reality support communication tool (something like augmented reality Skype) with one of my Austrian students.

Research agenda

I intend to continue my involvement in the Internet of Things respective ubiquitous systems with a focus on mobile authentication and cloud computing. I am especially interested in studying the potential of motivating different groups of people to come up with new ideas for smart things and integration scenarios. I will reflect these findings back on my story driven approach of requirements engineering and continue working as a book author in this space⁵ and apply this back to my teaching.

October 2006, ACM Digital Library, 2006, <http://doi.acm.org/10.1145/1188966.1188977>

4 Norbistrath, U., Kraaner, K., Vainikko, E., Batrašev, O.: *Friend-to-Friend Computing - Instant Messaging Based Spontaneous Desktop Grid*. The Third International Conference on Internet and Web Applications and Services (ICIW 2008), pp. 245-256, June 2008, Athens/Greece, IEEE Computer Society Press, <http://doi.ieeecomputersociety.org/10.1109/ICIW.2008.87>

5 Norbistrath, U., Zündorf, A., Jubeh, R. (2013) *Story Driven Modeling*. CreateSpace Independent Publishing Platform,

Furthermore, I will take the information overload case as a basis for advancing my research in complex search analysis, graph databases, graph transformation, and cloud services. I will also stay in close contact with my colleagues from data mining, machine learning, linguistics, and user interface design to encourage the integration of various expected prototypes to a product which could help to make the management of emails and messages significantly easier than it is today. As a short term goal, I would like to add to such a message management system the option to manage messages with multiple people or teams and simplify various learning and creative business processes in this way. In the long term I would like to generalize the handling of messages to the handling of documents and think about possibilities to replace classical document based information representation with a purely graph and networks based way of thinking.