

# **QoS AND MOBILE TECHNOLOGIES**

**EDITORS:**

**AISHA-HASSAN ABDALLA HASHIM**

**OMER MAHMOUD**

**RASHEED SAEED**

**DEPARTMENT OF ELECTRICAL AND COMPUTER  
ENGINEERING  
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA**



**IIUM Press**

Published by:  
IIUM Press  
International Islamic University Malaysia

First Edition, 2011  
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

ISBN: 978-967-418-142-0

Member of Majlis Penerbitan Ilmiah Malaysia -- MAPIM  
(Malaysian Scholarly Publishing Council)

Printed by :  
**IIUM PRINTING SDN.BHD.**  
No. 1, Jalan Industri Batu Caves 1/3  
Taman Perindustrian Batu Caves  
Batu Caves Centre Point  
68100 Batu Caves  
Selangor Darul Ehsan  
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543  
EMAIL: iiumprinting@yahoo.com

# TABLE OF CONTENTS

	TITLE	No
<b>PART 1:QoS APPROACHES</b>		
<b>CHAPTER 1:</b>	Introduction to QoS Approaches	2
<b>CHAPTER 2:</b>	Internet Quality Of Service Architectures	11
<b>CHAPTER 3:</b>	Integrated Services	17
<b>CHAPTER 4:</b>	Differentiated Services	21
<b>CHAPTER 5:</b>	Quality Of Service (QoS) Ad-Hoc On-Demand Distance Vector (AODV)	27
<b>CHAPTER 6:</b>	QoS Routing In Ad-Hoc Wireless Networks	33
<b>CHAPTER 7:</b>	MPLS And Traffic Engineering	41
<b>PART 2: MOBILITY MANAGEMENT APPROACHES</b>		
<b>CHAPTER 8:</b>	Introduction to Mobility Management	47
<b>CHAPTER 9:</b>	Nested Mobile Networks	53
<b>CHAPTER 10:</b>	Evaluation of NEMO Extensions	59
<b>CHAPTER 11:</b>	Handoff Process In Micromobility Protocols	65
<b>CHAPTER 12:</b>	Comparison Between Network Simulators	71
<b>PART 3: WIRELESS TECHNOLOGY</b>		
<b>CHAPTER 13:</b>	Introduction to Local Area Network (LAN) Communication Protocols	77
<b>CHAPTER 14:</b>	MANET routing protocols	85
<b>CHAPTER 15:</b>	VANET Applications	95
<b>CHAPTER 16:</b>	Vehicle To Vehicle Routing Protocols	101
<b>CHAPTER 17:</b>	Wi-Fi Mesh Network	111
<b>CHAPTER 18:</b>	Overview Of Wimax Mesh	117
<b>CHAPTER 19:</b>	Current Trends On WIMAX Using MIMO Technology	129
<b>CHAPTER 20:</b>	Self-Organized Femtocell Networks	141
<b>CHAPTER 21:</b>	Self-Organized Synchronization For Femtocell Network	155
<b>CHAPTER 22:</b>	Spectrum Management In Femtocell	169
<b>CHAPTER 23:</b>	Smart Grid Communication	179
<b>CHAPTER 24:</b>	UWB Overview	189
<b>CHAPTER 25:</b>	ZIGBEE Applications	197

<b>CHAPTER 26:</b>	Improvement Of Vertical Handover In GPRS/WIFI Seamless Convergence	205
<b>CHAPTER 27:</b>	The Application Of Sensor Network And Routing Protocols In Wireless Communication	215
<b>CHAPTER 28:</b>	A Study Of Channel Assignment Approach To Reduce Frequent Reassignment	227
<b>CHAPTER 29:</b>	Association Management Schemes For Wireless Mesh Network	231
<b>CHAPTER 30:</b>	Challenges In Multi-Radio Multi-Channel Wireless Mesh Network	237
<b>CHAPTER 31:</b>	Mobility Support in Diffserv and MPLS network	243
<b>CHAPTER 32:</b>	Mobility Management And Context Transfer	247
<b>CHAPTER 33:</b>	LTE -Advanced Overview	251
<b>CHAPTER 34:</b>	Time Synchronization Protocols And Approaches	261
<b>CHAPTER 35:</b>	MPLS Architectures	265

## CHAPTER 5

# QUALITY OF SERVICE (QoS) AD-HOC ON-DEMAND DISTANCE VECTOR (AODV)

NUR IDAWATI MD ENZAI\*, HASNORHAFIZA HUSNI\*, FARHAT ANWAR, OMER  
MAHMOUD, AISHA HASSAN ABDALLA HASHIM (AUTHOR)

*\*Fac. of Electrical Eng., Universiti Teknologi MARA (UiTM) Terengganu, 23000, Dungun,  
Malaysia. (Address)*

*nurid333@tgamu.uitm.edu.my (email)*

### 5.1 INTRODUCTION

The route discovery in AODV is on-demand and follows a route request/route reply query cycle [1]. When a source is in need of a route to a destination, it broadcasts a Route Request (RREQ) control message in search of a route. Nodes having a current route to the indicated destination respond by unicasting a Route Reply (RREP) to the source node.

In order to provide QoS, extensions can be added to these messages during the route discovery process. A node which receives a RREQ with a QoS extension must be able to meet that service requirement in order to either rebroadcast the RREQ (if it does not have a route to the destination) or unicast a RREP to the source. Several extensions are needed in the routing table structure and the RREQ and RREP messages as reported in [2] [3]. The following fields are added to each route table entry corresponding to each destination.

- Maximum delay
- Minimum available bandwidth
- List of sources requesting delay guarantees
- List of sources requesting bandwidth guarantees

Regarding the QoS extensions, [3] suggested that the maximum delay extension and minimum bandwidth extension can be appended to a RREQ by a node requesting a QoS route in order to place a maximum bound on the acceptable time delay experienced on any acceptable path from the source to the destination as well as to specify the minimum amount of bandwidth that must be made available. A special message, QoS-LOST message is generated to handle any QoS violation. The QoS-LOST message is forwarded to all the sources potentially affected by the change in the QoS parameter. These are the sources to which a RREP with a QoS extension has been forwarded before the sources are recorded in a list as a part of the table route entry.

In another proposal made by Perkins and Royer, two extension formats were introduced: QoS Object Extension Format and Maximum Jitter Extension Format. A node may append a QoS Object extension to a RREQ in order to find a path that satisfies the QoS parameters which are present in the QoS Object, which is situated within the QoS Object extension data. As a result, the Maximum Delay Extension Format which has