

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

123

## 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*

Riadh Dhaou   André-Luc Beylot  
Marie-José Montpetit   Daniel Lucani  
Lorenzo Mucchi (Eds.)

# Personal Satellite Services

5th International ICST Conference, PSATS 2013  
Toulouse, France, June 27-28, 2013  
Revised Selected Papers

## Volume Editors

Riadh Dhaou  
IRIT-ENSEEIH, 31071 Toulouse, France  
E-mail: riadh.dhaou@enseeiht.fr

André-Luc Beylot  
IRIT-ENSEEIH, 31071 Toulouse, France  
E-mail: beylot@enseeiht.fr

Marie-José Montpetit  
MIT, Cambridge, MA 02139, USA  
E-mail: mariejo@mit.edu

Daniel Lucani  
Instituto de Telecomunicações, Porto 4200-465, Portugal  
E-mail: daniel.lucani@fe.up.pt

Lorenzo Mucchi  
University of Florence, 50139 Florence, Italy  
E-mail: lorenzo.mucchi@unifi.it

ISSN 1867-8211	e-ISSN 1867-822X
ISBN 978-3-319-02761-6	e-ISBN 978-3-319-02762-3
DOI 10.1007/978-3-319-02762-3	
Springer Heidelberg New York Dordrecht London	

Library of Congress Control Number: 2013950911

CR Subject Classification (1998): C.2, H.4, J.1, J.2, C.4

© ICST Institute for Computer Science, Social Informatics and Telecommunications Engineering 2013  
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, 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.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

*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)

# Preface

It is our pleasure to welcome you to the 5th International Conference on Personal Satellite Services (PSATS) held in Toulouse, France during 27–28 June 2013.

Technology advances in communications together with changes in the regulatory framework are paving the way for next generation satellite systems. Broadband on the move, improved spectrum efficiency, flexible payloads are the keywords. These evolutions foster advances both for the end-users and the satellite operators, yielding opportunities for new value-added services including those that blur the frontiers between Earth observation, telecommunications and positioning. The legacy role of satellite communication as bearer of broadband and broadcast services is also confirmed as the need for global multimedia distribution rises.

In addition to that, the gap between terrestrial and the so-called space communication technologies is getting narrower. The space segment is now the natural bridge among heterogeneous networks providing flexible capacity wherever and whenever needed.

The Personal Satellite Service conference, confirms through its 5th edition that there is a need for a scientific forum where these evolutions are prepared. The conference provides a multifaceted floor for technology and networking where all R&D actors including academic and industrial researchers, practitioners, and students can meet and discuss. In organizing PSATS 2013, we were delighted to work with a dedicated team of volunteers whose efforts ensured a strong two day programme. The tireless work of these volunteers helped to ensure that PSATS continues to be a reputed conference in the area. We are grateful to the TPC chairs Dr Marie-Josée Montpetit (Cambridge MA, USA) and Dr. Daniel Lucani (Instituto de Telecomunicacoes Porto, Portugal). Thanks to their efforts, PSATS has a strong and focused technical programme. PSATS 2013 has 18 regular papers, 3 tutorials and 3 demos in diverse topics under Personal Satellite Services. The Technical Programme Committee of PSATS 2013 deserves a special mention, since their efforts have lead to a selective and strong technical programme. We thank the industrial chair Mr. Nicolas Chuberre (Thales Alenia Space, France), publicity chair Prof. Laurent Franck (Télécom Bretagne, Institut Mines Télécom, France), demos and tutorial chairs Dr. Emmanuel Dubois (CNES, France) and Dr. Fabrice Arnal (Thales Alenia Space, France), publications chair Dr. Lorenzo Mucchi (University of Florence, Italy), local organising chair Dr. Emmanuel Chaput (IRIT-ENSEEIH, France). We are grateful to the web chair Dr. Julien Fasson (IRIT-ENSEEIH, France) for a high quality and superb website. We are particularly grateful to the conference coordinator Ms Erica Polini (EAI, Italy). Her timely feedback and suggestions has ensured the organization of this two day program. We thank the venue manager and conference coordinator Ms. Elisa Mendini (EAI, Italy). Lastly, we are grateful to

the Steering Committee and the Advisory Committee for their support to the conference.

PSATS 2013 is proud to welcome Mr. Hugo Gonzales Perez, the programme officer for broadband and mobile initiatives at CNES (Centre National des Etudes Spatiales, France), as our keynote speaker. He will set the tone of the topic during the two days of the conference, with a special focus on new challenges for satellite communications.

PSATS 2013 includes three tutorials by experts in the area. The first tutorial, in the networking domain, entitled “Emergency Communications” is offered by Prof. Laurent Franck, Telecom Bretagne, France. The second tutorial, in the telecommunication domain, entitled “Advanced Techniques for Forward Error Correction for Future Satellite Systems” is presented by Prof. Jérôme Lacan, ISAE, France. The third tutorial entitled “Advanced Access & Networking Techniques for Future Aeronautical Systems Aided by Satellite” is offered by Mr. Christian Kissling, scientific researcher working in the Institute of Communications and Navigation at the German Aerospace Center (DLR), Germany. We sincerely hope that the delegates will find the state-of-the-art tutorials useful.

PSATS 2013 also included a panel discussion session of the topic: “Hybrid Satellite/Terrestrial Networks”. This session aims at discussing the most interesting scenarios combining satellite and terrestrial network technologies in the context of the future 5G network infrastructure. This session will bring in the view of the satellite operators, satellite research centres, SMEs and universities on the future role of satellite communications in our everyday life. We would also like to thank all the members of the panel session, and all the student volunteers of PSATS 2013.

PSATS has traditionally received strong support from industry over the years. This year as well, our corporate sponsors, have generously supported us with funds that enable us to hold a high quality conference. We thank our sponsors: ICST, Centre National des Etudes Spatiales (CNES, France), Institut National Polytechnique de Toulouse (INPT, France), Institut National de Recherche en Informatique (IRIT, France) and ASI, Italy. for their generous financial support. We thank Thales Alenia Space (TAS, France) for the technical support.

We thank all the authors and speakers for their technical contributions and the attendees for their participation. Given the excellent technical program and the hard work put in by all the organizers, we are sure that you will all have an intellectually stimulating and enjoyable PSATS 2013. We wish you a pleasant stay in Toulouse, France and we hope you will greatly enjoy the conference!

June 2013

Riadh Dhaou  
André-Luc Beylot

# Organization

## Program Committee

Carlos Aguilar	XLIM, France
Paolo Barsocchi	ISTI-CNR, Italy
Matteo Berio	German Aerospace Center (DLR), Germany
Carlo Caini	University of Bologna, Italy
Nedo Celandroni	ISTI-CNR, Italy
Bernhard Collini-Nocker	University of Salzburg, Austria
Michaël Crosnier	ASTRIUM, France
Haitham Cruickshank	University of Surrey, UK
Philip A. Dafesh	The Aerospace Corporation, USA
Franco Davoli	CNIT, Italy
Vincent Deslandes	EADS-Astrium, France
Roberto Di Pietro	University of Rome, Italy
PFabio Dovi	Politecnico di Torino, Italy
Alban Duverdier	CNES, France
Benoit Escrig	IRIT, France
Gorry Fairhurst	University of Aberdeen, UK
Julien Fasson	IRIT, France
Carles Fernandez-Prades	CTTC, Spain
Alberto Gotta	ISTI-CNR, Italy
Gentian Jakllari	IRIT, France
Igor Kotenko	SPIIRAS, Russia
Ajay Kulkarni	Cisco Systems, USA
Michele Luglio	University of Roma2, Italy
Muriel Medard	Cambridge MA, USA
Maria Luisa Merani	University of Modena & Reggio Emilia, Italy
Gabriele Oligeri	ISTI-CNR, Italy
Athanasios Panagopoulos	ICCS-NTUA, Greece
Charly Poulliat	IRIT, France
Anand Prasad	NEC Corporation, Japan
Jose Radzik	ISAE, France
Patrice Raveneau	IRIT, France
Cesare Roseti	University of Rome, Italy
Renaud Sallantin	IRIT, France
Raffaello Secchi	University of Aberdeen, UK
Aaditeshwar Seth	IIT Delhi, India
Petia Todorova	Fraunhofer Institut FOKUS, Germany
Alexey Vinel	SPIIRAS, Russia

## Conference Organization Credits

### Steering Committee

Imrich Chlamtac	Create-Net, Italy
Kandeepan	
Sithamparanathan	RMIT, Australia
Agnelli Stefano	ESOA/Eutelsat, France
Mario Marchese	University of Genoa, Italy

### Advisory Committee

Giovanni Giambene	University of Siena, Italy
Fun Hu	University of Bradford, UK
Vinod Kumar	Alcatel-Lucent, France

### General Chairs

Riadh Dhaou	IRIT-ENSEEIH, France
André-Luc Beylot	IRIT-ENSEEIH, France

### Industrial Chair

Mme Isabelle Buret	Thales Alenia Space, France
--------------------	-----------------------------

### Publicity Chair

Laurent Franck	Telecom Bretagne, France
----------------	--------------------------

### Demos and Tutorial Chairs

Emmanuel Dubois	CNES, France
Fabrice Arnal	Thales Alenia Space, France

### Publications Chair

Lorenzo Mucchi	University of Florence, Italy
----------------	-------------------------------

### Local Organising Chair

Emmanuel Chaput	IRIT-ENSEEIH, France
-----------------	----------------------

### Conference Coordinators

Erica Polini	EAI, Italy
--------------	------------

### Website Chair

Julien Fasson	IRIT-ENSEEIH, France
---------------	----------------------

## TPC Chairs

Marie-Josée Montpetit	Cambridge MA, USA
Daniel Lucani	Instituto de Telecomunicacoes Porto, Portugal

## Technical Program Committee

Carlos Aguilar	XLIM, France
Paolo Barsocchi	ISTI-CNR, Italy
Matteo Berio	German Aerospace Center (DLR), Germany
Carlo Caini	University of Bologna, Italy
Nedo Celandroni	ISTI-CNR, Italy
Bernhard Collini-Nocker	University of Salzburg, Austria
Michaël Crosnier	ASTRIUM, France
Haitham Cruickshank	University of Surrey, UK
Philip A. Dafesh	The Aerospace Corporation, USA
Franco Davoli	CNIT, Italy
Vincent Deslandes	EADS-Astrium, France
Roberto Di Pietro	University of Rome, Italy
Fabio Dovis	Politecnico di Torino, Italy
Alban Duverdier	CNES, France
Benoit Escrig	IRIT, France
Gorry Fairhurst	University of Aberdeen, UK
Julien Fasson	IRIT, France
Carles Fernandez-Prades	CTTC, Spain
Alberto Gotta	ISTI-CNR, Italy
Gentian Jakllari	IRIT, France
Igor Kotenko	SPIIRAS, Russia
Ajay Kulkarni	Cisco Systems, USA
Michele Luglio	University of Roma2, Italy
Muriel Medard	Cambridge MA, USA
Maria Luisa Merani	University of Modena & Reggio Emilia, Italy
Gabriele Oliveri	ISTI-CNR, Italy
Athanasios Panagopoulos	ICCS-NTUA, Greece
Charly Poulliat	IRIT, France
Anand Prasad	NEC Corporation, Japan
Jose Radzik	ISAE, France
Patrice Raveneau	IRIT, France
Cesare Roseti	University of Rome, Italy
Renaud Sallantin	IRIT, France
Raffaello Secchi	University of Aberdeen, UK
Aaditeshwar Seth	IIT Delhi, India
Petia Todorova	Fraunhofer Institut FOKUS, Germany
Alexey Vinel	SPIIRAS, Russia



# Table of Contents

## Satellite for Emergency and Aerocommunication

DTN LEO Satellite Communications through Ground Stations and GEO Relays . . . . .	1
<i>Pietrofrancesco Apollonio, Carlo Caini, and Martin Lülß</i>	
Airborne Base Stations for Emergency and Temporary Events . . . . .	13
<i>Alvaro Valcarce, Tinku Rasheed, Karina Gomez, Sithamparanathan Kandeepan, Laurent Reynaud, Romain Hermenier, Andrea Munari, Mihael Mohorcic, Miha Smolnikar, and Isabelle Bucaille</i>	
A Realization of Integrated Satellite-Terrestrial Communication Networks for Aeronautical Services via Joint Radio Resource Management . . . . .	26
<i>Yongqiang Cheng, Kai J. Xu, Anju Pillai, Prashant Pillai, Yin Fun Hu, Muhammad Ali, and Adeel Ahmed</i>	
On the Impact of Link Layer Retransmissions on TCP for Aeronautical Communications . . . . .	38
<i>Nicolas Kuhn, Nicolas Van Wambeke, Mathieu Gineste, Benjamin Gadat, Emmanuel Lochin, and Jérôme Lacan</i>	
Satellite and Wireless Links Issues in Healthcare Monitoring . . . . .	49
<i>Rahim Kacimi and Ponia Pech</i>	

## Satellite for networking

Content Delivery in Hybrid Networks Using SatTorrent . . . . .	65
<i>Bernd Klasen</i>	
Efficient Synchronization of Multiple Databases over Broadcast Networks . . . . .	77
<i>Muhammad Muhammad, Stefan Erl, and Matteo Berioli</i>	
Study on Research Challenges and Optimization for Internetworking of Hybrid MANET and Satellite Networks . . . . .	90
<i>Ye Miao, Zhili Sun, Fang Yao, Ning Wang, and Haitham S. Cruickshank</i>	
Security Architecture for Satellite Services over Cryptographically Heterogeneous Networks . . . . .	102
<i>Yingli Sheng, Haitham S. Cruickshank, Martin Moseley, and John Ashworth</i>	

## Resource Management

Generalized Encoding CRDSA: Maximizing Throughput in Enhanced Random Access Schemes for Satellite .....	115
<i>Manlio Bacco, Pietro Cassarà, Erina Ferro, and Alberto Gotta</i>	
Performance Evaluation of SPDY over High Latency Satellite Channels .....	123
<i>Andrea Cardaci, Luca Caviglione, Alberto Gotta, and Nicola Tonellotto</i>	
Fuzzy Based CRRM for Load Balancing in Heterogeneous Wireless Networks .....	135
<i>Muhammad Ali, Prashant Pillai, Yim Fun Hu, Kai J. Xu, Yongqiang Cheng, and Anju Pillai</i>	
Flexible QoS Support in DVB-RCS2 .....	146
<i>Ziaul Hossain, Arjuna Sathiseelan, Raffaello Secchi, and Gorry Fairhurst</i>	

## Air Interface

Impact of the Railway Centerline Geometry Uncertainties on the Train Velocity Estimation by GPS .....	156
<i>Guoliang Zhu, Lionel Fillatre, and Igor Nikiforov</i>	
A Satellite Radio Interface Compatible with Terrestrial 3GPP LTE System .....	162
<i>Hee Wook Kim, Taechul Hong, Kunseok Kang, and Bon-Jun Ku</i>	
Physical Channel Access (PCA): Time and Frequency Access Methods Simulation in NS-2 .....	174
<i>Nicolas Kuhn, Olivier Mehani, Huyen-Chi Bui, Jérôme Lacan, José Radzik, and Emmanuel Lochin</i>	
Spatial Filtering for Underlay Cognitive SatComs .....	186
<i>Shree Krishna Sharma, Symeon Chatzinotas, and Björn Ottersten</i>	
Network Coding Advantage over MDS Codes for Multimedia Transmission via Erasure Satellite Channels .....	199
<i>Pareesh Saxena and M.A. Vázquez-Castro</i>	
<b>Author Index</b> .....	211