

# Advances in Mobility Management for IP Networks

---

**Editors:**

**Aisha Hassan Abdalla Hashim**

**Othman Khalifa**

**Shihab A. Hameed**



**IIUM PRESS**

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# **Advances in Mobility Management for IP Networks**

**Editors:**

**Aisha Hassan Abdalla Hashim**

**Othman Khalifa**

**Shihab A. Hameed**



**IIUM Press**

Published by:

IUM Press  
International Islamic University Malaysia

First Edition, 2011  
©IUM Press, IUM

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

Aisha Hassan Abdalla Hashim, Othman Khalifa, Shihab A. Hameed: *Advances in Mobility Management for IP Networks*

ISBN: 978-967-418-140-6

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

Printed by :

**IUM 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: iumprinting@yahoo.com

# TABLE OF CONTENTS

No.	Title	Page No.
	<b>Acknowledgement</b>	v
	<b>Preface</b>	vi
	<b>Part 1: Internet Engineering Task Force (IETF) Approaches for Multicast and Mobility Management</b>	1
1	Introduction to Multicast Mobility Management Aisha Hassan Abdalla Hashim, Shihab A. Hameed, Jamal Ibrahim Daoud	2
2	Research Direction in Mobile IPv6 Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim, Sellami Ali, Wajdi Al-Khateeb	9
3	Operation of Context Transfer Protocol Aisha Hassan Abdalla Hashim, Othman Khalifa, Azana Hafizah Mohd Aman, Farhat Anwar, Shihab A. Hameed	15
4	The Study of Multicast Hierarchical Mobile IPv6 Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim, Akram M. Zeki	21
5	The Study Of Multicast Listener Discovery Aisha Hassan Abdalla Hashim, Imad Fakhri Taha Alshaikhli, Azana Hafizah Mohd Aman, Sellami Ali	27
6	MIPv6 Based Approaches for Mobility Management Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim, Imad Fakhri Taha Alshaikhli	32
7	HMIPv6 Based Approaches for Mobility Management Aisha Hassan Abdalla Hashim, Wajdi Al-Khateeb, Farhat Anwar, Azana Hafizah Mohd Aman	36

## **Part 2: Extensions to Mobile Multicast Schemes**

8	Introduction to Mobility Multicast Schemes Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman, Sellami Ali, Othman Khalifa	42
9	Qualitative Study of Mobility Management Approaches Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim, Imad Fakhri Taha Alshaikhli, Farhat Anwar	48
10	Architecture of M-HMIPv6/CXTP Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	53
11	Intra Domain Movement of M-HMIPv6/ CXTP Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	58
12	Inter Domain Movement of M-HMIPv6/ CXTP Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	64
13	Message Format of M-HMIPv6/CXTP Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	70
14	Signaling Flow of M-HMIPv6/ CXTP Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	76
15	Development of the Service Recovery Time and Signaling Cost Function Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	83
16	Evaluation Methods in Computer Networking Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	88
17	Ns2 Simulation Environment in M-HMIPv6 Omer Mahmoud, Azana Hafizah Mohd Aman	93
18	Service Recovery of Multicast Hierarchical Mobile IPv6 with Context Transfer Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	101
19	The Study of Signaling Cost Of M-HMIPv6 with Context Transfer Aisha Hassan Abdalla Hashim, Azana Hafizah Mohd Aman	106
20	Simulation Study of HMIPv6 And M-HMIPv6/CXTP Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	112

21	Packet Loss in M-HMIPv6 with Context Transfer Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	118
22	Evaluation of Handover Latency in M-HMIPv6 with Context Transfer Azana Hafizah Mohd Aman, Aisha Hassan Abdalla Hashim	124
23	Future Directions Azana Hafizah Mohd Aman, Omer Mahmoud, Aisha Hassan Abdalla Hashim	128
24	MIPv6 Extensions Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Omer Mahmoud, Md. Rafiqul Islam	133
25	IP Multicast Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Md. Rafiqul Islam, Rashid Abdelhaleem Saeed	139
26	Mobility Approaches to Support IP Multicast Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Rashid Abdelhaleem Saeed, Omer Mahmoud	144
27	Hierarchical Mobile Multicast Context Transfer (HMMCT) Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Omer Mahmoud, Rashid Abdelhaleem Saeed	152
28	Simulation Evaluation of HMMCT Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Omer Mahmoud, Rashid Abdelhaleem Saeed	157
29	Analytical Study of HMMCT Abdulrhman Mohammed Bin Mahfodh, Abdi Nasir Ahmed, Aisha Hassan Abdalla Hashim, Faiz Ahmed Mohamed Elfaki, Rashid Saad	165
<b>Part 3: QoS Approaches</b>		
30	Introduction to QoS Approaches in Mobile Ad Hoc Networks Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh, Akram M. Zeki	171

31	Routing Protocols For Ad Hoc Wireless Networks	176
	Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh, Gharib Subhi Mahmoud Ahmed	
32	Quality of Service (QoS) Issues In Manets	181
	Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh, Jamal Ibrahim Daoud	
33	Supporting QoS Multicast Routing Over Mobile Ad Hoc Networks	186
	Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh	
34	Position-Based Routing Protocols For Ad-Hoc Networks	191
	Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh	
35	Simulation in Wireless Networks: An Overview	196
	Mohammad Qabajeh, Aisha-Hassan A. Hashim, Othman Khalifa, Liana Qabajeh , Faiz Ahmed Mohamed Elfaki	

# EVALUATION METHODS IN COMPUTER NETWORKING

AISHA HASSAN ABDALLA HASHIM AND AZANA HAFIZAH MOHD AMAN

*ECE Dept, Fac. of Eng., International Islamic Univ. Malaysia (IIUM), Jalan Gombak, 53100  
Kuala Lumpur, Malaysia.*

*aisha@iiu.edu.my, azana80@gmail.com*

## 16.1 INTRODUCTION

In general, there are qualitative and quantitative evaluation methods in computer networking. Qualitative method aims to gather an understanding of computer networking and the reasons that govern such operations. It refers to network simulators that can be used to simulate computer networking environment. The qualitative method investigates the why and how of decision making, not just what, where, when. Hence, smaller but focused samples are more often needed than large samples. Qualitative method is used widely in computer networking research [1].

Quantitative method refers to the systematic empirical investigation of social phenomena via statistical, mathematical or computational techniques. The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to phenomena. The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships [1].

In communication and computer network research, network simulation is a technique where a program models the behavior of a network either by calculating the interaction between the different network entities such as hosts, routers, data links, packets, etc using mathematical formulas, or actually capturing and playing back observations from a production network. The behavior of the network and the various applications and services it supports can then be observed in a test lab; various attributes of the environment can also be modified in a controlled manner to assess how the network would behave under different conditions. When a simulation program is used in conjunction with live applications and services in order to observe end-to-end performance to the user desktop, this technique is also referred to as network emulation.

## 16.2 EVALUATION METHOD

In the quantitative method, equations are derived and values are collected based on selected data varying range. In qualitative method, on the other hand, data are collected based on simulation scenarios run on network simulator. Qualitative methods produce information only on the particular simulation, and any more general conclusions are only hypotheses. Quantitative methods can be used to verify, which of such hypotheses are true.

A network simulator is a software program that imitates the working of a computer network. In simulators, the computer network is typically modelled with devices, traffic