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Guest Editorial

European Transactions on Telecommunication: Special Issue on P2P Networking and P2P Services

Peer-to-peer (P2P) services evolved to the most popular applications in today's Internet. In particular, P2P networks became very popular amid the relentless spread of Gnutella, Kazaa, eDonkey and BitTorrent file sharing applications. Remarkably, only very simple protocols and almost no support by the transport network was required to make these distributed services operable on a large scale in very little time.

P2P entails a highly attractive paradigm in distributed computing: P2P is based on communication between equals. The peers are highly autonomous. P2P services provide simple and efficient mechanisms to pool and share exchangeable resources like CPU cycles, disk space or content. These features facilitate that any peer can be removed without resulting in a complete loss of service, in contrast to the traditional client/server concept, where a failure of the central control entity may corrupt the service completely. A further reason for the notable success of P2P is that these networks operate on the application level and typically form application-specific overlays. P2P overlays work without particular network or transport support, and can be run completely at the edge of a network. They apply self-organizing principles and special routing schemes to locate and exchange resources. While P2P overlays do implement a certain type of group communication structure, they do not suffer from the same deployment difficulties as multicast services did in the past. The P2P mode of operation however, also has some downsides. P2P protocols cause higher traffic volumes, including data traffic as well as signaling traffic, since the peers need to synchronize. P2P network topologies reveal high variability and traffic patterns of P2P applications fluctuate considerably in time and space. Traditional network design techniques and traffic engineering procedures have to be validated to work in the P2P context before they are applied. New engineering methods may be required in order to maintain the autonomous and self-organizing characteristics of P2P and to provide appropriate service stability, quality and efficiency for P2P services.

The aim of this special issue of the *European Transactions on Telecommunication* is to present very recent, outstanding research work on P2P networks and P2P services. The Call for Paper resulted in the submission of 42 papers from Europe, the United States and the Asian-Pacific region. The editor team has selected eight of these submissions after a thorough review process and extensive discussions for publication in this special issue.

The guest editor team of this ETT special issue would also like to thank the publisher, the reviewers and the authors for their efforts and flexibility to produce, review and finalize this special issue in a very short time frame. We hope that this special issue may serve to promote further research in this new and popular area of telecommunication.

The contribution of Azzouna and Guillemin evaluates the impact of P2P applications on traffic in wide area networks. The authors analyze measurements taken on a high speed IP backbone link carrying P2P applications traffic towards several ADSL areas. They observe that the prevalent part, the traffic is caused by P2P applications (almost 80% of total traffic) and that the usage of network becomes highly symmetric. Since long lasting TCP connections of P2P applications have a rather small bit rate and do not show evidence for long range dependency, the global traffic can be described by means of usual teletraffic models based on $M/G/\infty$ queues with Weibullian service times.

The paper of Schollmeier and Schollmeier investigates P2P traffic by a graph theoretical study of the properties of P2P overlays. Analytical topology models for infinite and finite random networks are used to derive performance characteristics for P2P protocols and to evaluate the effect of introducing centralized entities, such as superpeers.

Cholvi, Felber and Biersack propose novel mechanisms for improving the search efficiency in unstructured P2P networks. The mechanism is based on peers performing local dynamic topology adaptations, which are derived from query traffic patterns. The topology adaptation creates spontaneously semantic communities, i.e. groups of peers that share similar interests, in which file requests are fulfilled more efficiently.

Wierzbicki *et al.* investigate the possibility of caching of files in P2P file sharing applications. They show that the file popularity in P2P file sharing networks does not follow Zipf's law and that P2P file sharing traffic differs strongly from well-studied web traffic. The results are used to investigate the efficiency of different cache management policies for the FastTrack P2P file sharing protocol.

Sasabe *et al.* investigate scalable media search and in-time retrieval methods based on a P2P network architecture. The method is able to achieve continuous media play-out for popular media streams without introducing extra load on the system. The authors also investigate the failure of LRU cache replacement algorithms for continuous media play-out of unpopular media streams and propose a biological-inspired cache replacement mechanism that considers the balance between supply and demand for media streams. The algorithm can adapt easily to changes in the popularity of media streams.

Kumar *et al.* present a P2P network based on a butterfly overlay topology. The diameter of this overlay achieves a theoretical lower bound of $\log n / \log n \log n$, if the average routing table size is not more than $\log n$. Compared to existing DHT schemes, the diameter is reduced by a factor of $\log \log n$. This reduction translates into the same amount of reduction on query latency and average traffic per node. The authors show that the proposed scheme maintains the same level of robustness as existing DHT schemes.

Yamada, Hoshiai and Kimura propose brokerless trust and reputation mechanisms for the *COMNet* P2P framework. COMNet is an intelligent community spaces architecture, which supports the activation of communities through P2P technology. The proposed trust and reputation algorithms are solely based on information from other peers.

Bisignano, Di Modica and Tomarchio present a framework for mobile P2P applications, which combines P2P ad hoc communication with the capabilities of small mobile units. The framework is designed for J2ME enabled mobile devices in an infrastructure-less environment. One of the key features of the framework is the interoperability with JXTA, a well-known P2P open platform. A simple but effective example of application is provided showing the viability of the designed framework.

Kurt Tutschku, Coordinating Guest Editor
Department of Distributed Systems
Institute of Computer Science
University of Würzburg
Am Hubland
D-97074 Würzburg, Germany

Hermann de Meer
Faculty of Mathematics and Communication Sciences
University of Passau
Innstr. 33,
D-94032 Passau, Germany

Frank-Uwe Andersen
Siemens AG
Siemensdamm 62
D-13623 Berlin, Germany

Konosuke Kawashima
Department of Computer, Information and Communication Sciences
Tokyo University of Agriculture and Technology
184-8588 Tokyo, Japan

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AUTHORS' BIOGRAPHIES

Kurt Tutschku is an assistant professor at the Chair of Distributed Systems, University of Würzburg. He has received a doctoral degree from University of Würzburg in 1999. Kurt Tutschku is leading the Department's Group on network management and future network services. His research interest includes event- and traffic-oriented management of IP-based communication networks, planning and optimization of telecommunication systems, demand-oriented design of future generation, large scale IP networks, methods for the estimation and characterization of the spatial teletraffic distribution in mobile communication networks, design of algorithms and tools for demand based computer aided mobile network planning and the modeling and performance evaluation of future network services in next generation internet, particular of peer-to-peer systems. He has recently led multiple industry cooperations in the field of peer-to-peer with Siemens AG, BTexact, DATEV e.G. and Bertelsmann AG. He is currently also the chairman of Integration Activities Committee of European FP6 framework project 'EuroNGI' and is coordinating the work package on 'New Services'. Additional information is available at: http://www3.informatik.uni-wuerzburg.de/staff/tutschku

Hermann de Meer has led several nationally and internationally funded projects on performance modeling and computer networking. His research interests include peer-to-peer systems, quality of service, internet protocols, home networking, security and mobile computing. He is currently appointed as a full professor at the University of Passau, Germany, and as honorary professor at University College London, U.K. He had been an assistant professor at Hamburg University, Germany, a visiting professor at Columbia University in New York City, U.S.A. and a reader at University College London, U.K. Prof. H. De Meer is co-authoring a textbook on queuing networks and Markov chains—modeling and performance evaluation with computer science applications, published by John Wiley in 1998. Additional information is available at: http://www.fmi.uni-passau.de/lehrstuehle/demeer/

Frank-Uwe Andersen received his M.Sc. in Computer Science from the University of Dortmund, Germany. His professional career started with early carrier-grade voice-over-IP and internet-service-provider projects at Siemens in the US and in Germany. System engineering for wireless internet access specifically WAP and mobile portal technology followed. Subsequently, he participated in upcoming IPv6 related projects and research. Currently, he is working as a senior research engineer in the field of fourth generation wireless architectures and also in the field of peer-to-peer networks for user and network services in mobile environments.

Konosuke Kawashima received his B.E. degree from the University of Tokyo, Japan, in 1969 and Dr.Eng. degree from the same university in 1993. He is currently a professor, in the Department of Computer, Information and Communication Sciences, Tokyo University of Agriculture and Technology and also an executive adviser, director of the teletraffic Research Center of NTT Advanced Technologies Corp. (NTT-AT). His research involves teletraffic engineering and science for mobile communications and IP networks. He joined the Electrical Communication Laboratories of NTT in 1969, where he was engaged in the research and development of teletraffic engineering for packet networks, mobile communications and ATM and multimedia networks. From 1997 to 2001, he was a consultant for various networks in NTT-AT. He received the Young Engineer Award and Paper Award from the IEICE in 1978 and 1982 respectively. He also received the Best Paper Award from the Operations Research Society of Japan (ORSJ), in 1986 and the Technical Award from the Telecommunications Advancement Foundation in 1996. He is a member of IEICE, IPSJ, IEEE, ACM/SIGCOMM, IFIP WG6.3, a fellow of ORSJ and an international advisory member for International Teletraffic Congress.

