

Lecture Notes of the Institute  
for Computer Sciences, Social Informatics  
and Telecommunications Engineering

68

Editorial Board

Ozgur Akan

*Middle East Technical University, Ankara, Turkey*

Paolo Bellavista

*University of Bologna, Italy*

Jiannong Cao

*Hong Kong Polytechnic University, Hong Kong*

Falko Dressler

*University of Erlangen, Germany*

Domenico Ferrari

*Università Cattolica Piacenza, Italy*

Mario Gerla

*UCLA, USA*

Hisashi Kobayashi

*Princeton University, USA*

Sergio Palazzo

*University of Catania, Italy*

Sartaj Sahni

*University of Florida, USA*

Xuemin (Sherman) Shen

*University of Waterloo, Canada*

Mircea Stan

*University of Virginia, USA*

Jia Xiaohua

*City University of Hong Kong, Hong Kong*

Albert Zomaya

*University of Sydney, Australia*

Geoffrey Coulson

*Lancaster University, UK*

Kostas Pentikousis  
Ramón Agüero  
Marta García-Arranz  
Symeon Papavassiliou (Eds.)

# Mobile Networks and Management

Second International ICST Conference, MONAMI 2010  
Santander, Spain, September 22-24, 2010  
Revised Selected Papers

## Volume Editors

Kostas Pentikousis  
Huawei Technologies Düsseldorf GmbH  
European Research Centre, 10587 Berlin, Germany  
E-mail: k.pentikousis@huawei.com

Ramón Agüero  
Network Planning and Mobile Communications Laboratory  
Department of Communications Engineering  
University of Cantabria, 39005 Santander, Spain  
E-mail: ramon@tlmat.unican.es

Marta García-Arranz  
Network Planning and Mobile Communications Laboratory  
Department of Communications Engineering  
University of Cantabria, 39005 Santander, Spain  
E-mail: marta@tlmat.unican.es

Symeon Papavassiliou  
Network Management and Optimal Design Laboratory  
School of Electrical and Computer Engineering  
National Technical University of Athens, 15780 Athens, Greece  
E-mail: papavass@mail.ntua.gr

ISSN 1867-8211  
ISBN 978-3-642-21443-1  
DOI 10.1007/978-3-642-21444-8

e-ISSN 1867-822X  
e-ISBN 978-3-642-21444-8

Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2011928827

CR Subject Classification (1998): C.2, H.4, D.2, H.3, H.5, I.2

© ICST Institute for Computer Science, Social Informatics and Telecommunications Engineering 2011

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. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

# Preface

This volume is the result of the Second International ICST Conference on Mobile Networks and Management (MONAMI), which was held in Santander, Spain, during 22–24 September 2010, hosted by the University of Cantabria. Santander, a modern cosmopolitan city with a rich historical past, appealing social and cultural background, and high-quality service offerings, was the perfect backdrop for the second edition of the conference.

MONAMI aims at closing the gap between hitherto considered separate and isolated research areas, namely, multiaccess and resource management, mobility management, and network management. Although these have emerged as core aspects in the design, deployment, and operation of current and future networks, there is still little to no interaction between the experts in these fields. MONAMI enables cross-pollination between these areas by bringing together top researchers, academics, and practitioners specializing in the area of mobile network and service management. MONAMI 2010 more than doubled in terms of size and attendance when compared to the first edition in Athens, but remained a focused event. We are happy to announce that the third edition of MONAMI will be hosted by the University of Aveiro in September 2011. Our goal is to establish the conference over the years as a reference point for the research community.

The technical program featured 29 papers, which were selected after a thorough peer-review process based on their relevance to the scope of the conference and their technical merit. Thirty-six Technical Program Committee members made sure that each submitted paper was reviewed by at least three competent researchers. This volume is organized by subject in seven parts as follows. Papers 1 to 4 address “Routing and Virtualization” in Part I. “Autonomic Networking” aspects are discussed in Part II (papers 5-8). Papers 9 through 16 present new approaches for “Mobility Management” (Part III) and “Multiaccess Selection” (Part IV). Papers 17 to 24 consider “Wireless Network Management” and “Wireless Networks,” in Parts V and VI, respectively. Finally Part VII includes five papers presenting “Future Research Directions.” All papers were orally presented in a single-track format, with sufficient time allocated for discussion following each presentation, fostering active participation by all attendees.

The conference opened with a full-day tutorial on “Machine-to-Machine (M2M) Communication” by domain experts Mischa Dohler and Jesús Alonso-Zárata of CTTC. Joan Serrat of Universitat Politècnica de Catalunya opened the second day of the conference with a keynote on “Service Management in Future Networks: The C3SEM Vision.” Last but not least, José Manuel Hernández of Telefónica R+D gave the keynote on the third day of the conference entitled “SmartCities, the Silent IoT Revolution.”

We acknowledge the vital role that the Technical Program Committee members and additional referees played during the review process. Their efforts ensured that all submitted papers received a proper evaluation. We thank Create-Net for technically co-sponsoring the event and the University of Cantabria for hosting MONAMI 2010 as well as for providing organizational, logistics, and media support. Finally, we thank all delegates for attending MONAMI 2010 and making it such a vibrant conference!

December 2010

Kostas Pentikousis  
Ramón Agüero  
Marta García-Arranz

# Executive Committee

## Organizing Committee

### General Chairs

Kostas Pentikousis	Huawei Technologies European Research Center, Germany
Ramón Agüero	University of Cantabria, Spain

### Technical Program Committee Co-chairs

Marta García-Arranz	University of Cantabria, Spain
Symeon Papavasileiou	National Technical University of Athens, Greece

### Tutorial Chair

Oliver Blume	Alcatel-Lucent Bell Labs, Germany
--------------	-----------------------------------

### Publication Chair

Carlo Giannelli	University of Bologna, Italy
-----------------	------------------------------

### Publicity Chairs

Jarno Pinola	VTT Technical Research Centre of Finland, Finland
Carlo Giannelli	University of Bologna, Italy

## Steering Committee

### Co-chairs

Imrich Chlamtac	CREATE-NET, Italy
Kostas Pentikousis	Huawei Technologies European Research Center, Germany

# Technical Program Committee

Ramón Agüero	University of Cantabria, Spain
Rui Aguiar	University of Aveiro, Portugal
Toufik Ahmed	University of Bordeaux 1, France
Nadeem Akhtar	Centre of Excellence in Wireless Technology (CEWiT), India
Faouzi Bader	CTTC, Spain
Hussein Badr	Stony Brook University, USA
Roland Bless	Karlsruhe Institute of Technology, Germany
Oliver Blume	Alcatel-Lucent Bell Labs, Germany
Mischa Dohler	CTTC, Spain
Stephen Farrell	Trinity College Dublin, Ireland
Marta García-Arranz	University of Cantabria, Spain
Raffaele Gialfreda	CREATE-NET, Italy
Carlo Giannelli	University of Bologna, Italy
Tobias Hossfeld	University of Würzburg, Germany
Jussi Kangasharju	University of Helsinki, Finland
Theo G. Kanter	Mid-Sweden University, Sweden
Vasileios Karyotis	National Technical University of Athens, Greece
Timotheos Kastrinogiannis	National Technical University of Athens, Greece
Polychronis Koutsakis	Technical University of Crete, Greece
Zhaojun Li	Fujitsu Labs, UK
Emmanuel Lochin	ISAE - LAAS-CNRS, France
Raquel Morera	Telcordia Technologies, USA
Antonio de la Oliva	Carlos III University, Spain
Symeon Papavassiliou	National Technical University of Athens, Greece
Kostas Pentikousis	Huawei Technologies European Research Center, Germany
Miguel Ponce de Leon	Waterford Institute of Technology, Ireland
Antonio Puliafito	University of Messina, Italy
Anand R. Prasad	NEC Corporation, Japan
Javier Rubio-Loyola	National Polytechnic Institute, Mexico
Susana Sargento	University of Aveiro, Portugal
Peter Schoo	Fraunhofer-SIT, Germany
Joan Serrat	Polytechnic University of Catalonia, Spain
Haitao Tang	Nokia Siemens Networks, Finland
Andreas Timm-Giel	Hamburg University of Technology, Germany
Kurt Tutschku	University of Vienna, Austria
Christos Verikoukis	CTTC, Spain

## Additional Reviewers

Georgios Aristomenopoulos	National Technical University of Athens, Greece
Nicola Baldo	CTTC, Spain
Javier Baliosian	Universidad de la Republica, Uruguay
Roksana Boreli	NICTA, Australia
Dario Bruneo	Universita' di Messina, Italy
Paul Bucknell	Fujitsu, United Kingdom
Antonio Celesti	University of Messina, Italy
Johnny Choque	University of Cantabria, Spain
Marta Domingo	University of Cantabria, Spain
Eirini Eleni Tsiropoulou	National Technical University of Athens, Germany
Alberto Eloy Garcia Gutierrez	University of Cantabria, Spain
Shane Fox	TSSG Waterford Institute of Technology, Ireland
Jochen Furthmüller	Karlsruhe Institute of Technology, Germany
Jens Gebert	Alcatel-Lucent Bell Labs, Germany
Michael Georgiades	Cyprus University of Technology, Cyprus
Victor Gil	University Carlos III, Spain
Diogo Gomes	Instituto de Telecomunicacoes - University of Aveiro, Portugal
Mary Grammatikou	National Technical University of Athens, Greece
Christian Haas	Karlsruhe Institute of Technology, Germany
Matthias Hartmann	University of Würzburg, Germany
Mythri Hunukumbure	Fujitsu, United Kingdom
Vitor Jesus	Instituto de Telecomunicacoes - University of Aveiro, Portugal
Fernando Jose Velez	IT-DEM, Universidade da Beira Interior, Portugal
Ahmed Kazi	Pennsylvania State University, USA
Ivan Lopez-Arevalo	Cinvestav Tamaulipas, Mexico
Aarne Mammela	VTT Technical Research Centre of Finland, Finland
Jaume Nin	CTTC, Spain
Mikko Pervilä	University of Helsinki, Finland
Henrik Petander	NICTA, Australia
Manuel Ricardo	INESC Porto, Portugal
Luis Sanchez	University of Cantabria, Spain
Roberto Sanz	University of Cantabria, Spain
Christian Schwartz	University of Vienna, Austria
Eleni Stai	National Technical University of Athens, Greece
Alessandra Toninelli	University of Bologna, Italy
Fatima Zarinni	Stony Brook University, USA

# Table of Contents

## Part I: Routing and Virtualization

Generic Connectivity Architecture for Mobility and Multipath Flow Management in the Future Internet . . . . .	1
<i>Amanpreet Singh, Christoph Nass, Andreas Timm-Giel, Peter Schefczik, Horst Roessler, and Michael Scharf</i>	
Using BGP-4 to Migrate to a Future Internet . . . . .	14
<i>Pedro A. Aranda Gutiérrez, Petteri Pöyhönen, Luis Enrique Izaguirre Gamir, and Francisco Huertas Ferrer</i>	
Revisiting the Impact of Traffic Engineering Techniques on the Internet's Routing Table . . . . .	26
<i>Pedro A. Aranda Gutiérrez</i>	
End-to-End Performance Evaluation of Virtual Networks Using a Prototype Implementation . . . . .	38
<i>Asanga Udugama, Liang Zhao, Yasir Zaki, Carmelita Goerg, and Andreas Timm-Giel</i>	

## Part II: Autonomic Networking

Addressing Stability in Future Autonomic Networking . . . . .	50
<i>Timotheos Kastrinogiannis, Nikolay Tcholtchev, Arun Prakash, Ranganai Chaparadza, Vassilios Kaldanis, Hakan Coskun, and Symeon Papavassiliou</i>	
An Empirical Evaluation of a Shim6 Implementation . . . . .	62
<i>John Ronan and John McLaughlin</i>	
Future Autonomic Cooperative Networks . . . . .	71
<i>Michał Wódczak</i>	
An Autonomic Monitoring Framework for QoS Management in Multi-service Networks . . . . .	79
<i>Constantinos Marinos, Christos Argyropoulos, Mary Grammatikou, and Vasilis Maglaris</i>	

**Part III: Mobility Management**

Safetynet Version 2, a Packet Error Recovery Architecture for Vertical Handoffs ..... 87  
*Henrik Petander and Emmanuel Lochin*

A Mechanism for Vertical Handover Based on SAW Using IEEE 802.21 ..... 96  
*Jorge Lima de Oliveira Filho and Edmundo Madeira*

Proactive Vertical Handover Optimizations in the 3GPP Evolved Packet Core ..... 109  
*Marius Corici, Dragos Vingarzan, Thomas Magedanz, Cornel Pampu, and Qing Zhou*

Key Distribution Mechanisms for IEEE 802.21-Assisted Wireless Heterogeneous Networks ..... 123  
*F. Bernal-Hidalgo, R. Marin-Lopez, and A.F. Gómez-Skarmeta*

**Part IV: Multiaccess Selection**

Optimum Selection of Access Networks within Heterogeneous Wireless Environments Based on Linear Programming Techniques ..... 135  
*Johnny Choque, Ramón Agüero, Eva-María Hortigüela, and Luis Muñoz*

On the Empirical Analysis of Handover Latency Reduction by Means of Multi-RAT Devices: A Prototypical Approach ..... 150  
*David Gómez, Ramón Agüero, Jesús Herrero, Bruno Cendón, and Luis Muñoz*

On the Performance of Static Inter-cell Interference Coordination in Realistic Cellular Layouts ..... 163  
*David González G., Mario García-Lozano, Silvia Ruiz, and Joan Olmos*

Location-Based Ubiquitous Context Exchange in Mobile Environments ..... 177  
*Stefan Forsström, Victor Kardeby, Jamie Walters, and Theo Kanter*

**Part V: Wireless Network Management**

Energy Efficiency of Dynamic Interface Selection Mechanisms in Wireless Ad-Hoc Networks ..... 188  
*Luis Sanchez, Jorge Lanza, and Luis Muñoz*

Ubiquitous Computing by Utilizing Semantic Interoperability with Item-Level Object Identification . . . . .	198
<i>Janne Takalo-Mattila, Jussi Kiljander, Matti Eteläperä, and Juha-Pekka Soininen</i>	
Manager Selection over a Hierarchical/Distributed Management Architecture for Personal Networks . . . . .	210
<i>Jose A. Irastorza, Ramón Agüero, and Luis Muñoz</i>	
OLSRp: Predicting Control Information to Achieve Scalability in OLSR Ad Hoc Networks . . . . .	225
<i>Esunly Medina, Roc Mesequer, Carlos Molina, and Dolors Royo</i>	

## Part VI: Wireless Networks

Maximum Sum-Rate Interference Alignment Schemes for the 3-User Deterministic MIMO Channel . . . . .	237
<i>Óscar González and Ignacio Santamaría</i>	
A Novel LTE Wireless Virtualization Framework . . . . .	245
<i>Yasir Zaki, Liang Zhao, Carmelita Goerg, and Andreas Timm-Giel</i>	
Accurate Modelling of OFDMA Transmission Technique Using IEEE 802.16m Recommendations for WiMAX Network Simulator Design . . . . .	258
<i>Marco Miozzo and Faouzi Bader</i>	
A Simulation Implementation of the LTE-Uu Interface Datalink Layer in OMNeT++ . . . . .	270
<i>Mohammad Arouri, Ziyad Atiyeh, Anas Mousa, Amna Eleyan, and Hussein Badr</i>	

## Part VII: Future Research Directions

Scenarios, Research Issues, and Architecture for Ubiquitous Sensing . . . . .	285
<i>Theo Kanter, Victor Kardeby, Stefan Forsström, and Jamie Walters</i>	
Challenges for Cloud Networking Security . . . . .	298
<i>Peter Schoo, Volker Fusenig, Victor Souza, Márcio Melo, Paul Murray, Hervé Debar, Houssemed Medhioub, and Djamal Zeghlache</i>	
Video-Enhancing Functional Architecture for the MEDIEVAL Project . . . . .	314
<i>Daniel Corujo, Albert Banchs, Telemaco Melia, Michelle Wetterwald, Leonardo Badia, and Rui L. Aguiar</i>	

EARTH: Paving the Way for Future Energy Efficient Broadband Wireless Networks .....	326
<i>Luis Sanchez, Oliver Blume, Manuel Gonzalez, Gergely Biczók, Dieter Ferling, and István Gódor</i>	
A New Perspective on Mobility Management Scenarios and Approaches .....	340
<i>Tiago Condeixa, Ricardo Matos, Alfredo Matos, Susana Sargento, and Rute Sofia</i>	
<b>Author Index</b> .....	355