QOS-AWARE HANDOVER SCHEME FOR HIERARCHICAL MOBILE IPv6 USING CONTEXT TRANSFER WITH LINK LAYER TRIGGER

By

SHAMINI PILLAY A/P N. PILLAY

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Partial Fulfilment of the Requirements for the Degree of Master of Science

October 2004

Dedicated to

My Loving parents, my siblings, my dearest husband and my little darlings Pashz and Sidd

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in partial
fulfillment of the requirement for the degree of Master of Science

QOS-AWARE HANDOVER SCHEME FOR HIERARCHICAL MOBILE IPV6 USING CONTEXT TRANSFER WITH LINK LAYER TRIGGER.

By

SHAMINI PILLAY

October 2004

Chairman   : Professor Borhanuddin Mohd Ali, Ph.D.

Faculty   : Engineering

The incredible rate that the Internet is growing has made recently for the convergence of
the various networks into an unified IP based architecture. The challenge in such a
complex network is to provide a seamless support. Seamless handover is a combination
of fast and smooth handover. Thus seamless handover will basically offer lower latency
and packet drops.

In this study, we examine a QoS-aware handover scheme based on Hierarchical Mobile
IPv6 architecture. Enhancements to the scheme to improve seamless support are
investigated. The two main elements added to this system are the use of link layer trigger
and context transfer.

The detection and triggering of handover is an important functionality of handover,
which has a strong impact on its performance in terms of handover latency and

packet loss. Link layer trigger shortens the time for handover detection and therefore decrease the overall service interruption caused by handover.

The main purpose of context transfer is to reduce the time when a particular flow does not receive the contracted QoS due to a handover situation. This is achieved by transferring in advance the information to the access router where the mobile node is expected to be attaching next in order to maintain the QoS for that flow. Without context transfer, the access router takes some time to recover this information due to the exchange of signaling information. The time wasted here can be harmful for real-time applications that require timely delivery and a constant service level.

Apart from this, context transfer is also a way to preserve scarce wireless bandwidth between mobile node and the access router, as it does not use this wireless link to reinitiate QoS information as done previously in the QoS-aware handover scheme.

The proposed scheme performance is proven by means of simulation and an analytical study, whereby handover delay and packet loss are the main performance parameters. Simulation results have proved that the proposed scheme performs better by decreasing the handover delay by 75 % and packet loss rate by 16.3 %. Further the analytical study done validates the results obtain from simulation by proving analytically the decrease in handover delay, packet loss and utilization of bandwidth.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia untuk memenuhi sebahagian daripada keperluan Ijazah Master Sains

SKEMA PENGAMBILALIHAN BERDASARKAN KUALITI PERKHIDMATAN BAGI HIRARKI PROTOKOL INTERNET VERSI 6 BERGERAK DENGAN PEMINDAHAN MAKLUMAT BERSERTA PENCETUS LAPISAN PAUTAN

Oleh

SHAMINI PILLAY

Oktober 2004

Pengerusi   : Profesor Borhanuddin Modh Ali, Ph.D.

Fakulti   : Kejuruteraan

Kadar pertumbuhan Internet yang pesat telah mengabungkan pelbagai rangkaian kepada satu senibina berasaskan hanya kepada IP. Cabaran kepada rangkaian-rangkain tersebut ialah memberi sokongan pengambilalihan cepat and lancar. Maka ia akan memendekan masa pengambilalihan dan seterusnya mengurangkan keguguran paket.

Tesis menganalisa skema pengambilalihan berdasarkan kualiti perkhidmatan bagi Hirarki Internet Versi 6 Bergerak. Disini beberapa elemen akan ditambah kepada skema tersebut untuk memperolehi pengambilalihan yang cepat and juga lancar. Dua elemen yang akan dikaji untuk diintegrasikan kedalam skema tersebut ialah pemindahan maklumat dengan menggunakan pencetus lapisan pautan.

Pengesanan and pecetusan adalah fungsi penting dalam proses pengambilalihan. Ia memberi kesan mendalam terhadap masa pengambilalihan dan juga terhadap keguguran paket. Penggunaan pencetus lapisan pautan ini pada dasarnya mengurangkan masa untuk pengesanan pengambilalihan . Maka ia akan mengurangkan pada keseluruhannya gangguan perkhidmatan yang disebabkan oleh pengambilalihan.

Tujuan Utama menggunakan pemindahan maklumat adalah untuk mengurangkan masa dimana sesuatu rangkaian paket tidak menerima kualiti perkhidmatan yang dijanjikan disebabkan situasi pengambilalihan. Bagi mengelakkan situasi sedemikian, maklumat yang diperlukan dipindah kepada penghala capaian dimana nod mobil akan berpindah setelah pengambilalihan berlaku. Tanpa process pemindahan maklumat, penghala capaian memerlukan masa untuk mengasaskan semula maklumat kualiti perkhidmatan melalui pengisyaratan tertentu diantara nod mobil dan penghala capaian. Masa yang dibazirkan disini memberi kesan buruk kepada applikasi masa-sebenar yang memerlukan penghantaran packet dalam suatu jangka masa tetap dan kualiti perkhidmatan yang malar.

Selain dari ini, proses pemindahan maklumat amat penting bagi menjimat penggunaan jalur lebar yang sememangnya sedikit bagi komunikasi wayarless. Dengan menggunakan cara pemindahan maklumat, jalur lebar diantara nod mobil dan penghala capaian tidak digunakan untuk mengasaskan maklumat kualiti perkhidmatan seperti mana dilakukan di dalam skema asas pengambilalihan berdasarkan kualiti perkhidmatan.

Kelebihan skema yang dicadangkan dibuktikan dengan cara simulasi dan model berasaskan analitik. Masa pengambilalihan and keguguran paket adalah ukuran penting yang digunakan. Keputusan simulasi membuktikan bahawa skema yang dicadangkan megurangkan masa pengambilalihan sebanyak 75% dan keguguran paket sebanyak 16.3 % . Keputusan simulasi seterusnya disokong dengan membuat pengajian berasaskan model analitik. Pengajian ini telah membuktikan secara analitik pengurangan masa pengambilalihan , keguguran packet dan penggunaan jalur lebar.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor Prof. Dr. Borhanuddin Mohd Ali for his valuable guidance, enthusiastic encouragement and advises that made this work possible. His comment, time and involvement have played a significant role in improving the work seen in this thesis.

I would like to extend my gratitude to Dr. Sabira for her invaluable guidance, comments and advices throughout this work. Also for her many ideas to overcome certain inevitable research setbacks, which have helped me a lot in completing my work.

I would like to express my heartiest thanks to my dear friend Sahar for sparing her precious time, ideas and advise with me. Without her invaluable help, I would have not been able to complete the coding part of my work.

I am thankful to all academic and non-academic members of department computer and communication system Engineering, Universiti Putra Malaysia for cooperation and help. My gratefulness also goes to the administration and staff of the post-graduate center at UPM for all their cooperation.

Finally I would like to express my deepest appreciation to my family for their constant support and encouragement throughout the duration of my study.

I certify that an Examination Committee met on 13 October 2004 to conduct the final examination of Shamini Pillay on her Master of Science thesis entitled "QoS Aware Handover Scheme For Hierarchical Mobile IPV6 Using Context Transfer With Link Layer Trigger" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded a relevant degree. Members of the Examination Committee are as follows:

Abd. Rahman Ramli , Ph.D.
Professor
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

Mohd Adzir Mahdi, Ph.D.
Professor
Faculty of Engineering
Universiti Putra Malaysia
(Member)

Khairi Yusof, Ph.D.
Professor
Faculty of Engineering
Universiti Putra Malaysia
(Member)

Mashkuri Yaakob, Ph.D.
Professor
Faculty of Computer Science
Universiti Malaya
(Independent Examiner)

GULAM RUSUL RAHMAT ALI, Ph.D.
Professor/Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as partial fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

BORHANUDDIN MOHD ALI, Ph. D.
Professor
Faculty of Engineering
Universiti Putra Malaysia
(Chairman)

SABIRA KHATUN , Ph.D.
Faculty of Engineering
Universiti Putra Malaysia
(Member)

AINI IDERIS, Ph.D.
Professor/Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or currently submitted for any other degree at UPM or other institutions.

_____

SHAMINI PILLAY

Date:

TABLE OF CONTENTS

Page

CHAPTER