

Future Internet services and architectures: trends and visions

Guest editorial

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This special issue on *Future Internet Services and Architectures: Trends and Visions* is a selection of seven papers presented at the Workshop *Future Internet Architectures*, (open) second Euro-NF Workshop and Future Internet Cluster Meeting, June 9, 2009, Santander, Spain; co-located with the EU ICT Mobile Summit 2009. In this special issue, novel work and ideas are presented including first qualitative and quantitative results. Each paper has been reviewed by three expert reviewers. The guest editors would like to thank all workshop participants, paper authors, and reviewers for their outstanding work on this special issue.

The “Future Internet” or “Internet of the Future” is a demanding research field. On the one hand, multimedia entertainment services and smart networked services for every-day activities are more and more requested by users ubiquitously, anywhere at any time. On the other hand, heterogeneous networks are connected ranging from optical networks, WiFi hotspots, mesh networks, 3G to upcoming 4G networks, Near Field Communication (NFC) and Wireless Sensor Networks. To cope with this complexity and flexibility of networking, new self-organizing and adaptive methods are required to make these plethora of connected networks work effectively and efficiently.

In the *Future Internet Architectures* workshop, a variety of inspiring approaches have been presented ranging from disruptive network architecture assumptions and designs, such as opportunistic and context-aware or socially-aware networks, discussion on network virtualization to address the ossification of the Internet, to the effects of new networking paradigms in terms of cost and quality of experience which are two important aspects of networks from the user perspective.

The paper *Cost Models for QoS-differentiated Interconnecting and Wholesale Access Services in Future Generation Networks* by Alberto Eloy García, Laura Rodríguez de Lope, and Klaus D. Hackbarth, presents a cost model considering different traffic types and multiple service providers capable of supporting different multimedia services in terms of Quality of Service (QoS) and of aggregating available network resources. The perspective of a best fitting architecture for future Internet services is taken by the authors Nikolaos Fotiou, Dirk Trossen, and George C. Polyzos in their paper *Illustrating a Publish Subscribe Architecture*. This architecture uses the publish subscribe pattern for offering and providing services in a clean-slate approach.

Overlays are among the key enabling technologies for forming flexible networks. From the perspective of network coding, Luísa Lima, Diogo Ferreira, and João Barros discuss network coding for small range wireless network data dissemination in comparison to larger scale peer-to-peer networks in their work *Topology Matters in Network Coding*. Similarly, by introducing overlays, in the work *Context-Based Wireless Mesh Networks: A Case for Network Virtualization* by Ricardo Matos, Susana Sargento, Karin A. Hummel, Andrea Hess, Kurt Tutschku, and Hermann de Meer, networks become context-aware. Virtualization is used to build multiple virtual networks on top of the physical networks corresponding to the user’s current context and needs.

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By addressing the challenge of resource allocation within physical networks to setup virtual resources, the paper *Optimal Mapping of Virtual Networks with Hidden Hops* by Juan F. Botero, Xavier Hesselbach, Andreas Fischer, and Hermann de Meer, makes use of optimization theory where the presented approach assures a certain degree of fairness while performing resource allocation.

Flexibility of networks is also an opportunity to make networks more user-centric. The work of Tomasz Ciszowski, Wojciech Mazurczyk, Zbigniew Kotulski, Tobias Hossfeld, Markus Fiedler, and Denis Collange, *Towards Quality of Experience-Based Reputation Models for Future Web Service Provisioning* focuses on the Quality of Experience (QoE) of a user applied to Web services. In detail, this work proposes a reputation system for Web-services based on QoE. Considering relations between users, cooperation in encounter networks can be controlled as described by the work of Bernhard Klein and Helmut Hlavacs: *A Socially Aware Caching Mechanism for Encounter Networks*. This paper presents caching techniques which are considering social relations for caching decisions.

The guest editors are confident that the content of this special issue is of interest to readers who want to enhance their knowledge in novel approaches to tackle and utilize the growing flexibility of the “Future Internet”. Going one step further, this special issue intends to foster discussion and to encourage future research in the directions identified by the authors.



Hermann de Meer received his Ph.D. in 1992 on the topic “Transiente Leistungsbewertung und Optimierung rekonfigurierbarer fehlertoleranter Rechensysteme”. He had been an Assistant Professor at Hamburg University, Germany, a Visiting Professor at Columbia University in New York City, USA, and a Reader at University College London, UK. He is currently appointed as Full Professor at the University of Passau, Germany, and as Honorary Professor at University College London, UK. He is director of

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His main research interests include IT security and resilience, virtualization and energy efficiency, complex and self-organizing systems, peer-to-peer systems, quality of service and performance modeling, Internet protocols, home networking, and mobile computing. Hermann de Meer has led several nationally and internationally funded projects on Performance Modeling and Computer Networking. He currently holds several research grants funded by the Deutsche Forschungsgemeinschaft (DFG) and by the EU (FP6 and FP7). Prof. H. de Meer is co-authoring a textbook on “Queueing Networks and Markov Chains—Modeling and Performance Evaluation with Computer Science Applications”, published by John Wiley in 1998 and 2006.



Karin Anna Hummel received her Ph.D. in 2005 on the topic “Mobility-aware Distributed Computing in Shared Data Spaces” from the Vienna University of Technology, Austria. She is an assistant professor at the Distributed Systems group, University of Vienna. Before joining academia, Karin Anna Hummel was working as a software engineer and project manager with Siemens Austria on network management. She is currently leading two Euro-NF one-year projects on wireless mesh and opportunistic networking, and one French-Austrian bilateral project on generating resource-efficient mobility-predictors. Moreover, she is member of Euro-NF (EU FP7 Network of Excellence on the Network of the Future) and co-leader of working-group 2 in the COST-action IC0804 on “Energy Efficiency in Large Scale Distributed Systems”. Karin Anna Hummel is author of eight journal and 32 workshop and conference publications and co-editor of two proceeding books.



Robert Basmadjian received his Ph.D. degree in 2008 on the topic of “An Arbitrary Tree-Structured Replica Control Protocol” from University of Toulouse, France. Since 2009, he has been in postdoc position at the Chair of Computer Networks and Communications headed by Professor De Meer in University of Passau.

His main research interests include replication in large-scale distributed systems as well as energy efficiency of distributed systems.