1 Research Group on Computer Networks and Distributed Systems

1.1 Personnel

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1.2 Overview

The research group for Computer Networks and Distributed Systems (Rechnernetze und Verteilte Systeme, RVS) is active in several areas of computer communications and distributed systems.

Multimedia Communications The Internet is increasingly being used for multimedia data transfer (audio, video, data). We are studying how such services with high demands on the quality of communication systems and networks can be supported. In the past, we developed scalable simulation tools to support planning and operation of global IP networks. Nowadays, overlay networks and peer-to-peer systems are becoming more important for new Internet services, in particular to support communication within user groups. We are focusing on the design, development, and evaluation of methods to construct such overlay networks supporting the quality-of-service requirements of distributed applications and using network resources efficiently.

Wireless and Mobile Communication Decentralized system architectures and self-organization are fundamental concepts of future wireless and mobile communication systems. These concepts are particularly important in application scenarios such as sensor networks, mobile ad hoc networks (e.g. for direct communication between vehicles) and so-called mesh networks, which form low cost alternatives for the network access by end users. There is an urgent need for research on routing and transport protocols as well as on security and management mechanisms. In sensor networks, limited energy, computing and memory resources as well as limited reliability require special forms of distributed data processing and management.

Security in Distributed Systems The Internet simplifies access to distributed resources and services such as web services, e-learning contents, computer grids or sensor nodes. Traditional techniques for authentication and authorization are not very user-friendly and barely scalable. We investigate, design, implement, and evaluate novel schemes for efficient and secure authentication and authorization.

Distance Learning In all our lectures, we are using distance learning elements that are based on standard components but also on developments resulted from recent research projects. We are develop-

ing new methods and tools to support learners and teachers in e-learning environments. In particular, we aim to support practical experiments, mobile learning, and support for groups of learners.

1.3   Research Projects

National Competence Center in Research for Mobile Information and Communication Systems (NCCR-MICS)

The NCCR-MICS (http://www.mics.ch) project was launched in 2001. Its goal is to study fundamental and applied research questions raised by new generation mobile communication and information services, based on self-organization. Such systems have become very topical with the advent of mobile ad-hoc, peer-to-peer, and sensor networks. NCCR-MICS is composed of more than twenty research projects distributed over four clusters. The research project of the RVS group of the University of Berne is called "Distributed event detection and localization architecture for wireless sensor networks" (IP4), which aims at designing and implementing a distributed event detection, event localization, and data aggregation framework. It includes efficient and reliable signaling protocols as well as mechanisms to dynamically reprogram sensor network applications.

In the last year we developed our first approach of a fully distributed event localization scheme. The scheme consists of two algorithms: The distributed election-winner notification algorithm (DENA) determines the closest sensor node to an event and notifies all other nodes about that winner. The intensity-based localization algorithm (ILA) provides a signal independent position estimation of the event and is executed at the winner node. In order to support efficient data dissemination, we additionally proposed an adaptation of our dynamic delayed broadcast protocol (DDB) to tailor this approach to sensor networks with limited resources. Additionally, we investigated the applicability of the ILA by implementing it on Embedded Sensor Board (ESB) nodes from FU Berlin and running tests in multiple real world scenarios. The results of these tests indicate that lightweight localization and tracking is possible even with the cheap and inaccurate passive infrared (PIR) modules of the ESB sensor nodes used in our implementation. Work in progress adapts the ILA and DENA algorithms to object tracking.

Furthermore, we did a first basic implementation of a virtual backbone algorithm supporting our event localization framework. The goal of this work is on energy efficiency as well as adaptability to network constraints such

as connectivity, node mobility, energy distributions, etc. Another work was the implementation and evaluation of two MAC protocols, namely LMAC and TEEM, on ESBs. We got a number of insights concerning the implementation of a theoretical concept on real sensor hardware with all its limitations.

Mobile IP Telephony (MIPTel)

The MIPTel project aims to develop and support mobile telephony applications over IP networks. Providers are in great need of scalable, extensible, flexible and transparent charging and accounting methods, which take into account the specific attributes of wireless networks and requirements of diversified services. A wide range of accounting, charging and pricing schemes have been analyzed.

We found that the increasing user mobility requires a new approach to the existing charging and accounting concepts. While the users demand for increased service coverage, the providers aim for low infrastructure costs. Multi-hop cellular networks are a promising concept, which suits both needs. It combines the advantages of two worlds: the dynamics of mobile ad hoc networks and the reliability of wired networks. Mobile ad hoc networks are spontaneously created by interconnecting nodes operated by individual users. In order for the network to function, the nodes are required to participate in the packet transmission process, in particular they must forward packets transmitted by other nodes. This behavior is also known as cooperation among nodes. How to ensure the cooperation in civilian networks in the absence of a single authority is a challenging research question, which we tried to answer in this project. The project has been successfully completed with the PhD thesis of Attila Weyland, which presents the cooperation and accounting strategy for hybrid wireless networks called CASHnet.

CASHnet introduces charges and rewards to the packet transmission process using a hybrid accounting architecture. The charging and rewarding is done decentralized on the nodes and the refill of the virtual currency

account is done at service stations operated by a provider. It uses separate accounts for charging as well as rewarding and the exchange of the virtual currencies requires the help of the provider. Compared to fully decentralized accounting schemes like Nuglet, CASHnet ensures a constant cash flow and keeps the provider in control of it. Unlike completely centralized accounting schemes, CASHnet does not put additional signaling load on the links toward the base stations. It also allows cost sharing between sender and receiver located in different multi-hop cellular networks. Further, CASHnet supports the provider in the network planning process. We implemented and evaluated CASHnet in the network simulator ns-2 and developed and tested a prototype implementation of CASHnet under Linux.

We see the main contribution in the specification, development and evaluation of a complete cooperation and accounting architecture, which has several unique features: It retains as much flexibility as possible of the multi-hop communication paradigm through its hybrid accounting and decentralized security architecture. It keeps the provider in control of the cash flow through its two virtual currencies and accounts. It also ensures the security of the accounting mechanisms through non-repudiation.

Research staff: Attila Weyland, Carolin Latze

Efficient and Robust Overlay Networks (ERON)

The ERON projects aims at developing an efficient and robust overlay network. An overlay network is a virtual communication network built on top of an existing communication network such as the Internet. Overlay networks are used for different tasks such as routing of multicast messages. Since the full-mesh overlay network in which every pair of participants is communicating directly with each other is not scalable, overlay networks usually have other structures. One of the most important criteria for deciding which overlay network participants get "connected" is the communication delay, since it is the limiting factor on the maximum effective bandwidth for the TCP connections. Similar to a full-mesh overlay networks, measuring the communication delay between all overlay participants does not scale. To still be able to exploit the communication delay information, numerous communication delay prediction systems such as

IDMaps, GNP, ICS, Vivaldi, S-Vivaldi etc. were developed. Most promising communication delay prediction systems are coordinates-based. In the coordinates-based systems, communication partners are represented as points in an n-dimensional Euclidean space such that the distance function in that space predicts the communication delay.

In the ERON project we try to improve one of the most precise coordinates-based communication delay prediction system – GNP. In GNP the coordinates of a communication partner are calculated by measuring the communication delay to a fixed set of other communication partners (so called landmarks) and by performing multilateration. The coordinates of the landmarks are calculated by minimizing the sum of the square distances between measured and calculated coordinates. Since GNP uses a very general but slow function minimization, it is very computation-intensive especially with the increasing number of dimensions and landmarks.

We try to improve the GNP system by explicitly calculating the maximum number of dimensions that are needed to represent the coordinates of the landmarks and also to provide a good starting point for the function minimization. We also consider using other iterative function minimization algorithms such as Gauss-Newton-Iterative method. Another goal of our research is to exploit the statistical properties of the measured delays (mean, variance) to improve the predictions.

After improving the GNP system we are planning to develop an routing protocol, based on the greedy spatial routing. The goal is to have the routing protocol, which should is near-optimal compared to the routing in the network on which the overlay network bases.

Research staff: Dragan Milic

End-to-end Quality of service support over heterogeneous networks (EuQoS)

The *EuQoS* project (http://www.euqos.org) aims to resolve outstanding design issues presently associated with the delivery of end to end Quality of Service across heterogeneous networks. With the help of EuQoS these issues should be solved and the infrastructures should be upgraded so that new applications can be supported by the Internet and new service packages can be offered by operators, ISPs and other service providers.

Our research group is involved in the work packages WP1, WP3, WP5 and WP6.

WP1 (Business Model and System Design) aims to define an architecture for different aspects of the EuQoS system. Support for QoS in IP multicast is difficult to achieve due to the lack of wide deployment of IP multicast in the Internet and it seems that this will probably not change in the near future, even with the adoption of IPv6. Our research focuses on providing transparent support for application level multicast on end systems. This enables multicast communication across the Internet using only unicast communication offering QoS support.

WP3 (Implementation of the EuQoS System) delivers the proposed applications and services according to the architectures defined in WP1. We developed a transparent multicast facility known as "Multicast Middleware," which is based on a virtual network interface (TAP) and is implemented mostly using Java (version 5.0) to support different operating systems. The Multicast Middleware aims to be independent of the underlying QoS mechanisms. It will either use the EuQoS QoS signaling (introduced with the EuQoS project) or the measurement-based multicast to bridge gaps where no (EuQoS) QoS is offered by the underlying network. The overlay network is constructed using a Scribe/Pastry implementation called Freepastry.

WP5 (EuQoS Pan European trials) builds a testbed environment in which the developed prototypes and applications can be tested and evaluated. Different heterogeneous networks (WLAN, UMTS, LAN, xDSL, etc.) are interconnected in a full mesh among the partners. Our testbed represents a high speed gigabit-LAN-based network, which is interconnected by GRE tunnels to twelve other testbeds belonging to other EuQoS consortium partners involved in WP5. It is directly connected to the university's border router through a 1 Gbit/s network link.

WP6 (Dissemination, Standards and Training) focuses on delivering the project results to the public. This shall be achieved by four activities, namely development of training material, delivery of training, standardization contributions, as well as dissemination by demonstrations and publications. In addition to leading and managing the whole work package, our main contributions address the training activities. Within this context, a course focusing on QoS related topics is being developed for students and industrial learners. The goal of the course is also to raise the familiarity with QoS technologies for next generation networks and applications. The course is based on distance learning technologies and consists of seven QoS related modules. We have developed the didactical concept of the e-learning course and are coordinating its implementation. In particular,

we have developed the course modules "Applications' QoS demands" and "Implementing protocols on network simulators." For the latter module we are currently also developing a tool for the visualization and animation of simulator trace files. Now we are implementing a new module on "Multi-cast in EuQoS system." We are also participating in the development of the "EuQoS overview" module, where we mainly focus on the illustration of the content (animation and graphics). We are further developing and providing the course management system and the authentication & authorization framework required for the various module exercises.

Research staff: Thomas Bernoulli, Marc Brogle, Dragan Milic, Matthias Scheidegger, Thomas Staub, Marc-Alain Steinemann, Gerald Wagenknecht, Markus Wulff, Jana Krähenbühl, Torsten Braun

Virtual Internet and Telecommunications Laboratory of Switzerland (VITELS)

VITELS, a first series Swiss Virtual Campus (SVC) project has been funded within the SVC consolidation program. The VITELS goal has been to develop an e-learning course in English language that provides theory and practical hands-on exercises in the area of telecommunications and computer networks with real network hardware for computer science students. Currently, VITELS consists of eight modules, six designed and maintained by University of Bern, one by University of Neuchâtel, and one by University of Fribourg. The course is fully operational and has been productively used in different regular courses on the Bachelor level at the Universities of Bern (in the "Computer Networks" lecture), Fribourg, and Neuchâtel.

In the reporting period several VITELS related activities have been performed. The "VITELS Didactic and Design Guide" has been updated to include detailed instructions on the use of WebCT in order to ease the work of developpers of new modules and maintainers of existing ones. New modules have been agreed on with the University of Tübingen and Jyväskylä University of Applied Sciences. In the reporting period we have also continued the development of an improved course management system with student profiles and a much more flexible hands-on session reservation system. Upgrades to new versions of the Shibboleth based authentication and authorization infrastructure have been performed.

Operating Systems Laboratory (OSLab)

The Operating System Laboratory, OSLab, is an online course that will teach students about principles of operating systems using a constructivist approach and problem-oriented learning. OSLab focuses on the hands-on training experience of the students and will complement existing lectures. The course is modularly structured. Each module covers a topic and is self-contained. A teacher can select modules according to his need and easily add new modules to the course.

During this project we will create seven e-learning modules covering the topics of process scheduling, inter-process communication, memory management, file systems, distributed file systems, security as well as device drivers and input/output.

So far we have specified the theory and hands-on part of all seven modules in form of extended abstracts. In addition, we identified three main types of hands-on sessions and specified their requirements (OS-independent Programming, OS-dependent Programming and OS-dependent Configuration). We also published two guidelines, one for module authors, and one for course authors. This separation of roles allows module authors to focus on their tasks. These guides contain the experiences from our previously conducted E-Learning activities. Further, we developed administrative scripts for automatic user account creation and removal to be used for interactive theory as well as OS-dependent programming hands-on sessions. Last, we improved the FFGF (file framework generator & formatter) to support the generation of initialization modules and enabled both standalone use as well as interaction with the GCED (Guided Content Editor). Currently, we are investigating the possibility of automatic evaluation of the student's hands-on performance and are implementing the file systems module.

Graphical Editor for the Production of E-Learning Content

Among the results of the VITELS project is a didactics guide for laboratory-based e-learning courses, and a text-based tool for creating content according to these guidelines. This tool converts several HTML sources to the formats of the WebCT CE and Vista platforms. However, the usability of this tool is restricted by its non-graphical interface, especially if the user is not a computer expert. The goal of this project was therefore to implement a graphical editor for e-learning content.

During the project we have implemented an editor based on the multi-platform Java framework, which ensures that the editor runs on several platforms including Microsoft Windows, Mac OS X, and UNIX. Furthermore, it is implemented based on freely distributable components to avoid licensing problems. Besides its graphical HTML editing capabilities the editor has several special features: The creator of a course can predefine a course structure that will be enforced by the editor, and which can be browsed for easy access to different parts of the document. Furthermore, a small part of the editing window displays the relevant didactical guidelines for the section currently being edited. Formatting of content is done using the original tool. This ensures compatibility with already created content.

Research staff: Matthias Scheidegger, Marc-Alain Steinemann

eXperience Based Admission Control (XBAC)

The XBAC project aimed to create an overlay network architecture that provides a distance estimation service to user applications. Before an application opens a connection to a remote endpoint it can ask for a prediction of the quality of service to this destination. Depending of the prediction it can then decide to proceed with connection setup or to back off. Moreover, peer-to-peer networks can use the service to optimally configure their topology and also to adapt to later changes in quality of service.

The XBAC architecture is based on the idea of creating groups of end-points that are close to each other in the physical network topology. While communicating these endpoints gather measurement data, which they distribute to the other endpoints in their cluster. Thereby they create a common pool of network measurements, termed the group's *experience*. Using this experience, the group can give robust answers to QoS prediction requests. In contrast to other approaches, XBAC can detect clusters of remote nodes and groups based on end-to-end measurements, which leads to better scalability and enables inclusion of non-cooperative nodes into the system.

Based on the architecture defined in the XBAC project we have designed and developed a prototype for experimental deployment on PlanetLab. We have also defined test cases to estimate the scalability of the implementation in terms of CPU, memory, and bandwidth usage. Furthermore, evaluation of several possible variants of the joining-node procedure has allowed us to select the optimal one.

Research staff: Matthias Scheidegger, Ben Zahler

Wireless Mesh Networks

Today, various wireless network technologies are deployed in isolated networks. In order to interconnect these networks and thereby enhance the overall coverage a new key technology called wireless mesh networks (WMNs) has appeared. The wireless nodes of WMNs establish peer-to-peer connections with each other and form an ad hoc network without the presence of any additional infrastructure. In order to exploit WMNs for IP telephony and video conference applications we investigate the possibilities of path diversity and multi-stream coding. The characteristics of multiple paths are usually largely uncorrelated, i.e., the delay, jitter, and loss rate of the paths differ a lot from each other. Compared to a single path, multiple uncorrelated paths provide redundancy in the transmission, which we expect to improve the quality of the transmission. We investigate new algorithms for mapping coding and paths according to network conditions. Moreover, different existing multi-path routing protocols are being implemented in simulators (Omnet++, ns2). Some of the protocols will be implemented in Linux. They are planned to be integrated in our embedded Linux for WMNs.

An important aspect for the deployment of a real WMN testbed is the secure remote management of WMNs. The individual nodes have to be eas-

ily managed by a central unit. This includes possibilities of rapidly changing the system software, routing protocols and radio parameters. Further, configuration errors as well as system software bugs have to be corrected without the need of physical access to the nodes. During the project an embedded Linux distribution is being developed including a management solution with different fallback behaviors in case of errors. Our physical nodes are low priced embedded x86 based systems from PC Engines GmbH.

Besides the work on a real WMN testbed we have begun to evaluate the possibilities of a virtual mesh network running real Linux software. Our research focuses on a solution using XEN to virtualize the mesh nodes and interconnecting them by an emulation framework.

Research staff: Thomas Staub, Alican Geycasar, Stefan Ott, Michael Lustenberger, Daniel Balsiger

Power Saving in Wireless Ad Hoc Networks

Power saving mechanisms in wireless ad hoc network nodes mainly switch off the transmission and reception hardware for a maximum amount of time and turn it on again periodically for a given interval. Many approaches aim to synchronize the state changes of the nodes in the network through distributed beacon generation and introduce mechanisms where nodes synchronously wake up at designated points of time to exchange announcements about pending traffic. However, synchronization is difficult to achieve, in particular in wireless ad hoc networks. We developed, evaluated, and improved a power saving approach based on asynchronous wake-up patterns and wake-up announcements integrated with Ad-hoc On-demand Distance Vector (AODV) protocol. Significant improvements of the connectivity under low wake ratios can be achieved by carefully designed forwarding strategies of AODV route request messages.

Research staff: Philipp Hurni and Torsten Braun

Testbed for Mobile and Internet Communications

The RVS research group maintains its own testbed network for various purposes. One part of the testbed is used to build networks of experimental routers and end systems in order to be able to evaluate the behavior of new networking procedures and architectures in a realistic environment.

Another part of the network forms a productive network of Linux PCs and provides the storage capacity and CPU power for many of the RVS group's projects. The ERON project for example uses the available CPU power to compute embeddings of network distances into Euclidean space. Furthermore, a significant part of EuQoS project's testbed is located within the RVS testbed. It is a Gigabit LAN environment of 10 machines for pan-european trials, and it is connected via IP tunnels to 11 partners' sites. The available CPU power is used by three network traffic measuring points. An educational laboratory network for students' training is also connected and being extended by the OSLab project. The RVS group also takes part in PlanetLab (http://planet-lab.org), an open platform for developing, deploying, and accessing planetary-scale services. For this purpose we are hosting two PlanetLab nodes in our testbed network.

Research staff: All members of the RVS research group

1.4 Ph.D. Theses

- Attila Weyland: Cooperation and Accounting in Multi-Hop Cellular Networks, November, 2005

- Marc Danzeisen: Cellular Assisted Heterogeneous Networking, February, 2006

1.5 Diploma Theses

- Carolin Latze: Linux Implementation of a Cooperation and Accounting Strategy for Multihop Cellular Networks, February, 2006

- Tobias Roth: Beacon-Less Routing: An Implementation for GNU/Linux, December, 2005

- Thomas Spreng: Authentication and Authorization for Mobile Internet Users, February, 2006

- Isabel Steiner: Synergy of Ad-Hoc and Infrastructure Based Networking, April, 2006

1.6 Bachelor Theses and Computer Science Projects

- Tobias Roth: Client Based Auto-Configuration in Heterogeneous Networks, August, 2005

- David Wittwer: Einsatz von GPS-Empfängern zur Bestimmung von One-Way-Delays in einem Netzwerk, February, 2006

- Philipp Hurni: Simulation and Evaluation of Unsynchronized Power Saving Mechanisms in Wireless Ad hoc Networks, March, 2006

- Samuel Bissig: Office Monitoring with Sensor Networks, April 2006

1.7 Further Activities

Memberships

- Editorial Board of Elsevier's Computer Communications Journal (Torsten Braun)

- Editorial Board of Informatik Spektrum / Springer-Verlag (Torsten Braun)

- Editorial Board of Journal of Internet Engineering (Editor in Chief, Torsten Braun)

- Erweitertes Leitungsgremium Fachgruppe "Kommunikation und Verteilte Systeme," Gesellschaft für Informatik (Torsten Braun)

- Management Board of EU IST project EuQoS (Torsten Braun)

- Swiss Representative, Management Committee Member, and Working Group Chair of COST 290 Action "Traffic and QoS Management in Wireless Multimedia Networks" (Torsten Braun)

- SWITCH Stiftungsrat (Torsten Braun)

- SWITCH Stiftungsratsausschuss (Torsten Braun)

- Kuratorium Fritz-Kutter-Fonds (Torsten Braun)

- Expert for Diploma Exams at Fachhochschule Bern (Torsten Braun)

Conference Program Committees

- 14th IEEE Workshop on Local and Metropolitan Area Networks, Chania, Crete, Greece, 18–21 September 2005 (Torsten Braun)

- 3. Deutscher Workshop über Mobile Ad-Hoc Netzwerke (WMAN 2005), in conjunction with GI-Jahrestagung 2005, Bonn, September 21, 2005 (Torsten Braun)

- 30th IEEE Conference on Local Computer Networks, Sydney, November 15–17, 2005 (Torsten Braun)

- 3rd Annual Conference on Wireless On demand Network Systems and Services (WONS), Les Ménuires, France, January 18–20, 2006 (Torsten Braun)

- 5th International Conference on Ad-Hoc Networks & Wireless, Ottawa, August 17–19, 2006 (Torsten Braun)

- IEEE Consumer Communications and Networking Conference 2006 (CCNC 2006), January 7–10, 2006, Las Vegas (Torsten Braun)

- 4th International Workshop on Internet Performance, Simulation, Monitoring and Measurement (IPS-MoMe 2006), Salzburg, February 27–28, 2006 (Torsten Braun)

- 4th International Conference on Wired/Wireless Internet Communications (WWIC), Bern, May 10–12, 2006 (Torsten Braun, General Co-Chair; Ruth Bestgen, Thomas Bernoulli, Marc Brogle, Organizing Committee)

- 5th IFIP-TC6 Networking Conference, Coimbra, Portugal, May 15–19, 2006 (Torsten Braun)

- International Workshop: Towards the QoS Internet (To-QoS'2006), Coimbra, Portugal, May 19, 2006, held in conjunction with 2006 IFIP Networking Conference (Torsten Braun)

- 6th International Workshop on Applications and Services in Wireless Networks, Berlin, May 29–31, 2006 (Torsten Braun)

- 6th International Conference on Next Generation Teletraffic and Wired/Wireless Advanced Networking (NEW2AN), St.Petersburg, May 29–June 2, 2006 (Torsten Braun)

- 5th Conference on Security and Network Architectures (SAR 2006), Seignosse-Landes, France, June 6–9, 2006 (Torsten Braun)

- IEEE 2006 Workshop on High Performance Switching and Routing, Poznan, Poland, June 7–9, 2006 (Torsten Braun)

- 2006 IEEE International Conference on Communications (ICC 2006), Istanbul, June 11–15, 2006 (Torsten Braun)

- ACM Workshop on Real-World Wireless Sensor Networks (REAL-WSN), in conjunction with ACM MobiSys 2006, Uppsala, Sweden, June 19, 2006 (Torsten Braun)

- First workshop on advanced EXPerimental activities ON WIRELESS networks and systems (EXPONWIRELESS 2006), affiliated with IEEE WOWMOM 2006, Niagara-Falls, June 26–29, 2006 (Torsten Braun)

- 5th International Workshop on Advanced Internet Charging and QoS Technologies (ICQT'06), St Malo, France, June 27, 2006 (Torsten Braun)

- 32nd Euromicro Conference, Track on "Multimedia & Telecommunications: Dependable Adaptive Systems," Cavtat/Dubrovnik, Croatia, August 29–September 1, 2006 (Torsten Braun)

Reviewing Activities

- Research Council of Norway (Torsten Braun)

- VINNOVA (Swedish Governmental Agency for Innovation Systems) (Torsten Braun)

- Swiss National Science Foundation (Torsten Braun)

- RMIT University, Melbourne (Torsten Braun)

- Review Team für Fachbereiche Informatik und Scientific Computing an der Universität Salzburg (Torsten Braun)

- Elsevier Computer Networks Journal (Torsten Braun)

- Elsevier Ad Hoc Networks Journal (Thomas Staub, Torsten Braun)

- IEEE Network Magazine (Torsten Braun, Attila Weyland)

- IEEE Transactions on Mobile Computing (Torsten Braun)

- IEEE Infocom (Torsten Braun)

- IEEE Communications Magazine (Torsten Braun, Attila Weyland)

- ACM Transactions on Multimedia Computing Communications and Applications (Torsten Braun)

- Wiley International Journal of Communication Systems Springer Wireless Networks (Torsten Braun)

- Reviewer for The Handbook of Computer Networks, Wiley (Torsten Braun)

Invited Talks and Tutorials

- Torsten Braun: Entstehung und Funktionsweise des Internets, Collegium Generale "Virtuelle Welten? Die Realität des Internets", University of Bern, November 2, 2005

- Torsten Braun: Multimediale Dienste als Resultat der Konvergenz von Telekommunikation und Informatik, 12. Elite Telecom Tagung 2005, Bern, November 3, 2005

- Torsten Braun: Fernüberwachung von industriellen Anlagen über Sensor Internet, Heidelberger Innovationsforum, November 30, 2005

- Torsten Braun: Wireless Sensor Networks: A Systems View, Las Vegas, Tutorial at IEEE Consumer Communications and Networking Conference (CCNC), Las Vegas, January 8, 2006

- Torsten Braun: Optimized Stateless Broadcasting in Wireless Multi-hop Networks, 5th COST 290 meeting, February 9–10, 2006, Delft, The Netherlands

- Dragan Milic: Utilizing P2P Overlay Multicast using standard IP-Multicast Applications, Dagstuhl Seminar 06131 (Peer-to-Peer Systems and Applications), Dagstuhl, Germany, March 27, 2006

- Torsten Braun: Broadcasting and Reliable Transport in Wireless Multi-hop Networks, NEC Colloquium, April 13, 2006, Heidelberg

- Thomas Bernoulli: Experimental Lifetime Evaluation for MAC Protocols on Real Sensor Hardware, Workshop on Distributed Systems and Networks, held in conjunction with WWIC 2006, Bern, May 9, 2006

- Torsten Braun: Computer Networks and Distributed Systems Research @ University of Bern, Workshop on Distributed Systems and Networks, held in conjunction with WWIC 2006, Bern, May 9, 2006

- Torsten Braun: Telematiknetze, Kaderkurs Telematik, Bundesamt für Bevölkerungsschutz, Schwarzenburg, Switzerland, November 29, 2005; April 25, 2006; May 30, 2006

- Thomas Staub: Réseaux de communications, cours de cadres pour chefs de la télématique, Office fédéral de la protection de la population, Schwarzenburg, Switzerland, May 30, 2006

- Torsten Braun: The EuQoS project, Terena ENGINE workshop, Prague, June 1, 2006

Organized Events

Torsten Braun has been scientific chair of the MICS Scientific conference 2005 held from September 21–23 at Löwenberg / Murten (Switzerland). The RVS group hosted the the 6th COST 290 management committee meeting on May 9–10, 2006 as well as the 4th International Conference on Wired/Wireless Internet Communications (WWIC) on May 10–12, 2006.

Awards

Marc Heissenbüttel received the award from the GI/ITG Fachgruppe "Kommunikation und Verteilte Systeme" (KuVS) for his Ph.D. thesis on "Routing and Broadcasting in Ad-Hoc Networks." This award is given each year to outstanding Ph.D. theses in the area of Communication Networks and Distributed Systems.

1.8 Publications

Publications submitted in the academic year 2005/2006 and appearing in 2006/2007 or later are not listed.

Books and Book Chapters

- Torsten Braun, Georg Carle, Sonia Fahmy, Yevgeni Koucheryavy (Editors): Proceedings of the Wired/Wireless Internet Communications, WWIC 2006, Bern, Switzerland, Springer Verlag, ISBN 3-540-34023-8, May 10 - 12, 2006

Reviewed Journal and Conference Papers

- Marc Heissenbüttel, Torsten Braun, David Jörg, Thomas Huber: A Framework for Routing in Large Ad-Hoc Networks with Irregular Topologies, 4th Annual Mediterranean Ad Hoc Networking Workshop, Île de Porquerolles, France, June 21–24, 2005, ISBN 0-387-31171-8, pp. 119–128, Springer Boston

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