Research Report of the Research Group "Computer Networks and Distributed Systems"

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Research Projects

The current research topics of the Computer Networks and Distributed Systems research group are focussing the topics Quality-of-Service (QoS) for the Internet and Virtual Private Networks (VPNs). QoS support in the Internet is required for upcoming multimedia and business applications. In such scenarios, bandwidth and delay guarantees are essential for user acceptance of Internet applications. There are currently two approaches for QoS support being developed by the Internet Engineering Task Force (IETF): Integrated Services (IntServ) and Differentiated Services (DiffServ). Since the DiffServ approach promises better scalability, our research projects are centered around the DiffServ approach.

Charging and Accounting Technologies for the Internet (CATI)

The project CATI has been approved within the Swiss Priority Program for Information and Communications Structures by the Swiss National Science Foundation (SNF). CATI consists of two subprojects: "Charging and Accounting in the Internet and in Virtual Private Networks" (CAPIV) and "Management, Evaluation, Demonstrators, and Business" (MEDeB). The main goal of the CATI project is the design and implementation of charging and accounting mechanisms for higher-value Internet services such as integrated services, differentiated services and virtual private networks. Our work focuses on the development of a flexible VPN service including QoS support that can be configured dynamically by the user. The VPN QoS support will be based on mechanisms similar to that proposed by the Differentiated

Services working group of the IETF. Another important topic is how to provide Integrated Services over a QoS-enabled VPN. In the first part of the project an architecture has been developed that allows the user to dynamically setup, modify, and tear down QoS-enabled VPNs over the Internet. During setup and modification the user will also be able to know the costs of the desired VPN configuration. Besides QoS support, security is the major issue of the developed architecture. This architecture will be the basis for the demonstrator to be implemented and evaluated in the future.

Research Staff

Manuel Günter, Mevlyde Kasumi, Ibrahim Khalil

Financial Support

Swiss National Science Foundation Project No.: 5003-054559 and 5003-054560

Scalable Quality-of-Service for the Internet (SQUINT)

Differentiated Services (DiffServ) are a new approach to support QoS in the Internet which promises better scalability than the Integrated Services Architecture based on the Resource Reservation Setup Protocol (RSVP). The SQUINT project aimed to investigate the potential of the DiffServ concept. First, several services proposed by the DiffServ working group have been analyzed and evaluated. Several prototype implementations and products supporting DiffServ that appeared recently have been studied. An important issue is the behavior of DiffServ in overload conditions. Extensive simulations have been performed in order to evaluate how DiffServ networks behave if the load of certain links exceed the capacity of the assured bandwidth. It has been shown that DiffServ can provide some basic QoS support. However, network engineering becomes very important for DiffServ in order to avoid overload situations. The second part of the project studied the integration of the DiffServ architecture with other QoS-enabling technologies used in the Internet such as Asynchronous Transfer Mode (ATM), Multi-Protocol Label Switching (MPLS), Integrated Services based on RSVP, and Virtual Private Networks. Several synergies but also some problems have been identified if DiffServ is combined with one or more of these technologies.

Research Staff

Florian Baumgartner, Manuel Günter, Mevlyde Kasumi, Ibrahim Khalil

Financial Support

Deutsche Telekom AG

Differentiated Services over ATM

This project develops and evaluates concepts in order to improve Quality-of-Service for IP networks (Internet and Intranets) over ATM networks. The first goal of the project is to implement Differentiated Services over an ATM-based IP network. Functions required for DiffServ implementation within routers such as shaping or policing shall be replaced by ATM functionality. The implementation shall also include aggregation mechanisms allowing to negotiate Differentiated Services agreements on an aggregated flow

level. The architecture for an UNIX-based implementation of Assured and Expedited Forwarding has been designed and the experimentation network consisting of routers and ATM switches has been set up. Future topics will be the integration of the DiffServ implementation into an ATM/MPLS environment and the detection of aggressive user flows.

Research Staff

Hans Einsiedler

Financial Support

NEC Europe Ltd.

Linux/ATM

Wtihin this project, a device driver for an ATM network adapter card for the Linux operating system is being developed. Linux has become a very popular UNIX operating system running on standard personal computers.

Research Staff

Florian Baumgartner

Financial Support

Telscom AG

ATM Testbed

An experimental test network has been setup for the several research projects. This network consists of UNIX-based servers, routers, ATM switches, LAN switches as well as a variety of end systems.

Research Staff

Florian Baumgartner

Financial Support

Swiss National Science Foundation R’Equip Project No. 2160-053299.98/1, Stiftung zur Förderung der wissenschaftlichen Forschung an der Universität Bern, NEC Europe Ltd.

Student Projects

- Alexander Dobreff: Differentiated Services in ATM Networks

Activities

Program Committee Memberships

- Member of the Program Committee of the 9th IEEE Workshop on Local and Metropolitan Area Networks, Banff, Alberta, Canada, May 17-20, 1998 (T. Braun)
- Member of the Program Committee of the IEEE Annual Conference on Local Computer Networks (LCN) Lowell, Massachusetts, U.S.A., October 11-14, 1998 (T. Braun)
- Member of the Program Committee of the IFIP Conference on High Performance Networking (HPN'98) Vienna, Austria, September 21-25, 1998 (T. Braun)

Technical Committees

- SWITCH Stiftungsrat (T. Braun)
- Kommission Informatikdienste of the University of Berne (T. Braun)
- SPEEDUP Society (T. Braun)

Invited Talks

- "Differentiated Services", GI-Fachgespräch über Quality of Service, Mannheim, March 11, 1998 (T. Braun)
- "Differentiated Services in the Internet", Swisscom Colloquium, Bern, April 29, 1998 (T. Braun)
- "Virtual Private Networks", Colloquium at the Computer Engineering and Networks Laboratory, ETH Zürich, June 7, 1998 (T. Braun)
- "Differentiated Internet Services", Workshop on Distributed High Performance Computing and Gigabit Wide Area Networks, Institute for Experimental Mathematics, University of Essen, September 4, 1998, (T. Braun)
- "Differentiated Services: A New Approach for Quality of Service in the Internet", IFIP Conference on High Performance Networking, September 24, 1998, Vienna (T. Braun)
- "Differentiated Services in the Internet" October 1, 1998, Comdex Enterprise 98, October 1, 1998, Frankfurt am Main (T. Braun)
- "Differentiated Services for QoS in Virtual Private Networks", IBM Zürich Research Laboratories, November 6, 1998 (T. Braun)
- "Network Technologies for Tele-Teaching and Tele-Learning", Classroom 2000 Project Meeting, November 11, 1998, Technopark Bern (T. Braun)

Tutorials

- "IP Version 6", IFIP Conference on High Performance Networking, September 21, 1998, Vienna (T. Braun)
- "Computer Networks", NEC Computer & Communication Research Laboratories Heidelberg, February 9-12, and March 25-27, 1998 (T. Braun)

Publications

Refereed Papers

- F. Baumgartner, T. Braun, P. Habegger: Differentiated Services: A New Approach for Quality of Service in the Internet, IFIP Conference on High Performance Networking, September 21, 1998, Vienna (T. Braun)
- T. Braun, P. Habegger: Differentiated Services: Ein neuer Ansatz für Dienstgüte im Internet, Praxis der Informationsverarbeitung und Kommunikation, Vol. 21, No. 4, 1998
- T. Braun, M. Mähler: Implementation of Virtual LANs over ATM WANs, Proceedings Europto Series, Broadband European Networks and Multimedia Systems, SYBEN 98, May 18-20, 1998, Zürich, pp. 310-317
- H. Einsiedler, P. Hurley: Link Weighting: An Important Basis for Charging in the Internet, Third Global Internet Mini-Conference, in conjunction with IEEE Globecom ’98, Sydney, Australia, November 8-12, 1998
- S. Ducasse, M. Günter: Coordination of Active Objects by Means of Explicit Connectors, IEEE Computer Socitey Press: Proceedings of the DEXA workshops, August 1998, pp. 572-577

Unrefereed Papers

- T. Braun, M. Günter, M. Kasumi, I. Khalil: Virtual Private Network Architecture, CATI Project Deliverable, December 22, 1998