

# Lecture Notes in Computer Science

2216

Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Tokyo*

Ehab S. Al-Shaer Giovanni Pacifici (Eds).

# Management of Multimedia on the Internet

4th IFIP/IEEE International Conference on Management of  
Multimedia Networks and Services, MMNS 2001  
Chicago, IL, USA, October 29 – November 1, 2001  
Proceedings



Springer

## Series Editors

Gerhard Goos, Karlsruhe University, Germany  
Juris Hartmanis, Cornell University, NY, USA  
Jan van Leeuwen, Utrecht University, The Netherlands

## Volume Editors

Ehab S. Al-Shaer  
DePaul University, School of Computer Science  
243 South Wabash Avenue, Chicago, IL 60604-2301, USA  
E-mail: ehab@cs.depaul.edu  
Giovanni Pacifici  
IBM Research Division, Thomas J. Watson Research Center  
P.O. Box 704, Yorktown Heights, NY 10598, USA  
E-mail: giovanni@us.ibm.com

## Cataloging-in-Publication Data applied for

### Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Management of multimedia on the Internet : proceedings / 4th IFIP/IEEE  
International Conference on Management of Multimedia Networks and Services,  
MMNS 2001, Chicago, IL, USA, October 29 - November 1, 2001. Ehab S. Al-Shaer  
;  
Giovanni Pacifici (ed.). - Berlin ; Heidelberg ; New York ; Barcelona ; Hong Kong ;  
London ; Milan ; Paris ; Tokyo : Springer, 2001  
(Lecture notes in computer science ; Vol. 2216)  
ISBN 3-540-42786-4

CR Subject Classification (1998):C.2, H.5.1, H.3, H.5, K.3

ISSN 0302-9743

ISBN 3-540-42786-4 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York  
a member of BertelsmannSpringer Science+Business Media GmbH

<http://www.springer.de>

©2001 IFIP International Federation for Information Processing, Hofstrasse 3, A-2361 Laxenburg, Austria  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Stefan Sossna  
Printed on acid-free paper      SPIN 10840876      06/3142      5 4 3 2 1 0

# Preface

In recent years we have witnessed the explosion of multimedia traffic on the Internet. The availability of high-bandwidth connections together with the recent advances in high-quality video and audio compression techniques have created a fertile ground for the growth of multimedia applications such as interactive video on-demand, collaborative distance learning, and remote medical diagnosis. Furthermore, the availability of low bit rate video and audio applications (e.g., H.263 and G.728) and the proliferation of pervasive devices create a new demand for wireless multimedia communication systems. After a decade or more of research and development in multimedia networking, the research community has learned a number of lessons. First, increasing the capacity of the “best effort” networks and services does not provide an effective and permanent solution for offering a guaranteed Quality of Service (QoS). Second, the integration of service and network management is a key element in providing end-to-end service management. Third, management techniques for Internet multimedia services must be scalable and adaptive to guarantee QoS and maintain fairness with optimal network resource.

The IFIP/IEEE International Conference on Management of Multimedia Networks and Services 2001 was the fourth in its series aimed at stimulating technical exchange in the merging field of management of multimedia networking. The IFIP/IEEE MMNS is the premier IEEE/IFIP conference and known for its high-quality papers from various research communities. The aim of this conference is to provide a forum for exploratory research and practical contributions from researchers all over the world. A total of 106 papers were submitted to the conference, from North America, Europe, South America, The Middle East, and The Far East, of which 23 were accepted as full papers and 6 were accepted as short/position papers. The program covers a variety of research topics in the area of management of multimedia networks, i.e., QoS management, multi-point and multicast services management, monitoring, network programmability for multimedia services, policy-based management for multimedia services, packet scheduling and dropping techniques, resource management in wireless multimedia, configuration management of edge and core for multimedia services, wireless and mobile network management, multimedia traffic management, multimedia content protection, deployment of multimedia services, multimedia service engineering, multimedia session management and middleware support for management.

In closing we would like to thank the members of the Program Committee and the army of reviewers that helped us put together this year’s program. We are also indebted to Raouf Boutaba and Guy Pujolle in the Advisory Committee, for generously providing their advice and assistance. Finally, we are indebted to Hazem Hamed and Bin Zhang, for their assistance in handling the electronic paper submission process.

## **Conference Co-chairs**

Ehab Al-Shaer, DePaul University, USA  
Giovanni Pacifici, IBM Research, USA

## **Tutorial Chair**

Mohammed Atiquzzaman, University of Oklahoma, USA

## **Organization Committee Chair**

Greg Brewster, DePaul University, USA

## **Local Publicity Chair**

Curt White, DePaul University, USA

## **MBONE Broadcast Specialist**

John Kristoff, DePaul University, USA

## **Media Specialist**

Paul Sisul, DePaul University, USA

## **Advisory Committee**

Raouf Boutaba, University of Waterloo, Canada  
Guy Pujolle, Université Pierre et Marie Curie, France  
Wolfgang Zimmer, GMD FIRST, Germany

## Program Committee

Ahmed Abutaleb, Lucent Technologies, USA  
Nazim Agoulmine, University of Evry, France  
Salah Aidarous, NEC America, USA  
Kevin Almeroth, University of California, Santa Barbara, USA  
Nikos Anerousis, VoiceMate.com, USA  
Mohammed Atiquzzaman, University of Oklahoma, USA  
Michael Borella, 3Com, USA  
Mohamed Bettaz, Philadelphia University, Jordan  
Andrew Campbell, Columbia University, USA  
Jean Pierre Claudé, University of Versailles, France  
Mohammed Erradi, ENSIAS, Morocco  
Metin Feridun, IBM Research, Switzerland  
Dominique Gaiti, University of Troyes, France  
German Goldszmidt, IBM Research, USA  
Mohsen Guizani, University of West Florida, USA  
Abdelhakim Hafid, Telcordia, NJ, USA  
Masum Hasan, Cisco Systems, USA  
Go Hasegawa, Osaka University, Japan  
Ahmed Helmy, University of Southern California, USA  
Muhammad Jaseemuddin, Nortel Networks, Canada  
Joaquim Celestino Júnior, UECE, Brazil  
Ahmed Karmouch, University of Ottawa, Canada  
Lundy Lewis, APRISMA, USA  
Derong Liu, University of Illinois, Chicago, USA  
Manu Malek, Lucent Technologies, USA  
Allen Marshall, Queen's University, UK  
Ahmed Mehaoua, University of Versailles, France  
Jose M. Nogueira, Universidade Minas Gerais, Brazil  
Jong-Tae Park, Kyungpook National University, Korea  
Puneet Sharma, HP Labs, USA  
Yuval Shavitt, Tel Aviv University and Bell Labs, USA  
Chien-Chung Shen, University of Delaware, USA  
Rolf Stadler, Columbia University, USA  
Burkhard Stiller, ETH Zurich, Switzerland  
Ralf Steinmetz, GMD, Germany  
José Neuman de Souza, Universidade Federal do Ceara, Brazil  
Alaa Youssef, IBM Research, USA

## Organization Committee

Mouayad Albaghdadi, Motorola, USA  
Anthony Chung, DePaul University, USA  
Hazem Hamed, DePaul University, USA  
Yongning Tang, DePaul University, USA  
Bin Zhang, DePaul University, USA

## Reviewers

Ahmed Abutaleb, Lucent Technologies, USA  
Nazim Agoulmine, University of Evry, France  
Salah Aidarous, NEC America, USA  
Mouayad Albaghdadi, Motorola, USA  
Ehab Al-Shaer, DePaul University, USA  
Irfan Ali, Motorola, USA  
Kevin Almeroth, University of California, Santa Barbara, USA  
Hesham Anan, Microsoft, USA  
Nikos Anerousis, VoiceMate.com, USA  
Mohammed Atiquzzaman, University of Oklahoma, USA  
Mohamed Bettaz, Philadelphia University, Jordan  
Michael Borella, 3Com, USA  
Raouf Boutaba, University of Waterloo, Canada  
Greg Brewster, DePaul University, USA  
Andrew Campbell, Columbia University, USA  
Joaquim Celestino Júnior, UECE, Brazil  
Lai-Tee Cheok, Columbia University, USA  
Jerry Chow, Nortel Networks, USA  
Anthony Chung, DePaul University, USA  
Jean Pierre Claudé, University of Versailles, France  
Vasilios Darlagiannis, Darmstadt University of Technology, Germany  
Mohamed El-Darieby, Carleton University, Canada  
Abdulmoteleb El-Saddik, Darmstadt University of Technology, Germany  
Mohammed Erradi, ENSIAS, Morocco  
Metin Feridun, IBM Research, Switzerland  
Bill Gage, Nortel Networks, Canada  
Dominique Gaiti, University of Troyes, France  
German Goldszmidt, IBM Research, USA  
Mohsen Guizani, Univeristy of West Florida, USA  
Abdelhakim Hafid, Telcordia, USA  
Hazem Hamed, DePaul University, USA  
Masum Hasan, Cisco Systems, USA  
Go Hasegawa, Osaka University, Japan  
Bassam Hashem, Nortel Networks, Canada  
Ahmed Helmy, University of Southern California, USA  
Stefan Hoermann, Darmstadt University of Technology, Germany  
Sugih Jamin, University of Michigan, USA  
Muhammad Jaseemuddin, Nortel Networks, Canda  
Ahmed Karmouch, University of Ottawa, Canada  
Sung-Ju Lee, Hewlett Packard Labs, USA  
Lundy Lewis, APRISMA, USA  
Hongyi Li, Nortel Networks, Canada  
Ching-yung Lin, IBM TJ Watson Research Center, USA  
Derong Liu, University of Illinois at Chicago, USA  
Zhen Liu, IBM TJ Watson Research Center, USA  
Dimitrios Makrakis, University of Ottawa, Canada  
Manu Malek, Lucent Technologies, USA  
Allen Marshall, Queen's University, UK



Ahmed Mehaoua, University of Versailles, France  
Jonathan Munson, IBM TJ Watson Research Center, USA  
Jose Nogueira, Universidade Minas Gerais, Brazil  
Giovanni Pacifici, IBM Research, USA  
Jong-Tae Park, Kyungpook National University, Korea  
Guy Pujolle, Université Pierre et Marie Curie, France  
Utz Roedig, Darmstadt University of Technology, Germany  
Lopa Roychoudhuri, DePaul University, USA  
Mohamed-Vall Salem, Université de Montréal, Canada  
Puneet Sharma, HP Labs, USA  
Yuval Shavitt, Tel Aviv University and Bell Labs, USA  
Chien-Chung Shen, University of Delaware, USA  
José Neuman de Souza, Universidade Federal do Ceara, Brazil  
Rolf Stadler, Columbia University, USA  
Ralf Steinmetz, GMD, Germany  
Burkhard Stiller, ETH Zurich, Switzerland  
Yongning Tang, DePaul University, USA  
Olivier Verscheure, IBM Research, USA  
Paul Ward, University of Waterloo, USA  
Peter Westerink, IBM Research, USA  
Tilman Wolf, Washington University, USA  
Jason Yao, DePaul University, USA  
Alaa Youssef, IBM Research, USA  
Bin Zhang, DePaul University, USA  
Yi Zhang, University of Illinois at Chicago, USA  
Wolfgang Zimmer, GMD FIRST, Germany

# Table of Contents

## Management of Multimedia Traffic Streaming I

A Hysteresis Based Approach for Quality, Frame Rate, and Buffer Management for Video Streaming Using TCP .....	1
<i>Nagasuresh Seelam, Pankaj Sethi, and Wu-chi Feng, Ohio State University, USA</i>	
A Transmission Scheme for Streaming Variable Bit Rate Video over Internet .....	16
<i>Sunghoon Son, Electronics and Telecommunications Research Institute, Korea</i>	
MPEG-4 Video Transfer with TCP-Friendly Rate Control .....	29
<i>Naoki Wakamiya, Masaki Miyabayashi, Masayuki Murata, and Hideo Miyahara, Osaka University, Japan</i>	

## Resource Management in Wireless Multimedia

IP Radio Resource Control System .....	43
<i>John Vicente, Intel Corporation, and Andrew T. Campbell, Columbia University, USA</i>	
Is It Worth Involving Several Cooperating Agents for Multimedia User's Admission in Cellular Networks? .....	57
<i>Youssef Iraqi and Raouf Boutaba, University of Waterloo, Canada</i>	
Analysis of Random Access Protocol under Bursty Traffic .....	71
<i>Jianbo Gao and Izhak Rubin, University of California, Los Angeles, USA</i>	

## Management of Multimedia Traffic Streaming II

A Practical Model for VBR Video Traffic with Applications .....	85
<i>Tamás Borsos, Budapest University of Technology and Economics, Hungary</i>	
Enhancing Quality of MPEG Video through Partially Reliable Transport Service in Interactive Application .....	96
<i>Vincent Lecuire, Francis Lepage, Centre de Recherche en Automatique de Nancy, France, and Khalil Kammoun, University of Karlsruhe, Germany</i>	

Delivering of MPEG-4 Multimedia Content over Next Generation Internet .....	110
<i>Toufik Ahmed, Guillaume Buridant, and Ahmed Mehaoua, University of Versailles, France</i>	
Video Skimming and Summarization Based on Principal Component Analysis .....	128
<i>Dan Lelescu, Compression Science Inc., and Dan Schonfeld, University of Illinois at Chicago, USA</i>	

## **QoS Management on the Internet**

Distributed Resource Management to Support Distributed Application-Specific Quality of Service .....	142
<i>Gary Molenkamp, Michael Katchabaw, Hanan Lutfiyya, and Michael Bauer, The University of Western Ontario, Canada</i>	
Implementation of a Bandwidth Broker for Dynamic End-to-End Capacity Reservation over Multiple Diffserv Domains .....	160
<i>Ibrahim Khalil and Torsten Braun, University of Berne, Switzerland</i>	
The Impact of Confidentiality on Quality of Service in Heterogeneous Voice over IP Networks .....	175
<i>Johnathan M. Reason and David G. Messerschmitt, University of California, Berkeley, USA</i>	

## **Poster Session**

Queue Length Based Fair Queueing in Core-Stateless Networks .....	193
<i>Mingyu Zhai, Guanqun Gu, and Yuan Yuan, Southeast University, China</i>	
Study of TCP and UDP Flows in a Differentiated Services Network Using Two Markers System .....	198
<i>Sung-Hyuck Lee, Seung-Joon Seok, Seung-Jin Lee, and Chul-Hee Kang, Korea University, Korea</i>	
Equation-Based Dynamic Shaping Algorithm .....	204
<i>Halima Elbiaze, Tijani Chahed, Gérard Hébuterne and Tulin Atmaca Institut National des Telecommunications, France</i>	
A Novel Content-Based Video Streaming Algorithm for Fine Granular Scalable Coding .....	210
<i>Li Zhao, Qi Wang, Yuwen He, Shiqiang Yang and Yuzhuo Zhong, Tsinghua University, China</i>	

Topological Synthesis of Mobile Backbone Networks for Managing Ad Hoc Wireless Networks .....	215
<i>Izhak Rubin and Patrick Vincent, University of California, Los Angeles, USA</i>	
QoS Monitoring System on IP Networks .....	222
<i>Marcelo Borges Ribeiro, Lisandro Zambenedetti Granville, Maria Janilce Bosquiroli Almeida, and Liane Margarida Rockenbach Tarouco, Federal University of Rio Grande do Sul, Brazil</i>	

## **Fault Management on the Internet**

A Framework for Supporting Intelligent Fault and Performance Management for Communication Networks .....	227
<i>Hongjun Li and John S. Baras, University of Maryland, College Park, USA</i>	
Architecture of Generalized Network Service Anomaly and Fault Thresholds .....	241
<i>Zheng Zhang and Constantine Manikopoulos, New Jersey Institute of Technology, and Jay Jorgenson, City College of New York, USA</i>	
Providing Scalable Many-to-One Feedback in Multicast Reachability Monitoring Systems .....	256
<i>Kamil Saraç and Kevin C. Almeroth, University of California, Santa Barbara, USA</i>	
A Framework for Event Correlation in Communication Systems .....	271
<i>Mouayad Albaghdadi, Bruce Briley, Mohammed Petiwala, Mark Hamlen, Motorola Inc., Martha Evens, Illinois Institute of Technology, and Rafid Sukkar, Lucent Technologies, USA</i>	

## **Agents for Multimedia Management**

Policy-Based Management for Multimedia Collaborative Services .....	285
<i>Hamid Harroud, Mouhsine Lakhdissi, Ahmed Karmouch, University of Ottawa, and Cliff Grossner, Nortel Networks, Canada</i>	
Agent-Enhanced Dynamic Service Level Agreement in Future Network Environment .....	299
<i>David Chieng, Alan Marshall, The Queen's University of Belfast, Ivan Ho, and Gerard Parr, University of Ulster at Coleraine, U.K.</i>	
WEBARM: Mobile Code Based Agent for Web Application Response Measurement – Software Implementations and Analysis .....	313
<i>Joseph V. Elarde and Gregory B. Brewster, DePaul University, USA</i>	

**Multimedia Service Management**

The Dynamics of Price, Revenue, and System Utilization ..... 329  
    *Srinivasan Jagannathan and Kevin C. Almeroth, University of California,  
    Santa Barbara, USA*

Developing Pattern-Based Management Programs ..... 345  
    *Koon-Seng Lim and Rolf Stadler, Columbia University, USA*

Supermedia in Internet-Based Telerobotic Operations ..... 359  
    *Imad Elhajj, Ning Xi, Michigan State University, USA, Wai Keung Fung,  
    Yun hui Liu, Wen J. Li, Chinese University of Hong Kong, Hong Kong,  
    Tomoyuki Kaga, and Toshio Fukuda, Nagoya University, Japan*

**Author Index** ..... 373