Distributed Home Agent Mobility Management for IP Based Cellular Network

Chi Wah Yung

A dissertation submitted for the degree of

MASTER OF PHILOSOPHY (MPhil)

to

School of Electrical and Electronic Engineering
Faculty of Engineering, Computer and Mathematical Sciences

THE UNIVERSITY OF ADELAIDE, South Australia

March, 2013

MAJOR SUBJECT: WIRELESS COMMUNICATIONS & NETWORKING

Supervisors:

Prof Reginald Coutts, School of Electrical & Electronic Engineering

Prof Derek Abbott, School of Electrical & Electronic Engineering

Table of contents

List of figures

List of tables

List of acronyms

2.5G	Intermediate Generation of Cellular Network between 2G and 3G
2G	Second Generation Cellular Network
3G	Third Generation Cellular Network
4G	Forth Generation Cellular Network
AAA	Authentication, Authorization and Administration
AN	Access Network
BSC	Base Station Controller
CDMA	Code Division Multiple Access
CN	Correspondent Node
CoA	Care Of Address
CSD	Circuit Switched Data
DHAA	Dynamic Home Agent Anchoring Scheme
D-MIP	Distributed Agent Mobility Management Platform
FA	Foreign Agent
FDMA	Frequency Division Multiple Access
HA	Home Agent
HSPA	High Speed Packet Access
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPv6	Internet Protocol Version 6
ISO	International Organization for Standardization
IWF	Inter-working Function
MIP	Mobile IP Protocol
MIPv6	Mobile IP Protocol for Internet Protocol Version 6
MN	Mobile Node
MS	Mobile Station
NS2	Network Simulator 2
OPNET®	OPNET® is either registered trademarks or trademarks of OPNET Technologies, Inc. in the United States and/or other countries.
OSI	Open System Interconnection
PDA	Personal Digital Assistant
PDSN	Packet Data Serving Node
RAN	Radio Access Network
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UMTS	Universal Mobile Telephone System

Abstract

The convergence of wireless networks both fixed and mobile with the Internet is creating a revolution in the way wireless networked resources interact with each other. This thesis is concerned with mobile networks and proposes to deal with the mobility management problems for the mobile computing devices in the next generation of multi-technologies integrated IP based mobile networks. In order to do this, a new distributed home agent approach for mobility management has been developed that harmonizes the concept of micro-mobility and macro-mobility management in order to enable seamless mobility management on different kinds of wireless network environment especially interaction with the legacy cellular network in which resources are limited and expensive. The major contribution of this thesis is three-fold.

Firstly, this thesis proposes network access architecture and a distributed mobility management scheme, which enables the mobility of a mobile device in a cellular packet data network in order to reduce the latency and network traffic required to handle the mobility management functionality. A detailed design of the distributed mobility management scheme is presented for the implementation and the conceptual model is analysed.

Secondly, simulation of the mobility management schemes using two different network simulation packages to enable a comparison of the simulator functionalities is presented.

Finally, the results of the simulation and suggested future work are presented.

Declaration of originality

This work contains no material that has been accepted for the award of any other degree or diploma in any university or other tertiary institution to C. W. Yung and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of the thesis, when deposited in the University Library, being available for loan, photocopying, and dissemination through the library digital thesis collection, subject to the provisions of the Copyright Act 1968.

I also give permission for the digital version of my thesis to be made available on the web, via the University‘s digital research repository, the Library catalogue, the Australasian Digital Thesis Program (ADTP) and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Signed: _____ (C. W. Yung) **Date:** _____

Publications

The following are some of the publications of the candidate which are related to the theme of this thesis.

1. C. W. Yung, R. P. Coutts, and D. Abbott, ―Design of distributed agent mobility management platform (D-MIP) for IP-based wireless networks," *Proceedings of 4G Mobile Forum*, San Diego, USA, July 2005.
2. C. W. Yung, R. P. Coutts, and D. Abbott, ―Modeling and simulation of dynamic home agent anchoring scheme for mobility management of IP based wireless networks*,"* *Proceedings of 2006 Global Mobile Congress*, Beijing, China, Oct 2006.

Notable seminars and workshops

3. University of Adelaide Seminar, ―Design of distributed agent mobility management platform (D-MIP) for IP-based wireless networks," University of Adelaide, 2005.

Acknowledgments

It is my great pleasure to express my gratitude to all the people who have supported me greatly during the pursuit of my study. Without their encouragement and help, it would not have been possible for me to complete this dissertation.

Firstly, I would like to give my best appreciation to my two supervisors, Professor Reginald P. Coutts and Professor Derek Abbott, for their support, inspiration and encouragement to me throughout the course of the study. They have helped to provide me with required motivation and confidence in myself, and the courage to take this challenging task and finish this thesis so smoothly and quickly.

Secondly, I would like to thank all the staff and postgraduate associates in the School of Electrical and Electronic Engineering at the University of Adelaide. Their friendship, help and encouragement deserve my sincere appreciation. Also, their timely support, discussion and sharing made my study journey a lot easier and constantly inspired me on new knowledge and research topics.

Lastly but not the least, I want to give my special thankfulness to my family and friends. Their strong support and encouragement made this study possible.