
CHALLENGES IN AD HOC NETWORKING

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

CHALLENGES IN AD HOC NETWORKING

Fourth Annual Mediterranean Ad Hoc Networking Workshop, June 21-24, 2005, Île de Porquerolles, France

Edited by

K. Al Agha

LRI (Université Paris-Sud), France

I. Guérin Lassous

INRIA, France

G. Pujolle

LIP6 (Université Paris 6), France



Springer

Library of Congress Control Number: 2005937927

Challenges in Ad Hoc Networking

Edited by K. Al Agha, I. Guérin Lassous, and G. Pujolle

p. cm. (IFIP International Federation for Information Processing, a Springer Series in Computer Science)

ISSN: 1571-5736 / 1861-2288 (Internet)

ISBN-10: 0-387-31171-8

ISBN-13: 9780-387-31171-8

Printed on acid-free paper

Copyright © 2006 by International Federation for Information Processing.

All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer Science+Business Media, Inc., 233 Spring Street, New York, NY 10013, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with any form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.

The use in this publication of trade names, trademarks, service marks and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

Printed in the United States of America.

9 8 7 6 5 4 3 2 1

springeronline.com

Contents

Preface	xi
Wireless Transmissions With Combined Gain Relays Over Fading Channels	1
Theodoros A. Tsiftsis, George K. Karagiannidis and Stavros A. Kotsopoulos	
Adaptive Probabilistic NAV to Increase Fairness in Ad Hoc 802.11 MAC Layer	11
Claude Chaudet, Guillaume Chelius, Herve Meunier and David Simplot-Ryl	
A Link Layer Protocol for Self-organizing Ultra Wide Band Impulse Radio Networks	21
Nan Shi, Liang Xia and Ignas G. Niemegeers	
Power Control and Clustering in Wireless Sensor Networks	31
L. Dehni, F. Krief and Y. Bennani	
Protecting Transmissions when using Power Control on 802.11 Ad Hoc Networks	41
Alexandre Andrade Pires, José Ferreira de Rezende and Carlos Cordeiro	

A Power-Saving Algorithm and a Power-Aware Routing Scheme for IEEE 802.11 Ad Hoc Networks Nikos Pogkas and George Papadopoulos	51
Optimized Flooding and Interference-Aware QoS Routing in OLSR Dang Quan Nguyen and Pascale Minet	61
OLSR and MPR: Mutual Dependences and Performances Jerome Haerri, Christian Bonnet and Fethi Filali	67
OLSR improvement for distributed traffic applications Laurent Bouraoui, Arnaud de La Fortelle and Anis Laouiti	73
Multilevel Network Modeling to Achieve Cross-Layer Mechanisms M. Issoufou Tiado, R. Dhaou and A.-L. Beylot	79
Bandwidth Measurement in Wireless Networks Andreas Johnsson, Bob Melander and Mats Bjorkman	89
Performance Evaluation Study of an Available Bandwidth Measurement technique in multi-hop wireless ad hoc networks Soumer Brahim, Kamoun Farouk and Tounsi Hajer	99
Unified Support for Quality of Service Metrics Management in Mobile ad hoc Networks using OLSR Djamal-Eddine Meddour, Yvon Gourhant, Laurent Reynaud and Bertrand Mathieu	109
A Framework for Routing in Large Ad Hoc Networks with Irregular Topologies Marc Heissenbüttel, Torsten Braun, David Jörg and Thomas Huber	119
Routing in Extremely Mobile Networks Géraud Allard, Philippe Jacquet and Bernard Mans	129
MORHE: A Transparent Multi-level Routing Scheme for Ad Hoc Networks Michael Voorhaen, Erwin Van de Velde and Chris Blondia	139
Virtual Trellis Routing: how Regular Structures can ease Network Operations Julien Ridoux, Anne Fladenmuller and Yannis Viniotis	149

Connectivity Properties of Random Waypoint Mobility Model for Ad Hoc Networks Pasi Lassila, Esa Hyytiä and Henri Koskinen	159
On Improving Connectivity of Static Ad-Hoc Networks by Adding Nodes Henri Koskinen, Jouni Karvo and Olli Apilo	169
The Critical Neighbourhood Range for Asymptotic Overlay Connectivity in Dense Ad Hoc Networks Sandrine Calomme and Guy Leduc	179
Design of a flexible cross-layer interface for ad hoc networks Marco Conti, Gaia Maselli and Giovanni Turi	189
Emulation Architecture for Ad Hoc Networks Alessandra Giovanardi and Gianluca Mazzini	199
Wireless Local Area Networks and mobile devices to actualise the notion of ubiquitous computing in living classrooms: a case study in teaching and learning Astrophysics Serena Pastore	209
Throughput Analysis of an Aloha-Based MAC Policy for Ad Hoc Konstantinos Oikonomou and Ioannis Stavrakakis	219
Performance Evaluation of Broadcasting Protocols for Ad Hoc and Sensor Networks Hong Guo, François Ingelrest, David Simplot-Ryl and Ivan Stojmenovic	225
Mobility-aware Adaptive Counter-based Forwarding Elimination to Reduce Data Overhead in Multicast Ad Hoc Routing Carmen M. Yago-Sánchez, Pedro M. Ruiz-Martínez and Antonio F. Gómez-Skarmeta	235
Supporting Multicast in Ad-Hoc networks in a Hotspot Context Andreas Kassler, Susana Sargento, Adel Ben Mnaouer, Chen Lei, Nanyang Pedro Neves, Rui L. Aguiar and Pedro M. Ruiz	245

A Lightweight Clustering Algorithm for Utilizing Capacity Heterogeneity	255
Nicklas Beijar, Raimo Kantola and Jose Costa-Requena	
OLSR Trees: A Simple Clustering Mechanism for OLSR	265
Emmanuel Baccelli	
Asynchronous Architecture for Sensor Network Nodes	275
Aurélien Buhrig, Marc Renaudin and Dominique Barthel	
Evaluating Fault Tolerance Aspects in Routing Protocols for Wireless Sensor Networks	285
Daniel Fernandes Macedo, Luiz Henrique Andrade Correia, Aldri Luiz dos Santos, Antonio Alfredo F. Loureiro, José Marcos S. Nogueira and Guy Pujolle	
Service Discovery Protocol in Proactive Mobile Ad Hoc Networks	295
Maria Isabel Vara, Jose Maria Cabero, Jose Luis Jodrá and Jose Oscar Fajardo	
Autonomous Reconfiguration by Innovation of Diffusions: A Distributed Decision-Making Framework for Multi-State Mobile Ad Hoc Networks	301
Timothy. K. Forde, Linda Doyle and Donald O'Mahony	
Prefix Continuity and Global Address Autoconfiguration in IPv6 Ad Hoc Networks	311
Christophe Jelger and Thomas Noël	
Adaptive Real-Time VBR Video Traffic Predictor for IEEE 802.15.3 Wireless Ad Hoc Networks	321
Yi-Hsien Tseng, Eric Hsiao-Kuang Wu and Gen-Huey Chen	
An Efficient Proactive Threshold RSA Signature Scheme for disjoint large scale Ad Hoc Networks	331
Ruishan Zhang and Kefei Chen	
Hybrid Key Management Infrastructure for Mobile Ad hoc Networks	337
David Sanchez Sanchez and Heribert Baldus	
Design and Optimization of Reputation Mechanisms for Centralized Clustered Ad-Hoc Networks	347
Spyridon Vassilaras, Dimitrios Vogiatzis and Gregory S. Yovanof	

“Direction” forwarding for highly mobile, large scale ad hoc networks	357
Mario Gerla, Yeng-Zhong Lee, Biao Zhou, Jason Chen and Antonio Caruso	
Extending the Coverage of a 4G Telecom Network using Hybrid Ad-hoc Networks: a Case Study	367
Tânia Calçada and Manuel Ricardo	
Integration of Mobile-IPv6 and OLSR for Inter-MONET Communications	377
Hakim Badis, Ines Ben Hamida, Lila Boukhatem and Khaldoun Al Agha	
Analysis of the Multi-Point Relays selection in OLSR and Implications	387
Anthony Busson, Nathalie Mitton and Éric Fleury	
Selection metrics for cooperative multihop relaying	397
Jonghyun Kim and Stephan Bohacek	
Service Differentiation Mechanism via Cooperative Medium Access Control Protocol	407
Fatma Orsun, Hakan Topakkaya, Muharrem A. Tunc and Coskun Cetinkaya	

Preface

This book contains the refereed proceedings of the Fourth Annual Mediterranean Ad Hoc Networking Workshop, Med-Hoc-Net 2005. After Sardinia (Italy), Mahdia (Tunisia), Bodrum (Turkey), the workshop took place this year on the beautiful island, Île de Porquerolles (France).

The Med-Hoc-Net 2005 event consolidates the success of the previous editions of the workshop series. It aims to serve as a platform for researchers from academia, research, laboratories and industry from all over the world to share their ideas, views, results and experiences in the field of ad hoc networking.

This year, 73 papers were submitted. We accepted 39 papers as full papers and 10 papers as short papers. Each full paper consists in 10 pages in these proceedings and was presented orally at the workshop whereas each short paper consists in 5 pages in these proceedings and was presented as a poster at the workshop. The selected papers were grouped according to the following topics: Physical and MAC layers, Power Consumption, Quality of Service, Routing, Connectivity, Optimization and Testbeds, Multicast and Broadcast, Clustering, Sensor networks, Auto-organization and Adaptation, Security and Evolution and finally Analysis. The accepted papers came from all over the world, mainly from diverse countries in Europe, but also from USA, Brazil, Tunisia, China and Taiwan. We thank all authors for submitting their papers to Med-Hoc-Net 2005.

For each paper, we provided two reviews (sometimes three reviews). This could only be realized by the hard work of the Technical Program Committee composed of 35 members. We thank all the members of the

Technical Program Committee for their invaluable help with the paper reviews.

We have also two tutorials on Security in Wireless Ad Hoc Networking (Bülent Yener) and on Wireless and Ad Hoc Networks: Routing, Quality of Service and Scalability (Khaldoun Al Agha). We thank these speakers for their contribution. We also express our deep gratitude to Jean-François Diouris, Roger Wattenhofer and Mario Gerla for accepting our invitations to become keynote speakers for the workshop. The diversity of the keynote talks were in accordance to the diversity of the technical program.

Finally, the success of the workshop would not have been possible without the hard work of many colleagues. We wish to thank Joëlle Hnautra and Davor Males for the organization part and Ignacy Gawedzki for the nice web site of the workshop.

Khaldoun Al Agha and Guy Pujolle, General Chairs
Isabelle Guérin Lassous, Conference Program Chair